

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. A person with trisomy of 21st chromosome shows

(i) Furrowed tongue (ii) Characteristic palm crease (iii) Rudimentary ovaries (iv) Gynaecomastia

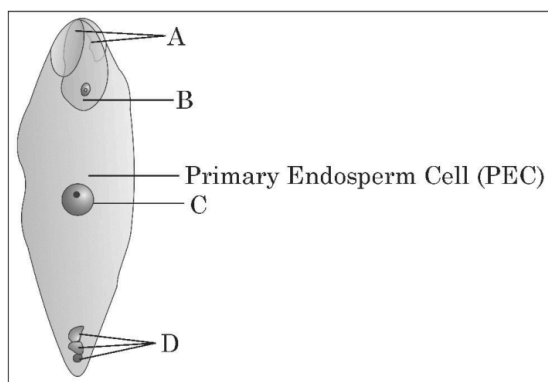
Select the correct option, from the choices given below:

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

2. Which one of the following chromosomal event will not result in genetic variation amongst the offsprings?

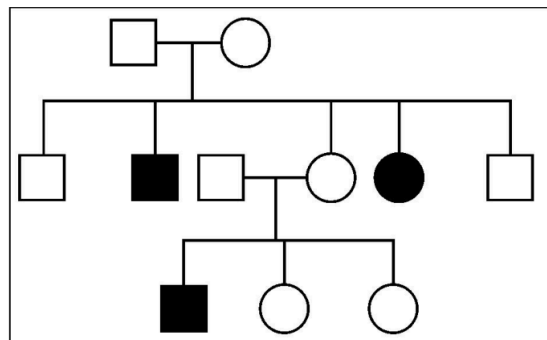
- (A) Independent assortment (B) Crossing over
(C) Linkage (D) Mutation

3. Identify the correct labellings in the figure of a fertilised embryo sac of an angiosperm given below:



- (A) A - zygote, B - degenerating synergids, C - degenerating antipodals, D - PEN
(B) A - degenerating synergids, B - zygote, C - PEN, D - degenerating antipodals
(C) A - degenerating antipodals, B - PEN, C - degenerating synergids, D - zygote
(D) A - degenerating synergids, B - zygote, C - degenerating antipodals, D - PEN

4. Study the pedigree chart of a family showing the inheritance pattern of a certain disorder. Select the option that correctly identifies the nature of the trait depicted in the pedigree chart.



- (A) Dominant X - linked (B) Recessive X - linked
(C) Autosomal dominant (D) Autosomal recessive

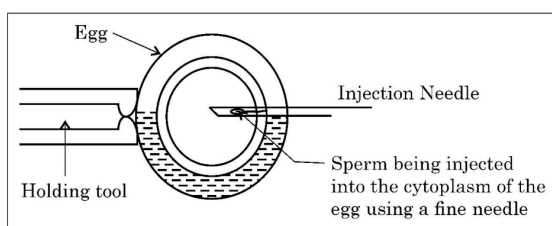
5. Which one of the following statements is correct in the context of observing DNA separation by agarose gel electrophoresis?

- (A) DNA can be seen in visible light. (B) DNA can be seen without staining in visible light.
(C) Ethidium bromide stained DNA can be seen in visible light. (D) Ethidium bromide stained DNA can be seen under UV light.

6. A phenomenon where a male insect mistakenly identified the patterns of a orchid flower as the female insect partner, and tries to copulate and thereby pollinates the flower is said to be:

- (A) Pseudocopulation
- (B) Pseudopollination
- (C) Pseudoparthenocarpy
- (D) Pseudofertilisation

7. Observe the schematic representation of assisted reproductive technology given below:



Identify the most appropriate technique depicted in the above diagram.

- (A) IUT
- (B) IUI
- (C) ICSI
- (D) ZIFT

8. The source of 'Smack' is:

- (A) Leaves of Cannabis
- (B) Flowers of Datura sativa
- (C) Fruits of Erythroxylum coca
- (D) Latex of Papaver somniferum

9. The first antibiotic was discovered accidentally by A while working on B. 'A' and 'B' are

- | | |
|--------------------------------------|--|
| (A) A - Waksman; B - Streptococcus | (B) A - Fleming; B - Penicillium notatum |
| (C) A - Waksman; B - Bacillus brevis | (D) A - Fleming; B - Staphylococci |

10. If the sequence of nitrogen bases of the coding strand in a transcription unit is 5' - ATGAATG - 3', the sequence of bases in its RNA transcript would be

- (A) 5' - AUGAUG - 3'
- (B) 5' - UACUAC - 3'
- (C) 5' - CAUUC AU - 3'
- (D) 5' - GUAAGUA - 3'

11. Match the following genes of the lac operon listed in column 'A' with their respective products listed in column 'B':

A (Gene): a. 'i' gene; b. 'z' gene; c. 'a' gene; d. 'y' gene

B (Products): (i) β -galactosidase; (ii) lac permease; (iii) repressor; (iv) transacetylase

Select the correct option:

- | | |
|------------------------------------|------------------------------------|
| (A) a-(i), b-(iii), c-(ii), d-(iv) | (B) a-(iii), b-(i), c-(ii), d-(iv) |
| (C) a-(iii), b-(i), c-(iv), d-(ii) | (D) a-(iii), b-(iv), c-(i), d-(ii) |

12. The human chromosome with the highest and least number of genes in them are respectively:

- | | |
|--------------------------|-------------------------|
| (A) Chromosome 21 and Y. | (B) Chromosome 1 and X. |
| (C) Chromosome 1 and Y. | (D) Chromosome X and Y. |

13. Assertion (A): In birds the sex of the offspring is determined by males.

Reason (R): Males are homogametic while females are heterogametic.

- | | |
|--|---|
| (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): “Biodiversity hotspots” are the regions which possess high levels of species richness, high degree of endemism.

Reason (R): Total number of biodiversity hotspots in the world is 22 with two of these hotspots found in India.

- | | |
|--|---|
| (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): AIDS is a syndrome caused by HIV.

Reason (R): HIV is a virus that damages the immune system with DNA as its genetic material.

- | | |
|--|---|
| (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. |

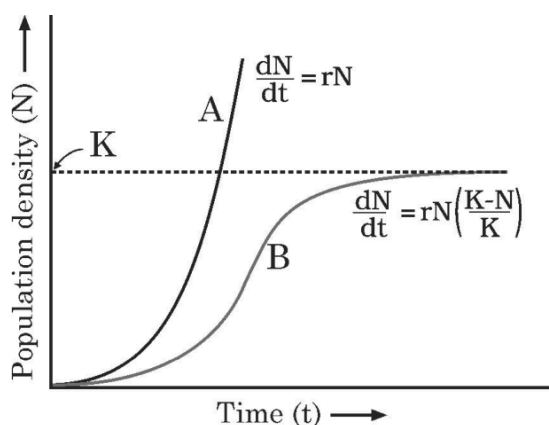
16. Assertion (A): In molecular diagnosis, single stranded DNA or RNA tagged with radioactive molecule is called a probe.

Reason (R): A probe always searches and hybridises with its complementary DNA in a clone of cells.

- | | |
|--|---|
| (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. |

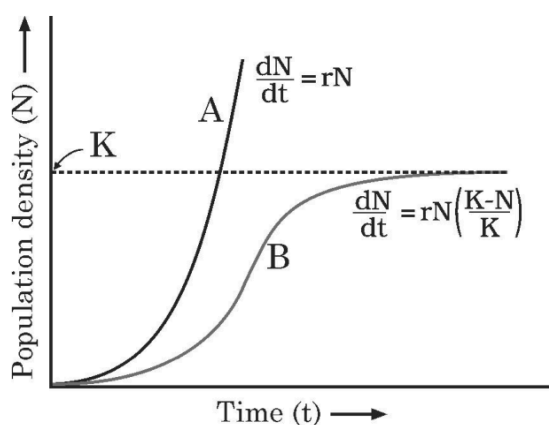
17. If the base adenine constitutes 31% of an isolated DNA fragment, then write what will be the expected percentage of the base cytosine in it. Explain how did you arrive at the answer given.

18(a). Observe the population growth curve and answer the questions given below:



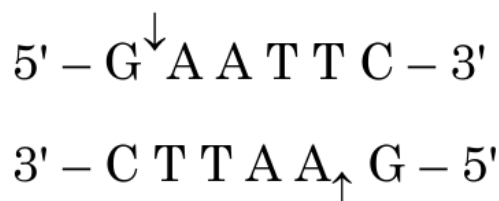
State the conditions under which growth curve 'A' and growth curve 'B' plotted in the graph are possible.

18(b). Observe the population growth curve and answer the questions given below:



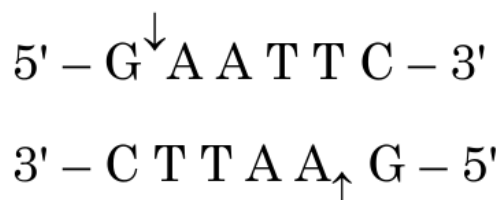
Mention what does 'K' in the graph represent.

19(a).



Name the restriction enzyme that recognises the given specific sequence of bases. What are such sequence of bases referred to as?

19(b).



What are the arrows in the given figure indicating? Write the result obtained thereafter.

20. List the events that reduce the Biochemical Oxygen Demand (BOD) of a primary effluent during sewage treatment.

21(a). "Farmers prefer apomictic seeds to hybrid seeds." Justify giving two reasons.

OR

21(b). Mention one advantage and one disadvantage of amniocentesis.

Section C

22. Explain the processing of heterogeneous nuclear RNA (hnRNA) into a fully functional mRNA in eukaryotes. Where does this processing occur in the cell?

23(a). “Mother's milk is considered very essential for the new born infant.” Justify.

23(b). What is a 'vaccine'? Explain the principle on which it works.

24(a). Tropical regions harbour more species than the temperate regions. How have biologists tried to explain this in their own ways? Explain.

OR

24(b). (i) What does an ecological pyramid represent?

(ii) The Ecological pyramids may have an 'upright' or an 'inverted' shape. Justify with the help of suitable examples.

25. State why plant breeders are interested in artificial hybridisation programme. How do they carry out this process?

26. (a) What are transgenic animals?

(b) Name the transgenic animal having the largest number amongst all the existing transgenic animals.

(c) State any 3 reasons for which these types of animals are being produced.

27. (a) Construct a pyramid of biomass in sea with phytoplankton and fishes. Explain giving reasons about the characteristic of the constructed pyramid.

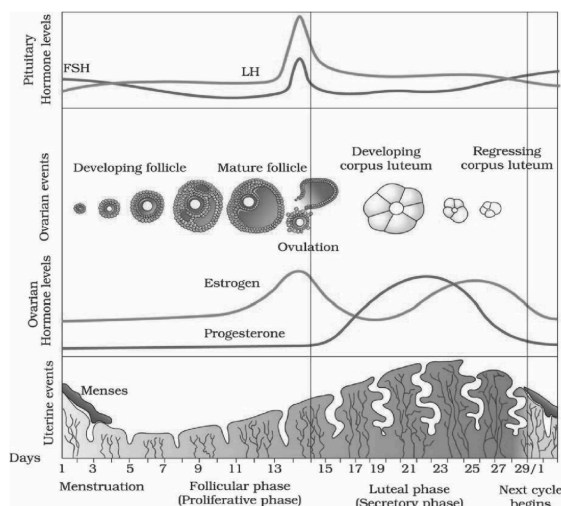
(b) In which condition will the pyramid remain always upright?

28. (a) Why does DNA replication occur within a replication fork and not in its entire length simultaneously?

(b) “DNA replication is continuous and discontinuous on the two strands within the replication fork.” Explain with the help of a schematic representation.

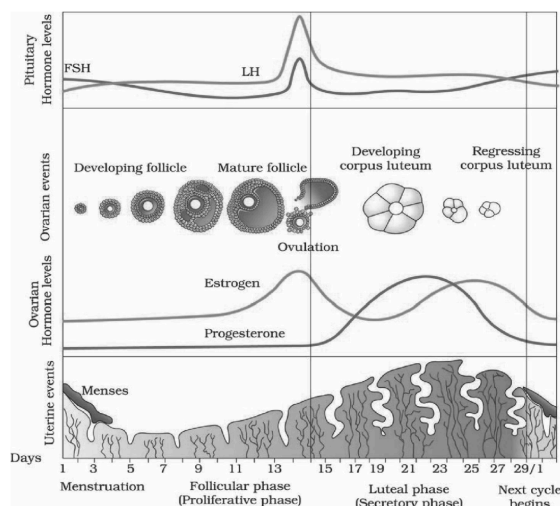
Section D

29(a). In a human female, the reproductive phase starts on the onset of puberty and ceases around middle age of the female. Study the graph given below regarding menstrual cycle and answer the questions that follow:



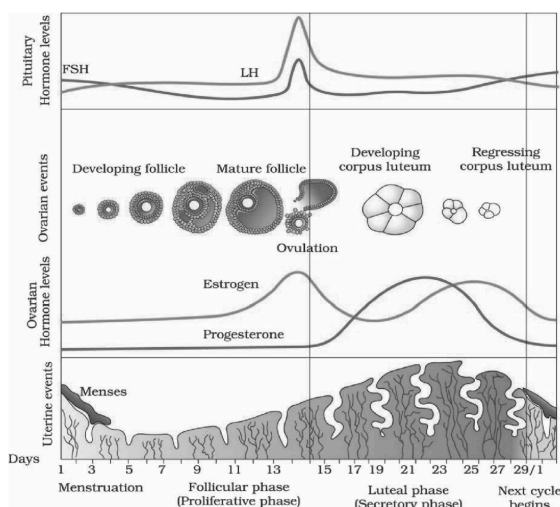
Name the hormones and their source organ, which are responsible for menstrual cycle at puberty.

29(b). In a human female, the reproductive phase starts on the onset of puberty and ceases around middle age of the female. Study the graph given below regarding menstrual cycle and answer the questions that follow:



For successful pregnancy, at what phase of the menstrual cycle an early embryo (upto 3 blastomeres) should be Implanted in the Uterus (IUT) of a human female who has opted for Assisted Reproductive Technology (ART)? Support your answer with a reason.

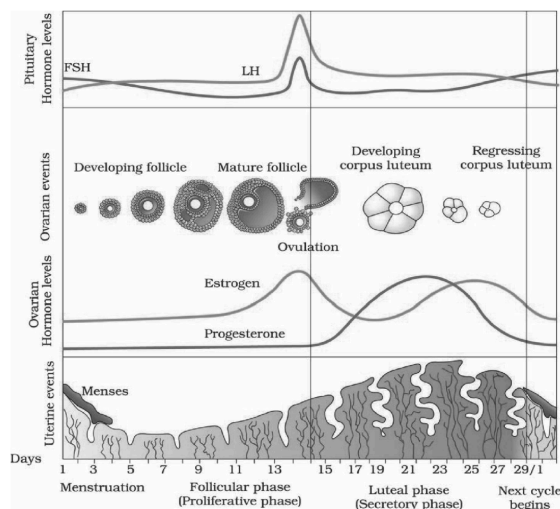
29(c). In a human female, the reproductive phase starts on the onset of puberty and ceases around middle age of the female. Study the graph given below regarding menstrual cycle and answer the questions that follow:



Name the hormone and its source organ responsible for the events occurring during proliferative phase of menstrual cycle. Explain the event.

OR

29(c). In a human female, the reproductive phase starts on the onset of puberty and ceases around middle age of the female. Study the graph given below regarding menstrual cycle and answer the questions that follow:



In a normal human female, why does menstruation only occur if the released ovum is not fertilised? Explain.

30(a). Read the following passage and answer the questions that follow:

“Mosquitoes are drastically affecting the human health in almost all the developing tropical countries. Different species of mosquitoes cause very fatal diseases so much so that many humans loose their life and if they survive, are unable to put in productive hours to sustain their life. With the result the health index of the country goes down.”

Name the form in which Plasmodium gains entry into (i) human body (ii) the female Anopheles body.

30(b). Read the following passage and answer the questions that follow:

“Mosquitoes are drastically affecting the human health in almost all the developing tropical countries. Different species of mosquitoes cause very fatal diseases so much so that many humans loose their life and if they survive, are unable to put in productive hours to sustain their life. With the result the health index of the country goes down.”

Why do the symptoms of malaria not appear in a person immediately after being bitten by an infected female Anopheles? Give one reason. Explain when and how do the symptoms of the disease would appear.

OR

30(b). Read the following passage and answer the questions that follow:

“Mosquitoes are drastically affecting the human health in almost all the developing tropical countries. Different species of mosquitoes cause very fatal diseases so much so that many humans loose their life and if they survive, are unable to put in productive hours to sustain their life. With the result the health index of the country goes down.”

Explain the events which occur within a female Anopheles mosquito after it has sucked blood from a malaria patient.

30(c). Read the following passage and answer the questions that follow:

“Mosquitoes are drastically affecting the human health in almost all the developing tropical countries. Different species of mosquitoes cause very fatal diseases so much so that many humans loose their life and if they survive, are unable to put in productive hours to sustain their life. With the result the health index of the country goes down.”

Name a species of mosquito other than female Anopheles and the disease, for which it carries the pathogen.

Section E

31(a)(i). Draw a diagram of a human sperm. Label any four parts and write their functions.

31(a)(ii). In a human female, probability of an ovum to get fertilized by more than one sperm is impossible. Give reason.

OR

31(b)(i). With the help of labelled diagram only, show the different stages of embryo development in a dicot plant.

OR

31(b)(ii). Endosperm development precedes embryo development. Justify.

32(a). (i) Draw a schematic diagram of the cloning vector pBR 322 and label (1) Bam HI site (2) gene for ampicillin resistance (3) 'ori' (4) 'rop' gene.

(ii) State the role of 'rop' gene.

(iii) A cloning vector does not have a selectable marker. How will it affect the process of cloning?

(iv) Why is insertional inactivation preferred over the use of selectable markers in cloning vectors?

OR

32(b). (i) Name the nematode (scientific name) that infects the roots of tobacco plant and reduces its yield.

(ii) Name the vector that is used to introduce nematode-specific genes into the host plant (tobacco).

(iii) How do sense and anti-sense RNAs function?

(iv) Why could parasite not survive in a transgenic tobacco plant?

33(a). Work out a dihybrid cross upto F_2 generation between pea plants bearing violet coloured axial flowers and white coloured terminal flowers using Punnett's square. Give their F_2 phenotypic ratio. State the Mendel's law of inheritance that was derived from such a cross.

OR

33(b). Explain the process of transcription in prokaryotes. How is it different from transcription in eukaryotes?

- End of Question Paper -