

Solution
ALL KERALA COMMON MODEL EXAMINATION 2023-24
Class 12 – Biology
SET-3
Section A

1. (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.

2. (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.

3. (c) Biopiracy

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

4. (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.

5. (b) Pleiotropy

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

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

7. (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.

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

9. (c) Alexander Fleming

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

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

11. (b) Copper-T

Explanation: Copper-T is a contraceptive method under intrauterine contraceptive device which prevents implantation and reduces the motility of sperm. It is implanted inside the uterus and works up to five years. So, it is the best method for spacing between two children.

12. (a) Be rapidly pumped back from the sedimentation tank to the aeration tank.

Explanation: A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum. The remaining major part of the sludge is pumped

into large tanks called anaerobic sludge digesters.

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



18. 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)

19. A - Testosterone

B - Spermatogenesis

C - Sertoli cells

D – Spermiogenesis

(4 x ½ =2)

20. 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)

21. When the toxin is present in an inactive form, it doesn't harm the organism which produces the toxin. For example; *B. thuringiensis* produces an insecticidal toxin that does not kill this bacterium. This toxin becomes active when it enters the alkaline pH of the gut of an insect and the insects killed in the process. (1+1)

SECTION – C

22. 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)

23. 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

24. In enzyme replacement therapy, the patient is given functional ADA (Adenosine Deaminase) by injection. 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.

Disadvantages

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

25. 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. (3 x 1 = 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)

26. 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)

27. a. Causative agent of pneumonia is *Streptococcus pneumoniae* while the causative agent of common cold is rhinovirus. (6X ½ =3)

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

Pneumonia	Common cold
Infected alveoli of lungs	Infected 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

28.

a. He feels energetic because nicotine raises blood pressure and increases heart beat. This is not good for his health.

b. CO binds to hemoglobin and reduces concentration of oxygen

c. Any one effect cancer of lung, throat, emphysema. (3x1=3)

SECTION -D

29.

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)

30. (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)

31. 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)

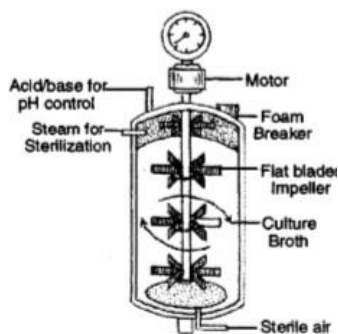
OR

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

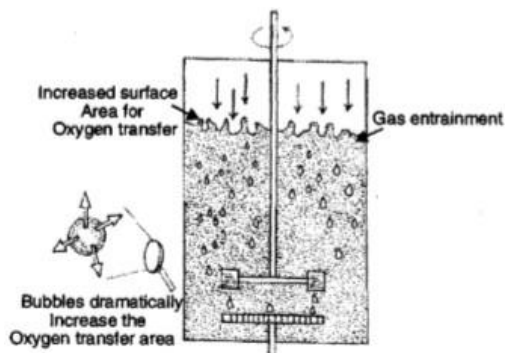
and this small subunit of ribosome binds to mRNA at the start codon that is AUG. Then it is recognised by initiator t-RNA, large subunit has two sites for subsequent amino acids to bind to each other with a peptide bond. Then it proceeds towards the elongation process where charged tRNAs sequentially 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)

32. 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)

33. The similarity between geitonogamy and xenogamy is that both pollinations take place by pollinating agencies, pollinating agencies transfer the pollen from anther of one flower to the receptive stigma of another plant in case of xenogamy and another flower of the same plant in geitonogamy.

The difference between the two is that in geitonogamy the pollen and stigma are genetically similar because they both belong to the same plant but in xenogamy, they are genetically different as they belong to different plants of same species. Geitonogamy is functionally cross-pollination but genetically self-pollination.

As cleistogamous flowers are the flowers which remain closed and never open, so in these flowers anther and stigma are in close association. So these flowers do not require pollinating agencies for pollination and thus produce assured seed set even in absence of pollinating agencies. (1+1+3)

OR

i. The three methods of pollen transfer in plants are

Autogamy

Geitonogamy

Xenogamy

ii. a. Water lily: achieves successful pollination by insects/wind.

b. Vallisneria: Female flowers on long stalks reach water surface; male flowers or pollen released on water and carried by water current to female flowers to achieve pollination.

iii. Genetic: Self-incompatibility/prevents self-pollen (same flower or other flowers of same plant) from fertilizing the ovules by inhibiting pollen germination, pollen tube growth in pistil. (1+2+1+1)