CBSE Sample Paper -01
Class 12 Biology
(Questions)

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.

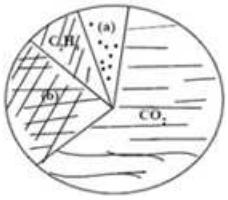
(iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

Section A

1. A human zygote has XXY sex chromosomes along with 22 pairs of autosomes. What sex will the individual be?
2. Define linkage.
3. What is Brood Parasitism?
4. What is the Ploidy of PEN?
5. What were the primitive earth conditions created by Miller?

Section B

6. Complete the steps for sepration and isolation of dna fragments.
   a. DNA fragment separates in matrix of.....
   b. DNA fragments are stained with.....
   c. DNA fragments are viewed under.....
   d. Fragments are extruded from gel piece. This is called.....
7. The figure given below shows relative contributions of various green-house gases to the total global warming.



(i) Name the gases (a) and (b)

(ii) Explain how increase in green-house gases in the atmosphere leads to melting of ice caps.

8. Give an account of surgical sterilization methods in males and females.
9. What are biological response modifiers?
10. Which microbe converts milk to curd?

OR

What are histones?

Section C

11. What are the primary lymphoid organs?
12. Elaborate the asexual mode of reproduction in the following:
    a) Chlamydomonas
    b) Hydra
    c) yeast
13. What are the symptoms of the disease which is confirmed by a Widal test?

OR

What are the complexities involved in transcription of eukaryotic DNA?

14. What are the major causes of cancer?
15. How can DNA fragments be separated on basis of size?
16. The rate of decomposition of detritus is affected by the abiotic factors like availability of oxygen, pH of the soil substratum, temperature etc. Discuss.
17. According to Hardy-Weinberg's principle the allele frequency of a population remains constant. If frequency of dominant allele is 0.6 than give frequency of heterozygous population
18. Three Codons on mRNA are not recognized by t RNA. What are they? What is the general term used for them? What is their role in protein synthesis?

19. In peas, tallness is dominant over dwarfness, and red colour of flowers is dominant over the white colour. When a tall plant bearing red flowers was pollinated by a dwarf plant bearing white flowers, the different phenotypicgroups were obtained in the progeny in numbers mentioned against them.

    Mention the genotypes of the two parents and of the types of four offspring.

20. Is pollination and fertilisation necessary in apomixis? Give reasons
21. How BOD is related to water pollution?
22. What is "The Evil Quartet"?
23. **Hanshal purchased one high milk yielding exotic breed of cow. Within a few years he earned lot of money by selling calves by using MOET. The mother cow met with a premature death. Raman objected to Hansal earning money by this way.**

    a) What values in life did Raman possess?

    b) Expand MOET.

    c) Briefly describe the process.

Section D

24. How does the pollen mother cell develop into mature pollen grain. Illustrate the stages with a labeled diagram

    OR

    Show diagrammatically stages of embryonic development from zygote up to implantation in humans
25. Who demonstrated the semi-conservative replication of DNA? Explain the procedure in detail.

    OR

    Describe the Fredrick Griffith's experiment to prove that DNA is the basic genetic material.
26. Elaborate on the key abiotic elements that contribute to the variation in habitats.

    OR

    Explain sickle cell anemia and its inheritance as a pedigree chart

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Answers

Section A

1. The individual will be male.
2. When two genes in a dihybrid cross are situated on the same chromosome, the proportion of parental gene combinations is much higher than the non-parental type. This physical association of genes on a chromosome is termed linkage.
3. The parasitic bird lays its eggs in the nest of its host and lets the host incubate them. During the course of evolution, the eggs of the parasitic bird have evolved to resemble the host's egg in size and colour to reduce the chances of the host bird detecting the foreign eggs and ejecting them from the nest.
4. 3n
5. High temperature, volcanic storms, reducing atmosphere containing CH_4,NH_3.

Section B

6.
   a. DNA fragment separates in matrix of **agarose.**
   b. DNA fragments are stained with **ethidium bromide.**
   c. DNA fragments are viewed under **UV light.**
   d. Fragments are extruded from gel piece. This is called **elution.**
7. The figure given below shows relative contributions of various green-house gases to the total global warming.
   (i) a) is N_2O and b) is methane
   (ii) The molecules of green house gases radiate heat energy, and a major part of which again comes to Earth's surface, thus heating it up once again. This cycle is repeated many a times. Therefore the temperature rises and leads to melting of ice caps.
8. Surgical methods, also called **sterilization**, are generally advised for the male/female partner as a terminal method to prevent any more pregnancies. Surgical intervention blocks gamete transport and thereby prevents conception. Sterilization procedure in the male is

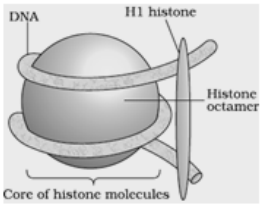
called 'vasectomy 'and that in the female, 'tubectomy'. In vasectomy, a small part of the vas deferens is removed or tied up through a small incision on the scrotum whereas in tubectomy, a small part of the fallopian tube is removed or tied up through a small incision in the abdomen or through vagina.

9. Tumor cells have been shown to avoid detection and destruction by immune system. Therefore, the patients are given substances called biological response modifiers such as **interferon** which activates their immune system and helps in destroying the tumor.

10. 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 and partially 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.

OR

Histones are positively charged, basic proteins. They organize to form a unit of eight molecules called as histones octamer. The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome.



Section C

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

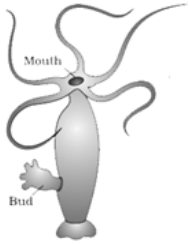
The bone marrow is the main lymphoid organ where all blood cells including lymphocytes are produced.

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.

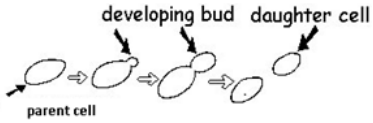
Both bone-marrow and thymus provide micro-environments for the developmentand maturation of T-lymphocytes.

12. Chlamydomonas is an alga which reproduces by formation of zoospores which are microscopic motile structures.

Hydra reproduces by formation of buds which bud from the parent body.



Yeast, the division is unequal and small **buds** are produced that remain attached initially to the parent cell which, eventually gets separated and mature into new yeast organisms.



13. *Salmonella typhi*is a pathogenic bacterium which causes **typhoid** fever in human beings. These pathogens generally enter the small intestinethrough food and water contaminated with them and migrate to otherorgans through blood. Sustained high fever (39° to 40°C), weakness,stomach pain, constipation, headache and loss of appetite are some ofthe common symptoms of this disease. Intestinal perforation and deathmay occur in severe cases. Typhoid fever could be confirmed by Widal test.

OR

The complexities involved in transcription of eukaryotic DNA

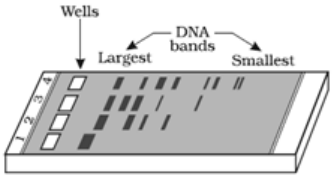
a. There are at least three RNA polymerases in the nucleus (in addition to the RNA polymerase found in the organelles)
    - The RNA polymerase I transcribes rRNAs (28S, 18S, and 5.8S), whereas the
    - The RNA polymerase II transcribes precursor of mRNA, the heterogeneous nuclear RNA (hnRNA).

- RNA polymerase III is responsible for transcription of tRNA, 5srRNA, and snRNAs (small nuclear RNAs)

b. The primary transcripts contain both the exons and the introns and are non-functional. Hence, it is subjected to a process called splicing where the introns are removed and exons are joined in a defined order.

14. Transformation of normal cells into cancerous neoplastic cells may be induced by physical, chemical or biological agents called **carcinogens**. Ionising radiations like X-rays and gamma rays and non-ionizing radiations like UV cause DNA damage leading to neoplastic transformation. 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**. Furthermore, several genes called **cellular oncogenes** (*c-onc*) or **proto oncogenes** have been identified in normal cells which, when activated under certain conditions, could lead to oncogenic transformation of the cells.

15. The cutting of DNA by restriction endonucleases results in the fragments of DNA. These fragments can be separated by a technique known as gel electrophoresis. Since DNA fragments are negatively charged molecules they can be separated by forcing them to move towards the anode under an electric field through a medium/matrix. Nowadays the most commonly used matrix is agarose which is a natural polymer extracted from sea weeds. The DNA fragments separate (resolve) according to their size through sieving effect provided by the agarose gel. Hence, the smaller the fragment size, the farther it moves.



The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation. The separated bands of DNA are cut out from the agarose gel and extracted from the gel piece. This step is known as elution. The DNA fragments purified in this way are used in constructing recombinant DNA by joining them with cloning vectors.

16. 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 favour decomposition whereas low temperature and anaerobiosis inhibit decomposition resulting in build up of organic materials.

The important steps in the process of decomposition are fragmentation, leaching, catabolism, humification and mineralization

17. Frequency of dominant allele 'p' is 0.6

Therefore that of recessive allele 'q' will be 0.4

Because, p + q = 1

Therefore, the frequency of heterozygous population will be 2pq i.e.

2 x 0.6 x 0.4 = 0.48.

18. The three codons not recognized by tRNA are UAA, UGA and UAG.

They are called stop codons.

They are involved in termination of protein synthesis.

19. Tall, Red = 138

Tall, White = 132

Dwarf, Red = 136

Dwarf, White = 128

Since the numbers obtained are In a ratio of 1 :1:1: 1, it is a dihybrid test cross involving a Cross between the heterozygous and recessive parents.

The genotypes of the parents are TtRr and ttrr.

And the genotypes of the offspring are TtRr, Ttrr, ttRr, ttrr.

20. Apomixis is a form of asexual reproduction that mimics sexual reproduction. There are several ways of development of apomictic seeds. In some species, the diploid egg cell is formed without reduction division and develops into the embryo without fertilisation. More often, as in many Citrus and Mango varieties some of the nucellar cells surrounding the embryo sac start dividing, protrude into the embryo sac and develop into the embryos

21. The amount of biodegradable organic matter in sewage water is estimated by measuring Biochemical Oxygen Demand (BOD). BOD refers to the amount of the oxygen that would be

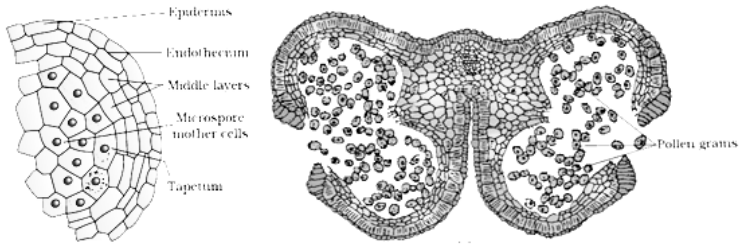
consumed if all the organic matter in one liter of water were oxidised by bacteria. The sewage water is treated till the BOD is reduced. The BOD test measures the rate of uptake of oxygen by micro-organisms in a sample of water and thus, indirectly, BOD is a measure of the organic matter present in the water. The greater the BOD of waste water, more is its polluting potential.

22. Accelerated rates of species extinction are due to 4 main causes which is called the evil quartet. They are
    a) Habitat loss and fragmentation
    b) Over-exploitation
    c) Alien species invasions
    d) Co-extinctions.

23. a. Raman was bold, having love for animals. He had ethics and prudence.
    b. Multiple Ovulation Embryo Transfer Technology.
    c. The cow is administered hormones, with FSH-like activity, to induce Follicular maturation and super ovulation.
    i. The animal is either mated with an elite bull or artificially inseminated.
    ii. The fertilized eggs at 8–32 cells stages, are recovered non-surgically andtransferred to surrogate mothers.
    iii. The genetic mother is available for another round of super ovulation.
    iv. This technology has been demonstrated for cattle, sheep, rabbits,buffaloes, mares, etc.

Section D

24. As the anther develops, the cells of the sporogenous tissue undergo meiotic divisions to form microspore tetrads. As each cell of the sporogenous tissue is capable of giving rise to a microspore tetrad. Each one is a potential pollen or microspore mother cell (PMC). The process of formation of microspores from a pollen mother cell through meiosis is called microsporogenesis. The microspores, as they are formed, are arranged in a cluster of four cells–the microspore tetrad. As the anthers mature and dehydrate, the microspores dissociate from each other and develop into pollen grains. Inside each microsporangium several thousands of microspores or pollen grains are formed that are released with the dehiscence of anther.



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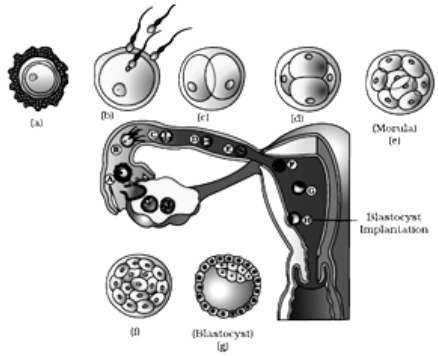
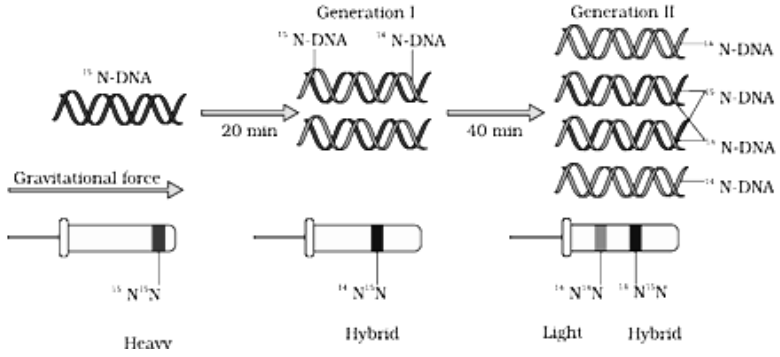


25. DNA replicates semi-conservatively. It was shown first in Escherichia coli and subsequently in higher organisms, such as plants and human cells. Meselson and Stahl proved the semi conservative replication

(i) They grew E. coli in a medium containing 15NH4Cl (15N is the heavy isotope of nitrogen) as the only nitrogen source for many generations. The result was that 15N was incorporated into newly synthesised DNA (as well as other nitrogen containing compounds). This heavy DNA molecule could be distinguished from the normal DNA by centrifugation in a cesium chloride (CsCl) density gradient.

(ii) Then they transferred the cells into a medium with normal 14NH4Cl and took samples at various definite time intervals as the cells multiplied, and extracted the DNA that remained as double-stranded helices. The various samples were separated independently on CsCl gradients to measure the densities of DNA.

(iii) The DNA that was extracted from the culture one generation after the transfer from 15N to 14N medium [that is after 20 minutes; E. coli divides in 20 minutes] had a hybrid or intermediate density. DNA extracted from the culture after another generation [that is after 40 minutes, II generation] was composed of equal amounts of this hybrid DNA and of 'light' DNA..



OR

When *Streptococcus pneumoniae* (pneumococcus) bacteria are grown on a culture plate, some produce smooth shiny colonies (S) while others produce rough colonies (R). This is because the S strain bacteria have a mucous (polysaccharide) coat, while R strain does not. Mice infected with the S strain (virulent) die from pneumonia infection but mice infected with the R strain do not develop pneumonia.

S strain ——-> Inject into mice ——> Mice die

R strain ———> Inject into mice ——-> Mice live

Griffith was able to kill bacteria by heating them. He observed that heat-killed S strain bacteria injected into mice did not kill them. When he injected a mixture of heat-killed S and live R bacteria, the mice died. Moreover, he recovered living S bacteria from the dead mice. S strain ——-> Inject into mice ——> Mice live (heat killed)

S strain (heat killed) + R strain (live) ———> Inject into mice ——-> Mice die

He concluded that the R strain bacteria had somehow been transformed by the heat-killed S strain bacteria. Some 'transforming principle', transferred from the heat-killed S strain, had enabled the R strain to synthesise a smooth polysaccharide coat and become virulent. This must be due to the transfer of the genetic material.

26. The important ones are

Abiotic components - temperature, water, light and soil.

Biotic components – pathogens, parasites, predators and competitors.

Temperature- It affects the kinetics of enzymes and through it the basal metabolism, activity and other physiological functions of the organism. A few organisms can tolerate and thrive in a wide range of temperatures (eurythermal), but, a vast majority of them are restricted to

a narrow range of temperatures (stenothermal). The levels of thermal tolerance of different species determine to a large extent their geographical distribution.

Water- Life is unsustainable without water. Its availability is so limited in deserts that only special adaptations make it possible to live there. The productivity and distribution of plants is heavily dependent on water. For aquatic organisms the quality (chemical composition, pH and salinity) of water becomes important. Some organisms are tolerant of a wide range of salinities others are restricted to a narrow range (stenohaline). Many freshwater animals cannot live for long in sea water and vice versa because of the osmotic problems, they would face.

Light- is required for

a) Photosynthesis

b) Flowering

c) Diurnal and seasonal migrations of organisms.

OR

Sickle cell anemia

- is an autosome linked recessive trait that can be transmitted from parents to the offspring when both the partners are carrier for the gene (or heterozygous).
- The disease is controlled by a single pair of allele, HbA and HbS.
- Out of the three possible genotypes only homozygous individuals for HbS (HbSHbS) show the diseased phenotype.
- Heterozygous (HbAHbS) individuals appear apparently unaffected but they are carrier of the disease as there is 50 per cent probability of transmission of the mutant gene to the progeny, thus exhibiting sickle-cell trait.
- The defect is caused by the substitution of Glutamic acid (Glu) by Valine (Val) at the sixth position of the beta globin chain of the haemoglobin molecule.
- The substitution of amino acid in the globin protein results due to the single base substitution at the sixth codon of the beta globin gene from GAG to GUG.

- The mutant haemoglobin molecule undergoes polymerisation under low oxygen tension causing the change in the shape of the RBC from biconcave disc to elongated sickle like structure.