

6. Match the organism shown in column I with its use in biotechnology given in column II. 1

Column I	Column II
A. <i>Bacillus thuringiensis</i>	(i) Cloning vector
B. <i>Thermus aquaticus</i>	(ii) Construction of first rDNA molecule
C. <i>Agrobacterium tumefaciens</i>	(iii) DNA polymerase
D. <i>Salmonella typhimurium</i>	(iv) Cry protein

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

7. What kind of pyramid would be obtained with the following data? 1

Secondary consumer: 120g, Primary consumer: 60g, Primary producer: 10g

- a) Upright pyramid of biomass
- b) Inverted pyramid of biomass
- c) Upright pyramid of numbers
- d) Pyramid of energy

8. Which was the last human chromosome to be completely sequenced? 1

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

9. The amino acid attaches to the tRNA at its 1

- a) 5'-end
- b) DHU loop
- c) 3'-end
- d) Anticodon site

10. Which microbes are used in fermentation to prepare Idli and Dosa? 1

- a) Virus
- b) Protozoa
- c) Fungi
- d) Bacteria

11. How many phenotypes can occur in the human blood group ABO with alleles $I^A I^B i$? 1

- a) 2
- b) 4
- c) 1
- d) 3

12. An exception to Mendel's law is?

- a) Incomplete dominance
- b) Dominance
- c) Purity of gametes
- d) Linkage

Question No. 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 cattle egret and grazing cattle in close association is a classic example of commensalism. 1

Reason: As grazing cattle move through the field, they stir up and flush out insects from the vegetation that otherwise might be difficult for egrets to find and catch.

14. Assertion: Tapetum is the innermost wall layer. It performs the function of providing nourishment to the developing pollen grains. 1

Reason: The cells of tapetum have dense cytoplasm and usually have more than one nucleus.

15. Assertion: When white eyed, yellow bodied *Drosophila* females were hybridized with red eyed, brown bodied males; and F₁ progeny was intercrossed, F₂ ratio deviated from 9:3:3:1. 1

Reason: When two genes in a dihybrid are on the same chromosome, the proportion of parental gene combinations is much higher than the non-parental type.

16. Assertion: When a bacterial population faces a particular antibiotic which it is sensitive to, it dies. 1

Reason: Few resistant bacteria survive.

SECTION-B

17. Explain the mechanism of 'sex determination' in birds. How does it differ from that of human beings? 2

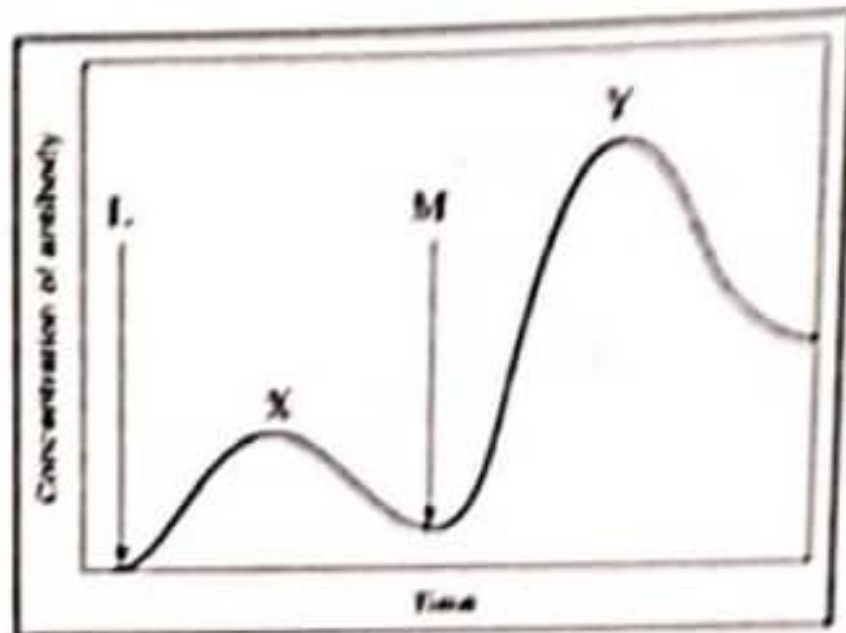
18. Write the location and functions of the following in human testis: 2

- a) Sertoli cells
- b) Leydig cells

19.

The graph given below indicates the administration of the first (I.) and second dose (M) of a vaccine. The corresponding response of the body is indicated by X and Y. Interpret the graph and explain the reason for such a response shown by the body.

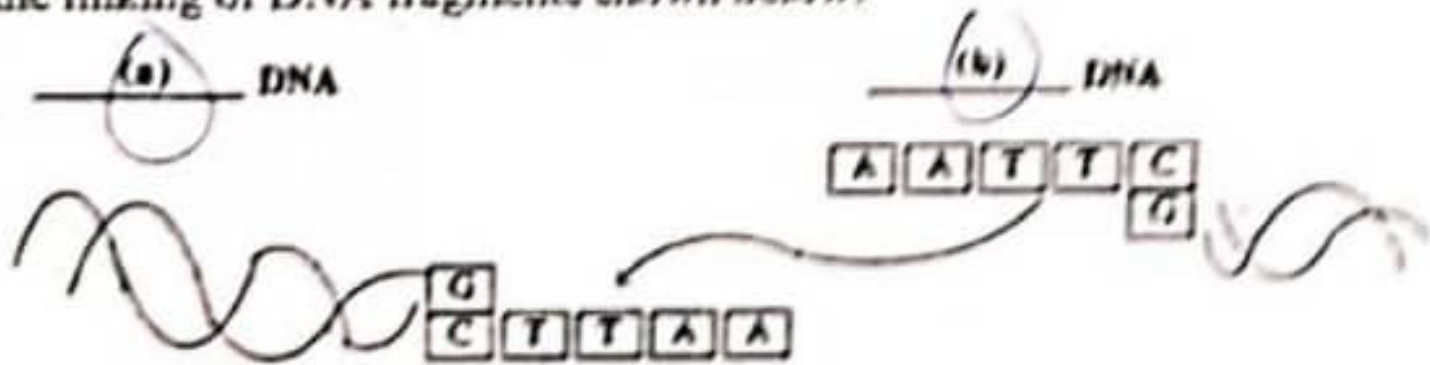
2



20.

Study the linking of DNA fragments shown below:

2



- a) Name 'a' and 'b' DNA.
- b) Name the restriction enzyme that recognises this palindrome.
- c) Name the enzyme that can link these two DNA fragments.

21.

Why should biodiversity be conserved? List any two ethical arguments in its support.

2

SECTION-C

22.

The diagram shows L.S. of a Maize seed. Label A to F.

3



23.

West Bengal tigers are protected in special settings in zoological parks. Tiger reserves are maintained in Western Ghats.

3

- a) How do these two approaches differ from each other? Mention the advantages of each one.
- b) What is the significance of the cryopreservation technique?

24.

Mention the product and its use produced by each of the microbes listed below:

3

- a) *Streptococcus*
- b) *Lactobacillus*
- c) *Monascus*

25. a) How is Hardy-Weinberg's expression " $(p^2 + 2pq + q^2) = 1$ " derived? 3
 b) List any two factors that can disturb the genetic equilibrium.

OR

- a) Divergent evolution leads to homologous structures. Explain with the help of an example.
 b) Mention how is mutation theory of Hugo deVries different from Darwin's theory of natural selection?

26. a) Describe any four devices which have been observed in plants to achieve cross pollination and discourage self-pollination. 3
 b) State what would continued self-pollination results in.

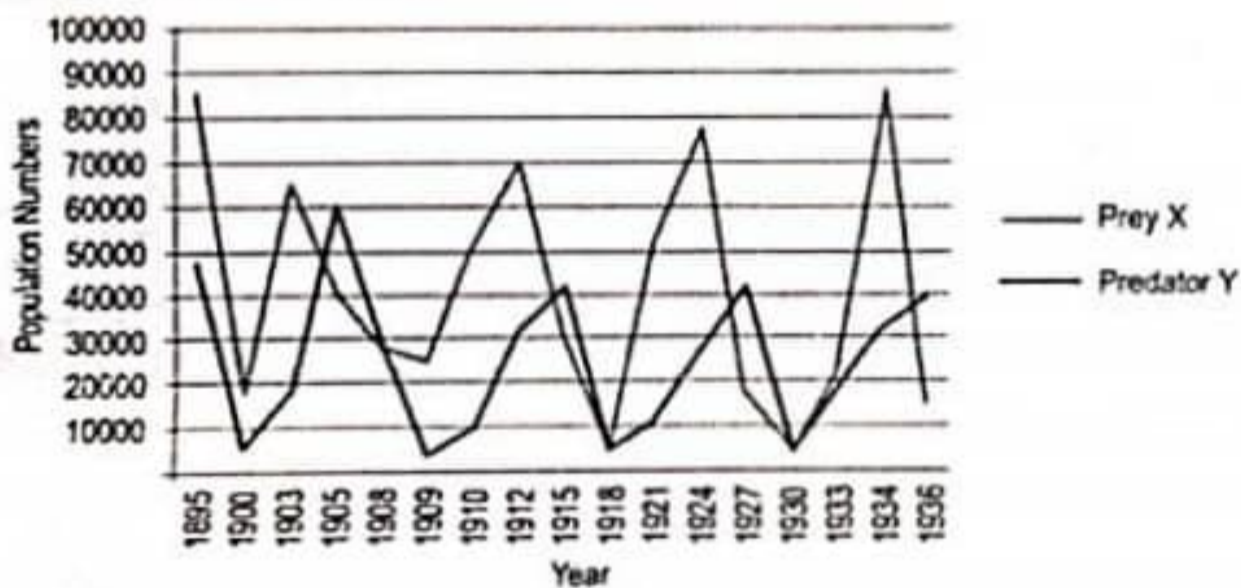
27. Recombinant DNA technology is of great importance in the field of medicine. With the help of a flow chart, show how this technology has been used in preparing genetically engineered human insulins. 3

28. A woman has certain queries as listed below, before starting with contraceptive pills. Answer them. 3
 a) What do contraceptive pills contain and how do they act as contraceptives?
 b) What schedule should be followed for taking these pills?

SECTION-D

Q. 29 and 30 are case-based questions.

29. Predator Y shown in the image below is a type of wild cat that inhabits the forests and preys primarily on prey X which are herbivores. Shown below is data on their respective populations over time. 4



- a) What is the likely cause for the pattern seen in the prey and predator populations through the years?
 b) Hypothetically, if all the predators of the forests become extinct, what will happen to the vegetation of the forest?
 c) Consider a situation where another similar species of predator immigrates to the forest. What is likely to happen over time and why?

30. Genetically modified cotton, the plant containing the pesticides gene from the bacteria *Bacillus thuringiensis* has been grown in India for about 20 years. This pesticide, now produced in each Bt plant cell, ought to protect the plant from bollworm, thereby increasing yields and reducing insecticide spraying on the cotton plant. According to the ministry of agriculture, from 2005, adoption of Bt cotton rose to 81% in 2007, and up to 93% in 2011. Many short-duration studies examining Bt cotton, in the early years, pronounced that Bt was a panacea for dwindling yields and pesticide expenses. The two-decade mark now provides an opportunity to review GM cotton in India more comprehensively. 4

- Cultivation of Bt cotton has been much in news. What does the prefix 'Bt' mean?
- Name the first transgenic cow developed and explain the improvement in the quality of the product produced by it.
- Why do toxic insecticidal proteins secreted by *Bacillus thuringiensis* kill the insect and not the bacteria itself?

OR

Expand GMO. How is it different from a hybrid?

SECTION-D

31. How does the pollen mother cell develop into mature pollen grain? Illustrate the stages with labelled diagrams. 5

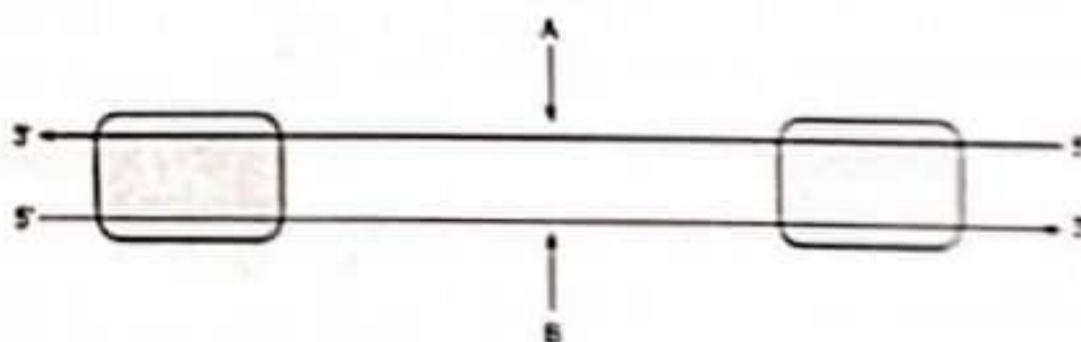
OR

- Explain the events taking place at the time of fertilization of an ovum in human females.
- Trace the development of the zygote upto its implantation in the uterus.
- Name and draw a labeled sectional view of the embryonic stage that gets implanted.

32. i) Explain the observations of Meselson and Stahl when 5

- they cultured *E. coli* in a medium containing $^{15}\text{NH}_4\text{Cl}$ for a few generations and centrifuged the content.
 - they transferred one such bacterium to the normal medium of $^{14}\text{NH}_4\text{Cl}$ and cultured for 2 generations?
- What does the above experiment prove?
 - Which is the first genetic material identified?

OR



- Identify strands 'A' and 'B' in the diagram of the transcription unit given above and write the basis on which you identified them.
- State the functions of Sigma factor and Rho factor in the transcription process in a bacterium.
- Write the functions of RNA polymerase-I and RNA polymerase-III in eukaryotes.

33. Draw and explain a logistic curve for a population of density (N) at time (t) whose intrinsic rate of natural increase is (r) and carrying capacity is (k). How is it different from exponential growth curve?

5

OR

- i) What is an age pyramid?
- ii) Name three representative kinds of age-pyramids for the human population and list the characteristics for each one of them.
- iii) If 18 individuals in a laboratory population of 80 fruit flies died in a week, then what would be the death rate for population for the said period?