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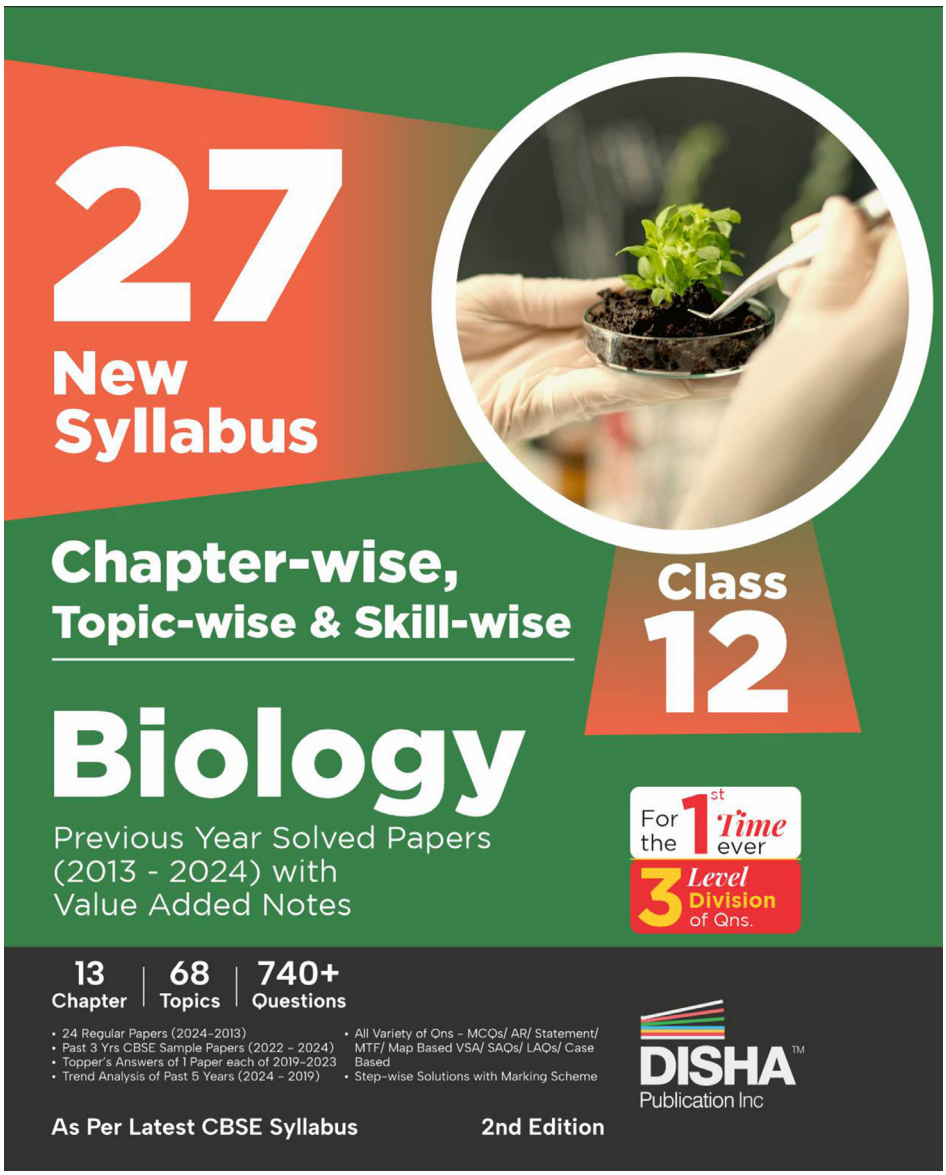
All India 2024 Solved Paper

This sample is taken from the **"27 New Syllabus Chapter-wise, Topic-wise & Skill-wise CBSE Class 12 Biology Previous Year Solved Papers (2013 - 2024) with Value Added Notes 2nd Edition"**



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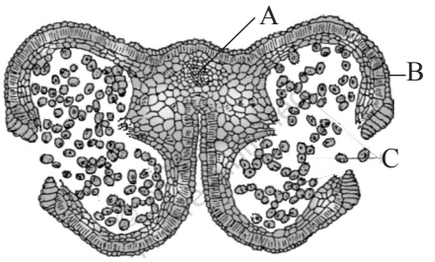
Chapterwise Topicwise CBSE 2024
All India and Delhi Solved Paper

Chapter 1 : Sexual Reproduction in Flowering Plants

Topic-1: *Pre-fertilisation: Structure and Events*

1 *Multiple Choice Question*

1. Study the following diagram of Transverse Section of a young anther of an angiosperm: **All India 2024, K**



Select the option where parts 'A', 'B' and 'C' are correctly identified.

(a) A - Connective, B - Endothecium, C - Pollen grain
(b) A - Endothecium, B - Connective, C - Pollen grain
(c) A - Pollen grain, B - Connective, C - Endothecium
(d) A - Endothecium, B - Pollen grain, C - Connective

5 *Short Answer Question (3 Marks)*

2. Draw a well labelled diagram of sectional view of male gametophyte/microspore of an angiosperm and write the functions of any two parts labelled. (Any four labels). **All India 2024, U**

6 *Long Answer Question*

3.

Observe the picture of *Commelina* plant bearing two types of flowers given above.

(i) Identify the two types of flowers labelled 'A' and 'B' in the picture.
(ii) Compare the two types of flowers with reference to:
  (1) Characteristic feature
  (2) modes of pollination
(iii) List any two 'out breeding devices' in flowering plants. Explain why do plants develop such devices. **All India 2024, A**

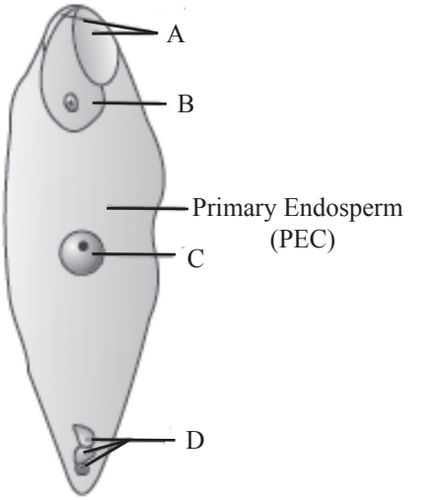
Topic-2: *Double Fertilisation*

1 *Multiple Choice Question*

4. In a fertilized ovule of an angiosperm, the cells in which n, 2n and 3n conditions respectively occur are: **All India 2024, U**

(a) antipodal, zygote and endosperm
(b) zygote, nucellus and endosperm
(c) endosperm, nucellus and zygote
(d) antipodals, synergids and integuments

5. Identify the correct labellings in the figure of a fertilised embryo sac of an angiosperm given below: **Delhi 2024, K**



(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, A-degenerating antipodals, D-PEN

5 *Short Answer Questions (3 Marks)*

6. 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. **Delhi 2024, Ap**

Topic-3: *Post-fertilisation : Structure and Events*

6 *Long Answer Question*

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

(ii) Endosperm development precedes embryo development. Justify. **Delhi 2024, A**

Topic-4: *Apomixis and Polyembryony*

4 *Very Short Answer Question (2 Marks)*

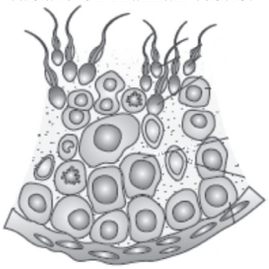
8. "Farmers prefer apomictic seeds to hybrid seeds." Justify giving two reasons. **Delhi 2024, U**

Chapter 2 : Human Reproduction

Topic-3: *Gametogenesis*

6 *Long Answer Questions*

9. The given diagram shows the sectional view of a seminiferous tubule of Human testis: **All India 2024, A**



(i) Name and describe the process depicted in the diagram which results in the development of spermatozoa.

(ii) Identify the cell where you are seeing a cluster of spermatozoa attached in the diagram. Write the function of the cell.

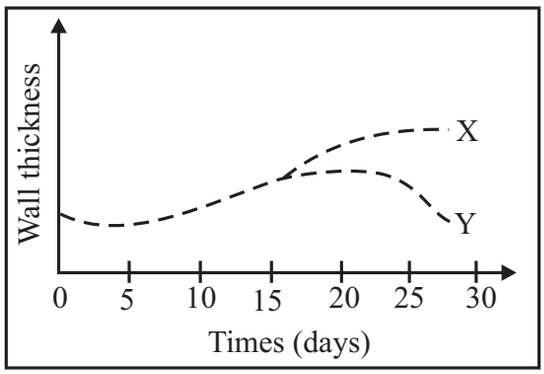
10. (i) Draw a diagram of a human sperm. Label any four parts and write their functions.

(ii) In a human female probability of an ovum to get fertilized by more than one sperm is impossible. Give reason. **Delhi 2024, U**

Topic-4: *Menstrual Cycle*

4 *Very Short Answer Question (2 Marks)*

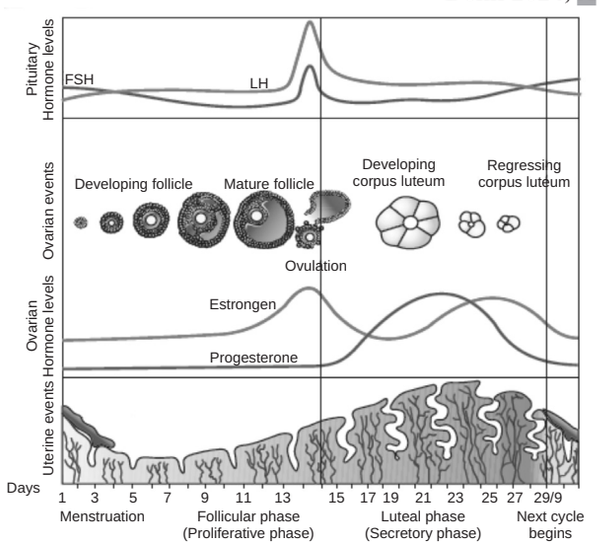
11. Study the graph given below that represents the changes in the thickening of the uterine wall in women 'X' and women 'Y' over a period of one month: **All India 2024, Ap**



What does the graph with respect to woman 'X' and woman 'Y' indicate? Give suitable reason.

7 *Case Based Question*

12. 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: **Delhi 2024, A**



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

(b) For successful pregnancy, at what phase of the menstrual cycle an early embryo (upto 8 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.

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

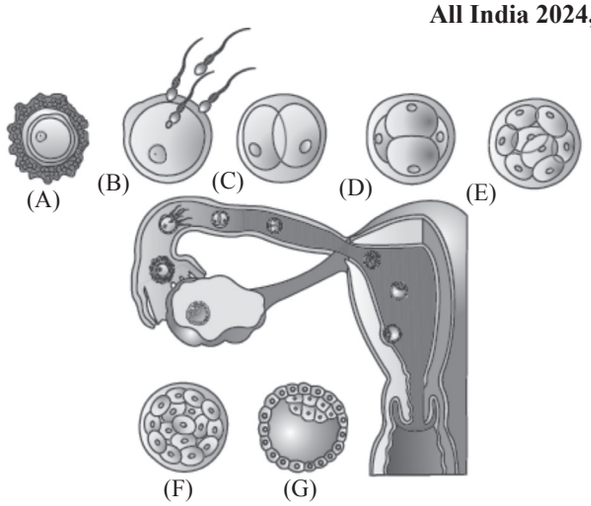
OR

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

Topic-5: *Fertilisation and Implantation*

1 *Multiple Choice Question*

13. Select the option that gives the correct identification of ovum, morula and blastocyst in a human female reproduction system as shown in the following diagram: **All India 2024, K**



(a) Ovum - B, Morula - D, Blastocyst - F
(b) Ovum - A, Morula - B, Blastocyst - G
(c) Ovum - A, Morula - E, Blastocyst - G
(d) Ovum - B, Morula - D, Blastocyst - G

Chapter 3 : Reproductive Health

Topic-2: *Population Stabilisation and Birth control*

3 *Matching Based Question*

14. Study the table given below: **All India 2024, U**

Contraceptive/ Contraceptive Method	Mode of Action
A. The pill	I. Prevent sperm reaching cervix
B. Condom	II. Prevent implantation
C. Vasectomy	III. Inhibits ovulation
D. Copper-T	IV. Semen contains no sperm

Select the option where contraceptive/contraceptive method are correctly matched with their mode of action.
(a) A - III, B - II, C - I, D - IV
(b) A - II, B - III, C - I, D - IV
(c) A - III, B - I, C - IV, D - II
(d) A - IV, B - III, C - II, D - I

4 *Very Short Answer Question (2 Marks)*

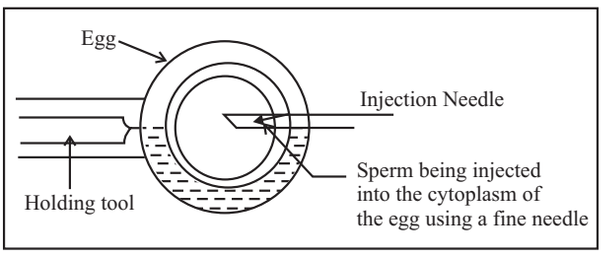
15. (a) Intensely lactating mothers generally do not conceive. Why?
(b) Our government has intentionally imposed strict conditions for MTP. Why? **All India 2024, U**

16. Mention one advantage and one disadvantage of amniocentesis. **Delhi 2024, K**

Topic-5: *Infertility*

1 *Multiple Choice Question*

17. Observe the schematic representation of assisted reproductive technology given below: **Delhi 2024, Ap**



Identify the most appropriate technique depicted in the above diagram.
(a) IUT (b) IUI
(c) ICSI (d) ZIFT

Chapter 4 : Principle of Inheritance and Variation

Topic-2: *Inheritance of One Gene*

5 *Short Answer Question (3 Marks)*

18. (a) A man with blood group 'A' marries a woman with blood group 'AB'. The first child born to them has blood group 'B'. Work out a cross to find the genotype of the father. Give the possible blood groups and their genotypes of the children that could be born to this couple. (Use a Punnet square).
(b) State the basis of 'ABO' blood grouping in humans. **All India 2024, Ap**

Topic-4: *Polygenic Inheritance and Pleiotropy*

1 *Multiple Choice Question*

19. A single gene that controls the expression of more than one trait is said to show **Delhi 2024, K**
(a) Multiple allelism
(b) Polygenic inheritance
(c) Incomplete dominance
(d) Pleiotropism

Topic-5: Sex Determination

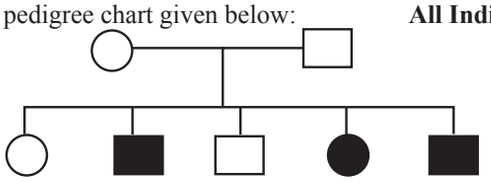
2 *Assertion Reason/Two Statement Type Question*

20. **Assertion (A):** In birds the sex of the offspring is determined by males. **Delhi 2024, U**
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 and (R) is not the correct explanation of (A).
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true.

Topic-7: Genetic Disorders

1 *Multiple Choice Questions*

21. Identify the category of genetic disorder depicted in the pedigree chart given below: **All India 2024, A**

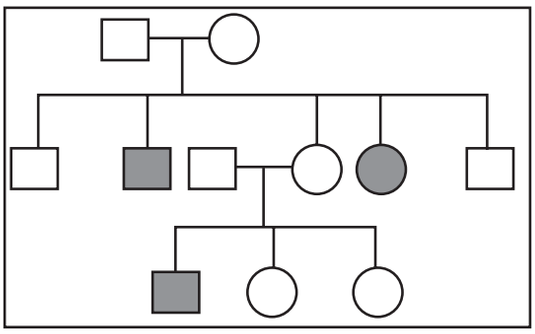


(a) X-Linked recessive (b)X-Linked dominant
(c) Autosomal recessive (d)Autosomal dominant

22. Turner's syndrome in humans occurs due to **All India 2024, K**
(a) Aneuploidy (b) Euploidy
(c) Polyploidy (d) Autosomal abnormality

23. A person with trisomy of 21st chromosome shows **Delhi 2024, K**
(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)

24. 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. **Delhi 2024, A**



(a) Dominant X - linked
(b) Recessive X - linked
(c) Autosomal dominant
(d) Autosomal recessive

25. If both the parents are carriers for thalassaemia, the chances of an afflicted child to be born to them is: **Delhi 2024, Ap**
(a) 25% (b) 50%
(c) 75% (d) 100%

6 *Long Answer Question*

26. (i) Why is sickle-cell anaemia, a human blood disorder so named?
(ii) Explain the genetic basis that results in the expression of this disorder.
(iii) Work out a cross to explain how normal parents may have a sickle-cell anaemic child. **All India 2024, U**

Chapter 5 : Molecular basis of Inheritance

Topic-1: The DNA

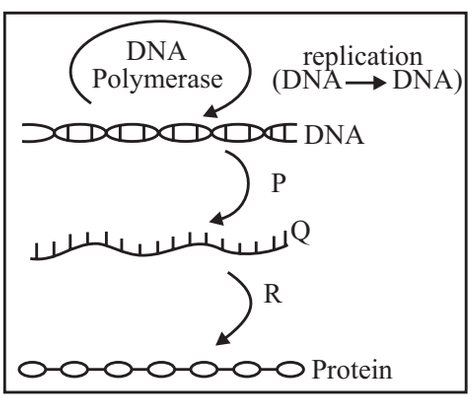
4 *Very Short Answer Question (2 Marks)*

27. 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. **Delhi 2024, Ap**

Topic-2: The Search for Genetic Material

1 *Multiple Choice Question*

28. Which of the options has correct identification of 'P', 'Q' and 'R' in the illustration of 'Central Dogma' given below? **All India 2024, U**



(a) P - Replication, Q - rRNA, R - Transcription
(b) P - Translation, Q - mRNA, R - Transcription
(c) P - Replication, Q - mRNA, R - Translation
(d) P - Transcription, Q - mRNA, R - Translation

6 *Long Answer Question*

29. (i) Why did Hershey and Chase use '^{35}S' and '^{32}P' in their experiment? Explain.
(ii) State the importance of (1) blending and (2) centrifugation in their experiment.
(iii) Write the conclusion they arrived at the end of their experiment **Delhi 2024, U**

Topic-5: Replication - The machinery & enzymes

5 *Short Answer Question (3 Marks)*

30. (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. **Delhi 2024, U**

Topic-6: Transcription

1 *Multiple Choice Question*

31. 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 **Delhi 2024, U**
(a) 5' - AUGAAUG - 3'
(b) 5' - UACUUAC - 3'
(c) 5' - CAUUCAU - 3'
(d) 5' - GUAAGUA - 3'

5 *Short Answer Question (3 Marks)*

32. Explain the processing of heterogeneous nuclear RNA (hnRNA) into a fully functional mRNA in eukaryotes. Where does this processing occur in the cell? **Delhi 2024, K**

7 *Case Based Question*

33. Read the following passage: **All India 2024, A**
Generally, in eukaryotic cells the average length of a transcription unit along a DNA molecule is about 8,000 nucleotides, so the RNA product of the transcription is also that long. But it only takes about 1200 nucleotides from the above RNA product to translate average sized polypeptide of 400 Amino acids.
(a) Name this RNA product transcribed from the DNA that subsequently translates into a polypeptide of 400 amino acids. Mention the enzyme responsible for transcribing this type of RNA from the DNA.
(b) Name and explain the process the RNA molecule transcribed from 8000 nucleotide long DNA undergoes to be able to translate a polypeptide of 400 amino acids.
(c) Write the number of RNA polymerases involved in the transcription of DNA in a prokaryote and eukaryotes.

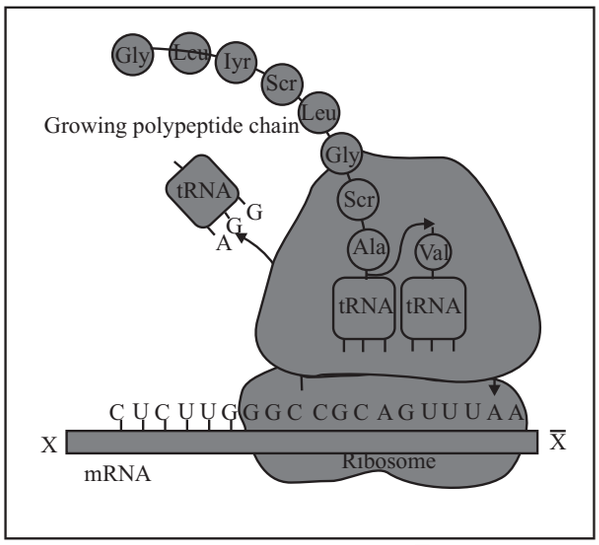
OR

(c) Mention the difference in the site of transcription in a prokaryote and eukaryote cell.

Topic-7: Genetic Code

6 *Long Answer Question*

34. Study the schematic diagram given below and answer the questions that follow: **All India 2024, U**



(i) Identify the polarity from 'X' to '$\bar{X}$' in the mRNA segment shown. Mention how many more amino acids can be added to the polypeptide that is being translated and why.
(ii) Write the initiating codon for translation, its anticodon and the amino acid it codes for.
(iii) Explain the charging of an adaptor molecule. Why this molecule needs to be charged?

Topic-9: Regulation of Gene Expression

3 *Matching Based Question*

35. Match the following genes of the lac operon listed in column 'A' with their respective products listed in column 'B': **Delhi 2024, K**

	A Gene		B Products
A.	'i' gene	(i)	β-galactosidase
B.	'z' gene	(ii)	lac permease
C.	'a' gene	(iii)	repressor
D.	'y' gene	(iv)	transacetylase

Select the correct option:

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

Topic-10: *Human Genome Project*

1 *Multiple Choice Question*

36. Which was the last of the 24 human chromosome to be completely sequenced? **All India 2024, K**

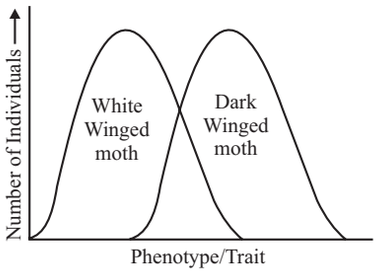
(a) Chromosome-1 (b) Chromosome-11
(c) Chromosome-21 (d) Chromosome-X

Chapter 6 : Evolution

Topic-2: *What are the Evidences for Evolution?*

6 *Long Answer Question*

37.



Natural selection operates in different ways in nature. **Delhi 2024, A**

(i) Identify the type of natural selection depicted in the graph above.
(ii) In England after industrialisation, the population of dark winged moths were favoured than white winged moth. Explain.
(iii) Anthropogenic action can enhance the rate of evolution. Explain with the help of an example.

Topic-4: *Biological Evolution and Mechanism of Evolution*

1 *Multiple Choice Question*

38. Who proposed the mutation theory in favour of organic evolution? **All India 2024, K**

(a) Weisman (b) Louis Pasteur
(c) Darwin (d) Hugo de Vries

Topic-7: *Origin and Evolution of Man*

5 *Short Answer Question (3 Marks)*

39. (a) Whose skulls 'A', 'B', and 'C' are shown below? Which of the two are more similar to each other?

'A' 'B' 'C'

(b) Name the (i) ape like (ii) man like primates that existed 1.5 million years ago. **All India 2024, U**

Chapter 7 : Human Health and Disease

Topic-1: *Common Diseases in Humans*

6 *Long Answer Question*

40. (i) Write the symptoms of malaria in human and explain what causes these symptoms.
(ii) Describe the different steps in the sexual mode of reproduction in the life cycle of a malarial parasite from the time of its initiation till where it is completed and ready to start a fresh cycle.
All India 2024, K

7 *Case Based Question*

41. Read the following passage and answer the questions that follow: **Delhi 2024, A**

"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."

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

(b) Explain the events which occur within a female *Anopheles* mosquito after it has sucked blood from a malaria patient.
(c) Name a species of mosquito other than female *Anopheles* and the disease, for which it carries the pathogen.

Topic-2: *Immunity*

1 *Multiple Choice Question*

42. Interferons are proteins secreted by **Delhi 2024, K**

(a) RBC (b) WBC
(c) Bacteria infected cell (d) Virus infected cell

5 *Short Answer Question (3 Marks)*

43. Draw a schematic diagram of an antibody molecule and label any 4 parts. Mention their chemical nature. Name the cells which produce them. **All India 2024, K**

Topic-3: *AIDS*

2 *Assertion Reason/Two Statement Type Question*

44. **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. **Delhi 2024, U**
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true and (R) is not the correct explanation of (A).
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true.

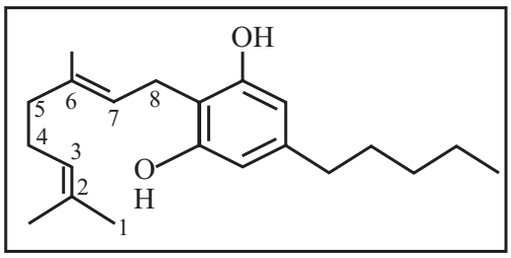
6 *Long Answer Question*

45. Describe the life cycle of HIV from the time of its entry into the human body full blown AIDS sets in. **All India 2024, U**

Topic-5: *Drugs and Alcohol Abuse*

5 *Short Answer Question (3 Marks)*

46. (i) Name the group of drugs whose skeletal molecule is shown below: **All India 2024, A**



(ii) How are such drugs consumed?
(iii) Name the human body organ affected by the consumption of these drugs.

Chapter 8 : Microbes in Human Welfare

Topic-2: *Industrial Products*

3 *Matching Based Question*

47. Study the following list of bioactive substances and their action: **All India 2024, U**

Bioactive Substance	Role
A. Statin	I. Removal of oil stains
B. Cyclosporin A	II. Removal of clots from blood vessels
C. Streptokinase	III. Lowering of blood cholesterol
D. Lipase	IV. Immuno-suppressive agent

Select the option in which the bioactive substances are correctly matched with their action.
(a) A - II, B - III, C - I, D - IV
(b) A - III, B - IV, C - II, D - I
(c) A - IV, B - I, C - II, D - III
(d) A - IV, B - II, C - I, D - III

5 *Short Answer Question (3 Marks)*

48. Identify a, b, c, d, e and f in the table given below: **Delhi 2024, K**

Sl. No.	Organism	Bioactive Molecule	Use
1.	*Monascus purpureus*	a	b
2.	c	d	Antibiotic
3.	e	Cyclosporin A	f

Topic-3: *Sewage Treatment*

1 *Multiple Choice Question*

49. During biological treatment of sewage, the masses of bacteria held together by fungal filaments to form mesh like structures are called **Delhi 2024, K**
(a) primary sludge (b) flocs
(c) activated sludge (d) anaerobic sludge

5 *Short Answer Question (3 Marks)*

50. Explain the role of the following during the sewage treatment: **All India 2024, K**
(a) flocs
(b) anaerobic sludge digester

Chapter 9 : Biotechnology: Principles and Processes

Topic-1: *Principles of Biotechnology*

2 *Assertion Reason/Two Statement Type Question*

51. **Assertion (A):** Plasmids are autonomously replicating circular extra-chromosomal DNA. **All India 2024, K**
Reason (R): Plasmids are usually present in Eukaryotic cells.
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).

(b) Both (A) and (R) are true and (R) is not the correct explanation of (A).
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true.

Topic-2: *Tools of Recombinant DNA Technology*

1 *Multiple Choice Questions*

52. The 'molecular scissors' fall in the category of: **All India 2024, K**
(a) Cleaving enzyme
(b) Endonuclease
(c) Exonuclease
(d) Restriction enzymes

53. Which one of the following statements is correct in the context of observing DNA separation by agarose gel electrophoresis? **Delhi 2024, K**
(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.

4 *Very Short Answer Question (2 Marks)*

54. 5' - G↓ A A T T C - 3'
3' - C T T A A↑ G - 5'
(a) Name the restriction enzyme that recognises the given specific sequence of bases. What are such sequence of bases referred to as?
(b) What are the arrows in the given figure indicating? Write the result obtained thereafter. **Delhi 2024, U**

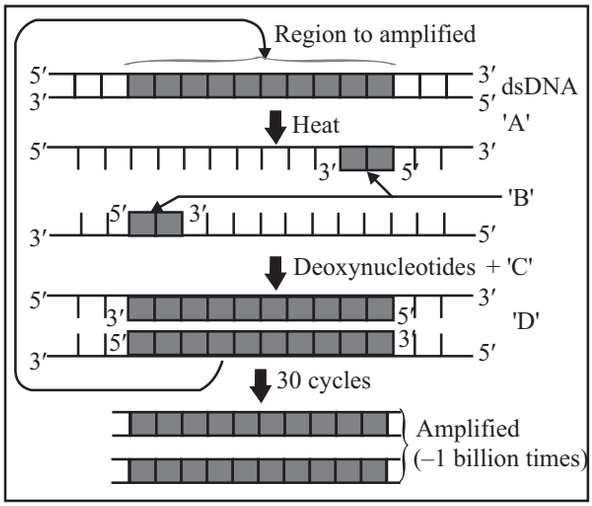
6 *Long Answer Question*

55. (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? **Delhi 2024, An**

Topic-3: *Processes of Recombinant DNA Technology*

5 *Short Answer Question (3 Marks)*

56. Study the steps shown below, that are carried during a specific technique: **All India 2024, U**



(a) Identify the steps 'A' and 'D' in the diagram.
(b) What does 'B' represent?
(c) Write what is 'C'? Name its source organism.
(d) Mention the use of this technique in molecular diagnostics.

Chapter 10 : Biotechnology and its Applications

Topic-1: *Biotechnological Applications in Agriculture*

6 *Long Answer Question*

57. (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? **Delhi 2024, U**

Topic-2: *Biotechnological Applications in Medicine*

1 *Multiple Choice Question*

58. ELISA technique is based on the principle of **All India 2024, K**
(a) DNA replication
(b) antigen-antibody interaction
(c) pathogen-antigen interaction
(d) antigen-protein interaction

2 *Assertion Reason/Two Statement Type Question*

59. **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. **Delhi 2024, K**
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).

(b) Both (A) and (R) are true and (R) is not the correct explanation of (A).
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true.

4 *Very Short Answer Questions (2 Marks)*

60. (a) Name the source from which insulin was extracted in earlier times. Why is this insulin no more in use by the diabetic patients?
(b) Why does the insulin synthesised in the human body undergo processing whereas the insulin produced by Eli Lily company does not need to undergo any processing? Explain. **All India 2024, U**

Topic-3: ***Transgenic Animals***

5 *Short Answer Question (3 Marks)*

61. Explain the role of transgenic animals in:
(a) Production of Biological products
(b) Studying diseases
(c) Chemical safety testing **All India 2024, K**

62. (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. **Delhi 2024, K**

Topic-4: ***Ethical Issues***

2 *Assertion Reason/Two Statement Type Question*

63. **Assertion (A):** Patents are granted by government to an inventor.
Reason (R): Patents prevents others from commercial use of an invention. **All India 2024, U**
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true and (R) is not the correct explanation of (A).
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true.

Chapter 11 : Organisms and Populations

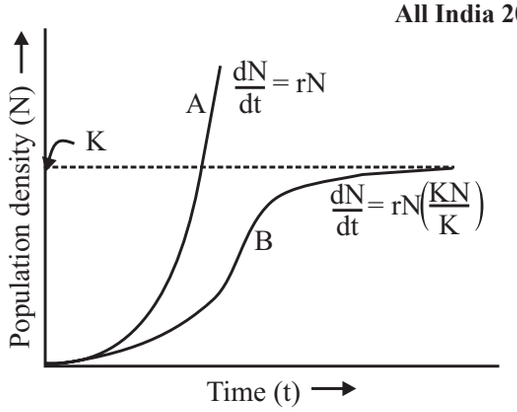
Topic-1: ***Population attributes***

2 *Assertion Reason/Two Statement Type Question*

64. **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. **Delhi 2024, U**
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true and (R) is not the correct explanation of (A).
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true.

7 *Case Based Question*

65. Populations evolve to maximise their reproductive fitness in the habitat in which they live. Ecologists suggest, the life history of organisms have evolved in relations to the constraints imposed by the biotic and abiotic components of the habitat in which they live. This gets reflected in the population growth pattern of all organisms including humans.
Study the population growth curves shown in the given graph and answer the questions that follow:
All India 2024, A



(a) Identify the growth curves 'A' and 'B'.
(b) Mention what does the dotted line in the graph indicate and state its importance also.

OR

(b) Growth curve 'B' shows a different pattern from that of growth curve 'A'. Justify giving one reason.
(c) (i) Which one of the two curves is more "realistic" and why?
(ii) Which one of the two curves is relevant in present days with respect to human population in our country and why?

Topic-2: ***Population growth***

1 *Multiple Choice Question*

66. 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: **Delhi 2024, U**
(a) Pseudocopulation
(b) Pseudopollination
(c) Pseudoparthenocarpy
(d) Pseudofertilisation

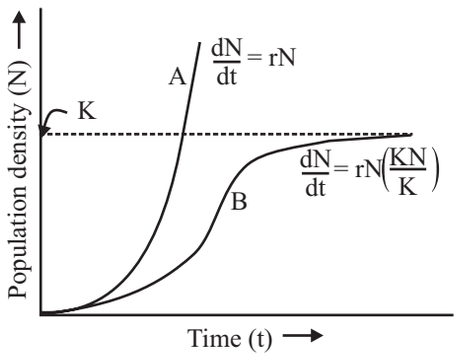
2 *Assertion Reason/Two Statement Type Question*

67. **Assertion (A):** A given fig species can be pollinated only by its partner' wasp.
Reason (R): The wasp pollinates the fig inflorescence while searching for suitable egg laying sites.
All India 2024, U
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true and (R) is not the correct explanation of (A).
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true.

4 *Very Short Answer Questions (2 Marks)*

68. Explain Brood parasitism with the help of a suitable example. **All India 2024, U**

69. Observe the population growth curve and answer the questions given below: **Delhi 2024, A**



(a) State the conditions under which growth curve 'A' and growth curve 'B' plotted in the graph are possible.
(b) Mention what does 'K' in the graph represent.

70. Explain how are plants benefitted by their association with "*Glomus* species". **Delhi 2024, K**

Chapter 12 : Ecosystem

Topic-4: Energy Flow

4 *Very Short Answer Question (2 Marks)*

71. Differentiate between grazing food chain and detritus food chain. **All India 2024, K**

Topic-5: Ecological Pyramid

2 *Assertion Reason/Two Statement Type Question*

72. **Assertion (A):** Some aquatic ecosystems have inverted biomass pyramids.
Reason (R): More energy is required by the organisms occupying higher trophic levels. **All India 2024, U**
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true and (R) is not the correct explanation of (A).
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true.

5 *Short Answer Question (3 Marks)*

73. (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. **Delhi 2024, U**

Chapter 13 : Biodiversity and Conservation

Topic-2: Patterns of Biodiversity

5 *Short Answer Question (3 Marks)*

74. Tropical regions harbour more species than the temperate regions. How have biologists tried to explain this in their own ways? Explain.
Delhi 2024, U

Topic-3: Loss of Biodiversity

4 *Very Short Answer Question (2 Marks)*

75. (a) Biodiversity hotspots cover less than 2% of Earth's land area. Strict protection of these areas can reduce the rate of ongoing extinctions. Explain.
(b) Name any two hotspots in India. **All India 2024, U**

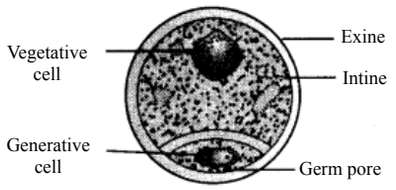
5 *Short Answer Question (3 Marks)*

76. The world is facing accelerated rates of species extinction largely due to human activities. Explain any three human activities responsible for accelerated rates of species extinction. **Delhi 2024, K**

Hints & Solutions

1. **(a)** In the given figure,
A – Connective, B - Endothecium, C - Pollen grains

2. **(1 Mark)**



Function of Exine- It has a role in Protection as it can withstand high temperature and strong acids and alkali.
Function of Intine- It helps in maturation of pollen and germination of pollen tube. **(2 Marks)**

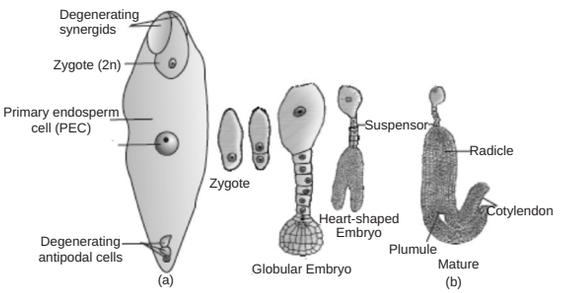
3. (i) A- Chasmogamous flower
B- Cleistogamous flower **(1 Mark)**
(ii) (1) In A, the flower is open and have exposed anther and stigma whereas in B, the flower is closed where anther and stigma lies close to each other.
(2) In A, both geitonogamy and xenogamy can occur due to well-exposed stigma and anther but in B only autogamy will occur as flower does not open at all. **(2 Marks)**
(iii) Self-incompatibility- This is a genetic mechanism and prevents self-pollen (from the same flower or other flowers of the same plant) from fertilising the ovules by inhibiting pollen germination or pollen tube growth in the pistil.
Production of unisexual flowers- If both male and female flowers are present on the same plant such as castor and maize (monoecious), it prevents autogamy but not geitonogamy. In several species such as papaya, male and female flowers are present on different plants, that is each plant is either male or female (dioecy). **(2 Marks)**

4. **(a)** n – antipodal cell, 2n – zygote, 3n – endosperm

5. **(b)**

6. If plant leaves i.e., diploid structure contain 2n = 10 chromosome Then zygote will also contain 10 chromosome and endosperm which is a triploid structure will contain 3n =15 chromosome.
Zygote and endosperm are formed by the process called double fertilization. **(1 Mark)**
DOUBLE FERTILISATION
- After entering one of the synergids, the pollen tube releases the two male gametes into the cytoplasm of the synergid.
- One of the male gametes moves towards the egg cell and fuses with its nucleus thus completing the syngamy.
- This results in the formation of a diploid cell, the zygote. The other male gamete moves towards the two polar nuclei located in the central cell and fuses with them to produce a triploid primary endosperm nucleus (PEN).
- As this involves the fusion of three haploid nuclei it is termed triple fusion. Since two types of fusions, syngamy and triple fusion take place in an embryo sac the phenomenon is termed double fertilisation, an event unique to flowering plants.
- The central cell after triple fusion becomes the primary endosperm cell (PEC) and develops into the endosperm while the zygote develops into an embryo. **(2 Marks)**

7. (i)

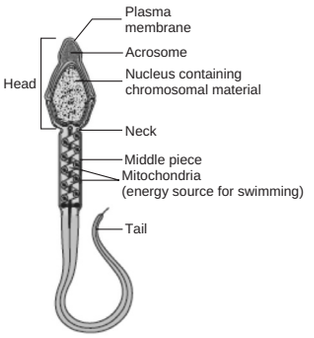


(3 Marks)
(ii) The primary endosperm cell divides repeatedly and forms a triploid endosperm tissue. The cells of this tissue are filled with reserve food materials and are used for the nutrition of the developing embryo. Thus, Endosperm development precedes embryo development. **(2 Marks)**

8. One of the problems of hybrids is that hybrid seeds have to be produced every year. If the seeds collected from hybrids are sown, the plants in the progeny will segregate and do not maintain hybrid characters. Production of hybrid seeds is costly and hence the cost of hybrid seeds become too expensive for the farmers. If these hybrids are made into apomicts, there is no segregation of characters in the hybrid progeny. Then the farmers can keep on using the hybrid seeds to raise new crop year after year and he does not have to buy hybrid seeds every year. **(2 Marks)**

9. (i) In testis, the immature male germ cells (spermatogonia) produce sperms by spermatogenesis that begins at puberty. The spermatogonia present on theinside 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. **(3 Marks)**
(ii) The cell where the cluster of spermatozoa attach is known as Sertoli cell. It provide nourishment to the developing spermatozoa. **(2 Marks)**

10. (i)



The sperm head contains an elongated haploid nucleus, the anterior portion of which is covered by a cap-like structure, acrosome. The acrosome is filled with enzymes that help fertilisation of the ovum. The middle piece possesses numerous mitochondria, which produce energy for the movement of tail that facilitate sperm motility essential for fertilisation. **(3 Marks)**

(ii) During fertilisation, a sperm comes in contact with the *zona pellucida* layer of the ovum and induces changes in the membrane that block the entry of additional sperms. Thus, it ensures that only one sperm can fertilise an ovum. **(2 Marks)**

11. In woman X, as the thickening of the uterine wall increased over a period of time, it indicates that the women X is pregnant as the wall preparing itself for implantation.
Whereas in women Y, as the thickening of the uterine wall decreased by the end of the month, it indicates that the woman Y is in her usual menstrual cycle and not pregnant. **(2 Marks)**

12. (a) FSH and LH – From pituitary gland
Estrogen and Progesterone - Ovary **(1 Mark)**

(b) During the secretory phase, the embryo is implanted. Embryo implantation requires a synchronous dialogue between a competent embryo (blastocyst stage) and a receptive endometrium. This period of endometrial receptivity to the embryo is called the implantation window. **(2 Marks)**

(c) Mainly Estrogen is produced in this phase and secreted from developing follicle of the ovary. During this phase, the primary follicles in the ovary grow to become a fully mature Graafian follicle and simultaneously the endometrium of uterus regenerates through proliferation. **(1 Mark)**

OR

(c) In the absence of fertilisation, the corpus luteum degenerates. The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium. Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy. This causes disintegration of the endometrium leading to menstruation, marking a new cycle. **(1 Mark)**

13. (c)

14. (c) A –III, B – I, C – IV, D - II

15. (a) Lactational amenorrhea i.e., absence of menstruation and therefore the cycle do not occur during the period of intense lactation following parturition. Therefore, as long as the mother breast-feeds the child fully, chances of conception are almost nil. **(1 Mark)**

(b) Government of India legalised MTP in 1971 with some strict conditions to avoid its misuse. Such restrictions are all the more important to check indiscriminate and illegal female foeticides which are reported to be high in India. **(1 Mark)**

16. Advantage – Amniocentesis is used to determine any genetic disorders and survival chances of the foetus. **(1 Mark)**

Disadvantage – It provide the sex of the foetus which could lead to female foeticides. **(1 Mark)**

17. (c) ICSI (Intra cytoplasmic sperm injection).

18. (a) Phenotype of Man's blood group : A
Genotype of Woman's blood group : AB
Phenotype of child: B
For the blood group of child to be B, The Man's genotype should be **Ai**. Then the genotype of child is Bi.
Possible genotypes of children that could be born to this couple:

Father's Phenotype/Mother's ↓ Phenotype →	A	B
A	AA	AB
i	Ai	Bi

(2 Marks)

(b) The basis of ABO blood grouping in human is Multiple allelism where three alleles governing the same character. **(1 Mark)**

19. (d) **20. (d)**

21. (c) Autosomal recessive

22. (a) **23. (d)**

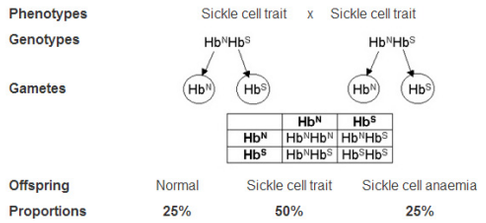
24. (d) The given pedigree analysis showing us the inheritance pattern of autosomal recessive disorder.

25. (a) Only 25% chances are there for child to be born with Thalassaemia.

26. (i) The sickle cell anemia is named so because of 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. **(1 Mark)**

(ii) This 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. **(2 Marks)**

(iii) Cross showing normal parents those who are carrier of sickle cell anemia, chances of having sickle cell anaemic child.



(2 Marks)

27. A = 31%, T = 31%
According to the formula, A + G = T + C
As we get to know, Amount of C = Amount of G
62 + 2C = 100%
2C = 38 ⇒ C = 19% **(1 Mark)**
This proportion was also based on the observation of Erwin Chargaff that for a double stranded DNA, the ratios between Adenine and Thymine and Guanine and Cytosine are constant and equals one. **(1 Mark)**

28. (d)

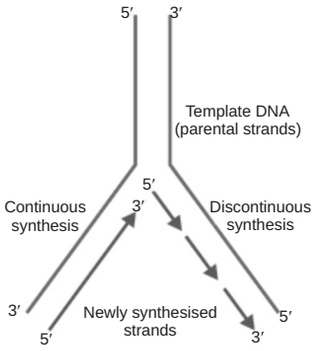
29. (i) They grew some viruses on a medium that contained radioactive phosphorus and some others on medium that contained radioactive sulfur. Viruses grown in the presence of radioactive phosphorus contained radioactive DNA but not radioactive protein because DNA contains phosphorus but protein does not. Similarly, viruses grown on radioactive sulfur contained radioactive protein but not radioactive DNA because DNA does not contain sulfur. **(2 Marks)**

(ii) (1) Blending: The viral coats are removed by agitating with the help of blender.
(2) Centrifugation: The virus particles are separated from the bacteria by spinning them in a centrifuge. **(2 Marks)**

(iii) Bacteria which was infected with viruses that had radioactive DNA were radioactive, indicating that DNA was the material that passed from the virus to the bacteria. Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This indicates that proteins did not enter the bacteria from the viruses. DNA is therefore the genetic material that is passed from virus to bacteria. **(1 Mark)**

30. (a) The two DNA strand cannot be separated to its entire length due to high energy requirement, thus replication occur within a replication fork. **(1 Mark)**

(b) The DNA-dependent DNA polymerases catalyse polymerisation only in one direction, that is 5′ → 3′. This creates some additional complications at the replicating fork. Consequently, on one strand (the template with polarity 3′ → 5′), the replication is continuous, while on the other (the template with polarity 5′ → 3′), is discontinuous. The discontinuously synthesised fragments are later joined by the enzyme DNA ligase.



(2 Marks)

31. (a)

32. 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. hnRNA undergoes additional processing called as capping and tailing. In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5′-end of hnRNA. In tailing, adenylate residues (200-300) are added at 3′-end in a template independent manner. It is the fully processed hnRNA, now called mRNA, that is transported out of the nucleus for translation. **(3 Marks)**

33. (a) RNA product transcribed by DNA is m-RNA. The enzyme is DNA dependent RNA polymerase responsible for transcribing. **(1 Mark)**

(b) Transcription
RNA polymerase binds to promoter and initiates transcription (Initiation). It uses nucleoside triphosphates as substrate and polymerises in a template depended fashion following the rule of complementarity. It somehow also facilitates opening of the helix and continues elongation. Only a short stretch of RNA remains bound to the enzyme. Once the polymerases reaches the terminator region, the nascent RNA falls off, so also the RNA polymerase. This results in termination of transcription.The RNA polymerase is only capable of catalysing the process of elongation. It associates transiently with initiation-factor (s) and termination-factor (r) to initiate and terminate the transcription. **(2 Marks)**

(c) There is single type of RNA polymerase in prokaryotes RNA polymerases in eukaryotes - RNA polymerase I, II, III **(1 Mark)**

OR

(c) In prokaryotes, site of transcription is cytosol whereas in eukaryotes the site is nucleus. **(1 Mark)**

34. (i) X to X' is 5'-----3', No more amino acids will be added due to the presence of stop codon at the end. **(1 Mark)**

(ii) Initiating codon –AUG
Anticodon – UAC
Amino acid it codes for- Methionine **(2 Marks)**

(iii) Amino acids are activated in the presence of ATP and linked to their cognate tRNA–a process commonly called as charging of tRNA or aminoacylation of tRNA to be more specific. Adaptor molecule need charging to initiate protein synthesis and translation. If two charged tRNAs are brought close enough, the formation of peptide bond between them would be favoured energetically. The presence of a catalyst would enhance the rate of peptide bond formation. **(2 Marks)**

35. (c) A – (iii), B – (i), C – (iv), D – (ii)

36. (a)

37. (i) The type of natural selection depicted in the graph is directional selection. **(1 Mark)**

(ii) Before industrialisation set in, it was observed that there were more white-winged moths on trees than dark-winged or melanised moths. However, in the collection carried out from the same area, but after industrialisation, i.e., in 1920, there were more dark-winged moths in the same area, i.e., the proportion was reversed. During post industrialisation period, the tree

trunks became dark due to industrial smoke and soots. Under this condition the white-winged moth did not survive due to predators, dark-winged or melanised moth survived. **(2 Marks)**

(iii) Similarly, excess use of herbicides, pesticides, etc., has only resulted in selection of resistant varieties in a much lesser time scale. This is also true for microbes against which we employ antibiotics or drugs against eukaryotic organisms/cell. Hence, resistant organisms/ cells are appearing in a time scale of months or years and not centuries. These are examples of evolution of anthropogenic action. **(2 Marks)**

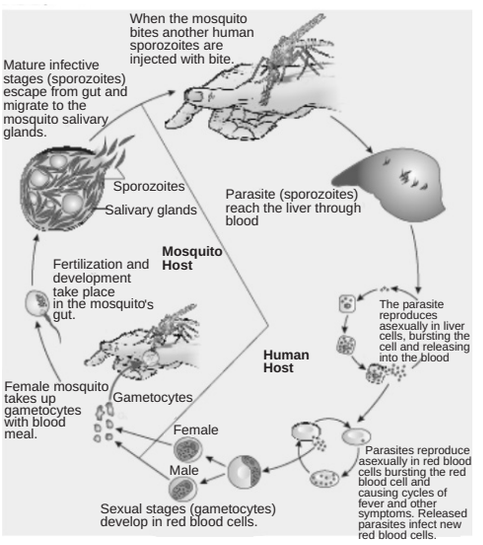
38. (d)

39. (a) In the given figure,
A – Adult Human B – Baby Chimpanzee
C – Adult Chimpanzee
The skull of adult human is more similar to baby chimpanzee. **(2 Marks)**

(b) (i) *Dryopithecus*
(ii) *Ramapithecus* **(1 Mark)**

40. (i) Symptoms of malaria are fever and chills after every three or four days due to rupture of RBCs associated with the release of haemozoin. **(2 Marks)**

(ii)



Different stages of sexual mode of reproduction in the life cycle of a malarial parasite :

(1) Sexual stages(Gametocytes) develops in the red blood cells of Human host.
(2) Female mosquito takes up the gametocytes through blood meal.
(3) Fertilization and development take place in the gut of mosquito.
(4) Mature infective stage (sporozoites) migrate and reach to the salivary gland of mosquito.
(5) From there the parasite enter another human host through the mosquito's bite. **(3 Marks)**

41. (a) (i) Sporozoite form (ii) Gametocyte form **(1 Mark)**

(b) *Plasmodium* enters the human body as sporozoites (infectious form)through the bite of infected female *Anopheles* mosquito. The parasites initially multiply within the liver cells and then attack the red blood cells (RBCs) resulting in their rupture. The rupture of RBCs is associated with release of a toxic substance, haemozoin, which is responsible for the chill and high fever recurring every three to four days. **(2 Marks)**

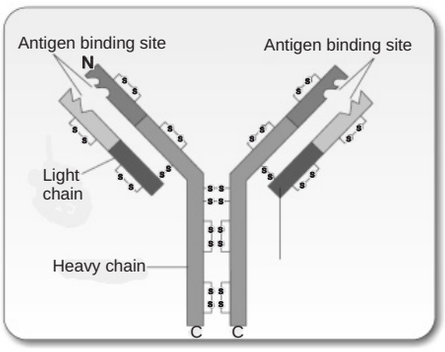
OR

(b) After female mosquito sucked blood from a malaria patient then it enters the human body as sporozoites (infectious form)through the bite of infected female *Anopheles* mosquito. The parasites initially multiply within the liver cells and then attack the red blood cells (RBCs) resulting in their rupture. The rupture of RBCs is associated with release of a toxic substance, haemozoin, which is responsible for the chill and high fever recurring every three to four days. **(2 Marks)**

(c) *Aedes* mosquito act as vector for dengue and chikungunya. **(1 Mark)**

42. (d)

43.

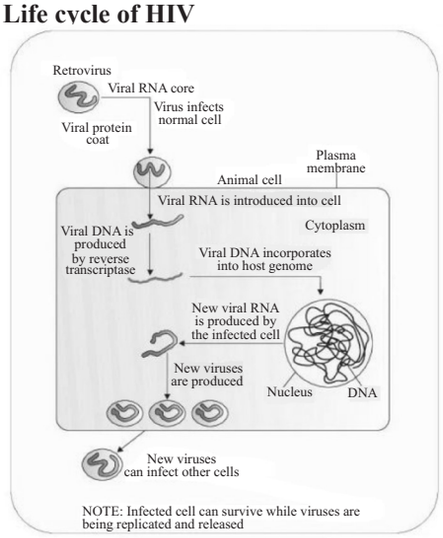


(2 Marks)

Their chemical nature is proteinaceous as it contain globulin protein. B-lymphocyte cells produces them. **(1 Mark)**

44. (c)

45. Life cycle of HIV



(3 Marks)

- After getting into the body of the person, the virus enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase.
- This viral DNA gets incorporated into host cell's DNA and directs the infected cells to produce virus particles.
- The macrophages continue to produce virus and in this way acts like a HIV factory. Simultaneously, HIV enters into helper T-lymphocytes (TH), replicates and produce progeny viruses.

- The progeny viruses released in the blood attack other helper T-lymphocytes. This is repeated leading to a progressive decrease in the number of helper T-lymphocytes in the body of the infected person. **(2 Marks)**

46. (i) Cannabinoids **(1 Mark)**
(ii) Generally taken by inhalation and oral ingestion **(1 Mark)**
(iii) It affects the cardiovascular system of the body. **(1 Mark)**

47. **(b)** A – III, B – IV, C – II, D – I

48. a = Statin
b = Lowers the blood-cholesterol
c = Penicillium notatum
d = Penicillin
e = Trichoderma polysporum
f = Immunosuppressive agent **(3 Marks)**

49. **(b)**

50. (a) flocs – Masses of bacteria associated with fungal filaments to form mesh like structure. It consumes the major part of organic matter present in the sewage. **(1 Mark)**
(b) Anaerobic sludge digestor – A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters. Here, other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge. During this digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide. These gases form biogas and can be used as source of energy as it is inflammable. **(2 Marks)**

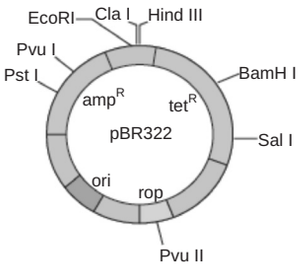
51. **(c)** Plasmids are usually present in prokaryotic cells, thus, (R) is false.

52. **(d)**

53. **(d)**

54. (a) EcoRI is the class of restriction endonucleases that recognises the specific sequence of bases. Such sequences are referred to as **Palindromic nucleotide sequences**. **(1 Mark)**
(b) The arrows indicate the cleaving of strand between the A and G by the restriction enzyme. After cleaving we will get sticky ends for ligation of other DNA. **(1 Mark)**

55. (i)



(2 Marks)
(ii) 'rop' codes for the proteins involved in the replication of the plasmid. **(1 Mark)**
(iii) The vector won't be able to differentiate between transformants and non-transformants. Selectable marker helps in eliminating non-transformants and selectively permitting the growth of transformants. **(1 Mark)**
(iv) Selection of recombinants due to inactivation of antibiotics is a cumbersome procedure because it requires simultaneous plating on two plates having different antibiotics. Therefore, alternative selectable markers have been developed which differentiate recombinants from non-recombinants on the basis of their ability to produce colour in the presence of a chromogenic substrate. **(1 Mark)**

56. (a) A – Denaturation
D – Extension **(1 Mark)**
(b) B – Annealing **(1/2 Mark)**
(c) C is *Taq* polymerase. It is obtained from *Thermus Aquaticus.* **(1/2 Mark)**
(d) In molecular diagnosis, PCR plays an important role in amplification of nucleic acid of any bacteria or viruses. **(1 Mark)**

57. (i) *Meloidegyne incognitia* **(1 Mark)**
(ii) *Agrobacterium tumeficians* **(1 Mark)**
(iii) These two RNA's being complementary to each other formed a double stranded (dsRNA) that initiated RNAi and thus, silenced the specific mRNA of the nematode. **(1 Mark)**
(iv) There would be no synthesis of infectious proteins because of silencing of mRNA in the host after the attack of parasite and thus the parasite could not survive. **(2 Marks)**

58. **(b)** ELISA is based on the principle of antigen-antibody interaction.

59. **(b)** Both the (A) and (R) are true but (R) is not the correct explanation of (A).

60. (a) Insulin used for diabetes was earlier extracted from pancreas of slaughtered cattle and pigs. Insulin from an animal source, though caused some patients to develop allergy or other types of reactions to the foreign protein. **(1 Mark)**
(b) Insulin synthesized in the human body contain an extra stretch of peptide C which is absent in mature insulin thus it need processing whereas in the insulin produced by Eli Lily company, two DNA sequences corresponding to A and B, chains of human insulin and introduced them in plasmids. of *E. coli* to produce insulin chains. Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form human insulin. **(1 Mark)**

61. (a) Transgenic animals that produce useful biological products can be created by the introduction of the portion of DNA (or genes) which codes for a particular product such as human protein (a-1-antitrypsin) used to treat emphysema. **(1 Mark)**
(b) Many transgenic animals are designed to increase our understanding of how genes contribute to the development of disease. These are specially made to serve as models for human diseases so that investigation of new treatments for diseases is made possible. **(1 Mark)**
(c) Transgenic animals are made that carry genes which make them more sensitive to toxic substances than non-transgenic animals. They are then exposed to the toxic substances and the effects studied. **(1 Mark)**

62. (a) Animals that have had their DNA manipulated to possess and express an extra (foreign) gene are known as transgenic animals. **(1 Mark)**
(b) 95% of transgenic animals are mice. **(1 Mark)**
(c) (i) Study of disease
(ii) Normal physiology and development
(iii) Vaccine safety **(1 Mark)**

63. **(b)** Both (A) and (R) are true but (R) is not the correct explanation of (A).

64. **(a)** Both (A) and (R) are true and (R) is the correct explanation of (A).

65. (a) A- Exponential growth curve
B- Logistic growth curve **(1 Mark)**

(b) Dotted line in the graph indicates the carrying capacity which represents the limit of resources to support the growth of organisms present in any habitat.**(1 Mark)**

OR

(b) The curve B is logical where the resources are limited whereas the curve A is exponential where the resources are unlimited. **(1 Mark)**

(c) (i) Curve B i.e., logistic curve is more realistic as the resources are always limiting in nature.

(ii) In present days, human population shows exponential growth and does not have any decline or crash. Thus, human population have J-shaped curve. **(2 Marks)**

66. **(a)** The Mediterranean orchid *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee. 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.

67. **(b)** Both (A) and (R) are correct but (R) is not the correct explanation of (A).

68. *Brood parasitism* in birds is a fascinating example of parasitism in which 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. Example - The movements of the cuckoo (koel) and the crow in your neighborhood park during the breeding season (spring to summer) and watch brood parasitism in action. **(2 Marks)**

69. (a) Growth curve A is plotted with when resources are unlimited whereas growth curve B is plotted when resources are limited. **(1 Mark)**

(b) 'K' in the graph represents carrying capacity of a habitat. **(1 Mark)**

70. Glomus species is a part of fungi that lives in almost all terrestrial lands. The *mycorrhizae* are associations between fungi and the roots of higher plants. The fungi help the plant in the absorption of essential nutrients from the soil while the plant in turn provides the fungi with energy-yielding carbohydrates. **(2 Marks)**

71.

Grazing food chain	Detritus food chain
(1) Energy is derived from sun.	(1) Energy is generated by organic matter or detritus.
(2) It begins with producers usually green plants at the first trophic level, the plant is then eaten by herbivores, which in turn consumed by carnivores.	(2) It begins with dead animals or fallen leaves which are eaten by decomposers or detrivores, which in turn are consumed by their predators.
(3) This type of food chain is usually large.	(3) This type of food chain is usually small.

(2 Marks)

72. **(c)** Because energy is lost at each trophic level by 10%, there is less total energy in next higher trophic level. Thus, (R) is false.

73. (i) Ecological pyramids represent food or energy relationship among different organism at different trophic levels. The base of each pyramid represents the producers or the first trophic level while the apex represents tertiary or top level consumer. **(1 Mark)**

(ii) 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.
The pyramid of biomass in sea is generally inverted because the biomass of fishes far exceeds that of phytoplankton. **(2 Marks)**

74. Ecologists and evolutionary biologists have proposed various hypotheses; some important ones are:

(i) 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.

(ii) 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.

(iii) There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity. **(3 Marks)**

75. (a) Biodiversity hotspots cover less than 2% of Earth's land area but host a disproportionately high number of species. By strictly protecting these areas, we can prevent habitat destruction and degradation, which are major drivers of species extinctions. This protection helps safeguard the unique and threatened species within these hotspots, reducing the rate of ongoing extinctions and preserving global biodiversity. **(1 Mark)**

(b) (i) Western ghat
(ii) Indo-Burma and Himalaya. **(1 Mark)**

76. (i) *Habitat loss and fragmentation:* This is the most important cause driving animals and plants to extinction. The most dramatic examples of habitat loss come from tropical rain forests. Once covering more than 14 per cent of the earth's land surface, these rain forests now cover no more than 6 per cent. They are being destroyed fast.

(ii) *Over-exploitation*: Humans have always depended on nature for food and shelter, but when 'need' turns to 'greed', it leads to over-exploitation of natural resources. Many species extinctions in the last 500 years (Steller's sea cow, passenger pigeon) were due to overexploitation by humans. Presently many marine fish populations around the world are over harvested, endangering the continued existence of some commercially important species.

(iii) *Alien species invasions*: When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive, and cause decline or extinction of indigenous species. The Nile perch introduced into Lake Victoria in east Africa led eventually to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake. **(3 Marks)**