

1700⁺ Objective



Chapter-wise

Question Bank for CBSE

SCIENCE

Class 10

with Case base, A/R & MCQs

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1

Chemical Reactions and Equations

Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

- Which of the following is a decomposition reaction?
 - $2\text{HgO} \xrightarrow{\text{Heat}} 2\text{Hg} + \text{O}_2$
 - $\text{CaCO}_3 \xrightarrow{\text{Heat}} \text{CaO} + \text{CO}_2$
 - $2\text{H}_2\text{O} \xrightarrow{\text{Electrolysis}} \text{H}_2 + \text{O}_2$
 - All of these
- On the basis of following features, identify the correct option.
 - This reaction occurs during corrosion.
 - This reaction occurs during respiration.
 - Decomposition reaction
 - Redox reaction
 - Combination reaction
 - Endothermic reaction
- Which of the following is not a physical change?
 - Boiling of water to give water vapour.
 - Melting of ice to give water.
 - Dissolution of salt in water.
 - Combustion of Liquefied Petroleum Gas (LPG).
- Which of the following can be decomposed by the action of light?
 - NaCl
 - KCl
 - AgCl
 - CuCl
- In which of the following the identity of initial substance remains unchanged?
 - Curdling of milk
 - Formation of crystals by process of crystallisation
 - Fermentation of grapes
 - Digestion of food
- Which of the following reactions involves the combination of two elements?
 - $\text{CaO} + \text{CO}_2 \rightarrow \text{CaCO}_3$
 - $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$
 - $\text{SO}_2 + \frac{1}{2}\text{O}_2 \rightarrow \text{SO}_3$
 - $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$
- When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained and the sulphuric acid so formed remains in the solution. The reaction is an example of –
 - a combination reaction
 - a displacement reaction
 - a decomposition reaction
 - a double decomposition reaction
- What happens when copper rod is dipped in iron sulphate solution?
 - Copper displaces iron
 - Blue colour of copper sulphate solution is obtained
 - No reaction takes place
 - Reaction is exothermic
- A student added dilute HCl to a test tube containing zinc granules and made following observations which one is correct?
 - The zinc surface became dull and black.
 - A gas evolved which burns with a pop sound.
 - The solution remained colourless.
 - The solution becomes green in colour.
- A dilute solution of sodium carbonate was added to two test tubes (A) containing dil HCl and (B) containing dilute NaOH. The correct observation was –
 - a brown coloured gas liberated in test tube A.
 - a brown coloured gas liberated in test tube B.
 - a colourless gas liberated in test tube A.
 - a colourless gas liberated in test tube B.

11. A balanced chemical equation is in accordance with –
 (a) Avogadro's law
 (b) law of multiple proportion
 (c) law of conservation of mass
 (d) law of gaseous volumes.
12. The equation

$$\text{Cu} + x\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + y\text{NO}_2 + 2\text{H}_2\text{O}$$
 The values of x and y are –
 (a) 3 and 5 (b) 8 and 6
 (c) 4 and 2 (d) 7 and 1
13. $\text{Zn} + \text{H}_2\text{SO}_4(\text{dil}) \longrightarrow \text{ZnSO}_4 + \text{H}_2\uparrow$
 Above reaction is –
 (a) decomposition reaction
 (b) single displacement reaction
 (c) combination reaction
 (d) synthesis reaction
14. The reaction in which two compounds exchange their ions to form two new compounds is –
 (a) a displacement reaction
 (b) a decomposition reaction
 (c) an isomerization reaction
 (d) a double displacement reaction
15. When the gases sulphur dioxide and hydrogen sulphide mix in the presence of water, the reaction is

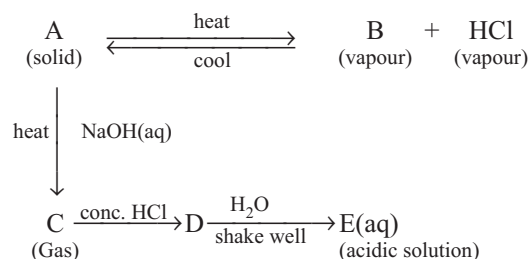
$$\text{SO}_2 + 2\text{H}_2\text{S} \rightarrow 2\text{H}_2\text{O} + 2\text{S}$$
 Here hydrogen sulphide is acting as –
 (a) an oxidising agent (b) a reducing agent
 (c) a dehydrating agent (d) a catalyst
16. $\text{CuO} + \text{H}_2 \rightarrow \text{H}_2\text{O} + \text{Cu}$, reaction is an example of –
 (a) redox reaction (b) synthesis reaction
 (c) neutralisation (d) analysis reaction
17. A substance which oxidises itself and reduces other is known as –
 (a) oxidising agent (b) reducing agent
 (c) both of these (d) none of these
18. A redox reaction is one in which –
 (a) both the substances are reduced.
 (b) both the substances are oxidised.
 (c) an acid is neutralised by the base.
 (d) one substance is oxidised while the other is reduced.
19. In the following equations :

$$\text{Na}_2\text{CO}_3 + x\text{HCl} \rightarrow 2\text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$$
 the value of x is –
 (a) 1 (b) 2
 (c) 3 (d) 4
20. In the equation, $\text{NaOH} + \text{HNO}_3 \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$
 nitric acid is acting as –
 (a) an oxidising agent (b) an acid
 (c) a nitrating agent (d) a dehydrating agent
21. $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$
 The above reaction is an example of a –
 (a) combination reaction
 (b) double displacement reaction
 (c) decomposition reaction
 (d) displacement reaction
22. White silver chloride in sunlight turns to –
 (a) grey (b) yellow
 (c) remain white (d) red
23. Black and white photography uses –
 (a) decomposition of silver chloride.
 (b) decomposition of silver bromide.
 (c) both
 (d) none of these
24. When copper powder is heated it gets coated with –
 (a) black copper oxide (b) yellow copper oxide
 (c) red copper oxide (d) None of these
25. Combination of phosphorus and oxygen is an example of –
 (a) oxidation (b) reduction
 (c) rancidity (d) None of these
26. Rusting of iron is an example of –
 (a) reduction (b) redox
 (c) oxidation (d) dissociation
27. Which of the following does not corrode when exposed to the atmosphere?
 (a) Iron (b) Copper
 (c) Gold (d) Silver
28. Take about 1.0g CaCO_3 in a test tube. Heat it over a flame, a colourless gas comes out. The reaction is called a
 (a) decomposition reaction
 (b) displacement reaction
 (c) double decomposition reaction
 (d) double displacement reaction
29. Hydrogen sulphide (H_2S) is a strong reducing agent. Which of the following reactions shows its reducing action?
 (a) $\text{Cd}(\text{NO}_3)_2 + \text{H}_2\text{S} \longrightarrow \text{CdS} + 2\text{HNO}_3$
 (b) $\text{CuSO}_4 + \text{H}_2\text{S} \longrightarrow \text{CuS} + \text{H}_2\text{SO}_4$
 (c) $2\text{FeCl}_3 + \text{H}_2\text{S} \longrightarrow 2\text{FeCl}_2 + 2\text{HCl} + \text{S}$
 (d) $\text{Pb}(\text{NO}_3)_2 + \text{H}_2\text{S} \longrightarrow \text{PbS} + 2\text{CH}_3\text{COOH}$

Chemical Reactions and Equations

30. $2\text{CuI} \rightarrow \text{Cu} + \text{CuI}_2$, the reaction is –
 (a) redox (b) neutralisation
 (c) oxidation (d) reduction
31. When copper turnings are added to silver nitrate solution, a blue coloured solution is formed after some time. It is because, copper –
 (a) displaces silver from the solution
 (b) forms a blue coloured complex with AgNO_3
 (c) is oxidised to Cu^{2+}
 (d) is reduced to Cu^{2+}
32. $\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Zn}(\text{s})$. This is –
 (a) oxidation (b) reduction
 (c) redox reaction (d) none of these
33. A substance A reacts with another substance B to produce the product C and a gas D. If a mixture of the gas D and ammonia is passed through an aqueous solution of C, baking soda is formed. The substances A and B are
 (a) HCl and NaOH (b) HCl and Na_2CO_3
 (c) Na and HCl (d) Na_2CO_3 and H_2O
34. Chemically the ‘water gas’ is
 (a) H_2O (gaseous) (b) $\text{CO}_2 + \text{H}_2$
 (c) $\text{CH}_4 + \text{H}_2\text{O}$ (d) $\text{CO} + \text{H}_2$
35. The oxidation number of sulphur is -4 in
 (a) H_2S (b) CS_2
 (c) Na_2SO_4 (d) Na_2SO_3
36. Identify the endothermic process from the following
 (a) Addition of conc. HCl to water
 (b) $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
 (c) $\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{O}(\text{g})$
 (d) $\text{CaO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Ca}(\text{OH})_2(\text{aq})$

37. The schematic diagram is given below

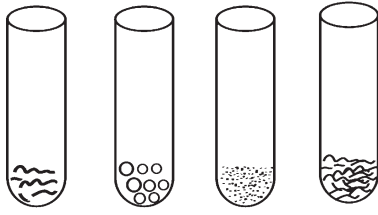


Which of the following is a correct statement ?

- (a) A and E are chemically same.
 (b) A and D are chemically same.
 (c) D and E are chemically same.
 (d) C and E are chemically same.

38. The oxidation states of P atom in POCl_3 , H_2PO_3 and $\text{H}_2\text{P}_2\text{O}_6$, respectively are
 (a) $+5, +4, +4$ (b) $+5, +5, +4$
 (c) $+4, +4, +5$ (d) $+3, +4, +5$
39. The process of respiration is :
 (a) Oxidation reaction which is endothermic
 (b) Reduction reaction which is endothermic
 (c) Combination reaction which is exothermic
 (d) Oxidation reaction which is exothermic
40. Silver articles become black when exposed to air. It is due to the formation of
 (a) Silver oxide (b) Silver nitrate
 (c) Silver chloride (d) Silver sulphide
41. A test tube along with calcium carbonate in it initially weighed 30.08 g. A heating experiment was performed on this test tube till calcium carbonate completely decomposed with evolution of a gas. Loss of weight during this experiment was 4.40 g. What is the weight of the empty test tube in this experiment?
 (a) 20.08 g (b) 21.00 g
 (c) 24.50 g (d) 2.008 g
42. Match chemical reactions given in the List I with the type of chemical reactions given in List II and select the correct answer using the options given below:

List I (Chemical reactions)	List II (Type of Chemical reactions)
A. Formation of NH_3 from N_2 and H_2	I. Decomposition
B. Calcination of zinc carbonate.	II. Double displacement
C. Reaction of aqueous BaCl_2 solution with dilute H_2SO_4	III. Combination
D. Rancidity of oils	IV. Redox
	V. Displacement
(a) A-I, B-V, C-III, D-IV	(b) A-III, B-IV, C-V, D-I
(c) A-IV, B-III, C-V, D-I	(d) A-III, B-I, C-II, D-IV

43. 

If we added FeSO_4 to above four test tubes, in which test tube we observe black residue?

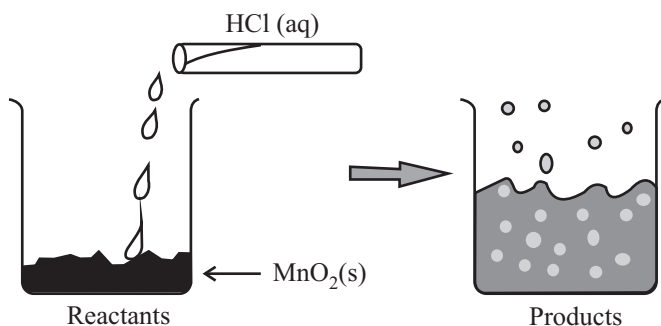
- (a) ‘A’ and ‘B’ (b) ‘B’ and ‘C’
 (c) ‘A’ and ‘C’ (d) ‘B’ and ‘D’

Case/Passage Based Questions

DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

The reaction between MnO_2 with HCl is depicted in the following diagram. It was observed that a gas with bleaching abilities was released. [From CBSE Question Bank-2021]



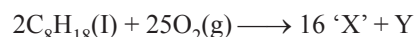
44. The chemical reaction between MnO_2 and HCl is an example of:
- displacement reaction
 - combination reaction
 - redox reaction
 - decomposition reaction.
45. Chlorine gas reacts with _____ to form bleaching powder.
- dry Ca(OH)_2
 - dil. solution of Ca(OH)_2
 - conc. solution of Ca(OH)_2
 - dry CaO
46. Identify the correct statement from the following:
- MnO_2 is getting reduced whereas HCl is getting oxidized
 - MnO_2 is getting oxidized whereas HCl is getting reduced.
 - MnO_2 and HCl both are getting reduced.
 - MnO_2 and HCl both are getting oxidized.
47. In the above discussed reaction, what is the nature of MnO_2 ?
- Acidic oxide
 - Basic oxide
 - Neutral oxide
 - Amphoteric oxide
48. What will happen if we take dry HCl gas instead of aqueous solution of HCl ?
- Reaction will occur faster.
 - Reaction will not occur.
 - Reaction rate will be slow.
 - Reaction rate will remain the same.

Case/Passage - 2

Chemistry in Automobiles:

For an internal combustion engine to move a vehicle down the road, it must convert the energy stored in the fuel into mechanical energy to drive the wheels. In your car, the distributor and battery provide this starting energy by creating an electrical “spark”, which helps in combustion of fuels like gasoline. Below is the reaction depicting complete combustion of gasoline in full supply of air:

[From CBSE Question Bank-2021]



49. Which of the following are the products obtained from the reaction mentioned in the above case?
- | Product 'X' | Product 'Y' |
|----------------------------|------------------------|
| (a) CO_2 | H_2O_2 |
| (b) H_2O | CO |
| (c) CH_3OH | H_2O |
| (d) CO_2 | H_2O |
50. Identify the types of chemical reaction occurring during the combustion of fuel:
- Oxidation & Endothermic reaction
 - Decomposition & Exothermic reaction
 - Oxidation & Exothermic reaction
 - Combination & Endothermic reaction
51. On the basis of evolution/absorption of energy, which of the following processes are similar to combustion of fuel?
- Photosynthesis in plants
 - Respiration in the human body
 - Decomposition of vegetable matter
 - Decomposition of ferrous sulphate.
- (ii) & (iii)
 - (i) & (ii)
 - (iii) & (iv)
 - (ii) & (i)
52. ‘A student while walking on the road observed that a cloud of black smoke belched out from the exhaust stack of moving trucks on the road.’ Choose the correct reason for the production of black smoke:
- Limited supply of air leads to incomplete combustion of fuel.
 - Rich supply of air leads to complete combustion of fuel.
 - Rich supply of air leads to a combination reaction.
 - Limited supply of air leads to complete combustion of fuel.
53. ‘Although nitrogen is the most abundant gas in the atmosphere, it does not take part in combustion’. Identify the correct reason for this statement.
- Nitrogen is a reactive gas
 - Nitrogen is an inert gas
 - Nitrogen is an explosive gas
 - Only hydrocarbons can take part in combustion

Chemical Reactions and Equations

» Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
 (b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
 (c) If **Assertion** is **correct** but **Reason** is **incorrect**.
 (d) If **Assertion** is **incorrect** but **Reason** is **correct**.

54. Assertion : Chlorine gas react with potassium iodide solution to form potassium chloride and iodine.

Reason : Chlorine is more reactive than iodine therefore displaces iodine from potassium iodide.

55. Assertion : When copper strip is placed in ferrous sulphate solution, colour of the solution changes.

Reason : Iron is more reactive than copper.

56. Assertion : Decomposition of vegetable matter into compost is an endothermic reaction.

Reason : Heat is required in an endothermic reaction.

57. Assertion : Reaction of sodium sulphate with barium chloride is a precipitation reaction.

Reason : Precipitation reaction produces insoluble salt.

58. Assertion: When a mixture of hydrogen and chlorine is placed in sunlight, hydrogen chloride is formed.

Reason : It is an example of combination reaction.

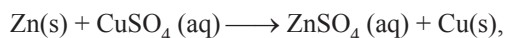
59. Assertion : Stannous chloride gives grey precipitate with mercuric chloride, but stannic chloride does not do so.

Reason : Stannous chloride is a powerful oxidising agent which oxidises mercuric chloride to mercury.

60. Assertion : Corrosion of iron is commonly known as rusting.

Reason : Corrosion of iron occurs in presence of water and air.

61. Assertion : In a reaction



Zn is a reductant but itself get oxidized.

Reason : In a redox reaction, oxidant is reduced by accepting electrons and reductant is oxidized by losing electrons.

62. Assertion : A reducing agent is a substance which can either accept electron.

Reason : A substance which helps in oxidation is known as reducing agent.

63. Assertion : The balancing of chemical equations is based on law of conservation of mass.

Reason : Total mass of reactants is equal to total mass of products.

» Match the Following

DIRECTIONS : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

64. Column II gives type of reaction mention in column I, match them correctly.

Column I	Column II
(A) $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$	(p) Displacement
(B) $\text{AgBr} \xrightarrow{\text{light}} \text{Ag} + \text{Br}$	(q) Combination
(C) $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$	(r) Decomposition
(D) $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{Cu}} \text{CH}_3\text{CHO} + \text{H}_2$	(s) Oxidation

65. Column I Column II

(A) $\text{KClO}_3 \xrightarrow{\Delta}$	(p) O_2
(B) $\text{ZnCO}_3 \xrightarrow{\Delta}$	(q) H_2O
(C) $\text{H}_2\text{CO}_3 \xrightarrow{\Delta}$	(r) CO_2
(D) $\text{C}_2\text{H}_6 \xrightarrow{\Delta}$	(s) ZnO
A B C D	
(a) p s, r q, r q, r	
(b) p q, r s, r r, p	
(c) q, r s, p p, s r	
(d) r q s p	

» Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

66. In a reaction two or more substances combine to form a new single substance.

67. Reactions in which heat is given out along with the products are called reactions.

68. Reactions in which energy is absorbed are known as reactions.
69. When an element displaces another element from its compound, a reaction occurs.
70. Two different atoms or groups of atoms (ions) are exchanged in reactions.
71. Precipitation reactions produce salts.
72. Reduction is the of oxygen or gain of hydrogen.
73. The digestion of food in the body is an example of reaction.
74. The addition of oxygen to a substance is called
75. When calcium carbonate is heated, it decomposes to give and
76. The new substances produced in a reaction are called as

>> True / False <<<

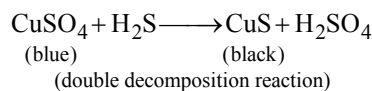
DIRECTIONS : Read the following statements and write your answer as true or false.

77. The number of atoms of each element is conserved in any chemical reaction.
78. Oxidation is the loss of electrons from a substance.
79. Reduction is the gain of electrons by a substance.
80. A complete chemical equation represents the reactants, products and their physical states symbolically.
81. A magnesium ribbon burns with a dazzling flame in air (oxygen) and changes into a white substance, magnesium oxide.
82. Rusting is a double decomposition reaction.
83. The reaction between nitrogen and hydrogen to give ammonia is an example of a combination reaction.
84. Action of heat on ferrous sulphate is an example of decomposition reaction.
85. The formation of Cu and H₂O in the reaction of copper oxide with hydrogen is an example of a redox reaction.

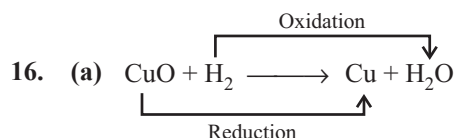
ANSWER KEY & SOLUTIONS

1. (d) A decomposition reaction is a type of chemical reaction in which a single compound breaks down into two or more elements or new compounds.
2. (b) Both are redox reactions. Redox reactions are characterised by the transfer of electrons between chemical species. One species undergoes oxidation while another species undergoes reduction.
3. (d) Combustion of liquefied petroleum gas is a chemical change. As it is an irreversible reaction and new products (carbon dioxide and water vapours) are formed during the change. Also, a lot of heat is released during this reaction.

4. (c)
5. (b) Formation of crystals by process of crystallization.
6. (b) Except (b) all other reactions involve compounds.

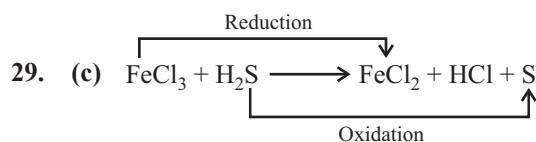
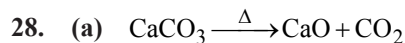


7. (d)
8. (c) Iron is more reactive than copper, hence Cu will not displace iron from iron sulphate, hence no reaction will take place.
9. (b) $\text{Zn} + 2\text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$
Hydrogen gas burns with a pop sound.
10. (c) $\text{Na}_2\text{CO}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
 $\text{Na}_2\text{CO}_3 + \text{NaOH} \longrightarrow \text{no reaction}$
11. (c)
12. (c) $\text{Cu} + 4\text{HNO}_3 \longrightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O}$
13. (b) 14. (d)
15. (b) Here H_2S is behaves as a reducing agent and oxidises to H_2O .

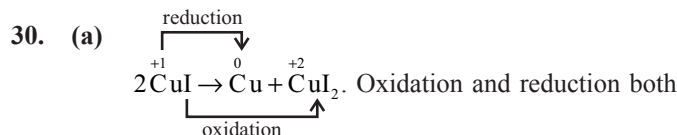


17. (b) 18. (d)
19. (b) $\text{Na}_2\text{CO}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$
20. (b) The reaction represents a neutralisation reaction in which base (NaOH) reacts with an acid (HNO_3) to form salt (NaNO_3) and water (H_2O).

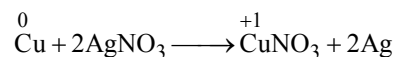
21. (d)
22. (a) White silver chloride in sunlight turns to grey.
23. (b)
24. (a) $2\text{Cu} + \text{O}_2 \xrightarrow{\Delta} 2\text{CuO}$
Black
25. (a) $4\text{P} + 3\text{O}_2 \xrightarrow{\text{(Oxidation)}} 2\text{P}_2\text{O}_3$
 $4\text{P} + 5\text{O}_2 \xrightarrow{\text{(Oxidation)}} 2\text{P}_2\text{O}_5$
26. (b) $2\text{Fe}(\text{s}) + \text{O}_2(\text{g}) + 4\text{H}^+(\text{aq}) \longrightarrow 2\text{Fe}^{2+}(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
27. (c) Gold is least reactive hence does not corrode at all.



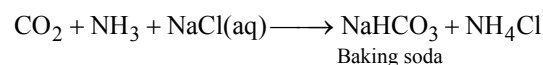
In the given reaction H_2S undergoes oxidation, hence behave as a reducing agent.



31. (a) Cu is more reactive than Ag.

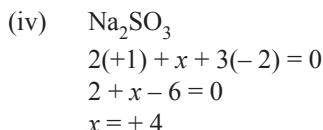
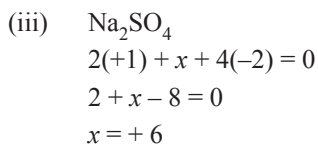
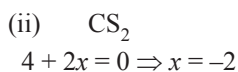


32. (b) $\text{Zn}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Zn}(\text{s})$; reduction
33. (b) $\text{HCl} + \text{Na}_2\text{CO}_3 \longrightarrow \text{NaCl}(\text{aq}) + \text{CO}_2 + \text{H}_2\text{O}$
(A) (B) (C) (D)



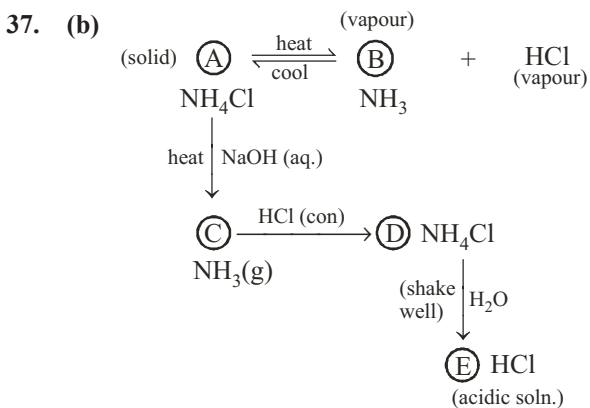
Hence A & B are HCl and Na_2CO_3

34. (d) Water gas $\rightarrow \text{CO} + \text{H}_2$
35. (*) Let the oxidation state of S be x
(i) H_2S
 $\therefore 2 + x = 0$
 $x = -2$



None of these, option is correct.

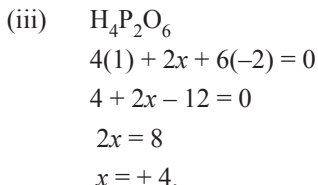
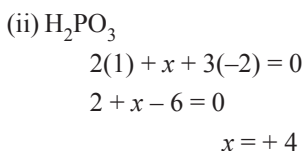
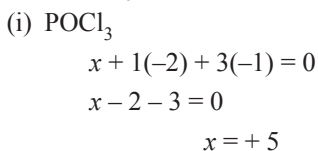
36. (c) Conversion of liquid to gas is endothermic process.



A = NH_4Cl ; D = NH_4Cl

Hence correct statement is: A and D are chemically same.

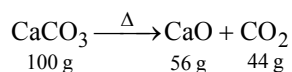
38. (a) Let the oxidation state of P-atom in POCl_3 , H_2PO_3 and $\text{H}_4\text{P}_2\text{O}_6$ be x .



39. (d) Respiration is oxidation and exothermic process.

40. (d) Layer of silver sulphide deposited on the silver articles when exposed to air.

41. (a) On thermal decomposition of calcium carbonate



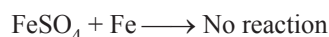
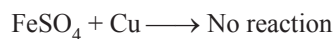
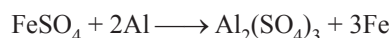
44 g CO_2 is formed from 100 g CaCO_3

4.40 g CO is formed from $\frac{100}{44} \times 44 = 10$ g CaCO_3

If mass of CaCO_3 is 10 g, then weight of empty test tube = $30.08 - 10.0 = 20.08$ g

42. (d) A-III, B-I, C-II, D-IV

43. (d) Zn and Al are more reactive than iron, therefore they will displace iron from its salt solution giving black residue, while Cu being less reactive than iron will not be able to displace iron from its salt solution.



44. (c) redox reaction

45. (a) dry $\text{Ca}(\text{OH})_2$

46. (a) MnO_2 is getting reduced whereas HCl is getting oxidized

47. (b) Basic oxide

48. (b) Reaction will not occur

49. (d)

50. (c)

51. (a)

52. (a)

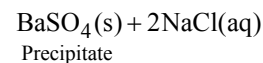
53. (b)

54. (a) Chlorine displaces iodine from potassium iodide solution.

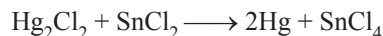
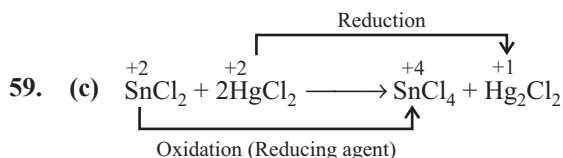
55. (d) When copper strip is placed in FeSO_4 solution, colour of the solution does not change.

56. (d) Decomposition of vegetable matter into compost is an exothermic reaction.

57. (a) $\text{Na}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \longrightarrow$



58. (a) A combination reaction is a reaction where two or more elements or compounds combine to form a single compound. Hydrogen and chlorine combine to give hydrogen chloride.



60. (b) Corrosion occurs due to oxidation of iron.

Chemical Reactions and Equations

61. (a)
62. (d) A reducing agent is a substance which oxidizes itself but reduces others i.e., loses electrons.
63. (a)
64. $A \rightarrow (q)$ $B \rightarrow (r)$ $C \rightarrow (p)$ $D \rightarrow (s)$
65. (a)
66. combination 67. exothermic
68. endothermic 69. displacement
70. double displacement 71. insoluble
72. loss 73. Decomposition reaction
74. oxidation 75. CaO (s) and CO₂ (g)
76. products
77. True 78. True 79. True 80. True
81. True 82. False 83. True 84. True
85. True

2

Acids, Bases and Salts

Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

- During the preparation of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to:
 - absorb the evolved gas.
 - moisten the gas.
 - absorb moisture from the gas.
 - absorb Cl^- ions from the evolved gas.
- To protect tooth decay we are advised to brush our teeth regularly. The nature of the tooth paste commonly used is:
 - Acidic
 - Neutral
 - Basic
 - Corrosive
- Which of the following is not a mineral acid?
 - Hydrochloric acid
 - Citric acid
 - Sulphuric acid
 - Nitric acid
- Which of the following acid is present in sour milk ?
 - glycolic acid
 - lactic acid
 - citric acid
 - tartaric acid
- An aqueous solution 'A' turns phenolphthalein solution pink. On addition of an aqueous solution 'B' to 'A', the pink colour disappears. The following statement is true for solution 'A' and 'B'.
 - A is strongly basic and B is a weak base.
 - A is strongly acidic and B is a weak acid.
 - A has pH greater than 7 and B has pH less than 7.
 - A has pH less than 7 and B has pH greater than 7.
- The product of complete neutralization of H_3PO_3 with NaOH is :
 - NaH_2PO_3
 - Na_2HPO_3
 - Na_3PO_3
 - $\text{Na}_3(\text{HPO}_3)_2$
- Chemical A is used for water softening to remove temporary hardness. 'A' reacts with sodium carbonate to generate caustic soda. What is 'A'?
 - Gypsum
 - Slaked lime
 - Quick lime
 - Lime stone
- An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change?
 - Baking powder
 - Lime
 - Ammonium hydroxide solution
 - Hydrochloric acid
- A blue litmus paper was first dipped in dil. HCl and then in dil. NaOH solution. It was observed that the colour of the litmus paper –
 - changed to red.
 - changed first to red and then to blue.
 - changed blue to colourless.
 - remains blue in both the solutions.
- The acid used in making vinegar is –
 - formic acid
 - acetic acid
 - sulphuric acid
 - nitric acid
- $\text{CuO} + (\text{X}) \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$. Here (X) is –
 - CuSO_4
 - HCl
 - H_2SO_4
 - HNO_3
- Reaction of an acid with a base is known as –
 - decomposition
 - combination
 - redox reaction
 - neutralization

Acids, Bases and Salts

13. When CO_2 is passed through lime water, it turns milky. The milkiness is due to formation of –
- (a) CaCO_3 (b) Ca(OH)_2
(c) H_2O (d) CO_2
14. Antacids contain –
- (a) weak base (b) weak acid
(c) strong base (d) strong acid
15. $2\text{NaOH} + \text{MgSO}_4 \longrightarrow ?$
- (a) $\text{MgO} + \text{Na}_2\text{SO}_4$ (b) $\text{Mg(OH)}_2 + \text{Na}_2\text{SO}_4$
(c) $\text{Mg(OH)}_2 + \text{Na}_2\text{O}$ (d) $\text{MgO} + \text{Na}_2\text{O}$
16. Bleaching powder gives smell of chlorine because it –
- (a) is unstable.
(b) gives chlorine on exposure to atmosphere.
(c) is a mixture of chlorine and slaked lime.
(d) contains excess of chlorine.
17. Plaster of paris is made from –
- (a) lime stone (b) slaked lime
(c) quick lime (d) gypsum
18. Chemical formula of baking soda is –
- (a) MgSO_4 (b) Na_2CO_3
(c) NaHCO_3 (d) MgCO_3
19. Washing soda has the formula –
- (a) $\text{Na}_2\text{CO}_3 \cdot 7\text{H}_2\text{O}$ (b) $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
(c) $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ (d) Na_2CO_3
20. Plaster of Paris hardens by –
- (a) giving of CO_2
(b) changing into CaCO_3
(c) combining with water
(d) giving out water
21. Which of the following is acidic in nature?
- (a) apple juice (b) soap solution
(c) slaked lime (d) lime
22. The reaction of metal with acid results in the formation of–
- (a) only hydrogen gas
(b) only salt
(c) both salt and hydrogen gas
(d) none of these
23. Which of the following acid does not react with metals?
- (a) sulphuric acid (b) phosphoric acid
(c) carbonic acid (d) nitric acid
24. When an oxide of a non-metal reacts with water which of the following is formed?
- (a) Acid (b) Base
(c) Salt (d) None of these
25. ‘Alum’ is an example of –
- (a) single salt (b) double salt
(c) acids (d) none of these
26. Which of the following statements is correct about an aqueous solution of an acid and of a base?
- (i) Higher the pH, stronger the acid
(ii) Higher the pH, weaker the acid
(iii) Lower the pH, stronger the base
(iv) Lower the pH, weaker the base
- (a) (i) and (iii) (b) (ii) and (iii)
(c) (i) and (iv) (d) (ii) and (iv)
27. A sample of soil is mixed with water and allowed to settle. The clear supernatant solution turns the pH paper yellowish-orange. Which of the following would change the colour of this pH paper to greenish-blue?
- (a) Lemon juice (b) Vinegar
(c) Common salt (d) An antacid
28. Plaster of paris is obtained –
- (a) by adding water to calcium sulphate.
(b) by adding sulphuric acid to calcium hydroxide.
(c) by heating gypsum to a very high temperature.
(d) by heating gypsum to 373 K.
29. What is the term for the positive and negative ions of a compound breaking apart in solution –
- (a) Conglomeration (b) Oxidation
(c) Dissociation (d) None of the Above
30. Of the aqueous solutions listed below, which would be the best conductor of an electric current?
- (a) HCl (b) H_3PO_4
(c) HOCl (d) CH_3COOH
31. Common salt besides being used in kitchen can also be used as the raw material for making
- (i) washing soda (ii) bleaching powder
(iii) baking soda (iv) slaked lime
- (a) (i) and (ii) (b) (i), (ii) and (iv)
(c) (i) and (iii) (d) (i), (iii) and (iv)
32. Which salt can be classified as an acid salt?
- (a) Na_2SO_4 (b) BiOCl
(c) Pb(OH)Cl (d) Na_2HPO_4

33. An element X reacts with dilute H_2SO_4 as well as with NaOH to produce salt and $\text{H}_2(\text{g})$. Hence, it may be concluded that:
- X is an electropositive element.
 - oxide of X is basic in nature.
 - oxide of X is acidic in nature.
 - X is an electronegative element.
- (a) I, II, III (b) IV, I, II
(c) III, IV, I (d) II, III, IV
34. The turmeric solution will turn red by an aqueous solution of -
- (a) potassium acetate (b) copper sulphate
(c) sodium sulphate (d) ferric chloride
35. The correct order of increasing pH values of the aqueous solutions of baking soda, rock salt, washing soda and slaked lime is
- (a) Baking Soda < Rock Salt < Washing Soda < Slaked lime
(b) Rock Salt < Baking Soda < Washing Soda < Slaked lime
(c) Slaked lime < Washing Soda < Rock Salt < Baking Soda
(d) Washing Soda < Baking Soda < Rock Salt < Slaked lime
36. You are provided with aqueous solutions of three salts — A, B and C, 2-3 drops of blue litmus solution, red litmus solution and phenolphthalein were added to each of these solution in separate experiments. The change in colours of different indicators were recorded in the following table:

Sample	With blue litmus solution	With red litmus solution	With phenolphthalein solution
A	No change	No change	No change
B	Turns red	No change	No change
C	No change	Turns blue	Turns pink

On the basis of above observations, identify A, B, and C from the following options:

- (a) A = NH_4Cl , B = NaCl, C = CH_3COONa
(b) A = NH_4Cl , B = CH_3COONa , C = NaCl
(c) A = NaCl, B = NH_4Cl , C = CH_3COONa
(d) A = CH_3COONa , B = NH_4Cl , C = NaCl
37. Aqua regia is the mixture of conc. HCl and conc. HNO_3 in the ratio:
- (a) 1 : 3 (b) 2 : 3
(c) 3 : 1 (d) 3 : 2

38. The chemical formula of 'Plaster of Paris' is
- (a) $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ (b) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
(c) $\text{CaSO}_4 \cdot \text{H}_2\text{O}$ (d) $\text{CaSO}_4 \cdot \frac{3}{2}\text{H}_2\text{O}$
39. A solution turns red litmus blue. Its pH is likely to be -
- (a) 2 (b) 4
(c) 5 (d) 10
40. A solution reacts with crushed egg-shells to give a gas that turns lime water milky. The solution contains -
- (a) NaCl (b) HCl
(c) LiCl (d) KCl
41. 10 mL of a solution of NaOH is found to be completely neutralised by 8 mL of a given solution of HCl. If we take 20 mL of the same solution of NaOH, the amount of HCl solution (the same solution as before) required to neutralise will be -
- (a) 4 mL (b) 8 mL
(c) 12 mL (d) 16 mL
42. Which of the following type of medicines is used for treating indigestion ?
- (a) Antibiotic (b) Analgesic
(c) Antacid (d) Antiseptic
43. Which of the following reaction does not results in the evolution of H_2 gas?
- (a) dilute sulphuric acid reacts with zinc granules.
(b) dilute hydrochloric acid reacts with magnesium ribbon.
(c) dilute sulphuric acid reacts with aluminium powder.
(d) dilute hydrochloric acid with dilute sodium hydroxide solution.

Case/Passage Based Questions

DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

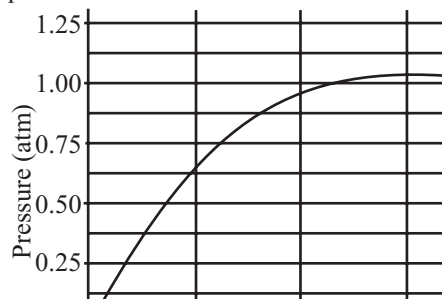
Marble's popularity began in ancient Rome and Greece, where white and off-white marble were used to construct a variety of structures, from hand-held sculptures to massive pillars and buildings.



[From CBSE Question Bank-2021]

Acids, Bases and Salts

44. The substance not likely to contain CaCO_3 is
 (a) Dolomite (b) A marble statue
 (c) Calcined gypsum (d) Sea shells.
45. A student added 10g of calcium carbonate in a rigid container, secured it tightly and started to heat it. After some time, an increase in pressure was observed, the pressure reading was then noted at intervals of 5 mins and plotted against time, in a graph as shown below. During which time interval did maximum decomposition took place?



- (a) 15-20 min (b) 10-15 min
 (c) 5-10 min (d) 0-5 min
46. Gas A, obtained above is a reactant for a very important biochemical process which occurs in the presence of sunlight. Identify the name of the process -
 (a) Respiration (b) Photosynthesis
 (c) Transpiration (d) Photolysis
47. Marble statues are corroded or stained when they repeatedly come into contact with polluted rain water. Identify the main reason.

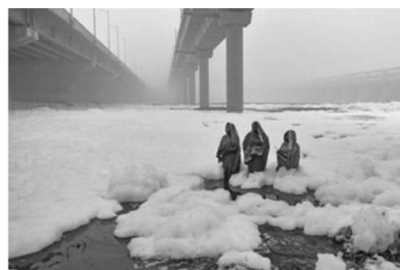


- (a) decomposition of calcium carbonate to calcium oxide
 (b) polluted water is basic in nature hence it reacts with calcium carbonate
 (c) polluted water is acidic in nature hence it reacts with calcium carbonate
 (d) calcium carbonate dissolves in water to give calcium hydroxide.
48. Calcium oxide can be reduced to calcium, by heating with sodium metal. Which compound would act as an oxidizing agent in the above process?
 (a) sodium (b) sodium oxide
 (c) calcium (d) calcium oxide

Case/Passage - 2

Frothing in Yamuna:

The primary reason behind the formation of the toxic foam is high phosphate content in the wastewater because of detergents used in dyeing industries, dhobi ghats and households. Yamuna's pollution level is so bad that parts of it have been labelled 'dead' as there is no oxygen in it for aquatic life to survive.



[From CBSE Question Bank-2021]

49. Predict the pH value of the water of river Yamuna if the reason for froth is high content of detergents dissolved in it.
 (a) 10-11 (b) 5-7
 (c) 2-5 (d) 7
50. Which of the following statements is correct for the water with detergents dissolved in it?
 (a) low concentration of hydroxide ion (OH^-) and high concentration of hydronium ion (H_3O^+)
 (b) high concentration of hydroxide ion (OH^-) and low concentration of hydronium ion (H_3O^+)
 (c) high concentration of hydroxide ion (OH^-) as well as hydronium ion (H_3O^+)
 (d) equal concentration of both hydroxide ion (OH^-) and hydronium ion (H_3O^+).

The table provides the pH value of four solutions P, Q, R and S

Solution	pH value
P	2
Q	9
R	5
S	11

51. Which of the following correctly represents the solutions in increasing order of their hydronium ion concentration?
 (a) $\text{P} > \text{Q} > \text{R} > \text{S}$ (b) $\text{P} > \text{S} > \text{Q} > \text{R}$
 (c) $\text{S} < \text{Q} < \text{R} < \text{P}$ (d) $\text{S} < \text{P} < \text{Q} < \text{R}$
52. High content of phosphate ion in river Yamuna may lead to:
 (a) decreased level of dissolved oxygen and increased growth of algae
 (b) decreased level of dissolved oxygen and no effect of growth of algae

- (c) increased level of dissolved oxygen and increased growth of algae
 (d) decreased level of dissolved oxygen and decreased growth of algae
53. If a sample of water containing detergents is provided to you, which of the following methods will you adopt to neutralize it?
- (a) Treating the water with baking soda
 (b) Treating the water with vinegar
 (c) Treating the water with caustic soda
 (d) Treating the water with washing soda

» Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
 (b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
 (c) If **Assertion** is **correct** but **Reason** is **incorrect**.
 (d) If **Assertion** is **incorrect** but **Reason** is **correct**.
54. **Assertion :** Aqueous solution of ammonium nitrate turns blue litmus red.
Reason : Ammonium nitrate is salt of strong acid and strong base.
55. **Assertion :** All alkalis are bases but all bases are not alkali.
Reason : Water soluble bases are alkali.
56. **Assertion :** Magnesium hydroxide is used as antacid.
Reason : Magnesium hydroxide is a strong base.
57. **Assertion :** Dry HCl gas does not change the colour of blue litmus paper to red.
Reason : Dry HCl gas is strongly basic.
58. **Assertion :** Sodium hydrogen carbonate is used in fire extinguisher.
Reason : Sodium hydrogen carbonate is a mild base.
59. **Assertion :** H_2CO_3 is a strong acid.
Reason : A strong acid dissociates completely or almost completely in water.
60. **Assertion :** Salts are the products of an acid-base reaction.
Reason : Salt may be acidic or basic.
61. **Assertion :** On adding H_2SO_4 to water the resulting aqueous solution get corrosive.

Reason : Hydronium ions are responsible for corrosive action.

» Match the Following

DIRECTIONS : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

62. Column II gives nature of acids and bases mention in column I, match them correctly.

Column I	Column II
(A) HCl	(p) Strong acid
(B) HCN	(q) Weak acid
(C) NaOH	(r) Weak base
(D) NH_4OH	(s) Strong base

63. Match the salts given in column I with the corresponding acid and base given in column II.

Column I	Column II
(A) KNO_3	(p) Nitric acid, Silver hydroxide
(B) AgNO_3	(q) Hydrochloric acid, Magnesium hydroxide
(C) MgCl_2	(r) Carbonic acid, Ammonium hydroxide
(D) $(\text{NH}_4)_2\text{CO}_3$	(s) Nitric acid, Potassium hydroxide

64. **Column I**
- (A) NaHCO_3
 (B) NaOH
 (C) KHSO_4
 (D) $\text{Ca}(\text{OH})_2$
- Column II**
- (p) Baking soda
 (q) Alkaline
 (r) Acidic salt
 (s) Bitter taste

» Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

65. Oxy acids contains atoms in addition to hydrogen atom.
66. An acid that contains more than one acidic hydrogen atom is called a
67. When an acid reacts with a metal, gas is evolved and a corresponding is formed.
68. When an acid reacts with a metal carbonate or metal hydrogen carbonate, it gives the corresponding salt, gas and

Acids, Bases and Salts

69. is the fixed number of water molecules chemically attached to each formula unit of a salt in its crystalline form.
70. ENO contains and is in nature.
71. Anhydrous sodium carbonate is commonly known as
72. Soda-acid fire extinguisher contains a solution of sodium hydrogen carbonate and
73. An alkali reacts with ammonium salts to produce corresponding salt, water and evolve
74. Zn(OH)_2 is a base.
76. Mixing concentrated acids or bases with water is a highly endothermic process.
77. Acids and bases neutralise each other to form corresponding salts and water.
78. The colour of caustic soda turns pink when phenolphthalein is added.
79. Hydrogen chloride gas turns the blue litmus red.
80. Sodium hydrogen carbonate is used in fire extinguisher.
81. Washing soda on strong heating gives sodium oxide and carbon dioxide.
82. Plaster of paris is obtained by heating gypsum at 373 K in a kiln.
83. Bleaching powder is used for disinfecting drinking water.
84. Solution of sodium hydrogen carbonate is alkaline in nature.

True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

75. Acidic nature of a substance is due to the formation of $\text{H}^+(\text{aq})$ ions in solution.

ANSWER KEY & SOLUTIONS

1. (c) Calcium chloride is good dehydrating agent so it is used to absorb moisture from the hydrogen chloride gas.
2. (c) The tooth paste commonly used is basic which help in neutralisation of the extra acid formed during tooth decay.
3. (b) Citric acid is an example of organic acid or edible acid while HCl, H₂SO₄ and HNO₃ are mineral acids.
4. (b) Lactic acid is present in sour milk.
5. (c) Aqueous solution of A is basic while that of B is acidic. Therefore A has pH greater than 7 and B has pH less than 7.
6. (b) H₃PO₃ is a dibasic acid.
- $$\text{H}_3\text{PO}_3 \rightleftharpoons \text{H}^+ + \text{H}_2\text{PO}_3^-$$
- $$\text{H}_2\text{PO}_3 \rightleftharpoons \text{H}^+ + \text{HPO}_3^{2-}$$
7. (b) Chemical 'A' is calcium hydroxide (slaked lime).
- $$\text{Ca}(\text{OH})_2 + \text{Na}_2\text{CO}_3 \longrightarrow 2\text{NaOH} + \text{CaCO}_3 \downarrow$$
8. (d) The given solution is basic in nature when excess of HCl is added, it becomes acidic.
9. (b) In acid, blue litmus changes to red and in basic solution red litmus changes to blue. Hence blue litmus first changes its color to red and then to blue.
10. (b) 6 - 12% acetic acid is known as vinegar.
11. (c) $\text{CuO} + \text{H}_2\text{SO}_4 \longrightarrow \text{CuSO}_4 + \text{H}_2\text{O}$
12. (d)
13. (a) $\text{Ca}(\text{OH})_2 + \text{CO}_2 \longrightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
14. (a) Antacids are weak bases which are given when a patient is suffering from acidity. These antacids neutralise the acid and give relief to patient.
15. (b) $2\text{NaOH} + \text{MgSO}_4 \longrightarrow \text{Mg}(\text{OH})_2 + \text{Na}_2\text{SO}_4$
16. (b) 17. (d) 18. (c) 19. (b)
20. (c) 21. (a) 22. (c)
23. (c) Carbonic acid is a weak and so it does not react with metal.
24. (a) A non metal oxide forms acid on treatment with water. e.g.,
- $$\text{CO}_2 + \text{H}_2\text{O} \longrightarrow \text{H}_2\text{CO}_3$$
- (Carbonic acid)
25. (b) 26. (d) 27. (d) 28. (d)
29. (c) Acids and bases go through a process of dissociation when they are put into solution. They break apart into positively and negatively charged particles.
30. (a) HCl is a strong acid.
31. (c)
32. (d) Because it can furnish H⁺ ions in solution.
33. (a) Element X can react with both acid and base. It shows that element X is amphoteric in nature and is an electropositive element.
34. (a) $\text{CH}_3\text{COOK} + \text{H}_2\text{O} \longrightarrow \underset{\text{Strong base}}{\text{KOH}} + \text{CH}_3\text{COOH}$
- The solution will be basic in nature so it turns turmeric to red.
35. (b) Rock Salt (NaCl) < Baking Soda (NaHCO₃) < Washing Soda (Na₂CO₃) < Slaked lime (CaCO₃)
36. (c) A neutral salt brings no change with blue litmus solution, red litmus solution and with phenolphthalein solution. An acidic salt turns blue litmus to red and brings no change in red litmus solution as well as in phenolphthalein solution.
- Basic salt turns red litmus to blue and also turns phenolphthalein solution pink.
- | Sample | Solution | With blue litmus solution | With red litmus solution | With phenolphthalein solution |
|--------|------------------------------------|---------------------------|--------------------------|-------------------------------|
| A | Neutral salt (NaCl) | No change | No change | No change |
| B | Acidic salt (NH ₄ Cl) | Turns red | No change | No change |
| C | Basic salt (CH ₃ COONa) | No change | Turns blue | Turns pink |
37. (c) Aqua-regia is 3 part conc. HCl and 1 part conc. HNO₃.
38. (a) Plaster of paris is calcium sulphate hemihydrate.
39. (d) The red litmus solution turns blue in basic solution. The pH of basic solution is more than 7.

Acids, Bases and Salts

40. (b) Since the gas produced turns lime water milky so the gas is CO_2 . The egg-shell is made of CaCO_3 which reacts with an acid (dil. HCl) to produce CO_2 .
- $$\text{CaCO}_3 + 2\text{HCl} \longrightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2\uparrow$$
41. (d) Since 10 mL of NaOH requires $\text{HCl} = 8\text{mL}$
- 20 mL of NaOH will require $\text{HCl} = \frac{8}{10} \times 20\text{ mL}$
- $$= 16\text{ mL}$$
42. (c) We use antacids for treating indigestion.
43. (d) Zinc + Sulphuric acid \longrightarrow
- Zinc sulphate + Hydrogen
- $$\text{Zn(s)} + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$$
- (b) Magnesium + Hydrochloric acid \longrightarrow
- Magnesium chloride + Hydrogen
- $$\text{Mg(s)} + 2\text{HCl(aq)} \longrightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})$$
- (c) Aluminium + Sulphuric acid \longrightarrow
- Aluminium sulphate + Hydrogen
- $$2\text{Al(s)} + 3\text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{Al}_2(\text{SO}_4)_3(\text{aq}) + 3\text{H}_2(\text{g})$$
- (d) dilute Hydrochloric acid + dilute sodium hydroxide \longrightarrow sodiumchloride + water
- $$2\text{HCl} + 2\text{NaOH} \longrightarrow 2\text{NaCl} + 2\text{H}_2\text{O}$$
44. (c) Calcined gypsum is $\text{CaSO}_4 \cdot -\text{H}_2\text{O}$
45. (d) 0-5 min
46. (b) Gas is CO_2 which is a important reactant in photosynthesis process.
47. (c) polluted water is acidic in nature hence it reacts with calcium carbonate
48. (d) calcium oxide
49. (a)
50. (b)
51. (c)
52. (a)
53. (b)
54. (c) Ammonium nitrate is salt of strong acid and weak base.
55. (a) Bases generate hydroxide ions in water hence water soluble bases are called alkalis.
56. (c) Magnesium hydroxide is a mild base and neutralise the excess acid in the stomach.
57. (c) Dry HCl gas does not show acidic character in absence of water. Therefore do not change the colour of blue litmus in dry condition.
58. (b) Sodium hydrogen carbonate react with acid present in fire extinguisher to produce carbon dioxide gas.
59. (d) H_2CO_3 (carbonic acid) is a weak acid.
60. (b)
61. (a) Because H_2SO_4 is a strong acid, it readily forms hydronium ions when dissolved in water which are responsible for its corrosive action.
62. A \rightarrow (p); B \rightarrow (q); C \rightarrow (s); D \rightarrow (r)
63. A \rightarrow (s); B \rightarrow (p); C \rightarrow (q); D \rightarrow (r)
64. A \rightarrow (p, q, r); B \rightarrow (q, s); C \rightarrow (q, r); D \rightarrow (q, s)
65. Oxygen
66. Polyprotic acid
67. Hydrogen, salt
68. Carbon dioxide, water
69. Water of crystallisation
70. Sodium hydrogen carbonate, basic
71. Soda ash
72. Sulphuric acid
73. Ammonia
74. Diacidic
75. True
76. False
77. True
78. True
79. False
80. True
81. False
82. True
83. True
84. True

3

Metals and Non-Metals

Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

- Which of the following metal is liquid at ordinary temperature?
(a) Aluminium (b) Mercury
(c) Magnesium (d) Potassium
- The atomic number of an element Y is 16. The number of electrons in Y^{2-} ion will be:
(a) 16 (b) 17
(c) 18 (d) 20
- Which of the following elements will form basic oxides?
(a) Barium (b) Aluminium
(c) Carbon (d) Phosphorus
- Which one of the following is not correct regarding the electrolytic refining of copper?
(a) Basic $Cu(OH)_2$ solution is used as cathode.
(b) Acidified $CuSO_4$ solution is used as electrolyte.
(c) Impure Cu is taken as cathode
(d) Cu^{2+} ion gets collected at anode.
- Which of the following compound is covalent in nature?
(a) Carbon tetrachloride (b) Ammonium chloride
(c) Lithium chloride (d) Calcium chloride
- A student by mistake used a wet gas jar to collect sulphur dioxide. Which one of the following tests of the gas is likely to fail ?
(a) Odour
(b) Effect on acidified $K_2Cr_2O_7$ solution
(c) Solubility test
(d) None of these
- Silicon is used in :
(a) solar energy devices (b) semiconductors
(c) transistors (d) all of these
- Which of the following is not a characteristics of metal ?
(a) Malleable (b) Electropositive nature
(c) Ductile (d) None of these
- $Zn + H_2O$ (Steam) \longrightarrow A + B, In the equation A and B are –
(a) Zn, H only (b) ZnH_2 and O_2
(c) ZnO_2 & O_2 (d) ZnO & H_2
- Removal of impurities from ore is known as –
(a) crushing and grinding (b) concentration of ore
(c) calcination (d) roasting
- Froth floatation method is used for the concentration of –
(a) oxide ores (b) sulphide ores
(c) sulphate ores (d) halide ores
- Heating of concentrated ore in absence of air for conversion into oxide ore is known as –
(a) roasting (b) calcination
(c) reduction (d) none of these
- Pure gold is –
(a) 24 carats (b) 22 carats
(c) 20 carats (d) 18 carats
- What is anode mud ?
(a) Fan of anode
(b) Metal of anode
(c) Impurities collected at anode in electrolysis during purification of metals
(d) All of these
- Which of the following pairs will give displacement reactions?
(a) $ZnSO_4$ solution and aluminium metal
(b) $MgCl_2$ solution and aluminium metal
(c) $FeSO_4$ solution and silver metal
(d) $AgNO_3$ solution and copper metal.

Metals and Non-Metals

16. Which of the following is a chemical method for preventing an iron frying pan from rusting?
- applying grease
 - applying paint
 - applying a coating of zinc
 - all of the above
17. An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be –
- calcium
 - carbon
 - silicon
 - iron
18. Aluminium does not oxidise readily in air because –
- it is high in the electrochemical series.
 - it is low in the electrochemical series.
 - the metal does not combine with oxygen.
 - the metal is covered with a layer of oxide which does not rub off.
19. The correct order of increasing chemical reactivity is –
- Zn < Fe < Mg < K
 - Fe < Mg < Zn < K
 - Fe < Mg < K < Zn
 - Fe < Zn < Mg < K
20. The least malleable is –
- aluminium
 - silver
 - gold
 - carbon
21. The metal that reacts with cold water is –
- mercury
 - sodium
 - zinc
 - tungsten
22. The only metal that is liquid at room temperature is –
- mercury
 - sodium
 - zinc
 - tungsten
23. The process of extraction of metal from its ores, is known as –
- concentration
 - calcination
 - purification
 - metallurgy
24. The compound from which metal is extracted economically is –
- slag
 - gangue
 - ore
 - mineral
25. The process to remove unwanted impurities from the ore is called –
- purification
 - calcination
 - bassemmerisation
 - concentration
26. The process to heat the ore in the presence of excess supply of air below its melting point is called –
- roasting
 - calcination
 - smelting
 - liquation
27. Graphite is a/an –
- alloy
 - metal
 - metalloid
 - non-metal
28. One of the constituents of amalgam is –
- aluminium
 - copper
 - iron
 - mercury
29. Which of the following metal reacts with water/steam to produce oxide instead of hydroxide ?
- Sodium
 - Potassium
 - Calcium
 - Magnesium
30. The white phosphorus is stored
- in air
 - under water
 - under kerosene
 - under CS₂
31. Sodium is obtained by the electrolysis of –
- an aqueous solution of sodium chloride
 - an aqueous solution of sodium hydroxide
 - fused sodium chloride
 - fused sodium sulphate
32. In the combined state, zinc is mainly found as –
- chloride
 - bromide
 - oxide
 - sulphide
33. Which of the following is incorrect?
- Chalcocite – Copper
 - Magnetite – Iron
 - Calamine – Aluminium
 - Galena – Lead
34. Among Mg, Cu, Fe, Zn the metal that does not produce hydrogen gas in reaction with hydrochloric acid is
- Cu
 - Zn
 - Mg
 - Fe
35. The major products of the following reaction,

$$\text{ZnS}(s) + \text{O}_2(g) \xrightarrow{\text{Heat}} \dots\dots\dots\text{are}$$
 - ZnO and SO₂
 - ZnSO₄ and SO₃
 - ZnSO₄ and SO₂
 - Zn and SO₂
36. Choose the incorrect pair
- NO - Neutral oxide
 - Cl₂O₇ - Acidic oxide
 - MgO - Basic Oxide
 - P₄O₁₀ - Basic oxide
37. Metal present in chloroplast is
- Iron
 - Copper
 - Magnesium
 - Cobalt

38. Magnesium ribbon is rubbed with sand paper before making it to burn. The reason of rubbing the ribbon is to:
- remove moisture condensed over the surface of ribbon.
 - generate heat due to exothermic reaction.
 - remove magnesium oxide formed over the surface of magnesium.
 - mix silicon from sand paper (silicon dioxide) with magnesium for lowering ignition temperature of the ribbon.
39. The element that cannot be used as a reducing agent is
- carbon
 - aluminium
 - sulphur
 - sodium
40. Al_2O_3 reacts with
- only water
 - only acids
 - only alkalis
 - both acids and alkalis
41. Which of the following is an example of neutral oxide?
- Fe_2O_3
 - Al_2O_3
 - CO
 - NO_2
42. A metal 'M' of moderate reactivity is present as its sulphide 'X'. On heating in air, 'X' converts into its oxide 'Y' and a gas evolves. On heating 'Y' and 'X' together, the metal 'M' is produced. 'X' and 'Y' respectively are
- 'X' cuprous sulphide, 'Y' cuprous oxide
 - 'X' cupric sulphide, 'Y' cupric oxide
 - 'X' sodium sulphide, 'Y' sodium oxide
 - 'X' calcium sulphide, 'Y' calcium oxide
43. Which of the following metals react with conc. sulphuric acid but does not react with a solution of ferrous sulphate?
- Cu
 - Zn
 - Fe
 - Mg
44. The formula of phosphate salt of a metal is MPO_4 . The formula of its nitrate salt will be
- MNO_3
 - $\text{M}(\text{NO}_3)_2$
 - $\text{M}_2(\text{NO}_3)_3$
 - $\text{M}(\text{NO}_3)_3$
45. Solder is an alloy of
- Pb and Sn
 - Zn and Pb
 - Pb and Zn
 - Zn and Sn
46. The following observations are given for four metals:
- Metal H does not react with dilute HCl.
 - Metal K reacts with warm water.
 - Metal L does not react with water but displaces metal H from its aqueous salt solution.
 - Metal M reacts with cold water.
- Choose the correct decreasing order of reactivity of these metals amongst the following:
- $\text{M} > \text{L} > \text{H} > \text{K}$
 - $\text{K} > \text{M} > \text{H} > \text{L}$
 - $\text{M} > \text{K} > \text{L} > \text{H}$
 - $\text{L} > \text{H} > \text{K} > \text{M}$
47. _____ gas is evolved when Mn react with very dilute HNO_3
- NO_2
 - H_2
 - N_2O
 - NO
48. _____ alloy is used for welding electrical wires
- Solder
 - German silver
 - Stainless steel
 - Gun metal
49. Aqueous solution of CsO_2 is :
- Basic
 - Neutral
 - Acidic
 - Amphoteric
50. Which of the following will give displacement reactions ?
- NaCl solution and copper metal
 - MgCl_2 solution and aluminium metal
 - FeSO_4 solution and silver metal
 - AgNO_3 solution and copper metal
51. Which of the following methods is suitable for preventing an iron frying pan from rusting ?
- Applying grease
 - Applying paint
 - Applying a coat of zinc
 - All the above
52. An element can react with oxygen to give a compound with high melting point. This compound is also water soluble. The element is likely to be
- Calcium
 - Carbon
 - Silicon
 - Iron
53. Food cans are coated with tin and not with zinc because
- zinc is costlier than tin.
 - zinc has higher melting point than tin.
 - zinc is more reactive than tin.
 - zinc is less reactive than tin.

Case/Passage Based Questions

DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

Metals are electropositive elements. They can easily lose electrons to form ions. Metals show distinguished physical as well as chemical properties. Generally most of the metals are ductile and malleable with exception such as mercury.

Metals and Non-Metals

These properties make them valuable for commercial as well as domestic uses. Reaction of a metal with water is one of important chemical property. Metals like sodium and potassium reacts with cold water while magnesium reacts with hot water. Metals like aluminium, zinc do not react with hot/cold water but they easily react with steam. When a metal react with hot/cold water the products are metal hydroxide and hydrogen, and when it react with steam, the product are metal oxide and hydrogen. Some metals like sodium, potassium react violently with water.

54. When zinc reacts with steam it produces:
 (a) Zn(OH)_2 (b) ZnO
 (c) O_2 (d) ZnO_2
55. Most ductile metal among the following is:
 (a) Au (b) Ag
 (c) Cu (d) Al
56. During the reaction of calcium with water, pieces of metal start floating due to the formation of:
 (a) Ca(OH)_2 (b) CO_2
 (c) H_2 (d) none of these
57. Consider the reactions:
 $\text{Na(s)} + \text{H}_2\text{O (l)} \longrightarrow \text{NaOH (aq)} + \text{H}_2 \text{ (g)} \dots\dots\dots\text{(i)}$
 $\text{Ca(s)} + \text{H}_2\text{O (l)} \longrightarrow \text{Ca(OH)}_2\text{(aq)} + \text{H}_2\text{(g)} \dots\dots\dots\text{(ii)}$
 (a) Reaction (i) is endothermic reaction.
 (b) Reaction (ii) is endothermic reaction.
 (c) Reaction (ii) is more exothermic than reaction (i).
 (d) Reaction (i) is more exothermic than reaction (ii).
58. Metals can be converted into thin sheet by hammering. This property is known as:
 (a) Ductility (b) Sonorous
 (c) Malleability (d) Both (a) and (c)

Case/Passage - 2

Elements can be classified as metals or non-metals on the basis of their properties. The easiest way to start grouping substances is by comparing their physical properties. Metals, in their pure state, have a shining surface. This property is called metallic luster. metals are generally hard. The hardness varies from metal to metal. some metals are used for making cooking vessels.

59. Metals generally are
 (a) reducing agents
 (b) oxidising agent
 (c) both oxidising and reducing agents
 (d) None of these
60. The most abundant metal in the earth's crust is -
 (a) iron (b) copper
 (c) aluminium (d) mercury

61. The metal that reacts with cold water is -
 (a) mercury (b) sodium
 (c) zinc (d) tungsten
62. Metal present in chloroplast is
 (a) Iron (b) Copper
 (c) Magnesium (d) Cobalt
63. Which of the following metal(s) catch fire on reaction with water?
 (a) Sodium (b) Potassium
 (c) Magnesium (d) both (a) and (b)

Case/Passage - 3

The huge annual loss due to corrosion is a national waste and should be minimized.

Following are some methods which are helpful to prevent corrosion

- (i) Coating the iron surface with paint or oil or grease prevents moist oxygen from coming in contact with the metal and thus effectively prevents rusting of iron.
- (ii) Galvanisation : Iron is blasted with fine sand to make the surface rough dipped in molten zinc and then cooled. A thin layer of zinc forms on the iron surface. Since zinc is more reactive than iron, it acts as a sacrificial metal and is preferentially oxidised thus preventing oxidation of iron.
- (iii) Electroplating with tin, nickel or chromium also prevents rusting.
- (iv) Alloying (mixing iron in its molten state with other metals) prevents rusting. Stainless steel is an alloy of iron with Cr or Ni.
64. The most durable metal plating on iron to protect against corrosion is :
 (a) nickel plating (b) copper plating
 (c) tin plating (d) zinc plating
65. The most convenient method to protect the bottom of ship made of iron is :
 (a) coating it with red lead oxide.
 (b) white tin plating.
 (c) connecting it with Mg block.
 (d) connecting it with Pb block.
66. The best way to prevent rusting of iron is :
 (a) making it cathode
 (b) putting in saline water
 (c) both of these
 (d) none of these

Case/Passage - 4

Some metals are chemically very reactive, whereas others are less reactive or unreactive. On the basis of vigourness of reactions of various metals with oxygen, water and acids, as well as displacement reactions, the metals have been arranged in a group or series according to their chemical reactivity. The arrangement of metals in a vertical column in the order of decreasing reactivities is called reactivity series of metals (or activity series of metals). In reactivity series, the most reactive metal is placed at the top whereas the least reactive metal is placed at the bottom. As we come down in the series, the chemical reactivity of metals decreases. Since the metals placed at the bottom of the reactivity series (like silver and gold) are less reactive, so they are usually found in free state (native state) in nature.

67. When metal Z is added to dilute HCl solution, there is no evolution of gas. Metal is :
- (a) K (b) Na
(c) Ag (d) Zn
68. Copper sulphate solution can be safely kept in a container made of :
- (a) aluminium (b) lead
(c) silver (d) zinc
69. Metal always found in free state is :
- (a) gold (b) silver
(c) copper (d) sodium

» Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
- (b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
- (c) If **Assertion** is **correct** but **Reason** is **incorrect**.
- (d) If **Assertion** is **incorrect** but **Reason** is **correct**.

70. **Assertion:** Metals are electropositive elements.

Reason: Metals form positive ions by losing electrons.

71. **Assertion:** Electric wires are made up of copper.

Reason: Non metals are bad conductor of electricity.

72. **Assertion:** Potassium oxide is a basic oxide.

Reason: Solution of potassium oxide in water turns red litmus blue.

73. **Assertion:** Sodium, potassium and magnesium are never found as free elements in nature.

Reason: Sodium, potassium and magnesium are reactive elements.

74. **Assertion:** Carbonate ores are changed into oxides by roasting process.

Reason: It is easier to obtain a metal from its oxides.

75. **Assertion :** Iron is found in the free state in nature.

Reason : Iron is highly reactive element.

76. **Assertion :** Different metals have different reactivities with water and dilute acids.

Reason : Reactivity of a metal depends on its position in the reactivity series.

77. **Assertion :** Zinc becomes dull in moist air.

Reason : Zinc is coated by a thin film of its basic carbonate in moist air.

78. **Assertion :** Zinc is used in the galvanisation of iron.

Reason : Its coating on iron articles increases their life by protecting them from rusting.

79. **Assertion :** Nitrate ores are rarely available.

Reason : Bond dissociation energy of nitrogen is very high.

» Match the Following

DIRECTIONS : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

- | | | |
|------------|------------------------------------|-----------------------|
| 80. | Column-I | Column-II |
| | (A) CaO | (p) Amphoteric oxide |
| | (B) Al ₂ O ₃ | (q) Neutral oxide |
| | (C) SO ₂ | (r) Basic oxide |
| | (D) H ₂ O | (s) Acidic oxide |
| 81. | Column-I | Column-II |
| | (A) Iodine | (p) Liquid metal |
| | (B) Diamond | (q) Liquid non-metal |
| | (C) Mercury | (r) Lustrous |
| | (D) Bromine | (s) Hardest substance |
| 82. | Column-I | Column-II |
| | (A) Good conductor of electricity | (p) Hydrogen |
| | (B) Food preservative | (q) Copper |
| | (C) Allotrope of carbon | (r) Nitrogen |
| | (D) Manufacture of ammonia | (s) Graphite |

Metals and Non-Metals

- | 83. Column-I
(Position of the Metal
in the Activity Series) | Column - II
(Related Reduction
Process) |
|---|---|
| A. The bottom of the series | (p) Electrolysis |
| B. The top of the series | (q) Reduction by heat
alone |
| C. The lower regions of
the series | (r) Found in native
state |
| D. The middle of the
series | (s) Reduction using
carbon or some
other reducing agent |

» Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

84. Metals combine with oxygen to form oxides.
85. Metals above hydrogen in the activity series can displace from dilute acids.
86. The surface of some metals, such as iron, is corroded when they are exposed to moist air for a long period of time. This phenomenon is known as
87. The best conductors of electricity are copper and
88. Manganese and react with very dilute nitric acid to evolve hydrogen gas.
89. An alloy of any metal with mercury is called the electrical conductivity of an alloy is than that of pure metals.
90. Stainless steel contains, and
91. Froth floatation process is used for the concentration of ores.
92. The method of removing volatile matter from carbonate ores is known as
93. Bronze is an alloy of copper and
94. The main ore of copper is
95. In electrolytic refining, impure metal is used as

» True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

96. Metals can form positive ions by losing electrons to non-metals.
97. Different metals have same reactivities with water and dilute acids.
98. A more reactive metal displaces a less reactive metal from its salt solution.
99. Metals occur in nature only as free elements.
100. Aluminium is the most abundant metal in the earth's crust.
101. Mercury and zinc are purified by liquation method.
102. The presence of carbon in pig iron makes it very soft and malleable.
103. Roasting is done for sulphide ores.
104. Reaction that takes place in aluminothermic process is also known as thermite reaction.

ANSWER KEY & SOLUTIONS

1. (b) Mercury is liquid metal at ordinary temperature.
2. (c) The number of electrons is Y^{2-} ion = $16 + 2 = 18$
3. (a) Barium will form basic oxide. Aluminium will form amphoteric oxide while carbon and phosphorus will form acidic oxides.
4. (a) In the process of electrolytic refining, impure metal is made anode and is connected to the positive terminal of battery. Pure metal is made cathode and is connected to the negative terminal of the battery. Cu^{2+} ions from the solution are deposited on the cathode while Cu from impure anode dissolves into the solution and the impurities settle down below anode as anode mud.
5. (a) Carbon tetrachloride is a covalent compound.
6. (d) 7. (d)
8. (d) All are characteristics of metal.
9. (d) 10. (b) 11. (b)
12. (b) Calcination involves heating of the ore below its fusion temperature in absence of air.
13. (a) 14. (c)
15. (d) Copper is more reactive than silver hence displaces silver from silver nitrate solution.
16. (c)
17. (a) $2Ca + O_2 \longrightarrow CaO$ (ionic compound)
 $CaO + H_2O \longrightarrow Ca(OH)_2$
18. (d) 19. (d) 20. (d) 21. (b)
22. (a) 23. (d) 24. (c) 25. (d)
26. (a) 27. (d) 28. (d) 29. (d)
30. (b) 31. (c) 32. (d) 33. (c)
34. (a) Cu does not produce hydrogen gas on reaction with hydrochloric acid. Cu is present below hydrogen in reactivity series, i.e. it is less reactive than hydrogen.
35. (a) $2ZnS(s) + 3O_2(g) \xrightarrow{\Delta} 2ZnO + 2SO_2$
The sulphide ore is heated in presence of air to produce its oxide form at a temperature below the melting point of the metal. The process is known as roasting.
36. (d) Non-metals oxides are acidic in nature.
37. (c) In chloroplast Mg is present.
38. (c) When magnesium is exposed to air, a layer of oxide is formed on its surface and it gets corroded. So, as to remove the layer, magnesium ribbon is rubbed.
39. (c) Sulphur has a tendency to gain electrons. It is a non-metal and cannot be used as reducing agent.
40. (d) Al_2O_3 is an amphoteric oxide, so it can react with both acids and alkalis, e.g.
41. (c) Fe_2O_3 is basic
 Al_2O_3 is amphoteric
CO is neutral
 NO_2 is acidic
42. (a) $Cu_2S + 3 O_2 \longrightarrow 2 Cu_2O + 2SO_2$
 $2 Cu_2O + Cu_2S \longrightarrow 6 Cu + SO_2$
X = Cuprous sulphide, Y = Cuprous oxide
43. (a) Cu reacts with conc. H_2SO_4 on heating but does not react with $FeSO_4$ as it is less reactive than Fe.
44. (d) As $M(NO_3)_3$.
45. (a) Solder is an alloy of Pb and Sn.
46. (c) Metals below hydrogen in a reactivity series does not react with dilute HCl. Medium reactive metals reacts with warm water and highly reactive metals react with cold water.

As per the given information H, K, L and M can be identified as Cu, Mg, Pb and K/Na respectively. So their reactivity order will be $M > K > L > H$ i.e.
 $K > Mg > Pb > Cu$.
47. (b) $Mn + 2HNO_3 \longrightarrow Mn(NO_3)_2 + H_2$.
Hydrogen gas is evolved when Mn reacts with very dilute HNO_3 .
48. (a) Solder alloy is used for welding electrical wires. The constituents of solder alloy are lead and tin.
49. (a) $2CsO_2 + 2H_2O \longrightarrow 2CsOH + H_2O_2 + O_2$
 CsO_2 is the oxide of alkali metal. It is a basic oxide. Due to formation of CsOH its aqueous solution is basic.
50. (d) Copper will displace silver from silver nitrate solution because copper lies above silver in reactivity series of metals.

Metals and Non-Metals

51. (d) All the above methods are helpful in preventing iron pan from rusting.
52. (a) Calcium (Ca) combines with oxygen to form calcium oxide (CaO) which has a high melting point and dissolves in water to form $\text{Ca}(\text{OH})_2$.
53. (c) Zinc is more reactive than tin (zinc is above tin in reactivity series) so it will react with organic acids (present in food) to form poisonous compounds. To avoid this food cans are coated with tin and not with zinc.
54. (b) $\text{Zn}(\text{s}) + \text{H}_2\text{O}(\text{g}) \longrightarrow \text{ZnO}(\text{s}) + \text{H}_2(\text{g})$
Steam
55. (a) Gold is most ductile metal.
56. (c) Hydrogen gas is formed during the reaction which get stick to the surface of the metal and make them float.
57. (d) Reaction (i) is more exothermic than reaction (ii).
58. (c) Malleability.
59. (a) As metals are electropositive in nature and have tendency to lose electrons.
60. (c)
61. (b) It is because of extremely high reactivity of sodium.
62. (c) In chloroplast Mg is present.
63. (d) Sodium and potassium both are extremely reactive and react with water so vigorously. The reaction is highly exothermic so the hydrogen evolved will catch fire.
64. (d) This is because zinc has higher oxidation potential than Ni, Cu and Sn. The process of coating of iron surface with zinc is known as galvanization. Galvanized iron sheets maintain their lustrue due to the formation of protective layer of basic zinc carbonate.
65. (c) To protect the bottom of the ship it is connected with more reactive metal than iron like magnesium. This technique is called cathodic protection.
66. (a) Cathodic protection is best method to prevent iron from rusting. In this method iron is made cathode by application of external current.
Saline water is highly conducting and hence accelerates the formation of rust.
67. (c) Ag does not displace hydrogen from acids since it is below hydrogen in activity series.
68. (c) Since silver is less reactive than copper it does not react with copper sulphate solution.
69. (a) Gold is a noble metal.
70. (a) Metals lose electrons to form positive ions therefore they are known as electropositive elements.
71. (b) Electric wires are made up of copper metal because metal are good conductor of electricity.
72. (b) Potassium is a metal and hence, it forms basic oxide. It turns red litmus blue.
73. (a) Sodium, potassium and magnesium are reactive elements and found at the top of the reactivity series. They do not occur in free state.
74. (d) Carbonate ores are changed into oxides by calcination process.
75. (d)
76. (a) The metals placed at the top of the series are most reactive.
77. (a) 78. (a)
79. (a) The bond dissociation energy of N_2 is very high due to presence of triple bond between two nitrogen atoms. Therefore, nitrate ores are rarely available.
80. $\text{A} \rightarrow (\text{r}); \text{B} \rightarrow (\text{p}); \text{C} \rightarrow (\text{s}); \text{D} \rightarrow (\text{q})$
81. $\text{A} \rightarrow (\text{r}); \text{B} \rightarrow (\text{s}); \text{C} \rightarrow (\text{p}); \text{D} \rightarrow (\text{q})$
82. $\text{A} \rightarrow (\text{q}, \text{s}); \text{B} \rightarrow (\text{r}); \text{C} \rightarrow (\text{s}); \text{D} \rightarrow (\text{r}, \text{p})$
83. $\text{A} \rightarrow (\text{r}); \text{B} \rightarrow (\text{p}); \text{C} \rightarrow (\text{q}); \text{D} \rightarrow (\text{s})$
84. basic 85. hydrogen
86. corrosion 87. silver 88. magnesium
89. amalgam, less 90. iron, chromium, carbon
91. sulphide 92. calcination 93. tin
94. copper pyrite 95. anode
96. True 97. False 98. True
99. False 100. True 101. False
102. False 103. True 104. True

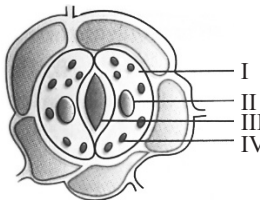
4

Life Processes

Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

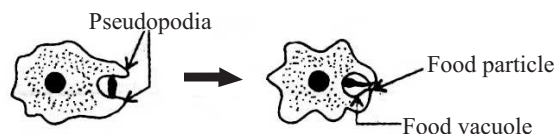
- A pacemaker is meant for
 - transporting liver.
 - transplanting heart.
 - initiation of heart beats.
 - regulation of blood flow.
- Root cap has no role in water absorption because:
 - It has no direct connection with the vascular system
 - It has no cells containing chloroplasts
 - It has no root hairs
 - It has loosely arranged cells.
- Veins can be differentiated from arteries because the veins
 - have valves
 - have hard walls.
 - have pure blood in them.
 - have thick walls.
- The function of the glomerulus and Bowman's capsule of the nephron is to
 - reabsorb water into the blood.
 - eliminate ammonia from the body.
 - reabsorb salts and amino acids.
 - filter the blood and collect the filtrate.
- An advantage of excreting nitrogenous wastes in the form of uric acid is that –
 - It is less toxic and reduces water loss and the subsequent need for water.
 - The formation of uric acid requires a great deal of energy.
 - Uric acid is the first metabolic breakdown products of acids.
 - Uric acid may be excreted through the lungs.
- In the following sketch of stomatal apparatus, parts I, II, III and IV were labelled differently by four students. The correct labelling is:

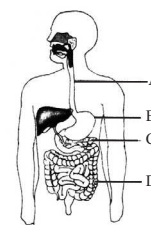


 - I-guard cell, II-stoma, III-starch granule, IV-nucleus
 - I-cytoplasm II-nucleus, III-stoma, IV-chloroplast
 - I-guard cell, II-starch, III-nucleus, IV-stoma
 - I-cytoplasm, II-chloroplast, III-stoma, IV-nucleus
- The correct order of air reaching from atmosphere to the lungs is through
 - external nares, larynx, trachea and air sac.
 - larynx, trachea, air sac and external nares.
 - trachea, air sac, external nares and larynx.
 - air sac, trachea, larynx and external nares.
- The rate at which oxygen moves from the alveoli of our lungs into our blood
 - depends on the difference in oxygen concentration between the alveoli and the blood.
 - depends on the color of the alveoli.
 - depends on the availability of energy to transport gases across the membrane.
 - none of the above
- Major function of contractile vacuole is

(a) Excretion	(b) Circulation
(c) Osmoregulation	(d) All of these
- Heart beat can be initiated by
 - Sino-auricular node
 - Atrio-ventricular node
 - Sodium ion
 - Purkinje's fibres

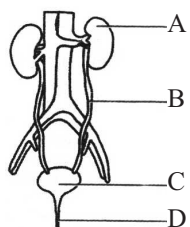
Life Processes

11. Digestion of food in human starts from
 (a) Duodenum (b) Small intestine
 (c) Mouth (d) Large intestine
12. Large intestine in man mainly carries out
 (a) absorption
 (b) assimilation
 (c) digestion of fats
 (d) digestion of carbohydrates
13. In *Amoeba* the digestion is intracellular because
 (a) *Amoeba* is unicellular
 (b) *Amoeba* is multicellular
 (c) *Amoeba* is found in a pond
 (d) *Amoeba* is a microscopic animal
14. The process of transpiration in plants helps in:
 (a) Opening of stomata
 (b) Absorption of CO₂ from atmosphere
 (c) Upward conduction of water and minerals
 (d) Absorption of O₂ from atmosphere.
15. Erythropoiesis may be stimulated by the deficiency of
 (a) Iron (b) Oxygen
 (c) Protein (d) None of these
16. In the cardiac cycle, diastole is –
 (a) The number of heart beats per minute
 (b) The relaxation period after contraction of the heart
 (c) The forceful pumping action of the heart
 (d) The contraction period after relaxation of the heart.
17. The breakdown of pyruvate to give carbon dioxide, water and energy takes place in
 (a) cytoplasm (b) mitochondria
 (c) chloroplast (d) nucleus
18. What is the term used when vessels open and let more blood through?
 (a) Vasoconstriction
 (b) Vasodilatation
 (c) Increased permeability
 (d) None of these
19. The chief function of lymph nodes in mammalian body is to
 (a) produce RBCs
 (b) collect and destroy pathogens
 (c) produce a hormone
 (d) destroy the old and worn out red blood cells
20. Select the correct statement?
 (a) Heterotrophs do not synthesise their own food.
 (b) Heterotrophs utilise solar energy for photosynthesis.
 (c) Heterotrophs synthesise their own food.
 (d) Heterotrophs are capable of converting carbon dioxide and water into carbohydrates.
21. In respiration, air passes through
 (a) Pharynx → nasal cavity → larynx → trachea → bronchi → bronchioles
 (b) Nasal cavity → pharynx → larynx → trachea → bronchi → bronchioles
 (c) Larynx → nasal cavity → pharynx → trachea
 (d) Larynx → pharynx → trachea → lungs
22. During deficiency of oxygen in tissues of human beings, pyruvic acid is converted into lactic acid in the
 (a) cytoplasm (b) chloroplast
 (c) mitochondria (d) golgi body
23. Choose the function of the pancreatic juice from the following?
 (a) Trypsin digests proteins and lipase digests carbohydrates.
 (b) Trypsin digests emulsified fats and lipase proteins.
 (c) Trypsin and lipase digest fats.
 (d) Trypsin digests proteins and lipase emulsify fats.
24. Choose the correct statement that describes arteries.
 (a) They have thick elastic walls, blood flows under high pressure, collect blood from different organs and bring it back to the heart.
 (b) They have thin walls with valves inside, blood flows under low pressure and carry blood away from the heart to various organs of the body.
 (c) They have thick elastic walls, blood flows under low pressure, carry blood from the heart to various organs of the body.
 (d) They have thick elastic walls without valves inside, blood flows under high pressure and carry blood away from the heart to different parts of the body.
25. 
 Pseudopodia
 Food particle
 Food vacuole
- Which activity is illustrated in the diagram of an *Amoeba* shown above?
 (a) Ingestion (b) Digestion
 (c) Egestion (d) Assimilation
26. From the given picture of the digestive system, identify the part labelled as gastric gland.

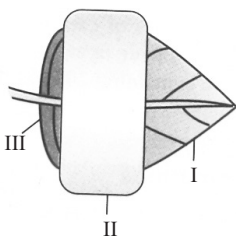


- (a) A
 (b) B
 (c) C
 (d) D

27. The diagram below represents a group of organs in the human body. Urine leaves the urinary bladder by passing through this structure labelled



- (a) A (b) B
(c) C (d) D
28. Given alongside is a sketch of a leaf partially covered with black paper and which is to be used in the experiment to show that light is compulsory for the process of photosynthesis. At the end of the experiment, which one of the leaf parts labelled I, II and III will become black when dipped in iodine solution?



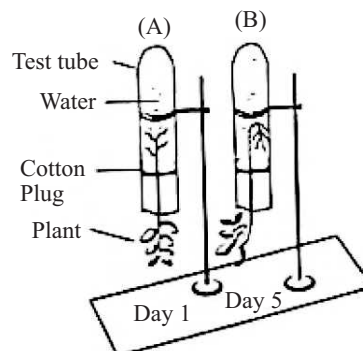
- (a) I only (b) II only
(c) I and III (d) II and III
29. The phenomenon of normal breathing in a human being comprises.
- (a) an active inspiratory and a passive expiratory phase.
(b) a passive inspiratory and an active expiratory phase.
(c) both active inspiratory and expiratory phases.
(d) both passive inspiratory and expiratory phases.
30. Filtration unit of kidney is
- (a) ureter (b) urethra
(c) neuron (d) nephron
31. A column of water within xylem vessels of tall trees does not break under its weight because of:
- (a) Tensile strength of water
(b) Lignification of xylem vessels
(c) Positive root pressure
(d) Dissolved sugars in water
32. Roots play insignificant role in absorption of water in:
- (a) *Pistia* (b) Pea
(c) Wheat (d) Sunflower

33. Which of the following statements is **not correct**?
- (a) Goblet cells are present in the mucosa of intestine and secrete mucus.
(b) Oxyntic cells are present in the mucosa of stomach and secrete HCl.
(c) Acini are present in the pancreas and secrete carboxypeptidase.

- (d) Brunner's glands are present in the submucosa of stomach and secrete pepsinogen.

34. Human urine is usually acidic because
- (a) excreted plasma proteins are acidic.
(b) potassium and sodium exchange generates acidity.
(c) hydrogen ions are actively secreted into the filtrate.
(d) the sodium transporter exchanges one hydrogen ion for each sodium ion in peritubular capillaries.
35. Which one of the following animals has two separate circulatory pathways?
- (a) Lizard (b) Whale
(c) Shark (d) Frog
36. Cow has a special stomach as compared to that of a lion in order to
- (a) absorb food in better manner.
(b) digest cellulose present in the food.
(c) assimilate food in a better way.
(d) absorb large amount of water.
37. Which of the following is not an enzyme?
- (a) Lipase (b) Amylase
(c) Trypsin (d) Bilirubin
38. Pancreatic juice contains more than one enzyme. Which among the following combination is correct?
- (a) Pepsin and Lipase
(b) Amylase and Pepsin
(c) Pepsin and Trypsin
(d) Trypsin and Lipase
39. Observe the experimental sets [A] & [B].

Observe the test tube A & B. From the list given below, choose the combination of responses of shoot and root that are observed in B.



- (a) Positive phototropism and positive geotropism
(b) Negative phototropism and positive geotropism
(c) Positive phototropism and negative geotropism
(d) Only negative phototropism

Life Processes

40. Which one of the following organisms respire through the skin?
- (a) Blue whale (b) Salamander
(c) Platypus (d) Peacock
41. The first enzyme that the food encounters in human digestive system is :
- (a) Pepsin (b) Trypsin
(c) Chymotrypsin (d) Amylase
42. Red blood corpuscles are formed in
- (a) Liver (b) Kidneys
(c) Small intestine (d) Bone marrow
43. The Excretory units of Annelids are:
- (a) Uniferous tubule (b) Flame cells
(c) Nephridia (d) Malpighian tubule
44. Open circulatory system is found in:
- (a) Prawn (b) Snakes
(c) Fish (d) Man
45. Haemoglobin is dissolved in Plasma of blood in:
- (a) Earthworm (b) Roundworm
(c) Tapeworm (d) Insects
46. Which one of the following organisms has a cellular respiratory pigment dissolved in plasma and is also a predaceous carnivore and shows matriphagy?
- (a) Scorpion (b) Cockroach
(c) Earthworm (d) Sea cucumber
47. Glucose is the prime source of energy in our body. However, it is stored in the form of glycogen in the muscle and liver of animals and in the form of starch in plants. As a result, everytime a cell requires glucose, it must hydrolyze glycogen which is an energy consuming process. Why does the cell store glycogen instead of glucose in free form?
- (a) Glycogen is more compact and more hydrophilic.
(b) Storage of glucose in free form will consume more ATP.
(c) Glucose in the free form creates more osmotic pressure.
(d) Glucose is highly reactive molecule hence storing in the free form can result in unwanted reactions in the cells.
48. A squirrel was eating a fruit on the ground. Suddenly, it was attacked by a dog. The squirrel rushed to the tree immediately and saved itself from the dangerous attack. What immediate changes are most likely to have taken place in the body of the squirrel?
- A. Blood flows to the stomach for rapid digestion.
- B. Adrenaline was secreted in the blood by the adrenal glands.
- C. Heart beat becomes faster and pumps more blood so that muscles get more oxygen.
- D. Adrenocorticotrophic hormone is secreted in the blood and blood flows more towards the vital organs.
- Select the correct combination of options given below:
- (a) A and B (b) A and C
(c) B and C (d) C and D
49. Removal of the pancreas impairs the breakdown of
- (a) lipids and carbohydrates only
(b) lipids and proteins only
(c) lipids, proteins and carbohydrates
(d) proteins and carbohydrates only
50. Microscopic examination of a blood smear reveals an abnormal increase in the number of granular cells with multiple nuclear lobes. Which one of the following cell Types has increased in number?
- (a) Lymphocytes (b) Monocytes
(c) Neutrophils (d) Thrombocytes
51. Which one of the following metabolic conversions requires oxygen?
- (a) Glucose to pyruvate
(b) Glucose to CO₂ and ethanol
(c) Glucose to lactate
(d) Glucose to CO₂ and H₂O
52. Which one of the following organs is NOT a site for the production of white blood cells?
- (a) Bone marrow (b) Kidney
(c) Liver (d) Spleen
53. Which of the following process occur only in animals?
- (a) Respiration (b) Nutrition
(c) Nervous control (d) Hormonal control
54. Tricuspid valve is present in
- (a) Right atria and right ventricle
(b) Left atria and left ventricle
(c) Wall of atrium
(d) Wall of ventricle
55. Root pressure is effective way transporting water in xylem. This pressure is generated
- (a) In bright sunlight
(b) During night
(c) At very low temperature
(d) In high trees

Case/Passage Based Questions

DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

There is a pair of bean-shaped organs P in the human body towards the back, just above the waist. A waste product Q formed by the decomposition of unused proteins in the liver is brought into organ P through blood by an artery R. The numerous tiny filters S present in organ P clean the dirty blood by removing the waste product Q. The clean blood goes into circulation through a vein T. The waste substance Q, other waste salts, and excess water form a yellowish liquid U which goes from organ P into a bag-like structure V through two tubes W. This liquid is then thrown out of the body through a tube X.

56. What is (i) organ P, and (ii) waste substance Q?
57. Name (i) artery R, and (ii) vein T.
58. What are tiny filters S known as?
59. Name (i) liquid U (ii) structure V (iii) tubes W, and (iv) tube X.

Case/Passage - 2

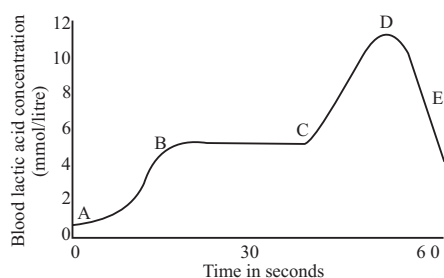
All living cells require energy for various activities. This energy is available by the breakdown of simple carbohydrates either using oxygen or without using oxygen.

60. Energy in the case of higher plants and animals is obtained by
- (a) Breathing (b) Tissue respiration
(c) Organ respiration (d) Digestion of food
61. The graph below represents the blood lactic acid concentration of an athlete during a race of 400 m and shows a peak at point D.

Lactic acid production has occurred in the athlete while running in the 400 m race.

Respiration in athletics

The blood of an athlete was tested before, during and after a 400m race:



Lactic acid production has occurred in the athlete while running in the 400 m race. Which of the following processes explains this event?

Which of the following processes explains this event?

- (a) Aerobic respiration (b) Anaerobic respiration
(c) Fermentation (d) Breathing
62. Study the graph below that represents the amount of energy supplied with respect to the time while an athlete is running at full speed.

Choose the correct combination of plots and justification provided in the following table.

	Plot A	Plot B	Justification
(a)	Aerobic	Anaerobic	Amount of energy is low and inconsistent in aerobic and high in anaerobic
(b)	Aerobic	Anaerobic	Amount of energy is high and consistent in aerobic and low in anaerobic
(c)	Anaerobic	Aerobic	Amount of energy is high and consistent in aerobic and low in anaerobic
(d)	Anaerobic	Aerobic	Amount of energy is high and inconsistent in anaerobic and low in aerobic

63. The characteristic processes observed in anaerobic respiration are:
- (i) presence of oxygen
(ii) release of carbon dioxide
(iii) release of energy
(iv) release of lactic acid
- (a) (i), (ii) only (b) (i), (ii), (iii) only
(c) (ii), (iii), (iv) only (d) (iv) only
64. Study the table below and select the row that has the incorrect information.

	Aerobic	Anaerobic
(a) Location	Cytoplasm	Mitochondria
(b) End Product	CO ₂ and H ₂ O	Ethanol and CO ₂
(c) Amount of ATP	High	Low
(d) Oxygen	Needed	Not needed

Life Processes

Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
 (b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
 (c) If **Assertion** is **correct** but **Reason** is **incorrect**.
 (d) If **Assertion** is **incorrect** but **Reason** is **correct**.

65. **Assertion:** Blood of insects is colourless.

Reason: The blood of insect does not play any role in transport of oxygen.

66. **Assertion:** Blood pressure is arterial blood pressure.

Reason: It is measured by sphygmomanometer.

67. **Assertion:** Chloroplast help in photosynthesis.

Reason: Mitochondria have enzymes for dark reaction.

68. **Assertion:** During physiology of excretion, deamination does not take place in liver.

Reason: Deamination is a process to make use of excess of amino acids which can not be incorporated into protoplasm.

69. **Assertion:** Photorespiration decreases net photosynthesis.

Reason: Rate of respiration in dark and light is almost same in all plants.

Match the Following

DIRECTIONS : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

70.	Column I	Column II
	(A) Autotrophic	(p) Leech nutrition
	(B) Heterotrophic nutrition	(q) <i>Paramecium</i>
	(C) Parasitic nutrition	(r) Deer
	(D) Digestion in food vacuoles	(s) Green plant.

71.	Column I (Animal)	Column II (Respiratory Organ)
	(A) Fish	(p) Trachea
	(B) Birds	(q) Gills
	(C) Aquatic	(r) Lungs
	(D) Earthworm	(s) Moist cuticle

72.	Column I	Column II
	(A) Regulation metabolic	(p) The removal of waste from an organism.
	(B) Reproduction	(q) The chemical process of oxidizing organic molecules to release energy.
	(C) Respiration	(r) The replication of an organism.
	(D) Excretion	(s) The control and coordination of chemical processes within the organism.

73.	Column I	Column II
	(A) Stomach	(p) The structure is the site where the chemical breakdown of proteins first occurs.
	(B) Large intestine	(q) This organ absorbs most of the water from the undigested food.
	(C) Small intestine	(r) This organ is the section of the alimentary canal where most of the food is absorbed into the blood.
	(D) Liver	(s) This organ secretes the chemical bile, which is used to emulsify fats.

Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

74. Ninety percent of the water lost by the plants during transpiration is through the of the leaf.
 75. The semi-liquid mixture of partially digested food found in the stomach is called
 76. The prevents the entry of food into the respiratory tract.
 77. Second heart sound heard as is due to closure of valves at the beginning of ventricular diastole.
 78. Kidney eliminate the excretory waste materials as their aqueous solution, called
 79. Energy rich compound generated during photosynthesis is

80. Pressure in the arteries during ventricular relaxation is called pressure.
81. Diffusion is insufficient to meet requirement of multicellular organisms like humans.

» True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

82. Translocation is the transportation of the products of photosynthesis.
83. In a general, digestion is simply hydrolysis of complex polymers to monomers.
84. The exchange of nutrients and waste products between the blood and cells occurs within the arteries.
85. Trypsin digests proteins into amino acids.
86. A complete digestive tract consists of an oral and an anal opening.
87. Only the multicellular organisms require transporting mechanisms.
88. Humans have an open circulatory system.
89. Living organisms must maintain a constant internal environment.
90. In humans, the alveoli are the functioning units of external respiration.
91. Circulatory system also performs the function of homeostasis.
92. Essential amino acids cannot be synthesized in human body.
93. Generally gravitational water is utilized by the plants.
94. In photosynthesis, carbon dioxide is given out by diffusion process.
95. Bowman's capsule is found in heart.

ANSWER KEY & SOLUTIONS

1. (c)
2. (c) Root cap is devoid of root hairs which are instrumental in water absorption by increasing the surface area to speed up osmosis and thus root cap is not involved in the water absorption.
3. (a) 4. (d) 5. (a) 6. (b)
7. (a) The correct pathway of air: nasal cavities (or oral cavity) > pharynx > trachea > primary bronchi (right & left) > secondary bronchi > tertiary bronchi > bronchioles > alveoli (site of gas exchange).
8. (a) During inhalation, there is a greater concentration of oxygen in the alveoli than in the blood of the pulmonary capillaries, so oxygen diffuses from the alveoli into the blood across the capillaries.
9. (c) 10. (a)
11. (c) Digestion begins in the mouth with the secretion of saliva and its digestive enzymes.
12. (a) The large intestine, or large bowel, is the last part of the digestive system in vertebrate animals. Its function is to absorb water from the remaining indigestible food matter, and then to pass the useless waste material from the body.
13. (a)
14. (c) Transpiration is an essential phenomenon. It's pulling action helps in absorption and transportation of water in the plant. It also supplies water for photosynthesis.
15. (b)
16. (b) Cardiac diastole is the period of the cardiac cycle when, after contraction, the heart relaxes and expands while refilling with blood returning from the circulatory system.
17. (b)
18. (b) Vasodilation is the widening of your blood vessels. It happens when smooth muscles found in the walls of arteries or large veins relax, allowing the blood vessels to become more open. This leads to an increase in blood flow through your blood vessels as well as a decrease in blood pressure.
19. (b) 20. (a) 21. (b)
22. (a) In the absence of oxygen, pyruvic acid is converted into lactic acid in the cytoplasm of the muscle cell.
23. (d) 24. (d) 25. (a) 26. (b)
27. (d) 28. (c)
29. (a) During inspiration, muscles of ribs and diaphragm contracts. Hence, it is an active process. During expiration, muscles of ribs and diaphragm relax. Hence, it is a passive process.
30. (d) Nephron filter blood in kidney.
31. (a) Due to tensile strength of water, a column of water within xylem vessels of tall trees does not break under its weight.
32. (a) *Pistia* is a hydrophyte plant where absorption of water by root is not important.
33. (d) Duodenum contains Brunner's glands which secrete mucus and digestive juices.
34. (c) Urine has acidic nature because hydrogen ions (H^+) are components of an acid which are secreted into the filtrate.
35. (b) Whale is a mammal and in mammals, two separate circulatory pathways are found - systemic circulation and pulmonary circulation. Oxygenated and deoxygenated bloods received by the left and right atria respectively pass on to the left and right ventricles. Thus, oxygenated and deoxygenated bloods are not mixed. This is referred to as double circulation.
36. (b)
37. (d) Bilirubin is yellow compound that occurs in the catabolic pathway which breaks down hence in vertebrates it is not an enzyme. Other options *i.e.*, lipase, amylase, and trypsin are lipid digesting, starch digesting and endopeptidase enzymes respectively.
38. (d) Pancreatic juice contains Pancreatic proteases (such as trypsin and chymotrypsin), Pancreatic amylase and Pancreatic lipase.
39. (a)
40. (b) Salamanders are a group of amphibians typically characterised by a lizard-like appearance with

- slender bodies, blunt snouts, short limbs and a tail. Salamanders breath through their skin and the thin membranes in the mouth and throat.
41. (d) The first enzyme that the food encounters in the digestive system is amylase. Digestion begins in the mouth with the secretion of saliva and its digestive enzymes. Saliva contains the digestive enzyme amylase, which works on carbohydrate, starch present in breads, potatoes or pasta to help break them down into simple sugars.
42. (d) Red blood cells are formed in the red bone marrow of bones. Stem cells in the red bone marrow called hemocytoblasts give rise to all of the formed elements in blood.
43. (c) The annelid excretory system is made up of long tubular organs called nephridia. Many species have a pair of nephridia in each segment.
44. (a) Open circulatory system is primarily found in invertebrates, in which the blood flows freely through cavities and there are no vessels to conduct the blood. This type of system is found in animals such as insects and some mollusks (snails, clams).
45. (a) Haemoglobin is found dissolved in the plasma of earthworm because they don't have proper respiratory system. It is dissolved in plasma for the diffusion of gases and other materials.
46. (a) In scorpion, the respiratory pigment is dissolved in plasma and it is also a predaceous carnivore that shows matrophagy, (a process in which an organism feed on its own mother).
47. (c) Glycogen is insoluble thus, storing it as glycogen will not upset the osmotic pressure rather than glucose which is soluble in water. And if cell store it as glucose, it will disturb the osmotic pressure (hypertonic) that will cause the cell to lyse.
48. (3) In this condition, adrenaline is secreted by adrenal gland into the blood stream which increases the heart rate, redistributing blood to the muscles and altering the blood metabolism, so as to maximise blood glucose levels primarily for the brain.
49. (c) The pancreas is a glandular organ. It is the part of the digestive system, located in the abdomen and produces insulin and other important enzymes and hormones that help break down foods. The enzymes include trypsin and chymotrypsin to digest proteins, amylase to break down carbohydrates and lipase, to break down fats into fatty acids and cholesterol.
50. (c) Granulocytes and agranulocytes are the two types of white blood cells found in blood. Eosinophils, neutrophils and basophils are the granulocytes. Monocytes and lymphocytes are the agranulocytes. If the microscopic examination of a blood smear reveals an abnormal increase in the number of granular cells with multiple nuclear lobes, so out of the given blood cells, neutrophils has increased in number.
51. (d) Aerobic respiration uses oxygen to break down glucose, amino acids and fatty acids and is the main way the body generates adenosine triphosphate (ATP), which supplies energy to the muscles. The products of this process are carbon dioxide and water.
52. (b) In the human adult, the bone marrow produces all of the red blood cells, 60-70 percent of the white cells (i.e., the granulocytes), and all of the platelets. The reticuloendothelial tissues of the spleen, liver, lymph nodes, and other organs produce the monocytes (4-8 percent of the white cells).
53. (c) Nervous control occurs only in animals.
54. (a) Tricuspid valve is present between right atria and right ventricle.
55. (b) During night, root pressure is effectively involved in transport of water through xylem. During day, due to the opening of stomata, transpiration pull becomes the major factor for transporting water in xylem.
56. (a) (i) Kidneys (ii) Urea
57. (b) (i) Renal artery (ii) Renal vein
58. (c) Nephrons
59. (d) (i) Urine (ii) Bladder
(iii) Ureters (iv) Urethra
60. (b) Tissue respiration
61. (b) Anaerobic respiration
62. (b)
- | | | |
|---------|-----------|---|
| Aerobic | Anaerobic | Amount of energy is high and consistent in aerobic and low in anaerobic |
|---------|-----------|---|
63. (c) (ii), (iii), (iv) only
64. (a) Location Aerobic-Cytoplasm and Anaerobic-Mitochondria
65. (b) The blood of an insect functions differently than the blood of a human. Insect blood, however, does not carry gases and has no haemoglobin which gives red colour to the blood.

Life Processes

66. (b) Blood pressure, sometimes called arterial blood pressure, is the pressure exerted by circulating blood upon the walls of blood vessels. Blood pressure is measured by sphygmomanometer.
67. (c) Dark reaction occurs in the stroma region of the chloroplast and mitochondria is involved in the synthesis of ATP.
68. (d) Deamination takes place in liver during excretion to make excess of amino acids which can not be incorporated into protoplasm.
69. (c)
70. (A) → (s), (B) → (r), (C) → (p), (D) → (q)
71. (A) → (q), (B) → (r), (C) → (p), (D) → (s)
72. (A) → (s), (B) → (r), (C) → (q), (D) → (p)
73. (A) → (p), (B) → (q), (C) → (r), (D) → (s)
74. stomata 75. chyme
76. epiglottis 77. Dup/Dubb, semilunar
78. urine 79. ATP
80. diastolic 81. oxygen
82. True 83. True 84. False 85. True
86. True 87. False 88. False 89. True
90. True 91. True 92. True 93. False
94. False 95. False

5

Light-Reflection and Refraction

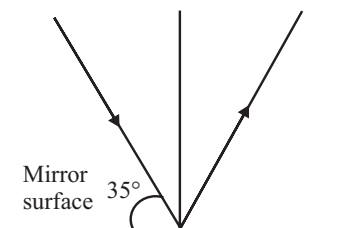
Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

- An object is at a distance of 0.5 m in front of a plane mirror. Distance between the object and image is
 - 0.5 m
 - 1 m
 - 0.25 m
 - 1.5 m
- Number of images formed when two plane mirrors are inclined at an angle 90° is
 - 3
 - 2
 - 4
 - 5
- Which one of the following statements is not correct?
 - A convex mirror is often used as driving rear-view mirror.
 - A convex mirror is often used as a shaving mirror.
 - A concave mirror is often used in a search light or a torch.
 - A concave mirror is often used as the reflector behind lamp in a projector
- The relation, $R = 2f$ holds true for :
 - concave mirrors only
 - convex mirrors only
 - all spherical mirrors
 - lens as well as for all spherical mirrors.
- A magnification greater than unity indicates :
 - real image
 - size of the image is smaller than that of object
 - size of the object is smaller than that of image
 - size of object is equal to that of image
- The image formed by a convex mirror
 - is always real
 - is always virtual
 - cannot say
 - None of these
- In case of erect object having inverted image, linear magnification is :
 - positive
 - negative
 - zero
 - no definite sign.
- If object lies symmetrically and number of images formed are 9, therefore two plane mirrors are kept at an angle of :
 - 72°
 - 40°
 - 36°
 - 50°
- Reciprocal of focal length of a lens gives the
 - power
 - radius
 - magnification
 - none of these
- Magnification of a lens is given by
 - $\frac{\text{image height}}{\text{object height}}$
 - $\frac{1}{\text{Radius}}$
 - $\frac{1}{\text{focal length}}$
 - $\frac{1}{\text{image distance}}$
- A man having height 2.5 m. He observes image of 1m height erect, then mirror used is
 - concave
 - convex
 - plane
 - None of these
- Where should an object be placed in front of a convex lens to get a real image of the size of the object?
 - At the principal focus of the lens
 - At twice the focal length
 - At infinity
 - Between the optical centre of the lens and its principal focus.

Light-Reflection and Refraction

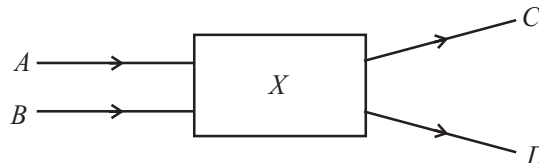
13. Find the angle of incidence and angle of reflection from the diagram.



- (a) $45^\circ, 40^\circ$ (b) $55^\circ, 55^\circ$
 (c) $60^\circ, 60^\circ$ (d) $30^\circ, 30^\circ$
14. A spherical mirror and a thin spherical lens have each a focal length of -15 cm. The mirror and the lens are likely to be
- (a) both concave.
 (b) both convex.
 (c) the mirror is concave and the lens is convex.
 (d) the mirror is convex, but the lens is concave.
15. Which of the following lenses would you prefer to use while reading small letters found in a dictionary?
- (a) A convex lens of focal length 50 cm.
 (b) A concave lens of focal length 50 cm.
 (c) A convex lens of focal length 5 cm.
 (d) A concave lens of focal length 5 cm.
16. An object is situated at a distance of $f/2$ from a convex lens of focal length f . Distance of image will be –
- (a) $+ (f/2)$ (b) $+ (f/3)$
 (c) $+ (f/4)$ (d) $-f$
17. An object is placed 60 cm in front of a concave mirror. The real image formed by the mirror is located 30 cm in front of the mirror. What is the object's magnification?
- (a) $+2$ (b) -2
 (c) $+0.5$ (d) -0.5
18. Two plane mirrors are set at right angle and a flower is placed in between the mirrors. The number of images of the flower which will be seen is
- (a) One (b) Two
 (c) Three (d) Four
19. A man is 6.0 ft tall. What is the smallest size plane mirror he can use to see his entire image
- (a) 3.0 ft (b) 6.0 ft
 (c) 12 ft (d) 24 ft

20. An object is placed 60 cm in front of a convex mirror. The virtual image formed by the mirror is located 30 cm behind the mirror. What is the object's magnification
- (a) $+2$ (b) -2
 (c) $+0.5$ (d) -0.5

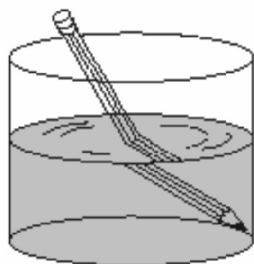
21. Light rays A and B fall on optical component X and come out as C and D .



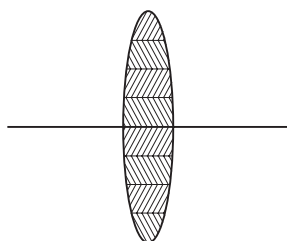
The optical component is a

- (a) concave lens (b) convex lens
 (c) convex mirror (d) prism
22. An object is placed 20.0 cm in front of a concave mirror whose focal length is 25.0 cm. What is the magnification of the object?
- (a) $+5.0$ (b) -5.0
 (c) $+0.20$ (d) -0.20
23. An object is placed at the radius of curvature of a concave spherical mirror. The image formed by the mirror is
- (a) located at the focal point of the mirror.
 (b) located between the focal point and the radius of curvature of the mirror.
 (c) located at the center of curvature of the mirror.
 (d) located out beyond the center of curvature of the mirror.
24. If the refractive indices for water and diamond relative to air are 1.33 and 2.4 respectively, then the refractive index of diamond relative to water is –
- (a) 5.5 (b) 1.80
 (c) 3.19 (d) None of these
25. There is an equiconvex lens of focal length of 20 cm. If the lens is cut into two equal parts perpendicular to the principle axis, the focal lengths of each part will be
- (a) 20 cm (b) 10 cm
 (c) 40 cm (d) 15 cm
26. An object is placed 20.0 cm in front of a concave mirror whose focal length is 25.0 cm. Where is the image located?
- (a) 1.0×10^2 cm in front of the mirror
 (b) 1.0×10^2 cm behind the mirror
 (c) 5.0×10^1 cm in front of the mirror
 (d) 5.0×10^1 cm behind the mirror

27. Which statement best describes the property of light waves illustrated in the diagram below?



- (a) Some materials absorb light waves.
 (b) Some materials reflect light waves.
 (c) Light waves are refracted by some materials.
 (d) Light waves are emitted by some materials.
28. Light waves
- (a) require air or another gas to travel through
 (b) require an electric field to travel through
 (c) require a magnetic field to travel through
 (d) can travel through perfect vacuum
29. What are the factors that determine the angle of deviation in a prism?
- (a) angle of incidence (b) wave length
 (c) angle of the prism (d) All the above
30. Morning sun is not so hot as the mid day sun because
- (a) Sun is cooler in the morning
 (b) Heat rays travel slowly in the morning
 (c) It is God gift
 (d) The sun's rays travel a longer distance through atmosphere in the morning
31. The layered lens shown below is made of two different transparent materials.



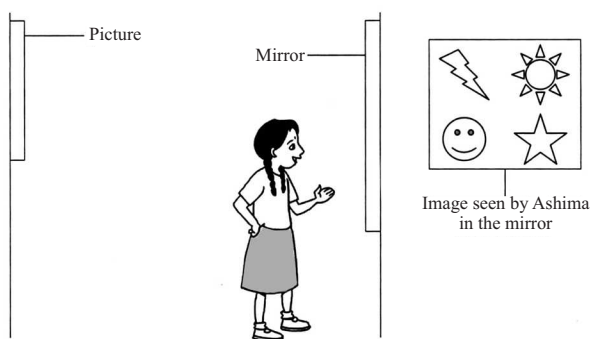
A point object is placed on its axis. The object will form

- (a) one image (b) infinite images
 (c) no image (d) two images
32. An object is placed in front of a concave mirror of focal length 50.0 cm and a real image is formed 75 cm in front of the mirror. How far is the object from the mirror
- (a) 25 cm (b) 30 cm
 (c) 150 cm (d) -150 cm
33. A number of images of a candle flame can be seen in a thick plane mirror. The brightest image is
- (a) Fourth (b) Second
 (c) Last (d) First
34. A ray from air enters water, then through a thick layer of glass placed below water. After passing through glass, it again comes out in air medium. Then final emergent ray will
- (a) Bend towards the normal
 (b) Suffer lateral displacement
 (c) Have the same path as if it had not passed through glass and water.
 (d) None of these
35. A concave spherical mirror has a radius of curvature of 100 cm. What is its focal length
- (a) 50 cm (b) 100 cm
 (c) 200 cm (d) 300 cm
36. Light is incident on an air-water interface at an angle of 25° to the normal. What angle does the refracted ray make with the normal
- (a) 19° (b) 34°
 (c) 25° (d) 90°
37. If the speed of light in medium -1 and medium -2 are $2.5 \times 10^8 \text{ ms}^{-1}$ and $2 \times 10^8 \text{ ms}^{-1}$, respectively, then the refractive index of medium -1 with respect to medium -2 is _____.
- (a) $\frac{3}{2.5}$ (b) $\frac{2}{2.5}$
 (c) $\frac{2.5}{3}$ (d) $\frac{2.5}{2}$
38. Under what conditions does a diverging lens form a virtual image of a real object
- (a) Only if $u > f$.
 (b) Only if $u < f$.
 (c) Only if $u = f$
 (d) A diverging lens always forms a virtual image of a real object.
39. A lens produces an enlarged, virtual image. What kind of lens is it?
- (a) converging
 (b) diverging
 (c) It could be either diverging or converging.
 (d) None

Light-Reflection and Refraction

40. In an experiment to determine the focal length of a concave lens, a student obtained the image of a distant window on the screen. To determine the focal length of the lens, she/he should measure the distance between the
- lens and the screen only
 - lens and the window only
 - screen and the window only
 - screen and the lens and also between the screen and the window

41. Ashima looks into the mirror and sees the reflection of the picture behind her.



Which of the following is the picture that is behind Ashima?

-
-
-
-

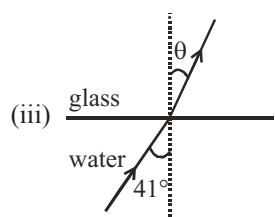
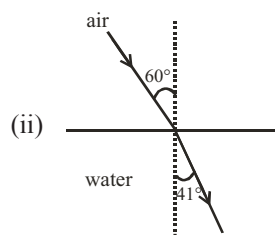
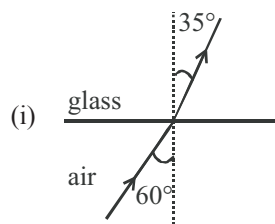
42. On the basis of experiment 'to trace the path of a ray of light passing through a rectangular glass slab' four students arrived at the following interpretations :
- Angle of incidence is greater than the angle of emergence.
 - Angle of emergence is less than the angle of refraction.
 - Emergent ray is parallel to the incident ray.
 - Emergent ray is parallel to the refracted ray.

The correct interpretation is that of the student.

- I
 - II
 - III
 - IV
43. Light waves
- are mechanical waves
 - are electromagnetic waves
 - travel with the same velocity in all media
 - requires a material medium for their propagation
44. Virtual images of object of the same size are formed by
- a concave mirror
 - a convex mirror
 - a plane mirror
 - all the above
45. Two plane inclined mirrors form 5 images by multiple reflection. The angle of inclination is
- 90°
 - 60°
 - 45°
 - 30°
46. A bright \times (cross) mark is made on a sheet of white paper. Over the white paper a rectangular glass-slab of thickness 3 cm is placed. On looking through, the image of the mark appears above the mark. It is below the upper surface of the slab by ($\mu_{\text{glass}} = 1.5$)
- 2.5 cm
 - 1.5 cm
 - 2 cm
 - 1.75 cm
47. Images formed by an object placed between two plane mirrors whose reflecting surfaces make an angle of 90° with one another lie on a
- Straight line
 - Zig-zag curve
 - Circle
 - Ellipse
48. A diver in a swimming pool wants to send a signal to a person lying on the edge of the pool by flashing his waterproof torch
- He must direct the beam of light vertically upwards
 - He must direct the beam horizontally
 - He must direct the beam at an angle to the vertical which is slightly lesser than the critical angle
 - He must direct the beam at an angle to the vertical which is slightly greater than the critical angle

49. Two plane mirrors are inclined at an angle θ . A ray of light is incident on one mirror and is then reflected from the other mirror. Then the angle between the first ray and the final ray will be

- (a) θ (b) 2θ
(c) between θ and 2θ (d) $> 2\theta$
50. A glass slab is placed in the path of a beam of convergent light, then the point of convergence of light
(a) moves towards the glass slab
(b) moves away from the glass slab
(c) remains at the same point
(d) undergoes a lateral shift
51. A real image is formed by a convex mirror when the object is placed at
(a) infinite
(b) between center of curvature and focus
(c) between focus and pole
(d) None of the above
52. A virtual image is formed by a concave mirror when the object is placed between
(a) infinity and center of curvature
(b) center of curvature and focus
(c) focus and the pole
(d) All of the above
53. Which of the following are used in a Kaleidoscope
(a) plane mirrors (b) concave
(c) convex mirrors (d) All of the above
54. When a convex lens made up of glass is immersed in water, its focal length
(a) decreases (b) does not change
(c) increases (d) None of the above
55. Find out the correct option from the following.
(A) The magnification is positive for all virtual images and is negative for all real images.
(B) The magnification of concave lens and convex mirror is always positive whereas the magnification of convex lens and concave mirror can be positive or negative depending on the position of the object before the lens.
(a) Only A is true
(b) Only B is true.
(c) Both A and B are true
(d) Both A and B are false
56. A person standing at some distance from a mirror finds his image erect, virtual and of the same size. Then the mirror is possibly
(a) plane mirror
(b) concave mirror
(c) plane or concave mirror
(d) plane or concave or convex mirror
57. Refraction of light from air to glass and from air to water are shown in figure (i) and (ii) below. The value of the angle in the case of refraction as shown in figure (iii) will be :



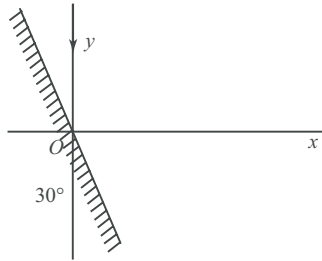
- (a) 30° (b) 35°
(c) 60° (d) none of the above

58. The focal length of a plane mirror is
(a) positive (b) negative
(c) zero (d) infinity
59. Rays from the sun converge at a point 15 cm in front of a concave mirror. Where should an object be placed so that size of its image is equal to the size of the object?
(a) 15 cm in front of the mirror
(b) 30 cm in front of the mirror
(c) between 15 cm and 30 cm in front of the mirror
(d) more than 30 cm in front of the mirror.
60. A convex mirror is used
(a) by a dentist
(b) for shaving
(c) as a rear view mirror in vehicles
(d) as a light reflector for obtaining a parallel beam of light.
61. In case of a concave mirror, when the object is situated at the principal focus, the image formed is
(a) real and inverted (b) of infinite size
(c) lies at infinity (d) All of these

Light-Reflection and Refraction

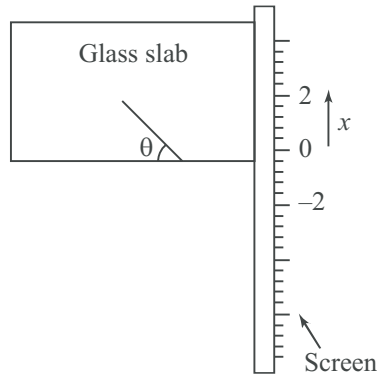
62. For an object at infinity, a concave mirror produces an image at its focus which is
 (a) enlarged (b) virtual
 (c) erect (d) real and point sized
63. An inverted image can be seen in a convex mirror,
 (a) under no circumstances
 (b) when the object is very far from the mirror
 (c) when the object is at a distance equal to the radius of curvature of the mirror
 (d) when the distance of the object from the mirror is equal to the focal length of the mirror
64. In order to get a diminished virtual image, the object can be placed anywhere in front of a
 (a) concave mirror (b) plane mirror
 (c) convex mirror (d) none of these
65. A full length image of a distant tall building can definitely be seen by using
 (a) a concave mirror
 (b) a convex mirror
 (c) a plane mirror
 (d) both concave as well as plane mirror
66. The concave mirrors are used in
 (a) reflecting telescopes (b) magic- lanterns
 (c) cinema projectors (d) All of these
67. Which of the following statements is true?
 (a) A convex lens has 4 dioptre power having a focal length 0.25 m
 (b) A convex lens has -4 dioptre power having a focal length 0.25 m
 (c) A concave lens has 4 dipotre power having a focal length 0.25 m
 (d) A concave lens has -4 dioptre power having a focal length 0.25 m
68. A virtual, erect and magnified image of an object is to be produced with a concave mirror of focal length 12 cm. Which of the following object distance should be chosen for this purpose?
 (a) 10 cm (b) 14 cm
 (c) 18 cm (d) 24 cm
69. A 10 mm long awlpin is placed vertically in front of a concave mirror. A 5 mm long image of the awl pin is formed at 30 cm in front of the mirror. The focal length of this mirror is
 (a) -30 cm (b) -20 cm
 (c) -40 cm (d) -60 cm
70. The linear magnification for a mirror is the ratio of the size of the image to the size of the object, and is denoted by m . Then, m is equal to (symbols have their usual meanings):
 (a) $\frac{f}{f-u}$ (b) $\frac{f-u}{f}$
 (c) $\frac{f}{f+v}$ (d) $\frac{f+v}{f}$
71. In case of a real and inverted image, the magnification of a mirror is
 (a) positive (b) negative
 (c) zero (d) infinity
72. Magnification produced by a rear view mirror fitted in vehicles
 (a) is less than one
 (b) is more than one
 (c) is equal to one
 (d) can be more than or less than one depending upon the position of the object in front of it.
73. The ratio of the sine of angle of incidence to the sine of angle of refraction is called
 (a) refractive index
 (b) optical density
 (c) relative density
 (d) none of these
74. When an objects is placed between two mirrors placed inclined to each at an angle 45° Number of images formed are
 (a) 3 (b) 5
 (c) 7 (d) None of these
75. Foam of soap always appears white as
 (a) it contains large hydrocarbon chains.
 (b) it absorbs red portion of the visible light
 (c) it reflects light of all wavelengths.
 (d) it has one hydrophobic end, which is insoluble in water.
76. Two lenses of focal length f_1 and f_2 are kept in contact coaxially. The power of the combination will be
 (a) $\frac{f_1 f_2}{f_1 + f_2}$ (b) $\frac{f_1 + f_2}{f_1 f_2}$
 (c) $\frac{f_1 f_2}{f_1 - f_2}$ (d) $f_1 + f_2$

77. A mirror is placed at an angle of 30° with respect to Y -axis (see figure). A light ray travelling in the negative y -direction strikes the mirror. The direction of the reflected ray is given by the vector

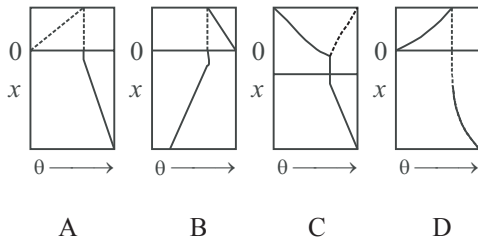


- (a) \hat{i} (b) $\hat{i} - \sqrt{3}\hat{j}$
 (c) $\sqrt{3}\hat{i} - \hat{j}$ (d) $\hat{i} - 2\hat{j}$

78. A ray of light originates from inside a glass slab and is incident on its inner surface at an angle θ as shown below.

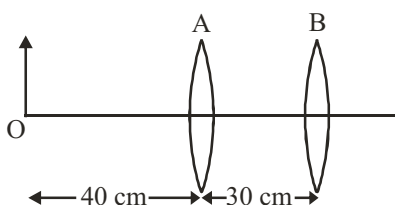


In this experiment, the location x of the spot where the ray hits the screen is recorded. Which of the following correctly shows the plot of variation of x with the angle θ ?



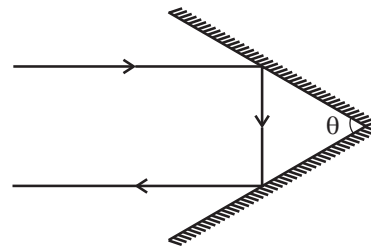
- (a) A (b) B (c) C (d) D

79. Two convex lenses A and B each of focal length 30 cm are separated by 30 cm, as shown in the figure. An object O is placed at a distance of 40 cm to the left of lens A.

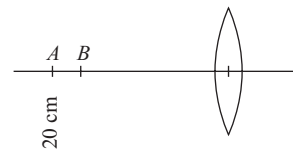


What is the distance of the final image formed by this lens system?

- (a) 120 cm to right of lens A
 (b) 90 cm to right of lens A
 (c) 22.5 cm to right of lens B
 (d) 45 cm to right of lens B
80. Two plane mirrors are kept on a horizontal table making an angle θ with each other as shown schematically in the figure. The angle θ is such that any ray of light reflected after striking both the mirrors returns parallel to its incident path. For this to happen, the value of θ should be



- (a) 30° (b) 45°
 (c) 60° (d) 90°
81. An object is placed at a distance of 40 cm from a concave mirror of focal length 15 cm. If the object is displaced through a distance of 20 cm towards the mirror, the displacement of the image will be
- (a) 30 cm away from the mirror
 (b) 36 cm away from the mirror
 (c) 36 cm towards the mirror
 (d) 30 cm towards the mirror
82. A pin AB of length 2 cm is kept on the axis of a convex lens between 18 cm and 20 cm as shown in figure. Focal length of convex lens is 10 cm. Find magnification produced for the image of the pin.



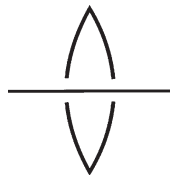
- (a) 0.83 (b) 1.00
 (c) 1.25 (d) 6.78
83. A concave mirror for face viewing has focal length of 0.4 m. The distance at which you hold the mirror from your face in order to see your image upright with a magnification of 5 is:
- (a) 0.24 m (b) 1.60 m
 (c) 0.32 m (d) 0.16 m

Light-Reflection and Refraction

84. A convex lens of focal length 20 cm is cut into two halves. Each of which is placed 0.5 mm and a point object placed at a distance of 30 cm from the lens as shown.

Then the image is at

- (a) 60 cm
(b) 30 cm
(c) 70 cm
(d) 50 cm



85. Focal length of a lens is 25 cm. In diopetre, power of lens will be

- (a) 0.04 (b) 0.4
(c) 4 (d) 2.5

86. When viewed vertically a fish appears to be 4 meter below the surface of the lake. If the index of refraction of water is 1.33, then the true depth of the fish is

- (a) 5.32 metres (b) 3.32 metres
(c) 4.32 metres (d) 6.32 metres

87. Two thin lenses of focal lengths f_1 and f_2 are placed in contact with each other such that the combination behaves as a glass slab. Then how are f_1 and f_2 related to each other?

- (a) $f_1 = \frac{1}{f_2}$ (b) $f_2 = -f_1$
(c) $f_1 = f_2$ (d) $f_1 = \sqrt{f_2}$

88. A convex lens of focal length 25 cm receives light from the sun. A diverging lens of focal length -12 cm is placed 37 cm to the right of the converging lens. Where is the final image located relative to the diverging lens?

- (a) 6 cm to the left (b) 25 cm to the left
(c) At infinity (d) 12 cm to the right

89. A camera lens focuses light from a 12.0 m tall building located 35.0 m away on film 50.0 mm behind the lens.

How tall is the image of the building on the film?

- (a) 17.1 mm (b) 7.00 mm
(c) 2.50 cm (d) 1.25 mm

90. A hollow lens is made of thin glass and in the shape of a double concave lens. It can be filled with air, water of refractive index 1.33 or CS_2 of refractive index 1.6. It will act as a diverging lens, if it is

- (a) filled with air and immersed in water
(b) filled with water and immersed in CS_2
(c) filled with air and immersed in CS_2
(d) filled with CS_2 and immersed in water

91. A diverging lens with magnitude of focal length 25 cm is placed at a distance of 15 cm from a converging lens of magnitude of focal length 20 cm. A beam of parallel light falls on the diverging lens. The final image formed is :

- (a) real and at a distance of 40 cm from the divergent lens
(b) real and at a distance of 6 cm from the convergent lens
(c) real and at a distance of 40 cm from convergent lens
(d) virtual and at a distance of 40 cm from convergent lens.

92. A beam of light from a source L is incident normally on a plane mirror fixed at a certain distance x from the source. The beam is reflected back as a spot on a scale placed just above the source L . When the mirror is rotated through a small angle θ , the spot of the light is found to move through a distance y on the scale. The angle θ is given by

- (a) $\frac{y}{x}$ (b) $\frac{x}{2y}$
(c) $\frac{x}{y}$ (d) $\frac{y}{2x}$

93. A glass beaker is filled with water up to 5 cm. It is kept on top of a 2 cm thick glass slab. When a coin at the bottom of the glass slab is viewed at the normal incidence from above the beaker, its apparent depth from the water surface is d cm. Value of d is close to (the refractive indices of water and glass are 1.33 and 1.5, respectively)

- (a) 2.5 cm (b) 5.1 cm
(c) 3.7 cm (d) 6.0 cm

94. A convex lens is put 10 cm from a light source and it makes a sharp image on a screen, kept 10 cm from the lens. Now a glass block (refractive index 1.5) of 1.5 cm thickness is placed in contact with the light source. To get the sharp image again, the screen is shifted by a distance d . Then d is:

- (a) 1.1 cm away from the lens
(b) 0
(c) 0.55 cm towards the lens
(d) 0.55 cm away from the lens

Case/Passage Based Questions

DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

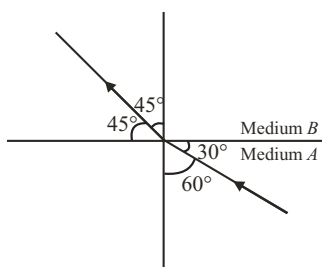
A 5.0 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 30 cm.

95. What is the distance of image from the pole of lens?
 (a) $v = 60$ cm (b) $v = -60$ cm
 (c) $v = 30$ cm (d) $v = -30$ cm
96. What is the power of the used lens?
 (a) $+5$ D (b) -5 D
 (c) $+0.5$ D (d) -0.5 D

Case/Passage - 2

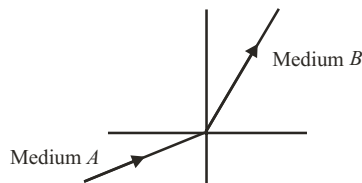
Light travels through a vacuum at a speed $c = 3 \times 10^8$ m/s. It can also travel through many materials, such as air, water and glass. Atoms in the material absorb, reemit and scatter the light, however. Therefore, light travels through the material at a speed that is less than c , the actual speed depending on the nature of the material. To describe the extent to which the speed of light in a material medium differs from that in a vacuum, we use a parameter called the index of refraction (or refractive index).

97. Figure shows a ray of light as it travels from medium A to



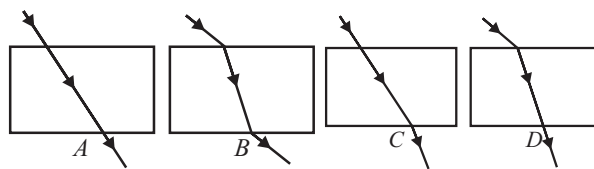
medium B . Refractive index of the medium B relative to medium A is

- (a) $\frac{\sqrt{3}}{2}$ (b) $\frac{\sqrt{2}}{\sqrt{3}}$
 (c) $\frac{1}{\sqrt{2}}$ (d) $\sqrt{2}$
98. A light ray enters from medium A to medium B as shown



in the figure. The refractive index of medium B relative to A will be

- (a) greater than unity (b) less than unity
 (c) equal to unity (d) zero
99. The path of a ray of light coming from air passing through a rectangular glass slab traced by four students shown as A , B , C and D in the figure. Which one of them is correct?



- (a) A (b) B
 (c) C (d) D

100. You are given water, mustard oil, glycerine and kerosene. In which of these media, a ray of light incident obliquely at same angle would bend the most?

- (a) Kerosene (b) Water
 (c) Mustard oil (d) Glycerine

101. A ray of light is incident in medium 1 on a surface that separates medium 1 from medium 2. Let v_1 and v_2 represent the velocity of light in medium 1 and medium 2 respectively. Also let n_{12} and n_{21} represent the refractive index of medium 1 with respect to medium 2 and refractive index of medium 2 with respect to medium 1, respectively. If i and r denote the angle of incidence and angle of refraction, then-

- (a) $\frac{\sin i}{\sin r} = n_{21} \frac{v_1}{v_2}$ (b) $\frac{\sin i}{\sin r} = n_{21} \frac{v_2}{v_1}$
 (c) $\frac{\sin i}{\sin r} = n_{12} \frac{v_1}{v_2}$ (d) $\frac{\sin i}{\sin r} = n_{12} \frac{v_2}{v_1}$

Case/Passage - 3

Inside a substance such as glass or water, light travels more slowly than it does in a vacuum. If c denotes the speed of light in a vacuum and v denotes its speed through some other substance, then $v = c/n$ where n is a constant called the index of refraction.

To good approximation, a substance's index of refraction does not depend on the wavelength of light. For instance, when red and blue light waves enter water, they both slow down by about the same amount. More precise measurements, however, reveal that n varies with wavelength. Table presents some indices of refraction of Custon glass, for different wavelengths of visible light. A nanometer (nm) is 10^{-9} meters. In a vacuum, light travels as $c = 3.0 \times 10^8$ m/s

Table : Indices of refraction of Custon glass

Approximately colour	Wavelength in vacuum (nm)	"Indices n"
yellow	580	1.5
yellow orange	600	1.498
orange	620	1.496
orange red	640	1.494

Light-Reflection and Refraction

102. Inside Custon glass
- Orange light travels faster than yellow light
 - Yellow light travels faster than orange light
 - Orange and Yellow light travels equally fast
 - We cannot determine which color of light travels faster
103. For blue-green of wavelength 520 nm, the index of refraction of Custon glass is probably closest to
- 1.49
 - 1.50
 - 1.51
 - 1.52
104. Which of the following phenomena happens because n varies with wavelength
- A lens focuses light
 - A prism breaks sunlight into different colors
 - Total internal reflections ensures that light travels down a fiber optic cable
 - Light rays entering a pond change direction at the pond's surface

Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
 - If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
 - If **Assertion** is **correct** but **Reason** is **incorrect**.
 - If **Assertion** is **incorrect** but **Reason** is **correct**.
105. **Assertion :** The diameter of convex lens required to form full image of an object is half the height of the object.
- Reason :** The smaller diameter lens will give full image of lower intensity.
106. **Assertion :** The image of a point object situated at the centre of hemispherical lens is also at the centre.
- Reason :** For hemisphere Snell's law is not valid.
107. **Assertion :** A point object is placed at a distance of 26 cm from a convex mirror of focal length 26 cm. The image will not form at infinity.
- Reason :** For above given system the equation $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$ gives $v = \infty$.
108. **Assertion :** When a concave mirror is held under water, its focal length will increase.
- Reason :** The focal length of a concave mirror is independent of the medium in which it is placed.
109. **Assertion :** A convex mirror is used as a driver's mirror.
- Reason :** Because convex mirror's field of view is large and images formed are virtual, erect and diminished.
110. **Assertion :** When the object moves with a velocity \vec{v} , its image in the plane mirror moves with a velocity of $-2\vec{v}$ with respect to the object.
- Reason :** The minimum height of the mirror to be required to see the full image of man of height h is $\frac{h}{2}$.
111. **Assertion :** As the temperature of a medium increases the refractive index decreases.
- Reason :** When a ray travels from vacuum to a medium, then μ is known as absolute refractive index of the medium. ($\mu_{\text{vacuum}} = 1$).
112. **Assertion :** If a spherical mirror is dipped in water, its focal length remains unchanged.
- Reason :** A laser light is focused by a converging lens. There will be a significant chromatic aberration.
113. **Assertion :** A virtual image cannot be projected on a screen.
- Reason :** Virtual images are formed by actual meeting of rays of light after reflection or refraction.
114. **Assertion :** Red light travels faster in glass than green light.
- Reason :** The refractive index of glass is less for red light than for green light.
115. **Assertion :** As light travels from one medium to another, the frequency of light does not change.
- Reason :** Because frequency is the characteristic of source.
116. **Assertion :** Light rays retrace their path when their direction is reversed (Law of reversibility of light rays)
- Reason :** For the refraction of light, water is denser than air, but for the refraction of sound, water is rarer than air.
117. **Assertion :** The mirrors used in search lights are parabolic and not concave spherical.
- Reason :** Silvered plano convex lens is used in search light.

Match the Following

DIRECTIONS : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

118. Match the following :

Column I

- (A) Power of convex mirror
(B) Power of concave mirror
(C) Power of plane mirror
(D) Power of convex lens

Column II

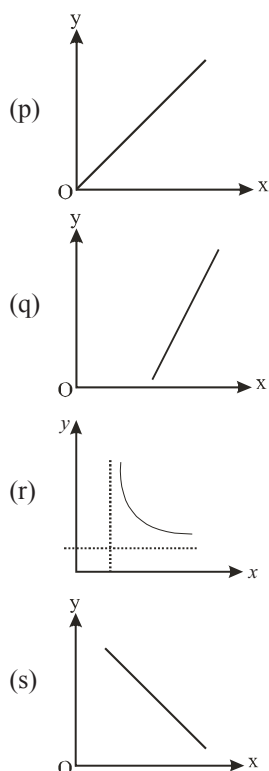
- (p) Positive power
(q) Negative power
(r) Zero power
(s) Infinite power

119. The graphs given apply to convex lens of focal length f , producing a real image at a distance v from the optical centre when self luminous object is at distance u from the optical centre. The magnitude of magnification is m . Identify the following graphs with the first named quantity being plotted along y-axis.

Column I

- (A) v against u
(B) $\frac{1}{v}$ against $\frac{1}{u}$
(C) m against v
(D) $(m + 1)$ against $\frac{v}{f}$

Column II



Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

120. The power of a convex lens is and that of a concave lens is

121. Light seems to travel in

122. A light ray travelling obliquely from a denser medium to a rarer medium bends the normal. A light ray bends the normal when it travels obliquely from a rarer to a denser medium.

123. In case of a rectangular glass slab, the refraction takes place at both interface and interface. The emergent ray is to the direction of incident ray.

124. Power of a lens is the reciprocal of its

125. The SI unit of power of a lens is

126. The angle of incidence is to the angle of reflection.

127. The reflecting surface of a spherical mirror may be curved or

128. The inner surface of the spoon can be approximated to a mirror.

129. The centre of the reflecting surface of a spherical mirror is a point called the

130. The centre of curvature of a concave mirror lies in of it.

131. Line passing through the pole and the centre of curvature of a spherical mirror is called the

132. A ray parallel to the principal axis, after reflection, will pass through the

133. The dentists use mirrors to see large images of the teeth of patients.

134. A transparent material bound by two surfaces, of which one or both surfaces are spherical, forms a

135. The degree of of light rays achieved by a lens is expressed in terms of its power.

136. An object is placed in front of a spherical mirror. The image is found to be virtual for all positions of the object. The spherical mirror is

137. Two immiscible transparent liquids A and B have 1.2 and 1.5 as their refractive indices (with respect to air). The refractive index of B with respect to A is

True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

Light-Reflection and Refraction

138. The reflecting surfaces, of all types, obey the laws of reflection.
139. Light travels in vacuum with an enormous speed of $3 \times 10^8 \text{ ms}^{-1}$.
140. The speed of light is different in different media.
141. The refractive index of a transparent medium is the ratio of the speed of light in vacuum to that in the medium.
142. The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane.
143. Image formed by a plane mirror is always virtual and erect.
144. The principal focus of a spherical mirror lies midway between the pole and centre of curvature.
145. Convex mirrors enable the driver to view much larger area than would be possible with a plane mirror.
146. A concave lens will always give a virtual, erect and diminished image.
147. A ray of light passing through the optical centre of a lens will emerge without any deviation.
148. The image in a plane mirror lies as far behind the mirror.
149. An object is placed in front of a mirror and an image of it is formed at the object itself. The mirror mentioned in question is a convex mirror.
150. A concave mirror can produce both real and virtual images.
151. Light travels faster in glass than in air.
152. The laws of reflection are valid for plane mirrors and not for spherical mirrors.
153. The mirror formula is valid only if the aperture of the mirror is small.
154. When a ray of light travels from air to water, its speeds up.
155. A lens that is thicker at the middle than at the edges is a diverging lens.

ANSWER KEY & SOLUTIONS

1. (b) In plane mirror, object distance = image distance

∴ Distance between object and image

$$= 0.5 + 0.5 = 1 \text{ m}$$

2. (a) $n = \frac{360^\circ}{90^\circ} = 4$

so numbe of images is $(n - 1) \Rightarrow (4 - 1) = 3$

3. (b) Concave mirror is used as a shaving mirror

4. (c) For all spherical mirrors $f = R/2$

5. (c) given, $m = \frac{\text{Image height}}{\text{object height}} > 1$

⇒ Image height > Object height

6. (b) Convex mirror always form virtual and erect image.

7. (b) 8. (c)

9. (a) Power = $\frac{1}{\text{focal length}}$

10. (a) Magnification, $m = \frac{\text{Image height}}{\text{Object height}}$

11. (b) Diminished, erect image is formed by convex mirror.

12. (b) 13. (b) 14. (a) 15. (c)

16. (d) For a spherical lens $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

For convex lens. $u = -f/2$ and f is +ve

$$\therefore \frac{1}{v} = \frac{1}{f} + \frac{1}{u} + \frac{1}{f} = +\frac{1}{f} - \frac{2}{f} \therefore v = -f$$

17. (d) 18. (c) 19. (a) 20. (c) 21. (a)

22. (a) 23. (c) 24. (b) 25. (c) 26. (b)

27. (c) 28. (d) 29. (d) 30. (d) 31. (d)

32. (d) 33. (b) 34. (b) 35. (a) 36. (a)

37. (b) 38. (d) 39. (a) 40. (a) 41. (b)

42. (c) 43. (b) 44. (c) 45. (b) 46. (c)

47. (c) 48. (c) 49. (b) 50. (b) 51. (d)

52. (c) 53. (a) 54. (c) 55. (c) 56. (a)

57. (b) ${}^a\mu_g = \frac{\sin 60^\circ}{\sin 35^\circ}$ and ${}^a\mu_w = \frac{\sin 60^\circ}{\sin 41^\circ}$

$$\therefore {}^a\mu_g = \frac{{}^a\mu_w}{\sin \theta} = \frac{\sin 41^\circ}{\sin \theta}$$

$$\text{or } \left(\frac{\sin 60^\circ / \sin 60^\circ}{\sin 35^\circ / \sin 41^\circ} \right) = \frac{\sin 41^\circ}{\sin \theta}$$

$$\therefore \theta = 35^\circ$$

58. (d) 59. (b) 60. (c) 61. (d) 62. (d)

63. (a) 64. (c) 65. (b) 66. (d) 67. (a)

68. (a) 69. (b) 70. (a) 71. (b) 72. (a)

73. (a)

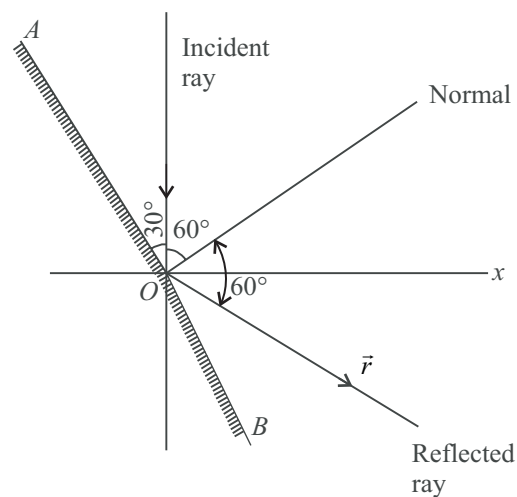
74. (c) Number of images formed = $\frac{360^\circ}{\theta} - 1 = 7$.

75. (c)

76. (b) $P = P_1 + P_2 \Rightarrow P = \frac{1}{f_1} + \frac{1}{f_2} \Rightarrow P = \frac{f_1 + f_2}{f_1 f_2}$

77. (c) According to laws of reflection,

angle of incidence = angle of reflection



- ∴ if a vector \vec{r} is along the reflected ray, then

$$\vec{r} = \cos 30^\circ \hat{i} - \sin 30^\circ \hat{j}$$

$$\vec{r} = \frac{\sqrt{3}}{2} \hat{i} - \frac{1}{2} \hat{j}$$

$$\vec{r} = \sqrt{3} \hat{i} - \hat{j}$$

Hence, the direction of the reflected ray vector is .

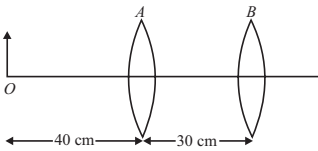
$$\sqrt{3} \hat{i} - \hat{j}$$

Light-Reflection and Refraction

78. (a) Angle of incidence, $i = 90^\circ - \theta$, decreases with increase in θ upto angle of incidence $i =$ critical angle reflection takes place so x is positive and beyond the critical angle refraction takes place so x is negative.

Hence graph 'A' correctly depicts variation of x with the angle θ .

79. (c) For lens A, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\Rightarrow \frac{1}{30} = \frac{1}{v} - \left(-\frac{1}{40}\right)$$


$$\Rightarrow \frac{1}{30} = \frac{1}{v} + \frac{1}{40}$$

$$= \frac{4+3}{120} = \frac{1}{120} \text{ or, } v = 120 \text{ cm.}$$

For lens B, $u = 90 \text{ cm}$ [$u = 120 - 30$]

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{30} = \frac{1}{v} - \frac{1}{90}$$

$$\frac{1}{v} = \frac{1}{30} + \frac{1}{90} = \frac{3+1}{90}$$

or, $v = 22.5 \text{ cm}$

Which is positive so that it is 22.5 cm from lens B.

80. (d) Two mirrors are inclined at an angle, $\theta = ?$

According to question, emergent ray is parallel to incident ray

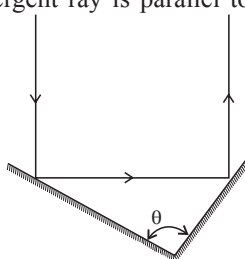
$$\therefore \text{deviation angle } \delta = 180^\circ$$

$$\text{But } \delta = 360^\circ - 2\theta$$

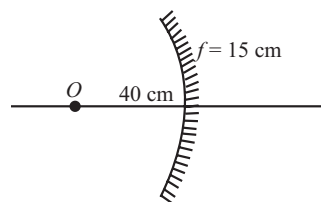
$$\text{or, } 360^\circ - 2\theta = 180^\circ$$

$$\text{or, } 2\theta = 180^\circ$$

$$\therefore \theta = 90^\circ$$



81. (b)



Using mirror formula, $\frac{1}{f} = \frac{1}{v_1} + \frac{1}{u}$

$$-\frac{1}{15} = \frac{1}{v_1} + \frac{1}{40} \Rightarrow \frac{1}{v_1} = \frac{1}{-15} + \frac{1}{40}$$

$$\therefore v_1 = -24 \text{ cm}$$

When object is displaced by 20 cm towards mirror
Now, $u_2 = -20$

$$\text{So, } \frac{1}{f} = \frac{1}{v_2} + \frac{1}{u_2}$$

$$\frac{1}{-15} = \frac{1}{v_2} - \frac{1}{20} \Rightarrow \frac{1}{v_2} = \frac{1}{20} - \frac{1}{15}$$

$$\therefore v_2 = -60 \text{ cm}$$

Therefore image shifts away from mirror by
 $= 60 - 24 = 36 \text{ cm}$

82. (c) For the end B, image distance of end B will be,

$$f = 10 \text{ cm}$$

$$u_B = -18 \text{ cm}$$

$$v_B = \text{image distance of end B}$$

As we know,

$$\frac{1}{f} = \frac{1}{v_B} - \frac{1}{u_B}$$

$$\frac{1}{v_B} = \frac{1}{f} + \frac{1}{u_B}$$

$$\frac{1}{v_B} = \frac{1}{10} - \frac{1}{18} = \frac{8}{180}$$

$$v_B = \frac{180}{8} \Rightarrow 22.5 \text{ cm}$$

Similarly, for the end A, image distance of end A will be,

$$f = 10 \text{ cm}$$

$$u_A = -20 \text{ cm}$$

$$v_A = \text{image distance of end A}$$

$$\frac{1}{f} = \frac{1}{v_A} - \frac{1}{u_A}$$

$$\frac{1}{v_A} = \frac{1}{f} + \frac{1}{u_A}$$

$$\frac{1}{v_A} = \frac{1}{10} - \frac{1}{20} = \frac{1}{20}$$

$$v_A = 20 \text{ cm}$$

So, length of image $A'B' = (v_B - v_A)$

$$= 22.5 - 20 = 2.5 \text{ cm}$$

$$\text{So magnification, } m = \frac{A'B'}{AB} \Rightarrow \frac{2.5}{2} = 1.25$$

83. (c) $+5 = -\frac{v}{u} \Rightarrow v = -5u$

$$\text{Using } \Rightarrow \frac{1}{v} + \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{-5u} + \frac{1}{u} = \frac{-1}{0.4}$$

$$\therefore u = -0.32 \text{ m.}$$

84. (a) Given,

Object distance, $u = 30\text{cm}$

when a lens is cut along the principle axis into two equal parts focal length remains same for each part.

\therefore Focal length, $f = 20\text{cm}$

using lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\text{P } \frac{1}{v} = \frac{1}{20} - \frac{1}{30} = \frac{1}{60}$$

$$\Rightarrow v = 60\text{ cm}$$

85. (c) Focal length of a lens, $F = 25\text{ cm}$

$$f = 0.25\text{ m}$$

$$P = \frac{1}{f} = \frac{1}{0.25} = 4D$$

86. (a) 87. (b) 88. (a) 89. (a)

90. (d) Here $\mu_{\text{CS}_2} > \mu_{\text{water}} > \mu_{\text{air}}$

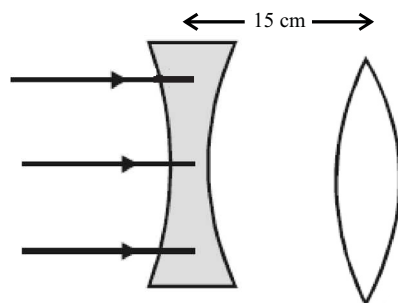
i.e., CS_2 is denser than water and water is denser than air.

When medium outside a lens is denser than medium of lens, then a concave lens will act like a convex lens and *vice-versa*.

Hence, lens here acts as a diverging lens when filled with CS_2 and immersed in water.

91. (c) As parallel beam incident on diverging lens will form image at focus.

$$\therefore v = -25\text{ cm}$$



$$f = -25\text{ cm}$$

$$f = 20\text{ cm}$$

The image formed by diverging lens is used as an object for converging lens,

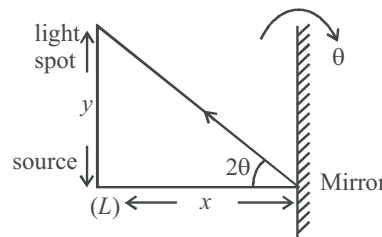
So for converging lens $u = -25 - 15 = -40\text{ cm}$, $f = 20\text{ cm}$

\therefore Final image formed by converging lens

$$\frac{1}{V} - \frac{1}{-40} = \frac{1}{20}$$

or, $V = 40\text{ cm}$ from converging lens real and inverted.

92. (d) When mirror is rotated by angle θ reflected ray will be rotated by 2θ .



$$\frac{y}{x} = 2\theta \Rightarrow \theta = \frac{y}{2x}$$

93. (b) Given: $d_1 = 5\text{ cm}$, $\mu_1 = 1.33$

$$d_2 = 2\text{ cm}, \mu_2 = 1.5$$

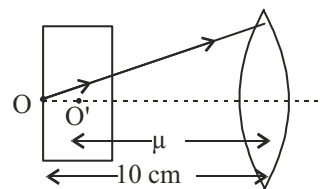
d_1 and d_2 are the thickness of slabs of medium with refractive index μ_1 and μ_2 , respectively.

using formula, $d = \frac{d_1}{\mu_1} + \frac{d_2}{\mu_2} + \dots$

$$\text{Apparent depth, } d = \frac{5}{1.33} + \frac{2}{1.5}$$

$$= 5.088\text{ cm} = 5.1\text{ cm}$$

94. (d)



As the object and image distance is same, object is placed at $2f$. Therefore $2f = 10$

$$\text{or } f = 5\text{ cm.}$$

$$\text{Shift due to slab, } d = t \left(1 - \frac{1}{\mu} \right)$$

in the direction of incident ray

$$\Rightarrow d = 1.5 \left(1 - \frac{2}{3} \right) = 0.5\text{ cm}$$

$$\text{Now, } u = -9.5\text{ cm}$$

$$\text{Again using lens formulas } \frac{1}{v} - \frac{1}{-9.5} = \frac{1}{5}$$

$$\Rightarrow v = 10.55\text{ cm}$$

Thus, screen is shifted by a distance $d = 10.55 - 10 = 0.55\text{ cm}$ away from the lens.

Light-Reflection and Refraction

95. (a) Object size $h_0 = 5.0$ cm, $f = 20$ cm,

Object distance $u = -30$ cm

$$\text{Since, } \frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$$

$$\text{Then } \frac{1}{v} = \frac{1}{20} + \frac{1}{-30} = \frac{1}{60}$$

$$\therefore v = +60 \text{ cm}$$

Positive sign of v shows that image is formed at a distance of 60 cm from the pole to the right of the lens.

Therefore image is real and inverted.

96. (a) Power = $\frac{1}{f} = \frac{1}{0.2\text{m}} = +5\text{D}$

97. (a) From figure, angle of incidence, $i = 60^\circ$ and angle of refraction, $r = 45^\circ$

Refractive index of the medium B relative to medium A , (from Snell's law)

$$\mu_{BA} = \frac{\sin i}{\sin r} = \frac{\sin 60^\circ}{\sin 45^\circ} = \frac{\left(\frac{\sqrt{3}}{2}\right)}{\left(\frac{1}{\sqrt{2}}\right)} = \frac{\sqrt{3}}{2}$$

98. (a) Since light rays in the medium B goes towards normal (figure), so it has greater refractive index i.e., denser w.r.t. medium A . Hence, refractive index of medium B relative to medium A is greater than unity.

99. (b) In a rectangular glass slab, the emergent rays are parallel to the direction of the incident ray, as the extent of bending of the ray of light at the opposite parallel faces air-glass and glass-air interface of the rectangular glass slab is equal and opposite.

This is why the ray emerges are parallel to the incident ray.

100. (d) Among the given material kerosene refractive index, $\mu = 1.44$, water $\mu = 1.33$, mustard oil $\mu = 1.46$ and glycerine $\mu = 1.74$. Glycerine is most optically denser. Therefore, ray of light bend most in glycerine.

101. (a) $\frac{\sin i}{\sin r} = n_{21} = \frac{v_1}{v_2}$

102. (a) 103. (c) 104. (b)

105. (d) Any size of lens, can form full image, only intensity of image decreases with decrease in size.

106. (c) The rays from centre of hemisphere cut at the centre after refraction - Snell's law is valid in each case of refraction.

107. (d) 108. (d) 109. (a) 110. (b)

111. (b) 112. (c)

113. (c) Virtual image is formed when the rays of light after reflection or refraction appear to meet at a point.

114. (a) 115. (a) 116. (c) 117. (c)

118. (A) \rightarrow p; (B) \rightarrow p; (C) \rightarrow r; (D) \rightarrow p

119. (A) \rightarrow r; (B) \rightarrow p; (C) \rightarrow q; (D) \rightarrow s

120. positive, negative. 121. straight lines.

122. away from, towards 123. air-glass, glass-air, parallel

124. focal length 125. dioptre

126. equal 127. inwards, outwards.

128. concave 129. pole

130. front 131. principal axis

132. principal focus 133. concave

134. lens. 135. convergence or divergence

136. convex 137. $5/4$

138. True 139. True 140. True 141. True

142. True 143. True 144. True 145. True

146. True 147. True 148. True 149. False

150. True 151. False 152. False 153. True

154. False 155. False

6

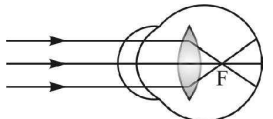

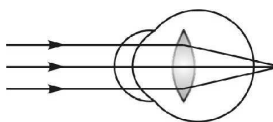
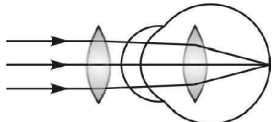
The Human Eye and the Colourful World

Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

- The human eye possesses the power of accommodation. This is the power to :
 - alter the diameter of the pupil as the intensity of light changes
 - distinguish between lights of different colours
 - focus objects at different distances
 - decide which of the two objects is closer.
- How does the eye change in order to focus on near or distant objects?
 - The lens moves in or out
 - The retina moves in or out
 - The lens becomes thicker or thinner
 - The pupil gets larger or smaller
- Which of the following changes occur when you walk out of bright sunshine into a poorly lit room?
 - The pupil becomes larger
 - The lens becomes thicker
 - The ciliary muscle relaxes
 - The pupil becomes smaller
- A person got his eyes tested. The optician's prescription for the spectacles reads:
Left eye : -3.00 D Right eye : -3.50 D
The person is having a defect of vision called :
 - presbyopia
 - myopia
 - astigmatism
 - hypermetropia
- A student sitting on the last bench in the class cannot read the writing on the blackboard clearly but he can read the book lying on his desk clearly. Which of the following statement is correct about the student?
 - The near point of his eyes has receded away.
 - The near point of his eyes has come closer to him.
 - The far point of his eyes has receded away.
 - The far point of his eyes has come closer to him.
- A man driving a car can read a distant road sign clearly but finds difficulty in reading the odometer on the dashboard of the car. Which of the following statement is correct about this man?
 - The near point of his eyes has receded away.
 - The near point of his eyes has come closer to him.
 - The far point of his eyes has receded away.
 - The far point of his eyes has come closer to him.
- Which of the following is not caused by the atmospheric refraction of light?
 - Twinkling of stars at night
 - Sun appearing higher in the sky than it actually is
 - Sun becoming visible two minutes before actual sunrise
 - Sun appearing red at sunset
- The sky appears dark to passengers flying at very high altitudes mainly because : **[CBSE 2020]**
 - Scatterings of light is not enough at such heights.
 - There is no atmosphere at great heights.
 - The size of molecules is smaller than the wavelength of visible light.
 - The light gets scattered towards the earth.
- A near sighted person cannot see distinctly beyond 50 cm from his eye. The power in diopter of spectacle lenses which will enable him to see distant objects clearly is
 - +50
 - 50
 - +2
 - 2

The Human Eye and the Colourful World

10. The following one is not a primary colour
 (a) Yellow (b) Red
 (c) Green (d) Blue
11. When a mirror is rotated an angle the reflected ray moves through double that angle, the instrument based on the above principle is
 (a) Periscope (b) Odometer
 (c) Refractometer (d) Sextant
12. In the visible spectrum the colour having the shortest wavelength is
 (a) Green (b) Red
 (c) Violet (d) Blue
13. The splitting of white light into several colours on passing through a glass prism is due to
 (a) refraction (b) reflection
 (c) interference (d) diffraction
14. 1. 
 2. 
 3. 
 4. 
- Identify the wrong description of the above figures
 (a) 1 represents far-sightedness
 (b) 2 correction for short sightedness
 (c) 3 represents far sightedness
 (d) 4 correction for far-sightedness
15. At sun rise or at sun set the sun appears to be reddish while at mid-day it looks white. This is because
 (a) Scattering due to dust particles and air molecules causes this phenomenon
 (b) The sun is cooler at sun rise or at sunset
 (c) Refraction causes this phenomenon
 (d) Diffraction sends red rays to the earth at these times.
16. A person 20 years old cannot see objects clearly which are nearer than 75 cms from his eyes, the disease he is suffering from is
 (a) Astigmatism (b) Myopia
 (c) Hypermetropia (d) Presbyopia
17. On entering a glass prism, sun rays are
 (a) Deviated but not dispersed
 (b) Deviated and dispersed
 (c) Dispersed but not deviated
 (d) Neither deviated nor dispersed.
18. A piece of cloth looks red in sun light. It is held in the blue portion of a solar spectrum, it will appear
 (a) red (b) black
 (c) blue (d) white
19. To get line spectrum, the substances are excited in their
 (a) solid state (b) molecular state
 (c) gaseous state (d) atomic state
20. A student can distinctly see the object upto a distance 15 cm. He wants to see the black board at a distance of 3 m. Focal length and power of lens used respectively will be
 (a) $-4.8 \text{ cm}, -3.3 \text{ D}$ (b) $-5.8 \text{ cm}, -4.3 \text{ D}$
 (c) $-7.5 \text{ cm}, -6.3 \text{ D}$ (d) $-15.8 \text{ cm}, -6.3 \text{ D}$
21. The pupil of the eye changes in size to adjust for
 (a) objects at different distances
 (b) objects of different sizes
 (c) different colors
 (d) different amounts of light
22. What power lens is needed to correct for nearsightedness where the uncorrected far point is 250 cm?
 (a) +2.5 diopters (b) -2.5 diopters
 (c) +0.4 diopters (d) -0.4 diopters
23. What power lens is needed to correct for farsightedness where the uncorrected near point is 50 cm?
 (a) +2 diopters (b) -3 diopters
 (c) +4 diopters (d) -2 diopters
24. In a room, artificial rain is produced at one end and a strong source of white light is switched on at the other end. To observe the rainbow an observer must
 (a) Look anywhere in the room
 (b) Look towards the source
 (c) Look towards the raindrops
 (d) Look in a direction equally inclined to the source of raindrops
25. Astigmatism can be corrected by
 (a) Bifocal lenses (b) Cylindrical lenses
 (c) Concave lenses (d) Planoconvex lenses
26. The least distance of vision of a longsighted person is 60 cm. By using a spectacle lens, this distance is reduced to 12 cm. The power of the lens is
 (a) +5.0 D (b) $+(20/3) \text{ D}$
 (c) $-(10/3) \text{ D}$ (d) +2.0 D

27. A man can see upto 100 cm of the distant object. The power of the lens required to see far objects will be

- (a) + 0.5 D (b) + 1.0 D
(c) + 1 D (d) - 5.0 D

28. Dispersion is the term used to describe

- (a) the propagation of light in straight lines
(b) The splitting of a beam of light into component colours
(c) The bending of a beam of light when it strikes a mirror
(d) The change that takes place in white light after passage through red glass.

29. A given ray of light suffers minimum deviation in an equilateral prism P. Additional prisms Q and R of identical shape and material are now added to P as shown in the figure. The ray will suffer

- (a) greater deviation
(b) same deviation
(c) no deviation
(d) total internal reflection



30. In a glass prism

- (a) Blue light is dispersed more than red light
(b) Red light is dispersed more than blue light
(c) Both red light and blue light are equally dispersed
(d) None of these

31. An optician while testing the eyes finds the vision of a patient to be 6/12. By this he means that

- (a) The person can read the letters of 6 inches from a distance of 12 m
(b) The person can read the letters of 12 inches from 6 m
(c) The person can read the letters of 6 m which the normal eye can read from 12 m
(d) The focal length of eye lens had become half that of the normal eye

32. A person cannot see objects clearly beyond 50 cm. The power of the lens to correct the vision is

- (a) +5 D (b) -0.5 D
(c) -2 D (d) +2 D

33. A long sighted person has a minimum distance of distinct vision of 50 cm. He wants to reduce it to 25 cm. He should use a

- (a) Concave lens of focal length 50 cm
(b) Convex lens of focal length 25 cm
(c) Convex lens of focal length 50 cm
(d) Concave lens of focal length 25 cm

34. A long-sighted person cannot see objects clearly at a distance less than 40 cm. from his eye. The power of the lens needed to read an object at 25 cm. is

- (a) - 2.5 D (b) + 2.5 D
(c) - 6.25 D (d) + 1.5 D

35. Twinkling of stars is on account of

- (a) Large distance of stars and storms in air
(b) Small size of stars
(c) Large size of stars
(d) Large distance of stars and fluctuations in the density of air.

36. White light is incident at an angle to the surface of a triangular piece of glass. Which color of light deviates most from its original path after leaving the glass?

- (a) red (b) orange
(c) green (d) blue

37. The middle vascular coat that darkens the eye chamber and prevents refraction by absorbing the light rays is

- (a) choroid (b) sclera
(c) retina (d) cornea

38. When light rays enter the eye, most of the refraction occurs at the

- (a) crystalline lens
(b) outer surface of the cornea
(c) iris
(d) pupil

39. When the light is bright,

- (a) the iris makes the pupil expand
(b) the iris and the pupil contract
(c) the iris and the pupil remain as they are
(d) none of the above

40. The eyelens light rays to form real, inverted and highly diminished image on the

- (a) converges, retina (b) diverges, retina
(c) converges, pupil (d) diverges, pupil

41. The surface of retina has about 125 million light sensitive

- (a) rods only (b) cones only
(c) rods and cones (d) neither rods nor cones

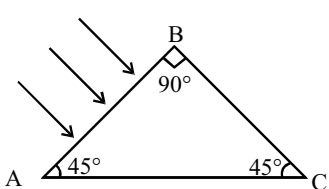
42. The 'far point' of a normal human eye is

- (a) 25 cm (b) 25 m
(c) 100 m (d) at infinity

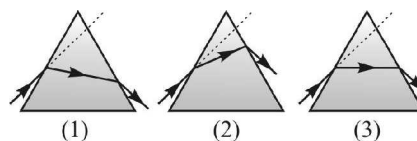
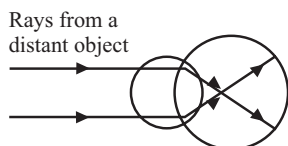
43. The property related to the sense of continuity of vision is called

- (a) persistence of vision
(b) colour blindness
(c) optical illusion
(d) none of these

The Human Eye and the Colourful World

44. When the ciliary muscles are relaxed, the eyelens is and distant objects can be seen clearly.
- (a) thin (b) thick
(c) inclined (d) none of these
45. While looking at nearby objects, the ciliary muscles the eyelens so as to its focal length.
- (a) contract, increase
(b) contract, decrease
(c) expand, increase
(d) expand, decrease
46. The change in focal length of an eyelens to focus the image of object at varying distances is done by the action of the
- (a) pupil (b) ciliary muscles
(c) retina (d) blind spot
47. Which of the following statement is correct?
- (a) A person with myopia can see distant objects clearly
(b) A person with hypermetropia can see nearby objects clearly
(c) A person with myopia can see nearby objects clearly
(d) A person with hypermetropia cannot see distant objects clearly
48. A person cannot see distinctly objects kept beyond 2 m. This defect can be corrected by using a lens of power
- (a) + 0.5 D (b) - 0.5 D
(c) + 0.2 D (d) - 0.2 D
49. A beam of light consisting of red, green and blue colours is incident on a right-angled prism as shown. The refractive index of the material of the prism for the above red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively. The prism will
- 
- (a) separate part of the red colour from the green and blue colours.
(b) separate part of the blue colour from the red and green colours.
(c) separate all the three colours from one another.
(d) not separate even partially any colour from the other two colours.
50. The rod cells correspond to
- (a) the colour of light
(b) the source of light
(c) the intensity of light
(d) none of these
51. Which of the following statements is correct regarding the propagation of light of different colours of white light in air?
- (a) Red light moves fastest
(b) Blue light moves faster than green light
(c) All the colours of the white light move with the same speed
(d) Yellow light moves with the mean speed as that of the red and the violet light
52. When a ray passes through a prism,
- (a) it goes undeviated
(b) it remains parallel to the base
(c) it bends towards the base
(d) none of the above
53. The clear sky appears blue because
- (a) blue light gets absorbed in the atmosphere
(b) ultraviolet radiations are absorbed in the atmosphere
(c) violet and blue lights get scattered more than lights of all other colours by the atmosphere
(d) light of all other colours is scattered more than violet and blue colour lights by the atmosphere
54. At noon the sun appears white as
- (a) light is least scattered
(b) all the colours of the white light are scattered away
(c) blue colour is scattered the most
(d) red colour is scattered the most
55. Which of the following phenomena contributes significantly to the reddish appearance of the sun at sunrise or sunset?
- (a) Dispersion of light
(b) Scattering of light
(c) Total internal reflection of light
(d) Reflection of light from the earth
56. The bluish colour of water in deep sea is due to
- (a) the presence of algae and other plants found in water
(b) reflection of sky in water
(c) scattering of light
(d) absorption of light by the sea
57. A student sitting on the last bench can read the letters written on the blackboard but is not able to read the letters written in his text book. Which of the following statements is correct?
- (a) The near point of his eyes has receded away
(b) The near point of his eyes has come closer to him

- (c) The far point of his eyes has come closer to him
 (d) The far point of his eyes has receded away
58. The danger signals installed at the top of tall buildings are red in colour. These can be easily seen from a distance because among all other colours, the red light
- is scattered the most by smoke or fog
 - is scattered the least by smoke or fog
 - is absorbed the most by smoke or fog
 - moves fastest in air
59. A person is suffering from both near sightedness and far sightedness. His spectacles would be made of
- two convex lenses with the upper lens having a larger focal length than the lower lens.
 - two concave lenses with the upper lens having a smaller focal length than the lower lens.
 - a concave lens as the upper lens and a convex lens as the lower lens
 - a convex lens as the upper lens and a concave lens as the lower lens
60. The stars twinkle in the night, because :
- Their emit light intermittently
 - Their star's atmosphere absorbs light intermittently
 - The earth's atmosphere absorbs light intermittently
 - The refractive index of air in atmosphere fluctuates
61. A Red object when seen through a thick blue glass appears:
- Green
 - Violet
 - Black
 - Red
62. If a person can see an object clearly when it is placed at 25 cm away from him, he is suffering from :
- myopia
 - hypermetropia
 - astigmatism
 - none of these
63. A person is suffering from some sight problem. From the given diagram say which defect he suffers from?
- Myopia
 - Hypermetropia
 - Cataract
 - Astigmatism



- 1
- 2
- 3
- None of these

- A concave lens of 0.5 D
 - A concave lens of 1.0 D
 - A concave lens of 2.0 D
 - A convex lens of 2.0 D
65. Select the correct statement about rainbow.
- We can see a rainbow in the western sky in the late afternoon
 - The double rainbow has red on the inside and violet in the outside
 - A rainbow has an arc shape, since the earth is round
 - A rainbow on the moon is violet on the inside and red on the outside
66. Various optical processes are involved in the formation of a rainbow. Which of the following provides the correct order in time in which these processes occur ?
- Refraction, total internal reflection, refraction
 - Total internal reflection, refraction total internal reflection
 - Total internal reflection, refraction, refraction
 - Refraction, total internal reflection, total internal reflection.
67. Pick the wrong answer in the context with rainbow.
- When the light rays undergo two internal reflections in a water drop, a secondary rainbow is formed.
 - The order of colours is reversed in the secondary rainbow.
 - An observer can see a rainbow when his front is towards the sun.
 - Rainbow is a combined effect of dispersion, refraction and reflection of sunlight.
68. The reason for using red light in traffic signals to stop vehicles.
- Red light has shorter wavelength
 - Red light has longer wavelength
 - Red light is very bright and attractive
 - Red light has highest angle of refraction

The Human Eye and the Colourful World

70. If for a given prism the angle of incidence is changed from 0° to 90° , the angle of deviation
- Increases
 - Decreases
 - First decreases and then increases
 - First increases and then decreases

Case/Passage Based Questions

DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

Human eye is spherical in shape and has diameter of about 2.5 cm. Sclerotic is a tough, opaque and white substance forming the outermost coating of the eyeball. The front portion is sharply curved and covered by a transparent protective membrane called the 'cornea'. Inner to the sclerotic there is a layer of black tissue called as choroids consisting of a mass of blood vessels, which nourishes the eye. The black colour does not reflect the light and hence rules out the blurring of image by reflection within the eyeball.

Behind the cornea, the space is filled with a liquid called the aqueous humour and behind that a crystalline lens. 'Iris' is a muscular diaphragm lying between the aqueous humour and the crystalline lens. Iris has an adjustable opening in the middle called the pupil of the eye. The pupil appears black because all the light entering is absorbed by the 'retina', which covers the inside of the rear part of the ball. Iris controls the amount of light entering because the retina absorbs nearly all the light, which falls upon it. This is done by varying the aperture of the pupil with the help of the iris. In dim light the iris dilates the pupil so that more light can enter in. When the light is bright the pupil contracts.

The crystalline lens divides the eyeball into two chambers. The chamber between the cornea and the lens is called the anterior chamber filled with a fluid called aqueous humour while the chamber between the lens and the retina is called the posterior chamber which is filled with a transparent gelatinous substance called vitreous humour.

The refractive indices of the cornea, pupil lens and fluid portion of the eye are quite similar. So, when a ray of light enters the eye, it is refracted at the cornea. This refraction produces a real inverted and diminished image of distant objects on the retina.

When the object is kept at different distances then, we may expect the image to be formed at different distances from the lens. It means, it may not form on the retina always.

But in reality it is not so. Image is always formed on the retina. This is possible because the curvature of the crystalline lens is altered by ciliary muscles. When the eye is focused on infinity the muscles are relaxed and the eye lens remains thin. If the object is brought near by, the curvature increases so that the image can be formed on the retina. This property of the eye lens is called accommodation.

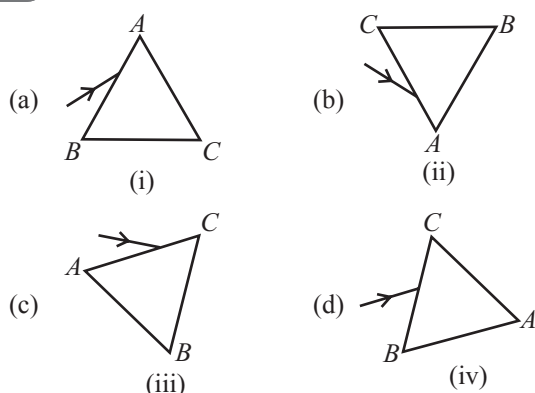
71. The change in focal length of an eye lens to focus the image of objects at varying distances is done by the action of _____
- pupil
 - ciliary muscles
 - retina
 - blind spot
72. The fluid between the retina and the lens is called _____
- aqueous humour
 - vitreous humour
 - aqua
 - humus
73. The part of the eye where optic nerves enter the eye
- pupil
 - ciliary muscles
 - retina
 - blind spot
74. The inner back surface of the eyeball is called
- pupil
 - ciliary muscles
 - retina
 - blind spot

Case/Passage - 2

The phenomenon of decomposition of the white light into its seven component colours when passing through a prism or through a transparent object delimited by non parallel surfaces is called dispersion of light. A beam of light containing all the visible spectrum of the light is white, because the sum of all the colors generates the white color. The light is decomposed in all the component colours, Violet, Indigo, Blue, Green, Yellow, Orange and Red, called as VIBGYOR. The band of the coloured components of a light beam is called its spectrum. The phenomenon can be explained by thinking that light of different colours (different wavelengths) has different velocities while travelling in a medium $v_m = f\lambda_m$.

Hence, the change in velocity of light observed when the light passes from the air to the glass, depends on the wavelength.

75. A prism ABC (with BC as base) is placed in different orientations. A narrow beam of white light is incident on the prism as shown in figure. In which of the following cases, after dispersion, the third colour from the top corresponds to the colour of the sky?



76. Which of the following statements is correct regarding the propagation of light of different colours of white light in air?
- Red light moves fastest
 - Blue light moves faster than green light
 - All the colours of the white light move with the same speed
 - Yellow light moves with the mean speed as that of the red and the violet light
77. When white light is allowed to pass through a glass prism, which colour deviates the least?
- Violet
 - Red
 - Green
 - Orange
78. When white light is allowed to pass through a glass prism, which colour deviates the most?
- Indigo
 - Green
 - Red
 - Violet
79. For a prism material, refractive index is highest for
- Red
 - Yellow
 - Orange
 - Violet

Case/Passage - 3

The ciliary muscles of eye control the curvature of the lens in the eye and hence can alter the effective focal length of the system. When the muscles are fully relaxed, the focal length is maximum. When the muscles are strained the curvature of lens increases (that means radius of curvature decreases) and focal length decreases. For a clear vision the image must be on retina. The image distance is therefore fixed for clear vision and it equals the distance of retina from eye-lens. It is about 2.5 cm for a grown-up person.

A person can theoretically have clear vision of objects situated at any large distance from the eye. The smallest distance at which a person can clearly see is related to minimum possible

focal length. The ciliary muscles are most strained in this position. For an average grown-up person minimum distance of object should be around 25 cm.

A person suffering for eye defects uses spectacles (Eye glass). The function of lens of spectacles is to form the image of the objects within the range in which person can see clearly. The image of the spectacle-lens becomes object for eye-lens and whose image is formed on retina.

The number of spectacle-lens used for the remedy of eye defect is decided by the power of the lens required and the number of spectacle-lens is equal to the numerical value of the power of lens with sign. For example power of lens required is +3D (converging lens of focal length 100/3 cm) then number of lens will be +3.

For all the calculations required you can use the lens formula and lens maker's formula. Assume that the eye lens is equiconvex lens. Neglect the distance between eye lens and the spectacle lens.

80. Minimum focal length of eye lens of a normal person is
- 25 cm
 - 2.5 cm
 - 25/9 cm
 - 25/11 cm
81. Maximum focal length of eye lens of normal person is
- 25 cm
 - 2.5 cm
 - 25/9 cm
 - 25/11 cm
82. A nearsighted man can clearly see object only upto a distance of 100 cm and not beyond this. The number of the spectacles lens necessary for the remedy of this defect will be
- +1 D
 - 1 D
 - +3 D
 - 3 D

Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
- If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
- If **Assertion** is **correct** but **Reason** is **incorrect**.
- If **Assertion** is **incorrect** but **Reason** is **correct**.

83. **Assertion :** When ray of light falls on the particles of a colloidal solution, the path of the beam is visible.

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Reason : Path of light is visible due to the scattering of light by the colloidal particles.

84. **Assertion :** Sun looks white at noon.

Reason : At noon, the light has to travel longer distance through the atmosphere before reaching the eye of an observer.

85. **Assertion :** When a ray of light passes through a prism, it bends towards the thicker part of the prism.

Reason : An incident ray strikes a prism, undergoes refraction and comes out as an emergent ray.

86. **Assertion:** Myopia is due to the increased converging power of the eye lens.

Reason: Myopia can be corrected by using spectacles made from concave lenses.

87. **Assertion:** The twinkling of stars is due to the fact that refractive index of the earth's atmosphere fluctuates.

Reason: In cold countries, the phenomenon of looming (*i.e.*, ship appears in the sky) takes place, because refractive index of air decreases with height.

88. **Assertion:** When we see an object, the image formed on the retina is real and inverted.

Reason: If the magnification of a system is less than one, then the image formed is inverted.

89. **Assertion:** Rainbow is an example of the dispersion of sunlight by the water droplets.

Reason: Light of shorter wavelength is scattered much more than light of larger wavelength.

Match the Following

DIRECTIONS : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

90. Column II gives lens that can be use to correct the defect of vision given in column I, match them correctly.

Column I	Column II
(A) Myopia	(p) Convex lens
(B) Hypermetropia	(q) Concave lens
(C) Astigmatism	(r) Cylindrical lens
(D) Presbyopia	(s) Bi-focal lens

Fill in the Blanks

Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

91. The coloured diaphragm between the cornea and the lens is
92. The middle point of the iris has a hole, which is called
93. The screen on which the image is formed by the lens system of the human eye is called
94. For young adult with normal vision, least distance of distinct vision =
95. The closest distance at which the eye can focus clearly is called the
96. For a normal eye, the range of vision is from
97. A person is short-sighted if his eyeball is too
98. The eye which cannot simultaneously see with the same distinctness all objects or lines making different inclinations is said to suffer from
99. The defect of the eye due to which a person is unable to distinguish between certain colours, known as
100. The ability of the eye to focus both near and distant objects, by adjusting its focal length, is called the
101. The smallest distance, at which the eye can see objects clearly without strain, is called the of the eye.
102. The splitting of white light into its component colours is called
103. causes the blue colour of sky and the reddening of the Sun at sunrise and sunset.
104. Sunlight comprises colours.

True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

105. Lens which is used for correcting the presbyopia defect of the eye is concave.
106. The colour that deviates maximum while passing through a glass prism is violet.
107. Water droplets act as tiny prism in the formation of rainbow.

108. The transparent spherical membrane covering the front of the eye is known as cornea.
109. The eye which can see near object clearly is said to suffer from hypermetropia.
110. The eye which cannot see distant objects clearly is said to suffer from myopia.
111. Colour blindness is a genetic disorder which occurs by inheritance.
112. In Myopia the image of distant objects is focused before the retina.
113. Hypermetropia is corrected by using a convex lens of suitable power.
114. A person suffering from myopia cannot see distant objects clearly.
115. The sun looks red at sunset because most of the blue light in sunrays is scattered leaving behind red and yellow lights.
116. Clouds look white because water droplets of clouds scatter all colours of light equally.
117. The sun is visible two minutes before the actual sunrise due to atmospheric refraction.

ANSWER KEY & SOLUTIONS

1. (c) The ability of the eye lens to change its shape to focus near and distant objects clearly is called power of accommodation.
2. (c) Curvature of eye lens is adjusted with the help of ciliary muscles.
3. (a) In poorly lit room or dim light the iris expands the pupil to allow more light to enter the eye.
4. (b) 5. (d) 6. (a)
7. (d) Near the horizon at sunrise and sunset, most of the blue light and shorter wavelengths are scattered away and hence sun appears red.
8. (a) Scattering of light is not enough at such heights.
9. (d) 10. (a) 11. (d) 12. (c)
13. (a) Dispersion arises because of basic phenomenon refraction.
14. (a) 15. (a) 16. (c) 17. (b)
18. (b) 19. (d)
20. (d) $v = -15$ cm, $u = -300$ cm
 As $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$
 $\Rightarrow \frac{1}{f} = \frac{1}{(-15)} - \frac{1}{(-300)} = \frac{-19}{300}$
 $f = -15.8$ cm = -0.158 m
 Power $P = \frac{-100 \times 19}{300} = -6.33$ D
21. (d) 22. (d) 23. (a) 24. (c) 25. (b)
26. (b) $v = -60$ cm, $u = -12$ cm
 $\therefore \frac{1}{(-60)} - \frac{1}{(-12)} = \frac{1}{f}$
 $\Rightarrow \frac{1}{f} = \frac{1}{15} \Rightarrow f = 15$ cm = $\frac{15}{100}$ m
 Power = $\frac{100}{15} = \frac{20}{3}$ D
27. (c) $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$
 Here $u = (-\infty)$
- $v = (-100)$
 $\frac{1}{f} = \frac{1}{(-100)} - \frac{1}{(-\infty)} = -\frac{1}{100}$
 $f = -100$ cm = -1 m
 power = -1 D
28. (b) 29. (a) 30. (a) 31. (c)
 32. (c) 33. (c) 34. (d) 35. (d)
 36. (d) 37. (a) 38. (b) 39. (b)
 40. (a) 41. (c) 42. (d) 43. (a)
 44. (a) 45. (b) 46. (b) 47. (c)
 48. (a)
 49. (a) Difference in refractive indices of blue and green colour are less so they are seen together and red is seen separate because deviation depends on refractive index.
 50. (c) 51. (c) 52. (c) 53. (c)
 54. (a) 55. (b) 56. (c) 57. (a)
 58. (b)
 59. (c) **Bifocal lens**– Convex lens (lower part) is used to read books and concave lens (upper part) for viewing distant object.
 60. (d) As refractive index of air in atmosphere fluctuates, stars twinkle in the night.
 61. (c) Red object that reflects only red and absorbs any other colour incident upon it.
 62. (a) Myopia is the defect of eye where person is not able to see far off objects and see near by objects clearly.
 63. (a) In myopia defect, image formation will take place before the retina.
 64. (c) $u = 2$ meter, $v = 0.4$ meter, $f = ?$
 $\frac{1}{f} = \frac{1}{-0.4} - \frac{1}{(-2)} = \frac{-5+1}{2} = \frac{-4}{2}$
 $\frac{1}{f} = \frac{-4}{2} = -2$; $P = \frac{1}{f} = 2$ D (concave lens)

65. (b) Rainbow is circular because locus of reflected rays reaching eye of observer is a circle not due to roundness of earth.

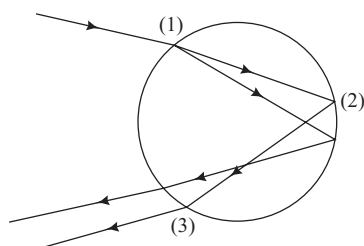
There is no rainbow on moon as there is no atmosphere.

In case of a primary rainbow, violet colour is on inside and red colour is on outside of arc.

In case of a secondary rainbow, red colour is on inside and violet colour is on outside of arc.

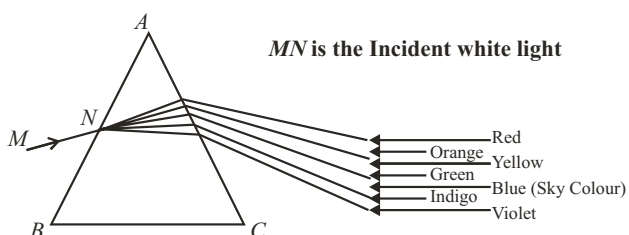
In late afternoon rainbow is visible in east side when light of sun in west side is reflected and refracted by a layer of water droplets.

66. (a) In primary rainbow, two refraction and one TIR
- (1) Refraction of incident ray
 - (2) TIR
 - (3) Again refraction when rays come out of liquid drops

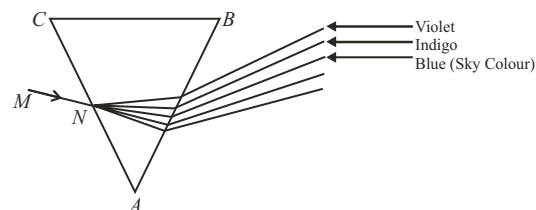


In secondary rainbow, two refraction and two TIR.

67. (c) Rainbow will be observed only when the sun is at the back side of observer.
68. (b) The primary reason why the colour red is used for traffic signals is that red light is scattered the least by air molecules. So, the red light is able to travel the longest distance.
69. (c) In case of minimum deviation, the light ray inside prism becomes parallel to base of the prism.
70. (c) 71. (b) 72. (b) 73. (d)
74. (c)
75. (b) Generally, in case of a prism (i), the formation of spectrum is shown below



In the above figure, from top the third colour is yellow. But we can see that from bottom the third colour is blue (colour of sky). So, we can obtain the correct situation by inverting the prism. Thus the required orientations can be found in case (ii).



So, option (b) is correct.

76. (c) Speed of light is same for all colours of white light in air but different colours have different wavelengths and frequencies.
77. (b) Red
78. (d) Violet
79. (d) Violet
80. (d) 81. (b)
82. (b) $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

Here $v = 2.5$ (Distance of retina as position of image is fixed)

$$u = -x$$

$$\frac{1}{f} = \frac{1}{2.5} + \frac{1}{x}$$

For f_{\min} : x is minimum $\frac{1}{f_{\min}} = \frac{1}{2.5} + \frac{1}{25}$

For f_{\max} : x is maximum $\frac{1}{f_{\max}} = \frac{1}{2.5} + \frac{1}{\infty}$

For near sighted man lens should make the image of the object within 100 cm range

For lens $u = -\infty$, $v = -100$

$$\frac{1}{f_{\text{lens}}} = \frac{1}{-100} - \frac{1}{-\infty} \Rightarrow P = -1 \text{ D}$$

83. (a) It is due to phenomenon called Tyndall effect.
84. (c) Sun look white at noon, as light has to travel shorter distance through the atmosphere before reaching the eye of an observer.
85. (b) When a light ray passes through denser medium from a rarer it undergoes refraction.
86. (b) In myopic eye due to the increased converging power of eye lens, the image of a far off object is formed in front of the retina.

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87. (b)
88. (c) The image formed on retina is real and inverted. If magnification is less than 1, then diminished image is formed not inverted.
89. (b)
90. (A) \rightarrow q; (B) \rightarrow p; (C) \rightarrow r; (D) \rightarrow p
91. iris 92. pupil 93. retina
94. 25 cm. 95. near point
96. 25 cm to infinity 97. long
98. astigmatism. 99. colour blindness
100. accommodation of the eye.
101. near point 102. dispersion.
103. Scattering of light 104. 7
105. False 106. True 107. True 108. True
109. False 110. True 111. True 112. True
113. True 114. True 115. True 116. True
117. True

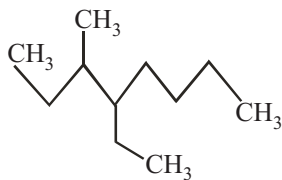
7

Carbon and Its Compounds

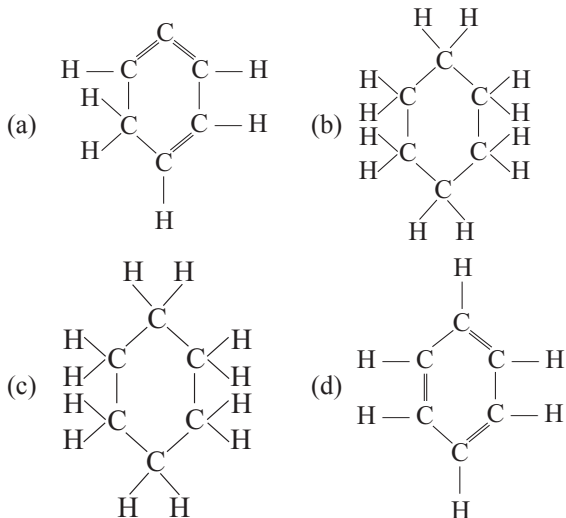
Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

1. The correct name of the given compound is:



- (a) 2, 3-diethyl heptane (b) 5-ethyl-6-methyl octane
 (c) 4-ethyl-3-methyl octane (d) 3-methyl-4-ethyl octane
2. Which of the following options is false about a soap?
- (a) The soap solution in water is neutral and can be used to wash all kinds of fabrics.
 (b) Soap forms lather only in soft water.
 (c) Soap is a metallic salt of higher fatty acids.
 (d) Soap cannot be used in slightly acidic medium.
3. Structural formula of benzene is:



4. What does isomerism explain?
- (a) A difference in molecular formulae.
 (b) A difference in molecular weights.
 (c) A difference in chemical properties and structural formulae.
 (d) A difference in molecular composition.
5. Buckminster fullerene is an allotropic form of
- (a) phosphorus (b) sulphur
 (c) carbon (d) tin
6. The number of 4° carbon atoms in 2,2,4,4-tetramethyl pentane is –
- (a) 1 (b) 2
 (c) 3 (d) 4
7. Which is a general formula of alkenes?
- (a) C_nH_{2n+2} (b) C_nH_{2n}
 (c) C_nH_{2n-2} (d) None of these
8. The functional group represent alcohol is –
- (a) – OH (b) – CHO
 (c) – COOH (d) $>C=O$
9. Which of the following is the purest form of carbon?
- (a) charcoal (b) coal
 (c) diamond (d) graphite
10. Organic compounds will always contain –
- (a) carbon (b) hydrogen
 (c) nitrogen (d) sulphur
11. Methane, ethane and propane are said to form a homologous series because all are –
- (a) hydrocarbons
 (b) saturated compounds
 (c) aliphatic compounds
 (d) differ from each other by a CH_2 group

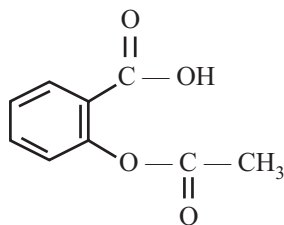
Carbon and Its Compounds

12. When methane is burnt in an excess of air, the products of combustion are –
 (a) C and H₂O (b) CO and H₂O
 (c) CO₂ and H₂ (d) CO₂ and H₂O
13. Which of the following gases is called ‘marsh gas’?
 (a) H₂ (b) CH₄
 (c) C₂H₄ (d) C₂H₂
14. The final product of chlorination of methane in the sun light is –
 (a) CH₃Cl (b) CH₂Cl₂
 (c) CHCl₃ (d) CCl₄
15. The number of oxygen molecules used in the combustion of 1 molecule of ethanol is –
 (a) 1 (b) 2
 (c) 3 (d) 4
16. General formula of alkyne is –
 (a) C_nH_{2n+2} (b) C_nH_{2n}
 (c) C_nH_{2n-2} (d) C_nH_n
17. When vanaspati oil reacts with hydrogen then it is converted into vanaspati ghee. In this process catalyst used is :
 (a) Fe (b) Mo
 (c) V (d) Ni
18. Observe the following pairs of organic compounds :
 (I) C₄H₉OH and C₅H₁₁OH
 (II) C₇H₁₅OH and C₅H₁₁OH
 (III) C₆H₁₃OH and C₃H₇OH
 Which of these pair is a homologous series according to increasing order of carbon atom?
 (a) (III) only (b) (II) only
 (c) (I) only (d) All of these
19. Carbon exists in the atmosphere in the form of :
 (a) carbon monoxide only.
 (b) carbon monoxide in traces, and carbon dioxide.
 (c) carbon dioxide only.
 (d) coal
20. Oils on treating with hydrogen in the presence of palladium or nickel catalyst form fats. This is an example of :
 (a) addition reaction
 (b) substitution reaction
 (c) displacement reaction
 (d) oxidation reaction
21. Chlorine reacts with saturated hydrocarbons at room temperature in the
 (a) absence of sunlight
 (b) presence of sunlight
 (c) presence of water
 (d) presence of hydrochloric acid
22. Pentane has the molecular formula C₅H₁₂. It has
 (a) 5 covalent bonds (b) 12 covalent bonds
 (c) 16 covalent bonds (d) 17 covalent bonds
23. Carbon forms four covalent bonds by sharing its four valence electrons with four univalent atoms, e.g. hydrogen. After the formation of four bonds, carbon attains the electronic configuration of:
 (a) helium (b) neon
 (c) argon (d) krypton
24. Which of the following does not belong to the same homologous series?
 (a) CH₄ (b) C₂H₆
 (c) C₃H₈ (d) C₄H₈
25. The enzyme involved in the oxidation of ethanol to form vinegar is –
 (a) zymase (b) oxidase
 (c) acetobacter (d) invertase
26. Glacial acetic acid is –
 (a) 100% acetic acid free of water
 (b) solidified acetic acid
 (c) gaseous acetic acid
 (d) frozen acetic acid
27. When ethanoic acid is heated with NaHCO₃ the gas evolved is –
 (a) H₂ (b) CO₂
 (c) CH₄ (d) CO
28. During decarboxylation of ethanoic acid with sodalime (NaOH + CaO), CO₂ is removed as –
 (a) CO₂ (b) CO
 (c) Na₂CO₃ (d) CaCO₃
29. When ethanoic acid reacts with ethanol, a sweet smelling product is formed. The functional group in the product is
 (a) aldehyde (b) ketone
 (c) alcohol (d) ester
30. Detergents can lather well in –
 (a) soft water (b) hard water
 (c) river water (d) any one of the above

31. 'Drinking alcohol' is very harmful and it ruins the health. 'Drinking alcohol' stands for –
 (a) drinking methyl alcohol
 (b) drinking ethyl alcohol
 (c) drinking propyl alcohol
 (d) drinking isopropyl alcohol
32. The treatment of acetic acid with lithium aluminium hydride produces –
 (a) methanol (b) ethanol
 (c) ethanal (d) methanal
33. The fermentation reactions are carried out in temperature range of –
 (a) 20-30°C (b) 30-40°C
 (c) 40-50°C (d) 50-60°C
34. Soaps are sodium salts of fatty acids. Which of the following fatty acids does not form soap?
 (a) butyric acid (b) oleic acid
 (c) palmitic acid (d) stearic acid
35. The OH group of an alcohol or the —COOH group of a carboxylic acid can be replaced by —Cl using :–
 (a) phosphorus pentachloride
 (b) hypochlorous acid
 (c) chlorine
 (d) hydrochloric acid
36. Which compound represents the vinegar?
 (a) HCOOH (b) CH₃CHO
 (c) HCHO (d) CH₃COOH
37. A & B both compounds give H₂ gas with sodium. If A & B react in presence of acid catalyst then they form ethyl acetate. Thus, A & B would be –
 (a) CH₃COOH, CH₃OH
 (b) HCOOH, CH₃COOH
 (c) CH₃COOH, C₂H₅OH
 (d) C₃H₇COOH, C₃H₇OH
38. During the cleansing action of soap dirt is surrounded by soap molecules. Soap molecule is like a tadpole which has a head and tail. These head and tail respectively are:
 (a) hydrophobic and hydrophilic
 (b) hydrophobic and hydrophobic
 (c) hydrophilic and hydrophilic
 (d) hydrophilic and hydrophobic
39. The total number of electrons and the number of electrons involved in the formation of various bonds present in one molecule of propanal (C₂H₅CHO) are respectively.
 (a) 32 and 20 (b) 24 and 20
 (c) 24 and 18 (d) 32 and 18
40. The number of structural isomers of the compound having molecular formula C₄H₉Br is
 (a) 3 (b) 5
 (c) 4 (d) 2
41. A sweet smelling compound formed by reacting acetic acid with ethanol in the presence of hydrochloric acid is
 (a) CH₃COOC₂H₅ (b) C₂H₅COOH
 (c) C₂H₅COOCH₃ (d) CH₃OH
42. Percentage of nitrogen in urea (NH₂CONH₂) is
 (a) 23.3% (b) 46.7%
 (c) 69.9% (d) 11.66%
43. The molecular formula of carboxylic acid that differs from the rest is
 (a) C₁₃H₂₆O₂ (b) C₂H₄O₂
 (c) C₉H₁₈O₂ (d) C₇H₁₂O₂
44. During laboratory preparation CH₄ gas is collected by downward displacement of water because
 (a) CH₄ is lighter than Air
 (b) CH₄ is poisonous gas
 (c) It does not dissolve in water
 (d) All the above statements are correct
45. Which one of the following statement is incorrect about graphite and diamond ?
 (a) Graphite is smooth and slippery.
 (b) Diamond is good conductor of heat.
 (c) Graphite is a good conductor of electricity.
 (d) Physical and chemical properties of graphite and diamond are same.
46. A compound 'X' reacts with a compound 'Y', to produce a colourless and odourless gas. The gas turns lime water milky. When 'X' reacts with methanol in the presence of concentrated H₂SO₄, a sweet smelling substance is produced. The molecular formula of the compound 'X' is –
 (a) C₂H₄O (b) C₂H₄O₂
 (c) C₂H₆O (d) C₂H₆O₂

Carbon and Its Compounds

47. The functional groups present in the following compound are –



- (a) alcohol, ketone and ester
 (b) ester and carboxylic acid
 (c) carboxylic acid and ketone
 (d) ester and alcohol
48. A compound of carbon, hydrogen and nitrogen contains these elements in the ratio of their atomic mass 9 : 1 : 3.5, if its molecular mass is 108 u. What is its molecular formula?
 (a) C_2H_2N (b) C_3H_4N
 (c) C_2HN_2 (d) $C_6H_8N_2$
49. How many grams of oxygen gas will be needed for complete combustion of 2 moles of 3rd member of alkyne series ?
 (a) 186 g (b) 256 g
 (c) 352 g (d) 372 g
50. A hydrocarbon 'A' (C_3H_8) on treatment with chlorine in presence of sunlight yielded compound 'B' as major product. Reaction of 'B' with aqueous KOH gave 'C' which on treatment with concentrated H_2SO_4 yielded 'D'. Hydrogenation of 'D' gave back 'A'. The sequence of reactions involved in above conversion is:
 (a) substitution, substitution, addition, dehydration
 (b) substitution, substitution, dehydration, addition
 (c) substitution, dehydration, addition, addition
 (d) addition, substitution, dehydration, substitution.
51. An organic liquid 'A' with acidified potassium dichromate gave product 'B'. The compound 'B' on heating with methanol in presence of concentrated sulphuric acid formed compound 'C' which on subsequent treatment with sodium hydroxide formed two product 'D' and 'E'. The product 'D' is known to affect the optic nerve causing blindness. Intake of 'D' in very small quantities can cause death. What are compound 'A', 'B', 'C', 'D' and 'E'?
 (a) A = Ethanol, B = Ethanoic acid, C = Methanol, D = Sodium acetate, E = Methyl ethanoate
 (b) A = Ethanol, B = Ethanoic acid, C = Methyl ethanoate, D = Methanol, E = Sodium acetate
 (c) A = Sodium acetate, B = Ethanoic acid, C = Methyl ethanoate, D = Methanol, E = Ethanol
 (d) A = Ethanol, B = Ethanoic acid, C = Methyl ethanoate, D = Sodium acetate, E = Methanol
52. In shaving creams _____ is added to prevent rapid drying.
 (a) Methanol (b) Glycerol
 (c) Ethanol (d) Glycol
53. An organic compound A on heating with concentrated H_2SO_4 gave product B and on warming with alkaline $KMnO_4$ gave compound C. Compound A on heating with compound C in presence of concentrated H_2SO_4 formed compound D, which has fruity smell. Identify the compounds A, B, C and D:
 (a) A = Alcohol, B = Carboxylic acid, C = Alkene, D = Ester
 (b) A = Carboxylic acid, B = Ester, C = Alkene, D = Alcohol
 (c) A = Alcohol, B = Alkene, C = Carboxylic acid, D = Ester
 (d) A = Alkene, B = Alcohol, C = Ester, D = Carboxylic acid
54. Two organic compounds 'A' and 'B' react with sodium metal and both produce the same gas 'X', but with sodium hydrogen carbonate, only compound B reacts to give a gas 'Y'. Identify 'A', 'B', 'X' and 'Y':
 (a) A = Ethylene, B = Ethyl alcohol, X = Carbon dioxide, Y = Hydrogen
 (b) A = Ethyl alcohol, B = Acetic acid, X = Hydrogen, Y = Carbon dioxide
 (c) A = Methyl alcohol, B = Ethyl alcohol, X = Hydrogen, Y = Carbon dioxide
 (d) A = Acetic acid, B = Formic acid, X = Carbon dioxide, Y = Hydrogen
55. Fermentation of sugarcane juice produces
 (a) Ethanol (b) Ethanal
 (c) Acetic acid (d) Gluconic acid
56. Antiknocking compound in gasoline is :
 (a) Triethyl lead (b) Trimethyl lead
 (c) Tetramethyl lead (d) Tetraethyl lead
57. Identify the correct order of boiling points of the following compounds-
 (A) $CH_3CH_2CH_2CH_2OH$
 (B) $CH_3CH_2CH_2CHO$
 (C) $CH_3CH_2CH_2COOH$
 (a) (A) > (B) > (C) (b) (C) > (A) > (B)
 (c) (A) > (C) > (B) (d) (C) > (B) > (A)

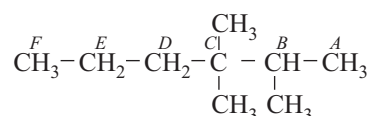
58. Ethane with the molecular formula C_2H_6 has :
- (a) 6 covalent bonds (b) 7 covalent bonds
(c) 8 covalent bonds (d) 9 covalent bonds
59. Butanone is four-carbon compound with the functional group :
- (a) carboxylic acid (b) aldehyde
(c) ketone (d) alcohol
60. While cooking, if the bottom of the vessel is getting blackened on the outside, it means that :
- (a) the food is not cooked completely.
(b) the fuel is not burning completely.
(c) the fuel is wet.
(d) the fuel is burning completely.

Case/Passage Based Questions

DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

A carbon atom attached to one, two, three and four other carbon atoms is called primary, secondary, tertiary and quaternary carbon respectively. Now consider following compound and answer the following questions.



61. In above compound how many carbon atom are primary?
- (a) 7 (b) 5
(c) 6 (d) 4
62. In above compound how many carbon atoms are secondary?
- (a) 2 (b) 1
(c) 3 (d) 0
63. In above compound which carbon atom is quaternary?
- (a) B (b) D
(c) F (d) C

Case/Passage - 2

Reactions in which an atom or a group of atoms is replaced by some other atom or another group of atoms without causing any change in the structure of the remaining part of the molecule, are called substitution reactions.

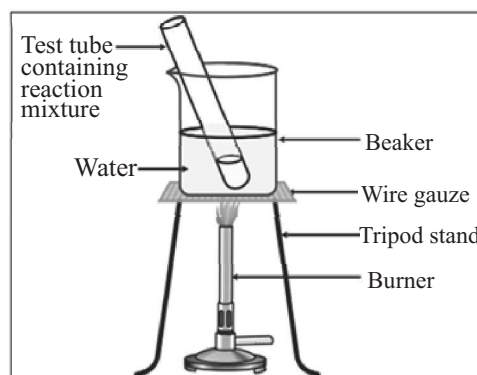
All organic compounds containing double or triple bonds give addition reactions, i.e., alkenes, alkynes and aromatic hydrocarbons give addition reactions.

Reactions in which the compounds react with oxygen and form carbon dioxide and water is known as combustion reaction. This process occurs with release of great amount of heat.

64. The reaction $CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl$ is :
- (a) substitution reaction
(b) addition reaction
(c) rearrangement reaction
(d) elimination reaction
65. The reaction $CH_2 = CH_2 + H_2 \longrightarrow CH_3 - CH_3$ is :
- (a) substitution reaction
(b) addition reaction
(c) rearrangement reaction
(d) elimination reaction
66. The reaction $C_2H_6 + O_2 \longrightarrow 2CO_2 + 3H_2O$ is :
- (a) substitution reaction
(b) rearrangement reaction
(c) addition reaction
(d) combustion reaction

Case/Passage - 3

The given diagram represent an experiment in which a test tube contains 1 mL of ethanol (absolute alcohol) and 1 mL glacial acetic acid along with a few drops of concentrated H_2SO_4 . Observe the diagram and answer the following questions.



67. Name the type of reaction taking place in this experiment.
68. Write the chemical equation.
69. Why reverse of this reaction is known as saponification reaction?
70. Give two uses of the resulting product.

Case/Passage - 4

Food, clothes, medicines, books, or many of the things are all based on this versatile element carbon. In addition, all living structures are carbon based. The earth's crust has only 0.02% carbon in the form of minerals. The element carbon occurs in different forms in nature with widely varying

Carbon and Its Compounds

physical properties. Both diamond and graphite are formed by carbon atoms, the difference lies in the manner in which the carbon atoms are bonded to one another. Carbon has the unique ability to form bonds with other atoms of carbon, giving rise to large molecules. This property is called catenation.

71. From the given alternatives, whose chemical and physical properties are *not* same?
- Graphite and Diamond
 - Phosphorous and Sulphur
 - Carbon and Hydrogen
 - Methyl alcohol and Acetic acid
72. Which of the following statements is not correct?
- Graphite is much less dense than diamond
 - Graphite is black and soft
 - Graphite has low melting point
 - Graphite feels smooth and slippery
73. Which of the following are isomers?
- Butane and isobutene
 - Ethane and ethene
 - Propane and propyne
 - Butane and isobutane
74. Which one of the following is not an allotrope of carbon?
- Soot
 - Graphite
 - Diamond
 - Carborundum
75. Pentane has the molecular formula C_5H_{12} . It has
- 5 covalent bonds
 - 12 covalent bonds
 - 16 covalent bonds
 - 17 covalent bonds

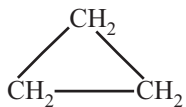
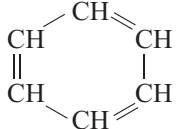
Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
 - If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
 - If **Assertion** is **correct** but **Reason** is **incorrect**.
 - If **Assertion** is **incorrect** but **Reason** is **correct**.
-
76. **Assertion:** Ethanoic acid is called as glacial acetic acid.
Reason: On cooling it freezes to form ice-like flakes. They appear like a glaciers.
77. **Assertion :** The correct IUPAC name for the compound
- $$H_3C - \overset{\text{CH}_3}{\underset{|}{CH}} - CH_2 - \overset{\text{CH}_3}{\underset{|}{CH}} - CH_2 - CH_3$$
- is 2, 4 dimethyl hexane not 3, 5 dimethyl hexane
Reason: When the parent chain has two or more substituents, numbering must be done in such a way that the sum of the locants on the parent chain is the lowest possible.
78. **Assertion:** Vegetable oil is converted into vegetable ghee by hydrogenation process in presence of nickel catalyst.
Reason: Unsaturated hydrocarbons add hydrogen to give saturated hydrocarbon in presence of a catalyst.
79. **Assertion:** Unsaturated hydrocarbon burns with sooty flame in excess supply of air.
Reason: Saturated hydrocarbon has more carbon content.
80. **Assertion :** Following are the members of a homologous series :
CH₃OH, CH₃CH₂OH, CH₃CH₂CH₂OH
Reason : A series of compounds with same functional group but differing by $-CH_2-$ unit is called a homologous series.
81. **Assertion :** Diamond and graphite are allotropes of carbon.
Reason : Some elements can have several different structural forms in the same physical state. These differing forms are called allotropes.
82. **Assertion :** Carbon monoxide is extremely poisonous in nature.
Reason : Carbon monoxide is formed by complete combustion of carbon.
83. **Assertion :** Carbon has ability to form long carbon chains.
Reason : Carbon has a unique property to form long straight and branched chains called catenation.
84. **Assertion :** All alcohols have similar chemical properties.
Reason : All alcohols contains similar hydroxy ($-OH$) functional group.
85. **Assertion :** Hydrogenation converts an oil into a fat, called vegetable ghee.
Reason : Hydrogenation is carried out in presence of a catalyst, usually finely divided nickel.

Match the Following

DIRECTIONS : Each question contains option given in two columns. options (A, B, C, D) in column I have to be matched with options (p, q, r, s) in column II.

- | | | |
|------------|---|--|
| 86. | Column I | Column II |
| (A) | Combustion reaction | (p) $C_3H_8 + Cl_2 \xrightarrow{UV \text{ light}} C_3H_7Cl + HCl$ |
| (B) | Oxidation reaction | (q) $CH_2=CH_2 + H_2 \xrightarrow{Ni/Pd} CH_3-CH_3$ |
| (C) | Addition reaction | (r) $2CH_4 + O_2(g) \xrightarrow[300^\circ C]{\text{Molybdenum oxide}} HCHO + 2H_2O$ |
| (D) | Substitution reaction | (s) $C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$ |
| 87. | Column I | Column II |
| (A) | — CHO | (p) Azo compounds |
| (B) | — CONH ₂ | (q) Aldehydes |
| (C) | — NH ₂ | (r) Acid amides |
| (D) | — N = N — | (s) Amines |
| 88. | Column I | Column II |
| (A) | $CH_2 = CH_2$ | (p) Saturated |
| (B) |  | (q) Unsaturated |
| (C) | $CH_3 - CH_2 - CH_3$ | (r) Acyclic |
| (D) |  | (s) Cyclic |

Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

89. The ability of carbon to form chains gives rise to a series of compounds.
90. Newly discovered allotrope of carbon is

91. The soft crystalline form of carbon is
92. Next homologue of ethane is
93. Valency of carbon in ethylene is
94. Ethylene burns in air to form CO₂ and
95. The molecular mass of any two adjacent homologues differ by amu.
96. The purest form of carbon is
97. The general formula of alcohols is
98. The functional group present in carboxylic acids is
99. Detergents cause pollution.

True / False

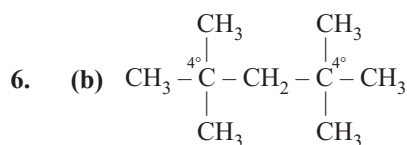
DIRECTIONS : Read the following statements and write your answer as true or false.

100. Carbon is a versatile element.
101. Carbon forms covalent bonds with itself and other elements such as hydrogen, oxygen, sulphur, nitrogen and chlorine.
102. Carbon and its compounds are some of our major sources of fuels.
103. Graphite is a good conductor of electricity.
104. The simplest saturated hydrocarbon is methane.
105. Ethanol is the first member of the alcohol homologous series.
106. Diamond is a good conductor of electricity.
107. Graphite is used in pencils.
108. When hydrocarbons burn in air, carbon dioxide and hydrogen are produced with heat energy.
109. If a hydrocarbon has double or triple covalent bond, it is saturated.
110. Unsaturated hydrocarbons give addition reactions.
111. By hydrogenation, vegetable oils are converted into vanaspati ghee.
112. Invertase and amylase are two enzymes involved in fermentation of ethanol from sugar.

ANSWER KEY & SOLUTIONS

1. (c) The name of the compound is 4-ethyl-3-methyl octane.
2. (a) The soap solution in water is not neutral and cannot be used to wash all kinds of fabrics.
3. (c) Benzene molecule contains alternate single and double bonds. Its formula is C_6H_6 .
4. (c) Isomers have same molecular formula, molecular weight and molecular composition but different chemical properties and structural formulae because the properties are based on the position of atoms.

5. (c)



7. (b)

8. (a) $-\text{OH} \Rightarrow$ alcohol
 $-\text{CHO} \Rightarrow$ aldehyde
 $-\text{COOH} \Rightarrow$ Carboxylic acid
 $\text{>C=O} \Rightarrow$ Ketone

9. (c) Diamond is the purest form of carbon.

10. (a)

11. (d) Methane (CH_4), ethane (C_2H_6) and propane ($\text{CH}_3\text{CH}_2\text{CH}_3$) differ from each other by CH_2 group. Hence these are said to form a homologous series.

12. (d) 13. (b) 14. (d)

15. (c) $\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \longrightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$

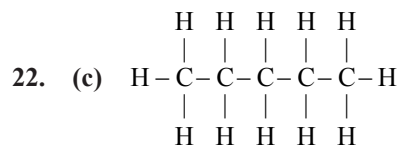
16. (c)

17. (d) Catalysts like Pd, Pt or Ni are used in hydrogenation process.

18. (c) $\text{C}_4\text{H}_9\text{OH}$ and $\text{C}_5\text{H}_{11}\text{OH}$ represent homologous series in increasing order of C atoms, other two also represent homologous series, but in decreasing order because they differ from each other by a CH_2 group.



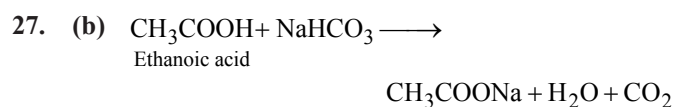
19. (b) 20. (a) 21. (b)



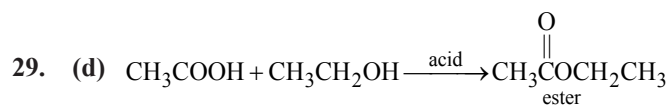
Pentane has 16 covalent bonds

($12\text{C} - \text{H}$ and $4\text{C} - \text{C}$ bonds)

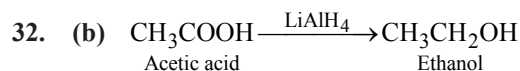
23. (b) 24. (d) 25. (c) 26. (a)



28. (c)

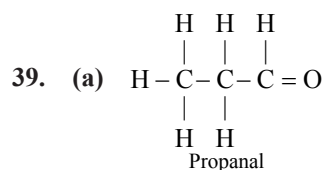


30. (d) 31. (b)



33. (a) 34. (a) 35. (a) 36. (d)

37. (c) 38. (d)



Total no. of electrons of C atoms = $3 \times 6 = 18$

Total no. of electrons of O atoms = $1 \times 8 = 8$

Total no. of electrons of H atoms = $6 \times 1 = 6$

Total no. of electrons in one molecule

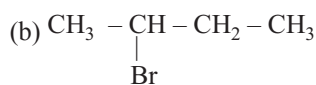
= $18 + 8 + 6 = 32$ electrons

Total no. of bonds = 10

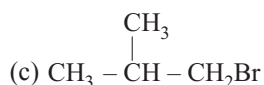
Each bond contains $2e^-$. Therefore no. of electrons involved in bonding.

= $2 \times 10 = 20$ electrons.

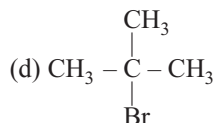
40. (c) (a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2 - \text{Br}$
 1 - Bromobutane



2-Bromobutane

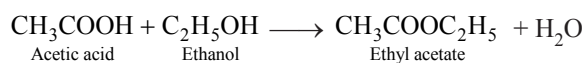


1-Bromo-2-methyl propane

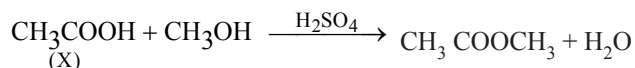
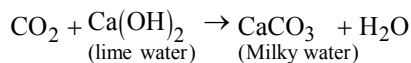
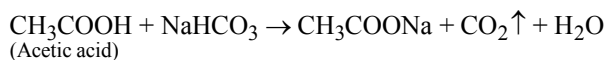


2-Bromo-2-methyl propane

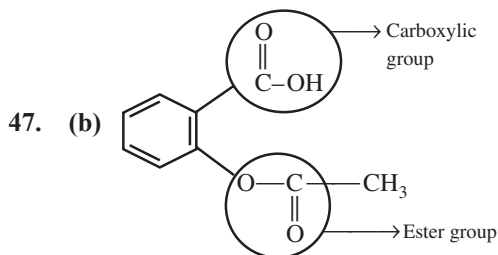
41. (a) Acetic acid reacts with ethanol in the presence of hydrochloric acid to produce ethyl acetate (ester) which is a sweet smelling compound.



42. (b) $\text{NH}_2\text{CONH}_2 \longrightarrow$ Molecular mass = 60
 % of N = $(28/60) \times 100 = 46.7\%$
43. (d) $\text{C}_{13}\text{H}_{26}\text{O}_2$, $\text{C}_2\text{H}_4\text{O}_2$, $\text{C}_9\text{H}_{18}\text{O}_2 \longrightarrow$ These acids contains single bond between carbon atoms (C-C). Its general formula is $(\text{C}_n\text{H}_{2n}\text{O}_2)$.
 $\text{C}_7\text{H}_{12}\text{O}_2 \longrightarrow$ It contains double bond (C = C). Its general formula is $(\text{C}_n\text{H}_{2n-2}\text{O}_2)$.
44. (c) CH_4 is non-polar compound, so it cannot be dissolved in water.
45. (d) Graphite and diamond show different physical and chemical properties. Diamond is colourless transparent substance. It does not conduct electricity. Graphite is greyish black. It is good conductor of electricity.
46. (b) $\text{X} + \text{Y} \longrightarrow$ gas (Colourless, odourless)



Here compound (X) is acetic acid.



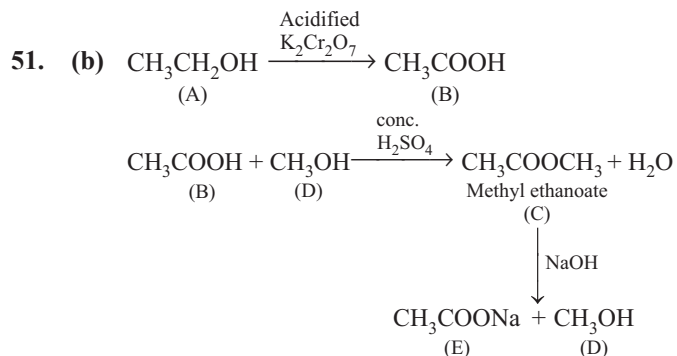
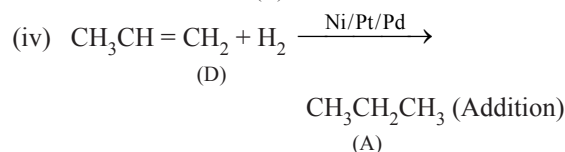
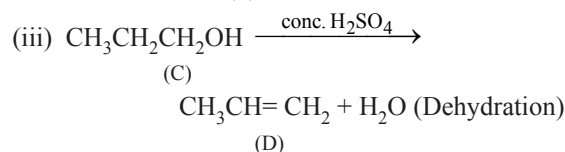
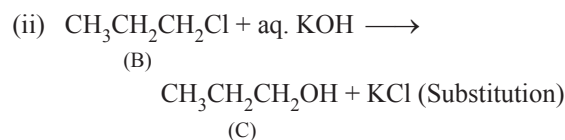
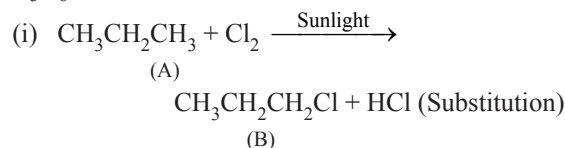
48. (d) $\text{C}_6\text{H}_8\text{N}_2$ i.e. $12 \times 6 + 8 \times 1 + 14 \times 2 = 108$ u.



For 2 moles of hydrocarbon, 11 moles of O_2 is required

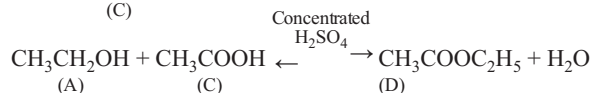
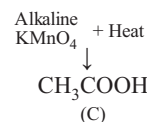
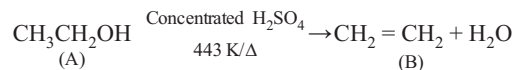
$$\therefore 11 \text{ moles} = 11 \times 32 = 352 \text{ g}$$

50. (b) C_3H_8 (A) is propane.



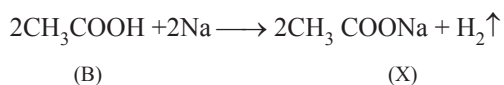
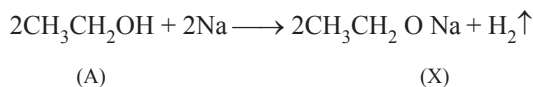
52. (b) Glycerol is added to shaving cream to prevent rapid drying.

53. (c) When ethanol (A) i.e. organic compound reacts with conc. H_2SO_4 , it forms ethene (B) along with water. When ethanol (A) reacts with alk. KMnO_4 , it will get oxidised to ethanoic acid (C). Ethanol reacts with ethanoic acid to form an ester called ethyl ethanoate (D), which gives a fruity smell.

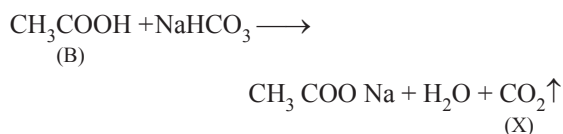


Carbon and Its Compounds

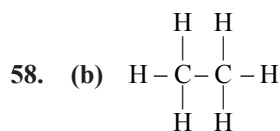
54. (b) When alcohol *i.e.* ethanol (A) and acid *i.e.* acetic acid (B) reacts with a sodium metal, then it liberates hydrogen gas (X).



When an acid reacts with carbonates or bicarbonates, it liberates CO_2 gas. So, when acetic acid (B) reacts with NaHCO_3 , it liberates CO_2 (Y) gas.



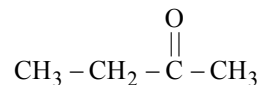
55. (a) Fermentation of sugarcane produces ethanol.
56. (d) Antiknocking agent in gasoline is tetraethyl lead (TEL). It raises the octane value of gasoline.
57. (b) Carboxylic acid molecule has higher extent of H-bonding than alcohol, therefore order of b.p. is $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} > \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} > \text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$



i.e., it has seven covalent bonds.

(6 C-H bonds and one C-C bond)

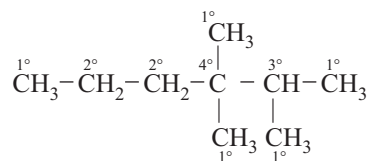
59. (c) The structure of butanone is



it has >C=O (ketonic group) as its functional group.

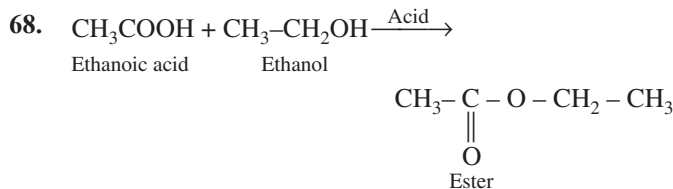
60. (b) The fuel is not burning completely, hence produce carbon particles which get deposited on the bottom of vessel.

61. (b) 62. (a) 63. (d)



64. (a) 65. (b) 66. (d)

67. Esterification reaction



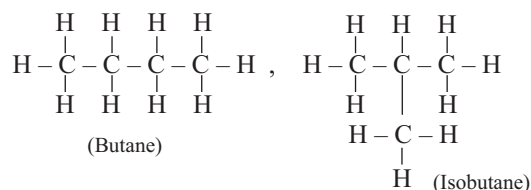
69. Reverse reaction is known as saponification reaction because it is used in the preparation of soap.

70. Esters are used in making perfumes and as a flavouring agent.

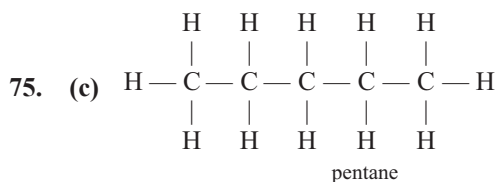
71. (d) Due to presence of different functional groups methyl alcohol and acetic acid. Possess different physical and chemical properties.

72. (c)

73. (d) Butane and isobutane have same chemical formula but different arrangement of atoms and have different structure.

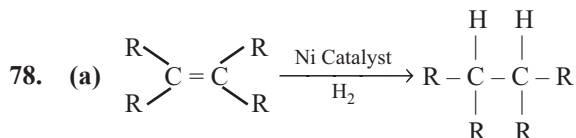


74. (d) Carborundum is SiC (silicon carbide).



76. (a) Ethanoic acid is also known as glacial acetic acid.

77. (a) The correct IUPAC name for the compound is 2, 4-dimethyl hexane not 3, 5 dimethyl hexane.



79. (c) Unsaturated hydrocarbon has more carbon content as compare to saturated hydrocarbon of comparable molecular mass.

80. (a) CH_3OH , $\text{CH}_3\text{CH}_2\text{OH}$, $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ belongs to same homologous series with -OH functional group and each member is differ by $-\text{CH}_2-$ unit.

81. (a) 82. (c) 83. (a) 84. (a)

85. (b) Hydrogenation or hardening of oil converted various unsaturated fatty glycerides to saturated glycerides

by the addition of hydrogen in the presence of a catalyst, usually finely divided nickel.

- | | | |
|--|---------------------|-------------|
| 86. A – (s), B – (r), C – (q), D – (p) | 95. 14 | 96. diamond |
| 87. A – (q), B – (r), C – (s), D – (p) | 97. $C_nH_{2n+1}OH$ | 98. $-COOH$ |
| 88. A – (q, r), B – (p, s), C – (p, r), D – (q, s) | 99. water | |
| 89. homologous | 100. True | 101. True |
| 90. fullerene | 103. True | 102. True |
| 91. graphite | 106. False | 104. True |
| 92. propane | 109. False | 107. True |
| 93. 4 | 112. False | 108. False |
| 94. water | | 109. True |
| | | 110. True |
| | | 111. True |

8

Periodic Classification of Elements

Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

- The three elements calcium, strontium and barium form a triad. What is the basis of this grouping?
 - Elements are in the increasing order of their atomic weights.
 - The atomic weight of the middle element is equal to the average of the atomic weight of extreme elements.
 - Elements in a triad have similar chemical properties.

(a) Only (i) and (ii) (b) Only (ii) and (iii)
(c) Only (i) and (iii) (d) (i), (ii) and (iii)
- Which one of the following elements will form an acidic oxide?
 - An element with atomic number 7
 - An element with atomic number 3
 - An element with atomic number 12
 - None of these
- On the basis of following features identify correct option.
 - These elements majorly forms acidic oxides.
 - These elements are majorly non-metals.

(a) *s*-block elements (b) *p*-block elements
(c) *d*-block elements (d) *f*-block elements
- Hydrogen has three isotopes ^1H , ^2H and ^3H . On what basis these elements were placed in modern periodic table?
 - Atomic mass
 - Atomic number
 - Both (a) and (b)
 - None of these
- An element 'X' is forming an acidic oxide. Its position in modern periodic table will be
 - Group 1 and Period 3
 - Group 2 and Period 3
 - Group 13 and Period 3
 - Group 16 and Period 3
- If Cl, Br and I, are Dobereiner's triad and the atomic masses of Cl and I are 35.5 and 127 respectively the atomic mass of Br is –
 - 162.5
 - 91.5
 - 81.25
 - 45.625
- Newland could classify elements only upto –
 - copper
 - chlorine
 - calcium
 - chromium
- Mendeleev classified elements in –
 - increasing order of atomic groups
 - eight periods and eight groups
 - seven periods and nine groups
 - eight periods and seven groups
- Noble gases were included in Mendeleev's periodic table in the –
 - 1st group
 - 7th group
 - 8th group
 - none of these
- The long form of periodic table consists of –
 - seven periods and eight groups
 - seven periods and eighteen groups
 - eight periods and eighteen groups
 - eighteen periods and eight groups
- In the modern periodic table which of the following does not have appropriate position?
 - Transition elements
 - Inert gases
 - Inner transition elements
 - Halogens
- An element M has atomic number 9 and atomic mass 17. Its ion will be represented by –
 - M
 - M^{2+}
 - M^-
 - M^{2-}

13. The correct order of first IE of C, N, O, F is –
 (a) $F > O > N > C$ (b) $C > N > O > F$
 (c) $O > N > F > C$ (d) $F > N > O > C$
14. Elements belonging to the same group have similar properties because –
 (a) they have similar electronic configuration of the outermost shell.
 (b) their atomic numbers go on increasing as we move down the group.
 (c) all of them are metallic elements.
 (d) none of the above
15. The atoms of elements belonging to the same group of periodic table have the same –
 (a) number of protons
 (b) number of electrons
 (c) number of neutrons
 (d) number of electrons in the outermost shell
16. Which of the following is the correct order of relative size?
 (a) $I^- > I^+ > I$ (b) $I^- > I > I^+$
 (c) $I > I^+ > I^-$ (d) $I^+ > I^- > I$
17. The element with the smallest size in the group 13 is –
 (a) beryllium (b) carbon
 (c) aluminium (d) boron
18. The element present in the 4th period is –
 (a) chlorine (b) iodine
 (c) fluorine (d) bromine
19. The most metallic element in the fifth period is –
 (a) silver (b) rubidium
 (c) gold (d) rhodium
20. If the two members of a Dobereiner triad are chlorine and iodine, the third member of this triad is –
 (a) fluorine (b) bromine
 (c) sodium (d) calcium
21. If the two members of a Dobereiner triad are phosphorus and antimony, the third member of this triad is –
 (a) arsenic (b) sulphur
 (c) iodine (d) calcium
22. According to Mendeleev periodic law, the properties of elements are periodic function of their –
 (a) atomic masses (b) atomic numbers
 (c) atomic volumes (d) densities
23. The elements with atomic numbers 2, 10, 18, 36, 54 and 86 are all –
 (a) halogens (b) noble gases
 (c) noble metals (d) light metals
24. How many periods are there in the long form of the periodic table?
 (a) 6 (b) 7
 (c) 8 (d) 9
25. The elements with atomic numbers 3, 11, 19, 37 and 55 belong to
 (a) alkali metals (b) alkaline earth metals
 (c) halogens (d) noble gases
26. The elements with atomic numbers 9, 17, 35, 53 and 85 belong to
 (a) alkali metals (b) alkaline earth metals
 (c) halogens (d) noble gases
27. Each transition series contains a total of –
 (a) 2 elements (b) 8 elements
 (c) 10 elements (d) 18 elements
28. The number of elements in each of the inner transition series are –
 (a) 2 (b) 8
 (c) 10 (d) 14
29. The number of elements in the third period of the periodic table are –
 (a) 2 (b) 8
 (c) 18 (d) 32
30. The total number of elements in VII A group of the periodic table are –
 (a) 3 (b) 5
 (c) 7 (d) 9
31. The total number of elements in the group IB are –
 (a) 3 (b) 5
 (c) 7 (d) 9
32. Which of the following elements has the least nonmetallic character?
 (a) fluorine (b) chlorine
 (c) bromine (d) iodine
33. About how many known elements are there till date?
 (a) 10 (b) 50
 (c) 118 (d) 200
34. Elements in the modern periodic table are arranged according to increasing –
 (a) atomic number (b) atomic weight
 (c) number of neutrons (d) chemical reactivity
35. Which of these things you will not find in the periodic table?

Periodic Classification of Elements

- (a) element name and symbol
 (b) atomic weight
 (c) atomic orbital radius
 (d) atomic number
36. Which scientist came up with the concept of a periodic table that included all of the known elements?
 (a) Joseph Priestly (b) Dmitri Mendeleev
 (c) Antoine Lavoisier (d) Albert Einstein
37. The alkali metals are in which group of the periodic table?
 (a) Group 1 (b) Group 2
 (c) Group 3 (d) Group 4
38. As you go down the group, the alkali metals become –
 (a) brighter (b) hotter
 (c) more reactive (d) less reactive
39. Where are the transition metals in the periodic table?
 (a) In group 0 (b) In group 1
 (c) In group 2 (d) In a central block
40. The noble gases are unreactive because
 (a) they react with sodium.
 (b) they have a full outer shell of electrons.
 (c) they have a half outer shell of neutrons.
 (d) they are too thin.
41. Which of the following element is not in the liquid state?
 (a) Hg (b) Li
 (c) Ga (d) Br
42. Which of the following elements does not belongs to alkaline earth metal group?
 (a) Rb (b) Sr
 (c) Ba (d) Ra
43. Arrange the following in increasing order of their atomic radius : Na, K, Mg, Rb –
 (a) $Mg < K < Na < Rb$ (b) $Mg < Na < K < Rb$
 (c) $Mg < Na < Rb < K$ (d) $Na < K < Rb < Mg$
44. Which is metalloid?
 (a) Pb (b) Sn
 (c) Si (d) Zn
45. Which shows variable valency?
 (a) *s*-block elements (b) *p*-block elements
 (c) *d*-block elements (d) Radioactive elements
46. Dobereiner triads is –
 (a) Li, K, Rb (b) Mg, S, As
 (c) Cl, Br, I (d) P, S, As
47. Elements in which 4*f* orbitals are progressively filled are called as –
 (a) transition elements (b) lanthanides
 (c) actinides (d) inert gases
48. Which of the following elements is a lanthanide (Rare-earth element)?
 (a) cadmium (b) californium
 (c) cerium (d) cesium
49. If the valence shell electronic configuration for an element is ns^2np^5 , this element will belong to the group of –
 (a) alkali metals (b) inert metals
 (c) noble gases (d) halogens
50. If an atom has electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$, it will be placed in –
 (a) second group (b) third group
 (c) fifth group (d) sixth group
51. On moving from left to right across a period in the table the metallic character –
 (a) increases
 (b) decreases
 (c) remains constant
 (d) first increases and then decreases
52. Which of the following is the atomic number of a metal?
 (a) 32 (b) 34
 (c) 36 (d) 38
53. Which has the maximum atomic radius?
 (a) Al (b) Si
 (c) P (d) Mg
54. Which one of the following ions has the highest value of ionic radius?
 (a) O^{2-} (b) B^{3+}
 (c) Li^+ (d) F^-
55. Which one of the following is the smallest in size?
 (a) N^{3-} (b) O^{2-}
 (c) F^- (d) Na^+
56. The size of the following species increases in the order –
 (a) $Mg^{2+} < Na^+ < F^- < Al$
 (b) $F^- < Al < Na^+ > Mg^{2+}$
 (c) $Al < Mg^{2+} < F^- < Na^+$
 (d) $Na^+ < Al < F^- < Mg^{2+}$
57. The correct order of radii is –
 (a) $N < Be < B$
 (b) $F^- < O^{2-} < N^{3-}$
 (c) $Na < Li < K$
 (d) $Fe^{3+} < Fe^{2+} < Fe^{4+}$

58. Which of the following is correct regarding ionic radii?
 (a) $Ti^{4+} < Mn^{7+}$ (b) $^{35}Cl^- < ^{37}Cl^-$
 (c) $K^+ > Cl^-$ (d) $P^{3+} > P^{5+}$
59. Consider following as a portion of the periodic table from Group No. 13 to 17. Which of the following statements is/are true about the elements shown in it?
- V, W, Y and Z are less electropositive than X.
 - V, W, X and Y are more electronegative than Z.
 - Atomic size of Y is greater than that of W.
 - Atomic size of W is smaller than that of X.

			V	Z
				Y
W				
X				

- I, II and III (b) II and III
(c) I and IV (d) III and IV
60. Mendeleev's periodic law states that the properties of elements are a periodic function of their
 (a) reactivity of elements (b) atomic size
 (c) atomic mass (d) electronic configuration
61. Chemical symbol of metal tungsten is
 (a) W (b) Xe
 (c) Y (d) Zr
62. Which is incorrect order of size?
 (a) $Na > Na^+$ (b) $Na^+ > Mg^{2+}$
 (c) $Cl^- > Cl$ (d) $F^- > O^{2-}$
63. The anion O^{2-} is isoelectronic with
 (a) F^+ (b) F^-
 (c) N^{2-} (d) N^{+3}
64. A part of the modern periodic table is presented below in which the alphabets represent the symbols of elements.

Group →	1	12	14	15	16	17
Period ↓				M	Q	V
2						
3	A	J			R	W
4	E		L			T
5	G					X

Consult the above part of the periodic table to predict which of the following is a covalent compound-

- RQ_2 (b) AT
(c) JQ (d) JX_2

65. The maximum number of electrons that can be filled in the shell with the principal quantum number $n = 4$ is
 (a) 64 (b) 26
 (c) 18 (d) 32
66. The ionic radii of N^{3-} , O^{2-} , F^- , Na^+ follow the decreasing order
 (a) $N^{3-} > O^{2-} > F^- > Na^+$
 (b) $N^{3-} > Na^+ > O^{2-} > F^-$
 (c) $Na^+ > O^{2-} > N^{3-} > F^-$
 (d) $O^{2-} > F^- > Na^+ > N^{3-}$
67. Consider the elements A, B, C and D with atomic numbers 6, 7, 14 and 15, respectively. Which of the following statements are correct concerning these elements?
- D will lose electron more easily than C.
 - C will gain electron more easily than B.
 - The element with highest electronegativity is D.
 - The element with largest atomic size is C.
- I and II (b) II and III
(c) II and IV (d) III and IV
68. Which of the following statement can help a chemistry student to predict chemical properties of an element?
- Position of element in the periodic table
 - Atomic number of the element
 - Number of shells in the atom
 - Number of electron in the outer most shell
- I, II and III (b) I, II and IV
(c) I, III and IV (d) II, III and IV
69. The element which normally exist in the liquid state are
 (a) Bromine and Iodine
 (d) Mercury and chlorine
 (c) Iodine and mercury
 (d) Bromine and mercury
70. Which gas being filled in weather balloon?
 (a) Helium (b) Neon
 (c) Hydrogen (d) Nitrogen
71. Manya, Kartik, Gurnoor and Sheena had arranged the ions F^- , Na^+ , O^{2-} and Mg^{2+} in decreasing orders of their ionic radii.
- Manya – $O^{2-} > Mg^{2+} > F^- > Na^+$
 Kartik – $Mg^{2+} > Na^+ > O^{2-} > F^-$
 Gurnoor – $O^{2-} > F^- > Na^+ > Mg^{2+}$
 Sheena – $F^- > Na^+ > O^{2-} > Mg^{2+}$
- Who had provided the correct order of their decreasing ionic radii?
 (a) Manya (b) Kartik
 (c) Gurnoor (d) Sheena

Periodic Classification of Elements

72. Consider the elements A, B, C and D with atomic numbers 11, 12, 16 and 17, respectively. Which among the following statements regarding these elements are correct?

- I. The element C will gain electron more easily than element D.
- II. The element B tends to lose electron more readily than C.
- III. The oxide of A will be least basic while that of D will be most basic.
- IV. The energy required to remove an electron from outermost shell from A will be minimum while that from D will be maximum.

- (a) I and III only (b) I and IV only
(c) II and III only (d) II and IV only

73. Which of the following is the correct order of reactivity of metals?

- (a) $Mg > Al > Zn > Fe$
(b) $Mg > Zn > Fe > Al$
(c) $Al > Mg > Zn > Fe$
(d) $Mg > Zn > Al > Fe$

74. The following is the correct decreasing order of the ionic radii-

- (a) $K^+ > Ca^{2+} > S^{2-} > Cl^-$
(b) $K^+ > Ca^{2+} > Cl^- > S^{2-}$
(c) $Ca^{2+} > K^+ > Cl^- > S^{2-}$
(d) $S^{2-} > Cl^- > K^+ > Ca^{2+}$

75. Electro-negativity of the following elements increase in the order:

- (a) C, N, Si, P (b) Si, P, C, N
(c) P, Si, N, C (d) N, Si, C, P

76. Which of the following statements is not a correct statement about the trends when going from left to right across the periods of periodic table.

- (a) The elements become less metallic in nature.
(b) The number of valence electrons increases.
(c) The atoms lose their electrons more easily.
(d) The oxides become more acidic.

77. Element X forms a chloride with the formula XCl_2 , which is a solid with a high melting point? X would most likely be in the same group of the periodic table as :

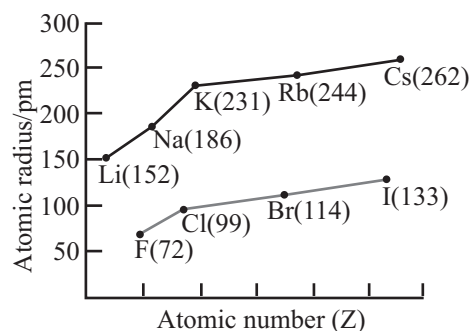
- (a) Na (b) Mg
(c) Al (d) Si

Case/Passage Based Questions

DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

Metallic Character The ability of an atom to donate electrons and form positive ion (cation) is known as electropositivity or metallic character. Down the group, metallic character increases due to increase in atomic size and across the period, from left to right electropositivity decreases due to decrease in atomic size. **Non-Metallic Character** The ability of an atom to accept electrons to form a negative ion (anion) is called non-metallic character or electronegativity. The elements having high electro-negativity have a higher tendency to gain electrons and form anion. Down the group, electronegativity decreases due to increase in atomic size and across the period, from left to right electronegativity increases due to decrease in atomic size.



78. Which of the following correctly represents the decreasing order of metallic character of Alkali metals plotted in the graph? **[CBSE Sample Issued 2021]**

- (a) $Cs > Rb > Li > Na > K$
(b) $K > Rb > Li > Na > Cs$
(c) $Cs > Rb > K > Na > Li$
(d) $Cs > K > Rb > Na > Li$

79. Hydrogen is placed along with Alkali metals in the modern periodic table though it shows non-metallic character

- (a) as Hydrogen has one electron & readily loses electron to form negative ion
(b) as Hydrogen can easily lose one electron like alkali metals to form positive ion
(c) as Hydrogen can gain one electron easily like Halogens to form negative ion
(d) as Hydrogen shows the properties of non-metals

80. Which of the following has highest electronegativity?

- (a) F (b) Cl
(c) Br (d) I

81. Identify the reason for the gradual change in electronegativity in halogens down the group.
- Electronegativity increases down the group due to decrease in atomic size
 - Electronegativity decreases down the group due to decrease in tendency to lose electrons
 - Electronegativity decreases down the group due to increase in atomic radius/ tendency to gain electron decreases
 - Electronegativity increases down the group due to increase in forces of attractions between nucleus & valence electrons
82. Which of the following reason correctly justifies that "Fluorine (72pm) has smaller atomic radius than Lithium (152pm)"?
- F and Li are in the same group. Atomic size increases down the group
 - F and Li are in the same period. Atomic size increases across the period due to increase in number of shells
 - F and Li are in the same group. Atomic size decreases down the group
 - F and Li are in the same period and across the period atomic size/radius decreases from left to right.

Case/Passage - 2

The table given below refers to the elements of the periodic table with atomic number from 3 to 18. These elements are shown by letters. (not by the usual symbols of the elements).

3	4	5	6	7	8	9	10
A	B	C	D	E	F	G	H
11	12	13	14	15	16	17	18
I	J	K	L	M	N	O	P

83. Which of the following are noble gases?
- H and P
 - G and O
 - D and L
 - A and I
84. Which are halogens?
- H and L
 - C and M
 - G and O
 - E and P
85. Which of the following elements have valency 4?
- F and N
 - C and K
 - D and L
 - H and P

Case/Passage - 3

Group VII A elements are strong non-metals because they can easily accept an electron to form an anion whereas group 1 A element are strong metals because they can very easily lose one electron to form cation.

Metals have the tendency to lose their valence electrons and form positive ions, so metallic character is related to the ionisation potential. Elements having low ionisation potential,

lose electrons easily. Thus, metallic character generally decreases across a period and increases down a group.

86. The non metallic character on moving along a period –
- increases
 - decreases
 - depends on the period
 - remains the same
87. Group 1 and group 2 elements are considered as strong metals because
- they have incomplete octet.
 - they can easily gain electrons.
 - they can easily lose electrons.
 - they form anions.
88. Which of the following is the correct decreasing order of metallic character?
- Ca > Sc > Ti > K
 - K > Ca > Sc > Ti
 - K > Sc > Ca > Ti
 - Ti > Sc > Ca > K

Case/Passage - 4

Question numbers 1 – 3 are based on the periodic table. Study the part of the modern periodic table presented below in which the alphabets represent the symbols of elements and answer the following questions.

Group →	1	12	14	15	16	17
Period ↓				M	Q	V
2						
3	A	J			R	W
4	E		L			T
5	G					X

89. Consult the above part of the periodic table to predict which of the given combination is a covalent compound: RQ₂, AT, JQ, JX₂.
90. Considering the above part of the periodic table, which of the given element is the most electropositive element?
91. Which of the given element is the most electronegative element?
92. Study the data of the following three categories A, B and C.

Category	Name of the element	Atomic Mass
A	Li	7
	Na	23
	K	39
B	N	14
	P	31
	As	74
C	B	10.8
	Al	27
	Ga	69.7

Periodic Classification of Elements

- From the given three categories A, B and C, Pick the one which forms Dobereiner's Triads.
- Why did Mendeleev place elements of category A, B and C in three different groups?
- Is Newland law of octaves applicable to all the three categories?

Give reason to justify your answer.

» Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
- If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
- If **Assertion** is **correct** but **Reason** is **incorrect**.
- If **Assertion** is **incorrect** but **Reason** is **correct**.

93. **Assertion:** Ionic size of N^{3-} is greater than F^- .

Reason: N^{3-} and F^- are isoelectronic anions.

94. **Assertion:** Atomic radius of aluminium atom is larger than magnesium atom.

Reason: Effective nuclear charge increase from magnesium to aluminium.

95. **Assertion:** Oxygen atom is divalent in most of its compounds.

Reason: Valency is the number of valence electrons present in the outermost shell of its atom.

96. **Assertion:** Silicon, germanium are the metalloids in the modern periodic table.

Reason: Silicon, germanium has properties of metal as well as non metals.

97. **Assertion:** Bulbs are usually filled with chemically active gases.

Reason: Nitrogen and argon gases are filled in order to prolong the life of the filament.

98. **Assertion :** Group 1 elements are known as the alkali elements.

Reason : s-orbital can accommodate only two electrons.

99. **Assertion :** Nitrogen has higher ionization energy than that of oxygen.

Reason : Nitrogen has smaller atomic size than that of oxygen.

100. **Assertion :** According to Mendeleev, periodic properties of elements are functions of their atomic number.

Reason : Atomic number is equal to the number of protons.

101. **Assertion :** Elements in the same vertical column have similar properties.

Reason : Elements have periodic dependence upon the atomic number.

» Match the Following

DIRECTIONS : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

102. Column II give period to which an element in column I belongs, match them correctly.

Column I	Column II
(A) Hydrogen	(p) 3
(B) Sodium	(q) 4
(C) Calcium	(r) 6
(D) Barium	(s) 1

103. Match the column –

Column I	Column II
(A) Element with largest size in second period	(p) boron
(B) Element with smallest size in group 13	(q) fluorine
(C) Element with maximum non-metallic character.	(r) bromine
(D) Element with smallest size in fourth period	(s) lithium

104.

Column I	Column II
(A) s-block elements	(p) Alkali metals
(B) p-block elements	(q) Alkaline earth metals
(C) Representative elements	(r) Halogens
(D) High ionisation energy	(s) Noble gases

»» Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

105. The law of triads was given by
106. According to modern periodic law, the elements are arranged in the periodic table in the order of their increasing
107. Elements with eight electrons in their outermost energy shell are called
108. If two elements have the same number of valence electrons, then they belong to the same of the periodic table.
109. The elements in groups 1, 2 and 13 to 18 are known as elements.
110. The valency of an atom is equal to its
111. The atomic size in a period from left to right.
112. Dobereiner grouped the elements into triads and Newlands gave the
113. Mendeleev arranged the elements in increasing order of their and according to their properties.
114. Mendeleev predicted the existence of some yet to be discovered elements on the basis of in his periodic table.
115. Elements in the modern periodic table are arranged in vertical columns called and horizontal rows called

»» True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

116. As nuclear charge increases, atomic orbitals become smaller and more stable.
117. As number of shells increases, atomic orbitals become larger and less stable.
118. Atomic radii decrease from left to right across a row of the periodic table.
119. Atomic radii increase from top to bottom down a column of the periodic table.
120. Fluorine has highest electron affinity in the periodic table.
121. Noble gases are placed extremely left in the periodic table.
122. Magnesium is more metallic in nature than sodium.
123. The number of shells increases in a given period from left to right in the periodic table.
124. The elements silicon, germanium and arsenic are called metalloids.
125. Elements are classified on the basis of similarities in their properties.
126. Rows in the periodic table are called periods.
127. The columns of the periodic table are called groups.
128. You will find metals on the extreme right side of the periodic table.
129. Although the order of elements is based on atomic number, vertical families share similar chemical properties.

ANSWER KEY & SOLUTIONS

1. (d) Dobereiner noticed that strontium had similar chemical properties as that of calcium and barium and its atomic weight fell midway between the two. Hence, elements like calcium, strontium and barium form a triad based on the given characteristics.
2. (a) Non-metals form acidic oxides. Element with atomic number 7 (electronic configuration 2, 5) is non-metal (N) and hence will form an acidic oxide, other elements Li(3) and Mg(12) are metals and hence form basic oxides.
3. (b) *p*-block elements majorly forms acidic oxides and are non-metals.
4. (b) On the basis of atomic number, elements were placed in the modern periodic table.
5. (d) Elements of group 16 and period 3 are non metals. Non metals generally form acidic oxides. Elements of group 1 and 2 form basic oxides while elements of group 13 form amphoteric oxides.
6. (c) According to Dobereneir's triad the atomic mass of Br will be average of the atomic masses of Cl & I

$$\text{Atomic mass of Br} = \frac{35.5 + 127}{2} = 81.25$$
7. (c) 8. (c) 9. (d) 10. (b)
11. (c)
12. (c) The element is halogen and has one electron less than inert gas configuration, hence its ion can be represented as M^- ion.
13. (d) In a period, the value of ionisation potential increases from left to right with breaks where the atoms have stable configurations hence the correct order will be
 $F > N > O > C$
14. (a) 15. (d) 16. (b) 17. (d)
18. (d) On moving along a period atomic radii decreases.
19. (b) The metallic character decreases as we move from left, to right in a period.
20. (b) 21. (a) 22. (a) 23. (b)
24. (b) 25. (a) 26. (c) 27. (c)
28. (d) 29. (b)
30. (b) The VII A group has 5 elements.
F, Cl, Br, I and At
31. (a) Group I B contain Cu, Ag and Au.
32. (d) Non-metallic character decreases in a group from top to bottom, hence iodine will be least non-metallic.
33. (c) There are about 118 known elements listed in the periodic table.
34. (a) The elements of the modern periodic table are organized according to increasing atomic number. The atomic number represents the number of electrons which is equal to number of protons in a neutral atom.
35. (c) You will not get information about the atomic radius of an atom. Periodic table will have the atomic number, atomic weight, name, and symbol for each element.
36. (b) Dmitri Mendeleev is credited with designing the modern periodic table.
37. (a) 38. (c) 39. (d) 40. (b)
41. (b) 42. (a) 43. (b) 44. (c)
45. (c) 46. (c) 47. (b) 48. (c)
49. (d) 50. (c) 51. (b)
52. (d) 38 is the atomic no. of strontium (Sr) which is *s*-block element and all elements of *s*-block are metals.
53. (d) Mg, as we move across the period atomic radius decreases.
54. (a) O^{2-} has the highest value of ionic radii as this can be explained on the basis of Z/e $\left\{ \frac{\text{Nuclear charge}}{\text{No. of electrons}} \right\}$

When Z/e ratio increases, the size decreases and when Z/e ratio decreases, size increases.
55. (d) $Na^+ < F^- < O^{2-} < N^{3-}$
All are isoelectronic, effective nuclear charge is highest for Na^+ so it has smallest size.
56. (a) $Mg^{2+} < Na^+ < F^- < Al$
 F^- has bigger size than Mg^{2+} and Na^+
57. (b) Ionic radii decreases significantly from left to right in a period among representative elements.

58. (d) Nuclear charge per electron is greater in P^{5+} . Therefore, its size is smaller.
59. (c) Electropositive nature increases from top to bottom in a group and decrease along a period. Therefore X is most electropositive.
Atomic size decreases along a period and increases down the group. Therefore $W < X$.
60. (c) Mendeleev's periodic law states that the physical and chemical properties of the elements are a periodic function of their atomic mass.
61. (a) Tungsten \rightarrow W
62. (d) Size of F^- is less than O^{2-}
63. (b) Anion O^{2-} has 10 electrons.
Anion F^- has 10 electrons.
64. (a) R and Q are members of Group 16th which is non metallic having O, S, Se, Te etc. These are characterised by showing the formation of covalent bond.
65. (d) The maximum number of electrons that can be filled in the shell with principle quantum number $(n) = 2n^2$.
Maximum number of electrons = $2(4)^2 = 32$
66. (a) Increase in positive charge decrease the ionic radii of cation while increase in negative charge increases the ionic size of anion. So $N^{3-} > O^{2-} > F^- > Na^+$.
67. (c)
68. (b) Position, atomic number and number of electrons in the outermost shell of an element predicts its chemical properties.
69. (d) Bromine and mercury exist in the liquid state.
70. (a) Helium is filled in weather balloon.
71. (c) The ions F^- , Na^+ , O^{2-} and Mg^{2+} are isoelectronic species having same electronic configuration but their nuclear charges differ from each other because of their difference in the number of protons in the nucleus. With increase in the number of protons in the nucleus, the electrons are more attracted towards nucleus thereby causing the decrease in ionic radius. Therefore, the given ions are
 F^- : no. of proton = 9 and no. of electron = 10
 Na^+ : no. of proton = 11 and no. of electron = 10
 O^{2-} : no. of proton = 8 and no. of electron = 10
 Mg^{2+} : no. of proton = 12 and no. of electron = 10
72. (d)

Atomic Number	Element	Electronic configuration
A(11)	Na	2, 8, 1
B(12)	Mg	2, 8, 2
C(16)	S	2, 8, 6
D(17)	Cl	2, 8, 7

From the above table it is clear that:

- (a) Chlorine (D) will gain electrons more easily than sulphur (C).
- (b) The oxide of sodium (A) which is an alkali metal, will be the most basic while that of chlorine (D) which is a halogen, will be the most acidic.
73. (a) The correct order of reactivity is as follows.
 $Mg > Al > Zn > Fe$
Alkali metals and alkaline earth metals are very reactive elements in the periodic table and reactivity decreases on moving from left to right in the periodic table.
74. (d) Among the isoelectronic species greater the ratio larger will be the ionic radii, hence the order is
 $S^{2-} > Cl^- > K^+ > Ca^{2+}$
75. (b) Electro-negativity increases on moving left to right in the periodic table, while it decreases on moving down the group.
The correct order of E.N. is
 $Si < P < C < N$
(1.8) (2.1) (2.5) (3.0)
76. (c) As we move from left to right in a period no. of shells remains same whereas one more electron is added thus the size of atom decreases and hence the valence electron becomes more and more near to the nucleus and hold of nucleus on valence electron increases, due to this, the tendency of an atom to lose valence electron decreases.
77. (b) X forms XCl_2 suggests that X is in +2 state in XCl_2 . Therefore X would most like be in gp 2 of periodic table.
78. (c) $Cs > Rb > K > Na > Li$
79. (b) As Hydrogen can easily lose one electron like alkali metals to form positive ion
80. (a) F
81. (c) Electronegativity decreases down the group due to increase in atomic radius/ tendency to gain electron decreases.

Periodic Classification of Elements

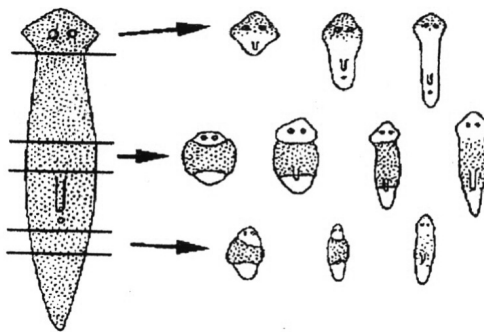
82. (d) F and Li are in the same period and across the period atomic size/radius decreases from left to right.
83. (a) H and P have complete octet.
84. (c) G and O
Both have 7 electrons in their outermost shell.
85. (c) Both have four electrons in their outermost shell.
86. (a) 87. (c)
88. (b) On moving along a period metallic character decreases.
89. R and Q are members of group 16th having elements, O, S, Se, Te etc. RQ₂ is characterised by showing the formation of covalent bond.
90. Element 'G' is the most electropositive element.
91. Element 'V' is the most electronegative element
92. (i) Dobereiner's Triads is A.
(ii) Mendeleev placed elements of category A, B and C in three different groups because they have different physical and chemical properties.
(iii) No, Newland's Law of octaves is not applicable for all three categories.
Because the **law of octaves** states that every eighth element has similar properties when the elements are arranged in the increasing order of their atomic masses.
93. (b) N³⁻ and F⁻ are isoelectronic anions. N³⁻ has only seven protons and F⁻ has nine. Therefore, N³⁻ has larger ionic size.
94. (d) Atomic radius of aluminium atom is smaller than magnesium atom because of increased effective nuclear charge.
95. (c) Valency of an element is determined by the number of valence electrons present in the outermost shell of its atom.
96. (a) Silicon and germanium are among the metalloids in the modern periodic table.
97. (d) Bulbs are usually filled with chemically inactive gases. Nitrogen and argon gases are inactive and are filled in order to prolong the life of the filament.
98. (b) Group I elements are known as alkali metals as the hydroxides of these metals are soluble in water and these solutions are highly alkaline in nature.
99. (c) Nitrogen has higher ionisation energy as it has stable half filled electronic configuration.
100. (d) According to Mendeleev, periodic properties of elements is a function of their atomic masses.
101. (b)
102. A → (s); B → (p); C → (q); D → (r)
103. A → (s); B → (p); C → (q); D → (r)
104. A → (p, q); B → (r, s); C → (p, q, r); D → (r, s)
105. Dobereiner 106. atomic number
107. noble gases 108. group
109. main group 110. combining capacity
111. decreases 112. law of octaves
113. atomic masses, chemical 114. gaps
115. 18, groups, 7, periods
116. True 117. True 118. True
119. True 120. False
121. False
Noble gases are placed extremely right in the periodic table.
122. False 123. False
The number of shells remain same in a given period.
124. True 125. True
126. True
Rows in the periodic table are called periods. The columns of the periodic table are called groups.
127. True
128. False
Inert gases are found on the far right of the periodic table. Halogens are in the second group from the right. Metals of all types are found around the left. Transition metal are found in the middle side of the periodic table.
129. True

9

How Do Organisms Reproduce

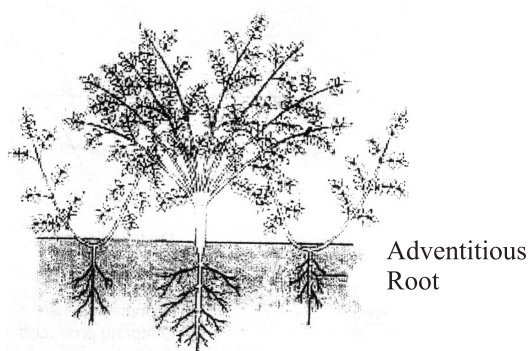
Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

- The vegetative reproduction in sweet potato is done by –
 - stem
 - leaf
 - root
 - flower
- Menstrual cycle is generally of
 - 21 days
 - 28 days
 - 38 days
 - 40 days
- Tunica albuginea is the covering around
 - ovary
 - testes
 - kidney
 - heart
- Example of external fertilization is
 - fish and frog
 - frog and monkey
 - dog and goat
 - goat and fish
- Plants of desired qualities are produced by:
 - Cutting
 - Grafting
 - Layering
 - Any one of (a), (b),(c)
- Budding and fission are processes used by
 - diocious species.
 - hermaphroditic organisms.
 - organisms requiring new gene combinations for each generation.
 - asexually reproducing species.
- Ovulation in mammals is caused by:
 - FSH and TSH
 - FSH and LH
 - FSH and LTH
 - LTH and LH
- Gemmule formation in sponges is helpful in:
 - Parthenogenesis
 - Sexual reproduction
 - Only dissemination
 - Asexual reproduction
- In mammals, the testes lie in scrotal sacs due to
 - presence of urinary bladder.
 - presence of rectum.
 - long vas-deferens.
 - requirement of low temperature for spermatogenesis.
- The following figure represents :
 
 - Budding in *Hydra*
 - Budding in *Planaria*
 - Regeneration in *Planaria*
 - Regeneration in *Hydra*
- The correct sequence of reproductive stages seen in flowering plants is
 - gametes, zygote, embryo, seedling
 - zygote, gametes, embryo, seedling
 - seedling, embryo, zygote, gametes
 - gametes, embryo, zygote, seedling

How Do Organisms Reproduce

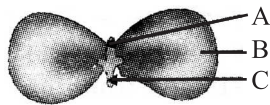
12.



The figure shown above illustrates which method of vegetative propagation?

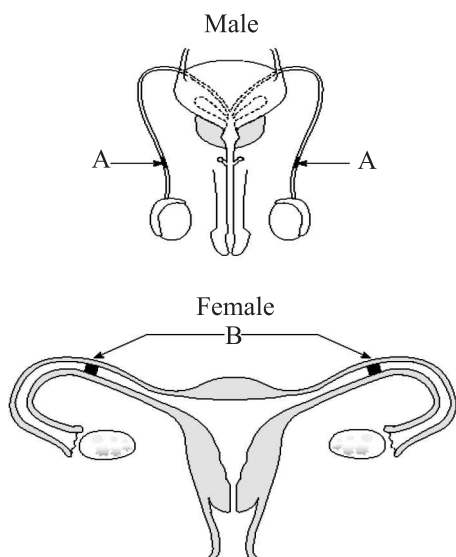
- (a) Bud formation
- (b) Grafting
- (c) Layering
- (d) Spore formation

13. In figure, the parts A, B and C are sequentially:



- (a) cotyledon, plumule and radicle
- (b) plumule, radicle and cotyledon
- (c) plumule, cotyledon and radicle
- (d) radicle, cotyledon and plumule

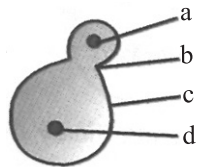
14. The diagrams below represent the reproductive systems in the human male and female.



The blockages shown at A and B would most likely interfere with the ability to

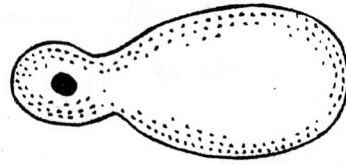
- (a) transport gametes
 - (b) produce mature gametes
 - (c) eliminate waste products through the urethra
 - (d) express secondary sex characteristics
15. Vegetative propagation is possible by
- (a) Root
 - (b) Stem
 - (c) Leaves
 - (d) All of these
16. Ovaries produce
- (a) oestrogen and progesterone
 - (b) oestrogen only
 - (c) progesterone only
 - (d) testosterone
17. Site of fertilization in mammals is
- (a) ovary
 - (b) uterus
 - (c) vagina
 - (d) fallopian tube
18. Fertilization does not occur in which part?
- (a) fallopian tube
 - (b) ampulla
 - (c) oviduct
 - (d) vagina
19. Seminiferous tubules are composed of
- (a) Spermatogonia
 - (b) Glandular epithelium
 - (c) Sensory epithelium
 - (d) Germinal epithelium
20. Cowper's glands are found in
- (a) male mammals
 - (b) female mammals
 - (c) male amphibians
 - (d) female amphibians
21. Progesterone is secreted by
- (a) corpus luteum
 - (b) thyroid
 - (c) thymus
 - (d) testes
22. The general method of asexual reproduction, in yeast fungus is –
- (a) by spores
 - (b) by budding
 - (c) binary fission
 - (d) gemma
23. Oral-contraceptives prevent the
- (a) fertilization
 - (b) ovulation
 - (c) implantation
 - (d) entrance of sperms in vagina
24. The process of development of organism like itself is called
- (a) budding
 - (b) flowering
 - (c) reproduction
 - (d) none of the above
25. Which of the following organisms do not depend on reproduction to exchange genetic information?
- (a) animals
 - (b) plants
 - (c) bacteria
 - (d) fungi

26. Like animals, plants produce
 (a) many more sperm than eggs.
 (b) a few more sperm than eggs.
 (c) equal numbers of sperm and eggs.
 (d) fewer sperm than eggs.
27. The asexual process replaced by the sexual method is known as:
 (a) Semigamy (b) Amphimixis
 (c) Apospory (d) Apomixis
28. The cyclic period of sexual activity in non-human female mammals is called
 (a) Menstruation (b) Luteinization
 (c) Oogenesis (d) Oestrous cycle
29. Characters transmitted from parents to offspring are present in
 (a) cytoplasm (b) ribosome
 (c) golgi bodies (d) genes
30. In sweet potato, vegetative propagation takes place by
 (a) Root (b) Stem
 (c) Leaves (d) Fruit
31. If a starfish is cut into pieces, each piece grows into a complete animal. The process is called
 (a) regeneration (b) reproduction
 (c) healing of wounds (d) growth
32. In the figure of budding in Yeast, structures a, b, c and d should be labelled respectively as

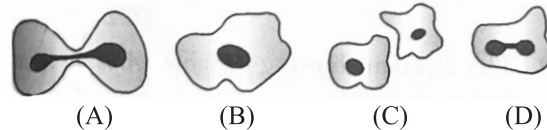


- (a) Nucleus of bud, bud, Yeast, nucleus
 (b) Dividing nucleus of bud, bud, Yeast, nucleus
 (c) Nucleus of bud, bud, Yeast, dividing nucleus of yeast
 (d) Dividing nucleus of Yeast, Yeast, bud, nucleus of bud.
33. The nutritive medium for the ejaculated sperms is given by
 (a) Seminal fluid (b) Vaginal fluid
 (c) Uterine lining (d) Fallopian tube
34. If both ovaries are removed from a rat, then which hormone is decreased in blood
 (a) Oxytocin (b) Oestrogen
 (c) Prolactin (d) Gonadotrophin
35. Which part of the ovary in mammals acts as an endocrine gland after ovulation ?

- (a) Vitelline membrane (b) Graafian follicles
 (c) Stroma (d) Germinal epithelium
36. In budding,
 (a) Outgrowth develops earlier than nuclear division
 (b) Nucleus divides earlier than development of outgrowth
 (c) Both occur simultaneously
 (d) There is no fixed sequence
37. A student upon observing a permanent slide of binary fission in *Amoeba* drew the following diagram. Identify the fault in the diagram:



- (a) Size of daughter cell to be formed is not appropriate.
 (b) Constriction has appeared before nuclear division.
 (c) Constriction is not equally deep on either side.
 (d) None of the above
38. In the process of binary fission:
 (a) Cytoplasm divides first followed by division of nucleus
 (b) Nucleus divides first followed by division of cytoplasm
 (c) Both nucleus and cytoplasm divide simultaneously
 (d) Cell protrudes followed by division of nucleus
39. Given below are stages of binary fission in *Amoeba*. Which one out of the following would you select as correct sequence of these stages?



- (a) A, B, C, D (b) A, C, A, B
 (c) B, D, A, C (d) C, A, D, B
40. (A): Vigorous contraction of the uterus at the end of pregnancy causes expulsion.
 (B): The stimulatory reflex between the uterine contraction and oxytocin results in weakening contractions.
 (a) Both the statements (A) and (B) are correct
 (b) Statement (A) is correct but (B) is incorrect.
 (c) Both the statements (A) and (B) are incorrect
 (d) Statement (B) is correct but (A) is incorrect.

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41. (A): The middle piece is called as power house of the sperm.
(B): The numerous mitochondria coiled around axial filament produce energy for the movement of the tail.
- Both the statements (A) and (B) are correct
 - Statement (A) is correct but (B) is incorrect.
 - Both the statements (A) and (B) are incorrect
 - Statement(B) is correct but (A) is incorrect.
42. Which of the following cells during gametogenesis is normally diploid?
- Spermatid
 - Spermatogonia
 - Secondary polar body
 - Primary polar body
43. In human females, meiosis II is not complete until?
- Fertilisation
 - Uterine implantation
 - Birth
 - Puberty
44. The human embryo gets nutrition from the mother blood with the help of a special organ called
- Zygote
 - Ovary
 - Oviduct
 - Placenta
45. The source of mammalian hormone 'relaxin' is
- ovary
 - stomach
 - intestine
 - pancreas
46. Grafting in monocot plants is not possible because they have
- Parallel venation
 - Have only one cotyledon
 - Have cambium
 - Have scattered vascular bundles
47. In the flowering plants sexual reproduction involves several events beginning with the bud and ending in a fruit. These events are arranged in four different combinations. Select the combination that has the correct sequence of events.
- Embryo, zygote, gametes, fertilization.
 - Gametes, fertilization, zygote, embryo.
 - Fertilization, zygote, gametes, embryo.
 - Gametes, zygote, embryo, fertilization.
48. "Double fertilization" is a complex mechanism of flowering plants that is also unique to angiosperms. Choose the most appropriate statement from the options listed below that explains this phenomenon.
- Fertilization in two flowers of the same plant forming endosperms.
 - Two male gametes fertilize two eggs inside the ovule as a result the ovary gives rise to bigger fruits.
 - Two fertilizations occur in a flower-one fertilization results in the formation of a diploid zygote and the second fertilization results in the formation of a triploid endosperm.
 - Two pollen grains sending two pollen tubes inside the ovary, resulting in the formation of two seeds inside the fruit.
49. During oogenesis in mammals, the second meiotic division occurs
- before fertilisation
 - after implantation
 - before ovulation
 - after fertilisation
50. The correct route that sperm follows when it releases from the testis of a mammal:
- Vas deferens → Epididymis → Urethra
 - Urethra → Epididymis → Vas deferens
 - Epididymis → Urethra → Vas deferens
 - Epididymis → Vas deferens → Urethra
51. Which of the following is not a part of the female reproductive system in human beings?
- Ovary
 - Uterus
 - Vas deferens
 - Fallopian tube
52. The anther contains
- sepals
 - ovules
 - carpel
 - pollen grains

Case/Passage Based Questions

DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

When the branches of a plant growing in the field are pulled towards the ground and a part of them is covered with moist soil (leaving the tips of the branches exposed above the ground), then after sometime new roots develop from the parts of branches buried in the soil. On cutting these branches from the parent plant, new plants are produced from the cut parts of branches which had developed roots.

- What is this method of propagation of plants known as?
- What type of branches should a plant have to be able to be propagated by this method?
- Name any two plants which are grown for their flowers and propagated by this method.
- Name any two plants which are grown for their fruits and propagated by this method.
- Name one plant which gets propagated by this method naturally by forming runners (soft horizontal stems running above the ground).

Case/Passage - 2

When an insect sits on the flower of a plant then some particles, present on the top of little stalks in the flower get stick to its body hair. When this insect now sits on the flower of another similar plant, then particles attached to the hair of insect are shifted to top of a flask-shaped organ at the centre of a flower. This particle grows a long tube B from the top of flask-shaped organ through which C moves down and reaches the bottom of the flask-shaped organ. Here C fuses with the nucleus of D, present in structure E.

The fusion of C and D forms a new cell F which grows and develops into a seed of the plant.

58. What are these particles? Name the process by which these particles are transferred from one flower to other flower of another similar plant.
59. What is the name of tube B?
60. What is C which moves down through the tube B?
61. Name D and E.
62. What is F?

Case/Passage - 3

The male reproductive system consists of portions which produce the germ-cells and other portions that deliver the germ-cells to the site of fertilisation. The formation of germ-cells or sperms takes place in the testes. These are located outside the abdominal cavity in scrotum because sperm formation requires a lower temperature than the normal body temperature. We have discussed the role of the testes in the secretion of the hormone, testosterone, in the previous chapter. In addition to regulating the formation of sperms, testosterone brings about changes in appearance seen in boys at the time of puberty. The sperms formed are delivered through the vas deferens which unites with a tube coming from the urinary bladder. The urethra thus forms a common passage for both the sperms and urine. Along the path of the vas deferens, glands like the prostate and the seminal vesicles add their secretions so that the sperms are now in a fluid which makes their transport easier and this fluid also provides nutrition. The sperms are tiny bodies that consist of mainly genetic material and a long tail that helps them to move towards the female germ-cell.

63. The seminiferous tubules of the testes are lined by the germinal epithelium consisting of
 - (a) spermatids
 - (b) cells of Sertoli
 - (c) spermatogonium
 - (d) spermatocytes

64. The seminiferous tubules of the testes are lined by the germinal epithelium consisting of
 - (a) sertoli cells
 - (b) cells of germinal epithelium
 - (c) cells of Leydig or interstitial cells
 - (d) secondary spermatocytes
65. Another name for Bulbourethral gland is
 - (a) Meibomian gland
 - (b) Prostate gland
 - (c) Perineal gland
 - (d) Cowper's gland
66. In man, Cryptorchidism is the condition when
 - (a) testes do not descent into the scrotum
 - (b) there are two testes in each scrotum
 - (c) testis degenerates in the scrotum
 - (d) testis enlarges in the scrotum
67. Which of these is an accessory reproductive gland in male mammals
 - (a) Inguinal gland
 - (b) Prostate gland
 - (c) Mushroom-shaped gland
 - (d) Gastric gland


Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
 - (b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
 - (c) If **Assertion** is **correct** but **Reason** is **incorrect**.
 - (d) If **Assertion** is **incorrect** but **Reason** is **correct**.
68. **Assertion:** Asexual reproduction is also called blastogenesis.
Reason: In asexual reproduction, there is no formation and fusion of gametes.
 69. **Assertion:** *Amoeba* shows multiple fission during unfavourable conditions.
Reason: Chances of survival are less during unfavourable conditions.

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70. **Assertion:** Urethra in human male acts as urinogenital canal.

Reason: Urethra carries only urine while sperms are carried by vasa deferentia only.

71. **Assertion:** In morula stage, cells divide without increase in size.

Reason: Zona pellucida remain undivided till cleavage is complete.

Match the Following

DIRECTIONS : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

72.	Column A	Column B
(A)	Animals which give birth to young one	(p) <i>Hydra</i>
(B)	Animal which produces bud	(q) <i>Planaria</i>
(C)	An animal which shows regeneration	(r) Placenta
(D)	Provides nutrition to the developing embryo from the mother	(s) Cross-pollination
(E)	The pollen transferred from one flower to another flower of other plant	(t) Germination
(F)	The process in which embryo develops into seedling	(u) Viviparous
(G)	Fertilised egg in humans gets implanted in	(v) Menstruation
(H)	When egg in humans is not fertilised, what happens?	(w) Uterus
73.	Column A	Column B
(A)	Seminal vesicle	(p) Latex sheath
(B)	Urinogenital duct	(q) Semen plasma

(C) Condom

(r) Protozoan

(D) Trichomoniasis

(s) Corpus spongiosum

Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

74. In many invertebrate organisms, both sexes are found in the same individual. This is called
75. During the birth process, the pituitary hormone signals the uterus to contract.
76. A technique to produce genetically alike individuals from a single cell is known as
77. Budding is a common method of asexual reproduction in yeast and
78. In, vegetative propagation occurs by leaves.
79. Surgically when fallopian tube is removed or ligated, it is called
80. An egg cell of a plant is contained in an present in an ovary.
81. Transfer of pollen from one flower to stigma of another flower of same species is termed
82. Ovaries are also responsible for the production of hormone called
83. Plants raised by vegetative propagation bear early and
84. Future shoot hidden in a seed is called
85. The gametes are formed in most of the multicellular organisms by a process of cell division called
86. The two parts tied together during grafting are called and
87. Simply break up into smaller pieces upon maturation is found in

True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

88. Basic event in reproduction is creation of DNA copy.
89. Copper-T is a contraceptive device used by women.
90. At the time of birth, a baby girl has thousands of immature eggs.
91. Sperms mature at a temperature higher than that of human body.

92. The only function of the testes is to produce sperm.
93. Animal development is limited to the period prior to bird hatching.
94. Onset of menstruation is termed as menopause.
95. In *Spirogyra*, asexual reproduction takes place by fragmentation.
96. Vegetative propagation by leaves occurs in sweet potato.
97. Transfer of male gametes to the stigma of flower is called pollination.
98. In mammals including man, fertilization takes place externally.
99. The ovulation takes place 10-12 days after the start of menstruation.
100. In human-beings, male can produce sperms upto the age of 45-50 years.
101. In fission, many bacteria and protozoa simply divide into two or more daughter cells.
102. Plants that produce asexually do not produce flower.
103. Placenta is the name of a vital connection between mother and embryo.
104. The male germ-cell produced by pollen grain contains half the amount of DNA as compared to the other body cells of the plant.
105. Vegetative propagation produces plants that are genetically similar to the parent plant.
106. Regeneration is the same as reproduction.
107. Before cell division copying of DNA is not essential.
108. Sexually transmitted diseases can be prevented by using condoms.
109. Plants produced by vegetative propagation are genetically similar to the parent plant.
110. Sexual reproduction does not lead to variation in a population.
111. The ovary of a flower grows into a fruit.

ANSWER KEY & SOLUTIONS

1. (c) Sweet potato is an example of vegetative propagation by roots. Sweet potato bears adventitious buds. When it is planted in the soil, new plants are produced from the roots.
2. (b)
3. (b) *Tunica albuginea* (testicles) is a layer of connective tissue which covers the testicles.
4. (a) External fertilization is a mode of reproduction in which a male sperm fertilizes a female egg outside of the female body. Example: fish and frog.
5. (b) Grafting is a horticultural technique used to join parts from two or more plants so that they appear to grow as a single plant. It is often used to combine the desirable or advantageous characteristics of two different plants.
6. (d) 7. (b) 8. (d) 9. (d)
10. (c) 11. (a) 12. (c) 13. (c)
14. (a) 15. (d) 16. (a) 17. (d)
18. (d)
19. (d) The germinal epithelium is the innermost layer of the testicle. It is also known as the wall of the seminiferous tubule within the testes.
20. (a) The Cowper's glands (or bulbourethral glands) are a pair of exocrine glands in the mammals (male reproductive system). They produce thick clear mucus prior to ejaculation that drains into the spongy urethra.
21. (a) The corpus luteum secretes progesterone, which is a steroid hormone responsible for the changes occur in the endometrium (its development) and its maintenance.
22. (b)
23. (b) The birth control pill works by stopping sperm from joining with an egg (which is called fertilization). The hormones in the pill stop ovulation. No ovulation means there's no egg hanging around for sperm to fertilize, so pregnancy can't happen.
24. (a)
25. (c) Bacteria have three mechanism for genetic information transfer without undergoing reproduction *i.e.*, transformation, transduction and conjugation.
26. (a) 27. (d)
28. (d) Oestrus cycle is the period in the sexual cycle of female mammals, except the higher primates, during which they are in heat *i.e.*, ready to accept a male and to mate.
29. (d) 30. (a)
31. (a) Regeneration means the regrowth of a damaged or missing organ part from the remaining tissue. Starfish exhibit regeneration.
32. (a) 33. (a) 34. (b) 35. (b)
36. (a) 37. (b) 38. (b) 39. (c)
40. (c) Vigorous contraction of the uterus at the end of pregnancy causes parturition. Parturition is induced by a complex neuroendocrine mechanism. The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex.
41. (a) The middle piece of human contains mitochondria coiled a round the axial filament called mitochondrial spiral. They provide energy for the movement of the sperm. So it is called as the 'power house of the sperm'.
42. (b) Spermatogonia are diploid male germ cells which undergo meiosis to form sperms.
43. (a) Meiosis II does not complete untill fertilisation occurs in females (in human being). If fertilisation takes place, it results in a fertilized mature ovum and second polar body.
44. (d) It is a connecting link between mother and developing foetus, which provides nutrients and removes the waste from baby's blood.
45. (a) Relaxin is produced in the corpus luteum, the placenta and the uterus in females as well as in other reproductive structures, this varies by species. It also promotes the development of mammary glands in pregnant mammals.
46. (d) Grafting in monocot plants is not possible because they have scattered Vascular Bundles.
47. (b)
48. (c) In double fertilization, one male gamete fuses with the egg and results in the formation of a diploid


- zygote and this process is called fertilization. The other male gamete fuses with the two polar nuclei to form a triploid endosperm. This process is called triple fusion. After fertilisation, the fertilized ovule forms the seed while the tissues of the ovary become the fruit.
49. (d) A primary oocyte begins the first meiotic division, but then arrests until later in life when it will finish this division in a developing follicle. This results in a secondary oocyte, which will complete meiosis if it is fertilized. So, the second meiotic division occurs after fertilisation.
50. (d) The sperm releases from the testis, enters into epididymis which leads to vas deferens. Then sperms are transferred into the urethra.
51. (c) Ovary, uterus and fallopian tube are the part of female reproductive system but vas deferens is a part of male reproductive system in human beings. The sperms are delivered through the vas deferens which unites with a tube coming from the urinary bladder.
52. (d) Stamens are the male reproductive parts of flowers. A stamen consists of an anther (which produces pollen) and a filament.
53. (a) Layering
54. (b) Slender branches (Thin branches)
55. (c) Jasmine and China rose
56. (d) Lemon and Guava
57. (e) Strawberry
58. (a) These particles are known as pollen grains; cross pollination
59. (b) Pollen-tube
60. (c) C is male gamete.
61. (d) D is female gamete (ovum or egg); E is ovule
62. (e) F is fertilised egg (zygote).
63. (b) 64. (a) 65. (d) 66. (a)
67. (b)
68. (b) Development of the offspring from reproductive units, such as buds or fragments, in asexual reproduction is called blastogenesis. In asexual reproduction, only one parent is involved, so also called uniparental reproduction.
69. (a)
70. (c) The urethra is the tube that allows urine to pass out of the body. In men, it's a long tube that runs through the penis. It also carries semen in men.
71. (a)
72. (A) → (u), (B) → (p), (C) → (q), (D) → (r), (E) → (s), (F) → (t), (G) → (w), (H) → (v)
73. (A) → (q), (B) → (s), (C) → (p), (D) → (r)
74. hermaphroditism 75. oxytocin
76. cloning 77. *Hydra*
78. *Bryophyllum* 79. tubectomy
80. ovule 81. cross-pollination
82. oestrogen/progesterone
83. flowers, fruits 84. plumule
85. meiosis 86. stock, scion
87. *Spirogyra*
88. True 89. True 90. True 91. False
92. False 93. False 94. False 95. True
96. False 97. True 98. False 99. True
100. False 101. True 102. False 103. True
104. True 105. True 106. False 107. False
108. True 109. True 110. False 111. True


10

Heredity and Evolution

Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

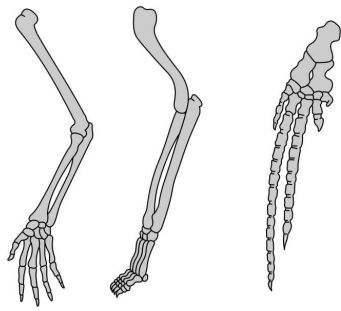
- A pair of contrasting characters is called
 - phenotype
 - genotype
 - allele
 - gene
- An allele is said to be dominant if
 - it is expressed only in heterozygous combination.
 - it is expressed only in homozygous combination.
 - it is expressed in both homozygous and heterozygous condition.
 - it is expressed only in second generation.
- Which of the following is a test cross?
 - $TT \times tt$
 - $Tt \times tt$
 - $Tt \times TT$
 - $tt \times tt$
- Which is the example of homologous organs?
 - Forelimbs of man and wings of bird
 - Wings of birds and wings of insects
 - Vermiform appendix and nictitating membrane
 - Archaeopteryx* and *Balanoglossus*
- Which of the following features do humans lack that other primates have ?
 - Forward-facing eyes
 - Short snouts
 - Flexible shoulder and elbow joints
 - Opposable big toes
- A pure tall plant can be differentiated from a hybrid tall plant:
 - By measuring length of plant
 - By spraying gibberellins
 - If all plants are tall after self-pollination
 - If all plants are dwarf after self-pollination
- In fruit flies wild-type colour is red and is dominant to white eye colour. Because this eye colour is located on the:
 - Y chromosome only
 - autosome only.
 - X and Y chromosomes
 - X chromosome only.
- The diagram below represents a portion of a nucleic acid molecule.

The part indicated by arrow X could be
 - adenine
 - ribose
 - deoxyribose
 - phosphate
- Mendel's concept of segregation implies that the two members of an allelic pair of genes –
 - are distributed to separate gametes
 - may contaminate one another
 - are segregated in pairs
 - are linked
- 

The figure above shows :
 - A bird sitting on a tree
 - Connection between Birds and Reptiles
 - Connection between Pisces and Aves
 - All of the above

11. If a homozygous red-flowered plant is crossed with a homozygous white-flowered plant, the offspring would be:
 (a) Half red-flowered (b) Half white-flowered
 (c) All red-flowered (d) Half pink-flowered
12. Which of the following would stop evolution by natural selection from occurring?
 (a) If humans became extinct because of a disease epidemic.
 (b) If a thermonuclear war killed most living organisms and changed the environment drastically.
 (c) If ozone depletion led to increased ultraviolet radiation, which caused many new mutations.
 (d) If all individuals in a population were genetically identical, and there was no genetic recombination, sexual reproduction, or mutation.
13. If the fossil of an organism is found in the deeper layers of earth, then we can predict that:
 (a) The extinction of organism has occurred recently.
 (b) The extinction of organism has occurred thousands of year ago.
 (c) The fossil position in the layers of earth is not related to its time of extinction.
 (d) Time of extinction cannot be determined.
14. A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers, but almost half of them were short. This suggests that the genetic make-up of the tall parent can be depicted as:
 (a) TTWW (b) TTww
 (c) TtWW (d) TtWw
15. Normal maize has starchy seed which remain smooth when dry. A mutant form has sugary seed which go crinkled when dry. When a mutant was crossed with a normal plant, an F_1 was produced which had smooth seeds. What would be the relative ratios of the different seed types, if the F_1 was allowed to self
 (a) 1 smooth : 3 sugary (b) 3 smooth : 1 sugary
 (c) 1 smooth : 1 sugary (d) All sugary
16. Mendel formulated some laws which are known as
 (a) Laws of germplasm
 (b) Laws of origin of species
 (c) Laws of recapitulation
 (d) Laws of inheritance
17. Vestigial organs are:
 (a) Primitive organs
 (b) Primordial organs
 (c) Organs reduced due to disuse
 (d) Organs marked only in embryonic stage
18. Who out of the following was of the strong opinion that acquired characteristics are inherited:
 (a) Lamarck (b) Lysenko
 (c) Mendel (d) Huxley
19. Guanine pairs with:
 (a) Adenine (b) Cytokine
 (c) Thymine (d) None of the above
20. Chemically a nucleotide has a:
 (a) Pentose group (b) Nitrogenous base
 (c) Phosphate group (d) All of these
21. Which of the following rediscovered the Mendel's work?
 (a) Correns (b) De Vries
 (c) Tschermak (d) All of these
22. Mendel's law of segregation is based on separation of alleles during:
 (a) Gametes formation
 (b) Seed formation
 (c) Pollination
 (d) Embryonic development
23. Mendel formulated the law of purity of gametes on the basis of:
 (a) Dihybrid cross (b) Monohybrid cross
 (c) Back cross (d) Test cross
24. The earliest living organisms were:
 (a) Multicellular (b) Eukaryotes
 (c) Prokaryotes (d) None of these
25. Sudden inheritable change is called:
 (a) Recombination (b) Mutation
 (c) Natural selection (d) Segregation
26. When one gene pair hides the effect of the other unit, this phenomenon is referred as –
 (a) Dominance (b) Mutation
 (c) Epistasis (d) None of these
27. The genotype of offspring formed from $Tt \times tt$ will be –
 (a) TT and tt (b) Tt and tt
 (c) only tt (d) only TT
28. A complete set of chromosomes inherited as a unit from one parent, is known as:
 (a) Karyotype (b) Gene pool
 (c) Genome (d) Genotype
29. Which of the following is Heterozygous?
 (a) TTRR (b) ttrr
 (c) TT (d) Tt
30. An experiment to prove that organic compounds were the basis of life, was performed by:
 (a) Oparin (b) Miller
 (c) Melvin (d) Fox

Heredity and Evolution

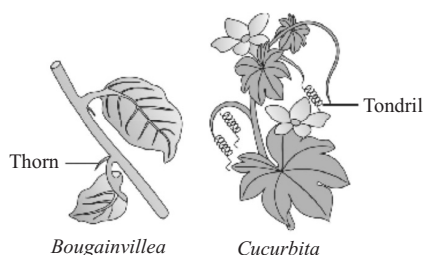
31. The idea of "Survival of fittest" was given by:
 (a) Darwin (b) Herbert Spencer
 (c) Germplasm RNA (d) Somatic DNA
32. If two parents have the genotypes $AA \times aa$, the probability of having an aa genotype in the F_2 generation is –
 (a) 25 percent (b) 50 percent
 (c) 75 percent (d) None of these
33. Heredity deals with the study of
 (a) resemblances and differences between the parents and offsprings.
 (b) resemblances between the parents and offsprings.
 (c) differences between the parents and offspring.
 (d) none of the above
34. The given figure shows bones in the forelimbs of three mammals.
- 
- For these mammals, the number, position, and shape of the bones must likely indicate that they may have
 (a) developed in a common environment.
 (b) developed from the same earlier species.
 (c) identical genetic makeup.
 (d) identical methods of obtaining food.
35. A male child will be born if
 (a) father is healthy
 (b) mother is well fed during pregnancy
 (c) genetic composition of child has XY set of chromosomes
 (d) genetic composition of child has XX set of chromosomes.
36. According to the evolutionary theory, formation of a new species is generally due to
 (a) sudden creation by nature.
 (b) accumulation of variations over several generations.
 (c) clones formed during asexual reproduction.
 (d) movement of individuals from one habitat to another.
37. Which of the following is dominant character according to the Mendel?
 (a) Dwarf plant and yellow fruit
 (b) Terminal fruit and wrinkled seed
 (c) White testa and yellow pericarp
 (d) Green coloured pod and rounded seed
38. From heredity point of view, which marriage is not suitable?
 (a) Man Rh (–) and Woman Rh (+)
 (b) Both Rh (+)
 (c) Both Rh (–)
 (d) Man Rh (+) and Woman Rh (–)
39. Which of the following are fossils?
 (a) Pollen grains buried in the bottom of a peat bog.
 (b) The petrified cast of a clam's burrow.
 (c) The impression of clam shell made in mud, preserved in mudstone.
 (d) All of the above.
40. Which of the following evolutionary mechanisms acts to slow down or prevent the evolution of reproductive isolation?
 (a) Natural selection (b) Gene flow
 (c) Mutation (d) Genetic drift
41. In natural selection,
 (a) the genetic composition of the population changes at random over time.
 (b) new mutations are generated over time.
 (c) all individuals in a population are equally likely to contribute offspring to the next generation.
 (d) individuals that possess particular inherited characters survive and reproduce at a higher rate than other individuals.
42. A heterozygous red-eyed female *Drosophila* mated with a white-eyed male would produce
 (a) red-eyed females and white-eyed males in the F_1
 (b) white-eyed females and red-eyed males in the F_1
 (c) half red and half white-eyed females and all white-eyed males in the F_1
 (d) half red and half white-eyed females as well as males in the F_1
43. Sex-linked disorders such as color blindness and haemophilia are
 (a) caused by genes on the X chromosome
 (b) caused by genes on the autosome
 (c) caused by genes on the Y chromosome
 (d) expressed only in men
44. The smallest unit that can evolve is a:
 (a) Species (b) Genotype
 (c) Gene (d) Population

45. Both prokaryotic and eukaryotic fossils are found in:
 (a) Azoic (b) Coenozoic
 (c) Proterozoic (d) Archaeozoic

46. (A): Genes pass from one generation to another.

(B): The unit of inheritance is genes.

- (a) Statement (A) and (B) both are correct.
 (b) Statement (A) is correct but (B) is incorrect.
 (c) Statement (A) is incorrect but (B) is correct
 (d) Statement (A) and (B) both are incorrect.
47. The given figure shows an example of:



- (a) Homologous organs (b) Convergent evolution
 (c) Divergent evolution (d) Both (a) and (c)
48. Which of the following statements best describe the theory of natural selection?
 (a) All organisms are equally suited to their environment.
 (b) Random selection will determine which organisms survive.
 (c) Organisms better adapted to their environment have greater reproductive success.
 (d) Organisms that produce the most offspring are better suited to their environment.
49. (A): Mendel was successful in his hybridisation.
 (B): Garden pea was proved as ideal experimental material.
 (a) Statement (A) and (B) both are correct.
 (b) Statement (A) is correct but (B) is incorrect.
 (c) Statement (A) is incorrect but (B) is correct
 (d) Statement (A) and (B) both are incorrect.
50. Match the following columns and select the correct answer from the codes given below.

Column-I	Column-II
A. Non-parental gene exchange	I. Crossing over
B. Non-sister chromatids	II. X and Y
C. Sex chromosome	III. Autosome-linked disease
D. Thalassaemia	IV. Recombination

- (a) A – IV; B – I; C – II; D – III
 (b) A – II; B – I; C – IV; D – III
 (c) A – II; B – IV; C – III; D – I
 (d) A – II; B – IV; C – I; D – III

51. In order to find out different types of gametes produced by a pea plant having the genotype AaBb, it should be crossed to a plant with the genotype:

- (a) AABB (b) AaBb
 (c) aabb (d) aaBB

52. (A): A good example of multiple alleles is ABO blood group system.

(B): When I^A and I^B alleles are present together in ABO blood group system, they both express their own types.

- (a) Statement (A) and (B) both are correct.
 (b) Statement (A) is correct but (B) is incorrect.
 (c) Statement (A) is incorrect but (B) is correct
 (d) Statement (A) and (B) both are incorrect.
53. Suppose that in sheep, a dominant allele (B) produces black hair and a recessive allele (b) produces white hair. If you saw a black sheep, you would be able to identify
 (a) its phenotype for hair colour.
 (b) its genotype for hair colour.
 (c) the genotypes for only one of its parents.
 (d) the genotypes for both of its parents.

54. Refer the given statements and select the **correct** option.

- (i) Percentage of homozygous dominant individuals obtained by selfing Aa individuals is 25%.
 (ii) Types of genetically different gametes produced by genotype AABbcc are 2.
 (iii) Phenotypic ratio of monohybrid F_2 progeny in case of *Mirabilis jalapa* is 3 : 1.
 (a) All the statements are correct.
 (b) Statements (i) and (ii) are true, but statement (iii) is false.
 (c) Statements (i) and (iii) are true, but statement (ii) is false.
 (d) Statements (ii) and (iii) are true, but statement (i) is false.

55. In a case of mammalian coat color, the principal gene identified is 'C' which codes for a tyrosinase enzyme. In case of rabbits four different phenotypes are observed *Full Color* > *Chinchilla* > *Himalayan* > *Albino* (in order of the expression of gene 'C' and its alleles). In a progeny obtained after crossing two rabbits, the percentages of *Chinchilla*, *Himalayan* and *Albino* rabbits were 50, 25 and 25 respectively. What must have been the genotypes of the parent rabbits?

- (a) $C^{ch}C^{ch} \times C^{ch}c$ (b) $C^{ch}C^{ch} \times C^{ch}c$
 (c) $C^{ch}c \times C^{ch}c$ (d) $C^{ch}C^{ch} \times C^{ch}C^{ch}$

56. The gene for hemophilia is present on X chromosome. If a hemophilic male marries a normal female, the probability of their son being hemophilic is

- (a) nil (b) 25%
 (c) 50% (d) 100%

Heredity and Evolution

57. In the experiment conducted by Mendel, RRyy (round green) and rrYY (wrinkled, yellow) seeds of pea plant were used. In the F₂ generation 240 progeny were produced, out of which 15 progeny had specific characteristics. What were the characteristics?
- (a) round and green (b) round and yellow
(c) wrinkle and yellow (d) wrinkle and green
58. A breeder crossed a pure bred tall plant having white flowers to a pure bred short plant having blue flowers. He obtained 202 F₁ progeny and found that they are all tall having white flowers. Upon selfing these F₁ plants, he obtained a progeny of 2160 plants. Approximately, how many of these are likely to be short and having blue flowers?
- (a) 1215 (b) 405
(c) 540 (d) 135
59. Varieties of vegetables such as cabbage, broccoli and cauliflower have been produced from a wild cabbage species. Such process of producing new varieties of living organisms is called
- (a) Natural selection (b) Artificial selection
(c) Speciation (d) Genetic drift
60. Which of the following are pairs of analogous organs?
- (I) Forelimbs of horse – Wings of bat
(II) Wings of bat –Wings of butterfly
(III) Forelimbs of horse – Wings of butterfly
(IV) Wings of bird – Wings of bat
- (a) (I) and (II) (b) (II) and (IV)
(c) (III) and (IV) (d) (II) and (III)
61. Of the periods listed below, which one is the earliest period when ostracoderms, the jawless and finless fishes, appeared?
- (a) Devonian period (b) Cambrian period
(c) Carboniferous period (d) Silurian period
62. Which one of the following options lists the primary energy source(s) for all forms of life on the earth?
- (a) Light, inorganic substances
(b) Inorganic substances, organic substances
(c) Light, organic substances
(d) N₂, CO₂
63. Four important events given below may have led to the origin of life on the earth.
- (A) Formation of amino acids and nucleotides
(B) Availability of water
(C) Organization of Cells
(D) Formation of complex molecules
- (a) A, B, C and D (b) B, A, D and C
(c) A, D, B and C (d) B, C, A and D
64. Which of the following carry hereditary characters to the off spring in the organism?
- (a) Ribosome (b) Chromosome
(c) Plasma (d) Lysosome
65. If the genotypes determining the blood groups of a couple are I^AI^O and I^AI^B, then the probability of their first child having type O blood is:
- (a) 0 (b) 0.25
(c) 0.50 (d) 0.75
66. A cross was carried out between two individuals heterozygous for two pairs of genes. Assuming segregation and independent assortment, the number of different genotypes and phenotypes obtained respectively would be:
- (a) 4 and 9 (b) 6 and 3
(c) 9 and 4 (d) 11 and 4
67. A plant with red coloured flowers is crossed with a plant having white flowers. The red and white colour of the flower is controlled by a single gene. Red is dominant over white. The F₁ progeny is self-pollinated and the flower colour in F₂ is observed. Given the above information, what is the expected phenotypic ratio of plants with different flower colours?
- (a) All plants with red flowers
(b) Red : white in the ratio of 3 : 1
(c) Pink : white in the ratio of 3 : 1
(d) Red : pink : white in a ratio of 1 : 2 : 1
68. Which one of the following is a correct statement about primates evolution?
- (a) Chimpanzees and gorillas evolved from macaques
(b) Humans and chimpanzees evolved from gorillas
(c) Humans, chimpanzees and gorillas evolved from a common ancestor
(d) Humans and gorillas evolved from chimpanzees
69. The gene for the genetic disease “Haemophilia” is present on the ‘X’ chromosome. If a haemophilic male marries a normal female, what would be the probability of their son being haemophilic.
- (a) 50% (b) 100%
(c) Nil (d) 3 : 1
70. A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bear violet flowers, but almost half of them were short. This suggests that the genetic make-up of the tall parent can be depicted as
- (a) TTWW (b) TTww
(c) TtWW (d) TtWw

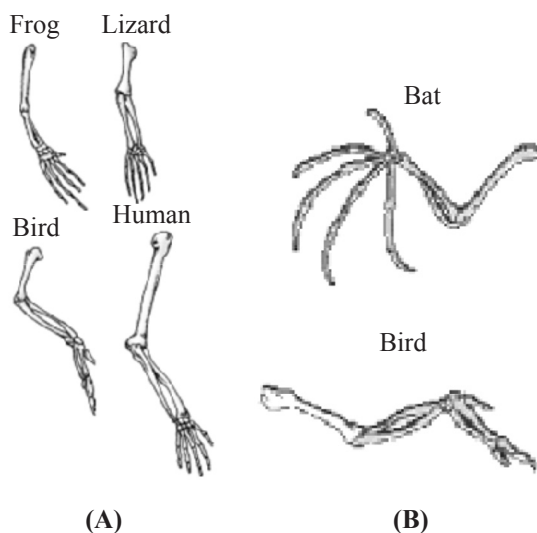
71. An example of homologous organs is
- our teeth and elephant's tusks
 - our arm and a dog's fore-leg
 - potato and runners of grass.
 - all of the above.

Case/Passage Based Questions

DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

72. Question number (a) - (d) are based on the images (A) and (B) given below. Study them and answer the following questions.



- What term can be used for the structure given in image A?
 - What term can be used for the structure given in image B?
 - Which image shows a common ancestry?
 - Which image has a common function but different origin?
73. A person first crossed pure-breed pea plants having round-yellow seeds with pure-breed pea plants having wrinkled-green seeds and found that only A-B type of seeds were produced in the F_1 generation. When F_1 generation pea plants having A-B type of seeds were cross-breed by self-pollination, then in addition to the original round-yellow and wrinkled-green seeds, two new varieties A-D and C-B type of seeds were also obtained.
- What are A-B type of seeds?
 - State whether A and B are dominant traits or recessive traits.
 - What are A-D type of seeds?
 - What are C-B type of seeds?

- Out of A-B and A-D types of seeds, which one will be produced in (i) minimum numbers, and (ii) maximum numbers, in the F_2 generation?

Case/Passage - 2

Most human chromosomes have a maternal and a paternal copy, and we have 22 such pairs. But one pair, called the sex chromosomes, is odd in not always being a perfect pair. Women have a perfect pair of sex chromosomes, both called X. But men have a mismatched pair in which one is a normal-sized X while the other is a short one called Y. So women are XX, while men are XY.

74. If a normal cell of human body contains 46 pairs of chromosomes then the numbers of chromosomes in a sex cell of a human being is most likely to be:
- 60
 - 23
 - 22
 - 40
75. Which of the following determines the sex of a child?
- The length of the mother's pregnancy
 - The length of time between ovulation and copulation
 - The presence of an X chromosome in an ovum
 - The presence of a Y chromosome in a sperm
76. In human males, all the chromosomes are paired perfectly except one. These unpaired chromosomes are:
- Large chromosome
 - Small chromosome
 - Y chromosome
 - X chromosome
77. The process where characteristics are transmitted from parent to offsprings is called:
- Variation
 - Heredity
 - Gene
 - Allele
 - None of the above
78. Who have a perfect pair of sex chromosomes?
- Girls only
 - Boys only
 - Both girls and boys
 - It depends on many other factors

Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
- If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
- If **Assertion** is **correct** but **Reason** is **incorrect**.
- If **Assertion** is **incorrect** but **Reason** is **correct**.

Heredity and Evolution

79. **Assertion:** Chromosomes are known as hereditary vehicles.

Reason: The chromosomes are capable of self-reproduction and maintaining morphological and physiological properties through successive generations.

80. **Assertion:** Ear muscles of external ear in man are poorly developed.

Reason: These muscles are useful which move external ear freely to detect sound efficiently.

81. **Assertion:** Although living organism always arise from other living organism, life should certainly have had a beginning.

Reason: The study of the conditions and the mechanisms involved in the creation of most primitive living structures on earth is actually the problem of origin of life.

82. **Assertion:** The establishment of reproductive isolations in an event of biological significance.

Reason: In the absence of reproductive isolation species can merge back into single population.

83. **Assertion:** DNA fingerprinting is a method in which polymerase chain reaction followed by DNA probe is used.

Reason: A DNA fingerprint is inherited and therefore, resembles that of parents.

84. **Assertion:** The birds have large, light spongy bones with air sacs.

Reason : These adaptations help them during flight.

85. **Assertion:** We have lost all the direct evidence of origin of life.

Reason: The persons responsible for protecting evidences were not skilled.

86. **Assertion:** Among the primates, chimpanzee is the closest relative of the present day humans.

Reason: The banding pattern in the autosome numbers 3 and 6 of man and chimpanzee is remarkably similar.

87. **Assertion:** Human ancestors never used their tails and so the tail expressing gene has disappeared in them.

Reason: Lamarck's theory of evolution is popularly called theory of continuity of germplasm.

88. **Assertion:** The genetic complement of an organism is called genotype.

Reason: Genotype is the type of hereditary properties of an organism.

Match the Following

DIRECTIONS : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

89. Match the genetic cross of the parents on the left with the genotypes of the offspring most likely to be produced from that cross on the right.

Column I	Column II
(A) $BB \times bb$	(p) 100% BB
(B) $Bb \times Bb$	(q) 100% bb
(C) $BB \times BB$	(r) 25% BB, 50%Bb, 25%bb
(D) $bb \times bb$	(s) 100% Bb

90. Match the physical evidence of evolution with the best description of that particular type of evidence.

Column I	Column II
(A) Fossils	(p) Comparing similarities and differences between amino acid sequences in two organisms.
(B) Embryology	(q) Comparing and contrasting cell structures found within an organism.
(C) Cytology	(r) The remains of dead organisms that are studied.
(D) DNA evidence	(s) Comparisons of the early development stages of an organism.

- 91.

Column A	Column B
(A) Genetic changes	(p) Homologous organ
(B) Independent assortment	(q) Fossil
(C) Natural selection	(r) Analogous organ
(D) Dihybrid ratio	(s) XY
(E) Male human beings	(t) 9 : 3 : 3 : 1
(F) Wing of a bat and a wing of a bird	(u) Darwin
(G) Remnant of ancient animals	(v) Mendel
(H) Arm of a man and wing of a bird	(w) DNA copying

» Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

92. Mendel performed his experiments on
93. According to modern concept, Mendel's factor is called a
94. Mendelian factors or genes as well as chromosomes are present in
95. The traits which express themselves in F_1 generation are called
96. The phenotypic ratio between tall and dwarf is
97. The phenotypic ratio in dihybrid cross is
98. There are pairs of chromosomes in human.
99. The offspring can be of two types with XX and chromosomes.
100. The traits which are acquired by an organism during its lifetime are called
101. Transmission of traits from one generation to the next generation is called
102. traits are unable to express in a hybrid.
103. Two types of nucleic acids are DNA and
104. Chromosome consists of a DNA molecule and
105. If tall plant contains TT gene then dwarf plant contains
106. Mendel choose characters in Pea for his experiments.
107. Broccoli has been developed from cabbage through artificial selection.
108. speciation occurs in geographically separated populations.
109. The first organisms were and not autotrophs.
100. The study of fossils, a branch of biology called was founded by Goerges Cuiver.

111. The age of fossil is usually determined by analysing the present in the rock from which fossil is recovered.
112. Theory of natural selection was proposed by
113. Wind of bat and wing of bird are the example of the organs.
114. Forelimbs of frog and lizard are the example of the organs.

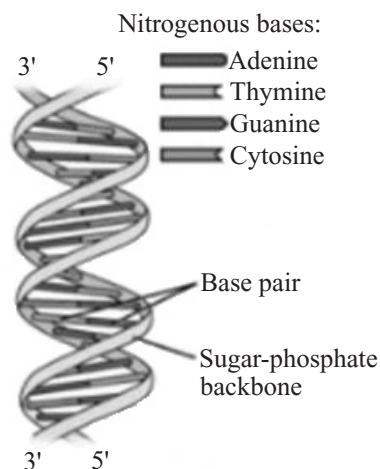
» True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

115. Mouth parts of insects show divergent evolution.
116. Life can originate on earth from pre-existing life only.
117. The atmosphere of the primitive earth was reducing.
118. Variations arising during the process of reproduction cannot be inherited.
119. Sex is determined by different factors in various species.
120. Changes in the non-reproductive tissues caused by environmental factors are inheritable.
121. Exchange of genetic material takes place in asexual reproduction.
122. A cross between a true tall and pure dwarf pea plant resulted in production of all tall plants because tallness is the dominant trait.
123. Reduction in weight of an organism due to nutrition is genetically controlled.
124. New species may be formed if DNA undergoes significant changes or chromosome number changes in the gametes.
125. Both the parents contribute DNA equally to the offspring.
126. Sex of the child is determined by the type of ovum provided by the mother.
127. A recessive trait can also be common as blood group O.
128. Attached ear lobe is recessive trait.
129. Charles Darwin discovered the law of independent assortment.

ANSWER KEY & SOLUTIONS

1. (c)
2. (c) An allele is dominant if it is expressed in both homozygous and heterozygous states. Dominant alleles express themselves in the homozygous as well as heterozygous condition. It is denoted by capital letter.
3. (b) A test cross involves mating of an unknown genotypic individual with a known homozygous recessive.
4. (a) 5. (d)
6. (c) Pure breeding varieties are the one that carries same allele for a particular character and pass the trait without change from one generation to next upon selfing. For example, pure breeding tall (TT) plant carries two copies of "T" allele and selfing of these plants produce a uniform progeny of tall plants only. Hybrids are the one which carries contrasting allele of a particular gene.
7. (a) In fruit flies, the wild-type eye color is red (XW) and is dominant to white eye color. Because this eye-color gene is located on the X chromosome only. Males are said to be hemizygous, because they have only one allele for any X-linked characteristic.
8. (a) The part indicated by arrow 'X' is adenine.



9. (a) The law of segregation states that the two alleles of a single trait will separate randomly, meaning that there is a 50% either allele will end up in either gamete.
10. (b) 11. (c) 12. (d) 13. (b)
14. (c) The genetic make-up of the tall parent can be depicted as TtWW. Since all the progeny bore violet

flowers, it means that the tall plant having violet flowers has WW genotype for violet flower colour. Since the progeny is both tall and short, the parent plant was not a pure tall plant. Its genotype must be Tt. Therefore, the cross involved is:

$$TtWw \times ttww$$

↓

$$TtWw - ttww$$

Therefore, half the progeny is tall, but all of them have violet flowers.

15. (c) Suppose the genotype of a normal plant with smooth seeds is SS and that of wrinkled seeds is ss. For a cross between SS and ss, all the offsprings produced will have genotype Ss (smooth seeds). If the F1 with smooth seeds Ss is allowed to self, then 3 smooth and 1 maize plant with wrinkled seeds will be formed.

Genotypes: Ss (smooth seeds) × Ss (smooth seeds)

Gametes	S	s
S	SS	Ss
s	Ss	ss

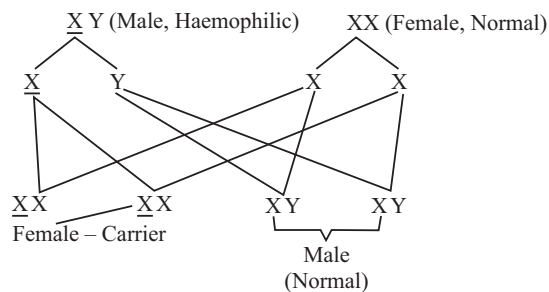
As is evident from Punnett square, 3 plants with smooth seeds and 1 with wrinkled seeds are formed.

16. (d) 17. (c) 18. (a) 19. (b)
20. (d) A nucleotide is made up of three parts: a phosphate group, a 5-carbon sugar, and a nitrogenous base. The four nitrogenous bases in DNA are adenine, cytosine, guanine and thymine.
21. (d)
22. (a) According to Mendel's monohybrid cross, during gamete formation, the alleles for each gene segregate from each other so that each gamete carries only one allele for each gene. It is called Law of Segregation.
23. (b)
24. (c) The first living things on Earth, single-celled microorganisms or microbes lacking a cell nucleus or cell membrane known as prokaryotes, seem to have first appeared on Earth almost four billion years ago, just a few hundred million years after the formation of the Earth itself.
25. (b)

26. (c) Epistasis is the phenomenon wherein the effect of one gene (locus) is dependent on the presence of one or more 'modifier genes', *i.e.*, the genetic background.
27. (b) 28. (c)
29. (d) Heterozygous means that an organism has two different alleles of a gene. Thus Tt is heterozygous.
30. (b) 31. (a) 32. (d) 33. (a)
34. (b) The given figures show the forelimbs of three mammals which indicate the homology among themselves. Homologous organs are those organs which are dissimilar in shape, size and function but their origin, basic plan and development are similar. Such differences are due to divergent evolution or adaptation for varied conditions.
35. (c) 36. (b)
37. (d) In peas, the dominant seed shape is round and the recessive is wrinkled (w). The dominant trait for pod color is green and recessive is yellow (y).
38. (d)
39. (d) A fossil is the mineralized partial or complete form of an organism, or of an organism's activity, that has been preserved as a cast, impression or mold. Thus all the given options are the examples of fossils.
40. (b) Gene flow is the movement of genes from one population to another population. It helps to prevent the genetic evolution of reproductive isolation.
41. (d) 42. (d)
43. (a) There are several disorders that are caused by abnormal sex-linked traits. A common Y-linked disorder is male infertility. In addition to hemophilia, other X-linked recessive disorders include color blindness, muscular dystrophy etc.
44. (d) A population is the smallest unit of living organisms that can undergo evolution.
45. (d)
46. (c) Chromosomes carry gene that passes on the traits of parents to the offspring during genetic recombination.
47. (d) The given figure of *Bougainvillea* and *Cucurbita* shows an example of homologous organ or divergent evolution. Homologous organs are those organs which are dissimilar in shape, size and function but their origin, basic plan and development are similar. Other examples in animals are forelimbs of frog, reptile, birds and mammals. Such differences are due to divergent evolution or adaptation for varied conditions.
48. (c) The theory of natural selection states that those individuals that are better adapted to their environment will have greater reproductive success.
49. (a) Mendel choose garden pea as plant material for his experiments, since it had the following advantages:
- Well defined characters.
 - Bisexual flowers.
 - Predominantly self-fertilisation.
 - Easy hybridisation.
- Besides these features, garden pea, being self-fertilised, had pure lines due to natural self fertilisation for a number of years. Therefore, any variety used was pure for the characters it carried. Mendel's success was mainly based on the fact that he considered a single character at one time.
50. (a) Crossing over takes place only between non-sister chromatids.
51. (c) In order to find out the gamete or the genotype of an unknown individual, scientists perform a test cross. In test cross, the individual in question is crossed with the homozygous recessive parent.
52. (a) ABO system consists of four blood groups-A, B, AB and O. ABO blood groups are controlled by gene I. The gene has three alleles I^A , I^B and i . This phenomenon is known as multiple allelism. I^A and I^B are completely dominant over i . When I^A and I^B are present together, they both express themselves and produce AB blood group. This phenomenon is known as co-dominance.
53. (a) Black is the phenotype of the sheep. Without further information, you cannot identify the genotype of a black sheep because it could be either BB or Bb. The possible genotypes of the parents of a black sheep could be $BB \times BB$, $BB \times Bb$, $Bb \times bb$, or $Bb \times Bb$.
54. (b)
55. (c) Here :
- Genotype of Full Colour - $C^{ch}C^{ch}$
 Genotype of Chinchilla - $C^{ch}C^h$ or $C^{ch}c$
 Genotype of Himalayan - C^hC^h or C^hc
 Genotype of Albino - cc
- Parents : $C^{ch}c \times C^hc$
- Gametes C^{ch} c C^h c
-
- $C^{ch}C^h$ $C^{ch}c$ C^hc cc
- Chinchilla 50% Himalayan 25% Albino 25%

Heredity and Evolution

56. (a)



Since all the male progeny will get the X chromosome from their mother, they will all be normal.

57. (d)

58. (d) According to dihybrid phenotypic ratio

$$9 : 3 : 3 : 1,$$

$$TW - 9 \qquad Tw \qquad - 3$$

$$tW - 3 \qquad tw \qquad - 1$$

The total number of short and blue flowered plants is

$$\frac{1}{16} \times 2130 = \frac{1080}{8} = 135$$

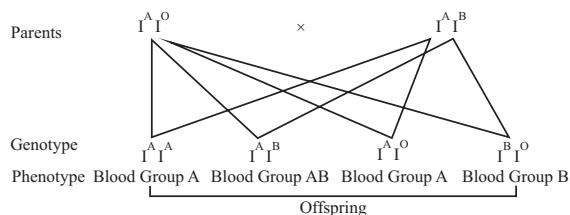
59. (b) Artificial selection is characterized by intentional reproduction of an organism having desirable traits. It is also called as selective breeding.

60. (b) Analogous organs are such organs which show anatomically different structures but doing similar functions. Example : wings of a bat and wings of a pigeon.

61. (b) 62. (a) 63. (b)

64. (b) Chromosomes carry genes, which are the hereditary characters to the offspring.

65. (a) The genotypes of offspring of parents having $I^A I^O$ and $I^A I^B$ blood groups are:



From the above cross, it is shown that none of the offspring will be of blood group O.

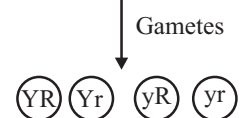
∴ The probability of their first child having type O blood is zero.

66. (c) In the given question, both parents are heterozygous for two pairs of genes. This means the cross is a dihybrid cross.

Let us assume a dihybrid cross,

Pure breeding – Yellow round seeds × Wrinkled green seeds
traits seeds seeds
(YYRR) (yyrr)

F₁ – Yellow round seeds
(YyRr)



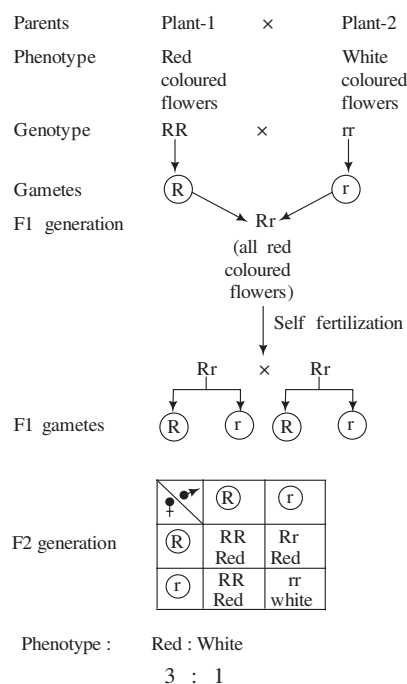
♂ \ ♀	YR	Yr	yR	yr
YR	YYRR yellow round	YYRr yellow round	YyRR yellow round	YyRr yellow round
Yr	YYRr yellow round	Yyrr yellow wrinkled	YyRr yellow round	Yyrr yellow wrinkled
yR	YyRR yellow round	YyRr yellow round	yyRR green round	yyRr green round
yr	YyRr yellow round	Yyrr yellow wrinkled	yyRr green round	yyrr green wrinkled

The genotype ratio is 1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1

The phenotypic ratio is 9 : 3 : 3 : 1

∴ The number of different genotypes and phenotypes obtained would be 9 and 4, respectively.

67. (b) Phenotypic ratio can be determined by doing a test cross and identifying the frequency of a trait or trait combinations that will be expressed based on the genotypes of the offspring.



68. (c) According to the new genetic research-when combined with known fossils-the lineage that led to humans, chimps, and gorillas evolved from a common ancestor about 10 million years ago.

69. (c)

Parents: X^hY × XX
 Haemophilic man Normal female

♀	♂	X^h	Y
X	X^hX	XY	
X	X^hX	XY	

70. (c) Since, all the progeny bore violet flowers, it implies that the tall plant with violet flowers has genotype 'WW' for violet flower colour. Since, the progeny obtained is both tall and short, the parent plant was not a pure tall plant and bears genes that determine short height of the plant. Therefore, the genotype of the plant with respect to height would be 'Tt'. So, if a cross is carried out between tall parent with violet flowers (TtWW) and short parent with white flowers (ttww), the progeny obtained is TtWw (8) : ttWw (4) : ttWw(4). All the progeny bear violet flowers but half of them are tall and half are short.

71. (d) Homologous organ have same origin but different functions like each of the organ above. Our teeth and elephant's tusks, our arm and a dog's fore-leg and potato and runners of grass are the examples of homologous organs.

72. (a) Homologous organs

(b) Analogous organs

(c) Image A shows common ancestry

(d) Image B *i.e.*, analogous organs have a different origin but common functions.

73. (a) Round yellow

(b) A (round) and B (yellow) are dominant traits

(c) Round-green

(d) Wrinkled-yellow

(e) (i) A–D (ii) A–B

74. (b) 75. (d) 76. (c) 77. (b)

78. (a) 79. (a)

80. (c) Ear muscles of external ear in man are poorly developed. These muscles are useless which move

external ear freely and these muscles are called vestigial organs.

81. (a) 82. (a)

83. (a) There is an inheritable quality to fingerprints. Pattern types are often genetically inherited, but the individual details that make a fingerprint unique are not.

84. (a) Birds have very light, honeycombed or hollow bones which help them to minimise the pull of gravity, mostly by reducing body weight.

85. (c)

86. (a) The banding pattern seen on stained chromosomes from humans and chimpanzee show striking similarities which indicates that they have evolutionary relationships (cytogenetic evidence).

87. (c) According to Lamarck's theory, continuous disuse of organs make them weak. The theory of continuity of germplasm was given by Weismann.

88. (a) Genotype of the organism include all dominant and recessive characters.

89. (A) → (s), (B) → (r), (C) → (p), (D) → (q)

90. (A) → (r), (B) → (s), (C) → (q), (D) → (p)

91. (A) → (w), (B) → (v), (C) → (u), (D) → (t), (E) → (s), (F) → (r), (G) → (q), (H) → (p)

92. garden pea

93. gene

94. pairs

95. dominant

96. 3 : 1

97. 9 : 3 : 3 : 1

98. 23

99. XY

100. acquired traits

101. heredity

102. recessive

103. RNA

104. protein

105. tt

106. Seven

107. Wild

108. Allopatric

109. heterotrophs

110. paleontology

111. radioactive materials

112. Darwin

113. analogous

114. homologous

115. True 116. True 117. True 118. False

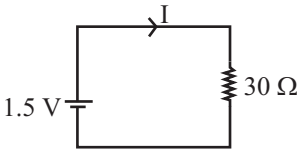
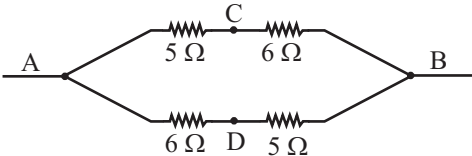


119. True 120. False 121. False 122. True

123. False 124. True 125. True 126. False

127. True 128. True 129. False

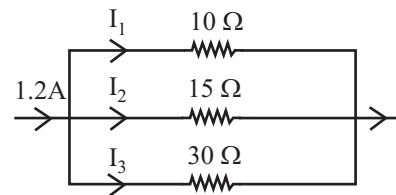
Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

- The charge of 150 coulomb flows through a wire in one minute. What is the electric current flowing through it?
 - 2.5 A
 - 3.5 A
 - 4.5 A
 - 5.5 A
- Find the current I flown in the circuit
 - 0.05 A
 - 5 A
 - 50 A
 - 500 A
- A current of 10 A flows through a conductor for 2 minutes. What is the amount of charge passed through the conductor?
 - 1200 C
 - 150 C
 - 18 C
 - 1.8 C
- A current of 10 A flows through a conductor for 2 minutes. Find the total number of electrons flowing through the conductor.
 - 75×10^{20}
 - 70×10^{15}
 - 60×10^{15}
 - 11×10^{12}
- A metal wire 80 cm long and 1.00 mm^2 in cross-section has a resistance of 0.92 ohm. It's resistivity is:
 - 0.000 115 ohm m
 - 0.0 115 ohm m
 - 1.15 ohm m
 - None of these
- 1 Ampere is equivalent to:
 - $\frac{1 \text{ coulomb}}{1 \text{ sec}}$
 - $\frac{1 \text{ volt}}{1 \text{ sec}}$
 - $\frac{1 \text{ volt meter}}{1 \text{ sec}}$
 - None
- Device used to measure electric current is:
 - Ammeter
 - Voltmeter
 - Galvanometer
 - Generator
- Reciprocal of resistance is called:
 - Inductance
 - Conductance
 - Resistivity
 - None of these
- Find the equivalent resistance between A and B of following circuit:
 
 - $\frac{6}{2} \Omega$
 - $\frac{5}{2} \Omega$
 - $\frac{11}{2} \Omega$
 - $\frac{1}{2} \Omega$
- The maximum resistance which can be made using four resistors each of resistance $\frac{1}{2} \Omega$ is **[CBSE 2020]**
 - 2Ω
 - 1Ω
 - 2.5Ω
 - 5Ω
- A current of 1 A is drawn by a filament of an electric bulb. Number of electrons passing through a cross section of the filament in 16 seconds would be roughly
 - 10^{20}
 - 10^{16}
 - 10^{18}
 - 10^{23}
- The proper representation of series combination of cells (Figure) obtaining maximum potential is
 - 
 - 



- (a) (i) (b) (ii)
(c) (iii) (d) (iv)
13. A cylindrical conductor of length l and uniform area of crosssection A has resistance R . Another conductor of length $2l$ and resistance R of the same material has area of cross section [CBSE 2020]
(a) $A/2$ (b) $3A/2$
(c) $2A$ (d) $3A$
14. If 'i' is the current flowing through a conductor of resistance 'R' for time 't'. then the heat produced (Q) is given by
(a) $\frac{i^2R}{t}$ (b) $\frac{iR^2}{t}$
(c) i^2Rt (d) iRt^2
15. An electric kettle consumes 1 kW of electric power when operated at 220 V. A fuse wire of what rating must be used for it?
(a) 1 A (b) 2 A
(c) 4 A (d) 5 A
16. A cylindrical rod is reformed to twice its length with no change in its volume. If the resistance of the rod was R , the new resistance will be
(a) R (b) $2R$
(c) $4R$ (d) $8R$
17. What is the current through a 5.0 ohm resistor if the voltage across it is 10V
(a) zero (b) 0.50 A
(c) 2.0 A (d) 5.0 A
18. The length of a wire is doubled and the radius is doubled. By what factor does the resistance change
(a) 4 times as large (b) twice as large
(c) unchanged (d) half as large
19. Resistance of a metallic conductor depends on _____.
(a) its length (b) its area of cross section
(c) its temperature (d) All the above
20. A 24V potential difference is applied across a parallel combination of four 6 ohm resistor. The current in each resistor is
(a) 1 A (b) 4 A
(c) 16 A (d) 36 A
21. Three resistances of 2Ω , 3Ω and 5Ω are connected in parallel to a 10V battery of negligible internal resistance. The potential difference across the 3Ω resistance will be
(a) 2 V (b) 3 V
(c) 5 V (d) 10 V
22. Two unequal resistances are connected in parallel. Which of the following statement is true
(a) current is same in both
(b) current is larger in higher resistance
(c) voltage-drop is same across both
(d) voltage-drop is lower in lower resistance
23. You are given n identical wires, each of resistance R . When these are connected in parallel, the equivalent resistance is X . When these will be connected in series, then the equivalent resistance will be
(a) X/n^2 (b) n^2X
(c) X/n (d) nX
24. A piece of wire of resistance R is cut into five equal parts. These parts are then connected in parallel. If the equivalent resistance of this combination is R' , then the ratio R/R' is
(a) $1/25$ (b) $1/5$
(c) 5 (d) 25
25. 2 ampere current is flowing through a conductor from a 10 volt emf source then resistance of conductor is
(a) 20Ω (b) 5Ω
(c) 12Ω (d) 8Ω
26. Charge on an electron is 1.6×10^{-19} coulomb. Number of electrons passing through the wire per second on flowing of 1 ampere current through the wire will be
(a) 0.625×10^{-19} (b) 1.6×10^{-19}
(c) 1.6×10^{-19} (d) 0.625×10^{19}
27. 20 coulomb charge is flowing in 0.5 second from a point in an electric circuit then value of electric current in amperes will be
(a) 10 (b) 40
(c) 0.005 (d) 0.05
28. In this circuit, the value of I_2 is
(a) 0.2 A
(b) 0.3 A
(c) 0.4 A
(d) 0.6 A



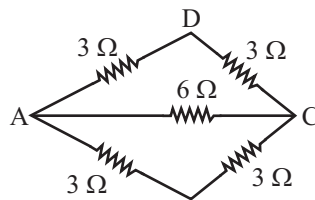
29. A letter 'A' is constructed of a uniform wire of resistance 1 ohm per cm. The sides of the letter are 20 cm and the cross piece in the middle is 10 cm long. The resistance between the ends of the legs will be
(a) 32.4 ohm (b) 28.7 ohm
(c) 26.7 ohm (d) 24.7 ohm

Electricity

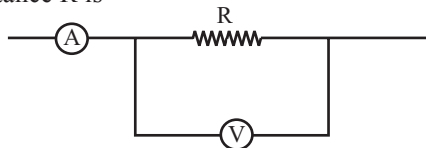
30. A wire of resistance R is cut into ten equal parts which are then joined in parallel. The new resistance is
 (a) $0.01 R$ (b) $0.1 R$
 (c) $10 R$ (d) $100 R$
31. If a wire is stretched to make its length three times, its resistance will become
 (a) three times (b) one-third
 (c) nine times (d) one-ninth
32. The resistivity of a wire depends on
 (a) length (b) area of cross-section
 (c) material (d) All the above

33. The effective resistance between the points A and B in the figure is

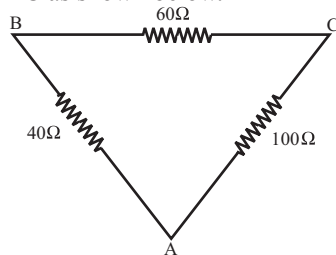
- (a) 5Ω
 (b) 2Ω
 (c) 3Ω
 (d) 4Ω



34. In the circuits shown below the ammeter A reads 4 amp. and the voltmeter V reads 20 volts. The value of the resistance R is



- (a) slightly more than 5 ohms
 (b) slightly less than 5 ohms
 (c) exactly 5 ohms
 (d) None of the above
35. Three resistors are connected to form the sides of a triangle ABC as shown below.

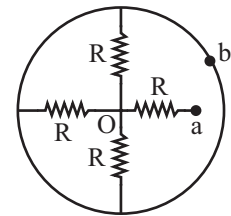


The resistance of side AB is 40 ohms, of side BC 60 ohms and of side CA 100 ohms. The effective resistance between the point A and B in ohms is

- (a) 50 (b) 64
 (c) 32 (d) 100
36. If one micro-amp. current is flowing in a wire, the number of electrons which pass from one end of the wire to the other end in one second is
 (a) 6.25×10^{12} (b) 6.25×10^{15}
 (c) 6.25×10^{18} (d) 6.25×10^{19}

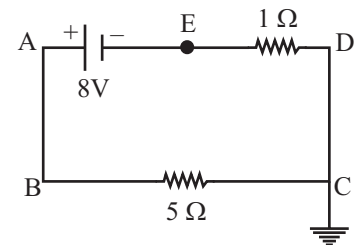
37. The unit for specific resistance is
 (a) ohm \times second (b) ohm \times m
 (c) ohm (d) ohm/cm
38. If the temperature of a conductor is increased, its resistance will
 (a) not increase
 (b) increase
 (c) decrease
 (d) change according to the whether
39. The equivalent resistance between points a and b of a network shown in the figure is given by

- (a) $\frac{3}{4}R$
 (b) $\frac{4}{3}R$
 (c) $\frac{5}{4}R$
 (d) $\frac{4}{5}R$

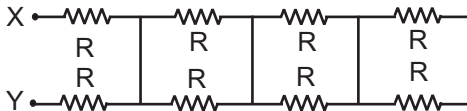
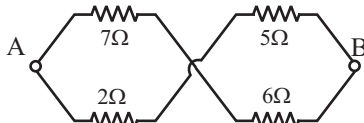


40. Two wires of resistance R_1 and R_2 are joined in parallel. The equivalent resistance of the combination is
 (a) $R_1 R_2 / (R_1 + R_2)$ (b) $(R_1 + R_2)$
 (c) $R_1 \times R_2$ (d) R_1 / R_2
41. In the given circuit, the potential of the point E is

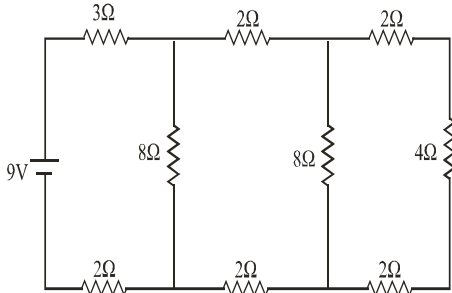
- (a) Zero
 (b) $-8 V$
 (c) $-4/3 V$
 (d) $4/3 V$



42. The resistance of a thin wire in comparison of a thick wire of the same material
 (a) is low
 (b) is equal
 (c) depends upon the metal of the wire
 (d) is high
43. If the specific resistance of a wire of length l and radius r is k then resistance is
 (a) $k\pi r^2/l$ (b) $\pi r^2/lk$
 (c) $kl/\pi r^2$ (d) k/lr^2
44. If a charge of 1.6×10^{-19} coulomb flows per second through any cross section of any conductor, the current constitute will be
 (a) $2.56 \times 10^{-19} A$ (b) $6.25 \times 10^{-19} A$
 (c) $1.6 \times 10^{-19} A$ (d) $3.2 \times 10^{-19} A$

45. The number of electrons flowing per second through any cross section of wire, if it carries a current of one ampere, will be
 (a) 2.5×10^{18} (b) 6.25×10^{18}
 (c) 12.5×10^{18} (d) 5×10^{18}
46. The number of electron passing through a heater wire in one minute, if it carries a current of 8 ampere, will be
 (a) 2×10^{20} (b) 2×10^{21}
 (c) 3×10^{20} (d) 3×10^{21}
47. The heat produced in a wire of resistance 'x' when a current 'y' flow through it in time 'z' is given by
 (a) $x^2 \times y \times z$ (b) $y \times z^2 \times x$
 (c) $x \times z \times y^2$ (d) $y \times z \times x$
48. In a wire of length 4m and diameter 6mm, a current of 120 ampere is passed. The potential difference across the wire is found to be 18 volt. The resistance of wire will be
 (a) 0.15 ohm (b) 0.25 ohm
 (c) 6.660 ohm (d) None of the these
49. The resistance of an incandescent lamp is
 (a) greater when switched off
 (b) smaller when switched on
 (c) grater when switched on
 (d) Same whether it is switched off or switched on
50. If resistance of a wire formed by 1.cc of copper be 2.46Ω . The diameter of wire is 0.32 mm, then the specific resistance of wire will be
 (a) 1.59×10^{-6} ohm. cm (b) 2.32×10^{-6} ohm. cm
 (c) 3.59×10^{-6} ohm. cm (d) 1.59×10^{-8} ohm. cm
51. A given piece of wire length ℓ , cross sectional area A and resistance R is stretched uniformly to a wire of length 2ℓ . The new resistance will be
 (a) 2 R (b) 4 R
 (c) R/2 (d) Remains unchanged
52. A given piece of wire of length ℓ , radius r and resistance R is stretched uniformly to a wire of radius $(r/2)$. The new resistances will be
 (a) 2 R (b) 4 R
 (c) 8 R (d) 16 R
53. There are two wires of the same length and of the same material and radial r and $2r$. The ratio of their specific resistance is
 (a) 1 : 2 (b) 1 : 1
 (c) 1 : 4 (d) 4 : 1
54. Specific resistance of a wire depends on the
 (a) length of the wire
 (b) area of cross-section of the wire
 (c) resistance of the wire
 (d) material of the wire
55. The resistance of some substances become zero at very low temperature, then these substances are called
 (a) good conductors (b) super conductors
 (c) bad conductors (d) semi conductors
56. The resistance of wire is 20Ω . The wire is stretched to three time its length. Then the resistance will now be
 (a) 6.67Ω (b) 60Ω
 (c) 120Ω (d) 180Ω
57. When the resistance of copper wire is 0.1Ω and the radius is 1 mm, then the length of the wire is (specific resistance of copper is 3.14×10^{-8} ohm \times m)
 (a) 10 cm (b) 10 m
 (c) 100 m (d) 100 cm
58. When the resistance wire is passed through a die the cross-section area decreases by 1%, the change in resistance of the wire is
 (a) 1% decrease (b) 1% increase
 (c) 2% decrease (d) 2% increase
59. The lowest resistance which can be obtained by connecting 10 resistors each of $\frac{1}{10}$ ohm is
 (a) $\frac{1}{250}\Omega$ (b) $\frac{1}{200}\Omega$
 (c) $\frac{1}{100}\Omega$ (d) $\frac{1}{10}\Omega$
60. The resistance $4R, 16R, 64R, \dots, \infty$ are connected in series, their resultant will be
 (a) 0 (b) ∞
 (c) $4/3 R$ (d) $3/4 R$
61. Resistance R, 2R, 4R, 8R \dots, ∞ are connected in parallel. Their resultant resistance will be
 (a) R (b) R/2
 (c) 0 (d) ∞
62. The equivalent resistance between points X and Y is

 (a) R (b) 2R
 (c) R/2 (d) 4 R
63. The equivalent resistance between points A and B is

 (a) 4Ω (b) 4.5Ω
 (c) 2Ω (d) 20Ω

Electricity

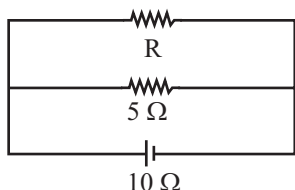
64. Three resistances 4Ω each of are connected in the form of an equilateral triangle. The effective resistance between two corners is
 (a) 8Ω (b) 12Ω
 (c) $3/8\Omega$ (d) $8/3\Omega$
65. Two wires of same metal have the same length but their cross-sections area in the ratio 3 : 1. They are joined in series. The resistance of the thicker wire is 10Ω . The total resistance of the combination will be
 (a) 40Ω (b) $40/3\Omega$
 (c) $5/2\Omega$ (d) 100Ω
66. A certain piece of silver of given mass is to be made like a wire. Which of the following combination of length (L) and the area of cross-sectional (A) will lead to the smallest resistance
 (a) L and A
 (b) $2L$ and $A/2$
 (c) $L/2$ and $2A$
 (d) Any of the above, because volume of silver remains same
67. A certain wire has a resistance R. The resistance of another wire identical with the first except having twice of its diameter is
 (a) $2R$ (b) $0.25R$
 (c) $4R$ (d) $0.5R$
68. What length of the wire of specific resistance $48 \times 10^{-8}\Omega\text{-m}$ is needed to make a resistance of 4.2Ω (diameter of wire = 0.4 mm)
 (a) 4.1 m (b) 3.1 m
 (c) 2.1 m (d) 1.1 m
69. The resistance of an ideal voltmeter is
 (a) zero (b) very low
 (c) very large (d) Infinite
70. Masses of 3 wires of same metal are in the ratio 1 : 2 : 3 and their lengths are in the ratio 3 : 2 : 1. The electrical resistances are in ratio
 (a) 1 : 4 : 9 (b) 9 : 4 : 1
 (c) 1 : 2 : 3 (d) 27 : 6 : 1
71. We have two wires A and B of same mass and same material. The diameter of the wire A is half of that B. If the resistance of wire A is 24 ohm then the resistance of wire B will be
 (a) 12 ohm (b) 3.0 ohm
 (c) 1.5 ohm (d) None of the above
72. The electric resistance of a certain wire of iron is R. If its length and radius are both doubled, then
 (a) The resistance will be doubled and the specific resistance will be halved
 (b) The resistance will be halved and the specific resistance will remain unchanged
 (c) The resistance will be halved and the specific resistance will be doubled
 (d) The resistance and the specific resistance, will both remain unchanged
73. When a wire of uniform cross-section a , length l and resistance R is bent into a complete circle, resistance between any two of diametrically opposite points will be
 (a) $R/4$ (b) $R/8$
 (c) $4R$ (d) $R/2$
74. A solenoid is at potential difference 60V and current flows through it is 15 ampere , then the resistance of coil will be
 (a) 4Ω (b) 8Ω
 (c) 0.25Ω (d) 2Ω
75. A strip of copper and another of germanium are cooled from room temperature to 80 K . The resistance of
 (a) Each of these increases
 (b) Each of these decreases
 (c) Copper strip increases and that of germanium decreases
 (d) Copper strip decreases and that of germanium increases
76. In the circuit shown in the figure, the current through

 (a) the 3Ω resistor is 0.50A
 (b) the 3Ω resistor is 0.25A
 (c) the 4Ω resistor is 0.50A
 (d) the 4Ω resistor is 0.25A
77. Two electric lamps each of $100\text{ watts } 220\text{V}$ are connected in series to a supply of 220 volts . The power consumed would be –
 (a) 100 watts (b) 200 watts
 (c) 25 watts (d) 50 watts
78. If it takes 8 minutes to boil a quantity of water electrically, how long will it take to boil the same quantity of water using the same heating coil but with the current doubled
 (a) 32 minutes (b) 16 minutes
 (c) 4 minutes (d) 2 minutes
79. An electric bulb is filled with
 (a) hydrogen (b) oxygen and hydrogen
 (c) ammonia (d) nitrogen and argon
80. When current is passed through an electric bulb, its filament glows, but the wire leading current to the bulb does not glow because
 (a) less current flows in the leading wire as compared to that in the filament
 (b) the leading wire has more resistance than the filament
 (c) the leading wire has less resistance than the filament
 (d) filament has coating of fluorescent material over it

81. Which of the following terms does not represent electrical power in a circuit?

- (a) I^2R (b) IR^2
(c) VI (d) V^2/R

82. The power dissipated in the circuit shown in the figure is 30 watts. The value of R is

- (a) $20\ \Omega$
(b) $15\ \Omega$
(c) $10\ \Omega$
(d) $30\ \Omega$



83. The filament of an electric bulb is of tungsten because

- (a) Its resistance is negligible
(b) It is cheaper
(c) Its melting point is high
(d) Filament is easily made

84. When the current passes through the filament, it gets heated to incandescence and give light while the connecting wires are not heated because

- (a) The connecting wires are good conductor of heat while the filament is bad conductor
(b) The connecting wires are of low resistance while the filament is of high resistance
(c) The density of connecting wires is less than that of the filament
(d) The connecting wires are bad conductor of heat while the filament is good conductor

85. Which one of the following heater element is used in electric press

- (a) copper wire (b) nichrome wire
(c) lead wire (d) iron wire

86. What should be the characteristic of fuse wire?

- (a) High melting point, high specific resistance
(b) Low melting point, low specific resistance
(c) High melting point, low specific resistance
(d) Low melting point, high specific resistance

87. The heating element of an electric heater should be made with a material, which should have

- (a) high specific resistance and high melting point
(b) high specific resistance and low melting point
(c) low specific resistance and low melting point
(d) low specific resistance and high melting point

88. Resistance of conductor is doubled keeping the potential difference across it constant. The rate of generation of heat will

- (a) become one fourth (b) be halved
(c) be doubled (d) become four times

89. A current I passes through a wire of length l , radius r and resistivity ρ . The rate of heat generated is

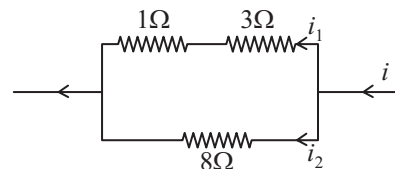
- (a) $\frac{I^2\rho l}{r}$ (b) $\frac{I^2\rho l}{\pi r^2}$
(c) $\frac{I^2\rho l}{\pi r}$ (d) none of these

90. The resistance R_1 and R_2 are joined in parallel and a current is passed so that the amount of heat liberated is H_1 and H_2 respectively. The ratio H_1/H_2 has the value

- (a) R_2/R_1 (b) R_1/R_2
(c) R_1^2/R_2^2 (d) R_2^2/R_1^2

91. Power dissipated across the $8\ \Omega$ resistor in the circuit shown here is 2 watt. The power dissipated in watt units across the $3\ \Omega$ resistor is

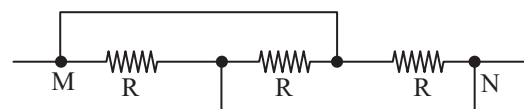
- (a) 1.0
(b) 0.5
(c) 3.0
(d) 2.0



92. In house electrical circuits the fuse wire for safety should be of

- (a) High resistance – high melting point
(b) Low resistance – high melting point
(c) Low resistance – low melting point
(d) High resistance – low melting point

93. What is the equivalent resistance of the following arrangement between M and N



- (a) $R/2$ (b) $R/3$
(c) $R/4$ (d) $R/6$

94. If a wire of resistance $1\ \Omega$ is stretched to double its length, then resistance will be

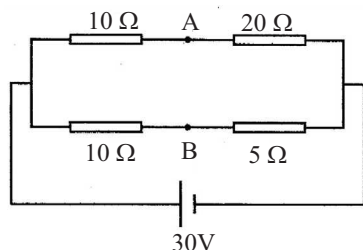
- (a) $\frac{1}{2}\ \Omega$ (b) $2\ \Omega$
(c) $\frac{1}{4}\ \Omega$ (d) $4\ \Omega$

95. Across a metallic conductor of non-uniform cross section a constant potential difference is applied. The quantity which remains constant along the conductor is :

- (a) current (b) drift velocity
(c) electric field (d) current density

Electricity

96. In the circuit diagram shown below, V_A and V_B are the potentials at points A and B respectively. Then, $V_A - V_B$ is



- (a) -10 V (b) -20 V
 (c) 0 V (d) 10 V
97. The diameter of a wire is reduced to one-fifth of its original value by stretching it. If its initial resistance is R , what would be its resistance after reduction of the diameter?
- (a) $\frac{R}{625}$ (b) $\frac{R}{25}$
 (c) $25 R$ (d) $625 R$
98. A heater coil is cut into two equal parts and only one part is used in the heater, the heat generated now will be
- (a) doubled (b) four times
 (c) one fourth (d) halved
99. The resistance of a wire is R . After melting it is remoulded such that its area of cross section becomes n times its initial area of cross section. Its new resistance will be

- (a) nR (b) $\frac{R}{n}$
 (c) n^2R (d) $\frac{R}{n^2}$

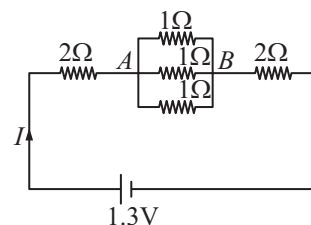
100. The resistance of a wire is ' R ' ohm. If it is melted and stretched to ' n ' times its original length, its new resistance will be :

- (a) $\frac{R}{n}$ (b) n^2R
 (c) $\frac{R}{n^2}$ (d) nR

101. Three electric bulbs of rating $40\text{ W} - 200\text{ V}$; $50\text{ W} - 200\text{ V}$ and $100\text{ W} - 200\text{ V}$ are connected in series to a 600 V supply. What is likely to happen as the supply is switched on?

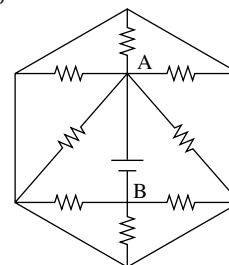
- (a) Only 50 W bulb will fuse
 (b) Both 40 W and 50 W bulbs will fuse.
 (c) All the three bulbs will emit light with their rated powers.
 (d) 100 W bulb will emit light of maximum intensity.

102. In the circuit given, the ratio of work done by the battery to maintain the current between point A and B to the work done for the whole circuit is



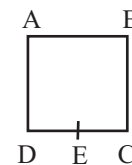
- (a) $\frac{1}{117}$ (b) $\frac{1}{13}$
 (c) $\frac{1}{12}$ (d) 1

103. What is the current supplied by the battery in the circuit shown below? Each resistance used in circuit is of $1\text{ k}\Omega$ and potential difference $V_{AB} = 8\text{ V}$



- (a) 64 mA
 (b) 15 mA
 (c) 9.87 mA
 (d) 1 mA

104. A wire of resistance R is bent to form a square ABCD as shown in the figure. The effective resistance between E and C is: (E is mid-point of arm CD)

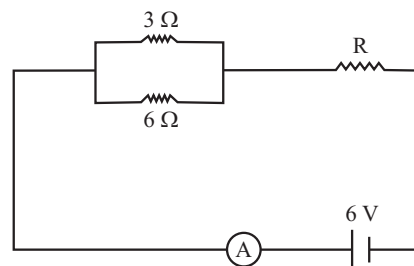


- (a) R (b) $\frac{7}{64}R$
 (c) $\frac{3}{4}R$ (d) $\frac{1}{16}R$

105. Which of the following acts as a circuit protection device?

- (a) conductor (b) inductor
 (c) switch (d) fuse

106. If the ammeter in the given circuit reads 2 A , What is the value of resistance R (the resistance of ammeter is negligible).



- (a) $1\ \Omega$ (b) $2\ \Omega$
 (c) $3\ \Omega$ (d) $4\ \Omega$

107. A circuit to verify Ohm's law uses ammeter and voltmeter in series or parallel connected correctly to the resistor. In the circuit :

- ammeter is always used in parallel and voltmeter is series
- Both ammeter and voltmeter must be connected in parallel
- ammeter is always connected in series and voltmeter in parallel
- Both, ammeter and voltmeter must be connected in series

108. An electric bulb is rated 220V and 100W. When it is operated on 110V, the power consumed will be

- 100W
- 75W
- 50W
- 25W

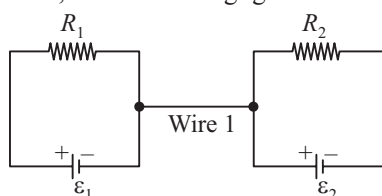
109. From a power station, the power is transmitted at a very high voltage because –

- it is generated only at high voltage
- it is cheaper to produce electricity at high voltage
- electricity at high voltage is less dangerous
- there is less loss of energy in transmission at high voltage

110. Two electric bulbs rated P_1 watt V volts and P_2 watt V volts are connected in parallel and applied across V volts. The total power (in watts) will be

- $P_1 + P_2$
- $\sqrt{P_1 P_2}$
- $\frac{P_1 P_2}{P_1 + P_2}$
- $\frac{P_1 + P_2}{P_1 P_2}$

111. In the circuit, wire 1 is of negligible resistance. Then,



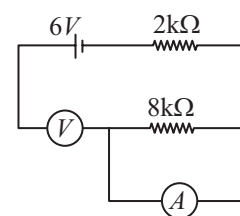
- current will flow through wire 1, if $\varepsilon_1 \neq \varepsilon_2$
- current will flow through wire 1, if $\frac{\varepsilon_1}{R_1} \neq \frac{\varepsilon_2}{R_2}$
- current will flow through wire 1, if

$$\frac{\varepsilon_1 + \varepsilon_2}{(R_1 + R_2)} \neq \frac{\varepsilon_1 - \varepsilon_2}{(R_1 - R_2)}$$

- no current will flow through wire 1

112. In the circuit shown below, a student performing Ohm's law experiment accidentally puts the voltmeter and the ammeter as shown in the circuit below. The reading in the voltmeter will be close to

- 0 V
- 4.8 V
- 6.0 V
- 1.2 V



113. A student in a town in India, where the price per unit (1 unit = 1 kW-hr) of electricity is ₹5.00, purchases a 1 kVA UPS (uninterrupted power supply) battery. A day before the exam, 10 friends arrive to the student's home with their laptops and all connect their laptops to the UPS. Assume that each laptop has a constant power requirement of 90 W. Consider the following statements

- All the 10 laptops can be powered by the UPS if connected directly.
- All the 10 laptops can be powered if connected using an extension box with a 3A fuse.
- If all the 10 friends use the laptop for 5 hours, then the cost of the consumed electricity is about ₹22.50.

Select the correct option with the true statements.

- I only
- I and II only
- I and III only
- II and III only

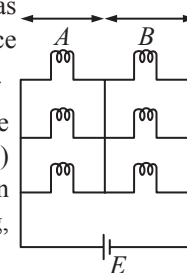
114. A copper wire is stretched to make it 0.5% longer. The percentage change in its electrical resistance if its volume remains unchanged is:

- 2.0%
- 2.5%
- 1.0%
- 0.5%

115. Six similar bulbs are connected as shown in the figure with a DC source of emf E , and zero internal resistance.

The ratio of power consumption by the bulbs when (i) all are glowing and (ii) in the situation when two from section A and one from section B are glowing, will be:

- 4 : 9
- 9 : 4
- 1 : 2
- 2 : 1



Case/Passage Based Questions

DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

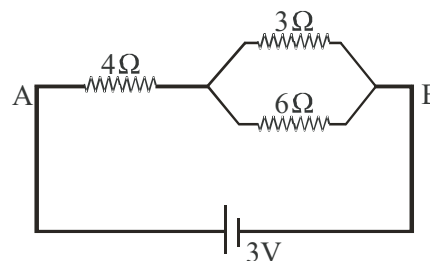
Two tungsten lamps with resistances R_1 and R_2 respectively at full incandescence are connected first in parallel and then in series, in a lighting circuit of negligible internal resistance. It is given that: $R_1 > R_2$.

Electricity

- 116.** Which lamp will glow more brightly when they are connected in parallel?
- Bulb having lower resistance
 - Bulb having higher resistance
 - Both the bulbs
 - None of the two bulbs
- 117.** If the lamp of resistance R_1 now burns out, how will the illumination produced change?
- Net illumination will increase
 - Net illumination will decrease
 - Net illumination will remain same
 - Net illumination will reduced to zero
- 118.** Which lamp will glow more brightly when they are connected in series?
- Bulb having lower resistance
 - Bulb having higher resistance
 - Both the bulbs
 - None of the two bulbs
- 119.** If the lamp of resistance R_2 now burns out and the lamp of resistance R_1 alone is plugged in, will the illumination increase or decrease?
- Illumination will remain same
 - Illumination will increase
 - Illumination will decrease
 - None
- 120.** Would physically bending a supply wire cause any change in the illumination?
- Illumination will remain same
 - Illumination will increase
 - Illumination will decrease
 - It is not possible to predict from the given datas
- 121.** Which of the following terms does not represent electrical power in a circuit?
- I^2R
 - IR^2
 - VI
 - V^2/R
- 122.** An electric bulb is rated 220V and 100W. When it is operated on 110V, the power consumed will be—
- 100 W
 - 75 W
 - 50 W
 - 25 W
- 123.** Two conducting wires of the same material and of equal lengths and equal diameters are first connected in series and then in parallel in an electric circuit. The ratio of heat produced in series and in parallel combinations would be—
- 1 : 2
 - 2 : 1
 - 1 : 4
 - 4 : 1
- 124.** In an electrical circuit three incandescent bulbs. A, B and C of rating 40 W, 60 W and 100 W, respectively are connected in parallel to an electric source. Which of the following is likely to happen regarding their brightness?
- Brightness of all the bulbs will be the same
 - Brightness of bulb A will be the maximum
 - Brightness of bulb B will be more than that of A
 - Brightness of bulb C will be less than that of B
- 125.** In an electrical circuit, two resistors of 2Ω and 4Ω respectively are connected in series to a 6V battery. The heat dissipated by the 4Ω resistor in 5s will be
- 5 J
 - 10 J
 - 20 J
 - 30 J

Case/Passage - 3

Answer the following questions based on the given circuit.



The rate at which electric energy is dissipated or consumed in an electric circuit. This is termed as electric power,

$$P = IV, \text{ According to Ohm's law } V = IR$$

We can express the power dissipated in the alternative forms

$$P = I^2R = \frac{V^2}{R}$$

If 100W – 220V is written on the bulb then it means that the bulb will consume 100 joule in one second if used at the potential difference of 220 volts. The value of electricity consumed in houses is decided on the basis of the total electric energy used. Electric power tells us about the electric energy used per second not the total electric energy.

The total energy used in a circuit = power of the electric circuit \times time.

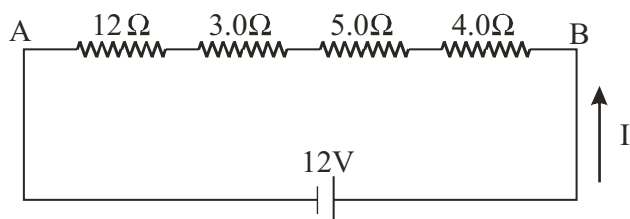
- 126.** The potential drop across the 3Ω resistor is
- 1 V
 - 1.5 V
 - 2 V
 - 3 V
- 127.** The equivalent resistance between points A and B is
- 7Ω
 - 6Ω
 - 13Ω
 - 5Ω

128. The current flowing through in the given circuit is

- (a) 0.5 A (b) 1.5 A
(c) 6 A (d) 3 A

Case/Passage - 4

Answer the following questions based on the given circuit.



129. The equivalent resistance between points A and B, is

- (a) 12 Ω (b) 36 Ω
(c) 32 Ω (d) 24 Ω

130. The current through each resistor is

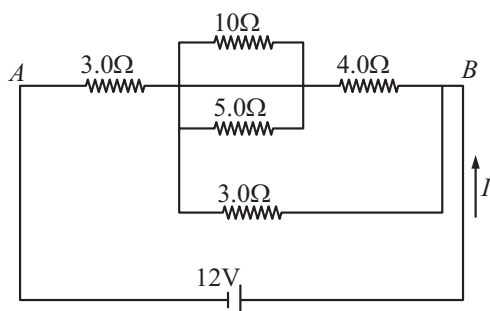
- (a) 1 A (b) 2.3 A
(c) 0.5 A (d) 0.75 A

131. The potential drop across the 12Ω resistor is

- (a) 12 V (b) 6 V
(c) 8 V (d) 0.5 V

Case/Passage - 5

Answer the following questions based on the given circuit.



132. The equivalent resistance between points A and B

- (a) 6.2 Ω (b) 5.1 Ω
(c) 13.33 Ω (d) 1.33 Ω

133. The current through the battery is

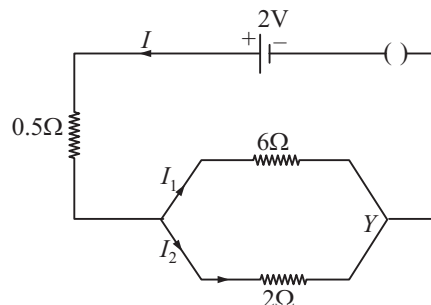
- (a) 2.33 A (b) 3.12 A
(c) 4.16 A (d) 5.19 A

134. The current through the 4.0 ohm resistor is

- (a) 5.6 A (b) 0.98 A
(c) 0.35 A (d) 0.68 A

Case/Passage - 6

Answer the following questions based on the given circuit.



135. The total resistance of the circuit is

- (a) 2 Ω (b) 4 Ω
(c) 1.5 Ω (d) 0.5 Ω

136. The current flowing through 0.5Ω resistor is

- (a) 1 A (b) 1.5 A
(c) 3 A (d) 2.5 A

137. The current flowing through 6Ω resistor is

- (a) 0.50 A (b) 0.75 A
(c) 0.80 A (d) 0.25

Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
(b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
(c) If **Assertion** is **correct** but **Reason** is **incorrect**.
(d) If **Assertion** is **incorrect** but **Reason** is **correct**.

138. **Assertion :** Fuse wire must have high resistance and low melting point.

Reason : Fuse is used for very small current flow only.

139. **Assertion :** Alloys are commonly used in electrical heating devices like electric iron and heater.

Reason : Resistivity of an alloy is generally higher than that of its constituent metals but the alloys have low melting points than their constituent metals.

140. **Assertion :** In a simple battery circuit, the point of lowest potential is negative terminal of the battery.

Reason : The current flows towards the point of higher potential as it flows in such a circuit from the negative to positive terminal.

163. The resistance of a conductor depends directly on its, inversely on its, and also directly proportioned on the of the conductor.
164. $1 \text{ volt} \times 1 \text{ coulomb} = \dots\dots\dots$
165. Potential difference is a quantity.
166. The resistance of a semiconductor with increase in temp.
167. The S.I. unit of resistivity is
168. Physical quantity represented by coulomb per second is
169. Two resistances of 2Ω each are connected in parallel. The equivalent resistance is
170. The resistance of a wire is proportional to the square of its radius.
171. Kilowatt is the unit of electrical but kilowatt-hour is the unit of electrical
172. Energy spent in kilowatt-hour

$$\frac{\text{volt} \times \dots\dots\dots \times \dots\dots\dots}{1000}$$
173. A fuse is a short piece of wire of high and low
174. Fuse wire has a melting point and is made of an alloy of and, If the current in a circuit rises too high, the fuse wire
175. A fuse is connected in to the wire.
176. Electric energy is produced by the of charges.
177. Energy converted per unit charge is measured with an instrument called a
178. The electrical energy dissipated in a resistor is given by $W = \dots\dots\dots$
179. The unit of power is
180. One watt of power is consumed when 1 A of current flows at a potential difference of
181. $1 \text{ kW h} = \dots\dots\dots$
182. The alloy which is used for making the filament of bulbs is
183. Power transmission is carried out at high..... and low

184. Rate at which electric work is done is called

True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

185. The quantity of charge flowing through a point multiplied by time is a current.
186. The resistivity of all pure metals increases with the rise in temperature.
187. Ohm's law is a relation between the power used in a circuit to the current and the potential difference.
188. Direction of current is taken opposite to the direction of flow of electrons.
189. The equivalent resistance of several resistors in series is equal to the sum of their individual resistances.
190. In parallel combination, the reciprocal of equivalent resistance is the sum of the reciprocal of individual resistance.
191. The series arrangement is used for domestic circuits.
192. The reciprocal of resistance is called specific resistance.
193. Resistivity is measured in ohm-metre.
194. The resistance of a wire is directly proportional to length.
195. The resistance of a wire is directly proportional to area.
196. The resistivity of alloys decreases with the rise in temp.
197. The filament resistance of glowing bulb is greater, to its resistance when it is not glowing.
198. The commercial unit of electrical energy is kilowatt-hour (kWh).
199. Pure tungsten has high resistivity and a high melting point (nearly 3000°C).
200. When a metallic conductor is heated the atoms in the metal vibrate with greater amplitude and frequency.
201. One kilowatt is equal to 10 horse power.
202. Fuse is a thin wire which melts and breaks the electric circuit due to only high voltage.

ANSWER KEY & SOLUTIONS

1. (a) $Q = 150 \text{ C}, t = 60 \text{ sec so, } I = \frac{Q}{t} = \frac{150}{60} = 2.5 \text{ A}$

2. (a) $V = IR \Rightarrow I = \frac{V}{R} = \frac{1.5\text{V}}{30\Omega} = 0.05 \text{ A}$

3. (a) $Q = I \times t \Rightarrow Q = 10 \text{ A} \times (2 \times 60 \text{ sec}) = 1200 \text{ C}$

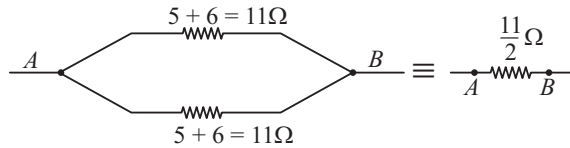
4. (a) Charge on one electron $e = -1.6 \times 10^{-19} \text{ C}$
So, number of electrons flow

$$n = \frac{Q}{e} = \frac{10 \times 2 \times 60}{1.6 \times 10^{-19}} = 75 \times 10^{20}$$

5. (a) $R = \rho \frac{l}{A} \Rightarrow \rho = R \frac{A}{l} = 0.000115 \Omega \text{ m}$

6. (a) 7. (a) 8. (b)

9. (c) $R_{\text{equivalent}} = \frac{(5+6)}{2} = \frac{11}{2} \Omega$



10. (a) To get the maximum resistance, all four resistors should be connected in series,

$$\therefore R = \frac{1}{2} \Omega + \frac{1}{2} \Omega + \frac{1}{2} \Omega + \frac{1}{2} \Omega = 2 \Omega$$

11. (a) 12. (a) 13. (c) 14. (c)

15. (d) 16. (c) 17. (c) 18. (d)

19. (d) 20. (b) 21. (d) 22. (c)

23. (b) 24. (d) 25. (b) 26. (d)

27. (b) 28. (c) 29. (c) 30. (b)

31. (c) 32. (c) 33. (b) 34. (a)

35. (c) 36. (b) 37. (b) 38. (b)

39. (b) 40. (a) 41. (c) 42. (d)

43. (c) 44. (c) 45. (b) 46. (d)

47. (a) 48. (a) 49. (c) 50. (a)

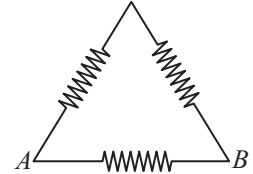
51. (b) 52. (d) 53. (b) 54. (d)

55. (b) 56. (d) 57. (b) 58. (d)

59. (b) 60. (b) 61. (b) 62. (b)

63. (b)

64. (d) $R_{AB} = \frac{(4+4) \times 4}{4+4+4} = \frac{8}{3} \Omega$



65. (a) Same metal means same specific resistance

$$\frac{R_1}{R_2} = \frac{A_2}{A_1} = \frac{1}{3} \Rightarrow R_2 = 3R_1 = 3 \times 10 = 30 \Omega$$

$$R = R_1 + R_2 = 40 \Omega$$

66. (c) $R \propto \frac{\ell}{A}$. Hence minimum for option (c)

67. (b) $R \propto \frac{1}{A} \propto \frac{1}{r^2}$. Hence $\frac{1}{4}$

68. (d) $R = \frac{\rho \ell}{A}$; $\ell = \frac{RA}{\rho} = \frac{4.2 \times \pi \left(\frac{0.4 \times 10^{-3}}{2}\right)^2}{4.8 \times 10^{-8}} = 1.1 \text{ m}$

69. (c) Ideal voltmeter should not draw any current flow source hence its resistance = ∞ .

Practically infinite resistance is not possible, but ideal voltmeter is possible with the help of potentiometer that you will learn in higher classes.

70. (d) $R = \frac{\rho \ell}{A} = \frac{d \rho \ell^2}{m}$; $R \propto \frac{\ell^2}{m}$

$$\left[V = A\ell, d = \frac{m}{V} = \frac{m}{A\ell} \Rightarrow A = \frac{m}{d\ell} \right]$$

$$R_1 : R_2 : R_3 = \frac{9}{1} : \frac{4}{2} : \frac{1}{3} = 9 : 2 : \frac{1}{3} = 27 : 6 : 1$$

71. (c) Same material \rightarrow same density, specific resistance as they are material property.

$$R = \frac{\rho \ell}{A} = \frac{\rho V}{A^2} = \frac{\rho m}{dA^2}$$

$$R \propto \frac{1}{A^2} \propto \frac{1}{r^4}$$

$$\frac{R_A}{R_B} = \frac{r_B^4}{r_A^4} = 2^4 = 16 \Rightarrow R_B = \frac{24}{16} = 1.5 \Omega$$

72. (b) $R = \frac{\rho \ell}{A} = \frac{\rho \ell}{\pi r^2}$

$$R' = \frac{\rho 2\ell}{\pi(2r)^2} = \frac{R}{4}$$

Specific resistance will remain same as it is a material property but remember it depends on temperature.

73. (a) Two resistance ($R/2$) will be in parallel, hence

$$R_{eq} = R/4$$

74. (a) $V = i \times R$; $R = 60/15 = 4 \Omega$

75. (d) Copper is a conductor while germanium is a semi-conductor. Resistance of temperature decreases with temperature while that of semi-conductor increases hence resistance of copper strip decreases and that of germanium increases.

76. (d) 2Ω , 4Ω , 2Ω on right side are in series resultant parallel to 8Ω then in series with 2Ω , 2Ω then in parallel with 8Ω , then in series with 3Ω , 2Ω . Thus, $R_{eq} = 9 \text{ ohm}$.

$$i = 9/9 = 1 \text{ amp flow from battery.}$$

Passing through 3Ω it will divide into equal parts ($1/2 \text{ amp}$) in 8Ω (near to cell) and remaining section then again divide into equal parts ($1/4 \text{ amp}$) in 8Ω (middle one) and remaining section hence $1/4 \text{ amp}$ passes through 4Ω .

77. (d) 78. (d) 79. (d)

80. (c) 81. (b) 82. (c) 83. (c)

84. (b) 85. (a)

86. (d) Fuse wire should be such that it melts immediately when strong current flows through the circuit. The same is possible if its melting point is low and resistivity is high.

87. (a) A heating wire should be such that it produces more heat when current is passed through it and also does not melt. It will be so if it has high specific resistance and high melting point.

88. (b) The rate of generation of heat, for a given potential difference is, $P = V^2/R$

89. (b) The rate of heat generation
 $= I^2 R = I^2 (\rho \ell / \pi r^2)$.

90. (a) Heat produced, $H = V^2 t / R$ i.e., $H \propto 1/R$
 so $H_1/H_2 = R_2/R_1$.

91. (c) Power = $V \cdot I = I^2 R$

$$i_2 = \sqrt{\frac{\text{Power}}{R}} = \sqrt{\frac{2}{8}} = \sqrt{\frac{1}{4}} = \frac{1}{2} \text{ A}$$

$$\text{Potential over } 8\Omega = Ri_2 = 8 \times \frac{1}{2} = 4V$$

This is the potential over parallel branch. So,

$$i_1 = \frac{4}{4} = 1 \text{ A}$$

$$\text{Power of } 3\Omega = i_1^2 R = 1 \times 1 \times 3 = 3W$$

92. (d) In house electrical circuits the fuse wire for safety should be of high resistance and low melting point.

93. (b) An the three resistors are connected in parallel

$$\frac{1}{R_{eq}} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} \Rightarrow \frac{1}{R_{eq}} = \frac{3}{R} \quad R_{eq} = \frac{R}{3}$$

94. (d) Resistance (R) = $\frac{\rho L}{A}$

Length is stretched to double

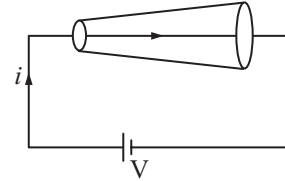
$$L' = 2L$$

$$\text{Area } A' = \frac{A}{2} \quad \therefore R' = \frac{\rho \times 2L}{\frac{A}{2}}$$

$$R' = 4 \frac{\rho L}{A} \Rightarrow R' = 4R$$

$$R = 1\Omega \quad \therefore \text{New Resistance, } R' = 4\Omega$$

95. (a) Here, metallic conductor can be considered as the combination of various conductors connected in series. And in series combination current remains same.



96. (d) $\therefore 10\Omega$ and 20Ω are in series = $(10 + 20)\Omega = 30\Omega$
 and 10Ω and 5Ω are in series = $(10 + 5)\Omega = 15\Omega$

$$R_{eff} = \frac{30 \times 15}{15 + 30} = \frac{450}{45} = 10\Omega$$

$$\text{So the total current } I = \frac{V}{R} = \frac{30}{10} = 3 \text{ Ampere}$$

In branch CA current = 1A

In branch CB current = 2A

$$\therefore V_C - V_A = 10 \text{ Volt} \quad \dots(i)$$

$$\& V_C - V_B = 20 \text{ Volt} \quad \dots(ii)$$

Subtracting (i) from (ii), $V_A - V_B = 10 \text{ volt}$.

97. (d) Let the Diameter of wire = $\frac{d}{5}$

$$\text{Radius will be} = \frac{r}{5}$$

Changed Area will be = $A = \pi r^2$

$$= \pi \left(\frac{r}{5}\right)^2 = \frac{\pi r^2}{25} \Rightarrow A = \frac{\pi r^2}{25} \Rightarrow 25A = \pi r^2$$

Electricity

Hence stretched length will be = $25 l$

$$\text{Change resistance } (R) = \frac{\rho \ell}{A} = \frac{\rho(25\ell)}{A/25} = 625 R$$

98. (a) Resistance of the heater be R .

New resistance of heater is $R/2$

$$\text{Initial power} = \frac{V^2}{R} \quad \text{Final power} = \frac{V^2}{R/2} = 2 \frac{V^2}{R}$$

\therefore Heat generated is doubled.

99. (d) $R = \frac{\rho \ell}{A}$; New area = nA \therefore New length = $\frac{\ell}{n}$

$$\Rightarrow R' = \frac{\rho \ell}{n^2 A} = \frac{R}{n^2}$$

100. (b) We know that, $R = \frac{\rho \ell}{A}$

$$\text{or } R = \frac{\rho \ell^2}{\text{Volume}} \Rightarrow R \propto \ell^2$$

According to question $\ell_2 = n\ell_1$

$$\frac{R_2}{R_1} = \frac{n^2 \ell_1^2}{\ell_1^2}$$

$$\text{or, } \frac{R_2}{R_1} = n^2$$

$$\Rightarrow R_2 = n^2 R_1$$

101. (b) Resistance of 40 W – 200 V, 50 W – 200 V, 100 W – 200 V are respectively.

$$R_{40} = \frac{V^2}{P_{40}} = \frac{200 \times 200}{40} = 1000 \Omega$$

$$R_{50} = 800 \Omega \text{ and } R_{100} = 400 \Omega$$

$$I = \frac{600}{1000 + 800 + 400} = \frac{600}{2200} = 0.2727 \text{ A}$$

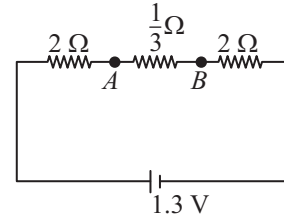
$$I_{40} = \frac{P_1}{V} = \frac{40}{200} = 0.2 \text{ A}$$

$$I_{50} = \frac{P_2}{V} = \frac{50}{200} = \frac{5}{20} = 0.25 \text{ A}$$

$$I_{100} = \frac{P_3}{V} = \frac{100}{200} = 0.5 \text{ A}$$

Clearly, 0.2 A & 0.25 A < 0.27 A hence both 40 W and 50 W bulbs will fuse.

102. (b) After simplifying the given circuit, we get,



$$R_{AB} = \frac{1}{3} \Omega$$

Then equivalent resistance across the battery,

$$R_{eq} = 2 + \frac{1}{3} + 2 = \frac{13}{3} \Omega$$

$$\text{So current in circuit, } I = \frac{V}{R_{eq}} \Rightarrow \frac{1.3}{13} \times 3 \text{ amp}$$

$$I = \frac{3}{10} \text{ amp}$$

Power dissipated across arm AB ,

$$P_{AB} = I^2 \times R_{AB} = \left(\frac{3}{10}\right)^2 \times \frac{1}{3}$$

$$P_{AB} = \frac{3}{100} = 0.03 \text{ Watt}$$

Total power dissipated in circuit,

$$P_{ckt} = I^2 \times R_{eq} = \left(\frac{3}{10}\right)^2 \times \frac{13}{3}$$

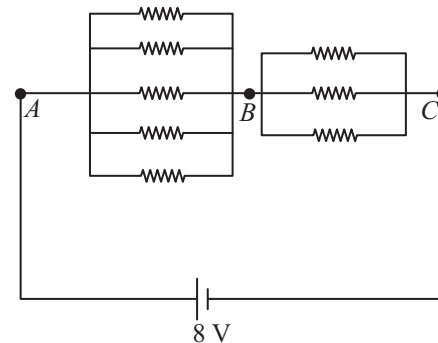
$$P_{ckt} = \frac{39}{100} = 0.39 \text{ watt}$$

Ratio of power across A and B to total power = Ratio of work done across A and B to total circuit

$$\therefore W = P \times t$$

$$\text{So, } \frac{P_{AB}}{P_{ckt}} = \frac{W_{AB}}{W_{ckt}} = \frac{0.03}{0.39} = \frac{1}{13}$$

103. (b) After simplifying the given circuit, we get



$$\text{Resistance between arm } AB, R_{net AB} = \frac{1}{5} k\Omega = \frac{1000}{5} \Omega$$

Resistance between arm BC , $R_{net BC} = \frac{1}{3}k\Omega = \frac{1000}{3}\Omega$

So, $R_{net} = R_{net AB} + R_{net BC}$

We get, $R_{net} = \frac{1000}{5} + \frac{1000}{3}$

$R_{net} = \frac{8000}{15}\Omega$

According to ohm's law, $V = IR$

$I = \frac{8 \times 15}{8000} = 15mA$

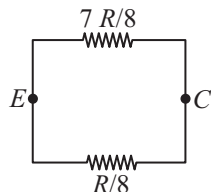
104. (b) Here $R_{DA} = R_{AB} = R_{BC} = R/4$

and $R_{DE} = R_{EC} = R/8$

Now $R_{ED}, R_{DA}, R_{AB}, R_{BC}$ are in series.

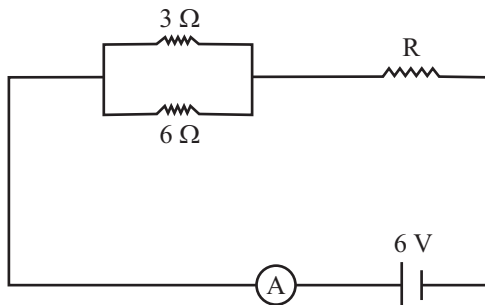
$\therefore R_s = \frac{R}{8} + \frac{R}{4} + \frac{R}{4} + \frac{R}{4} = \frac{R + 2R + 2R + 2R}{8} = \frac{7R}{8}$

$\therefore R_{eq} = \frac{\left(\frac{7R}{8}\right)\left(\frac{R}{8}\right)}{R} = \frac{7R}{64}$



105. (d) Fuse is an safety device that operates to provide over current protection of an electrical circuit. A fuse is mainly a metal wire that melts when too much current flows through it due to low melting point and protects electric appliances.

106. (a) $I = 2 A$



Two resistance are in parallel,

$\frac{1}{R_1} = \frac{1}{3} + \frac{1}{6} = \frac{2+1}{6} = \frac{3}{6} = \frac{1}{2}$

$\therefore R_1 = 2\Omega$... (i)

$R_{eq} = \frac{\text{Voltage}}{\text{Current}}$

$R_{eq} = \frac{6 V}{2 A} = 3 \Omega$... (ii)

where unknown resistance R , from (i) and (ii)

$R = 3 \Omega - 2 \Omega$

$R = 1 \Omega$

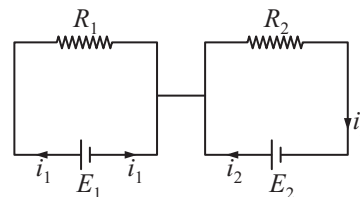
107. (c) **Ammeter** : In series connection, the same current flows through all the components. It aims at measuring the current flowing through the circuit and hence, it is connected in series.

Voltmeter : A voltmeter measures voltage change between two points in a circuit. So we have to place the voltmeter in parallel with the circuit component.

108. (d) 109. (d)

110. (a) In parallel combination, total power $P = P_1 + P_2$

111. (d) Current leaving the cell must be equal to current going into the cell.

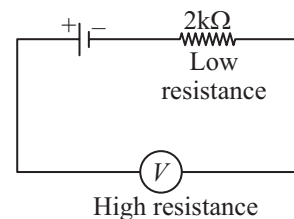


For any value of E or R current going from first loop to second loop must be zero.

Hence, there is no current through the wire 1.

112. (c) The resistance of ammeter is very low and resistance of voltmeter is very high. When ammeter is put in parallel to $8k\Omega$ resistor, nearly whole of current goes through the ammeter.

The equivalent circuit is as follows



Hence, maximum potential drop occurs in the voltmeter.

So, reading of voltmeter is nearly $6 V$.

113. (c) Power delivered by the UPS battery is $1kVA$ i.e. $1000 V.A = 1000W$

When all the laptops connected directly to UPS then total power requirement

$90 \times 10 = 900W$,

Electricity

So battery (UPS) can provide power to all laptops.
If all laptops are used for 5 hours, then cost of electricity consumed as the cost of electricity is ₹5.00 per unit.

$$= \frac{900 \times 5 \times 3600}{3.6 \times 10^6} \times 5 = 22.5$$

114. (c) Resistance, $R = \frac{\rho \ell}{A}$

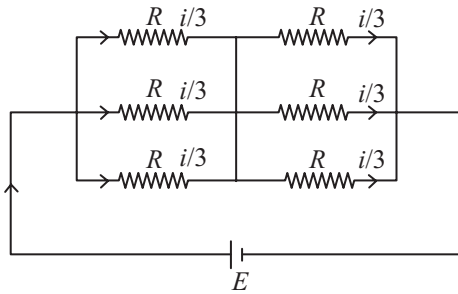
$$R = \rho \frac{\ell}{A} \times \frac{\ell}{\ell} = \frac{\rho \ell^2}{V}$$

[∵ Volume (V) = Aℓ]

Since resistivity and volume remains constant therefore % change in resistance

$$\frac{\Delta R}{R} = \frac{2\Delta \ell}{\ell} = 2 \times (0.5) = 1\%$$

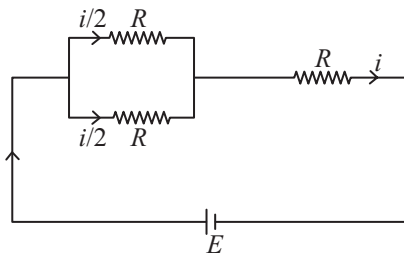
115. (b) When all bulbs are glowing



$$R_{eq} = \frac{R}{3} + \frac{R}{3} = \frac{2R}{3}$$

$$\text{Power } (P_i) = \frac{E^2}{R_{eq}} = \frac{3E^2}{2R} \quad \dots(i)$$

When two from section A and one from section B are glowing, then



$$R_{eq} = \frac{R}{2} + R = \frac{3R}{2}$$

$$\text{Power } (P_f) = \frac{2E^2}{3R} \quad \dots(ii)$$

Dividing equation (i) by (ii) we get

$$\frac{P_i}{P_f} = \frac{3E^2 3R}{2R 2E^2} = 9:4$$

116. (a) When the lamps are connected in parallel, then potential difference V across each lamp will be same and will be equal to potential necessary for full brightness of each bulb. Because illumination produced by a lamp is proportional to electric power consumed in it, and power consumed,

$$P_1 = \frac{V^2}{R_1} < \frac{V^2}{R_2} = P_2$$

Hence, illumination produced by 2nd bulb will be higher than produced by 1st bulb, i.e., bulb having lower resistance will shine more brightly.

117. (b) When R_1 burns out, then power is dissipated in R_2 only. Because internal resistance is quite low in lighting circuit, potential difference is still equal to V , hence, power dissipated in 2nd lamp, i.e.,

$$\frac{V^2}{R_2} < \left(\frac{V^2}{R_1} + \frac{V^2}{R_2} \right)$$

i.e., net power consumed initially. In other words, net illumination will now decrease.

118. (b) When two lamps are connected in series, the potential difference across each lamp will be different but current I flowing through each lamp will be same.

$$\text{Hence, } P_1 = I^2 R_1 > I^2 R_2 = P_2$$

i.e., illumination produced by 1st lamp will be higher as compared to that produced by 2nd lamp, i.e., lamp having higher resistance will glow more brightly.

119. (b) When lamp of resistance R_2 burns out and only lamp of resistance R_1 is connected in the circuit then current flowing the circuit will change. Let new current be I' . Because potential difference still remains same (due to low internal resistance), hence

$$I' R_1 = I (R_1 + R_2)$$

$$\text{or } I' = \frac{I(R_1 + R_2)}{R_1}$$

If P' is the power consumed, then

$$P' = I'^2 R_1 = I^2 \frac{(R_1 + R_2)(R_1 + R_2)}{R_1}$$

When both the lamps were present then total power consumed was given by:

$$P_s = P_1 + P_2 = I^2 (R_1 + R_2), \text{ i.e., } P' > P_s$$

i.e., illumination gets increased when only one bulb is used.

120. (a) If a water pipe is given bend at some points, then it definitely reduces the flow of water in the pipe but this is not true in case of an electric current flowing in a conductor because electric current is established in a conductor due to drift motion of electrons in it along the line of the potential gradient. Hence, illumination is not affected due to bending along the length of supply wires.

121. (b) $P = VI = V^2/R = I^2R$

122. (d) $P = \frac{V^2}{R} \Rightarrow R = \frac{V^2}{P} = \frac{220 \times 220}{100} = 484 \Omega$

$$P = \frac{V^2}{R} = \frac{110 \times 110}{484} = 25W$$

123. (c) $R_S = R_1 + R_2 = R + R = 2R$

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R}$$

$$R_P = R/2$$

$$\frac{H_1}{H_2} = \frac{V^2 R_P}{R_S V^2} = \frac{R_P}{R_S} = \frac{R}{2 \times 2R} = \frac{1}{4} = 1:4$$

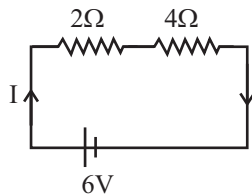
124. (c) The bulb with the highest wattage glows with maximum brightness. Brightness of bulb B (100 W) is maximum.

Correct order of brightness will be,

Bulb of 100 W > Bulb of 60 W > Bulb of 40 W.

125. (c) Given, resistors, $R_1 = 2\Omega$ and $R_2 = 4\Omega$

Voltage, $V = 6V$



Equivalent Resistance,

$$= R_1 + R_2 = 2 + 4 = 6\Omega \text{ [Series combination]}$$

$$\text{Current, } I = \frac{V}{R} = \frac{6}{6} = 1A.$$

Heat dissipated in 4Ω Resistor

$$= I^2 R t = 1 \times 4 \times 5 = 20 J$$

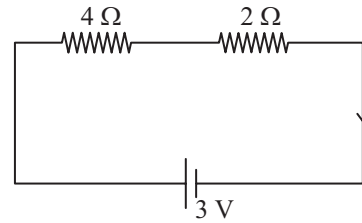
$$[I = 1A, R = 4\Omega, t = 5 \text{ sec.}]$$

126. (b) Equivalent resistance of 3Ω and $6\Omega = \frac{3 \times 6}{3 + 6} = 2\Omega$

as they are in parallel they have same p.d.

$$i = \frac{3}{6} = \frac{1}{2}$$

$$\text{P.D. across } 3\Omega = \frac{1}{2} \times 3 = 1.5 \text{ volt}$$



127. (b) 128. (a)

129. (d) Given : $R_1 = 12\Omega, R_2 = 3.0\Omega, R_3 = 5.0\Omega, R_4 = 4.0\Omega$,
All four resistors are in series combination, so
 $R_s = R_1 + R_2 + R_3 + R_4$
 $= 12\Omega + 3.0\Omega + 5.0\Omega + 4.0\Omega = 24\Omega$

130. (c) The current through all resistors in series is the same

$$I = \frac{V}{R} = \frac{V}{R_s} = \frac{12V}{24\Omega} = 0.50 A$$

131. (b) Potential drop across, 12Ω resistor

$$V = IR = 12\Omega (0.5A)$$

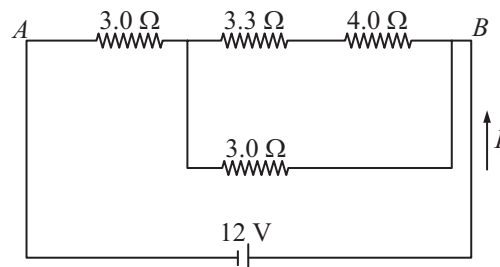
$$\text{or } V = 6V$$

132. (b) Here we have a variety of series-parallel combinations.

We follow the general procedures outlined in the text.

The 10Ω and the 5.0Ω are in parallel

$$R_{p_1} = \frac{(10\Omega)(5.0\Omega)}{10\Omega + 5.0\Omega} = 3.33\Omega$$

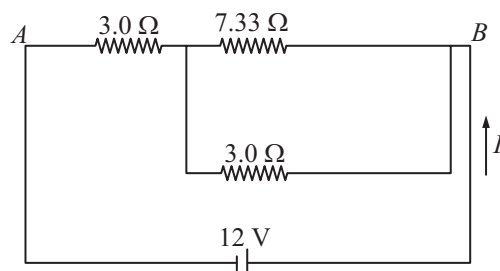


(i) The circuit reduces to figure (a)

Now the 3.33Ω and the 4.0Ω are in series.

$$R_{s_1} = 3.33\Omega + 4.0\Omega = 7.33\Omega$$

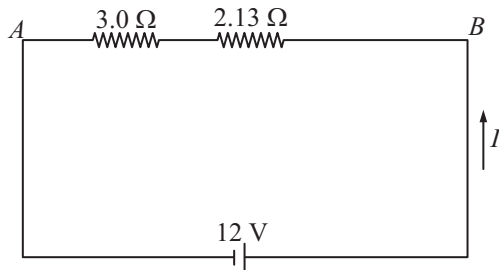
The circuit reduces to figure (ii)



Electricity

- (ii) The 7.33Ω and the 3.0Ω are in parallel.

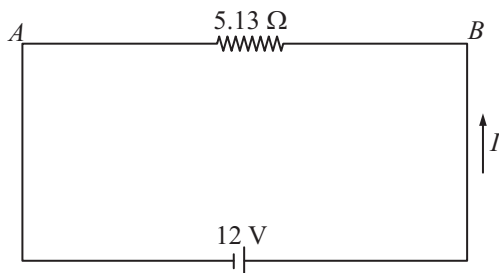
$$R_{p_2} = \frac{(7.33\Omega)(3.0\Omega)}{7.33\Omega + 3.0\Omega} = 2.13\Omega$$



- (iii) The circuit reduces to figure (iii).

Finally, the 2.13Ω and the 3.0Ω are in series.

$$R = R_{s_2} = 2.13\Omega + 3.0\Omega = 5.13\Omega = 5.1\Omega$$



- (iv) The circuit reduces to figure (iv).

133. (a) From Ohm's law, $I = \frac{V}{R} = \frac{12V}{5.13\Omega} = 2.33A = 2.3A$

134. (d) To find the current through the 4.0 ohm resistor, we need to expand the combinations.

In figure (iii), the current through the 2.13Ω and 3.0Ω is the same as the total current, $2.33 A$.

The voltage across the 2.13Ω is then $V_{2.13} = (2.13 \Omega)(2.33 A) = 4.96 V$.

In figure (ii), the voltage across the 7.33Ω and 3.0Ω is the same as that across the 2.13Ω , $4.96 V$.

So, the current through the 7.33Ω is

$$I_{7.33} = \frac{4.96V}{7.33\Omega} = 0.677A$$

In figure (i), the current through the 3.33Ω and the 4.0Ω is the same as the current through the 7.33Ω

Therefore, $I_{4.0} = 0.68 A$.

135. (a) E.m.f. of the battery = $2V$

Effective resistance of the parallel resistors is given by R_1 .

$$\frac{1}{R_1} = \frac{1}{6} + \frac{1}{2} = \frac{1+3}{6} = \frac{4}{6} = \frac{2}{3} \Rightarrow R_1 = \frac{3}{2} = 1.5 \Omega$$

Total resistance of the circuit, $R = 1.5 + 0.5 = 2\Omega$

136. (a) Main current $I = \frac{V}{R} = \frac{2}{2} = 1A$

Current flowing through 0.5Ω resistor = $1A$

137. (d) P.D. across the junctions :

$$V_1 = IR_1 = 1 \times 1.5 = 1.5V$$

Hence current I_1 , flowing through 6Ω resistor

$$I_1 = \frac{V_1}{6} = \frac{1.5}{6} = 0.25 A$$

138. (c)

139. (c) Alloys are used in electrical heating device because they have high resistivity or resistance as compared to pure metals and high melting point.

140. (c) It is clear that in a battery circuit, the point of lowest potential is the negative terminal of battery. and current flows from higher potential to lower potential.

141. (c) It is common error to say that $V = Ri$ is a statement of Ohm's law. The essence of Ohm's law is that the value of R is independent of the value of V . The equation $V = Ri$ is used for finding resistance of all conducting devices, whether they obey Ohm's law or not.

142. (d) (A) will read zero but (V) will read E

143. (d) ρ is the characteristic of the material of resistors. It does not depend on the length and cross-sectional area of resistors. But R depends on the length and the cross-sectional area of the resistor.

So, R_1 may be greater than R_2 even when $\rho_1 \leq \rho_2$.

144. (a) 145. (d)

146. (c) Resistivity is a material property.

147. (c) $\rho = \rho_0(1 + \alpha\Delta T)$

148. (b) Glow = Power (P) = I^2R

$$\therefore \frac{dP}{P} = 2\left(\frac{dI}{I}\right) = 2 \times 0.5 = 1\%$$

149. (a) Power loss = $i^2R = \left(\frac{P}{V}\right)^2 R$

[P = Transmitted power]

150. (b) $P = \frac{V^2}{R}$; $R \propto \frac{1}{P}$ (same rated voltage)

151. (c) Here, $P = \frac{E^2}{R}$, so $P \propto R$ only when I is constant.

Here I increases as R is decreased. Hence the reason is wrong.

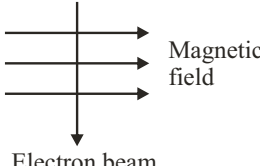
152. (A) → (q); (B) → (p); (C) → (s); (D) → (r)
153. (A) → q; (B) → r; (C) → p; (D) → s
154. electric current 155. zero
156. series
157. potential difference 158. resistivity
159. ampere 160. Resistance
161. ohm (Ω)
162. directly proportional, temperature
163. length, area of cross-section, resistivity
164. joule 165. Scalar
166. decreases 167. ohm-meter
168. electric current
169. 1Ω 170. inversely.
171. power, energy
172. ampere, hour
173. resistance, melting point
174. low, lead, tin, melts
175. series, live
176. separation
177. voltmeter
178. $V \times I \times t$
179. watt (W)
180. 1 V
181. 3,600,000 J
182. Tungsten
183. voltage, current
184. electric power
185. False 186. True 187. False
188. True 189. True 190. True
191. False 192. False 193. True
194. True 195. False 196. False
197. True 198. True 199. True
200. True 201. False 202. False

12

Magnetic Effects of Electric Current

Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

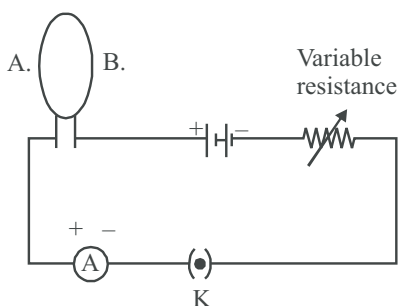
- A magnet attracts:
(a) plastics (b) carbon
(c) aluminium (d) iron and steel
- A plotting compass is placed near the south pole of a bar magnet. The pointer of plotting compass will:
(a) point away from the south pole
(b) point parallel to the south pole
(c) point towards the south pole
(d) point at right angles to the south pole
- Which of the following statements is incorrect regarding magnetic field lines?
(a) The direction of magnetic field at a point is taken to be the direction in which the north pole of a magnetic compass needle points.
(b) Magnetic field lines are closed curves
(c) If magnetic field lines are parallel and equidistant, they represent zero field strength
(d) Relative strength of magnetic field is shown by the degree of closeness of the field lines
- The magnetic field lines in the middle of the current carrying solenoid are
(a) circles
(b) spirals
(c) parallel to the axis of the tube
(d) perpendicular to the axis of the tube
- The front face of a circular wire carrying current behaves like a north pole, The direction of current in this face of the circular wire is:
(a) clockwise (b) downwards
(c) anticlockwise (d) upwards
- The most suitable material for making the core of an electromagnet is:
(a) soft iron (b) brass
(c) aluminium (d) steel
- In an electric motor, the direction of current in the coil changes once in each:
(a) two rotations (b) one rotation
(c) half rotation (d) one-fourth rotation
- An electron beam enters a magnetic field at right angles to it as shown in the Figure.


The diagram shows a magnetic field represented by three horizontal arrows pointing to the right. A vertical arrow labeled 'Electron beam' points downwards, intersecting the magnetic field lines at a right angle.

The direction of force acting on the electron beam will be:
(a) to the left (b) to the right
(c) into the page (d) out of the page
- The force experienced by a current-carrying conductor placed in a magnetic field is the largest when the angle between the conductor and the magnetic field is:
(a) 45° (b) 60°
(c) 90° (d) 180°
- The force exerted on a current-carrying wire placed in a magnetic field is zero when the angle between the wire and the direction of magnetic field is:
(a) 45° (b) 60°
(c) 90° (d) 180°
- A circular loop placed in a plane perpendicular to the plane of paper carries a current when the key is ON.

The current as seen from points A and B (in the plane of paper and on the axis of the coil) is anti clockwise and clockwise respectively. The magnetic field lines point from B to A. The N-pole of the resultant magnet is on the face close to

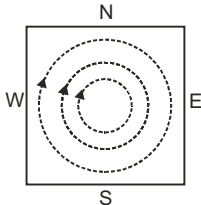
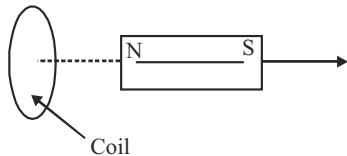
- A
- B
- A if the current is small, and B if the current is large
- B if the current is small and A if the current is large



- A small magnet is placed perpendicular to a uniform magnet field. The forces acting on the magnet will result in
 - Rotational motion
 - Translatory motion
 - No motion at all
 - Translational and rotational motion both
- Which one of the following substances is the magnetic substances?

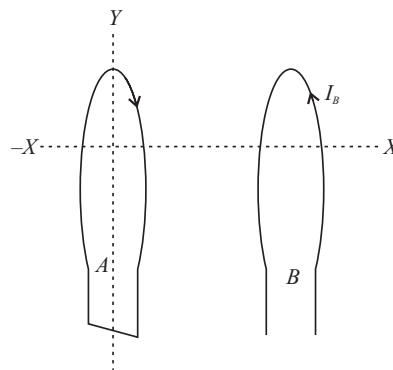
(a) Mercury	(b) Iron
(c) Gold	(d) Silver
- Magnetic lines do not intersect one-another because
 - they are at a distance
 - they are in the same direction
 - they are parallel to another
 - at the point of intersection there will be two direction of the magnetic force which is impossible
- By removing the inducing magnet, the induced magnetism is
 - Finished after some time
 - Finished just after
 - Not finished for a long time
 - Not changed
- A current carrying wire in the neighbour hood produces
 - no field
 - electric and magnetic fields
 - electric field only
 - magnetic field only
- The magnetic lines of force, inside a current carrying solenoid, are
 - along the axis and are parallel to each other
 - perpendicular to the axis and equidistance from each other
 - circular and they do not intersect each other
 - circular at the ends but they are parallel to the axis inside the solenoid.
- Which of the following determines the direction of magnetic field due to a current carrying conductor?
 - Faraday's laws of electromagnetic induction
 - Fleming's left-hand rule
 - Lenz's rule
 - Maxwell's cork screw rule
- Along the direction of current carrying wire, the value of magnetic field is
 - zero
 - infinity
 - depends on the length of the wire
 - uncertain
- The value of magnetic field due to a small element of current carrying conductor at a distance r and lying on the plane perpendicular to the element of conductor is
 - zero
 - maximum
 - inversely proportional to the current
 - none of the above
- The value of intensity of magnetic field at a point due to a current carrying conductor depends
 - Only on the value of current
 - Only on a small part of length of conductor
 - On angle between the line joining the given point to the mid point of small length and the distance between the small length and the given point
 - On all of the above
- The direction of magnetic lines of forces close to a straight conductor carrying current will be
 - along the length of the conductor
 - radially outward
 - circular in a plane perpendicular to the conductor
 - helical
- When an electron beam is moving in a magnetic field, then the work done is equal to the
 - charge of electron
 - magnetic field
 - product of electronic charge and the magnetic field
 - zero

Magnetic Effects of Electric Current

24. A current carrying loop lying in a magnetic field behaves like a.
- A magnetic dipole
 - magnetic pole
 - magnetic material
 - non-magnetic material
25. Two identical coaxial circular loops carry a current i each circulating in the same direction. If the loops approach each other, you will observe that
- the current in each increases,
 - the current in each decreases,
 - the current in each remains the same,
 - the current in one increases whereas that in the other decreases
26. An induced e.m.f. is produced when a magnet is plunged into a coil. The strength of the induced e.m.f. is independent of
- the strength of the magnet
 - number of turns of coil
 - the resistivity of the wire of the coil
 - speed with which the magnet is moved
27. The laws of electromagnetic induction have been used in the construction of a
- galvanometer
 - voltmeter
 - electric motor
 - generator
28. Direction of induced e.m.f. is determined by -
- Fleming's left hand rule
 - Fleming's right hand rule
 - Maxwell's rule
 - Ampere's rule of swimming
29. The phenomenon of electromagnetic induction is -
- the process of charging a body.
 - the process of generating magnetic field due to a current passing through a coil.
 - producing induced current in a coil due to relative motion between a magnet and the coil.
 - the process of rotating a coil of an electric motor.
30. The device used for producing electric current is called a
- generator
 - galvanometer
 - ammeter
 - motor
31. In an electric motor, conversion takes place of
- Chemical energy into electrical energy
 - Electrical energy into mechanical energy
 - Electrical energy into light
 - Electrical energy into chemical energy
32. The current in a generator armature is AC because
- the magnetic field reverses at intervals
 - the current in the field coils is AC
 - the rotation of the armature causes the field through it to reverse
 - the commutator feeds current into it in opposite directions every half cycle
33. The current in the armature of a motor is reversed every half cycle due to the action of a(n)
- armature
 - field coil
 - brush
 - commutator.
34. In an electric motor, the energy transformation is
- from electrical to chemical
 - from chemical to light
 - from mechanical to electrical
 - from electrical to mechanical
35. The direction of induced current is obtained by
- Fleming's left hand rule
 - Maxwell's cork-screw rule
 - Ampere's rule
 - Fleming's right hand rule
36. A metal sheet is placed in a variable magnetic field which is increasing from zero to maximum. Induced current flows in the directions as shown in figure. The direction of magnetic field will be -
- normal to the paper, inwards
 - normal to the paper, outwards
 - from east to west
 - from north to south
- 
37. A magnet NS is placed along the axis of a circular coil. The magnet is moved away from the coil. The induced current in the coil is:
- Zero
 - Clockwise
 - Anti-clockwise
 - None of these
- 
38. Four situations are given below-
- An infinitely long wire carrying current
 - A rectangular loop carrying current
 - A solenoid of finite length carrying current
 - A circular loop carrying current.
- In which of the above cases will the magnetic field produced be like that of a bar magnet?
- I
 - I and III
 - Only III
 - Only IV

39. The similar magnets of steel are than the magnets of soft iron
 (a) stronger (b) of equal strength
 (c) weaker (d) none of the above
40. A bar of soft iron is placed flat on the table. A bar magnet is taken and its south pole is placed on one end of the bar of soft iron. The magnet is held almost vertically. The bar is stroked from one end to the other with magnet. On the other end of the bar, magnet is lifted and again placed on the first end and the bar is again stroked. The end of the bar where the magnet is lifted will be
 (a) south pole
 (b) no pole
 (c) south and north both type
 (d) north pole
41. When a bar magnet is broken into two pieces?
 (a) we will have a single pole on each piece
 (b) each piece will have two like poles
 (c) each piece will have two unlike poles
 (d) each piece will be lose magnetism
42. The permanent magnets are kept with soft iron pieces at ends as keepers
 (a) to magnetise the soft iron pieces
 (b) to increase the strength of the magnets
 (c) to avoid self demagnetisation
 (d) for physical safety of the magnets
43. Whenever the magnetic flux linked with a coil changes, an induced e.m.f. is produced in the circuit. The e.m.f. lasts
 (a) for a short time
 (b) for a long time
 (c) for ever
 (d) so long as the change in flux takes place
44. A magnet is moved towards a coil (i) quickly (ii) slowly, then the induced e.m.f. is
 (a) larger in case (i)
 (b) smaller in case (i)
 (c) equal in both the cases
 (d) larger or smaller depending upon the radius of the coil
45. The laws of electromagnetic induction have been used in the construction of a
 (a) galvanometer (b) voltmeter
 (c) electric motor (d) generator
46. The diagram below shows two circular loops of wire (A and B) centred on and perpendicular to the X -axis and

oriented with their planes parallel to each other. The Y -axis passes vertically through loop A (dashed line). There is a current I_B in loop B as shown in the diagram. Possible actions which we might perform on loop A are



- (I) move A to the right along X -axis closer to B
 (II) move A to the left along X -axis away from B
 (III) as viewed from above, rotate A clockwise about Y -axis
 (IV) as viewed from above, rotate A anti-clockwise about y -axis

Which of the actions will induce a current in A only in the direction shown?

- (a) Only (I) (b) Only (II)
 (c) Only (I) and (IV) (d) Only (II) and (III)
47. An electron move with velocity v in a uniform magnetic field B . The magnetic force experienced by the electron is
 (a) Always zero
 (b) Never zero
 (c) Zero if v is perpendicular to B
 (d) Zero if v is parallel to B

Case/Passage Based Questions

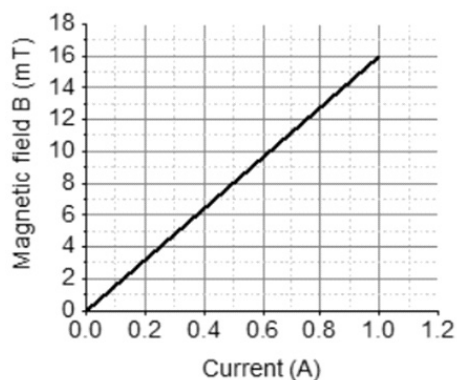
DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

A solenoid is a long helical coil of wire through which a current is run in order to create a magnetic field. The magnetic field of the solenoid is the superposition of the fields due to the current through each coil. It is nearly uniform inside the solenoid and close to zero outside and is similar to the field of a bar magnet having a north pole at one end and a south pole at the other depending upon the direction of current flow. The magnetic field produced in the solenoid is dependent on a few factors such as, the current in the coil, number of turns per unit length etc. The following graph is obtained by a researcher while doing an experiment to see the variation of the magnetic field

Magnetic Effects of Electric Current

with respect to the current in the solenoid. The unit of magnetic field as given in the graph attached is in milli-Tesla (mT) and the current is given in Ampere.



48. What type of energy conversion is observed in a linear solenoid?
- Mechanical to Magnetic
 - Electrical to Magnetic
 - Electrical to Mechanical
 - Magnetic to Mechanical
49. What will happen if a soft iron bar is placed inside the solenoid?
- The bar will be electrocuted resulting in short-circuit.
 - The bar will be magnetised as long as there is current in the circuit.
 - The bar will be magnetised permanently.
 - The bar will not be affected by any means.
50. The magnetic field lines produced inside the solenoid are similar to that of ...
- a bar magnet
 - a straight current carrying conductor
 - a circular current carrying loop
 - electromagnet of any shape
51. After analysing the graph a student writes the following statements.
- The magnetic field produced by the solenoid is inversely proportional to the current.
 - The magnetic field produced by the solenoid is directly proportional to the current.
 - The magnetic field produced by the solenoid is directly proportional to square of the current.
 - The magnetic field produced by the solenoid is independent of the current.
- Choose from the following which of the following would be the correct statement(s).
- Only IV
 - I and III and IV
 - I and II
 - Only II
52. From the graph deduce which of the following statements is correct.
- For a current of 0.8A the magnetic field is 13 mT
 - For larger currents, the magnetic field increases non-linearly.
 - For a current of 0.8A the magnetic field is 1.3 mT
 - There is not enough information to find the magnetic field corresponding to 0.8A current.

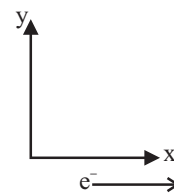
Case/Passage - 2

For a conductor of length L carrying a current of I in a field B the force experienced by the conductor $\vec{F} = I \vec{L} \times \vec{B}$

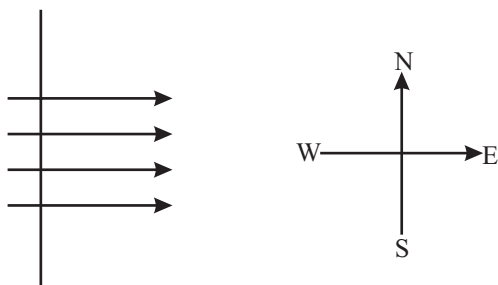
If the current-carrying conductor in the form of a loop of any arbitrary shape is placed in a uniform field, then, $\vec{F} = 0$ i.e., the net magnetic force on a current loop in a uniform magnetic field is always zero. Here it must be kept in mind that in this situation different parts of the loop may experience elemental force due to which the loop may be under tension or may experience a torque.

Direction of force can be determined by Fleming's left hand rule, right hand palm rule or screw rule.

53. The direction of induced current is obtained by
- Fleming's left hand rule
 - Maxwell's cork-screw rule
 - Ampere's rule
 - Fleming's right hand rule
54. An electron moving with uniform velocity in x-direction enters a region of uniform magnetic field along y-direction. Which of the following physical quantity(ies) is (are) non-zero and remain constant?
- Velocity of the electron
 - Magnitude of the momentum of the electron.
 - Force on the electron.
 - The kinetic energy of electron.
- (a) Only I and II. (b) Only III and IV.
(c) All four (d) Only II and IV.
55. Which of the following can produce a magnetic field?
- Electric charges at rest
 - Electric charges in motion
 - Only by permanent magnets
 - Electric charges whether at rest or in motion
56. A wire is lying horizontally in the north-south direction and there is a horizontal magnetic field pointing towards



the east. Some positive charges in the wire move north and an equal number of negative charges move south. The direction of force on the wire will be



- (a) east
 (b) down, into the page
 (c) up, out of the page
 (d) west

57. Four situations are given below-

- I. An infinitely long wire carrying current
 II. A rectangular loop carrying current
 III. A solenoid of finite length carrying current
 IV. A circular loop carrying current.

In which of the above cases will the magnetic field produced be like that of a bar magnet?

- (a) I (b) I and III
 (c) Only III (d) Only IV

Case/Passage - 3

The strength of the magnetic field produced by a current-carrying circular coil (or circular wire) depends on (i) Current flowing through the coil. (ii) Radius of the circular coil. (iii) Number of turns of wire in the circular coil.

58. A long horizontal power line is carrying a current of 100 A in the east-west direction. The direction of magnetic field at a point 1.0 m below it is
 (a) south to north
 (b) north to south
 (c) east to west
 (d) west to east
59. What type of curve we get, between magnetic field and distance along the axis of a current carrying circular coil?
 (a) Straight (b) Circular
 (c) Parabolic (d) None of these
60. If a current carrying straight conductor is placed in east-west direction, then the direction of the force experienced by the conductor due to earth's magnetic field is:
 (a) downward (b) upward
 (c) east-west (d) west east

Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
 (b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
 (c) If **Assertion** is **correct** but **Reason** is **incorrect**.
 (d) If **Assertion** is **incorrect** but **Reason** is **correct**.

61. **Assertion :** Magnetic field interacts with a moving charge and not with a stationary charge.

Reason : A moving charge produces a magnetic field.

62. **Assertion :** No net force acts on a rectangular coil carrying a steady current when suspended freely in a uniform magnetic field.

Reason : Force on coil in magnetic field is always non-zero.

63. **Assertion :** Force experienced by moving charge will be maximum if direction of velocity of charge is perpendicular to applied magnetic field.

Reason : Force on moving charge is independent of direction of applied magnetic field.

64. **Assertion :** There is no change in the energy of a charged particle moving in a magnetic field although a magnetic force is acting on it.

Reason : Work done by centripetal force is always zero.

65. **Assertion :** In a conductor, free electrons keep on moving but no magnetic force acts on a conductor in a magnetic field.

Reason: Force on free electrons due to magnetic field always acts perpendicular to its direction of motion.

66. **Assertion :** A proton moves horizontally towards a vertical long conductor having an upward electric current. It will deflect vertically downward.

Reason : Seeing the proton and the conductor from the side of the proton, the magnetic field at the site of the proton will be towards right. Hence the force $\vec{F} = q\vec{v} \times \vec{B}$ will deflect the proton vertically downward.

67. **Assertion :** A spark occurs between the poles of a switch when the switch is opened.

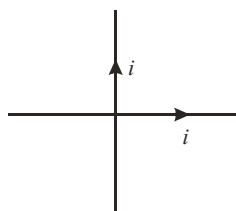
Reason : Current flowing in the conductor produces magnetic field.

Magnetic Effects of Electric Current

Match the Following

DIRECTIONS : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

- | 68. | Column I | Column II |
|-----|------------------------------------|---|
| | (A) An electric motor works on | (p) to a battery |
| | (B) An electric motor is also | (q) direct current |
| | (C) A commutator is used to | (r) reverse the direction of flow of current. |
| | (D) Commutator rings are connected | (s) known as DC MOTOR |
69. Equal currents i flow in two wires along x and y axis as shown. Match the following :



- | Column I | Column II |
|---------------------------------------|--------------------------------|
| (A) Magnetic field in first quadrant | (p) inwards |
| (B) Magnetic field in second quadrant | (q) outwards |
| (C) Magnetic field in third quadrant | (r) may be inwards or outwards |
| (D) Magnetic field in fourth quadrant | |

Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

70. A compass needle is a magnet.
71. Field lines are used to represent a
72. Field lines are shown closer together where the magnetic field is
73. A metallic wire carrying an electric current has associated with it a field.
74. The field lines about the wire consist of a series of concentric circles whose direction is given by the rule.

75. The magnetic lines of force are the lines drawn in a magnetic field along which a pole would move.
76. An electric current can be used for making temporary magnets known as
77. The unit of magnetic field is
78. The N-pole of a compass points to the pole of a permanent magnet.
79. The force that a magnetic field exerts on a current is always perpendicular to the and to the
80. In a magnetic field pointing away from you, an electron traveling to the right will experience a force in the direction.
81. Magnetic fields are produced by
82. You are looking into a solenoid, at its S-pole, along its axis. From your view point, the direction of the current in the solenoid is
83. Crowding the wires of a solenoid more closely together will the strength of the field inside it.
84. Magnetic field lines emerge from the pole of a solenoid or a permanent magnet.
85. You are looking down the axis of a solenoid, and the current from your position is clockwise. The end of the solenoid facing you is a pole.
86. A generator converts mechanical energy into energy. It works on the basis of
87. In our houses we receive AC electric power of with a frequency of
88. The frequency for A.C. (alternating current) in USA is
89. The armature in a motor rotates within a(n) field.
90. To produce DC, the output of a generator must be fed through a (n)
91. In any generator, the current in the armature is of the type.
92. In an AC generator, maximum number of lines of force pass through the coil when the angle between the plane of coil and lines of force is

True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

93. A magnetic field exists in the region surrounding a magnet, in which the force of the magnet can be detected.

94. The pattern of the magnetic field around a conductor due to an electric current flowing through it depends on the shape of the conductor.
95. A current-carrying conductor when placed in a magnetic field always experiences a force.
96. The direction of force on a current carrying conductor placed in a magnetic field can be reversed by reversing the direction of current flowing in the conductor.
97. The direction of force on a current carrying conductor placed in a magnetic field cannot be reversed by reversing the direction of magnetic field.
98. Two magnetic lines of force never intersect each other.
99. The field lines inside the infinite solenoid are in the form of parallel straight lines.
100. An electric generator works on the principle of electromagnetic induction.
101. In a DC electric motor a pair of split rings is used as commutator.
102. The magnitude of induced current can be increased by decreasing the speed of rotation of coil.

ANSWER KEY & SOLUTIONS

1. (d) Magnet attracts iron and steel
2. (c)
3. (c) If magnetic field lines are parallel and equidistant then it represents uniform magnetic field.
4. (c) 5. (c)
6. (a) Soft iron is the most suitable material for making the core of an electromagnet
7. (c) The direction of current changes in each half rotation in an electric motor.
8. (c) 9. (c) 10. (d) 11. (a) 12. (a)
13. (b) 14. (d) 15. (b) 16. (d) 17. (a)
18. (d) 19. (a) 20. (b) 21. (d) 22. (c)
23. (d) 24. (a) 25. (b) 26. (c) 27. (d)
28. (b) 29. (c) 30. (a) 31. (b) 32. (c)
33. (d) 34. (d) 35. (d) 36. (b)
37. (b) The induced current in coil is in clockwise direction when N pole of powerful magnet is moved to right.
38. (c) A long coil of finite length of wire carrying current consisting of closely packed loops is called solenoid whose magnetic field resembles that of a bar magnet.
39. (c) 40. (d) 41. (c) 42. (c) 43. (d)
44. (a) 45. (d)
46. (a) In loop shown current is anti-clockwise.
-
- So to induce an anti-clockwise current in A, flux going into A must be increased and by bringing A closer to B, we get an anti-clockwise current in A. This is in accordance with Lenz's law.
47. (d) We know, Lorentz Force
- $$F = q v B \sin \theta$$
- where θ is angle between the direction s of v and B .
- Case-I, If $\theta = 0^\circ$
- $$\therefore F = 0$$
- Case-II, If $\theta = 90^\circ$
- $$\therefore F = q v B \neq 0$$
48. (c) Electrical to Mechanical
49. (b) The bar will be magnetised as long as there is current in the circuit.
50. (a) A bar magnet
51. (d) Only II
52. (a) For a current of 0.8 A the magnetic field is 13 mT
53. (d) Fleming's right hand rule.
54. (d) Velocity and force change due to change in direction but magnitude of PE and KE of electron remain constant speed is constant.
55. (b) Magnetic field (B) is produced by moving charge.
56. (b) According to Fleming's left hand rule the direction of force on the wire will be down into the page.
57. (c) A long coil of finite length of wire carrying current consisting of closely packed loops is called solenoid whose magnetic field resembles that of a bar magnet.
58. (b) 59. (d) 60. (a)
61. (a) A moving charge experiences a force in magnetic field. It is because of interaction of two magnetic fields, one which is produced due to motion charge and other in which charge is moving.
62. (c) Force acting on each pair of the opposite sides of the coil are equal.
63. (c) Force on moving charge will be maximum if direction of velocity of charge is perpendicular to direction of magnetic field
64. (a) Magnetic force is always perpendicular to the direction of motion of charged particle, i.e., work done on the charge particle moving on a circular path in magnetic field is zero.
65. (c) In a conductor, the average velocity of electrons is zero. Hence no current flows through the conductor. Hence, no force acts on this conductor.

66. (a) 67. (b)
68. (A) \rightarrow q, (B) \rightarrow s, (C) \rightarrow r, (D) \rightarrow p
69. (A) \rightarrow r, (B) \rightarrow q, (C) \rightarrow r, (D) \rightarrow p
70. small 71. magnetic field
72. greater. 73. magnetic
74. right-hand 75. north magnetic
76. electromagnets 77. tesla
78. South 79. field, current
80. downward 81. currents
82. clockwise 83. increase
84. North 85. south
86. electrical, electromagnetic induction.
87. 220 V, 50 Hz. 88. 60 Hz
89. magnetic 90. commutator
91. A.C 92. 90 degree
93. True 94. True 95. False 96. True
97. False 98. True 99. True 100. True
101. True 102. False

Multiple Choice Questions (MCQs)

DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

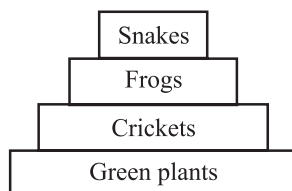
- An example of a producer in the aquatic food web would be:
 - Duckweed
 - Ducks
 - Fish
 - Insects
- Which one is recyclable waste?
 - Paper
 - Torn clothes
 - Metallic and plastic discards
 - All the above
- Which of the following does not form part of particulate matter?
 - Dust
 - Fly ash
 - Aerosols
 - Nitric oxide
- Which of the following are environment-friendly practices?
 - Carrying cloth-bags to put purchases in while shopping
 - Switching off unnecessary lights and fans
 - Walking to school instead of getting your mother to drop you on her scooter
 - All of the above
- Habitat together with functions of species constitute:
 - Trophic level
 - Boundary
 - Topography
 - Niche
- Plants are killed in winter by frost:
 - Because of dessication and mechanical damage to the tissue.
 - Because no photosynthesis take place at such a low temperature.
 - Because respiration ceases at such low temperature.
 - Because there is no transpiration.
- In order to maintain proper ecological balance
 - the existing forests would be cleared and new ones should be planted.
 - some quick growing annuals should be planted if a tree must be cut for other uses.
 - tree must be cut whenever necessary because the underground part performs the useful purpose.
 - a tree should be planted in place of one to be cut.
- It is said, the Tajmahal may be destroyed due to
 - Flood in Yamuna river
 - Decomposition of marble as a result of high temperature
 - Air pollutants released from oil refinery of Mathura
 - All the above
- In an ecosystem, the function of the producers is to
 - convert organic compounds into inorganic compounds.
 - trap solar energy and convert it into chemical energy.
 - utilize chemical energy.
 - release energy.
- Free services provided to humans by ecosystems include
 - control of atmospheric carbon dioxide concentration.
 - prevention of soil erosion.
 - filtering of pollutants from water and air.
 - all of the above
- Carcinogenic chemicals produced during recycling of plastics and polythene is/are
 - formaldehyde
 - polycyclic aromatic compounds
 - vinyl chloride
 - dioxins and furans

12. Organisms of a higher trophic level which feed on several types of organisms belonging to a lower trophic level constitute the
- (a) food web (b) ecological pyramid
(c) ecosystem (d) food chain
13. A decrease in the grass population will most immediately decrease the available energy for the
- (a) mouse (b) snake
(c) hawk (d) frog
14. Why do scientists think that human-induced global warming will be more harmful to plants and animals than were past, natural climate fluctuations ?
- (a) Because temperatures will change faster
(b) Because the temperature changes will be larger
(c) Because species now are less adaptable than species in the past
(d) Because ecosystems are now more complicated than they used to be
15. Each step in a food chain is called a
- (a) trophic level. (b) consumer level.
(c) food web. (d) producer.
16. As a biologist, if you become very interested in the study of the interaction of organisms with each other and the environment your subspeciality would be
- (a) Zoology (b) Ecology
(c) Botany (d) Herpetology
17. The last chain of food is
- (a) producers (b) decomposers
(c) parasites (d) none of these
18. Trophic levels are formed by –
- (a) only plants
(b) only animals
(c) only carnivores
(d) organisms linked in food chain
19. The part of earth comprising water is called an
- (a) atmosphere (b) hydrosphere
(c) lithosphere (d) none of the above
20. The maximum energy is stored at following tropical level in any ecosystem
- (a) Producers (b) Herbivores
(c) Carnivores (d) Top carnivores
21. Pyramids of energy are
- (a) always upright (b) always inverted
(c) mostly upright (d) mostly inverted
22. Individuals of any species at a place form
- (a) biotic community (b) ecosystem
(c) population (d) biome
23. City garbage can be used to produce
- (a) sewage sludge (b) useful articles
(c) biogas and manure (d) all of the above.
24. Acid rain is the downpour of
- (a) carbon dioxide in rain (b) dust in rain
(c) sulphur dioxide in rain (d) oxygen in rain
25. Select the most dangerous pollutant
- (a) CO (b) SO₂
(c) NO₂ (d) CO₂
26. Ozone layer is essential because it absorbs most of the
- (a) infrared radiations (b) heat
(c) solar radiation (d) ultraviolet-radiation
27. The biotic and abiotic components interacting with each other in a pond form
- (a) a community (b) a population
(c) an ecosystem (d) a biome
28. Environment consists of
- (a) land, air, water
(b) light, temperature and rainfall
(c) plants, animals and microbes
(d) All the above.
29. Carnivores represent
- (a) primary consumers
(b) secondary and tertiary consumers
(c) reducers
(d) zooplankton.
30. World environment day is celebrated on
- (a) 15th March (b) 15th April
(c) 4th May (d) 5th June
31. Flow of energy in an ecosystem is always
- (a) unidirectional (b) bidirectional
(c) multi-directional (d) no specific direction

Our Environment

32. Which of the following is a biodegradable waste?
 (a) Radioactive wastes (b) Aluminium cans
 (c) DDT (d) Cattle dung
33. For corrosion of metals, there should be
 (a) Exposed surface of metal
 (b) Moisture
 (c) Air
 (d) All these
34. Sun gives radiations in the form of
 (a) Infra-red radiation (b) Visible light
 (c) Ultra-violet (d) All these
35. In an ecosystem green plants are known as
 (a) primary consumers (b) secondary consumers
 (c) producers (d) tertiary consumers
36. Carbon monoxide is a pollutant because
 (a) It reacts with O_2
 (b) It inhibits glycolysis
 (c) Reacts with haemoglobin
 (d) Makes nervous system inactive
37. The presence of which of the following pollutants in the atmosphere has caused damage to Taj Mahal?
 (a) CO_2
 (b) SO_2
 (c) Pb particles
 (d) Radioactive disintegrations
38. Which of the following does not affect ozone layer?
 (a) Cl_2 (b) CH_3Cl
 (c) NO (d) $CFCl_3$
39. Which one is present in maximum number in an ecosystem?
 (a) Herbivores (b) Carnivores
 (c) Producers (d) Omnivores.
40. The percentage of solar radiation absorbed by all the green plants for the process of photosynthesis is about
 (a) 1% (b) 5%
 (c) 8% (d) 10%
41. Decrease in number of trees may cause
 (a) increase in rainfall
 (b) decrease in rainfall
 (c) increase in temperature
 (d) conservation of nutrients in soil
42. Rag pickers remove
 (a) plastic, polythene, paper and metal wastes
 (b) rags, cardboard, glass articles
 (c) both (a) and (b)
 (d) food articles.
43. As energy is passed from one trophic level to another, the amount of usable energy
 (a) increases
 (b) decreases
 (c) remains the same
 (d) energy is not passed from one trophic level to another
44. In the biosphere, which of the following is the ultimate source of energy?
 (a) Carbon (b) Water
 (c) Sunlight (d) Nitrogen
45. Sulphur dioxide affects
 (a) Haemoglobin of blood (b) Arteries
 (c) Alveoli of lungs (d) Nerves
46. Pyramid of energy in a forest ecosystem is
 (a) Always inverted
 (b) Always upright
 (c) Both upright and inverted depending on ecosystem
 (d) First upright then inverted
47. CO_2 absorbs some of the that radiates from the surface of earth to space
 (a) ozone (b) heat
 (c) ultraviolet light (d) smog
48. Human-caused changes to the nitrogen cycle are expected to result in
 (a) an increase in acid rain.
 (b) an increase in the loss of species from ecosystems.
 (c) higher concentrations of a greenhouse gas.
 (d) all of the above
49. The biological process by which carbon is returned to its reservoir is
 (a) photosynthesis (b) denitrification
 (c) carbon fixation (d) cellular respiration
50. Which of the following constitute a food-chain?
 (a) grass, wheat and mango
 (b) grass, goat and human
 (c) goat, cow and elephant
 (d) grass, fish and goat

51. As a black widow spider consumes her mate, what is the lowest trophic level she could be occupying
 (a) third (b) first
 (c) second (d) fourth
52. Among the most dangerous non-biodegradable waste is
 (a) cow-dung (b) plastic articles
 (c) garbage (d) radioactive waste
53. In an ecosystem, the 10% of energy is transferred from one trophic level to the next in the form of
 (a) heat energy (b) light energy
 (c) chemical energy (d) mechanical energy
54. Organisation involved in formulating programmes for protecting environment is:
 (a) WHO (b) UNDP
 (c) UNEP (d) UNICEF
55. In every food chain green plants are
 (a) decomposers (b) producers
 (c) consumers (d) None of the above.
56. The decomposers in an ecosystem
 (a) convert inorganic material, to simpler forms.
 (b) convert organic material to inorganic forms.
 (c) convert inorganic materials into organic compounds.
 (d) do not break-down organic compounds.
57. If a grasshopper is eaten by a frog, then the energy transfer will be from
 (a) producer to decomposer
 (b) producer to primary consumer
 (c) primary consumer to secondary consumer
 (d) secondary consumer to primary consumer
58. The diagram below shows a food pyramid.



Which level of the food pyramid contains consumers with the least biomass?

- (a) snakes (b) frogs
 (c) crickets (d) green plants

59. Which two of the following statements regarding food chains are **correct**?
 (i) Removal of 80% tigers resulted in increased growth of vegetation.
 (ii) Removal of most carnivores resulted in increased population of deer.
 (iii) Length of food chain is limited to 3 – 4 trophic levels due to energy loss.
 (iv) Length of food chain may vary from 2 – 3 trophic levels.
 (a) (i) and (iv) (b) (i) and (ii)
 (c) (ii) and (iii) (d) (iii) and (iv)
60. Match the terms given in column-I with their definition given in column-II and choose the correct option.
- | Column - I | Column - II |
|-----------------|--|
| A. Food chain | I. An organism that eats meat. |
| B. Food web | II. An organism that eats plants. |
| C. Heterotrophs | III. An organism that makes its food from light or chemical energy. |
| D. Autotrophs | IV. An organism that gets its energy by eating other organisms. |
| E. Carnivore | V. The sequence of organisms of who eats whom in a biological community. |
| F. Herbivore | VI. The network of all the interrelated food chains in a biological community. |
- (a) A – V; B – VI; C – IV; D – III; E – I; F – II
 (b) A – VI; B – IV; C – III; D – I; E – II; F – V
 (c) A – III; B – I; C – II; D – V; E – VI; F – IV
 (d) A – II; B – V; C – VI; D – IV; E – III; F – I

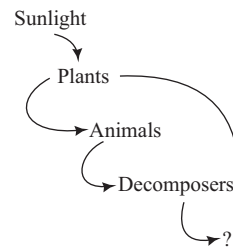
61. **Assertion:** Pond ecosystem is upright in the pyramid of number.

Reason: Phytoplanktons are maximum and secondary consumers are lesser in number.

- (a) Statement (A) and (B) both are correct.
 (b) Statement (A) is correct but (B) is incorrect.
 (c) Statement (A) and (B) both are incorrect.
 (d) Statement (A) is incorrect but (B) is correct.
62. Which of the following ecological pyramid is never inverted?
 (a) Pyramid of number in forest ecosystem
 (b) Pyramid of biomass in pond ecosystem
 (c) Pyramid of energy in parasitic food chain
 (d) Pyramid of biomass in parasitic food chain

Our Environment

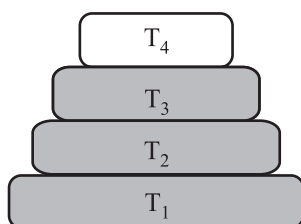
63. Match column - I with column - II and select the correct answer using the codes given below.
- | Column - I | Column - II |
|---------------|---------------|
| A. Phosphorus | I. Atmosphere |
| B. Carbon | II. Producers |
| C. Goat | III. Rock |
| D. Grasses | IV. T2 |
- (a) A – III; B – II; C – IV; D – I
 (b) A – III; B – I; C – IV; D – II
 (c) A – I; B – III; C – II; D – IV
 (d) A – II; B – III; C – IV; D – I
64. Which of the following pair is **incorrectly** matched ?
- (a) Autotrophs – Fungi
 (b) Primary consumers – Zooplankton
 (c) Secondary consumers – Fishes
 (d) Decomposers – Fungi
65. Abundance of coliform bacteria in a water body is indicative of pollution from
- (a) petroleum refinery (b) metal smelter
 (c) fertilizer factory (d) domestic sewage
66. Prolonged exposure to the fumes released by incomplete combustion of coal may cause death of a human because of
- (a) inhalation of unburnt carbon particles.
 (b) continuous exposure to high temperature.
 (c) increased level of carbon monoxide.
 (d) increased level of carbon dioxide.
67. Which among grass, goat, tiger and vulture in a food chain, will have the maximum concentration of harmful chemicals in its body due to contamination of pesticides in the soil?
- (a) Grass since it grows in the contaminated soil
 (b) Goat since it eats the grass
 (c) Tiger since it feeds on the goat which feeds on the grass
 (d) Vulture since it eats the tiger, which in turn eats the goat, which eats the grass
68. Which of the following is an result of biological magnification?
- (a) Top level predators may be harmed by toxic chemicals in environment.
 (b) Increase in carbon dioxide
 (c) The green-house effect will be most significance at the poles
 (d) Energy is lost at each trophic level of a food chain
69. What is the main reason for increase in temperature in a glass house?
- (a) Sunlight is completely absorbed by plants in the glass house
 (b) Radiation fails to escape from the glass house completely
 (c) Plant do not utilize sunlight in a glass house
 (d) Plants produce heat inside the glass house
70. Read the following statements carefully.
- (I) Energy transfer in the biotic world always proceeds from the autotrophs.
 (II) Energy flow is unidirectional.
 (III) Energy availability is maximum at the tertiary level.
 (IV) There is loss of energy from one trophic level to the other.
- Select the relevant statements for the forest ecosystem
- (a) I, II and IV (b) I, II and III
 (c) I, III and IV (d) II, III and IV
71. In a highly pesticide polluted pond. Which of the following aquatic organisms will have the maximum amount of pesticide per gram of body mass?
- (a) Lotus (b) Fishes
 (c) *Spirogyra* (d) Zooplanktons
72. DDT is non-biodegradable chemical when it enters food chain it gets accumulated in each trophic level. This phenomenon is called as -
- (a) Eutrophication
 (b) Chemical amplification
 (c) Biomagnification
 (d) Chemical magnification
73. The following diagram shows a simple version of energy flow through food web.



What happens to energy having the decomposers?

- (a) It is used by the decomposers itself.
 (b) It is reflected from the surface of earth.
 (c) It is lost as heat
 (d) It is used in natural biocomposting

74. Which of the following groups contain only biodegradable items ?
- Grass, flowers and leather
 - Grass, wood and plastic
 - Fruit-peels, cake and lime-juice
 - Cake, wood and grass
75. Which of the following constitute a food-chain?
- Grass, wheat and mango
 - Grass, goat and human
 - Goat, cow and elephant
 - Grass, fish and goat
76. Which of the following are environment-friendly practices?
- Carrying cloth-bags to put purchases in while shopping.
 - Switching off unnecessary lights and fans.
 - Walking to school instead of getting your mother to drop you on her scooter.
 - All of the above.
77. Organisms which synthesise carbohydrates from inorganic compounds using radiant energy are called
- decomposers
 - producers
 - herbivores
 - carnivores
78. Which of the statement is incorrect?
- All green plants and blue-green algae are producers.
 - Green plants get their food from organic compounds.
 - Producers prepare their own food from inorganic compounds.
 - Plants convert solar energy into chemical energy.
79. Which of the following limits the number of trophic levels in a food chain?
- Decrease in energy at higher trophic levels.
 - Deficient food supply.
 - Polluted air.
 - Water.
80. In the given diagram, the various trophic levels are shown in a pyramid. At which trophic level is maximum energy available?



- T_4
- T_2
- T_1
- T_3

81. What will happen if deer is missing in the food chain given below?

Grass \rightarrow Deer \rightarrow Tiger

- The population of tiger increases.
- The population of grass decreases.
- Tiger will start eating grass.
- The population of tiger decreases and the population of grass increases.

Case/Passage Based Questions

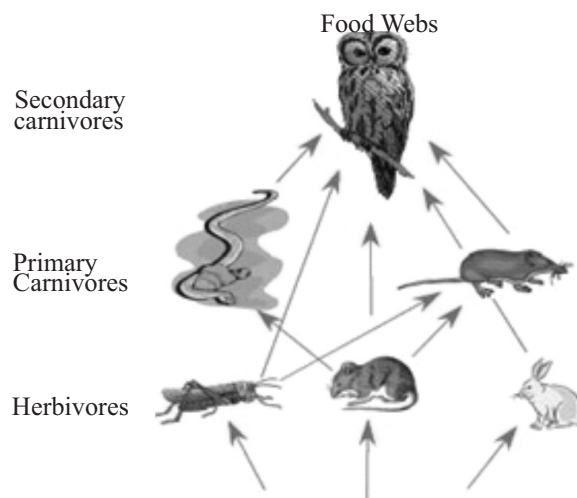
DIRECTIONS : Study the given case/passage and answer the following questions.

Case/Passage - 1

Food chains are very important for the survival of most species. When only one element is removed from the food chain it can result in extinction of a species in some cases. The foundation of the food chain consists of primary producers.

Primary producers, or autotrophs, can use either solar energy or chemical energy to create complex organic compounds, whereas species at higher trophic levels cannot and so must consume producers or other life that itself consumes producers. Because the sun's light is necessary for photosynthesis, most life could not exist if the sun disappeared. Even so, it has recently been discovered that there are some forms of life, chemotrophs, that appear to gain all their metabolic energy from chemosynthesis driven by hydrothermal vents, thus showing that some life may not require solar energy to thrive.

[From CBSE Question Bank-2021]



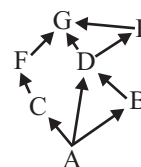
Our Environment

82. If 10,000 J solar energy falls on green plants in a terrestrial ecosystem, what percentage of solar energy will be converted into food energy?
- (a) 10,000 J
(b) 100 J
(c) 1000 J
(d) It will depend on the type of the terrestrial plant.
83. If Ravi is consuming curd/yogurt for lunch, which trophic level in a food chain he should be considered as occupying ?
- (a) First trophic level (b) Second trophic level
(c) Third trophic level (d) Fourth trophic level
84. The decomposers are not included in the food chain. The correct reason for the same is because decomposers:
- (a) Act at every trophic level of the food chain
(b) Do not breakdown organic compounds
(c) Convert organic material to inorganic forms
(d) Release enzymes outside their body to convert organic material to inorganic forms
85. Matter and energy are two fundamental inputs of an ecosystem. Movement of
- (a) Energy is bidirectional and matter is repeatedly circulating.
(b) Energy is repeatedly circulation and matter is unidirectional.
(c) Energy is unidirectional and matter is repeatedly circulating.
(d) Energy is multidirectional and matter is bidirectional.
86. Which of the following limits the number of trophic levels in a food chain?
- (a) Decrease in energy at higher trophic levels
(b) Less availability of food
(c) Polluted air
(d) Water
87. The mussel can be described as
- (a) Producer (b) Primary consumer
(c) Secondary consumer (d) decomposer
88. Which trophic level is incorrectly defined?
- (a) Carnivores – secondary or tertiary consumers
(b) Decomposers – microbial heterotrophs
(c) Herbivores – primary consumers
(d) Omnivores – molds, yeast and mushrooms
89. The given figure best represents:



- (a) Grassland food chain (b) Parasitic food chain
(c) Forest food chain (d) Aquatic food chain

90. Why do all food chains start with plants?
- (a) Because plants are easily grown
(b) Because plants are nutritious
(c) Because plants can produce its own energy
(d) Because plants do not require energy
91. In the food web, what two organisms are competing for food?



- (a) A and B (c) A and C
(b) D and F (d) B and D

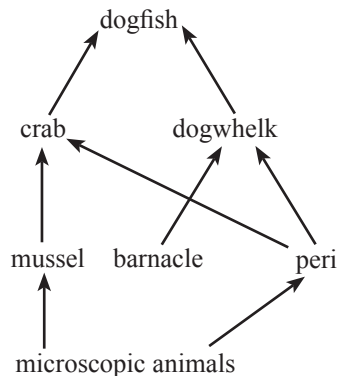
92. Consider the following statements concerning food chains:
- (i) Removal of 80% tigers from an area resulted in greatly increased growth of vegetation
(ii) Removal of most of the carnivores resulted in an increased population of herbivores.
(iii) The length of the food chains is generally limited to 3 – 4 trophic levels due to energy loss
(iv) The length of the food chains may vary from 2 to 8 trophic levels

Which two of the above statements are correct?

- (a) (i), (iv) (b) (i), (ii)
(c) (ii), (iii) (d) (iii), (iv)

Case/Passage - 2

The diagram below shows a food web from the sea shore



[From CBSE Question Bank-2021]

93. Which of the following group of organisms are not included in ecological food chain?

- (a) Carnivores (b) Saprophytes
(c) Herbivores (d) Predators

Case/Passage - 3

Biosphere is a global ecosystem composed of living organisms and abiotic factors from which they derive energy and nutrients. An ecosystem is defined as structural and functional unit of the biosphere comprising of living and non-living environment that interact by means of food chains and chemical cycles resulting in energy flow, biotic diversity and material cycling to form a stable, self-supporting system

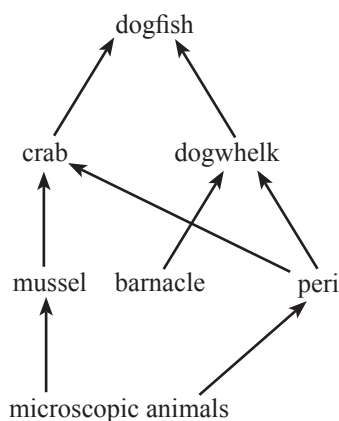
[From CBSE Question Bank-2021]



94. Which trophic level is incorrectly defined?

- (a) Carnivores – secondary or tertiary consumers
(b) Decomposers – microbial heterotrophs
(c) Herbivores – primary consumers
(d) Omnivores – molds, yeast and mushrooms

The diagram below shows a food web from the sea shore



95. The mussel can be described as

- (a) Producer
(b) Primary consumer
(c) Secondary consumer
(d) decomposer

96. The given figure best represents:



- (a) Grassland food chain (b) Parasitic food chain
(c) Forest food chain (d) Aquatic food chain

Assertion & Reason

DIRECTIONS: Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
(b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
(c) If **Assertion** is **correct** but **Reason** is **incorrect**.
(d) If **Assertion** is **incorrect** but **Reason** is **correct**.

97. **Assertion:** In an ecosystem, the function of producers is to convert organic compounds into inorganic compounds.
Reason: Green plants, the producers, transduce solar energy.

98. **Assertion:** Ecology is study of relationship between living organisms and their environment.

Reason: The biotic community and non-living environment of an area function together to form an ecosystem.

99. **Assertion:** Animals adopt different strategies to survive in hostile environment.

Reason: Praying mantis is green in colour which merges with plant foliage.

100. **Assertion:** Abiotic component of an ecosystem involves cycling of material and flow of energy.

Reason: This is essential to keep biotic factors alive.

101. **Assertion:** The crown fires are most destructive as they burn the tree top.

Reason: Due to crown fire, the temperature of that area may rise upto 700°C.

102. **Assertion:** Trophic levels are formed by only plants.

Reason: Food chains and webs are formed due to linked organisms on the basis of their nutrition.

Our Environment

- 103. Assertion:** A network of food chains existing together in an ecosystem is known as food web.
Reason: An animal like kite cannot be a part of a food web.
- 104. Assertion:** Supersonic jets cause pollution as they thin out ozone.
Reason: Depletion of ozone cause green house effect.
- 105. Assertion:** Tropical rain forests are disappearing fast from developing countries such as India.
Reason: No value is attached to these forests because these are poor in biodiversity.

Match the Following

DIRECTIONS : Each question contains options given in two columns which have to be matched. options (A, B, C, D) in column I have to be matched with options (p, q, r, s) in column II.

- | | | | |
|-------------|--|-------------------------|--|
| 106. | Column I | Column II | |
| | (A) Grass | (p) Primary carnivore | |
| | (B) Grasshopper | (q) Secondary carnivore | |
| | (C) Frog | (r) Producer | |
| | (D) Hawk | (s) Primary consumer | |
| 107. | Column A | Column B | |
| | (A) Third trophic level | (p) Ozone | |
| | (B) Accumulation of pesticides at higher trophic level | (q) CFCs | |
| | (C) Green plants | (r) Herbivore | |
| | (D) Flow of energy in an ecosystem | (s) Biomagnification | |
| | (E) Consists of 3 atoms of oxygen | (t) Decomposers | |
| | (F) Main cause of depletion of ozone layer | (u) Producers | |
| | (G) Second trophic level | (v) Unidirectional | |
| | (H) Break-down of dead organic compounds | (w) Carnivores | |
- 110.** The hierarchies within a food web are called levels.
- 111.** Without the in a food web many chemicals would not be recycled.
- 112.** Decrease in ozone in stratosphere is linked to release of synthetic chemicals like
- 113.** The make the energy from sunlight available to the rest of the ecosystem.
- 114.** The use of chemicals like CFCs has endangered the layer.
- 115.** The waste we generate may be or
- 116.** All the interacting organisms in an area together with the non-living constituents of the environment form an
- 117.** Gardens and crop fields are example of ecosystem.
- 118.** The decomposers comprising micro-organisms like and
- 119.** The energy flows from to the heterotrophs and decomposers.
- 120.** The flow of energy is always in food chains.
- 121.** The interlocking pattern of various food chains is referred as
- 122.** The disposal of the waste we generate is causing seriousproblems.
- 123.** The various populations of living organisms in an area together form community.
- 124.** All the ecosystems taken together in a geographical area form a bigger unit known as
- 125.** Hydrosphere, lithosphere and atmosphere along with living organism form
- 126.** The plants trap energy and convert it into energy.
- 127.** The energy available at each successive trophic level isof the previous level.
- 128.** Nitrogen-fixing bacteria live in nodules on the roots of plants.
- 129.** Nitrates and nitrites present in the soil are changed intoby micro-organisms.
- 130.** The increased nitrogen in rivers and lakes boosts the growth of and other phytoplankton at the cost of other aquatic organisms.

Fill in the Blanks

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

- 108.** Climate refers to the prevailing conditions.
- 109.** The total amount of per unit time produced in an ecosystem is called the gross primary productivity.

True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

131. Non-biodegradable articles are the ones which cannot be digested.
132. Ozone is formed in stratosphere by action of ultraviolet radiations on oxygen.
133. Earth is kept warm due to green house flux.
134. Biodegradable wastes should be separated and kept in blue colour bins for garbage collectors.
135. Blue green algae are producers.
136. The reproduction and other activities of living organisms are affected by the abiotic components of ecosystem.
137. Specific enzymes are needed for the break-down of a particular substance.
138. The materials like plastics are not acted upon by physical process.
139. Secondary consumers in a food chain are always carnivores.
140. Carbon dioxide causes depletion of ozone layer thereby allowing more UV-radiations to reach the earth.
141. Organisms can make organic compounds from inorganic substances by using the radiant energy of the sun in the presence of chlorophyll.
142. Ecology is the scientific study of the interaction of organisms with each other and the environment.
143. The abiotic components of the environment are the living factors.
144. The amount of usable energy remains constant as it is passed from one trophic level to another.
145. The energy within an ecosystem is fixed and never changes.
146. Human population and technology are having a destructive impact on the biosphere.

ANSWER KEY & SOLUTIONS

1. (a) 2. (d) 3. (d) 4. (d)
 5. (d) 6. (a) 7. (d) 8. (c)
 9. (b) 10. (d) 11. (d) 12. (a)
 13. (a) 14. (a) 15. (a) 16. (b)
 17. (b) 18. (d) 19. (b) 20. (a)
 21. (a) 22. (c) 23. (c) 24. (c)
 25. (a) 26. (d) 27. (c) 28. (d)
 29. (b) 30. (d) 31. (a) 32. (d)
 33. (d) 34. (d) 35. (c) 36. (c)
 37. (b) 38. (a) 39. (c) 40. (a)
 41. (c) 42. (c) 43. (b) 44. (c)
 45. (c) 46. (b) 47. (b) 48. (d)
 49. (d) 50. (b) 51. (d) 52. (d)
 53. (c) 54. (c) 55. (b) 56. (b)
 57. (c) 58. (c)
59. (c) Statement (ii) and (iii), regarding food chain, are correct.
60. (a)
61. (a) In the graphical representation pyramid of number shows the arrangement of number of individuals (population size) of different trophic levels in a food chain in an ecosystem.
- The pyramid of pond ecosystem is upright, because the base of this pyramid is occupied by the maximum number of phytoplanktons (autotrophs) and number of individuals which gradually decreases towards the primary and secondary consumers side respectively.
62. (c) 63. (b)
64. (a) Fungi is not autotrophic. Autotrophs are producers which make their own food through the process of photosynthesis.
65. (d) Domestic sewage contains faecal matter, having coliform bacteria *E. coli*. If a water body has coliform bacteria, it indicates pollution from domestic sewage.
66. (c) Incomplete combustion of coal produces carbon monoxide which is highly toxic and can cause death of human.
67. (d) The increase in concentration of harmful chemical substance like pesticides in the body of living organisms at each trophic level of a food chain is called biological magnification. The organism which occurs at the highest trophic level in the food chain will have the maximum concentration of harmful chemicals in its body. Since vulture occupies the top level as it eats the tiger, which in turn eats the goat, which eats the grass in the food chain. So, it will have the maximum concentration of harmful chemicals in its body.
68. (a) The accumulation of harmful chemicals with an increase in trophical level is known as biological magnification.
69. (b) This process can be seen in green house effect. Infra-red radiations fails to escape from glass house. As a result temperature rises in a glass house.
70. (a) 71. (b)
72. (c) The phenomenon of accumulation of non-biodegradable chemicals, e.g., DDT, in a food chain at each trophic level is called biomagnification.
73. (d) Decomposers are present at the final level in a food web. They breakdown dead and decaying organic matter (plants and animals) and convert into nutrients in the soil. They naturally increase the decomposition process and therefore used in natural biocomposting.
74. (c) and (d) The term biodegradable is used to describe materials that decompose through the actions of bacteria, fungi, and other living organisms. Temperature and sunlight may also play roles in the decomposition of biodegradable plastics and other substances.
- Example: human and animal excreta, plant products like rubber, paper, wood, leaves, cotton, and wool, dead remains of living organisms, kitchen waste, agricultural waste.
75. (b) Food chain is a linear sequence of organisms which starts from producer organism and ends with decomposer species. In the given group, grass is a producer, goat is a herbivore and human is top carnivore.

76. (d) Eco-friendly products promote green living that helps to conserve energy and also prevent air, water and noise pollution. They prove to be a boon for the environment and also prevent human health from deterioration.
77. (b) Organisms which synthesise carbohydrates from inorganic compounds using radiant energy are called producers e.g., all green plants. The producers make the energy from sunlight available to the rest of the ecosystem.
- Organisms which consume the food produced, either directly from producers or indirectly by feeding on other consumers are the consumers.
- Microorganisms which break-down the complex organic substances into simple inorganic substances used by plants are called decomposers.
- Carnivores and herbivores are types of consumers.
78. (b) Producers capture the solar energy and convert it into chemical energy. All green plants and certain blue-green algae which can produce food by photosynthesis come under this category and are called the producer.
79. (a) There is a loss of energy as we go from one trophic level to the next, this limits the number of trophic levels in a food-chain.
80. (c) 81. (d)
82. (b) 100 J
83. (c) Third Trophic level
84. (a) Act at every trophic level of the food chain
85. (c) Energy is unidirectional and matter is repeatedly circulating
86. (a) Decrease in energy at higher trophic level
87. (c) Secondary consumer
88. (d) Omnivores – molds, yeast and mushrooms
89. (a) Grassland food chain
90. (c) Because plants can produce its own energy
91. (d) B and D
92. (c) (ii), (iii)
93. (b) Saprophytes
94. (d) Omnivores – molds, yeast and mushrooms
95. (c) Secondary consumer
96. (a) Grassland food chain
97. (a) 98. (a)
99. (a) Animals blend with the surroundings or background to remain unnoticed for protection and aggression.
100. (a) 101. (a) 102. (d)
103. (c) In the food web, different food chains are interconnected. Each chain consists of different trophic levels *i.e.*, producers, consumers and detritivores. So, kite can also be a part of food web.
104. (a)
105. (c) Tropical rain forests have disappeared mainly due to man's activities. Due to over population in countries like India, rain forests are cut to make place available for man to live and build houses. To build buildings and factories man has incessantly cut down trees. This has caused the depletion of rain forests.
106. (A) → r (B) → s (C) → p (D) → q
107. (A) → (w), (B) → (s), (C) → (u), (D) → (v), (E) → (p), (F) → (q), (G) → (r), (H) → (t)
108. weather 109. organic material
110. trophic 111. decomposers
112. Chlorofluorocarbons 113. producers
114. ozone
115. biodegradable, non-biodegradable.
116. ecosystem 117. artificial
118. bacteria, fungi 119. autotrophs
120. unidirectional 121. food web
122. environmental 123. biotic
124. biome 125. biosphere
126. light, chemical 127. 10%
128. leguminous 129. ammonia
130. algae
131. True 132. True 133. True 134. False
135. True 136. True 137. True 138. False
139. True 140. False 141. True 142. True
143. False 144. False 145. False 146. True