

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. 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' - AUGAAUG - 3' (B) 5' - UACUUAC - 3'
(C) 5' - CAUUCAU - 3' (D) 5' - GUAAGUA - 3'

2. How many base pairs will be there in 20 nucleosomes in a DNA double helix?

- (A) 4000 (B) 40
(C) 20 (D) 2000

3. A person with trisomy of 21st chromosome shows

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

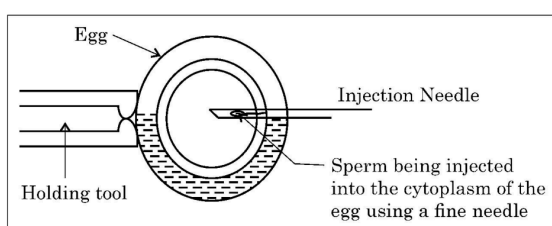
Select the correct option, from the choices given below:

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

4. Single step large mutation leading to speciation is also called

- (A) founder effect (B) saltation
(C) branching descent (D) natural selection

5. 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

6. 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)

7. Which one of the following enzymes a fungal cell should be treated with to get the DNA along with other macro molecules released from it?

- (A) Isozymes (B) Cellulase
(C) Ribonuclease (D) Chitinase

8. During biological treatment of sewage, the masses of bacteria held together by fungal filaments to form mesh like structures are called

- (A) primary sludge (B) flocs
(C) activated sludge (D) anaerobic sludge

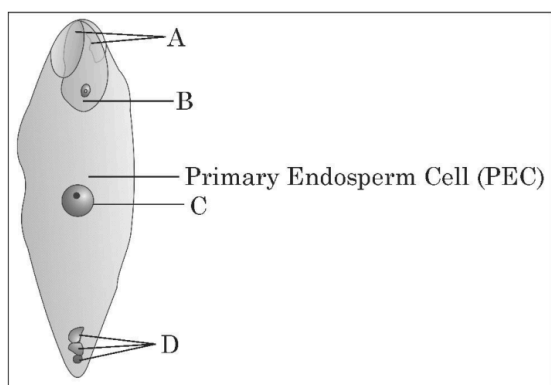
9. Which one of the following is not a characteristic feature of "humus" that is formed during decomposition of detritus?

- (A) amorphous, colloidal, dark coloured substance (B) amorphous, colloidal, light coloured substance
(C) substance resistant to microbial action (D) colloidal substance

10. Interferons are proteins secreted by

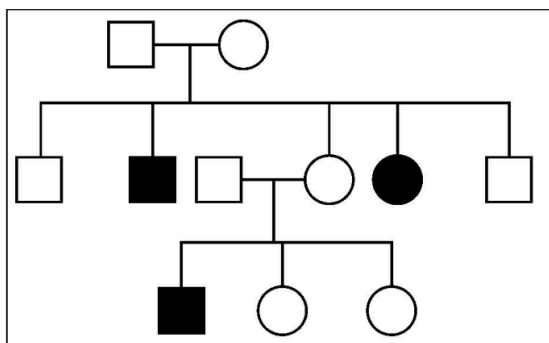
- (A) RBC (B) WBC
(C) Bacteria infected cell (D) Virus infected cell

11. 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

12. 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

13. **Assertion (A):** Communities that comprise of more species tend to be more stable.

Reason (R): A higher number of species results in less year to year variation in total biomass.

- (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):** The sugar-phosphate backbone of two chains in DNA double helix show anti-parallel polarity.

Reason (R): The phosphor-diester bonds in one strand go from a 3' carbon of one nucleotide to a 5' carbon of adjacent nucleotide, whereas those in complementary strand go vice versa.

- (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 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.

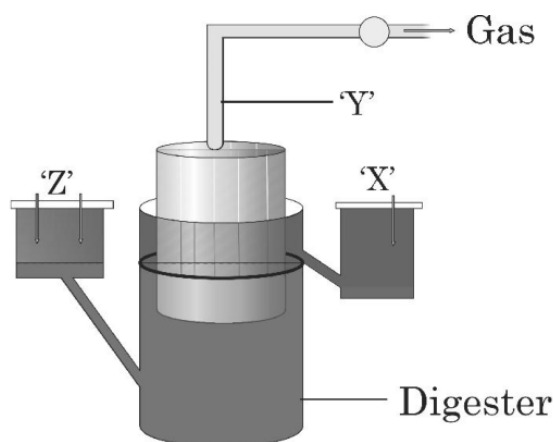
16. **Assertion (A):** AIDS is a syndrome caused by HIV.

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.

Section B

17. Answer the questions based on the typical biogas plant diagram given below:



(a) Identify 'X', 'Y' and 'Z'.

(b) Why is dung preferred for the production of biogas?

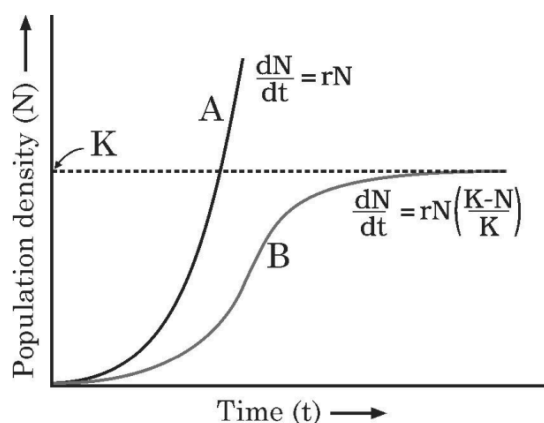
18. If the base adenine constitutes 31% of an isolated DNA fragment, then write what will be the expected percentage of the base cytosine in it. Explain how did you arrive at the answer given.

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

OR

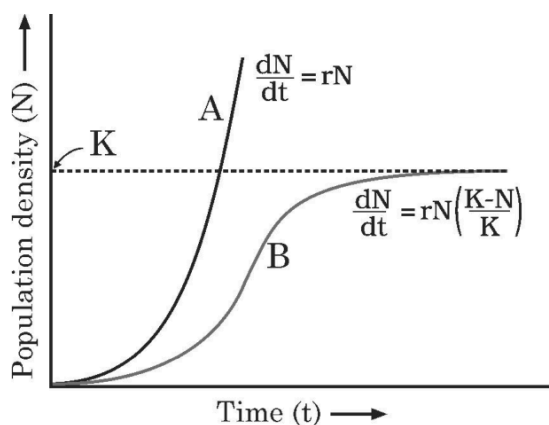
19(b). Mention one advantage and one disadvantage of amniocentesis.

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



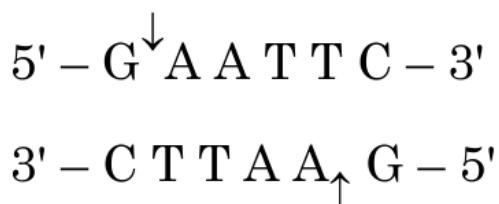
State the conditions under which growth curve 'A' and growth curve 'B' plotted in the graph are possible.

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



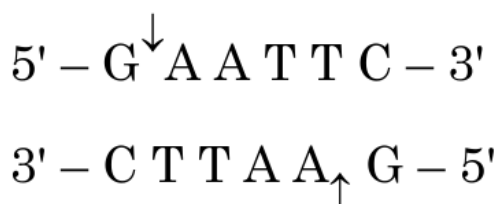
Mention what does 'K' in the graph represent.

21(a).



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

21(b).



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

Section C

22. (a) How is the grazing food chain different from the detritus food chain?

(b) "The detritus food chain may be connected to the grazing food chain at some levels in an ecosystem." Give an example in support of the statement.

23. If the cells in the leaves of a maize plant contain 10 chromosomes each, write the number of chromosomes in its endosperm and zygote. Name and explain the process by which an endosperm and a zygote are formed in maize.

24. (a) Why must a cell be made 'competent' in biotechnology experiments? How does calcium ion help in doing so?

(b) State the role of "biolistic gun" in biotechnology experiments.

25. (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.

26. Expression of different genes for different traits may show dominance, incomplete dominance or co-dominance. Write about expression of such genes with the help of one example each.

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

OR

27(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.

28. Identify a, b, c, d, e and f in the table given below:

Sl. No. 1: Organism - *Monascus purpureus*;
Bioactive Molecule - a; Use - b

Sl. No. 2: Organism - c; Bioactive Molecule - d;
Use - Antibiotic

Sl. No. 3: Organism - e; Bioactive Molecule - Cyclosporin A; Use - f

Section D

29(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 (1) human body (2) the female Anopheles body.

29(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

29(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.”

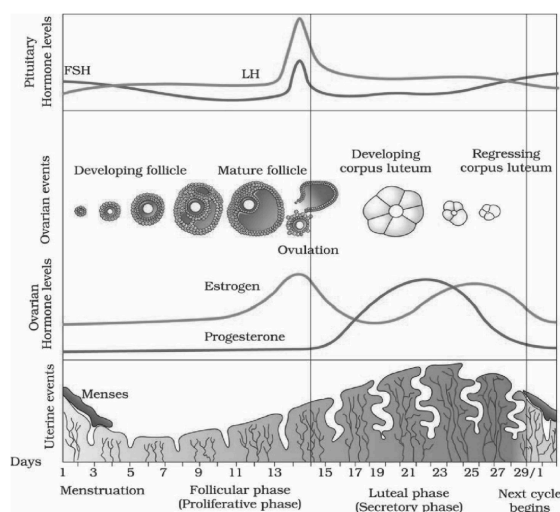
Explain the events which occur within a female Anopheles mosquito after it has sucked blood from a malaria patient.

29(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.”

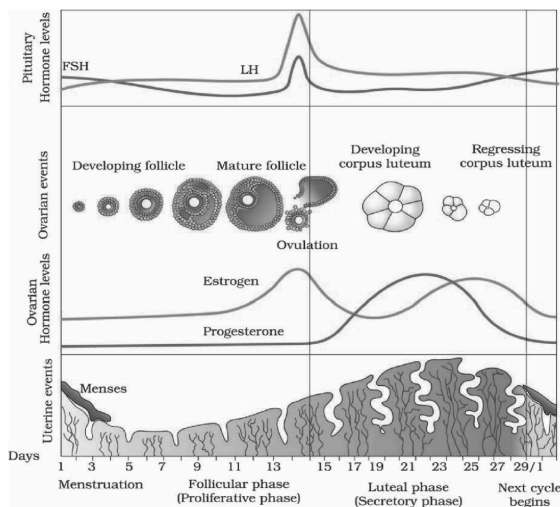
Name a species of mosquito other than female Anopheles and the disease, for which it carries the pathogen.

30(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:



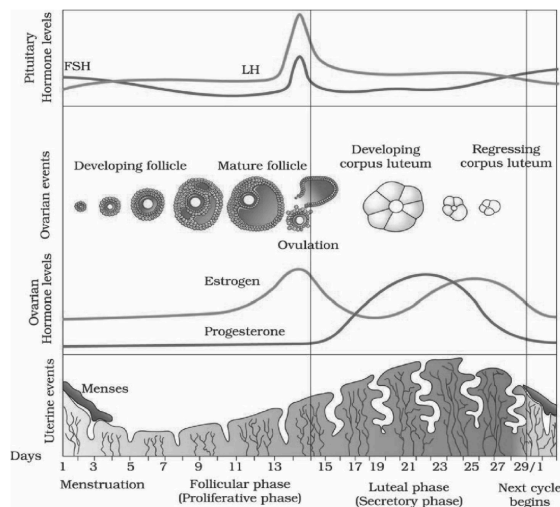
Name the hormones and their source organ, which are responsible for menstrual cycle at puberty.

30(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.

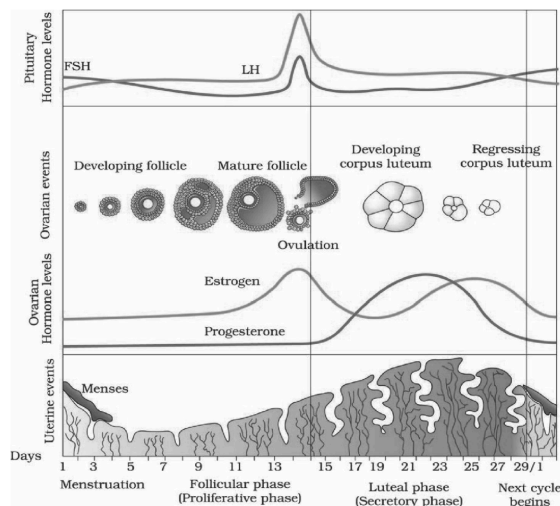
30(c). In a human female, the reproductive phase starts on the onset of puberty and ceases around middle age of the female. Study the graph given below regarding menstrual cycle and answer the questions that follow:



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

OR

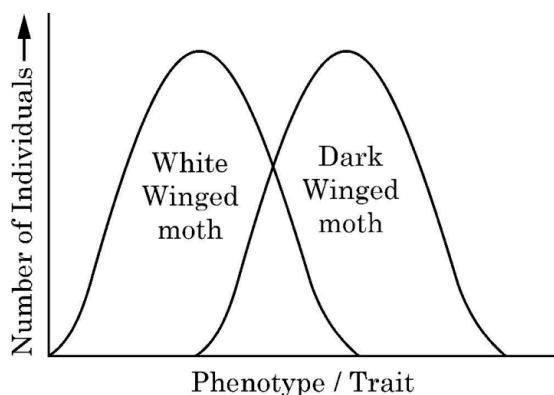
30(c). In a human female, the reproductive phase starts on the onset of puberty and ceases around middle age of the female. Study the graph given below regarding menstrual cycle and answer the questions that follow:



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

Section E

31(a)(i). Natural selection operates in different ways in nature.



Identify the type of natural selection depicted in the graph above.

31(a)(ii). Natural selection operates in different ways in nature.

In England after industrialisation, the population of dark winged moths were more favoured than white winged moth. Explain.

31(a)(iii). Natural selection operates in different ways in nature.

Anthropogenic action can enhance the rate of evolution. Explain with the help of an example.

OR

31(b)(i). Why did Hershey and Chase use ^{35}S and ^{32}P in their experiment? Explain.

OR

31(b)(ii). State the importance of (1) blending and (2) centrifugation in their experiment.

OR

31(b)(iii). Write the conclusion they arrived at the end of their experiment.

32(a). (i) Describe the events of spermatogenesis with the help of a schematic diagram.

(ii) Explain the role of hormones in spermatogenesis.

OR

32(b). (i) Show the development of megaspore mother cell upto the formation of mature embryo sac in flowering plants with the help of labelled diagrams only.

(ii) How does geitonogamy differ from xenogamy?

(iii) Name the type of flowers that are invariably autogamous.

33(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

33(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?

- End of Question Paper -