

Question Paper

Conducted by the Central Board of Secondary Education (CBSE)



Time Allowed: 3 Hours

Maximum Marks: 70

General Instructions

- (i) This question paper contains **33 questions**. All questions are compulsory.
- (ii) Section A: Questions 1 to 16 carry 1 mark each.
- (iii) Section B: Questions 17 to 21 carry 2 marks each.
- (iv) Section C: Questions 22 to 28 carry 3 marks each.
- (v) Section D: Questions 29 to 30 carry 4 marks each.
- (vi) Section E: Questions 31 to 33 carry 5 marks each.
- (vii) Attempt one alternative where an internal choice is provided. Follow the instructions within each question.
- (viii) Draw neat, properly labelled diagrams wherever necessary.

Section A

1. Interferons are proteins. In humans they are secreted by:

- (A) Thymus gland (B) B-lymphocytes
(C) Viral infected cells (D) Tonsils

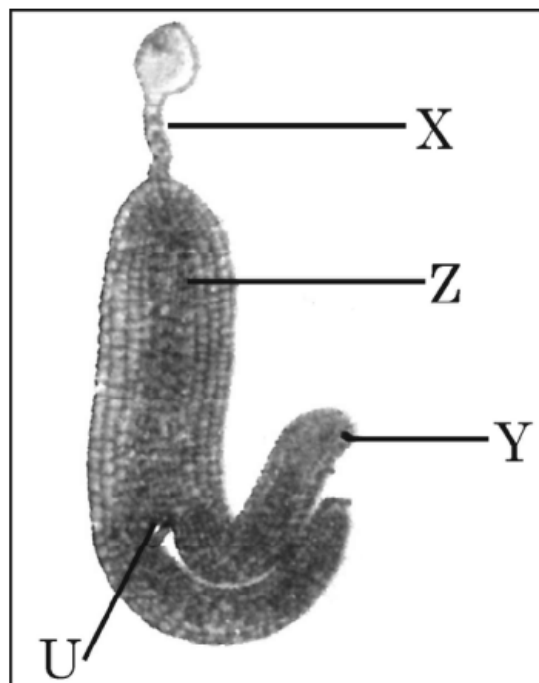
2. Select the pathogen mismatched with the symptoms of disease caused by it from the list given below:

- | | |
|---|--|
| (A) Entamoeba histolytica : Constipation, abdominal pain. | (B) Epidermophyton : Dry scaly lesions on nail. |
| (C) Wuchereria bancrofti : Chronic inflammation of lymphatic vessels of lower limb. | (D) Haemophilus influenzae : Blockage of the intestinal passage. |

3. The primary productivity in an ecosystem is expressed as:

- (A) $\text{gm}^{-2} \text{yr}^{-1}$ (B) $\text{gm}^{-2} \text{yr}$
(C) $\text{Kcal m}^{-2} \text{yr}^{-1}$ (D) Kcal m^{-2}

4. Select the option that shows the correctly identified 'U', 'X', 'Y' and 'Z' in a developing dicot embryo.



- | | |
|---|---|
| (A) X - Plumule (2n), Y - Suspensor (n), Z - Cotyledon (2n), U - Radicle (2n). | (B) X - Plumule (2n), Y - Suspensor (2n), Z - Radicle (2n), U - Cotyledon (2n). |
| (C) X - Suspensor (2n), Y - Cotyledon (2n), Z - Radicle (2n), U - Plumule (2n). | (D) X - Cotyledon (2n), Y - Radicle (n), Z - Plumule (n), U - Suspensor (n). |

5. Given below are four aspects of Reproductive Health in Column A and their related information in Column B:

Column A (Terms used in Reproductive Health):
(A) MTP, (B) Amniocentesis, (C) Saheli, (D) Family Planning

Column B (Significant information): (i) Analysing fetal cells from amniotic fluid of the foetus, (ii) Legalised in 1971, (iii) Programme initiated in 1951, (iv) Non-steroidal oral contraceptive

Select the correct match from the following options:

- | | |
|---|--|
| (A) (A)-(iv), (B)-(ii),
(C)-(iii), (D)-(i) | (B) (A)-(ii), (B)-(i), (C)-(iv), (D)-(iii) |
| (C) (A)-(i), (B)-(iii),
(C)-(ii), (D)-(iv) | (D) (A)-(ii), (B)-(i), (C)-(iii), (D)-(iv) |

6. At which stage during evolution did human use hides to protect their bodies and buried their dead?

- | | |
|------------------|---------------------|
| (A) Homo habilis | (B) Neanderthal man |
| (C) Java man | (D) Homo erectus |

7. Given below is a sequence of bases in mRNA of a bacterial cell. Identify the amino acid that would be incorporated at codon position 3 and codon position 5 during the process of its translation.

3' AUCAGGUUUGUGAUGGUACGA 5'

- | | |
|----------------------------------|-----------------------|
| (A) Phenylalanine,
Methionine | (B) Cysteine, Glycine |
| (C) Alanine, Proline | (D) Serine, Valine |

8. Interaction between clown fish living among the stinging tentacles of sea anemone is an example of -

- | | |
|----------------|------------------|
| (A) Amensalism | (B) Parasitism |
| (C) Mutualism | (D) Commensalism |

9. Important attributes belonging to a population but not to an individual are:

- (i) Birth rate and death rate
- (ii) Male and female
- (iii) Birth and death
- (iv) Sex-ratio

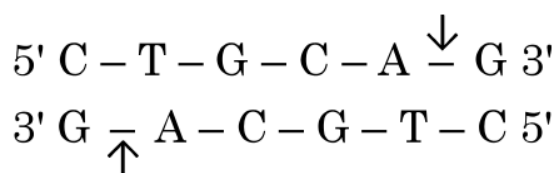
Select the correct option from the given options:

- | | |
|--------------------|------------------|
| (A) (i) only | (B) (ii) only |
| (C) (ii) and (iii) | (D) (i) and (iv) |

10. Which one of the following groups faces maximum threat of extinction?

- | | |
|-----------------|-------------|
| (A) Gymnosperms | (B) Birds |
| (C) Amphibian | (D) Mammals |

11. Given below is the restriction site of a restriction endonuclease Pst-I and the cleavage sites on a DNA molecule.



Choose the option that gives the correct resultant fragments by the action of the enzyme Pst-I.

- | | | |
|-----|----------------------|----------------------|
| (A) | 5' C - T - G | C - A - G 3' |
| | 3' G - A - C - G - T | C 5' |
| (B) | 5' C - T | G - C - A - G 3' |
| | 3' G - A - G - C | T - C 5' |
| (C) | 5' C - T - G - C | A - G 3' |
| | 3' G - A - C - G | T - C 5' |
| (D) | 5' C - T - G - C - A | G 3' |
| | 3' G | A - C - G - T - C 5' |

12. Given below are the list of the commercially important products and their source organisms. Select the option that gives the correct matches.

List A (Bioactive Products): (A) Cyclosporin A, (B) Statins, (C) Streptokinase, (D) Penicillin

List B (Microbes / Source Organism): (i) Streptococcus, (ii) Trichoderma polysporum, (iii) Penicillium notatum, (iv) Monascus purpureus

- | | |
|--|--|
| (A) (A)-(i), (B)-(ii), (C)-(iii), (D)-(iv) | (B) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i) |
| (C) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i) | (D) (A)-(ii), (B)-(iv), (C)-(i), (D)-(iii) |

13. Assertion (A): Decomposition process is slower if detritus is rich in lignin and cutin.

Reason (R): Decomposition is largely an oxygen requiring process.

- | | |
|--|---|
| (A) Both (A) and (R) are true and (R) is the correct explanation of (A). | (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A). |
| (C) (A) is true, but (R) is false. | (D) (A) is false, but (R) is true. |

14. Assertion (A): Determining the sex of an unborn child followed by MTP is an illegal practice.

Reason (R): Amniocentesis is a practice to test the presence of genetic disorders also.

- | | |
|--|---|
| (A) Both (A) and (R) are true and (R) is the correct explanation of (A). | (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A). |
| (C) (A) is true, but (R) is false. | (D) (A) is false, but (R) is true. |

15. Assertion (A): In Thalassemia an abnormal myoglobin chain is synthesized due to a gene defect.

Reason (R): α -Thalassemia is controlled by genes HBA1 and HBA2 on chromosome 16.

- | | |
|--|---|
| (A) Both (A) and (R) are true and (R) is the correct explanation of (A). | (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A). |
| (C) (A) is true, but (R) is false. | (D) (A) is false, but (R) is true. |

16. Assertion (A): Synthetic oligonucleotide polymers are used during Annealing in a PCR.

Reason (R): The primers bind to the double stranded DNA at their complementary regions.

- | | |
|--|---|
| (A) Both (A) and (R) are true and (R) is the correct explanation of (A). | (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A). |
| (C) (A) is true, but (R) is false. | (D) (A) is false, but (R) is true. |

Section B

17. (a) State the principle involved in separation of DNA fragments using gel electrophoresis.

(b) How are DNA fragments visualised once they are separated by gel electrophoresis?

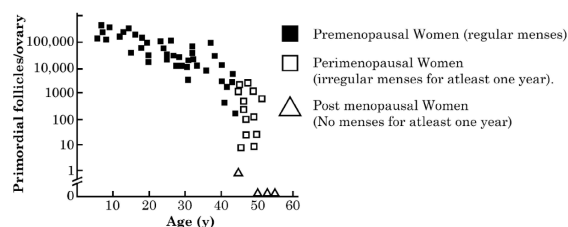
18(a). (i) Give an example of a genus of fungi that forms mycorrhizial association with plants.

(ii) How does the plant derive benefits from this association?

OR

18(b). Name any two techniques used to detect the cancer of internal organs and write about any one of them.

19. The graph given below shows the number of primordial follicles per ovary in women at different ages. Study the graph and answer the questions that follow.



(a) What is the average age of the women at the onset of menopause?

(b) At what age are maximum primordial follicles present in the ovary, according to the given graph?

20. "Abingdon tortoise in Galapagos islands became extinct within a decade on introduction of goats in the island." Explain giving reason.

21. By using Punnett square depict the genotypes and phenotypes of test crosses (where green pod colour (G) is dominant over yellow pod colour (g)) in Garden pea with unknown genotype.

Section C

22. Explain how did the experiment conducted by S.L. Miller substantiate that life evolved from pre-existing non-living organic molecules.

23(a). "Plasmodium protozoan needs both a mosquito and a human host for its continuity." Explain.

OR

23(b). We all must work towards maintaining good health because 'health is wealth'. Enlist any six ways of achieving good health.

24. Name and explain a surgical contraceptive method that can be adopted by the male partner of a couple.

25. "Biodiversity plays a major role in many ecosystem services that nature provides."

(a) Describe any two broadly utilitarian arguments to justify the given statement.

(b) State one ethical reason of conserving biodiversity.

26. One of the major approaches of crop improvement programme is Artificial Hybridisation. Explain the steps involved in making sure that only the desired pollen grain pollinate the stigma of a bisexual flower by a plant breeder.

27. Eli Lilly's contribution for diabetic patients through r-DNA technology has been overwhelmingly accepted. Explain how?

28. Human Genome Project (HGP) was a mega project launched in the year 1990 with some important goals.

(a) Enlist any four prime goals of HGP

(b) Name any one common non-human animal model organism which has also been sequenced thereafter.

29(a). The chromosome number is fixed for all normal organisms leading to species specification whereas any abnormality in the chromosome number of an organism results into abnormal individuals. For example, in humans 46 is the fixed number of chromosomes both in male and female. In male it is ' $44 + XY$ ' and in female it is ' $44 + XX$ '. Thus the human male is heterogametic, in other words produces two different types of gametes one with ' $22 + X$ ' chromosomes and the other with ' $22 + Y$ ' chromosomes respectively. Human female, on the other hand is homogametic i.e. produces only one type of gamete with ' $22 + X$ ' chromosomes only.

Sometimes an error may occur during meiosis of cell cycle, where the sister chromatids fail to segregate called nondisjunction, leading to the production of abnormal gametes with altered chromosome number. On fertilisation such gametes develop into abnormal individuals.

State what is aneuploidy.

29(b). The chromosome number is fixed for all normal organisms leading to species specification whereas any abnormality in the chromosome number of an organism results into abnormal individuals. For example, in humans 46 is the fixed number of chromosomes both in male and female. In male it is ' $44 + XY$ ' and in female it is ' $44 + XX$ '. Thus the human male is heterogametic, in other words produces two different types of gametes one with ' $22 + X$ ' chromosomes and the other with ' $22 + Y$ ' chromosomes respectively. Human female, on the other hand is homogametic i.e. produces only one type of gamete with ' $22 + X$ ' chromosomes only.

Sometimes an error may occur during meiosis of cell cycle, where the sister chromatids fail to segregate called nondisjunction, leading to the production of abnormal gametes with altered chromosome number. On fertilisation such gametes develop into abnormal individuals.

If during spermatogenesis, the chromatids of sex chromosomes fail to segregate during meiosis, write only the different types of gametes with altered chromosome number that could possibly be produced.

29(c). The chromosome number is fixed for all normal organisms leading to species specification whereas any abnormality in the chromosome number of an organism results into abnormal individuals. For example, in humans 46 is the fixed number of chromosomes both in male and female. In male it is ' $44 + XY$ ' and in female it is ' $44 + XX$ '. Thus the human male is heterogametic, in other words produces two different types of gametes one with ' $22 + X$ ' chromosomes and the other with ' $22 + Y$ ' chromosomes respectively. Human female, on the other hand is homogametic i.e. produces only one type of gamete with ' $22 + X$ ' chromosomes only.

Sometimes an error may occur during meiosis of cell cycle, where the sister chromatids fail to segregate called nondisjunction, leading to the production of abnormal gametes with altered chromosome number. On fertilisation such gametes develop into abnormal individuals.

A normal human sperm ($22 + Y$) fertilises an ovum with karyotype ' $22 + XX$ '. Name the disorder the offspring thus produced would suffer from and write any two symptoms of the disorder.

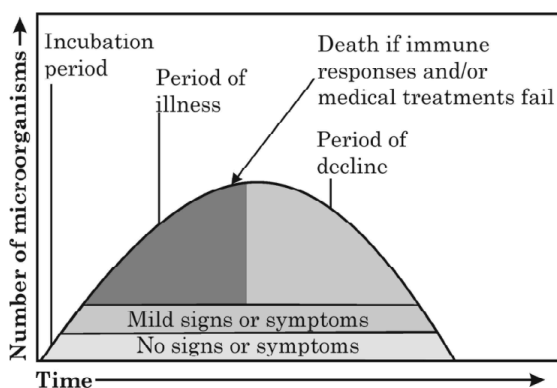
OR

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Sometimes an error may occur during meiosis of cell cycle, where the sister chromatids fail to segregate called nondisjunction, leading to the production of abnormal gametes with altered chromosome number. On fertilisation such gametes develop into abnormal individuals.

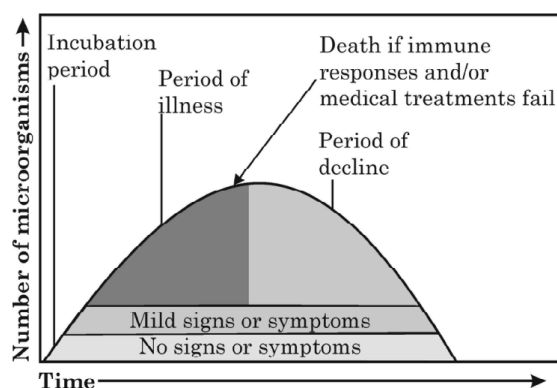
Name a best known and most common autosomal aneuploid abnormality in human and write any two symptoms.

30(a). When a microorganism invades a host, a definite sequence of events usually occur leading to infection and disease, causing suffering to the host. This process is called pathogenesis. Once a microorganism overcomes the defense system of the host, development of the disease follows a certain sequence of events as shown in the graph. Study the graph given below for the sequence of events leading to appearance of a disease and answer the questions that follow:



In which period, according to the graph there are maximum chances of a person transmitting a disease / infection and why?

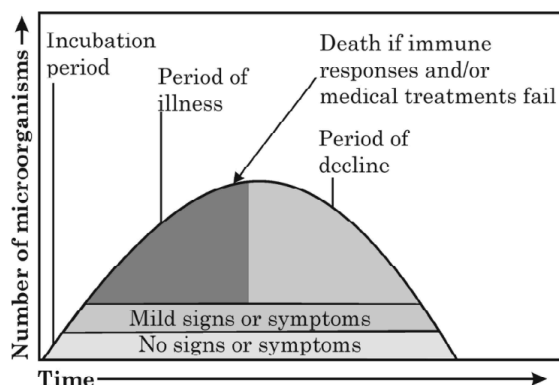
30(b). When a microorganism invades a host, a definite sequence of events usually occur leading to infection and disease, causing suffering to the host. This process is called pathogenesis. Once a microorganism overcomes the defense system of the host, development of the disease follows a certain sequence of events as shown in the graph. Study the graph given below for the sequence of events leading to appearance of a disease and answer the questions that follow:



Study the graph and write what is an incubation period. Name a sexually transmitted disease that can be easily transmitted during this period. Name the specific type of lymphocytes that are attacked by the pathogen of this disease.

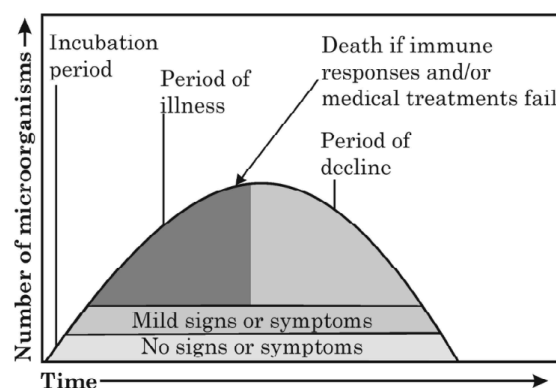
OR

30(b). When a microorganism invades a host, a definite sequence of events usually occur leading to infection and disease, causing suffering to the host. This process is called pathogenesis. Once a microorganism overcomes the defense system of the host, development of the disease follows a certain sequence of events as shown in the graph. Study the graph given below for the sequence of events leading to appearance of a disease and answer the questions that follow:



Draw a schematic labelled diagram of an antibody.

30(c). When a microorganism invades a host, a definite sequence of events usually occur leading to infection and disease, causing suffering to the host. This process is called pathogenesis. Once a microorganism overcomes the defense system of the host, development of the disease follows a certain sequence of events as shown in the graph. Study the graph given below for the sequence of events leading to appearance of a disease and answer the questions that follow:



In which period, the number of immune cells forming antibodies will be the highest in a person suffering from pneumonia? Name the immune cells that produce antibodies.

Section E

31(a). Bioreactors are the containment vehicles of any biotechnology-based production process. For large scale production and for economic reasons the final success of biotechnological process depends on the efficiency of the bioreactor.

Answer the following questions w.r.t. the given paragraph:

- (i) List the operational guidelines that must be adhered to so as to achieve optimisation of the bioreactor system. Enlist any four.
- (ii) Mention the phase of the growth we refer to in the statement "Optimisation of growth and metabolic activity of the cells".
- (iii) Is the biological product formed in the bioreactor suitable for the intended use immediate? Give reason in support of your answer.

OR

31(b)(i). 'EcoRI' has played very significant role in r-DNA technology.

- (I) Explain the convention for naming EcoRI.
- (II) Write the recognition site and the cleavage sites of this restriction endonuclease.

OR

31(b)(ii). What are the protruding and hanging stretches of DNA produced by these restriction enzymes called? Describe their role in formation of r-DNA.

32(a). "It is sometimes observed that the F_1 progeny shows a phenotype that resembles both the parents." Explain this type of inheritance using the example of A, B, O blood groups in human.

OR

- 32(b).** (i) Explain the process of aminoacylation of tRNA and its role in the process of translation.
- (ii) How does initiation of the translation process occur in prokaryotes? Explain.
- (iii) Where are the untranslated regions located on mRNA and why?

33(a)(i). Explain the monosporic development of embryo sac in the ovule of an angiosperm.

33(a)(ii). Draw a diagram of the mature embryo sac of an angiospermic ovule and label any four parts in it.

OR

33(b)(i). Explain the formation of placenta after the implantation in a human female.

OR

33(b)(ii). Draw a diagram showing human foetus within the uterus and label any four parts in it.

- End of Question Paper -