

Solution
ALL KERALA COMMON MODEL EXAMINATION 2023-24
Class 12 – Biology
SET-1
Section A

1. (b) AIDS

Explanation: Regular use of contraceptive methods may cause some side effects such as abdominal pain, breast cancer, and nausea. AIDS is a viral disease caused by HIV and not a side effect of the contraceptive methods.

2. (b) Stable particles

Explanation : Filtration and sedimentation

3. (a) Presently the population is sufficient but is undergoing depletion.

Explanation: A vulnerable species is one which has been categorized by the International Union for Conservation of Nature as likely to become endangered unless the circumstances threatening its survival and reproduction improve. The population of Vulnerable species is sufficient but is undergoing depletion due to some factors so that it is facing the risk of extinction in the medium-term in the future.

4. (d) Saheli

Explanation: Saheli is an oral contraceptive for the female containing non-steroidal preparation with very few side effects and high contraceptive value. It is once a week pill.

5. (c) Biopiracy

Explanation: Exploiting biological resources of other nation without proper authorization from the country or people concerned without compensatory payment is called biopiracy.

6. (a) Rhodospirillum

Explanation: Rhodospirillum is a free-living anaerobic nitrogen-fixer. Rhizobium lives as symbiotic with leguminous plants and Azotobacter and Beijerinckia are symbiotic nitrogen fixers.

7. (b) Pleiotropy

Explanation: When a gene shows two unrelated phenotypic expressions the phenomenon is known as pleiotropy.

8. (c) A-electrodes, B-NH₃ + H₂ + H₂O +CH₂, C-cold water, D-vacuum, E-U trap

9. (b) Zooplankton

Explanation: Zooplankton are primary consumers in aquatic food chains that feed upon phytoplankton. Therefore, they are present at the second trophic level in a lake.

10. (b) Directional selection as giraffes with longer neck lengths are selected.

11. (c) Alexander Fleming

Explanation: The first natural antibiotic was discovered by Alexander Fleming is Penicillin in 1928.

12. (a) a - Vector DNA, b - Foreign DNA

13. (c) A is true but R is false.

Explanation: Natural methods work on the principle of avoiding chances of the

meeting of ovum and sperm, e.g. periodic abstinence, lactational amenorrhea. In barrier methods, ovum and sperm are prevented from physically meeting with help of a barrier, e.g. condoms, cervical caps, etc.

14. (c) A is true but R is false.

Explanation: The dough used for making food such as dosa and idli is fermented by bacterial. The puffed-up appearance of dough is due to the production of carbon dioxide gas.

15. (a) Both A and R are true and R is the correct explanation of A.

16. (b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

SECTION – B

17. a. cry IAc codes for toxic insecticidal protein as inactive protoxins in *Bacillus thuringiensis*. This toxin kills the cotton bollworm.

b. RNA interference is associated with the silencing of specific mRNA and is a method of cellular defense in eukaryotes. (1+1)

18. The presence of adenine bases from the poly-A tail which denotes the 3' end of the mRNA. (1+1)



19. a. A - Thalamus, B - Seed, C - Endocarp.

b. In apple, along with the ovary the thalamus also contributes to fruit formation. So, apple is called false fruit. (1+1)

20. A - Testosterone

B - Spermatogenesis

C - Sertoli cells

D – Spermiogenesis (4 x ½ = 2)

21. a. The organic farmers do not recommend eradication of insect pests as, without them, the beneficial predatory and parasitic insects, which depend upon pests as food or hosts would not be able to survive.

b. The ladybird beetles and dragonflies feed upon aphids and mosquitoes respectively. Hence, they act as biocontrol agents by helping farmers to get rid of them.

OR

Lactic Acid Bacteria (LAB) constitute a diverse group of microorganisms associated with plants, meat, and dairy. They are used in the manufacture of dairy products such as acidophilus milk, yogurt, buttermilk, and cheeses.

Role of LAB in human stomach:

Lactic acid bacteria have a number of well-established benefits. They can improve lactose digestion, play a role in preventing and treating diarrhea and act on the immune system, helping the body to resist and fight infection. It plays a very beneficial role in checking disease-causing microbes. (1+1)

SECTION – C

22. a. When the inducer is present, it combines with the repressor, coded by i gene. After reacting with repressor it inactivates the repressor. The repressor now cannot bind to the operator, hence the pathway for RA polymerase is open. The structural genes (z, y, a) are transcribed and the metabolism continues.
 b. Lactose is inducer. (2+1)

23. Haemophilia is a recessive X-linked genetic type disorder. Haemophilia is more common among males than females because males only inherit one X-chromosome. There are 46 chromosomes in humans Females have XX chromosome while males have X and Y chromosome. So, male offspring inherit X-chromosome from their mother and Y-chromosome from their father Males only have one X-chromosome and if the X-chromosome and this is the reason that males are suffering from haemophilia is the x- chromosome carries the mutation. While in females as they have so X chromosomes, and this is a recessive disorder. (3 x 1 =3)

24. Every individual in a population competes with other individuals for food, shelter and mate. Competition can occur between individuals of two different species or between individuals of the same species. (3 X 1 =3)

Intraspecific condition	Interspecific condition
Intraspecific condition involves the competition between individuals of the same species.	Interspecific condition involves the competition between the individuals belonging to two different species.
Intraspecific competition occurs for all the requirements.	Interspecific competition is for one or more requirements.
Intraspecific competition occurs for between individuals which exhibit similar adaptation.	Interspecific competition involves individuals with many types of adaptations.
Intraspecific competition is severe.	Interspecific competition is not severe

25. a. Hereditary disease can be corrected by gene therapy. It is a collection of methods that allows correction or replacement of defective genes. The first gene therapy was given in 1990 to a 4 years old girl with Adenosine Deaminase (ADA) deficiency. It is caused due to the deletion of gene for adenosine deaminase.

b. Disadvantages

- i. The patient does not completely recover from the disease.
- ii. It needs periodic injections of the enzyme to the patients. (2+1)

26. Species diversity decreases as we move towards the poles, because
- i. Temperature decreases and conditions become harsh.
 - ii. Both the amount and intensity of solar radiation decrease.
 - iii. Vegetation decreases.
 - iv. Less resources available to support species.

Speciation is generally a function of time and environmental stability, so if conditions are too harsh, it is difficult for the species to survive and adapt. This results in a decrease in biodiversity towards the poles. (3x1=3)

OR

The entire inhabited part of the earth and its atmosphere including the living components is called the biosphere. The three main constituents of the biosphere are:

- i. Hydrosphere: It includes all the water components of oceans, seas, rivers and other inland water.
- ii. Lithosphere: It comprises the solid components of the earth crust which support life.
- iii. Atmosphere: It is formed of gaseous cover which envelops the hydrosphere and lithosphere. (1+2)

27. Some organisms have organs which have similar function but differ anatomically. These are called analogous structures. They are the result of convergent evolution. Sweet potato tubers (underground, root modifications) and potato tubers (underground, stem modification) are both fleshy and serve the function of storage of food materials thus serving a similar function but are of different origin. (3 x 1 =3)

28. a. Causative agent of pneumonia is *Streptococcus pneumoniae* while the causative agent of common cold is rhinovirus. (1+1+1)

b. Following are the symptoms of pneumonia and common cold that differs from other:

Pneumonia	Common cold
Infects alveoli of lungs	Infects nose & respiratory passage instead of lungs
Fever, chills	Nasal congestion and discharge, sore throat
Lips /fingers may turn grey to black in severe case	Lips/fingers are not affected in case of common cold

SECTION -D

29. (a) It occurs in the ampullary-isthmic junction of the fallopian tube.

(b) Zona pellucida

(c) The sperms in the female genital tract undergo activation by the secretions of the genital tract. The activated sperms undergo acrosomal reactions releasing chemicals contained in the acrosome. These chemicals act on follicle cells, corona radiata, and digest zona pellucida. The plasma membrane of the sperm fuses with the plasma membrane of secondary oocyte so that only the sperm nucleus enters the oocyte.

OR

Penetration of sperm nucleus induces meiotic division II to form ovum (ootid) and a secondary polar body. The fusion of the sperm with the ovum, nucleus form zygote, a process called fertilisation. The zygote undergoes within hours after fertilisation

and the young embryo is slowly moving down the fallopian tube towards the uterus. At the end of the 4th day, the embryo reaches the uterus. It has 8-16 blastomeres and this solid mass of cells is known as morula (little mulberry) as it looks like a mulberry. The morula develops into a blastocyst (64-cells) with a cavity called blastocoel. It undergoes implantation. (1+1+2)

30.

- a. Gambusia fish.
- b. After sporozoite infection when RBC ruptures a toxic substance haemozoin is released which cause chilling and high fever.
- c.
 - i. liver cell of human
 - ii. RBC of human

OR

Dengue, Chikungunya, Vector – Aedes mosquitoes. (1+1+2)

31. Advantages of cross-pollination :

- i. Cross-pollination brings about genetic recombinations and introduces the variations in the offsprings. Some of these variations are more useful and help the individuals in the struggle for existence and adapt to the changing environment.
- ii. Plants are diseases resistant.
- iii. New and improved varieties of plants can be produced by artificial cross-pollination.
- iv. The yield is quite high and never falls below an average minimum.
- v. The seeds are much better, usually larger, healthy and more vigorous due to the phenomenon of hybrid vigour.

Disadvantages of cross-pollination :

- i. Cross-pollination is not a sure method as the chance factor is always there.
- ii. It is a less economical develop many devices to promote and effect this kind of pollination by various pollinating agencies.
- iii. Highly wasteful method as plants have to spend a large amount of energy to produce a large number of pollen grains,
- iv. Harmful or undesirable characters may be introduced in the individuals and may persist in the race permanently.
- v. The very good characters of the race are likely to be lost in the next generation.

(2 ½ + 2 ½)

OR

a. Role of stigma in pollen pistil interaction:

- i. It acts as a Landing platform for the pollen grain.
- ii. It enables continuous chemical interaction between pollen and pistil.
- iii. It rejects incompatible pollen grains.
- iv. It promotes the growth of pollen tube of the compatible pollen grain leading to fertilization.

b. Post-pollination events:

- i. Plants that shed pollen grains at a two-celled condition (a vegetative cell and a generative cell), the generative cell divides and forms the two male gametes during the growth of pollen tube in the stigma.
- ii. Plants that shed pollen in the three-celled condition, pollen tubes carry the two male gametes from the beginning.
- iii. Pollen tube, after reaching the ovary, enters the ovule through the micropyle and then enters one of the synergids through the filiform apparatus which guides the entry of pollen tube.
- iv. After entering one of the synergids, the pollen tube releases the two male gametes into the cytoplasm of the synergid.
- v. One of the male gametes moves towards the egg cell and fuses with its nucleus thus completing the syngamy. This results in the formation of a diploid cell, the zygote.
- vi. The other male gamete moves towards the two polar nuclei located in the central cell and fuses with them to produce a triploid primary endosperm nucleus (PEN). As this involves the fusion of three haploid nuclei, it is termed as triple fusion.
- vii. Since two types of fusions, syngamy and triple fusion take place in an embryo sac the phenomenon is termed double fertilization.
- viii. The central cell after triple fusion becomes the primary endosperm cell (PEC) and develops into the endosperm while the zygote develops into an embryo. (2+3)

32. a. Following is the contribution of above-mentioned scientists in deciphering the genetic code:

- i. **George Gamow** - He proposed that since there are only four bases and if they have to code for 20 amino acids then the code should be made up of three nucleotides.
- ii. **Har Gobind Khorana** - He developed a chemical method to synthesize RNA molecules with a defined combination of bases (homopolymers and copolymers).
- iii. **Marshall Nirenberg**- He developed cell-free systems for protein synthesis, which helped in deciphering the codes.
- iv. **Severo Ochoa**- He discovered an enzyme (polynucleotide phosphorylase) which helped in polymerizing RNA with defined sequences in a template-independent manner i.e. enzymatic synthesis of RNA.

b. Genetic code is a set of three different nucleotides taken at a time which code for a specific amino acid. It has a very important role in protein synthesis. For example:

- i. The codon is a triplet. A permutation combination of 4³ would generate 64 codons out of which 61 codes for amino acids while 3 does not code for any amino acid thus act as a stop codon.
- ii. The unambiguous and specific nature of codon (one codon codes for only one amino acid) helps in synthesizing specific protein with almost no error.

- iii. Some of the amino acids are coded by more than one codon (degeneracy nature of codon).
- iv. The genetic code is nearly universal which means one codon codes for the same amino acid in almost all species. (2+3)

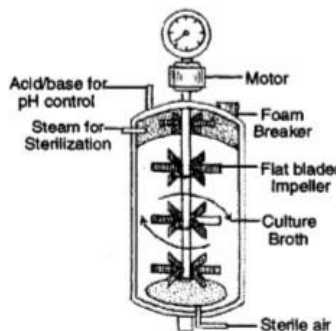
OR

During the process of translation in prokaryotes, amino acids are activated in the presence of ATP and they are linked to their aminoacylation of tRNA, as ribosome is the cellular factory for protein synthesis which exists as two subunits for the initiation

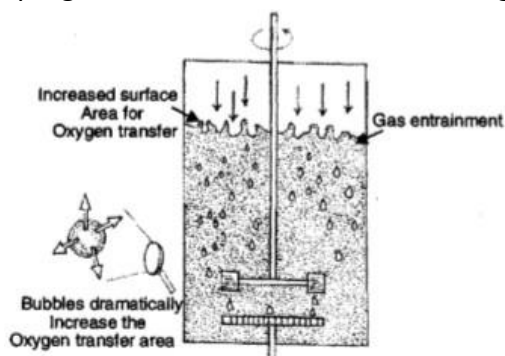
and this small subunit of ribosome binds to mRNA at the start codon that is AUG. Then it is recognised by initiator t-RNA, large subunit has two sites for subsequent amino acids to bind to each other with a peptide bond. Then it proceeds towards the elongation process where charged tRNAs sequentially bind to the appropriate codon in mRNA, by forming complementary base pairs with the tRNA anticodon. Then ribosome moves codon by codon along with the m-RNA, and amino acids are added one by one, at the end, a release factor binds to the stop codon which can be UAA / UAG / UGA for terminating the translation. (10 X ½ =5)

- 33. The bioreactors are large vessels in which raw materials in large volumes (100-1000 litres) are biologically converted into large quantities of specific products, using microbial, plant, animal or human cells or individual enzymes. A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions (temperature, pH, substrate, salts, vitamins, oxygen).

- i. Sample stirred-tank bioreactor



- ii. Sparged stirred-tank bioreactor through which sterile air bubbles are sparged.



One of the most commonly used bioreactors is of stirring type.

A stirred tank reactor is usually cylindrical or with a curved base to facilitate the mixing of the reactor contents. The stirrer facilitates even mixing and oxygen availability throughout the bioreactor. Alternatively, air can be bubbled through the reactor. The bioreactor has an agitator system, an oxygen delivery system, a foam control system, a temperature control system, pH control system, sampling ports so that small volumes of the culture can be withdrawn periodically. (1+2+1+1)

OR

a. Polymerase chain reaction or PCR consists of the following three steps:

Denaturation- The two DNA strands of template DNA separate from each other when heated to 92°C.

Annealing- The primers anneal to the 3' end of single strands of DNA.

Extension- The primers are extended by DNA polymerase by the addition of nucleotides to form complete strands of DNA.

DNA polymerases are enzymes responsible for assembling nucleotides to create new DNA molecules. During DNA replication, the polymerase reads the existing DNA strands and semi-conservatively creates new complementary DNA strands.

b. Application of PCR in the field of:

i. Biotechnology

Multiple copies of the gene of interest can be made through In vitro process gene amplification

ii. Diagnostics

Early detection of disease at a time when the symptoms are not yet visible can detect mutations in genes in suspected cancer patients a powerful technique to identify many other genetic disorders. (3+2)