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, D and E 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

1. Identify the plant in which emasculation is not required for artificial hybridization.
(a) Rice (b) Wheat
(c) Pea (d) Papaya

2. Which of the following is not a component of immune system ?
(a) Lymphocytes (b) Plasma Proteins
(c) Red Blood Cells (d) Bone Marrow

3. Select the option that shows correct statements :
(I) Corpus luteum secretes progesterone.
(II) Only FSH attains a peak level in middle of cycle.
(III) LH surge induces rupture of graafian follicle.
(IV) Luteal phase of menstrual cycle is also called proliferative phase.
(a) Only (II) is correct.
(b) (I) and (III) are correct.
(c) Only (IV) is correct.
(d) (II) and (IV) are correct.

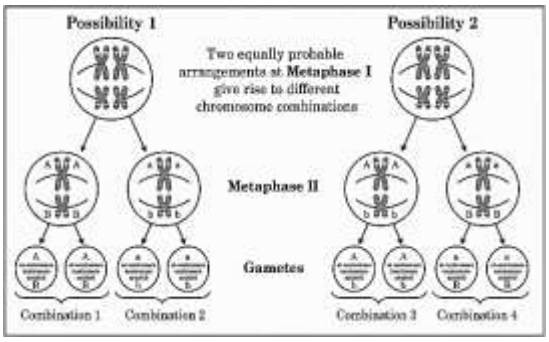
4. Select the mismatched pair :
(a) Mega diversity countries in the world - 12
(b) Genetically different strains of rice in India - Less than 1000
(c) Robert Mays estimation on global species diversity - 7 million species worldwide
(d) Zoological parks - Ex-situ conservation

5. Pomato was produced by fusing protoplasts of
(a) Tomato and Potato
(b) Pomegranate and Tomato
(c) Pomegranate and Potato
(d) Pomegranate, Potato and Tomato

6. In an ecosystem, different species occupy different levels and vertical distribution of species is found. This is called ___ .
(a) Stratification (b) Layering
(c) Fragmentation (d) Population

7. Which of the following sacred groves is found in Meghalaya ?
(a) Jaintia hills (b) Bastar
(c) Chanda (d) Sarguja

8. In the following figure, two ways of pairing of two homologous pairs of chromosomes are shown. Which of the following phenomena is expressed?



(a) Linkage of genes
(b) Independent assortment of genes
(c) Multiple alleles
(d) Incomplete dominance

9. Match Column-I with Column-II and choose the correct option :

Column-I		**Column-II**	
(A)	Biolistic gun	**(I)**	Bacterial cell
(B)	Chitinase	**(II)**	Tumour inducing
(C)	Ti	**(III)**	Animal cell
(D)	Ca^{++}	**(IV)**	Fungal cell
		(V)	Plant cell

(A) (B) (C) (D)
(a) (I) (II) (III) (IV)
(b) (II) (V) (I) (III)
(c) (V) (IV) (II) (I)
(d) (V) (I) (IV) (II)

10. The idea of use and disuse of organs for evolution of organism was proposed by
(a) Charles Darwin (b) Thomas Malthus
(c) Hugo De Vries (d) Lamarck

11. Which of the following statements about plasmids is incorrect?
(a) Plasmids have the ability to replicate within the bacterial cell.
(b) Their replication is controlled by chromosomal DNA.
(c) They are autonomously replicating circular extra-chromosomal DNA.
(d) They often carry antibiotic resistant genes.

12. Which connective tissue connects ovary to pelvic wall and uterus?
(a) Tendons (b) Ligaments
(c) Cartilage (d) Bone

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) given below :
(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation for Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation for Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

13. Assertion (A) : The population of melanized moths increased in industrial areas after Industrial Revolution.
Reason (R) : In Industrial environment lichen covered trees were replaced by soot-covered trees offering better camouflage to dark coloured moths.

14. Assertion (A) : The milk produced by transgenic cow 'Rosie' was nutritionally more balanced product for human babies than natural cow milk.
Reason (R) : It was human protein enriched milk containing human alpha lactaglobulin.

15. Assertion (A) : Flocs are masses of bacteria associated with fungal filaments in secondary treatment of sewage.
Reason (R) : Flocs help in digestion of solid waste by anaerobic respiration.

16. **Assertion (A) :** In terrestrial ecosystem much larger fraction of energy flows through grazing food chain.
Reason (R) : Grazing food chain may be connected to Detritus food chain at some levels.

SECTION – B

17. **(A)** Define Humoral immune response.
(B) Name any two types of antibodies found to give humoral immune response in humans.

18. **(A) (i)** How does a farmer use dormancy of seed to his advantage?
(ii) Differentiate between pea seed and castor seed.

OR

(B) Identify the stage of follicle where primary oocyte undergoes first meiotic division.
Also mention the products of this division.

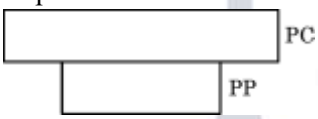
19. Study the sequence of bases in a DNA molecule that is shown below and answer the questions.
5' - GAATTC - 3'
3' - CTTAAG - 5'
(A) What are such sequences called ? Name the enzyme used that recognises such nucleotide sequences.
(B) How do these enzymes function?

20. **(A)** Analyse the following two cases of sex determination in different organisms :
Case I : Males have (XO) sex chromosomes and females have two copies of same sex chromosome (XX).
Case II : Females have two different sex chromosomes (ZW) and males have two copies of same sex chromosome (ZZ).
Identify the type of heterogamety in each case, giving one example of each.

OR

(B) (i) Differentiate between a DNA and RNA nucleotide.
(ii) Name the two types of bonds present within a single nucleotide.

21. **(A)** Given below is a pyramid found in an ecosystem, where each bar represents the standing crop available in the trophic level.



(i) Identify the kind of pyramid and with the help of an example explain the conditions where this kind of pyramid is possible in nature.
(ii) Write any two limitations of ecological pyramids.

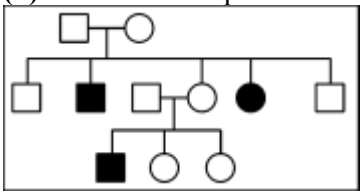
OR

(B) In an ecosystem there was loss of biodiversity due to some project in that area.
(i) How will biodiversity be affected ? (2 points)
(ii) List two major causes of loss of biodiversity.

SECTION – C

22. **(A)** Do all pollen grains remain viable for the same length of time ? Support your answer with two suitable examples.
(B) How are pollen grains stored in pollen banks?

23. **(A)** What is pedigree analysis ? Mention its importance in human genetics. (2 pts.)
(B) Analyse the following pedigree and write the
(i) Pattern of inheritance.
(ii) Give one example of disease showing such an inheritance pattern.



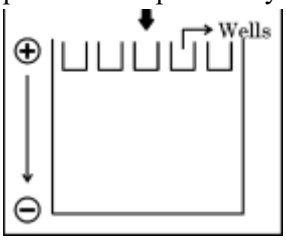
24. **(A)** How is Hardy-Weinberg expression $(p^2 + 2pq + q^2) = 1$ derived?
(B) List any two factors that disturb the genetic equilibrium.

25. Draw a neat diagram of megasporangium of an angiosperm and label any six parts.

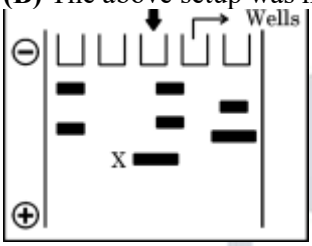
26. **(A)** Mention the scientific name of the source plant and the part from which opioids are extracted.
(B) How are morphine and heroin related? Mention the effect each one of them has on human body.

27. A farmer grew two varieties of corn crop in field A and B . He grew normal corn crops in field A and GM corn crops in field B.
He observed that corn borers attacked only in field A. To control it, spores of Bt were sprayed on field A .
(A) Name the gene in the spores responsible for control of pest.
(B) What effect will the spores of Bt have on insect pest ?
(C) How has corn plants of field B developed resistance against this pest? Explain.

28. Observe the given picture carefully. A mixture of DNA with fragments ranging from 100 base pairs to 1800 base pairs were separated by electrophoresis on agarose gel with the following arrangement:



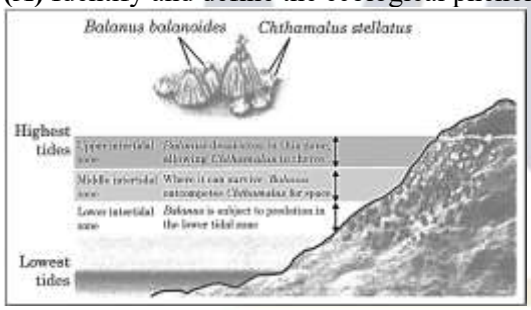
(A) What result will be obtained in staining with ethidium bromide ? Explain with reasons.
(B) The above setup was modified as shown below and a band with 100 base pairs was obtained at X.



What changes were made to the previous design to get a band at ' X '. Why did the band appear at ' X '?

SECTION – D

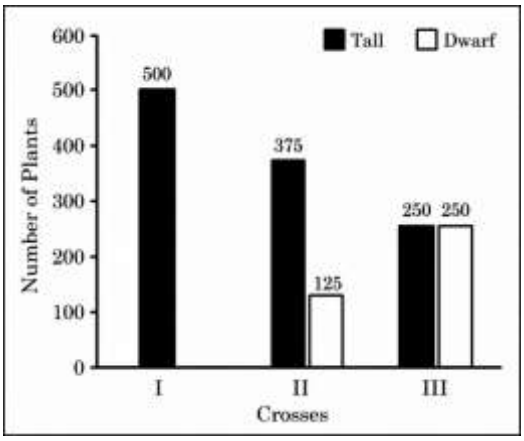
29. The diagram below shows the distribution of two barnacle species, Chthamalus and Balanus on a rocky sea shore. When Balanus is experimentally removed, Chthamalus expands its range in lower intertidal zone.
(A) Identify and define the ecological phenomenon demonstrated by this observation.



OR

(A) State the principle that explains the elimination of one species.
(B) Two different species can compete for the same resource. Give another example of it.
(C) How do species avoid competition in nature? Explain with an example.

30. A student performed some crosses in plants and represented the result in the form of bar graphs as shown below. Each graph displays the phenotypic proportion of the progeny. Study the graphs and answer the questions :



(A) What can you infer about the genotype of parents in crosses I and II?

OR

(A) Which genetic cross is represented by these crosses?

(B) Looking at bar graph of cross III, identify the type of cross performed and its importance in genetics.

(C) What conclusion can you draw from the results of bar graphs of crosses I and II? Name the genetic principle illustrated.

SECTION – E

31. **(A)** Trace the events from fertilization till implantation of blastocyst in human female. Also mention the site where fertilization takes place.

OR

(B) (i) Case studies of some couples are given below. They were not able to have kids even though the parents were not taking any precautions. They also do not wish to adopt a child or take the help of donors. Study these cases and suggest an appropriate Assisted Reproductive Technology that could help them.

Case I - Female - Normal Reports

Male - Normal sperms but no connection between epididymis and vas deferens.

Case II - Female - Normal eggs but Fallopian tube blocked.

Male - Normal sperms. Male reports are normal.

Case III - Female - Normal Reports.

Male-Low sperm count with less motility.

(ii) Copper releasing intrauterine devices are very effective and popular contraceptive devices. Name any two copper releasing IUDs. Write two reasons that make them effective contraceptives.

32. **(A) (i)** Watson and Crick's discovery of double helical structure was based on which two findings. Also mention the name of the scientists associated with these findings.

(ii) Write down the salient features of double helix structure of DNA (any three points).

OR

(B) Given below is a stretch of DNA showing the coding strand of structural gene of transcription unit.

5' - ATG ACC GTA TTT TCT GTA GTG CCC GTA CTT CAG GCA TTA 3'

(i) Write the corresponding template strand and m-RNA strand that will be transcribed along with its polarity.

(ii) If GUA of transcribed mRNA is an intron, then depict the sequence involved in formation of mRNA / mature / processed hnRNA strand:

(1) In a bacterium

(2) In humans

(iii) How many amino acids the resulting polypeptide will have after the process of translation in humans?

33. **(A) (i)** Name the protozoan species that is responsible for causing the most serious and even fatal malarial disease.

(ii) Name the host in which the parasite completes its sexual stages and explain the changes taking place.

(iii) How does the parasite damage the human body after entering the blood stream?

(iv) Suggest two effective preventive measures to control the spread of this disease in endemic regions.

OR

(B) (i) What are bio-fertilizers ?

(ii) Name the different types of microorganisms used as biofertilizers in organic farming and explain how each contributes to soil fertility.

(iii) Write two advantages of using bio-fertilizers over chemical fertilizers.

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SECTION A

34. To separate repetitive DNA from bulk genomic DNA, which of the following method is used ?
(a) Elution
(b) Southern Blotting
(c) Polymerase Chain Reaction
(d) Density Gradient Centrifugation.

35. Select the correct option :
(a) Tropics between − Higher biodiversity 23.5°N − 23.5°S than temperate areas
(b) Columbia − 105 bird species
(c) New York − 1400 bird species
(d) India − 2000 bird species

36. In a dihybrid cross, 2400 individuals are produced in F_2 generation. Approximately how many will be phenotypically similar to parents?
(a) 2000 (b) 1500
(c) 580 (d) 450

37. What could be the reason of extinction of Abingdon Tortoise from Galapagos Islands ?
(a) Intraspecific Competition
(b) Predation
(c) Parasitism
(d) Interspecific Competition

38. What conclusion can be drawn if the forelimbs of an aquatic animal and a terrestrial animal have similar anatomical structure?
(a) Live in same habitat
(b) Share common ancestors
(c) Forelimbs perform same functions
(d) Forelimbs are analogous

39. How many of the following features are related to Nirodh - a popular brand of condoms?
(I) Prevention of sexually transmitted infections.
(II) Phagocytosis of sperms.
(III) Male contraceptive device.
(IV) Acts as chemical barrier.
(V) Physiological changes in cervical mucus.
(a) (I), (II), (IV) (b) (I) and (III)
(c) (I), (II), (V) (d) (II) and (IV)

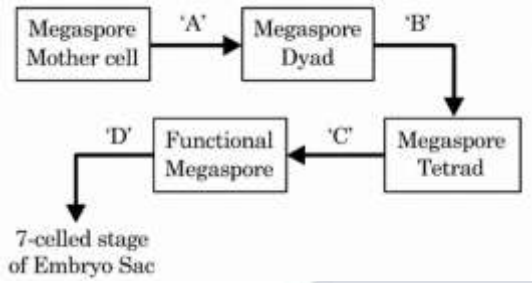
40. A bacterium having radioactive thymidine in its DNA is allowed to multiply in a medium having non-radioactive thymidine for two generations. What percentage of bacteria will have radioactive thymidine in its DNA?

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

41. What is the role of histamine released by mast cells ?
(a) Lowers blood pressure
(b) Causes allergic symptoms
(c) Stimulates antibody formation
(d) Destroys pathogens

42. Which of the following is used to visualize DNA bands under UV light after gel electrophoresis?
(a) Acetocarmine (b) Safranine
(c) Ethidium Bromide (d) Potassium Iodide

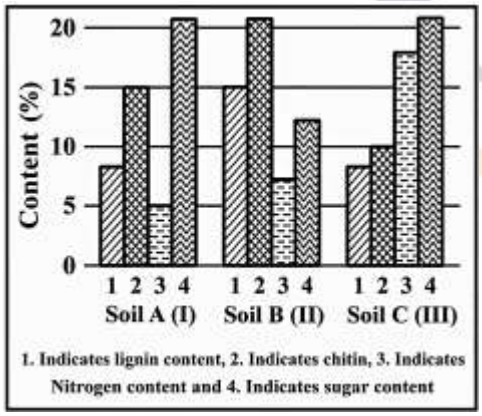
43. Given below are stages of embryo sac formation from megaspore mother cell. Identify the correct option for the cell division marked A, B, C and D.



(a) A - Meiosis-I, B - No division, C - Mitosis, D - Meiosis-II
(b)A -Meiosis-I, B -Meiosis-II, C - No division, D - Mitosis
(c) A- Mitosis, B - Meiosis-I, C - Meiosis-II, D - No division
(d) A - No division, B - Mitosis, C - Meiosis-I, D - Meiosis-II

44. Genetically modified tobacco plants were produced using Agrobacterium vectors. Which property of Agrobacterium helps in carrying nematode specific genes into the host plant?
(a) Infectious for monocot plant; has Ti plasmid
(b) Infectious for dicot plant; has Ti plasmid
(c) Infectious for plants and animals ; has Ti plasmids
(d) Infectious for monocot and dicot plants; has cry gene

45. Observe the contents (1),(2),(3) and (4) of soil samples (I), (II) and (III) shown in the graph. If the temperature and moisture of all soil samples are identical, which soil sample(s) will show faster decomposition?



(a) Soil Sample (I) (b) Soil Sample (II)
(c) Soil Sample (III) (d) Both Soil Samples (II) and (III)

For Question numbers 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 Code (a), (b), (c) and (d) as given below :

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation for Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not correct explanation for Assertion (A).

(c) Assertion (A) is true, Reason (R) is false.
(d) Assertion (A) is false, Reason (R) is true.

46. Assertion (A) : Apomixis leads to production of genetically identical offsprings.
Reason (R) : Apomixis involves fertilization between two genetically similar plants.

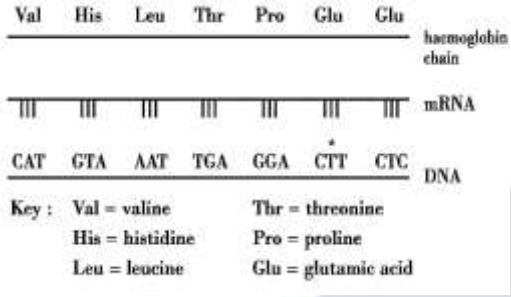
47. Assertion (A) : Microbes are used for commercial production of alcohol and beverages.
Reason (R) : Yeast converts glucose into ethanol and carbon dioxide during fermentation.

48. Assertion (A) : IUCN Red List helps in identifying and protecting endangered species worldwide.
Reason (R) : The list includes the species facing risk of extinction.

49. Assertion (A) : DNA Ligase is used to join DNA fragments.
Reason (R) : It catalyses the formation of glycosidic bonds between nucleotides.

SECTION – B

50. (A) The diagram below shows the sequence of amino acids in part of haemoglobin molecule.



(i) If the base $\overset{*}{T}$ is substituted with A , in 'C $\overset{*}{T}$ T ' of DNA strand how would it affect the haemoglobin chain?
(ii) Name the condition and the effects associated with the above substitution.

OR

(B) DNA is considered a more stable genetic material than RNA. Justify this statement with suitable reasons.

51. How do scientists use microinjection and gene gun in biotechnology?

52. After significant reduction of BOD during secondary treatment of sewage, what further processes are carried out ? Mention any one important outcome of these processes.

53. (A) In some cases, measuring population density by counting individuals may not be feasible. Mention two other parameters that can be used and justify their use with suitable examples.

OR

(B) What factors contribute to the Amazonian rain forests in South America being the most biodiverse regions on Earth ?

54. (A) (i) Name the organ that forms a connection between foetus and the uterus of a pregnant human female.
(ii) How does it support both nutrition and hormonal regulation?

OR

(B) Give reasons for :
(i) All copulations do not lead to pregnancy.
(ii) Meiosis I in spermatogenesis and oogenesis are markedly different.

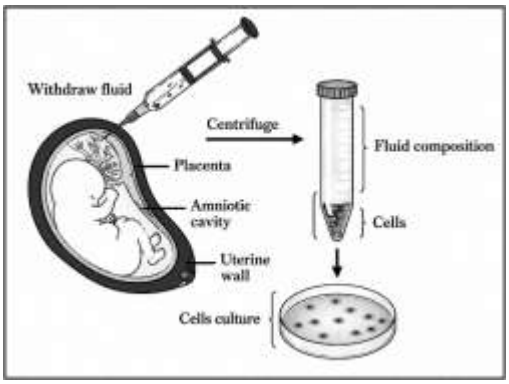
SECTION – C

55. There are limitations of traditional breeding techniques that led to promotion of micro-propagation?
(A) Mention two advantages of micropropagation.
(B) Give two examples where it is commercially adopted.

56. (A) Give the scientific name of the organism used by Morgan to study sex-linked traits.
(B) Write any four reasons why this organism made it an ideal experimental model.

57. Draw a neat diagram of enlarged view of one microsporangium of a Young anther of an angiosperm. Label the different layers of the wall and write the functions of the outermost and innermost layer.

58. Study the diagram given below :



(A) Name and explain the procedure shown in the diagram. Mention one of its advantage and one disadvantage.
(B) How is 'Saheli' different from other oral pills in terms of its composition and advantage ?

59. S.L. Miller conducted an experiment in 1953 to simulate the conditions of early earth in a laboratory setup.
Answer the following questions based on the experiment :
(A) What was the aim of his experiment?
(B) Name the gases used and the source of energy.

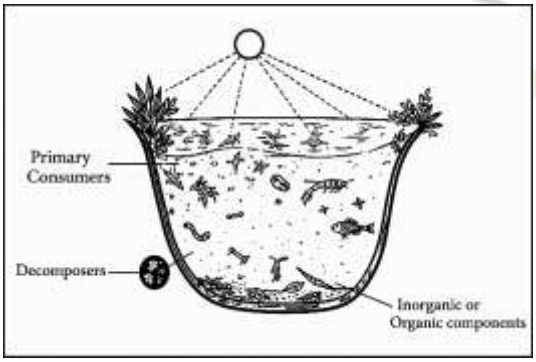
60. **(A)** What is a genetic code ?
(B) Why did scientists feel the need to propose a genetic code?
(C) Genetic code is said to be 'Universal'. Why ?

61. **(A)** A person inhales dust and pathogens but does not always fall sick. Explain how the body protects against such infections.
(B) Name and describe any two barriers involved in this protection.

SECTION – D

62. Gene manipulation is a fast emerging science. It started with the development of recombinant DNA molecules. This technology which mostly involves cutting and pasting of desired DNA fragments is based on two most important discoveries in bacteria - presence of plasmid and restriction endonucleases. The science of r-DNA technology took birth when Cohen and Boyer (1973) were able to produce a piece of gene containing foreign DNA introduced into plasmid of E.coli.
(A) Name one core technique of biotechnology that alters the genetic material.
(B) What is a plasmid? Mention its importance in biotechnology.
(C) Which gene was isolated by Cohen and Boyer and from which bacteria?
OR
(C) How is the action of exonuclease different from that of endonuclease?

63. Below is shown a pond that represents a self-sustaining natural ecosystem with both biotic and abiotic components interacting in a balanced food web.



Based on the diagram, answer the questions :
(A) Mention two abiotic components of a pond ecosystem.
(B) Differentiate between the roles of producers and decomposers in such an ecosystem.
(C) Draw a simple food chain operating in such an ecosystem and label each trophic level.
OR
(C) Why is transfer of energy not 100% efficient between trophic levels?

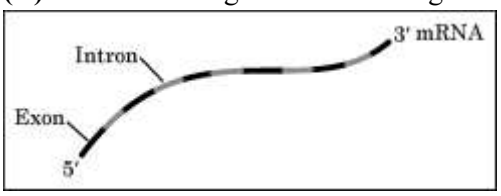
SECTION-E

64. (A) (i) Explain the role of stigma in pollen pistil interaction.
(ii) Describe the post pollination events leading to double fertilization in angiosperms starting with 2-celled pollen grain.

OR

(B) (i) Explain menstrual phase in the menstrual cycle of human female.
(ii) Why is follicular phase also called proliferative phase?
(iii) Explain the events that occur in Graafian follicle at the time of ovulation and thereafter.
(iv) Draw a Graafian follicle and label - Antrum and secondary oocyte.

65. (A) Observe the segment of mRNA given below and answers the questions given below :



(i) Explain and illustrate the steps involved to make fully processed hn RNA.
(ii) Gene encoding RNA polymerase I and RNA polymerase III have been affected by mutation. Explain its impact on the synthesis of polypeptide giving reasons.

OR

(B) In a particular cattle, the coat colour red and white are controlled by single pair of alleles. A calf that receives allele for red coat from mother and allele for white coat from father shows equal number of red and white hairs on its coat.
(i) Is this an example of Co-dominance or incomplete dominance. Give a reason for your answer.
(ii) With the help of a genetic cross upto F_2 generation, explain what will be the consequent phenotype of calf when
(1) Red is dominant over white,
(2) Red is incompletely dominant.

66. (A) A 30 year old man was admitted to a hospital with recurrent infections, weight loss, prolonged fever. His blood report showed a decline in count of T-Lymphocytes thus affecting immune system.
(i) Identify the disease and its causative agent.
(ii) How did the pathogen affect the immune system once it entered the body? Explain.
(iii) Mention two major modes of its transmission.

OR

(B) (i) Why are microbes considered effective biocontrol agents in sustainable agriculture?
(ii) Explain the role of the following as biocontrol agents naming the pests or diseases they help to control :
(1) A Bacterium
(2) A Fungus
(3) Virus

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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.
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SECTION A

67. Foetal ejection reflex in human female triggers the release of which hormone?
(a) Oxytocin from foetal pituitary gland

(b) hCG from placenta
(c) Progesterone from corpus luteum
(d) Oxytocin from maternal pituitary gland

68. Which of the following is not a functional unit of an ecosystem?

(a) Energy flow (b) Decomposition
(c) Stratification (d) Productivity

69. Match Column I with Column II and select the correct option :

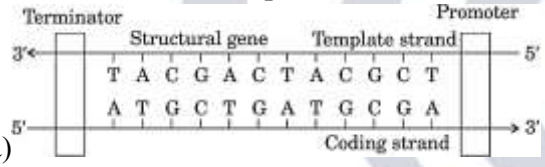
Column I		**Column II**	
(A)	Primers	**(I)**	β-galactosidase
(B)	Insertional inactivation	**(II)**	To separate and purify products
(C)	Bioreactor	**(III)**	Chemically synthesized oligonucleotides
(D)	Downstream processing	**(IV)**	Large scale production of specific product of activity of microbes

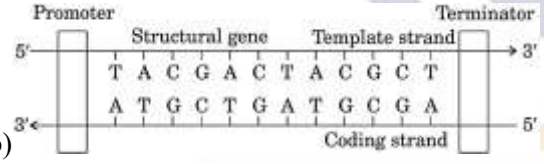
(a) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
(b) (A)-(III), (B)-(I), (C)-(II), (D)-(IV)
(c) (A)-(I), (B)-(III), (C)-(IV), (D)-(II)
(d) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)

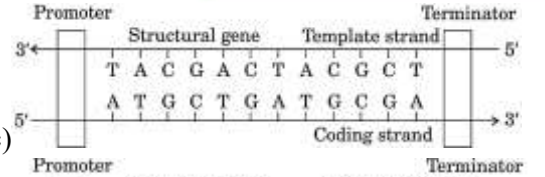
70. Golden rice is a promising transgenic crop. When released for cultivation, it will help in :

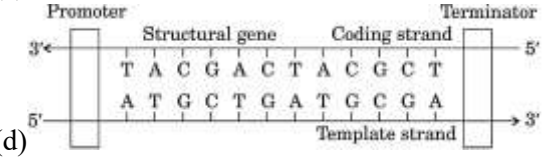
(a) Producing petrol-like fuel
(b) Reduction of Vitamin A deficiency in humans
(c) Pest resistance
(d) Herbicide tolerance

71. Four different transcription units are shown below. Choose the option with the correct image.

(a)


(b)


(c)


(d)


72. Appearance of antibiotic-resistant bacteria is an example of evolution due to:

(a) Adaptive radiation (b) Divergent evolution
(c) Artificial selection (d) Anthropogenic action

73. Identify the statements that correctly describe Darwin's Theory of Evolution.

(I) Overproduction of organisms leads to competition.

(II) Variation is inherited and causes evolution.
(III) Acquired characters are inherited.
(IV) Survival depends on favourable traits.
(V) New species arise due to accumulation of favourable variations.
Choose the correct option.
(a) (I), (II), (IV) and (V) are correct
(b) (II), (III) and (V) are correct
(c) All are correct
(d) Only (I) and (IV) are correct

74. Which of the following is not a symptom of Ascariasis ?
(a) Intestinal blockage (b) Muscular pain and fever
(c) Anaemia (d) Skin ulcers

75. Every trophic level has a certain mass of living material at a particular time. What is it called ?
(a) Standing crop (b) Primary productivity
(c) Standing state (d) Ecological efficiency

76. The smallest part of DNA molecule that can be changed by point mutation is :
(a) Oligonucleotide (b) Codon
(c) Gene (d) Nucleotide

77. Some statements regarding drugs and alcohol are given below :
(I) Adolescents are more vulnerable to peer pressure.
(II) Drug addiction leads to increased tolerance level of the receptors present in our body.
(III) Alcohol affects the central nervous system.
(IV) Excessive use of drugs helps to increase energy.
(V) Anabolic steroids decrease aggressiveness.
Choose the option with correct statement(s).
(a) Statements (I), (IV) and (V) are correct
(b) Statements (I), (II) and (III) are correct
(c) Only statements (I) and (V) are correct
(d) Only statement (III) is correct

78. Select the correct option for the pair of plants pollinated by water.
(a) Vallisneria and Hydrilla
(b) Zostera and Water lily
(c) Water lily and Parthenium
(d) Water hyacinth and Water lily

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) : Activated sludge contains large population of bacteria.
Reason (R) : These bacteria help in anaerobic digestion of human waste in biogas plant.

80. Assertion (A) : Ecosystems require a constant supply of energy to synthesize the molecules they require.
Reason (R) : This is to counteract the universal tendency towards increasing disorderliness as per Second Law of Thermodynamics.

81. Assertion (A) : DNA cannot pass through cell membrane of a bacterial cell.
Reason (R) : DNA is a hydrophilic molecule.

82. Assertion (A) : Repetitive sequences are stretches of DNA sequences that are thought to have no direct coding functions.
Reason (R) : They shed light on chromosome structure, dynamics and evolution.

SECTION B

83. **(A)** A person complains of persistent itching in the groin region and scalp. The person also shows dry and scaly lesions on skin, nails, etc.

(i) Identify the disease.

(ii) Name its two causative agents.

(iii) Mention its mode of transmission.

OR

(B) A girl develops sneezing, watery eyes and difficulty in breathing every time she visits a flower garden.

(i) Identify the condition.

(ii) Name the immune component responsible for this condition.

(iii) Name the chemical released.

(iv) State one medicine used to treat such a condition.

84. **(A) (i)** Mention any two characteristics of Neanderthal man that lived near East and Central Asia.

(ii) Identify the following hominids with respect to human evolution :

(I) Brain capacity 900 cc , probably ate meat.

(II) First human-like with brain capacity $650 - 800$cc

OR

(B) The allele for brown eyes (B) is dominant over blue eyes (b). In a population, 36% of individuals have blue eyes.

Assuming Hardy-Weinberg equilibrium, calculate :

(i) Frequency of allele B

(ii) Percentage of heterozygous individuals

(iii) Percentage of individuals that are homozygous dominant

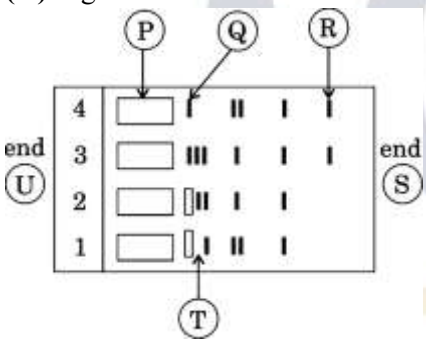
(Working to be shown)

85. What did Henking observe in his experiments on insects that led to the discovery of sex chromosome? How did his observation contribute to our understanding of sex determination?

86. **(A) (i)** Given below is the schematic representation of the process of electrophoresis. Identify the alphabets representing the :

(I) Anode end, and

(II) Lightest/Smallest DNA in matrix.



(ii) What is Agarose gel and why is it used in this process?

OR

(B) After performing gel electrophoresis, a student observes that DNA fragments are not visible.

(i) Suggest a reason for this and explain how fragments can be made visible.

(ii) Also explain how a specific DNA fragment can be collected from the gel for further use.

87. GEAC is a regulatory body under the Ministry of Environment, Forest and Climate Change in India.

(A) Write the full form of GEAC.

(B) Mention two of its important functions related to biotechnology.

SECTION C

88. **Answer the following questions:**

(A) Explain the different ways by which apomictic seeds can be developed.

(B) Mention one advantage of apomictic seeds for farmers.

89. **(A)** What is meant by translation in protein synthesis ?
(B) Explain charging of tRNA (aminoacylation of tRNA) and mention its importance in the process of translation.

90. **(A)** What is the carrying capacity of a species in a habitat ?
(B) Explain the growth curve that takes this capacity into account.

91. In vitro fertilization (IVF) is a popular method these days that is helping childless couples to bear a child.
(A) Write the different steps that are carried out in this technique.
(B) Would you consider gamete intra fallopian transfer as a type of IVF ? Justify your answer.

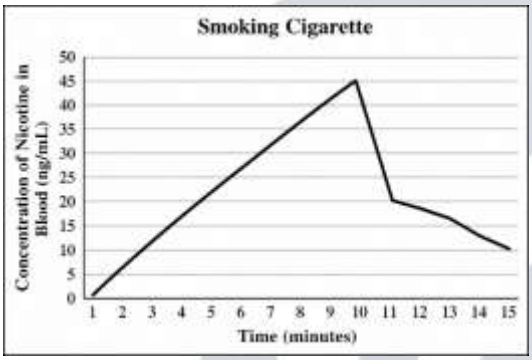
92. Draw a neat diagram of a maize grain showing the internal structure and label any five parts.

93. Cow dung and water are mixed and fed into a biogas plant to allow digestion of biowastes. The person performing this process says that there is no need to provide an inoculum.
(A) Do you agree with him? Justify your answer.
(B) What happens to the biowaste inside the digester ?
(C) Name the useful by-products obtained from this process and mention how they are used.

94. **(A)** Describe the experiment conducted by T.H. Morgan on Drosophila melanogaster involving eye colour and body colour.
(B) How did the results deviate from Mendelian inheritance pattern?
(C) Explain the two genetic terms used by Morgan for his observations.

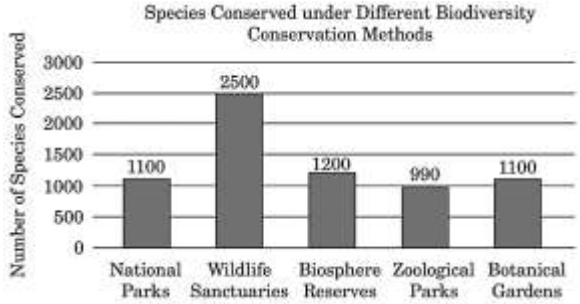
SECTION D

95. **Read the following passage and answer the question that follow:**
The data below shows the concentration of nicotine smoked by a smoker taking 10 puffs/minute.



(A) **(i)** With reference to the above graph, explain the concentration of nicotine in the blood at 10 minutes.
OR
(ii) How will this affect the concentration of carbon monoxide and haem-bound oxygen at 10 minutes ?
(B) How does cigarette smoking result in high blood pressure and increase in heart rate?
(C) To which class of compounds does nicotine belong? Name one other drug from the same class.

96. **Read the following passage and answer the questions that follow :**
India is one of the megadiverse countries housing around 8 · 1 per cent of global species diversity, although its land area is only 2 · 4 per cent of the world's land area. Many of the species are highly threatened due to human activities like deforestation, mining and habitat fragmentation. Laws like Wildlife (Protection) Act, 1972 were enacted by the Government of India to preserve our biological wealth. Various conservation measures are being implemented to save the threatened species.
The following bar graph shows the number of species conserved under different biodiversity conservation methods.



Conservation Method

Study the graph and answer the questions.

(A) Which method conserves the highest number of species? Is it ex situ or in situ conservation?

(B) Which other methods shown in the diagram are opposite to the one identified by you in question (A)? How are these two conservation approaches different?

(C) (i) Write two features of Biodiversity hotspots.

OR

(ii) To which category do sacred groves belong and how do they help in bio-conservation?

SECTION E

97. (A) (i) Describe the series of experiments conducted by Frederick Griffith. Comment on the significance of the result obtained.

(ii) State the contribution of Avery, MacLeod and McCarty.

OR

(B) The following questions are based on haemophilia.

(i) Work out the crosses between :

(I) Normal female and Haemophilic male

(II) Carrier female and Normal male

(III) Carrier female and Haemophilic male

(ii) Write the conclusions you draw from these crosses. Comment on the type of inheritance of the disease.

(Use : X - Normal, X^h - Haemophilic)

98. (A) (i) Explain any two basic principles/core techniques on which biotechnology is based.

(ii) Describe any three key tools used in Recombinant DNA technology.

OR

(B) "Early and accurate diagnosis of diseases is vital in medical technology."

(i) Name the conventional methods of diagnosis and their disadvantages.

(ii) Which three diagnostic techniques have been developed through Biotechnology ? Explain how each one helps in detecting diseases.

99. (A) Oogenesis is a discontinuous process that begins before birth and is completed after puberty.

(i) Trace the development of a gamete mother cell till its release from the ovary during ovulation.

(ii) Name the two pituitary hormones that play an important role in the process.

OR

(B) (i) Draw a labelled two-celled structure of male gametophyte of an angiosperm.

(ii) Name the three layers that surround the cytoplasm of a male gametophyte starting from innermost to outermost layer.

(iii) Which organic material makes the outermost layer ? Mention its advantage.

(iv) Why is the outermost layer of male gametophyte not continuous?

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SECTION A

100. Choose the option that gives the correct number of pollen grains that will be formed after 325 microspore mother cells undergo microsporogenesis.

(a) 325 (b) 650
(c) 1300 (d) 975

101. Select the phase of menstrual cycle in which the remaining parts of Graafian follicle transform into the corpus luteum.
(a) Secretory phase (b) Proliferative phase
(c) Menstrual phase (d) Ovulatory phase

102. A female undergoing IVF treatment has blocked fallopian tube. The technique by which the embryo with more than 8 blastomeres will be transferred into the female for further development is :
(a) ZIFT (b) GIFT
(c) IUT (d) AI

103. Select the correct statement.
All genes located on the same chromosome :
(a) form different groups depending upon their relative distance.
(b) form one linkage group.
(c) will not form linkage groups.
(d) form interactive groups that affect the phenotype.

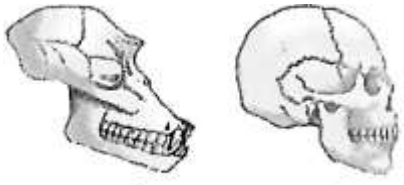
104. Choose the correct statements :
(I) Polycistronic mRNA is generally found in eukaryotes.
(II) The RNA polymerase II transcribes precursor of mRNA , the hnRNA.
(III) The process of translation of mRNA begins when the mRNA encounters the large subunit of ribosomes.
(IV) Stop codons do not have any tRNAs.
(a) (I) AND (II) (b) (II) AND (III)
(c) (II) AND (IV) (d) (I), (II) AND (IV)

105. Name the extinct ancestor of humans who ate only fruits and hunted with stone weapons.
(a) Ramapithecus (b) Australopithecus
(c) Dryopithecus (d) Homo erectus

106. Nicotine affects blood pressure and heart rate due to release of certain adrenal hormones. Following are some of the adrenal hormones:
(I) Adrenaline
(II) Cortisol
(III) Noradrenaline
(IV) Aldosterone
Select the correct option :
(a) (I) AND (II) (b) (I) AND (IV)
(c) (II) AND (III) (d) (I) AND (III)

107. Microbes used for biocontrol of pest butterfly caterpillars is :
(a) Saccharomyces cerevisiae
(b) Bacillus thuringiensis
(c) Streptococcus sp.
(d) Trichoderma

108. The given diagram shows the skulls of two different mammals.



A B

Which of the following options accurately describes the differences between these skulls?
(a) Skull B is the ancestor of skull A.
(b) Skull A has more brain capacity than skull B.
(c) Skull A is of a human and skull B is of an adult chimpanzee.
(d) Skull A is of an adult chimpanzee and skull B is of a human.

109. In RNAi, genes are silenced using which of the following biomolecules ?

(a) ssDNA (b) dsDNA
(c) dsRNA (d) ssRNA

110. Connell's elegant field experiments on the rocky seacoast of Scotland, found that larger barnacles Balanus dominated the intertidal area and removed the smaller barnacles Chathamalus. This happened due to :

(a) Parasitism (b) Predation
(c) Mutualism (d) Competition

111. Protein encoded by gene Cry-I Ab controls the infestation of which of the following?

(a) Cotton bollworms (b) Mosquitoes
(c) Corn borer (d) Agrobacterium

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(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

112. Assertion (A) : Cleistogamous flowers have assured seed set.
Reason (R) : Cleistogamous flowers are invariably autogamous and do not depend on any pollinating agents.

113. Assertion (A) : The human blood group ' AB ' exemplifies co-dominance.
Reason (R) : The gene for human blood group trait exists in three allelic forms I^A, I^B and i .

114. Assertion (A) : Nucleopolyhedrovirus are useful as they are good biocontrol agents.
Reason (R) : They are species-specific, narrow spectrum bioinsecticides

115. Assertion (A) : The pyramid of biomass in a pond aquatic ecosystem is always inverted.
Reason (R) : The biomass of consumers like fishes far exceeds that of the producers like phytoplanktons.

SECTION B

116. How do 'implants' act as an effective method of contraception in human females? Mention one advantage of implants over contraceptive pills.

117. (A) Write one way by which apomictic seeds can be developed.
(B) Why do farmers prefer apomictic seeds over hybrid seeds?

118. A laboratory assistant collected three water samples, namely river water, untreated sewage water and secondary effluent discharged from a sewage treatment plant. But the laboratory attendant did not note which was which. The samples were labelled A, B and C and subjected to a BOD test. The BOD values of the three samples A, B and C were recorded as 30mg/L, 8mg/L and 400mg/L respectively.
(A) Which sample of the water is most polluted?
(B) Can you assign the correct label to each, assuming the river water is relatively clean?

119. Write the role of 'ori' and 'restriction' site in a cloning vector pBR322.

120. (A) Biodiversity must be conserved as it plays an important role in many ecosystem services that nature provides. Explain any two ecosystem services.

OR

(B) (i) State, what does 'standing crop' of a trophic level represent.
(ii) List any two ways of measuring the standing crop of a trophic level.

SECTION C

121. Differentiate between wind-pollinated and insect-pollinated flowers. Give an example of each type.

122. (A) Construct a complete transcription unit with promoter and terminator on the basis of the hypothetical coding strand given below:

(B) Write the RNA strand transcribed from the above transcription unit along with its polarity.

123. Explain the three different ways in which natural selection operates. Explain with the help of graphs.

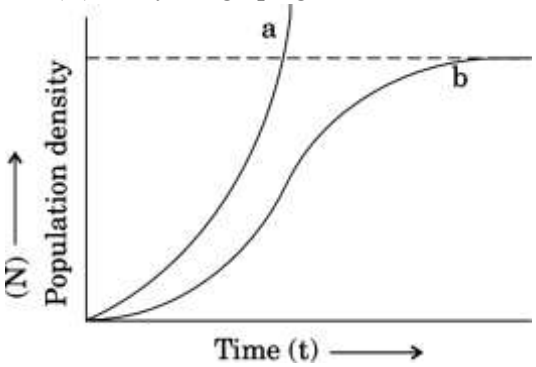
124. **(A)** How do some viruses cause cancer in humans?

(B) How do benign tumours turn malignant ? How do malignant tumours harm the human body?

125. **(A)** How is insulin different from proinsulin?

(B) Explain all the stages of how human insulin is produced through rDNA technology.

126. **(A)** Study the graph given below and answer the questions that follow:



(i) Write the status of food and space in the curves a and b.

(ii) In the absence of predators, which one of the two curves would appropriately depict the prey population?

(iii) 'Time' has been shown on x -axis and there is a parallel dotted line above it. Give the significance of this dotted line.

OR

(B) Answer the following questions:

(i) Define 'predation'.

(ii) Why is predation required in a community of different organisms? Give any two points.

(iii) Why are predators 'prudent' in nature?

127. **There are many animals, which have become extinct in the wild, but continue to be maintained in zoological parks. Answer the questions that follow:**

(A) What type of bio-diversity conservation is observed in this case ?

(B) Explain any other two ways which help in this type of conservation.

(C) Besides zoological parks, mention one place that serves this purpose.

SECTION D

128. Read the following passage and answer the questions that follow :

Gene expresses itself in a cell system as a protein/enzyme. How an expression of gene occurs in a cell system, when it needs to occur and how the gene expression is regulated in prokaryotic cell system was studied by the combined efforts of Francois Jacob, a geneticist and Jacques Monod, a biochemist. For their work on lactose metabolism in E. coli and introducing the concept of 'lac operon', they were awarded the Nobel Prize in 1965.

(A) It is said that 'lac operon' has to be operational at a very low level in the bacterial cell all the time. Justify.

(B) (i) How are the structural genes activated in the lac operon in E. coli?

OR

(ii) Why is the regulation of operon called negative regulation?

(C) Why is lac operon said to be a transcriptionally regulated system ?

129. **Read the following passage and answer the questions that follow:**

Immunity in our body is of two types (i) Innate immunity, and (ii) Acquired immunity. Innate immunity is a non-specific defence mechanism, whereas Acquired immunity is pathogen specific. Acquired immunity is characterised by memory. Antibodies are specific to antigens and there are four types of antibodies produced in our body $-$IgA, IgE, IgG and IgM. It shows primary response where it encounters the pathogen for the first time and secondary response during the subsequent encounters with the same antigen/pathogen. These immune responses are carried out with the help of two special types of lymphocytes present in the blood.

(A) Name the two types of specialised cells which carry out the primary and secondary responses.

(B) (i) Name any two barriers present in our body that provide innate immunity.

OR

(ii) The organ transplants (grafts) are often rejected if not taken from suitable compatible persons. Mention the characteristic of our immune system that is responsible for the rejection.

(C) How is active immunity different from passive immunity? Write any two differences.

SECTION E

130. **(A)** Study the flow chart given below. Name the hormones involved at each stage and explain their functions.

Hypothalamus
↓
Pituitary
↓
Ovary
↓
Pregnancy

OR

(B) (i) Draw a diagram of L.S. of maize grain and label its any six parts.
(ii) Differentiate between perisperm and endosperm giving one example of each.

131. **(A)** Write the types and locations of the genes causing thalassemia in humans. State the cause and symptoms of the disease. How is sickle-cell anemia different from this disease ?

OR

(B) (i) Enlist any four prime goals of the Human Genome Project (HGP).
(ii) List the two methodologies which were involved in the human genome project. Mention how they were used.
(iii) Expand 'YAC' and mention what it was used for.

132. **(A) (i)** EcoR I has played a very important role in rDNA technology.
(I) Explain the convention for naming EcoR I.
(II) Write the recognition site of this endonuclease restriction enzyme.
(ii) Name the overhanging stretches of DNA produced by these restriction enzymes. Describe their role in the formation of rDNA.

OR

(B) (i) Insertional inactivation is a method to detect the recombinant DNA. Explain this method.
(ii) Name the commonly used vector for transferring genes in plants from bacteria.
(iii) How is this able to transform a normal plant cell into a tumour?

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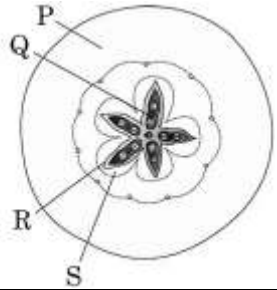
SECTION A

133. **Identify the parts P, Q, R, S in the figure given below and select the option in the correct order.**



P	Q	R	S

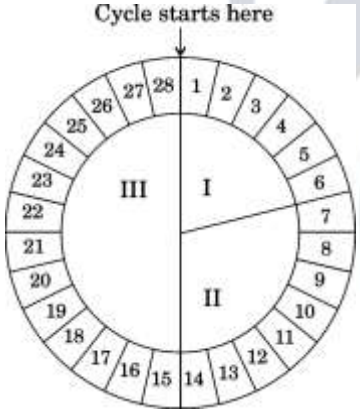
(a) Seed	Thalamus	Mesocarp	Endocarp
(b) Thalamus	Seed	Endocarp	Mesocarp
(c) Seed	Thalamus	Endocarp	Mesocarp
(d) Thalamus	Seed	Mesocarp	Endocarp

134. The foetal ejection reflex in human triggers the release of ___ hormone from ___ .
Fill in the blanks by choosing right option.
(a) oxytocin, foetal pituitary
(b) oxytocin, maternal pituitary
(c) human chorionic gonadotropin, placenta
(d) progesterone, corpus luteum

135. A DNA molecule is 160 base pairs long. It has 30% Guanine. How many Adenine bases are present in this DNA molecule?
(a) 48 (b) 64
(c) 96 (d) 192

136. In Pisum sativum, the flower colour may be violet (V) or white (v). What proportion of the offspring in a cross of ' VV × ' vv ' would be expected to be violet?
(a) 25% (b) 50%
(c) 75% (d) 100%

137. In a human female, menstrual cycle of 28 days is represented by the diagram given below.



Select the correct statement related with this diagram.
(a) Primary follicle of ovary matures into Graafian follicle in phase II.
(b) The hormone secreted in large amounts in phase III is also responsible for maintaining pregnancy in human females.
(c) Corpus luteum secretes progesterone in phase I, however it degenerates completely in phase III.
(d) Both (a) and (b).

138. Arrange the following in the correct sequence of their evolution and select the correct option :
(I) Seaweed
(II) Invertebrates
(III) Jawless fish
(a) (I), (II), (III) (b) (I), (III), (II)
(c) (II), (III), (I) (d) (II), (I), (III)

139. Monascus purpureus is a yeast used commercially in the production of which one of the following?
(a) Ethanol (b) Streptokinase
(c) Citric acid (d) Statins

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

$5'C-T-G-C-A\downarrow G3'$

$3'G\underset{\uparrow}{\ }A-C-G-T-C5'$

Choose the option that gives the correct resultant fragments.

(a) 5′ C – T – G C – A – G 3′
3′ G – A – C – G – T C 5′

(b) 5′ C – T G – C – A – G 3′
3′ G – A – C – G T – C 5′

(c) 5′ C – T – G – C A – G 3′
3′ G – A – C – G T – C 5′

(d) 5′ C – T – G – C – A G 3′
3′ G A – C – G – T – C 5′

141. Choose a correct option that shows an interaction in which one species benefits while the other is neither harmed nor benefitted.

(a) Mycorrhizal associations between fungi and roots of higher plants
(b) Sea anemone and clownfish
(c) Abingdon tortoises and goats in the Galapagos Island
(d) Cuscuta on hedge plants

142. Transgenic animals have their genetic material manipulated. Select the correct option in reference to transgenic animals.

(a) Foreign DNA and RNA are present in their cells.
(b) Foreign RNA is present in all of their cells.
(c) Foreign DNA is present in all of its cells.
(d) Foreign RNA is present in some of its cells.

143. Select the odd option in the context of convergent evolution.

(a) Eyes of Octopus and Mammals
(b) Flippers of Penguins and Dolphins
(c) Flying Squirrel and Flying Phalanger
(d) Thorns of Bougainvillea and Tendrils of Cucurbita

144. Which of the following fish led to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in Lake Victoria of East Africa?

(a) Catla Catla (b) Dogfish
(c) Nile Perch (d) African Catfish

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 with 8 to 16 blastomeres is called a morula.
Reason (*R*) : The morula continues to divide and transform into trophoblast.

146. Assertion (A) : Repetitive sequences make up a very large portion of human genome.
Reason (*R*) : Repetitive sequences do not have direct coding functions in the genome.

147. Assertion (A) : Trichoderma species are free living fungi that are very common in the root ecosystems.
Reason (*R*) : They are effective bio-control agents of several plant pathogens.

148. **Assertion (A) :** The use of chitinase enzyme is necessary for the separation of DNA from yeast cells but not in the case of Spirogyra.

Reason (*R*) : Fungal cell wall is made up of fungal chitin.

SECTION B

149. **(A)** Mention the functions of each of the following:

(i) Tassels of Corn Cob

(ii) Scutellum

OR

(B) Farmers prefer apomictic seeds over hybrid seeds. Give any two reasons.

150. Define the term 'amniocentesis'. Why has the government imposed a statutory ban in spite of its importance in the medical field?

151. Name the lymphoid organ that acts as a large reservoir of erythrocytes. Explain its role as a lymphoid organ.

152. **(A)** Suggest how a virus-free healthy plant can be obtained from a diseased sugarcane plant.

OR

(B) In order to force bacteria to take up the recombinant DNA, they must be made competent. Explain how it can be achieved.

153. **(A)** Differentiate between grazing food chain and detritus food chain.

OR

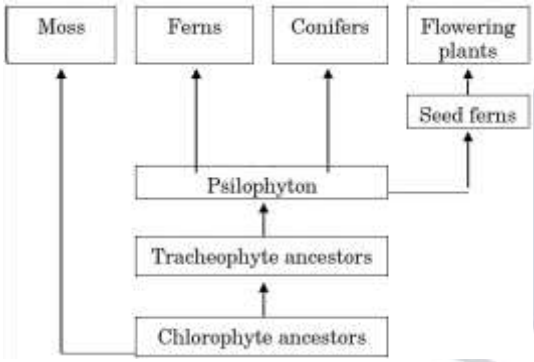
(B) Ecological pyramids are widely accepted but they still have some limitations. Write any two limitations.

SECTION C

154. List any three outbreeding devices that flowering plants have developed for cross-pollination and explain how they help to encourage cross-pollination.

155. Draw a labelled diagram of a 'replicating fork' showing the polarity. Why does DNA replication occur within such 'fork'?

156. **Study the given chart showing evolution of plants. Answer the following questions :**



(A) Identify the plant which acts as an immediate ancestor of both ferns and conifers.

(B) Name the nearest ancestors of flowering plants.

(C) Name the most primitive group of plants.

(D) Psilophyton provides common ancestry to which classes?

(E) Name the common ancestor of psilophyton and seed ferns.

(F) Name the common ancestor of mosses and tracheophytes.

157. Mention a product of human welfare obtained with the help of each one of the following :

(A) Saccharomyces cerevisiae

(B) Propionibacterium shermanni

(C) Aspergillus niger

(D) Trichoderma polysporum

(E) Acetobacter aceti

(F) Streptococcus

158. Transgenic animals are produced by man. Explain any three ways in which such animals can be beneficial to humans.

159. Explain Gause's 'Competitive Exclusion Principle' with the help of a suitable example.

160. Explain the level of biodiversity at genetic, species and ecological levels with the help of one example each.

SECTION D

161. Read the following passage and answer the questions that follow :

The process of copying genetic information from template strand of DNA into RNA is called transcription. It is mediated by RNA polymerase. Transcription takes place in the nucleus of eukaryotic cells. In transcription, only a segment of DNA and only one of the strands is copied into RNA.

(A) Why is the strand of DNA with $3' \longrightarrow 5'$ polarity transcribed and not the other strand of $5' \longrightarrow 3'$ polarity?

(B) (i) Why is hnRNA required to undergo splicing?

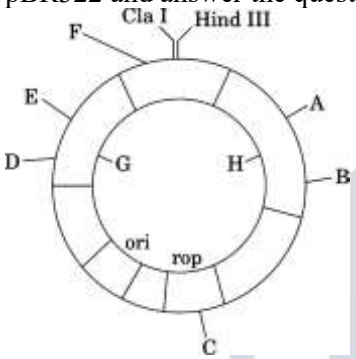
OR

(ii) Mention the two additional processes which hnRNA needs to undergo after splicing to become functional.

(C) Why is only one strand of the DNA transcribed ? Give two reasons.

162. Read the following passage and answer the questions that follow :

We know that plasmids and bacteriophages are the most commonly used vectors in biotechnology experiments. If we can link an alien piece of DNA to the plasmid DNA, the alien DNA can be multiplied equal to the copy number of the plasmid. Engineered vectors are used these days. Study the diagram of the E. coli cloning vector pBR322 and answer the questions that follow:



(A) Why are plasmids and bacteriophages used as cloning vectors?

(B) (i) Identify:

(I) The gene in the cloning vector that controls the copy number of the vector.

(II) The restriction site - C in the 'rop' gene.

OR

(ii) Identify and name two selectable markers shown in the diagram.

(C) Name the two restriction sites each in the two genes you have identified as selectable markers.

SECTION E

163. (A) Briefly explain the events of fertilisation and implantation in an adult human female.

OR

(B) (i) Arrange the following hormones in sequence of their secretion in a pregnant woman :
hCG; LH; FSH; Relaxin.

(ii) Mention the source and the functions of the above mentioned hormones.

164. (A) Work out separate monohybrid crosses up to F_2 generation between two pea plants and two Antirrhinum plants, both having contrasting traits with respect to the colour of the flower. Comment on the patterns of inheritance in the crosses carried out in such two cases.

OR

(B) Answer the following questions:

(i) How does a chromosomal disorder differ from a Mendelian disorder? Write one example for each.

(ii) Name the phenomenon that leads to situations like ' XO ' abnormality in humans. Also name this genetic disorder. How are individuals with an XO chromosomal abnormality affected? Write its symptoms as well as karyotype.

165. (A) (i) Draw the structure of an antibody molecule and label any four of its parts.

(ii) Differentiate between active and passive immunity. Write any three differences.

OR

(B) (i) (I) Write the scientific names of the two species of filarial worms causing filariasis.

(II) How do they affect the body of infected persons?

(III) How does the disease spread?

(ii) Mention the source and the role of the following in providing defence against infection in the human body:
(I) Histamine
(II) Interferons

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, D and E 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

166. Identify the ploidy of primary spermatocytes formed during spermatogenesis. Select the correct option.
(a) Haploid (b) Diploid
(c) Triploid (d) Tetraploid

167. When the wrong type of pollen falls on the stigma of a flower, during the process of pollination, what decision does the pistil take?
(a) Accepts the pollen (b) Rejects the pollen
(c) Dissolves the pollen (d) Modifies the pollen

168. Which one of the following options is the work of Oswald Avery, Colin MacLeod and Maclyn Mc Carty?
(a) The genetic material is a protein
(b) They discovered that DNA alone could transform S-Bacteria to R-Bacteria
(c) Proteases affected transformation
(d) RNases affected transformation

169. Which one of the following combinations of base pair is present only in RNA ?
(a) Adenine and Thymine
(b) Guanine and Cytosine
(c) Uracil and Adenine
(d) Thymine and Guanine

170. When glutamic acid changes to valine at the 6^{th} position of the beta globin chain of haemoglobin, it results in a genetic disorder. Choose the option that indicates the correct disorder.
(a) Thalassemia (b) Phenylketonuria
(c) Sickle cell anaemia (d) Haemophilia

171. In the lac operon, which gene is responsible for the production of permease enzyme ?
(a) i gene (b) z gene
(c) y gene (d) a gene

172. A person has a short stature with small round head, furrowed tongue and partially open mouth. Select the option indicating the chromosomal disorder.
(a) Turner's syndrome (b) Klinefelter's syndrome
(c) Down's syndrome (d) Dwarfism

173. If a double-stranded DNA has 30% of cytosine, what will be the percentage of adenine in it ?
(a) 20% (b) 40%
(c) 30% (d) 60%

174. Inoculum used for curd formation is rich in which one of the following components?

(a) Vitamin B_{12} (b) Lactic acid bacteria

(c) Carbon dioxide (d) Cheese

175. Which one of the following reasons is correct for divergent evolution to happen?

(a) Adaptation to different needs

(b) Predator-Prey inter-relationship

(c) Selection of similar habitat

(d) Different structures evolving for the same function

176. Restriction enzymes cut the DNA strand at specific recognition sites to form sticky ends. Select the option that describes the sticky ends correctly.

(a) Long double-stranded stretches of DNA which hang loosely on both sides.

(b) They are over-hanging stretches of RNA.

(c) They form hydrogen bonds with their complementary cut counterparts.

(d) They are sticky at their ends and hence prevent enzyme action.

177. Name one item from the following which involves the use of bacteria:

(a) Wine (b) Penicillin

(c) Citric acid (d) Curd

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(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

178. Assertion (A) : To isolate DNA from plant cell enzyme chitinase is used.

Reason (R) : Chitinase breaks down the plant cell wall.

179. Assertion (A) : Eukaryotic mRNA requires post-transcription processing for formation of functional mRNA.

Reason (R) : Eukaryotic transcripts possess extra non-functional segments called introns.

180. Assertion (A) : An increase in BOD indicates that the water is fit for consumption.

Reason (R) : BOD is a measure of the organic matter present in water.

181. Assertion (A) : Organisations like GEAC are necessary to monitor GM researches and to test the safety of introducing Genetically Modified organisms for public services.

Reason (R) : GM researches can have unpredictable results which can even be disastrous, when Genetically Modified organisms are introduced into the ecosystem.

SECTION B

182. (A) The male reproductive system functions with the help of hormones. How does GnRH affect the male reproductive system?

OR

(B) Various glands are present in the body and they play vital roles in the functioning of the body.
Name any two male accessory glands of the male reproductive system. Write one common function of these accessory glands.

183. (A) Explain the mechanism of sex-determination in insects like Drosophila and Grasshopper.

OR

(B) How does a chromosomal disorder differ from a Mendelian disorder ? Name any two chromosomal disorders.

184. There are many methods to control diseases that are spread by insect vectors.

(A) Name any two diseases spread in this manner.

(B) What is the function of fishes like Gambusia to control the above diseases?

185. Mention the key tools of Recombinant DNA technology. Write a line about any four of them, giving their function.

186. **(A) (i)** Which organisms capture energy that sustains the entire living world ? What is the source of this energy?

(ii) How do ecosystems comply with the Second Law of Thermodynamics?

OR

(B) "Alien species are highly invasive and are a threat to indigenous species." Substantiate this statement with the help of any two examples.

SECTION C

187. **Answer the following questions:**

(A) Where do the Coleoptile and Coleorhiza appear in a monocot seed?

(B) What is meant by free nuclear endosperm ? Give an example.

(C) What are parthenocarpic fruits ? Give an example.

188. **Answer the following questions:**

(A) Write the specific location of vasa efferentia and vas deferens in the male reproductive system.

(B) What is a polar body which is formed during oogenesis process in females? When is it first produced?

(C) Write the fate of the Graafian follicle after ovulation.

189. **(A)** State the dual role of deoxyribonucleoside triphosphates during DNA replication.

(B) In which phase of the cell cycle does replication of DNA occur in eukaryotes? What would happen if cell division is not followed after DNA replication?

190. Describe the process of translation in protein synthesis.

191. Explain how Bacillus thuringiensis acts as a microbial biocontrol agent.

192. Expand the term 'ELISA'. On which principle is the 'ELISA' test based? Explain the process.

193. **Answer the following questions:**

(A) Name the type of interaction seen between fig tree and wasps.

(B) Mention the benefits that the female wasps desire from the fig tree from such an interaction.

(C) Give one example where animal-plant interaction involves 'co-evolution' other than the relationship between fig tree and wasps.

SECTION D

194. **Read the following passage and answer the questions that follow:**

There was a massive fire in a market place. As a result many people were injured and burnt beyond recognition.

(A) When does a requirement like DNA techniques arise ? Which technique may be suggested in the given situation?

(B) What is matched between the victims and kin ? Does it help in other ways also ?

(C) (i) What is 'Satellite DNA'? What role does it play ?

OR

(ii) Apart from 'forensic science', how is DNA fingerprinting used?

195. **Read the following passage and answer the questions that follow:**

It is said that early screening is the key to boosting survival rates in cancer patients.

(A) Why is early screening so crucial ?

(B) What preventive measures would reduce the risk of cancer?

(C) (i) Write the causes of cancer. What is the name given to these agents?

OR

(ii) Differentiate between viral oncogenes and proto-oncogenes?

SECTION E

196. **(A) (i)** What is the 'RCH' programme and what is its motive?

(ii) Make a list of five steps to implement the programme and to create awareness among the people about reproduction-related aspects.

(iii) Which test in this field is meant for useful study but is misused by people? Write the importance of this test.

OR

(B) (i) Write the average duration of human pregnancy. By what name is this period known as?
(ii) Explain the terms Menarche and Menopause.
(iii) Name and explain the sterilisation methods in males and females.

197. **(A)** Describe the steps involved in Recombinant DNA technology in a specific sequence.

OR

(B) (i) In Recombinant DNA technology, it is essential to first make the bacterial cells 'competent'. How is this process carried out?
(ii) Name and explain the methods by which an alien DNA can be made to enter :
(I) a plant cell,
(II) an animal cell.

198. **Read the following passage and answer the questions that follow:**

(A) The role of Species Diversity for providing stability to the ecosystem is still not accepted by all ecologists.
(i) What is meant by 'Stable Community'?
(ii) What are its characteristics?
(iii) Name the ecologist who carried out experiments on the above to provide a tentative answer and also write his findings.

OR

(B) Answer the following questions:
(i) Write the role of detritivores and give one example also.
(ii) Explain 'Catabolism' and 'Humification' - steps of decomposition.
(iii) Compare the grazing food chain and detritus food chain in the aspect of their :
(I) origin, and
(II) energy status.