**CBSE Sample Paper -10**
**Class 12 Biology**
**(Question)**

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**General Instructions:**

(i) All questions are compulsory.

(ii) This question paper consists of four Sections A, B, C and D. Section A contains 5 questions of one mark each, Section B is of 5 questions of two marks each, Section C is of 12 questions of three marks each and 1 question of four mark and Section D is of 3 questions of five marks each.

(iii) There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weightage. A student has to attempt only one of the alternatives in such questions.

(iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

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## Section A

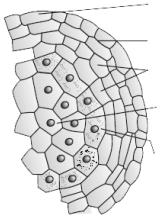
1. What is phenotype?
2. What is totipotency?
3. If the sequence of nitrogen bases of the coding strand of DNA in a transcription unit is:

   5' - A T G A A T G - 3'.

4. Explain the term emasculation.
5. What is Adaptive radiation?

## Section B

6. How do sweet potato and potato differ in terms of evolution?
7. Identify the diagram and label the parts.



8. What are the barriers that comprise Innate Immunity?
9. Which microbe converts milk to curd?
10. Give some examples of diseases and their insect vectors.

**OR**

What are the different methods of breeding?

## Section C

11. What is the fate of the product of fertilization in humans?

12. How was the genetic code elucidated?
13. How was the theory of chemical evolution proved?
14. What are the different levels at which gene regulation can be achieved?
15. What are the primary lymphoid organs?
16. Explain some methods of Molecular Diagnosis.
17. Explain with examples, how do the plant animal interactions involve co-evolution.
18. Cancer is one of the most dreaded diseases of human beings and is a major cause of death all over the globe. Explain the
    i. Causes of cancer
    ii. Techniques of detection and diagnosis
    iii. Treatment and cure.
19. The rate of decomposition of detritus is affected by the abiotic factors like availability of oxygen, pH of the soil substratum, temperature etc. Discuss.
20. What are the different methods of breeding?
21. When is insulin fully functional?
22. You have identified a useful gene in a bacteria. Make a flow chart of the steps that you would follow to transfer this gene to a plant.
23. **A Couple young quarreled with the hospital authority on suspicion that their child had been exchanged after birth. The couple based their argument on the fact that their child is Oblood group whereas they are A and B blood groups respectively. The doctor smiled and explained.**
    a) What values of the doctor is reflected here?
    b) How can the child be O blood group as explained by the doctor?
    c) Which test method can be considered authentic to identify the biological parents of the child?
    d) Name the other blood group(s) which the child could have inherited.

**Section D**

24. a) What may be the probable reasons for the greater biodiversity of tropics?
    b) Explain the importance of species diversity in reference to the "rivet popper hypothesis".

**OR**

Give the journey of sperm formation with diagram. What are the hormones involved?

25. In a medium where E.coli was growing, lactose was added ,which induced the lac operon. Then why does the lac operon shut down after some time after the addition of lactose in the medium. Explain.

**OR**

Answer the following:

a) Represent schematically the independent assortment of chromosomes..

b) What are the requisites for a molecule to be a genetic material?

26. How do you represent the food and energy relationships between organisms?

**OR**

What are biogeochemical cycles? Explain the carbon cycle.

**CBSE Sample Paper -10**

**Class 12 Biology**

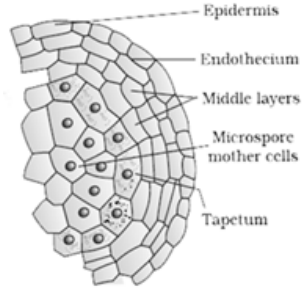
**Answers**

**Section A**

1. The external appearance of an organism is called phenotype.
2. Capacity of generating a whole plant from cell/explants is called totipotency.
3. 5' – AUGAAUG – 3'.
4. If the female parent bears bisexual flowers, removal of anthers from the flower bud before the anther dehisces using a pair of forceps is necessary. This step is referred to as emasculation.
5. This process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation

**Section B**

6. Sweet potato is a root modification and potato is a stem modification.
   Different structures evolving for same function are considered analogous structures and are examples of convergent evolution.
7. Structure of microsporangium showing wall layers




8. Innate immunity consists of four types of barriers. These are:
   i. Physical barriers.
   ii. Physiological barriers.
   iii. Cellular barriers.
   iv. Cytokine barriers.
9. Micro-organisms such as *Lactobacillus* and others commonly called **lactic acid bacteria (LAB)** grow in milk and convert it to curd. During growth, the LAB produce acids that

coagulate andpartially digest the milk proteins. A small amount of curd added to the fresh milk as inoculum or starter contain millions of LAB, which at suitable temperatures multiply, thus converting milk to curd, which also improves its nutritional quality by increasing vitamin B12.

10. Malaria by female Anopheles mosquito

Dengue or Chikungunya by Aedes mosquito.

**OR**

Inbreeding, out breeding, out crossing, cross breeding and interspecific hybridization.

## Section C

11. The product of fertilization is the zygote.

The mitotic division starts as the zygote moves through the isthmus of the oviduct called cleavage towards the uterus and forms 2, 4, 8, 16 daughter cells called blastomeres. The embryo with 8 to 16 blastomeres is called a morula. The morula continues to divide and transforms into blastocyst as it moves further into the uterus. The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass. The trophoblast layer then gets attached to the endometrium and the inner cell mass gets differentiated as the embryo. After attachment, the uterine cells divide rapidly and cover the blastocyst. As a result, the blastocyst becomes embedded in the endometrium of the uterus. This is called implantation and it leads to pregnancy.

12. A genetic code is that which directs the sequence of amino acids during synthesis of proteins. The chemical method developed by HarGobind Khorana was instrumental in synthesizing RNA molecules with defined combinations of bases (homopolymers and copolymers). Marshall Nirenberg's cell-free system for protein synthesis finally helped the code to be deciphered. Severo Ochoa enzyme (polynucleotide phosphorylase) was also helpful in polymerizing RNA with defined sequences in a template independent manner (enzymatic synthesis of RNA).

The salient features of genetic code are as follows:

(i) The codon is triplet. 61 codons code for amino acids and 3 codons do not code for any amino acids, hence they function as stop codons.

(ii) One codon codes for only one amino acid, hence, it is unambiguous and specific.

(iii) Some amino acids are coded by more than one codon, hence the code is degenerate.

(iv) The codon is read in mRNA in a contiguous fashion. There are no punctuations.

(v) The code is nearly universal: for example, from bacteria to human UUU would code for Phenylalanine (phe). Some exceptions to this rule have been found in mitochondrial codons, and in some protozoans.

(vi) AUG has dual functions. It codes for Methionine (met), and it also act as initiator codon.

13. Oparin and Haldane proposed that the first form of life could have come from pre-existing non-living organic molecules (e.g. RNA, protein, etc.) and that formation of life was preceded by chemical evolution, i.e., formation of diverse organic molecules from inorganic constituents. The conditions on earth were – high temperature, volcanic storms, reducing atmosphere containing CH4, NH3, etc.

    Miller created similar conditions in a laboratory scale. He created electric discharge in a closed flask containing CH4, H2, NH3 and water vapour at 8000C. He observed formation of amino acids. Insimilar experiments others observed, formation of sugars, nitrogen bases, pigment and fats. Analysis of meteorite content also revealed similar compounds indicating that similar processes areoccurring elsewhere in space.

14. Gene regulation could be exerted at

    (i) transcriptional level (formation of primary transcript),

    (ii) processing level (regulation of splicing),

    (iii) transport of mRNA from nucleus to the cytoplasm,

    (iv) translational level.

15. The primary lymphoid organs are **bone marrow** and **thymus** where immature lymphocytes differentiate into antigen-sensitive lymphocytes.

    - The bone marrow is the main lymphoid organ where all blood cells including lymphocytes are produced.
    - The thymus is a lobed organ located near the heart and beneath the breastbone. The thymus is quite large at the time of birth but keeps reducing in size with age and by the time puberty is attained it reduces to a very small size.

- Both bone-marrow and thymus provide micro-environments for the development and maturation of T-lymphocytes.

16. Recombinant DNA technology, Polymerase Chain Reaction (PCR) and Enzyme Linked Immuno-sorbent Assay (ELISA) are some of the techniques in Molecular Diagnosis.

    Presence of a pathogen (bacteria, viruses, etc.) is normally suspected only when the pathogen has produced a disease symptom. By this time the concentration of pathogen is already very high in the body. However, very low concentration of a bacteria or virus (at a time when the symptoms of the disease are not yet visible) can be detected by amplification of their nucleic acid by PCR. PCR is now routinely used to detect HIV in suspected AIDS patients. It is being used to detect mutations in genes in suspected cancer patients too. It is a powerful techqnique to identify many other genetic disorders.A single stranded DNA or RNA, tagged with a radioactive molecule (probe) is allowed to hybridise to its complementary DNA in a clone of cells followed by using autoradiography. The clone having the mutated gene will hence not appear on the photographic film, because the probe will not have complimentarity with the mutated gene. ELISA is based on the principle of antigen-antibody interaction. Infection by pathogen can be detected by the presence of antigens (proteins, glycoproteins, etc.) or by detecting the antibodies synthesised against the pathogen.

17. Plant-animal interactions often involve co-evolution of the mutualists, that is, the evolutions of the flower and its pollinator species are tightly linked with one another. In many species of fig trees, there is a tight one-to-one relationship with the pollinator species of wasp. It means that a given fig species can be pollinated only by its 'partner' wasp species and no other species. The female wasp uses the fruit not only as an oviposition (egg-laying) site but uses the developing seeds within the fruit for nourishing its larvae. The wasp pollinates the fig inflorescence while searching for suitable egg-laying sites. In return for the favour of pollination the fig offers the wasp some of its developing seeds, as food for the developing wasp larvae.

    The Mediterranean orchid Ophrys employs 'sexual deceit' to get pollination done by a species of bee. One petal of its flower bears an uncanny resemblance to the female of the bee in size, colour and markings. The male bee is attracted to what it perceives as a female, 'pseudocopulates' with the flower, and during that process is dusted with pollen from the

flower. When this same bee 'pseudocopulates' with another flower, it transfers pollen to it and thus, pollinates the flower. If the female bee's colour patterns change even slightly for any reason during evolution, pollination success will be reduced unless the orchid flower co-evolves to maintain the resemblance of its petal to the female bee.

18. In our body, cell growth and differentiation is highly controlled and regulated. In cancer cells, there is breakdown of these regulatory mechanisms. Normal cells show a property called contact inhibition by virtue of which contact with other cells inhibits their uncontrolled growth. Cancer cells appear to have lost this property. As a result of this, cancerous cells just continue to divide giving rise to masses of cells called tumors. Tumors are of two types: benign and malignant. Benign tumors normally remain confined to their original location and do not spread to other parts of the body and cause little damage. The malignant tumors, on the other hand are a mass of proliferating cells called neoplastic or tumor cells. These cells grow very rapidly, invading and damaging the surrounding normal tissues. As these cells actively divide and grow they also starve the normal cells by competing for vital nutrients.

**Causes of Cancer-**

- Ionizing radiations like X-rays and gamma rays and non-ionizing radiations.
- The chemical carcinogens present in tobacco smoke have been identified as a major cause of lung cancer.
- Cancer causing viruses called oncogenic viruses have genes called viral oncogenes.

**Treatment and cure-**

- Surgery.
- Radiation therapy In radiotherapy, tumor cells are irradiated lethally, taking proper care of the normal tissues surrounding the tumor mass.
- Immunotherapy.
- Several chemotherapeutic drugs are used to kill cancerous cells. Some of these are specific for particular tumors. Majority of drugs have side effects like hair loss, anemia, etc.

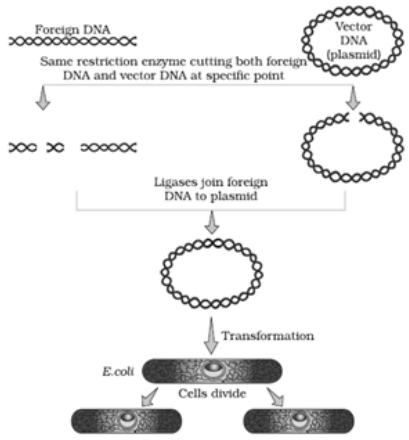
19. Decomposition is largely an oxygen-requiring process. The rate of decomposition is controlled by chemical composition of detritus and climatic factors. In a particular climatic condition, decomposition rate is slower if detritus is rich in lignin and chitin, and quicker, if

detritus is rich in nitrogen and water-soluble substances like sugars. Temperature and soil moisture are the most important climatic factors that regulate decomposition through their effects on the activities of soil microbes. Warm and moist environment favor decomposition whereas low temperature inhibit decomposition resulting in buildup of organic materials.

20. The different methods of breeding are:
    a. Inbreeding,
    b. Out breeding,
    c. Out crossing,
    d. Cross breeding and
    e. Interspecific hybridization.

21. Insulin is synthesised as a pro-hormone (like a pro-enzyme, the pro-hormone also needs to be processed before it becomes a fully mature and functional hormone) which contains an extra stretch called the C peptide. This C peptide is not present in the mature insulin and is removed during maturation into insulin.

22.

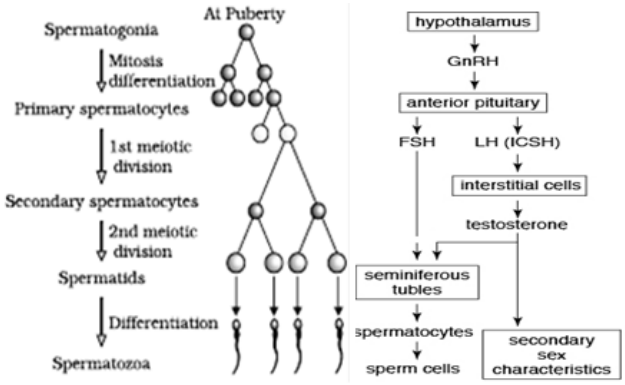



23.
    a. The doctor was assertive, patient and pragmatic.
    b. Possible if the parents are hererozygotes, i.e. Ai x Bi. If the child receives i from both the parents, it becomes ii, and expresses O blood group.
    c. DNA finger printing.
    d. A or B or AB.

## Section D

24.
    a) Reasons for the greater biodiversity of tropics

- Speciation is generally a function of time, unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification,
- Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity and
- There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity



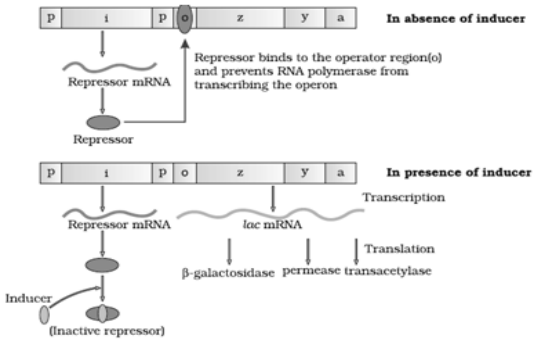

b) The 'rivet popper hypothesis was used by Paul Ehrlich. In an airplane (ecosystem) all parts are joined together using thousands of rivets (species). If every passenger travelling in it starts popping a rivet to take home (causing a species to become extinct), it may not affect flight safety (proper functioning of the ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak over a period of time. Furthermore, which rivet is removed may also be critical. Loss of rivets on the wings (key species that drive major ecosystem functions) is obviously a more serious threat to flight safety than loss of a few rivets on the seats or windows inside the plane.

**OR**

In testis, the immature male germ cells (spermatogonia) produce sperms by spermatogenesis that begins at puberty. The spermatogonia (sing. spermatogonium) present on the inside wall of seminiferous tubules multiply by mitotic division and increase in numbers. Each spermatogonium is diploid and contains 46 chromosomes. Some of the spermatogonia called primary spermatocytes periodically undergo meiosis. A primary spermatocyte completes the first meiotic division (reduction division) leading to formation

of two equal, haploid cells called secondary spermatocytes, which have only 23 chromosomes each. The secondary spermatocytes undergo the second meiotic division to produce four equal, haploid spermatids. The spermatids are transformed into spermatozoa (sperms) by the process called spermiogenesis. After spermiogenesis, sperm heads become embedded in the Sertoli cells, and are finally released from the seminiferous tubules by the process called spermiation.

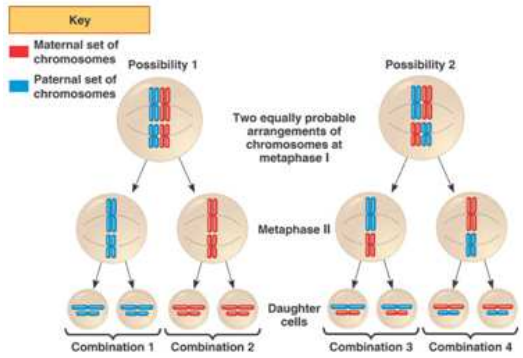
25. The lac operon consists of one regulatory gene (the i gene) and three structural genes (z, y, and a). The i gene codes for the repressor of the lac operon. The z gene codes for beta-galactosidase (β-gal), which is primarily responsible for the hydrolysis of the disaccharide, lactose into its monomeric units, galactose and glucose. The y gene codes for permease, which increases permeability of the cell to β-galactosides. The a gene encodes a transacetylase. Hence, all the three gene products in lac operon are required for metabolism of lactose.




Lactose is the substrate for the enzyme beta-galactosidase and it regulates switching on and off of the operon. Hence, it is termed as inducer. In the absence of a preferred carbon source such as glucose, if lactose is provided in the growth medium of the bacteria, the lactose is transported into the cells through the action of permease The lactose then induces the operon in the following manner. The repressor of the operon is synthesised (all-the-time – constitutively) from the i gene. The repressor protein binds to the operator region of the operon and prevents RNA polymerase from transcribing the operon. In the presence of an inducer, such as lactose or allolactose, the repressor is inactivated by interaction with the inducer. This allows RNA polymerase access to the promoter and transcription proceeds.. Essentially, regulation of lac operon can also be visualised as regulation of enzyme synthesis by its substrate. Glucose or galactose cannot act as inducers for lac operon. Regulation of lac operon by repressor is referred to as negative regulation.

**OR**

a) Representation of the independent assortment of chromosomes..




b) A molecule that can act as a genetic material must fulfill the following criteria:

i. It should be able to generate its replica (Replication).

ii. It should chemically and structurally be stable.

iii. It should provide the scope for slow changes (mutation) that are required for evolution.

iv. It should be able to express itself in the form of 'Mendelian Characters'.

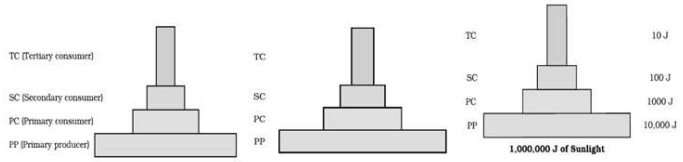
26. The food or energy relationship is expressed in terms of number, biomass or energy. The base of each pyramid represents the producers or the first trophic level while the apex represents tertiary or top level consumer. The three ecological pyramids that are usually studied are (a) pyramid of number; (b) pyramid of biomass and (c) pyramid of energy

Any calculations of energy content, biomass, or numbers has to include all organisms at that trophic level. No generalisations we make will be true if we take only a few individuals at any trophic level into account. Also a given organism may occupy more than one trophic level simultaneously. One must remember that the trophic level represents a functional level, not a species as such. A given species may occupy more than one trophic level in the same ecosystem at the same time; for example, a sparrow is a primary consumer when it eats seeds, fruits, peas, and a secondary consumer when it eats insects and worms.

In most ecosystems, all the pyramids, of number, of energy and biomass are upright, i.e., producers are more in number and biomass than the herbivores, and herbivores are more in number and biomass than the carnivores. Also energy at a lower trophic level is always more than at a higher level.

The pyramid of biomass in sea is also generally inverted because the biomass of fishes far exceeds that of phytoplankton.

Pyramid of energy is always upright, can never be inverted, because when energy flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step. Each bar in the energypyramid indicates the amount of energy present at each trophic level in a given time or annually per unit area there are certain limitations of ecological pyramids such as it does not take into account the same species belonging to two or more trophic levels. It assumes a simple food chain, something that almost never exists in nature; it does not accommodate a food web. Moreover, saprophytes are not given any place in ecological pyramids even though they play a vital role in the ecosystem.




Pyramid of number Pyramid of biomass Pyramid of energy

**OR**

The movement of nutrient elements through the various components of an ecosystem is called **nutrient cycling** or **biogeochemical** cycles.

Nutrient cycles are of two types: (a) **gaseous** and (b) **sedimentary.**

Carbon cycling occurs through atmosphere, ocean and through living and dead organisms.

A considerable amount of carbon returns to the atmosphere as CO2 through respiratory activities of theproducers and consumers. Decomposers also contribute substantially to CO2 pool by their processing of waste materials and dead organic matter of land or oceans. Some amount of the fixed carbon is lost to sediments and removed from circulation. Burning of wood, forest fire and combustion of organic matter, fossil fuel, volcanic activity are additional sources for releasing CO2 in the atmosphere.