

General Instructions :

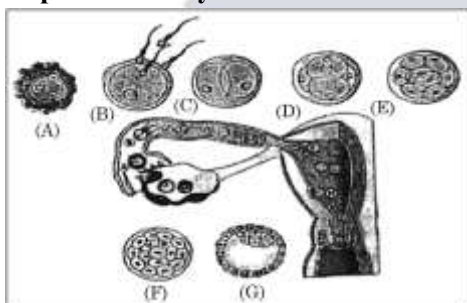
Read the following instructions carefully and follow them :

- (i) This question paper contains 33 questions. All questions are compulsory.
- (ii) Question paper is divided into FIVE sections - Section A, B, C, D and E.
- (iii) Section A - question number 1 to 16 are multiple choice type questions. Each question carries 1 mark.
- (iv) Section B - question number 17 to 21 are very short answer type questions. Each question carries 2 marks.
- (v) Section C - question number 22 to 28 are short answer type questions. Each question carries 3 marks.
- (vi) Section D - question number 29 and 30 are case-based questions. Each question carries 4 marks. Each question has subparts with internal choice in one of the subparts.
- (vii) Section E - question number 31 to 33 are long answer type questions. Each question carries 5 marks.
- (viii) There is no overall choice. However, an internal choice has been provided in section B, C and D of question paper. A candidate has to write answer for only one of the alternatives in such questions.
- (ix) Kindly note that there is a separate question paper for Visually Impaired candidates.
- (x) Wherever necessary, neat and properly labelled diagrams should be drawn.

SECTION - A

Question Nos. 1 to 16 are Multiple Choice type Questions, carrying 1 mark each.

1. In a fertilized ovule of an angiosperm, the cells in which n , $2n$ and $3n$ conditions respectively occur are :
 - (a) antipodal, zygote and endosperm
 - (b) zygote, nucellus and endosperm
 - (c) endosperm, nucellus and zygote
 - (d) antipodals, synergids and integuments
2. 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:



- (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
3. Study the table given below :

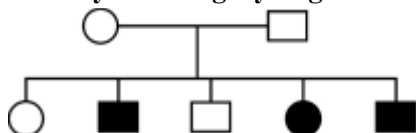
Contraceptive / Contraceptive Method	Mode of Action	
	I.	Prevent sperm reaching cervix
A. The pill	I.	Prevent sperm reaching cervix
B. Condom	II.	Prevent implantati on
C. Vasectomy	III.	Inhibits ovulation

D. Copper-I	IV.	Semen contains no sperm
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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. Identify the category of genetic disorder depicted in the pedigree chart given below :

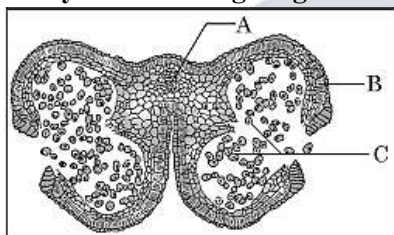


- (a) X-Linked recessive
 (b) X-Linked dominant
 (c) Autosomal recessive
 (d) Autosomal dominant

5. Which was the last of the 24 human chromosome to be completely sequenced ?

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

6. Study the following diagram of Transverse Section of a young anther of an angiosperm :



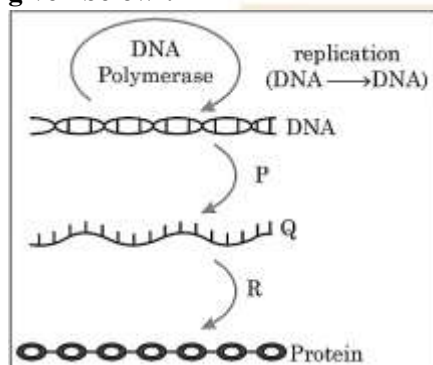
Select the option where parts 'A', 'B' and 'C' are correctly identified.

- (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.

7. Turner's syndrome in humans occurs due to

- (a) Aneuploidy (b) Euploidy
 (c) Polyploidy (d) Autosomal abnormality

8. Which of the options has correct identification of ' P ', ' Q ' and ' R ' in the illustration of 'Central Dogma' given below ?



- (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

9. Who proposed the mutation theory in favour of organic evolution ?

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

10. Study the following list of bioactive substances and their action:

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

11. The 'molecular scissors' fall in the category of :

- (a) Cleaving enzyme (b) Endonuclease
(c) Exonuclease (d) Restriction enzymes

12. ELISA technique is based on the principle of

- (a) DNA replication
(b) antigen-antibody interaction
(c) pathogen - antigen interaction
(d) antigen - protein interaction

Question Nos. 13 to 16 consist of two statements - Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below :

- (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.

13. 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.

14. Assertion (A) : Plasmids are autonomously replicating circular extrachromosomal DNA.

Reason (R) : Plasmids are usually present in Eukaryotic cells.

15. Assertion (A) : Patents are granted by government to an inventor.

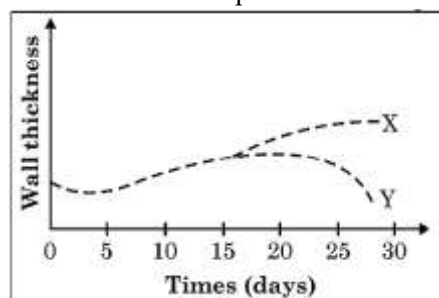
Reason (R) : Patents prevents others from commercial use of an invention.

16. Assertion (A) : Some aquatic ecosystems have inverted biomass pyramids.

Reason (R) : More energy is required by the organisms occupying higher trophic levels.

SECTION – B

17. 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 :



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

18. (A) Intensely lactating mothers generally do not conceive. Why ?
 (B) Our government has intentionally imposed strict conditions for MTP. Why?
19. (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 Lilly company does not need to undergo any processing ? Explain.
20. (A) Differentiate between grazing food chain and detritus food chain.

OR

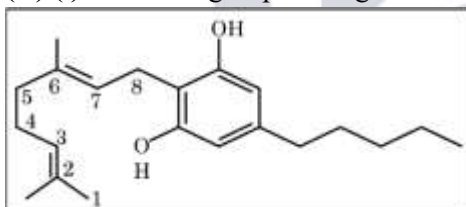
- (B) Explain Brood parasitism with the help of a suitable example.
21. (A) Biodiversity hotspots cover less than 2% of Earth's land area. Strict protection of these areas can reduce the rate of ongoing extinctions. Explain.
 (B) Name any two hotspots in India.

SECTION - C

22. 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).
23. (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.
24. (A) Whose skulls 'A', 'B', and 'C' are shown below ? Which of the two are more similar to each other?



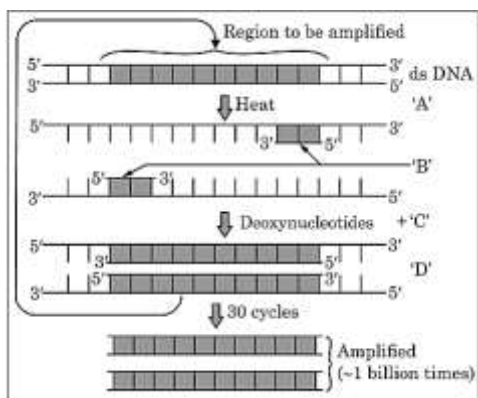
- (B) Name the (i) ape like (ii) man like primates that existed 1.5 million years ago.
25. (A) (i) Name the group of drugs whose skeletal molecule is shown below :



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

OR

- (B) Draw a schematic diagram of an antibody molecule and label any 4 parts. Mention their chemical nature. Name the cells which produce them.
26. Explain the role of the following during the sewage treatment :
 (A) flocs
 (B) anaerobic sludge digester
27. Study the steps shown below, that are carried during a specific technique :



- (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.

28. Explain the role of transgenic animals in :

- (A) Production of Biological products
 (B) Studying diseases
 (C) Chemical safety testing

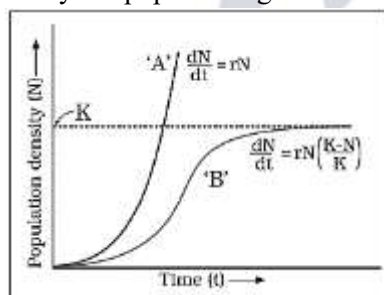
SECTION - D

(Case Based Questions)

Question No. 29 and 30 are case based questions. Each question has 3 subquestions with internal choice in one sub-question.

29. 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 :



- (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?

30. Read the following passage :

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.

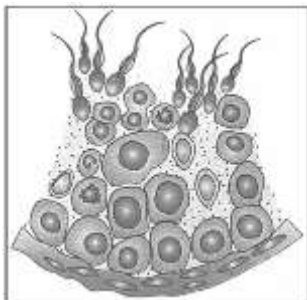
- (A) Name this RNA product transcribed from the DNA that subsequently translates into a polypeptide of 400 amino acids. Mention the enzyme responsible for transcribing this type of RNA from the DNA.
 (B) Name and explain the process the RNA molecule transcribed from 8000 nucleotide long DNA undergoes 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.

SECTION – E

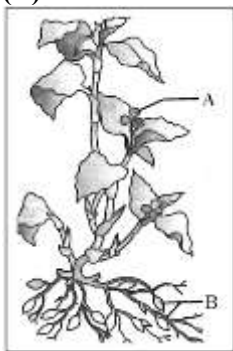
31. (A) The given diagram shows the sectional view of a seminiferous tubule of Human testis :



- Name and describe the process depicted in the diagram which results in the development of spermatozoa.
- Identify the cell where you are seeing a cluster of spermatozoa attached in the diagram. Write the function of the cell.

OR

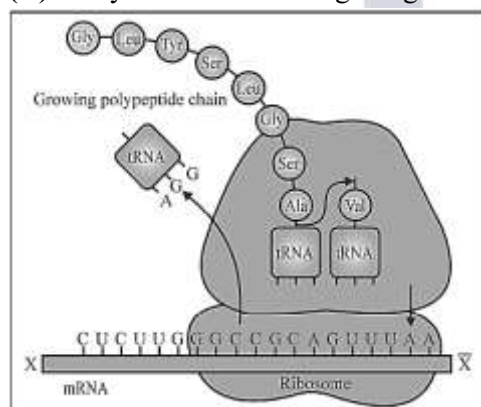
(B)



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

- Identify the two types of flowers labelled 'A' and 'B' in the picture.
- Compare the two types of flowers with reference to:
 - Characteristic feature
 - modes of pollination
- List any two 'out breeding devices' in flowering plants. Explain why do plants develop such devices.

32. (A) Study the schematic diagram given below and answer the questions that follow:



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

OR

- Why is sickle-cell anaemia, a human blood disorder so named ?
- Explain the genetic basis that results in the expression of this disorder.
- Work out a cross to explain how normal parents may have a sickle cell anaemic child.

33. (A) Describe the life cycle of HIV from the time of its entry into the human body till full blown AIDS sets in.

OR

(B) (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.

General Instructions :

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(v) Section C-questions number 22 to 28 are short answer type questions. Each question carries 3 marks.

(vi) Section D - questions number 29 and 30 are case-based questions. Each question carries 4 marks. Each question has subparts with internal choice in one of the subparts.

(vii) Section E - questions number 31 to 33 are long answer type questions. Each question carries 5 marks.

(viii) There is no overall choice. However, an internal choice has been provided in Sections B, C and D of the question paper. A candidate has to write answer for only one of the alternatives in such questions.

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

SECTION A

Questions no. 1 to 16 are Multiple Choice Type Questions, carrying 1 mark each.

34. The part of the ovule that develops into protective coats of a seed after fertilization in a typical flowering plant is:

- | | |
|-----------------|---------------|
| (a) embryo sac | (b) nucellus |
| (c) integuments | (d) megaspore |

35. A DNA fragment has 2000 nucleotides, out of which 140 are Adenine. How many bases does this DNA segment possess that have triple hydrogen bonds between them?

- | | |
|----------|----------|
| (a) 280 | (b) 860 |
| (c) 1720 | (d) 1860 |

36. During the 1850s in the pre-industrialisation era in England, the expected effect of natural selection on the number of dark-winged moths as compared to white-winged moths was :

- | |
|-------------------------------|
| (a) more in number |
| (b) less in number |
| (c) both were equal in number |
| (d) both were less in number |

37. In which one of the following floral plants are many embryos formed in the seeds without fertilisation of the egg cell ?

- | | |
|------------------|-------------|
| (a) Black pepper | (b) Mustard |
| (c) Groundnut | (d) Citrus |

38. A Snapdragon plant bearing pink colour flowers is crossed with a Snapdragon plant bearing white colour flowers. The expected phenotypic percentage of the offspring is :

- | |
|------------------------------------|
| (a) 50% Red : 50% White |
| (b) 25% Red : 50% Pink : 25% White |
| (c) 50% Pink : 50% White |
| (d) 25% Pink : 50% Red : 25% White |

39. In which of the given chromosomal disorders does the individual have tall stature with feminised character?

- | | |
|----------------------------|-----------------------|
| (a) Klinefelter's syndrome | (b) Down's syndrome |
| (c) Turner's syndrome | (d) Edwards' syndrome |

40. S.L. Miller in 1953, to support the theory of chemical evolution, created conditions in the closed flask that included :

- | |
|--|
| (a) CH ₄ , O ₂ , NH ₃ , H ₂ O vapour at 1800°C |
|--|

- (b) $\text{CH}_4, \text{H}_2, \text{NH}_3, \text{H}_2\text{O}$ vapour at 800°C
 (c) $\text{CH}_4, \text{CO}_2, \text{H}_2, \text{H}_2\text{O}$ vapour at 1800°C
 (d) $\text{CH}_4, \text{NH}_4, \text{SO}_2, \text{H}_2\text{O}$ vapour at 800°C

41. In an experiment, *E. coli* is grown in a medium containing $^{14}\text{NH}_4\text{Cl}$. (^{14}N is the light isotope of Nitrogen) followed by growing it for six generations in a medium having heavy isotope of nitrogen (^{15}N). After six generations, their DNA was extracted and subjected to CsCl density gradient centrifugation. Identify the correct density (Light/Hybrid/Heavy) and ratio of the bands of DNA in CsCl density gradient centrifugation.

- (a) Hybrid: Heavy, 1: 16
 (b) Light : Heavy, 1 : 31
 (c) Hybrid: Heavy, 1: 31
 (d) Light : Heavy, 1 : 05

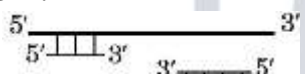
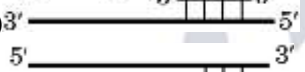
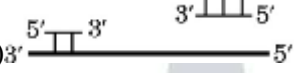
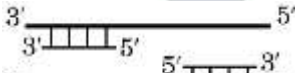
42. Which disease is the patient suffering from who is showing symptoms such as sustained high fever (39°C to 40°C), stomach pain, constipation, headache, loss of appetite and weakness ?

- (a) Pneumonia (b) Malaria
 (c) Typhoid (d) Amoebiasis

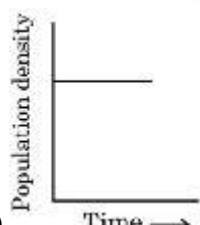
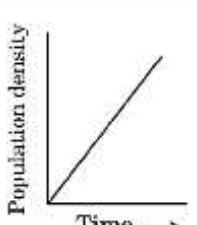
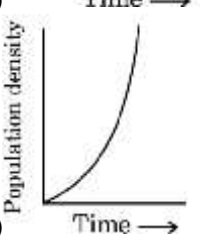
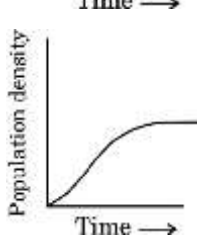
43. Which native plasmid did Stanley Cohen and Herbert Boyer use for the construction of the first recombinant DNA ?

- (a) *Salmonella typhimurium*
 (b) *Streptococcus pneumoniae*
 (c) *Escherichia coli*
 (d) *Haemophilus influenzae*

44. Which one of the following represents the correct annealing of primers to the DNA to be amplified in the PCR ?

- (a) 
 (b) 
 (c) 
 (d) 

45. The population growth curve applicable for a population growing in a geometric fashion, when the resources are not limiting in the habitat will be:

- (a) 
 (b) 
 (c) 
 (d) 

For Questions number 13 to 16, two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

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

46. **Assertion (A)** : Primary transcripts in eukaryotes are subjected to splicing to remove the introns.

Reason (R) : Primary transcripts contain both exons and introns and the introns are non-functional in eukaryotes.

47. **Assertion (A)** : The chronic use of alcohol by a person leads to cirrhosis.

Reason (R) : Alcohol addiction at times becomes the cause of mental and financial distress to the entire family of the addicted person.

48. **Assertion (A)** : The zygote gives rise to heart-shaped embryo and subsequently proembryo in most angiosperms.

Reason (R) : The zygote is present at the micropylar end of the embryo sac and develops into an embryo.

49. **Assertion (A)** : The stirrer facilitates the even mixing of oxygen availability in a bioreactor.

Reason (R) : Stirred-tank bioreactors generally have a flat base.

SECTION B

50. Oral contraceptives are widely accepted for controlling the increasing rate of population. Name the two important components of oral contraceptives. Why is 'Saheli' considered a preferred contraceptive by women?

51. What is a vaccine? Write the basis on which it acts when administered in the body.

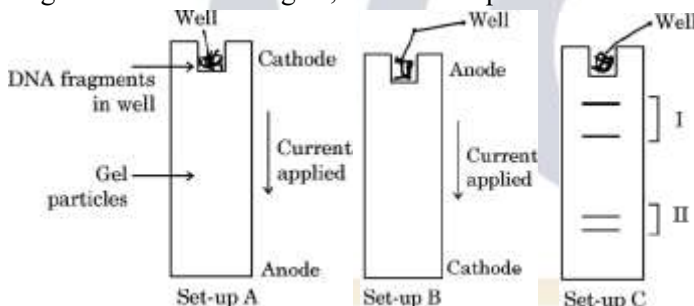
52. Consider the given data of a hypothetical small portion of mRNA that codes for a functional polypeptide chain and answer the questions that follow:

mRNA 5'-UCAUUACCACGAUUCUUUAAAAGA - 3'

(A) How many amino acids will be formed from the given codons, if substitution of 'U' by 'C' takes place at the 5th codon? Explain your answer.

(B) Write the number of amino acids that would be in the polypeptide synthesised by a similar mRNA as above, where in the fourth codon instead of 'C' there is 'U'. Justify your answer.

53. With reference to the set-ups (A, B and C) given below, of the electrophoretic separation of a mixture of DNA fragments of varied lengths, answer the questions that follow :



(A) In which one of the two Set-ups, A or B, would you see the DNA fragments separated and why? Justify your answer.

(B) In Set-up C, which one of the two, I / II, are the bands of longer fragments of DNA? Justify your answer.

54. (A) Write important features of 'humus' formed during the decomposition cycle in a terrestrial ecosystem.

OR

(B) (i) Graphically represent the relationship between species richness and area on a log-log scale for bats and fishes.

(ii) Write the equation for the relationship as on a logarithmic scale.

SECTION C

55. Draw a longitudinal section of pistil of a flower showing growth of the pollen tube. Label the part :

(A) through which the pollen tube moves down.

(B) the cell wherein the pollen tube releases its contents.

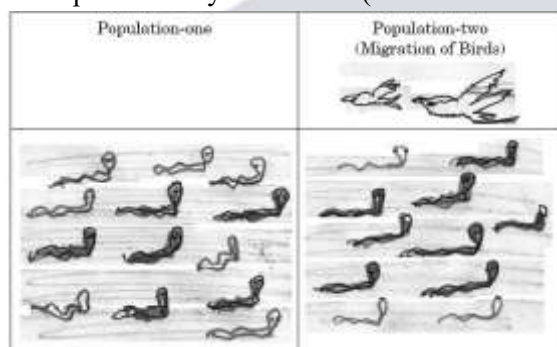
56. Explain the IUI and IUT methods of assisted reproductive technologies.

57. Three crosses were carried out in pea plants with respect to flower colour violet/white (V/v) and flower position axial/terminal (A/a). Study in the table the crosses 'a', 'b' and 'c' where parental phenotypes and their F_1 progeny phenotypes are given.

Parental plants (Phenotypes)	F_1 Progeny (Phenotypes)
(A) Violet, axial $\times$ white, axial	6/16 white, axial 2/16 white, terminal 6/16 violet, axial 2/16 violet, axial
(B) Violet, axial $\times$ white, terminal	1/4 violet, axial 1/4 violet, terminal 1/4 white, axial 1/4 white, terminal
(C) Violet, axial $\times$ violet, axial	3/4 violet, axial 1/4 white, axial

Find the genotypes of each of the parental pairs of crosses 'a', 'b' and 'c'.

58. A population of snakes lived in a desert with brown sand. Study the drawings given below showing the change in the population from 'one' to 'two' over time and answer the question that follows. Brown snakes and Grey snakes are represented by alleles A/a (Dominant/recessive).



- (A) If the frequency of the recessive trait is 9% in population-one, work out the frequency of homozygous dominant and heterozygous dominant snakes.
- (B) Name the mechanism of evolution that must have operated so that population-two evolved from population-one.
59. (A) (i) List two major reasons for using cow-dung in a biogas plant instead of using domestic sewage.
(ii) Mention one use of the unspent slurry of the biogas plant.
- OR**
- (B) Name the bioactive molecule and its microbial source generally used by physicians to treat the patients for :
(i) Myocardial infarction
(ii) High blood cholesterol level
(iii) Organ transplantation
60. (A) Give the scientific name of the bacteria widely used in biotechnology to create a GM cotton crop resistant to bollworm attacks.
(B) Explain how GM cotton crop is able to resist insect attacks.
61. Describe how fig tree and wasp relationship is a spectacular example of mutualism.

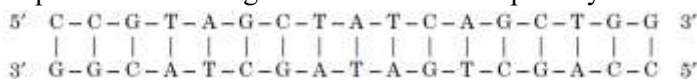
SECTION D

Questions no. 29 and 30 are case-based questions. Each question has 3 sub-questions with internal choice in one sub-question.

62. Read the passage given below and answer the questions that follow. In recombinant DNA technology, restriction enzymes are used as they recognize and cut DNA within a specific recognition sequence. BamH I is one such restriction enzyme which binds at the recognition sequence 5' G-G-A-T-C-C 3' and cleaves this sequence between

G and G on each strand, whereas Alu I binds at the recognition sequence 5' A-G-C-T 3' and cleaves these sequences between G and C on each strand.

(A) If Alu I is used to cut the given DNA strand, how many DNA fragments would be formed ? Write the sequence of each fragment formed with its polarity.



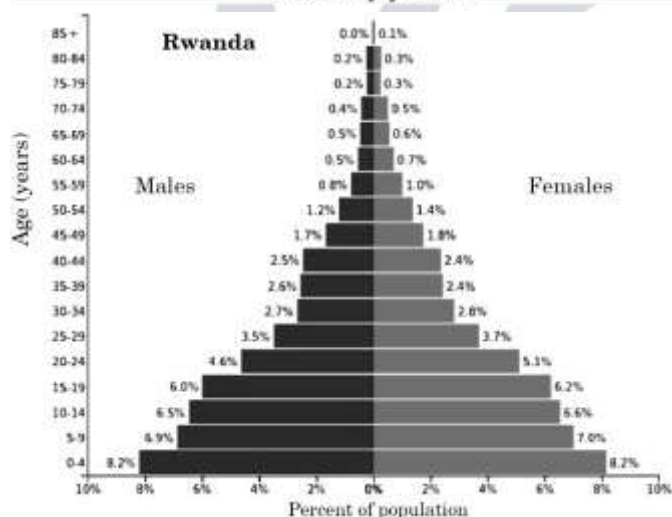
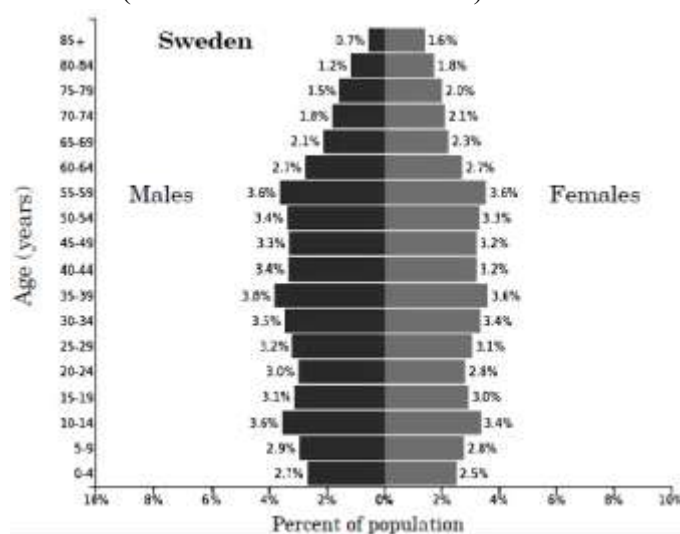
(B) Which one of the two restriction enzymes BamH I or Alu I will preferably be used on the same given DNA strand to make a recombinant DNA molecule and why?

(C) After binding to the two strands of the double helix DNA, where specifically does the restriction enzyme act to cut the two strands of DNA ? Write the specific term used for the specific nucleotide sequences of DNA recognised by a restriction endonuclease.

OR

(C) Write the specific sequence of DNA segment recognised by the restriction endonuclease EcoRI.

63. Study the figures given below that depict the comparative age distribution of human populations in Sweden and Rwanda. (International Data Base 2003) and answer the questions that follow :



(A) What can be inferred from the very broad base of Rwanda's age pyramid? Support your answer with the data provided in the figure.

(B) Sweden has an age distribution that is approximately of the same width near its base as at the apex. What does this indicate?

(C) Name the type of age pyramid shown above for Sweden.

OR

(C) Name the type of age pyramid shown above for Rwanda.

SECTION E

64. (A) (i) Explain any four devices that flowering plants have developed to encourage cross-pollination.
(ii) Why do plants discourage self-pollination? State any one reason.

OR

(B) Explain the ovarian and uterine events taking place along with the role of pituitary and ovarian hormones, during menstrual cycle in a normal human female under the following phases:

- (i) Follicular phase/proliferative phase
(ii) Luteal phase/secretory phase
(iii) Menstrual phase

65. (A) "The influence of both the alleles in a heterozygous state is clearly expressed in codominance." Explain with the help of inheritance of ABO blood group in humans.

OR

(B) "A group of genes are regulated and expressed together as a unit in lac operon."

- (i) Explain the mechanism of switching 'on' of the structural genes of lac operon.
(ii) "Regulation of 'lac operon' is referred to be negatively regulated." Justify giving a reason.

66. (A) (i) Describe the life cycle of Plasmodium from the time it enters the human body till a female Anopheles mosquito bites an infected person.

(ii) Mention the two events of Plasmodium life cycle that occur within the female Anopheles body.

OR

(B) (i) Write two differences between malignant tumor and benign tumor.

(ii) Explain any three diagnostic techniques for the detection of cancer.

General Instructions :

Read the following instructions carefully and follow them:

- (i) This question paper contains 33 questions. All questions are compulsory.
(ii) Question paper is divided into five sections - Sections A, B, C, D and E.
(iii) Section A - questions number 1 to 16 are multiple choice type questions. Each question carries 1 mark.
(iv) Section B - questions number 17 to 21 are very short answer type questions. Each question carries 2 marks.
(v) Section C-questions number 22 to 28 are short answer type questions. Each question carries 3 marks.
(vi) Section D - questions number 29 and 30 are case-based questions. Each question carries 4 marks. Each question has subparts with internal choice in one of the subparts.
(vii) Section E - questions number 31 to 33 are long answer type questions. Each question carries 5 marks.
(viii) There is no overall choice. However, an internal choice has been provided in Sections B, C and D of the question paper. A candidate has to write answer for only one of the alternatives in such questions.
(ix) Kindly note that there is a separate question paper for Visually Impaired candidates.
(x) Wherever necessary, neat and properly labelled diagrams should be drawn.

SECTION A

Questions no. 1 to 16 are Multiple Choice Type Questions, carrying 1 mark each.

67. An angiosperm embryo sac is located within the :

- (a) Placenta (b) Megasporangium
(c) Nucellus (d) Ovary

68. Match the items in Column I with those in Column II and select the correctly matched option from those given below :

	Column I		Column II
	Cross		Phenotypic Ratio
(1)	Mendelian monohybrid	(i)	1: 2: 1 (F ₂)
(2)	Incomplete dominance	(ii)	1: 1
(3)	Mendelian dihybrid	(iii)	3: 1 (F ₂)

(4)	Test cross (monohybrid)	(iv)	9: 3: 3: 1 (F ₂)
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- (a) (1)-(ii), (2)-(iv), (3)-(i), (4)-(iii)
 (b) (1)-(iii), (2)-(i), (3)-(iv), (4)-(ii)
 (c) (1)-(iii), (2)-(iv), (3)-(i), (4)-(ii)
 (d) (1)-(ii), (2)-(i), (3)-(iv), (4)-(iii)

69. In humans, the secondary oocyte completes meiotic division when :

- (a) it gets implanted in the uterine endometrium.
 (b) it is released from the matured Graafian follicle.
 (c) it is penetrated by the sperm cell.
 (d) acrosomal enzymes break down the zona pellucida.

70. Which one of the following statements is not true ?

- (a) Flippers of whales and dolphins are homologous organs.
 (b) Homologous organs have similar anatomical structure, but perform different functions.
 (c) Homology indicates common ancestry.
 (d) Homologous structures are a result of convergent evolution

71. A population is in genetic equilibrium/Hardy-Weinberg equilibrium for a gene with 2 alleles (dominant allele is 'A' and recessive allele 'a'). If the frequency of allele 'A' is 0.6, then the frequency of genotype 'Aa' is :

- (a) 0.21 (b) 0.42
 (c) 0.48 (d) 0.32

72. In the double helical structure of DNA molecule, the strands are :

- (a) identical and complementary
 (b) identical and non-complementary
 (c) anti-parallel and complementary
 (d) anti-parallel and non-complementary

73. In a 'transcription unit', the 'terminator' is located towards the :

- (a) 3' end of the template strand
 (b) 5' end of the template strand
 (c) 5' end of the coding strand
 (d) 3' end of the coding strand

74. A woman with normal vision has a colour blind father. She marries a man with normal vision. The percentage chance of their progeny being colour blind is :

- (a) 25% (b) 50%
 (c) 75% (d) 100%

75. The vector for dengue fever is :

- (a) Female Aedes mosquito
 (b) Female Anopheles mosquito
 (c) Male Aedes mosquito
 (d) Female Culex mosquito

76. Which one of the following pairs is not correctly matched ?

- (a) Clostridium butylicum - Butyric acid
 (b) Trichoderma polysporum - Cyclosporin A
 (c) Monascus purpureus - Citric Acid
 (d) Streptococcus - Streptokinase

77. Which one of the following is not a feature of plasmids?

- (a) Circular (b) Self-replicating
 (c) Single stranded (d) Extra-chromosomal

78. The pyramid of biomass in sea is generally inverted because in sea :

- (a) Biomass of fishes exceeds that of phytoplankton.
- (b) Number of phytoplanktons is more.
- (c) Number of phytoplanktons is less.
- (d) Large fishes feed on small fishes.

For Questions number 13 to 16, two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

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

79. Assertion (A) : RNA is unstable and can mutate at a faster rate.

Reason (R) : The presence of 2' – OH group in every nucleotide of RNA makes it labile and easily degradable.

80. Assertion (A) : Virus-infected cells produce interferons.

Reason (R): Interferons can cause inflammation of virus-infected cells.

81. Assertion (A) : Specific enzymes are used to degrade the cell wall in organisms to isolate the DNA from the cell.

Reason (R) : Fungal cell wall is degraded by the enzyme cellulase.

82. Assertion (A) : Loss of biodiversity can occur due to overexploitation of resources.

Reason (R) : Introduction of *Clarias gariepinus* in Indian rivers has led to a decline in native Indian fishes.

SECTION B

83. (A) Name any two copper releasing intra-uterine devices. State two reasons that make them effective contraceptives.

OR

(B) Name any two outbreeding devices that flowering plants have developed and explain how they help in encouraging cross-pollination.

84. Although Haemophilia and sickle cell anemia are two blood related Mendelian disorders, yet, they differ in their pattern of inheritance. State any two differences.

85. Identify A, B, C and D in the following table :

Scientific name of the plant	Drug	Effect on the human body/human system
(a) <i>Papaver somniferum</i>	A	Depressant/ slows down body function
(b) <i>Cannabis sativa</i>	Cannabinoids	B
(c) <i>Erythroxylum coca</i>	C	D

86. Write the role of 'ori' and restriction site in the cloning vector pBR 322.

87. How is the rate of decomposition affected by the nature of detritus and temperature?

SECTION C

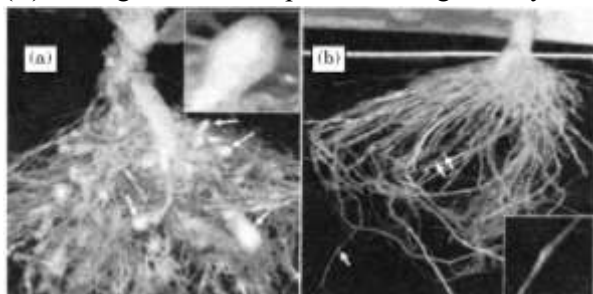
88. (A) Why is "in vitro fertilization (IVF)" so named ? State its importance.

(B) Distinguish between GIFT and ZIFT.

89. (A) (i) Write the karyotype and the genetic disorder of an individual who has developed from a zygote formed from an 'XX' egg fertilised by a 'Y' sperm.
(ii) Mention any two symptoms of this genetic disorder.
(iii) Write the possible reason that leads to the formation of this 'XX' egg.

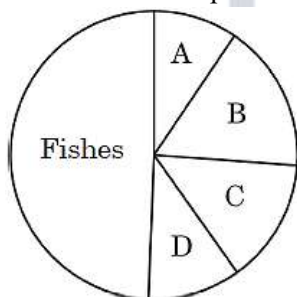
OR

- (B) In case of any dispute, a very small sample of tissue or even a drop of blood can help us to determine the paternity of a child. Provide a scientific explanation to substantiate the statement.
90. (A) Explain the process by which amino acid gets attached to the tRNA molecule during translation process.
(B) How does the translation process get terminated?
(C) Expand 'UTR'. Where are they located ?
91. (A) Differentiate between humoral immune response and cell-mediated immune response.
(B) Draw a schematic diagram of an antibody molecule and label any four parts.
92. The picture given below shows:
(A) Roots of a typical control tobacco crop plant (infected).
(B) Transgenic tobacco plant showing healthy roots even after deliberate infection by nematode.



Explain how this transformation was achieved in the tobacco plant.

93. Given below is a pie chart representing global diversity of vertebrates.



- (A) Redraw the pie chart identifying the groups 'A', 'B', 'C' and 'D' in their respective positions.
(B) Mention two examples of recently extinct animals.
94. Predation is referred to as a detrimental interaction. Explain any three positive roles, supported by an example each, that a predator plays in an ecosystem.

SECTION D

Questions No. 29 and 30 are case-based questions. Each question has 3 subparts with internal choice in one subpart.

95. Read the following passage and answer the questions that follow.

Spermatogenesis is an important primary sex characteristic in humans and all other vertebrates. The process is coordinated and controlled under the influence of hormones. It starts with the onset of puberty in humans and thereafter continues. The primordial cells within the embryonic testis which differentiate into spermatogonia are the precursors of the sperms. These are located at the outer walls of the seminiferous tubules where the process of spermatogenesis proceeds.

- (A) State the site of action of FSH in the testes and describe its action thereafter.

OR

- (A) Describe the role of LH in the process of spermatogenesis.
(B) Name the cells and their products which undergo:
(i) Mitosis and Differentiation
(ii) Meiosis I and Meiosis II

during the process of spermatogenesis.

(C) Name the accessory ducts that the sperms travel through from seminiferous tubules to reach the epididymis.

96. Read the following passage and answer the questions that follow.

In 1981, the health workers of United States of America had become aware of the increased frequency of Kaposi's sarcoma, cancer of the skin and blood vessels and another disease pneumocystis pneumonia, a respiratory infection caused by a protozoan. Both these diseases were very rare in the general population, but occurred frequently in more severely "immunosuppressed" individuals. This led to the recognition of the immune system disorder that was named Acquired Immune Deficiency Syndrome (AIDS).

In 1983, virologists working in the USA and France had identified a causative agent for 'AIDS', now known as Human Immunodeficiency Virus (HIV). 'HIV' follows a set path to attack the human body to cause the disease.

(A) Name the group of cells the HIV attacks after gaining entry into the human body and write the various events that occur within this cell.

(B) Write the expanded form of the diagnostic test used for detecting AIDS. Write the possible treatment available for the disease at present.

(C) Mention any two steps suggested by WHO for preventing the spread of this disease.

OR

(C) "A patient suffering from AIDS does not die of this disease but from some other infection." Justify the statement.

SECTION E

97. (A) (i) Explain the process of double fertilization in an angiosperm starting from the germination of pollen grains on the stigma, mentioning the ploidy of the end products formed at the end. State the role of synergids during the course of the process.

(ii) Why does the development of endosperm precede that of the embryo?

OR

(B) (i) Mention the site where fertilisation of the ovum occurs in a human female. Explain the process of fertilization and mention how polyspermy is prevented.

(ii) Name the embryonic stage that gets implanted in the uterus. Explain the process of implantation in a human female.

98. (A) (i) Compare the pattern of inheritance of flower colour in garden pea plant (violet/white) with snapdragon plant (red/white) on the basis of the following :

(1) F_1 phenotypic expression;

(2) expected phenotypic and genotypic expression of F_2 generation;

(3) the conclusion you reached at the end of the comparison made.

(ii) List any two characteristics of pattern of inheritance of human blood group ABO.

OR

(B) (i) Draw a schematic, self-explanatory labelled diagram of lac operon in a 'switched on condition'.

(ii) Why is regulation of lac operon referred to as negative regulation?

99. (A) (i) Why should a cell be made competent to take up an alien DNA ? How can a bacterial cell be made competent using calcium ions? Explain.

(ii) (1) State the importance of gel electrophoresis in biotechnology.

(2) Explain the principle on which this technique works.

(3) Mention why ethidium bromide is used in this technique.

OR

(B) 'Bt cotton', the genetically modified crop, has greatly helped the cotton farmers to increase their crop yield.

(i) How was Bt cotton plant made resistant to bollworm ? Explain.

(ii) Describe the mechanism that leads to the death of bollworms feeding on Bt cotton plants.

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(iii) Section A - questions number 1 to 16 are multiple choice type questions. Each question carries 1 mark.

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- (vii) Section E - questions number 31 to 33 are long answer type questions. Each question carries 5 marks.
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SECTION A

Questions no. 1 to 16 are Multiple Choice Type Questions, carrying 1 mark each.

100. In which of the following plants are both male and female flowers born on the same plant and the mode of pollination can be geitonogamy or xenogamy?

- (a) Papaya (b) Date Palm
(c) Maize (d) Spinach

101. Which one of the following hormones is secreted by the human placenta that helps in the maintenance of pregnancy?

- (a) Relaxin
(b) Human Chorionic Gonadotropin
(c) Oxytocin
(d) Human Placental Lactogen

102. The periodic abstinence by a couple for family planning should be from :

- (a) Day 5 to 10 of menstrual cycle
(b) Day 13 to 15 of menstrual cycle
(c) Day 10 to 17 of menstrual cycle
(d) Day 16 to 20 of menstrual cycle

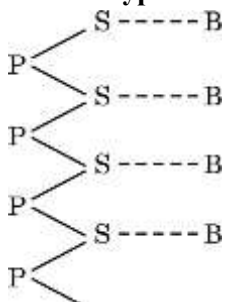
103. Select the incorrect match from the following :

Human Karyotype	Characters
(a) 45 + XX	Broad palm with characteristic palm crease
(b) 44 + XXY	Overall feminine development
(c) 44 + XO	Sterile females as ovaries are rudimentary
(d) 44 + XY	Normal male

104. You know that there are twenty different types of naturally occurring amino acids and four different types of bases in the DNA. A combination of 3 such bases code for a specific amino acid. If instead there are 96 different amino acids and 12 different bases in the DNA, then the minimum number of combination of bases required to form a codon is :

- (a) 6 (b) 8
(c) 2 (d) 4

105. The type of bond represented by the dotted line '-----' in a schematic polynucleotide chain is :



- (a) Hydrogen bond (b) Peptide bond
(c) N-glycosidic linkage (d) Phosphodiester bond

106. In which of the following conditions/diseases is there a substantial increase in the activity of mast cells observed in the human body?
- (a) Typhoid (b) Allergy
(c) Ascariasis (d) AIDS
107. *Lactobacillus* that sets milk into curd is categorised as :
- (a) Cyanobacteria
(b) Archaeobacteria
(c) Chemosynthetic bacteria
(d) Heterotrophic bacteria
108. Which one of the following transgenic animals is being used to test the safety of the polio vaccine?
- (a) Sheep (b) Goat
(c) Pig (d) Mice
109. Restriction Endonuclease - Hind II always cuts DNA molecules at a particular point by recognising a specific sequence of :
- (a) Six base pairs (b) Four base pairs
(c) Seven base pairs (d) Three base pairs
110. The improved trait that is found in the genetically modified transgenic crop - Golden rice is :
- (a) High lysine content (b) Insect resistant
(c) High protein content (d) High vitamin-A content
111. The rate of formation of new organic matter by consumers, and the biomass available for consumption of herbivores as well as decomposers are referred to as :
- (a) Gross primary productivity and Net primary productivity
(b) Net primary productivity and Secondary productivity
(c) Secondary productivity and Net primary productivity
(d) Secondary productivity and Gross primary productivity
- For Questions number 13 to 16, two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.
112. **Assertion (A)** : The laws of our country permit legal adoption and it is as yet, one of the best methods for childless couples looking for parenthood.
Reason (R) : Emotional, religious and social factors are no deterrents to the legal adoption of orphaned and destitute children in India.
113. **Assertion (A)** : Linked genes do not show dihybrid F_2 ratio 9: 3: 3: 1.
Reason (R) : Linked genes do not undergo independent assortment.
114. **Assertion (A)** : *Agrobacterium tumefaciens* is a pathogen of several monocot plants.
Reason (R) : It is able to deliver a piece of DNA known as 'T-DNA' to transform normal plant cells into a tumor.
115. **Assertion (A)** : Indian Government has set up an organisation known as GEAC to decide the validity of GM research.
Reason (R) : Genetic modification of organisms has no effect when such organisms are introduced in the ecosystem.

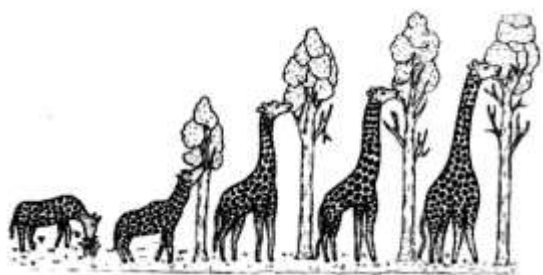
SECTION B

116. Identify A, B, C and D in the table given below:

Terms	Part of the plant it represents
Pericarp	'A'

'B'	Cotyledon in seed of grass family
Embryonal axis	'C'
'D'	Remains of nucellus in a seed

117. Observe the picture given below. Name the naturalist and write the explanation given by him that evolution of life forms had occurred on the basis of this example.



118. Write the basic steps followed in the Assisted Reproductive Technologies (ART) programme to help childless couples. Why is it also known as test tube baby programme?
119. (A) A farmer while working on his farm was bitten by a poisonous snake. He was rushed to a nearby health centre where the doctor gave him an injection to save his life.
- (i) What did the doctor inject and why?
- (ii) Name the kind of immunity provided by this injection.

OR

- (B) Why do organic farmers not recommend complete eradication of insect pests? Explain giving reason.
120. Study the diagram of a pyramid of biomass given below. Name the two standing crops that could be occupying level 'A' and level 'B' in it. Name this type of pyramid and the ecosystem in which it is found.



SECTION C

121. Explain the mode of action of contraceptive pills taken by human females. Mention the schedule to be followed for effective outcome.
122. (A) Name and write two characteristics of the type of DNA that forms the basis of DNA fingerprinting technique.
- (B) Mention any two applications of this technique.
123. (A) Explain the significance of the experiment carried out by S.L. Miller. Name the scientists whose hypothesis prompted him to carry out this experiment.
- (B) How does meteorite analysis favour this hypothesis?
124. Identify A, B, C, D, E and F in the table given below :

Name of Human Disease	Causative Organism	Symptoms
Pneumonia	Streptococcus	'A'

Typhoid	'B'	High fever, weakness, headache, stomach pain
Common Cold	Rhino virus	'C'
Ringworm	'D'	Dry scaly lesions on body parts, redness, itching
Ascariasis	Ascaris	'E'
'F'	Entamoeba histolytica	Constipation, cramps, stools with mucous and blood clots

125. In a family, the father, the daughter and the son are colour blind, whereas the mother has normal vision. Do you think the son and the daughter have inherited the disease from their father? Work out a cross to justify your answer.

126. (A) (i) What are transgenic animals ?

(ii) Name the first transgenic cow and state its importance.

OR

(B) (i) Explain the convention for naming EcoRI.

(ii) With the help of an illustration only, show the action of EcoRI on a DNA Polynucleotide.

127. (A) Explain how it is ensured that the orchid *Ophrys* is pollinated by a specific species of bee.

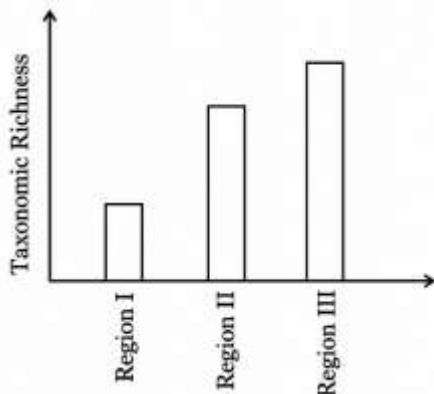
(B) Describe co-evolution with the help of this example.

SECTION D

Questions No. 29 and 30 are case-based questions. Each question has 3 sub-questions with internal choice in one sub-question.

128. Read the following passage and answer the questions that follow. Isn't it incredible that India's land area is only 2.4 per cent of the world's total land area whereas its share of the global species diversity is an impressive 8.1 per cent ! However, in these estimates of species, prokaryotes do not figure anywhere.

Biologists are always keen on collecting data with respect to species diversity observed in different regions of the world. The data collected based on the survey conducted for species richness of groups of mammals in three different regions of the world is shown in the bar graph given below :



(A) Why is the species richness maximum in Region III in the bar graph?

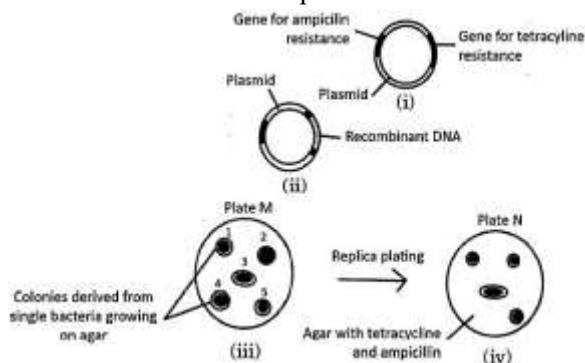
OR

(A) Why is the species richness minimum in Region I in the bar graph ?

(B) Plants and animals do not have uniform diversity in the world but show rather uneven distribution. Mention what this kind of diversity is referred to as.

(C) Why is it that prokaryotes do not have an estimated number of their species diversity as seen in plants and animals? Explain.

129. Study the diagram given below that shows the steps involved in the procedure of selecting transformed bacteria and answer the questions that follow:



(A) Identify the colony that has got transformed. Justify your answer.

(B) What are the sites in a plasmid called where ampicillin and tetracycline resistance genes are inserted? State their role in genetic engineering.

(C) Name two enzymes playing an important role in genetic engineering.

OR

(C) State the role of β -galactosidase in insertional inactivation.

SECTION E

130. (A) (i) Explain the development of male gametophyte in an angiosperm.

(ii) Draw a labelled diagram of a three-celled male gametophyte.

OR

(B) (i) Draw a diagrammatic sectional view of ovary of human female and label the following :

- (1) Blood vessels
- (2) Primary follicle
- (3) Tertiary follicle
- (4) Ovum

(ii) At which stage of life are primary follicles formed in a human female?

(iii) Explain the events (both hormonal and structural) that occur at the time of ovulation till the onset of the next menstrual cycle.

131. (A) Stability, as one of the properties of genetic material, was very evident in one of the very early experiments in genetics. Name the scientist and describe his experiment. State the conclusion he arrived at.

OR

(B) A tall pea plant bearing violet flowers with unknown genotype is given. Find the genotype by working out different crosses only by selfing the plants. Write the genotypic and phenotypic ratios of each cross shown by you.

132. (A) (i) Name and explain the property present in normal cells but is lost in cancer cells.

(ii) All normal human cells have genes that may become cancerous under certain conditions. Name them and explain how.

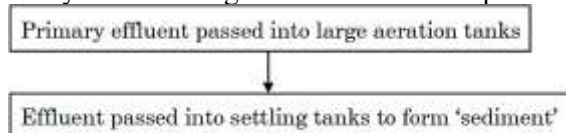
(iii) State the role of the following techniques in detection and diagnosis of cancer :

- (1) Biopsy and Histopathology
- (2) Magnetic Resonance Imaging

OR

(B) Large quantities of sewage are generated every day in cities as well as in towns and are treated in Sewage Treatment Plants (STPs) to make them less polluting. Given below is the flow diagram of stages of STP.

Study the flow diagram and answer the questions that follow :



- (i) (1) Why is primary effluent passed into large aeration tanks?
 (2) What is the 'sediment' formed, referred to as? Mention its significance.
 (3) Explain the final step in the settling tank before the treated effluent is released into water bodies.
 (ii) Name any two organisms commonly used as biofertilisers, belonging to different kingdoms. Write how each one acts as a biofertiliser.

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 (ii) Question paper is divided into five sections - Sections A, B, C, D and E.
 (iii) Section A - questions number 1 to 16 are multiple choice type questions. Each question carries 1 mark.
 (iv) Section B - questions number 17 to 21 are very short answer type questions. Each question carries 2 marks.
 (v) Section C - questions number 22 to 28 are short answer type questions. Each question carries 3 marks.
 (vi) Section D - questions number 29 and 30 are case-based questions. Each question carries 4 marks. Each question has subparts with internal choice in one of the subparts.
 (vii) Section E - questions number 31 to 33 are long answer type questions. Each question carries 5 marks.
 (viii) There is no overall choice. However, an internal choice has been provided in Sections B, C and D of the question paper. A candidate has to write answer for only one of the alternatives in such questions.

SECTION A

Questions no. 1 to 16 are Multiple Choice Type Questions, carrying 1 mark each.

133. When a pollen tube emerges from the germinating pollen grain, it carries along with it :
 (a) cytoplasm, vegetative cell and generative cell
 (b) cytoplasm and generative cell
 (c) cytoplasm and vegetative cell
 (d) cytoplasm, vegetative cell and one male gamete
134. Scutellum in maize grain represents :
 (a) Endosperm (b) Cotyledon
 (c) Embryo (d) Coleoptile
135. Tightly linked genes on the same chromosome lead to :
 (a) very low recombination
 (b) very high recombination
 (c) no recombination
 (d) non-parental combination
136. The type of sex determination in honeybee is referred to as :
 (a) Diploidy (b) Haploidy
 (c) Haplodiploidy (d) Diplohaploidy
137. The type of plant forms that existed along with dinosaurs are :
 (a) Progymnosperms (b) Tracheophytes
 (c) Bryophytes (d) Conifers
138. Overuse of antibiotics has increased resistance in bacteria in a very short span of time due to :
 (a) chance mutations
 (b) the role played by selection of resistant varieties
 (c) adaptive evolution
 (d) divergent evolution
139. Which one of the following options is not a characteristic of polygenic inheritance?
 (a) Have distinct alternate forms
 (a) Dependent upon number of genes
 (b) Additive effect of every allele
 (d) Uninfluenced by environment
140. When the F_1 phenotypic ratio of a cross is 1:1, the parental phenotype and genotype are:
 (a) Homozygous recessive $\times$ homozygous dominant
 (b) Heterozygous $\times$ heterozygous dominant

- (c) Homozygous dominant $\times$ heterozygous dominant
(d) Heterozygous dominant $\times$ homozygous recessive

141. Which one of the following is the causative agent of dengue fever?

- (a) Flavivirus (b) Alphavirus
(c) Rhinovirus (d) Adenovirus

142. In 'lac' operon which one of the following is not a structural gene?

- (a) z gene (b) y gene
(c) a gene (d) p gene

143. Which one of the following makes up 95% of all the transgenic animals?

- (a) Sheep (b) Cow
(c) Fish (d) Mice

144. The interaction between two species where one species is harmed and the other is unaffected is referred to as :

- (a) Mutualism (b) Predation
(c) Amensalism (d) Competition

For Questions number 13 to 16 , two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

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

145. **Assertion (A) :** The embryo in a seed may enter a state of inactivity called dormancy.

Reason (R) : This state occurs when all conditions are favourable.

146. **Assertion (A) :** DNA is a long polymer of deoxyribonucleotides.

Reason (R) : Polymer of N-base + deoxyribose sugar + phosphate with free phosphate moiety at 5' end of deoxyribose sugar that is referred to as the 5' end of the polymer has a free OH⁻ at 3' end of the deoxyribose sugar, referred to as 3' end of the polymer.

147. **Assertion (A) :** Malaria is caused by female Anopheles mosquito.

Reason (R) : The female Anopheles mosquito requires human blood to produce eggs.

148. **Assertion (A) :** Adenosine deaminase (ADA) deficiency causes severe disorders in humans as ADA is crucial for the immune system to function.

Reason (R) : This can be treated permanently by bone marrow transplantation in adult humans.

SECTION B

149. List in correct sequence, the male sex accessory ducts in humans.

150. Write the dual functions of the codon 'AUG'.

151. "Antibiotics should be taken as prescribed by the doctors." Justify the statement.

152. State the characteristics of stem cells.

153. (A) A number of insects are feeding on a big tree which are being fed by small birds. The small birds are being preyed upon by large birds.

(i) Name the different trophic levels in this situation.

(ii) Mention the types of pyramids that can be formed based on the biomass and the number respectively in the above situation.

OR

(B) State the effect of the following on the rate (both low and high) of decomposition of detritus:

- (i) Composition of detritus
(ii) Climatic factors

SECTION C

154. (A) Where and when does corpus luteum develop in a human female? Name the hormone and its source gland, that influences its development.

(B) State the role of corpus luteum during:

- (i) Menstrual cycle
- (ii) Pregnancy

155. Where does fertilisation occur in a human female?

Explain the process of fertilisation.

156. A colour blind son and a daughter with normal vision are born to a couple with "normal" vision. Explain the pattern of inheritance of this trait in this family.

157. What are fossils ? How do fossils help to understand the process of evolution?

158. Name any three enzymes obtained from microbes and mention the role played by them in human welfare.

159. (A) Write the steps that would be followed to develop a bollworm-resistant cotton crop plant.

OR

(B) How does silencing of mRNA prevent infestation of tobacco plants by *Meloidogyne incognita*? Explain.

160. Biodiversity exists at all levels of biological organisation ranging from macromolecules within cells to biomes. Explain the three most important levels of biodiversity with the help of one example from each.

SECTION D

Questions No. 29 and 30 are case-based questions. Each question has 3 sub-questions with internal choice in one sub-question.

161. Read the passage given below and answer the questions that follow.

"Biotechnology is based on the manipulation of the genes either by addition of a desirable gene or deletion of an undesirable gene from the genome of an organism. This genetic engineering is carried out keeping the welfare of the humans in mind."

(A) Write the specific sequence of nucleotides that are recognised by EcoRI on a DNA segment. Where in this specific sequence does the enzyme make a 'cut' in the sugar-phosphate backbone of the DNA?

(B) Mention how a "transformant" can be distinguished from a "non-transformant" bacterial colony in a culture medium.

OR

(B) List the five tools generally used in genetic engineering.

(C) Name a synthetic/engineered vector. Why does it have multiple restriction sites in it?

162. Read the passage given below and answer the questions that follow.

"All living beings including humans are interdependent and can never exist in isolation. In this web of interdependence, organisms tend to develop various kinds of interactions where some benefit, others are harmed and still many others remain neutral or unaffected."

(A) Name the specific type of interaction that exists between a cuckoo and a crow during their breeding season. Mention the role of each one in this interaction.

OR

(A) List any four adaptive features the parasites have evolved with, in order to survive in their host.

(B) State what is 'commensalism' and give an example.

(C) Give an example of plant and animal having mutualistic interactions between them.

SECTION E

163. (A) (i) Describe the process of double fertilisation in angiosperms.

(ii) Explain the process of development of endosperm in a coconut.

OR

(B) (i) Describe the process of spermatogenesis in humans.

(ii) Name the hormones and mention their roles in the regulation of the process of spermatogenesis.

164. (A) (i) State what is mutation.

(ii) With the help of a suitable example from humans, explain point mutation and mention the symptoms that appear due to this mutation.

(iii) Name another type of mutation.

OR

(B) Describe the experiment performed by Meselson and Stahl. Write the conclusion at which they arrived, at the end of their experiment.

165. (A) State what is innate immunity. Write any four ways in which it is accomplished in a human body.

OR

- (B) (i) Name the parasite that causes malaria in humans (scientific name). How does the parasite gain entry into the human body? Explain the parasitic cycle in the human body that causes the disease.
(ii) Write the symptoms of the disease and mention what causes them to appear.

General Instructions :

Read the following instructions carefully and follow them :

- (i) This question paper contains 33 questions. All questions are compulsory.
- (ii) Question paper is divided into FIVE sections - Section A, B, C, D and E.
- (iii) Section A - question number 1 to 16 are multiple choice type questions. Each question carries 1 mark.
- (iv) Section B - question number 17 to 21 are very short answer type questions. Each question carries 2 marks.
- (v) Section C-question number 22 to 28 are short answer type questions. Each question carries 3 marks.
- (vi) Section D - question number 29 and 30 are case-based questions. Each question carries 4 marks. Each question has subparts with internal choice in one of the subparts.
- (vii) Section E - question number 31 to 33 are long answer type questions. Each question carries 5 marks.
- (viii) There is no overall choice. However, an internal choice has been provided in section B, C and D of question paper. A candidate has to write answer for only one of the alternatives in such questions.
- (ix) Kindly note that there is a separate question paper for Visually Impaired candidates.
- (x) Wherever necessary, neat and properly labelled diagrams should be drawn.

SECTION – A

Question Nos. 1 to 16 are Multiple Choice type Questions, carrying 1 mark each.

166. A single gene that controls the expression of more than one trait is said to show

- (a) Multiple allelism
- (b) Polygenic inheritance
- (c) Incomplete dominance
- (d) Pleiotropism

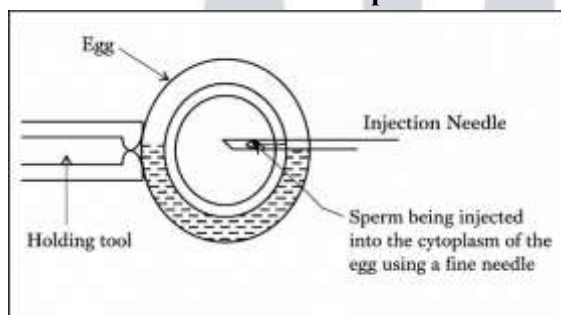
167. A person with trisomy of 21st chromosome shows

- (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)

168. 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

169. Interferons are proteins secreted by

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

170. 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

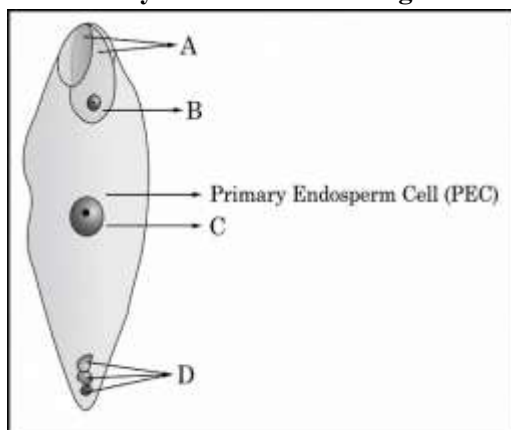
171. Which one of the following statements is correct in the context of observing DNA separation by agarose gel electrophoresis?

- (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.

172. 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 :

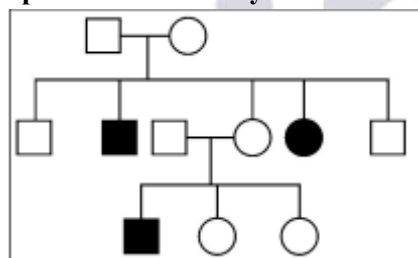
- (a) Pseudocopulation (b) Pseudopollination
 (c) Pseudoparthenocarpy (d) Pseudofertilisation

173. 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

174. 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

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

A		B	
Gene		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)

176. If both the parents are carriers for thalassaemia, the chances of an afflicted child to be born to them is :

- (a) 25% (b) 50%
(c) 75% (d) 100%

177. 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'

Question number 13 to 16 consist of two statements - Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

- (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.

178. 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.

179. 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.

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

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

181. 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.

SECTION-B

182. (A) "Farmers prefer apomictic seeds to hybrid seeds." Justify giving two reasons.

OR

(B) Mention one advantage and one disadvantage of amniocentesis.

183. 5' - G[↓]AATTC - 3'

3' - CTTA 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.

184. Observe the population growth curve and answer the questions given below:

(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.

185. Explain how are plants benefitted by their association with "Glomus species".

186. 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.

SECTION-C

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

Sl. No.	Organism	Bioactive Molecule	Use
1.	Monascus purpureus	a	b
2.	c	d	Antibiotic

3.	e	Cyclosporin A	f
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188. (A) Tropical regions harbour more species than the temperate regions. How have biologists tried to explain this in their own ways? Explain.

OR

(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.

189. (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.

190. 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.

191. (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.

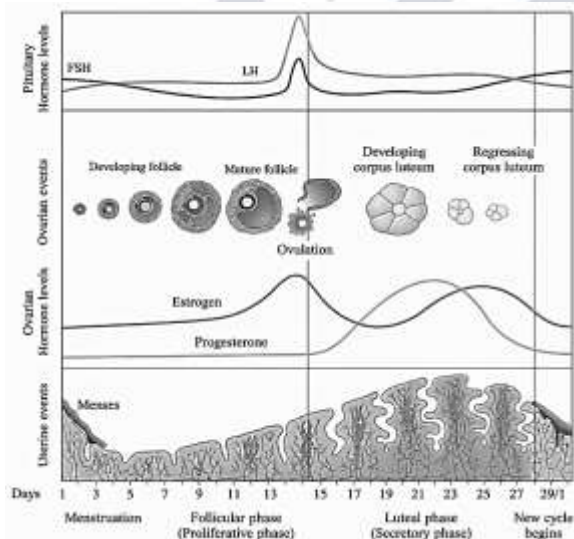
192. Explain the processing of heterogeneous nuclear RNA (hnRNA) into a fully functional mRNA in eukaryotes. Where does this processing occur in the cell?

193. 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.

SECTION-D

Q. No. 29 and 30 are case based questions. Each question has 3 subquestions with internal choice in one sub-question.

194. 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



(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 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.

(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.

195. 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."

(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.

SECTION-E

196. (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

(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?

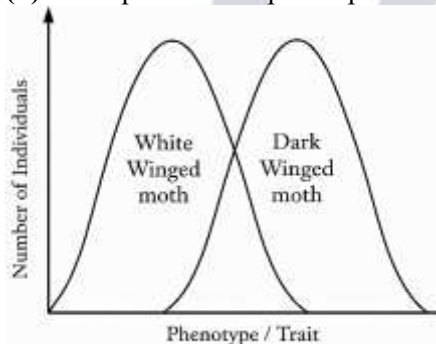
197. (A) (i) Draw a diagram of a human sperm. Label any four parts and write their functions.

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

OR

(B) (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.



198. (A) Natural selection operates in different ways in nature.

(i) Identify the type of natural selection depicted in the graph above.

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

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

OR

(B) (i) Why did Hershey and Chase use ⁴⁵S ' and ⁴²P ' 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.