



# BIOLOGY

## BOOKS - TRUEMAN BIOLOGY

### GENETICS AND EVOLUTION

#### Section A

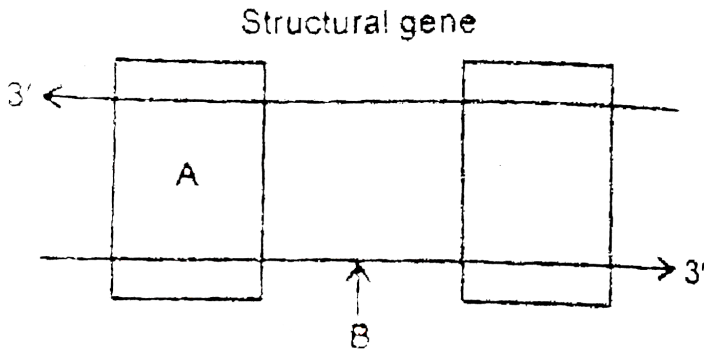
1. Which of Mendel's Law of Inheritance is universally acceptable and without exception?

State the law.



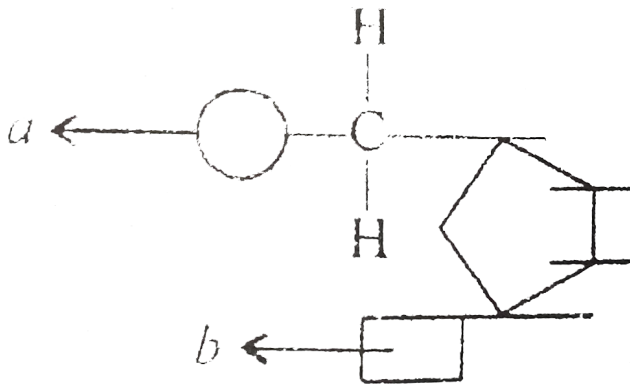
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2. Name the parts 'A' and 'B' of the transcription unit given below.



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3. Name the components 'a' and 'b' in the nucleotide with a purine, given in the figure:



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4. Why hnRNA is required to undergo splicing?

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5. State any one reason to explain why RNA viruses mutate and evolve faster than other viruses



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6. How is the length of DNA usually calculated?



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7. How does HIV differ from bacteriophage?



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8. The gene I that controls the ABO blood grouping in human beings has three alleles  $I^A$ ,  $I^B$  and  $i$

(a) How many different genotypes are likely to be present in human population?

(b) Also, how many phenotypes are possibly present?





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9. Provide one word or one sentence information about 'plasmid' with respect to its (i) chemical nature and (ii) its duplication.



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10. Name the event during cell division that results in the gain or loss of chromosome.



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**11.** Mention the contribution of genetic maps in human genome project.



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**12.** Name one autosomal dominant and one autosomal recessive. Mendelian disorder in human.



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**13.** A human being suffering from Down's Syndrome shows trisomy of 21<sup>st</sup> chromosome. Mention the cause of this chromosomal abnormality.

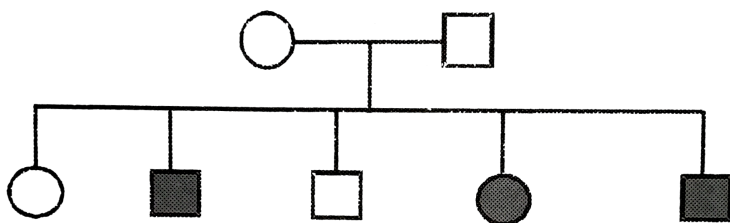


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**14.** A pedigree chart given here, presents a particular generation which shows a trait irrespective of sexes (ie.. present in both male and female). Neither of the parents of the



particular generation shows that trait. Draw your conclusion on the basis of the pedigree.



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**15.** In order to obtain the  $F_1$  generation, Mendel pollinated a true-breeding, say, tall plant with a true-breeding dwarf plant. But for getting the  $F_2$  generation, he simply self-pollinated the tall  $F_1$  plants. Why?



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16. "Genes contain the information that is required to express a particular trait. Explain



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17. How are alleles of particular gene differ from each other? Explain its significance.



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**18.** For the expression of traits genes provide only the potentiality and the environment provides the opportunity. Comment on the veracity of the statement.



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**19.** A, B, D are three independently assorting genes with their recessive alleles a, b, d respectively. A cross was made between

individuals of Aa bb DD genotype with aa bb dd. Explain the type of genotypes of the offspring produced.



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**20.** Sometimes cattle or even human beings give birth to their young ones that are having extremely different sets of organs like limba/position of eye(s) etc. Comment .



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**21.** In a nucleus, the number of RNA nucleoside triphosphates is 10 times more than the number of DNA nucleoside triphosphates, still only DNA nucleotides are added during the DNA replication, and not the RNA nucleotides. Why?



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**22.** Name the enzyme and state its property that is responsible for continuous and

discontinuous replication of the two strands of a DNA molecule.



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**23.** Pick out the ancestral line of Cycads from the list given below-Ferns, herbaceous lycopods, seed ferns, and horsetails



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24. Mention the type of evolution that has brought the similarity as seen in potato tuber and sweet potato.



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25. 

1.5 mya	↑	Java man
	↓	Homo habilis - more man like
2 mya	↓	Australopithecus - hunted with stones.

Study the ladder of human evolution given above and answer the following questions.

(i) Where did Australopithecus evolve?

(ii) Write the scientific name of Java man?



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**26.** Coelacanth was caught in 1938 in South Africa. Why is it very significant in the evolutionary history of vertebrates?



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**27.** Name the common ancestor of the great apes and man. In which period were they surviving?



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**28.** When did fishes evolve?



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**29.** Does mutation alter Hardy Weinberg equilibrium?



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**30.** By what Latin name, the first Hominid was known? Mention the period it was surviving.



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**31.** Among Ramapithecus, Australopithecines and Homo habilis who probably did not eat meat ?



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**32.** Write the formula to calculate allele frequency in future generations according to Hardy-Weinberg genetic equilibrium.



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**33.** Identify the examples of convergent evolution from the following :

(i) Flippers of penguins and dolphins

(ii) Eyes of octopus and mammals

(iii) Vertebrate brains





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**34.** Identify the examples of homologous structures from the following-

(i) Vertebrate hearts

(ii) Thorns in Bougainvillea and tendrils of Cucurbita.

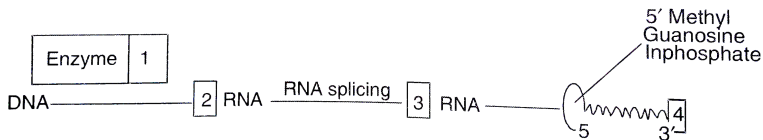
(iii) Food storage-organs in sweet potato and potato.



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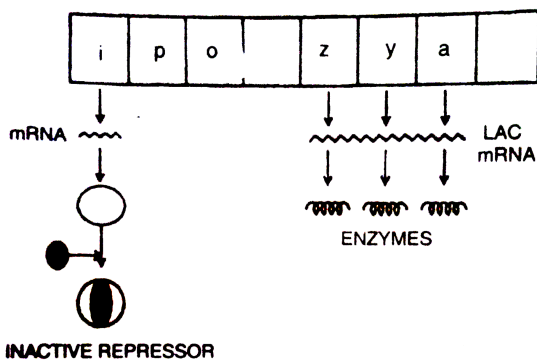
## Section B

1. Given below is a sequence of steps of transcription in a eukaryotic cell. Fill up the blanks (1,2,3,4) left in the sequence .



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2. Study the figure given below and answer the questions:



- (i) How does the repressor molecule get inactivated?
- (ii) When does the transcription of lac mRNA stop?
- (iii) Name the enzyme transcribed by the gene Z'.

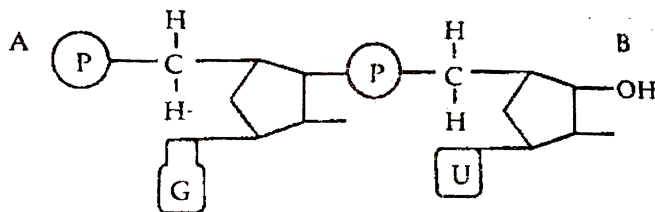


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3. Expand DNA and RNA. Name the sugar moiety present in these structures.

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4. Answer the questions based on the dinucleotide shown below :



(i) Name the type of sugar guanine base is attached to ?

(ii) Name the linkage connecting the two nucleotides

(iii) Identify the 3' end of the dinucleotide.

Given a reason for your answer.



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5. How do histones acquire positive charge?



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6. State the dual role of deoxyribonucleoside triphosphates during DNA replication.



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7. Mention the role of ribosomes in peptide-bond formation. How does ATP facilitate it?



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8. In a Mendelian monohybrid cross the  $F_2$  generation shows identical genotypic and phenotypic ratios. What does it tell us about the nature of alleles involved? Justify your answer.



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9. What is Down's syndrome? Give its symptoms and cause. Why is it that the chances of having a child with Down's

syndrome increases if the age of the mother exceeds forty years ?



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**10.** What are the characteristic features of a true-breeding line?



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**11.** If a father and son are both defective in red-green color vision, is it likely that the son

inherited the trait from his father? Comment.



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**12.** What would happen if histones were to be mutated and made rich in acidic amino acids such as aspartic acid and glutamic acid in place of basic amino acids such as lysine and arginine?



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**13.** Recall the experiment done by Frederick Griffith. If RNA, instead of DNA was the genetic material, would the heat killed strain of Pneumococcus have transformed the R-strain into virulent strain? Explain your answer.



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**14.** Describe Chargaff rule.



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**15.** Differentiate between nucleotide and nucleoside.



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**16.** Mention the inducers in Lac and tryptophan operon concept.



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**17.** Expand VNTR. Mention its application.



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**18.** Define DNA polymerisation. Mention the role of REN and DNA ligase.



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**19.** Name the accepted model of plasma membrane. Who proposed it?



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20. What are the functions of (i) methylated guanine cap, (ii) poly-A"tail" in a mature mRNA?



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21. Differentiate between Exons and Introns.



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**22.** Comment on the utility of variability in number of tandem repeats during DNA fingerprinting .



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**23.** Write the full of VNTR. How is VNTR different from 'Probe' ?



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**24.** A non-haemophilic couple was informed by their doctor that there is possibility of a haemophilic child being born to them .Draw a checker board and find out the percentage of possibility of such a child among the progeny.



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**25.** In a particular plant species majority of the plants bear purple flowers. Very few plants bear white flowers. No intermediate colours

are observed. If you are given a plant bearing purple flowers, how would you ascertain that it is a pure breed for that trait? Explain.



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**26.** A cross between a red flower bearing plant and a white flower bearing plant of *Antirrhinum* produced all plants having pink flowers. Work out a cross to explain how this is possible.



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27. In a typical monohybrid cross the  $F_2$ -population ratio is written as 3:1 for phenotype but expressed as 1:2:1 for genotype. Explain with the help of an example.



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28. Work out a cross to find the genotype of a tall pea plant. Name the type of cross.



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**29.** (a) Write the specific features of the genetic code AUG

(b) Explain aminoacylation of the tRNA



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**30.** Arrange the following groups of plants in an ascending evolutionary scale: Cycads: Rhynia-like plants: Chlorophyta ancestors: Dicotyledons, and Seed ferns. (in proper sequence)





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**31.** While creation and presence of variation is directionless, natural selection is directional as it is in the context of adaptation. Comment.



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**32.** Define Genetic drift. Mention the types.



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**33.** Who proposed "survival of the fittest" theory?



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**34.** In which plant did Mendel perform his experiments? Why did he choose it?



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**35.** Define migration. Mention the types of migration in fishes.



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**36.** How do darwin' s finches illustrate adaptive radiation ?



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**37.** List the two main propositions of Oparin and Haldane.



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**38.** Write the Oparin and Haldane hypothesis about the origin of life on Earth. How does meteorite analysis favour this hypothesis?



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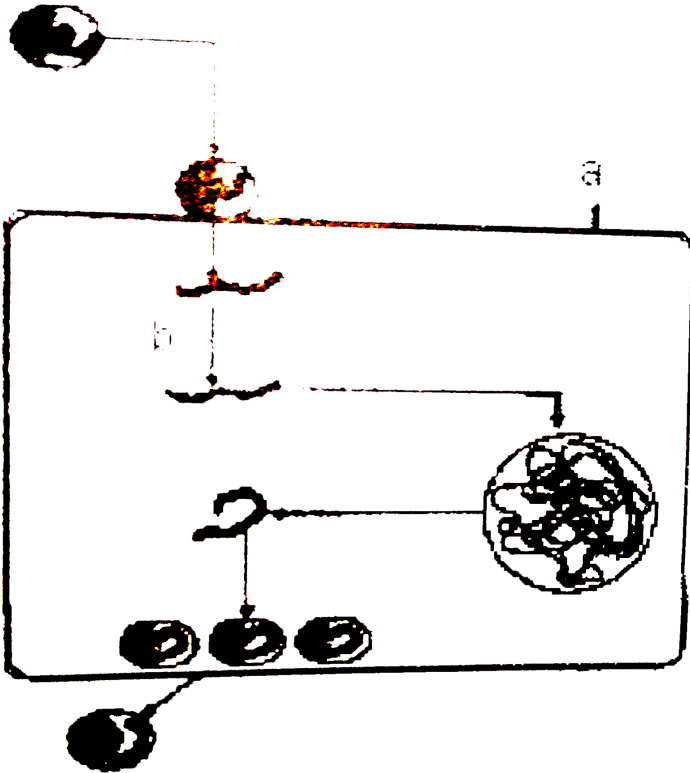
## Section C

**1.** (i) What does this diagrammatic sketch depict?

(ii) Identify 'a' and 'b'

(iii) Name the widely used diagnostic test

when a person gets this disease.



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2. A 3' \_\_\_\_\_ 5' B

C 5' \_\_\_\_\_ 3'D

AB and CD represent two strands of a DNA molecule. When this molecule undergoes replication, forming a replication fork between A and C in the above.

(i) Name the template strands for replication.

(ii) Using which strand as the template, will there be continuous synthesis of a complementary DNA strand?

(iii) Complementary to which strand will Okazaki segments get synthesised and

discontinuous synthesis will occur

(iv) What are template strands and Okazaki pieces?

(v) In which direction is a new strand synthesized?



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3. What is the function of reverse transcriptase enzyme?



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4. What are types of sex-linkage?



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5. Define haemophilia. What type of sex linkage does it belong to?



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6. What is 'semi-conservative' DNA replication? Who discovered it and when?





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**7. Expand:**

PCR

ELISA



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**8. Mention the reason for sickle cell anemia.**



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9. Who discovered ABO blood group. When was it discovered?



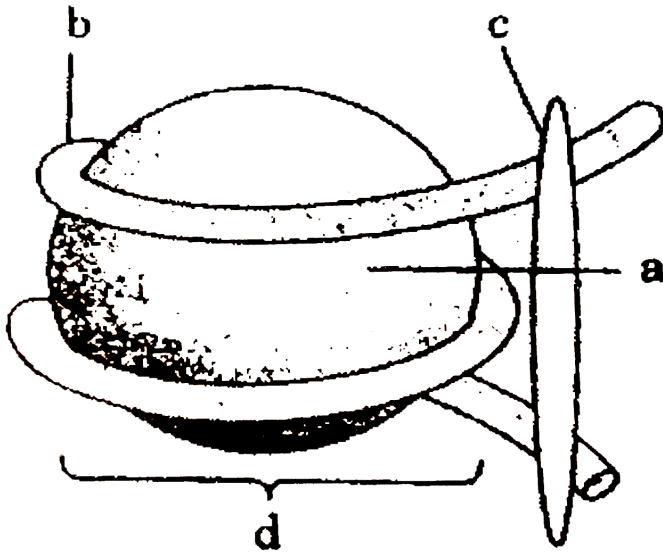
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10. (a) What is this diagram representing?

(b) Name the parts a, b and c.

(c) In the eukaryotes the DNA molecules are organized within the nucleus. How is the DNA molecule organized in a bacterial cell in

absence of a nucleus?



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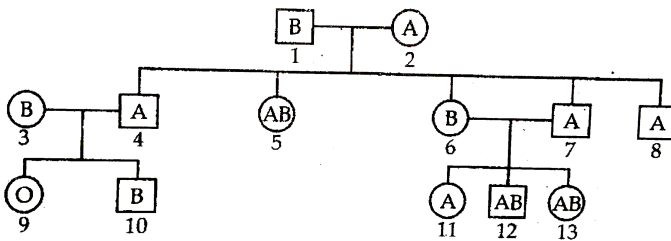
11. In human genome which one of the chromosomes has the most genes and which one has the fewest?





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12. Study the pedigree chart given, showing the Inheritance pattern of blood groups in a family and answer the following questions



- (a) Give the possible genotypes of the individuals 1 and 2.
- (b) Which antigen or antigens will be present on the plasma membranes of the RBC's of

individuals 5 and 9.

(c) Give the genotypes of the individuals 3 and 4.



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**13.** Differentiate between phenotype and genotype.



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**14. (i)** Why are grasshopper and *Drosophila* said to show male heterogamity ? Explain.

(ii) Explain female heterogamity with the help of an example.



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**15.** Why is tRNA called an adaptor molecule?



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**16. (i)** List the chromosomal disorders a human may suffer from if karyotype analysis of the individual shows 47 chromosomes instead of normal 46

(ii) Explain the cause that results in the gain of chromosome number.

(iii) Mention the symptoms of any one the disorders an individual can suffer from



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**17.** How are dominance, codominance and incomplete dominance patterns of inheritance different from each other?



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**18.** A pea plant with purple flowers was crossed with white flowers producing all 50 plants with only purple flowers. On selfing, these plants produced 482 plants with purple flowers and 162 with white flowers. What genetic

mechanism accounts for these results?

Explain.



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**19.** (i) Name the enzyme that catalysis the transcription of hnRNA. (ii) Why does the hnRNA need to undergo changes? List the changes hnRNA undergoes and where in the cell such changes take place?



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**20.** Unambiguous, universal and degenerate are some of the terms used for the genetic code. Explain the salient features of each one of them.



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**21. (a)** Name the scientist who called t-RNA an adapter molecule.

**(b)** Draw a clover leaf structure of t-RNA showing the following:

**(i)** tyrosine attached to its amino acid site

(ii) anticodon for this amino acid in its correct site (codon for tyrosine is UAC)

(c) What does the actual structure of t-RNA look like?



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**22.** During the studies on genes in *Drosophila* that were sex-linked T.H. Morgan found F<sub>2</sub>-population phenotypic ratios deviated from expected 9 : 3 : 3 : 1. Explain the conclusion he arrived at.





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**23.** Explain the mechanism of sex determination in insects like *Drosophila* and grasshopper.



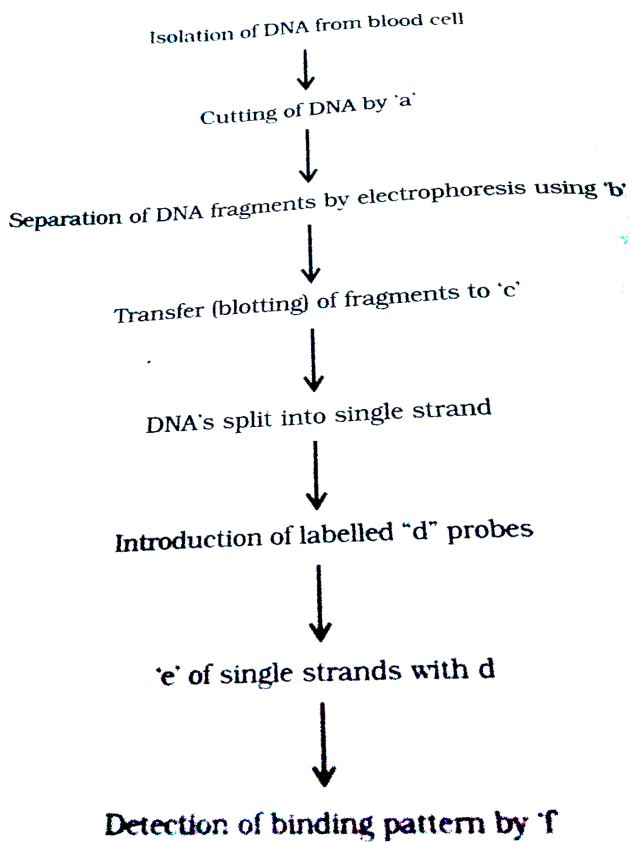
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**24.** Who determines the sex of an unborn child? Mention whether temperature has a role in sex determination.



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25. The following is the flow chart highlighting the steps in DNA finger printing technique. Identify a, b, c, d, e and f.





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**26.** Study the given pedigree chart showing the pattern of blood group inheritance in a family

(a) Given the genotype of the following:

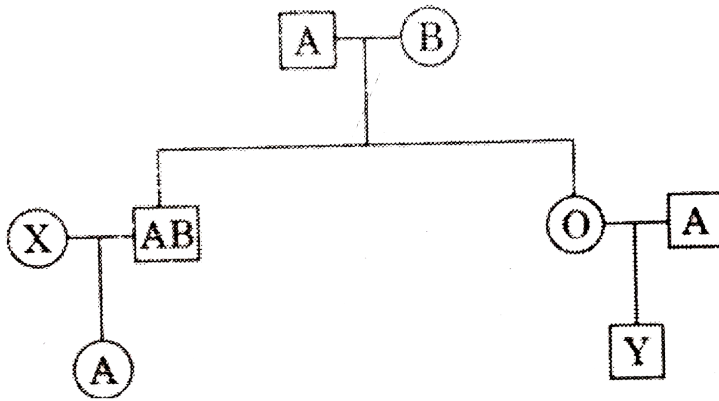
(i) Parents

(ii) The individual 'X' in second generation

(b) State the possible blood groups of the individual 'Y' in third generation

(c) How does the inheritance of this blood

group explain codominance?



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27. a) Construct a complete transcription unit with promoter and terminator on the basis of hypothetical template strand given below



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



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**28.** What is the genetic basis for proof that codon is a triplet?



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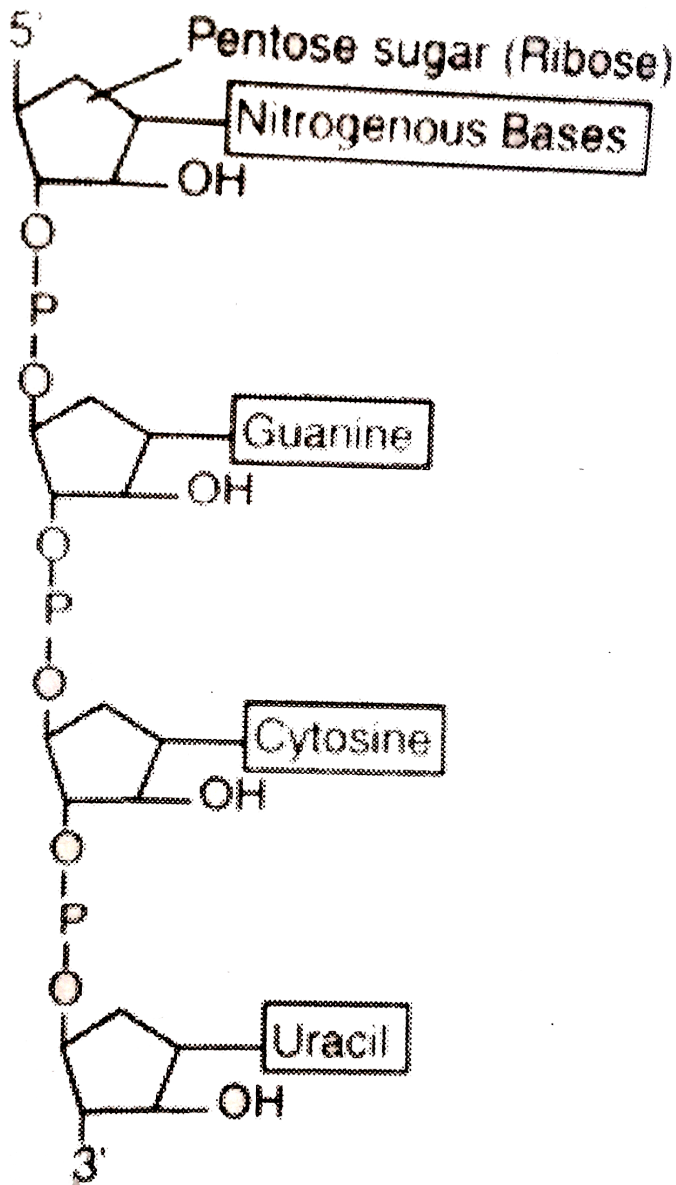
**29.** What is satellite DNA in a genome ? Explain their role in DNA fingerprinting .



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**30.** Describe the structure of an RNA polynucleotide chain having four different

types of nucleotides.



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**31.** Explain the pattern of inheritance of haemophilia in humans. Why is the possibility of a human female becoming a haemophilic is extremely rare? Explain.



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**32.** In a maternity clinic, for some reasons the authorities are not able to hand over the two new-borns to their respective real parents.



Name and describe the technique that you would suggest to sort out the matter.



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**33. a)** Explain DNA polymorphism as the basis of genetic mapping of human genome.

b) State the role of VNTR in DNA fingerprinting.



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**34.** Explain codominance taking an example of human blood groups in the population.



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**35.** Define natural selection. Mention its types.



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**36.** "A population has been exhibiting genetic equilibrium". Answer the following with regard

to the above statement.

(i) Explain the above statement.

(ii) Name the underlying principle.

(iii) List any two factors which would upset the genetic equilibrium of the population.



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**37.** In the 1950s, there were hardly any mosquitoes in Delhi. The use of the pesticide DDT on standing water killed their larvae. It is believed that now there are mosquitoes

because they evolved DDT resistance through the interaction of mutation and Natural Selection. Pointwise. state in a sequence how that could have happened.



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**38.** Discovery of Lobefins is considered very significant by evolutionary biologists. Explain.



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39. Study the figure and answer the following



(a) Write your observations on the variations seen in the Darwin's finches shown above .

(b) Where did Darwin explain the existence of different varieties of finches?

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40. (a) Rearrange the following in an ascending order of evolutionary tree: Reptiles.

salamander, lobe fins and frogs (b) Name two reproductive characters that probably make reptiles more successful than amphibians.



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**41.** (a) What is adaptive radiation.

(b) Explain with the help of suitable example where adaptive radiation has occurred to represent convergent evolution.



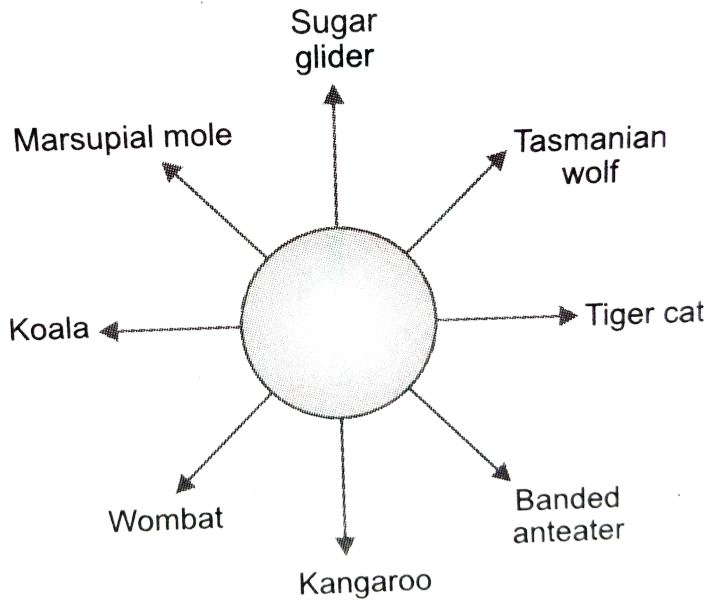
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**42.** Study the figures below and answer the following :

(a) Mention the specific geographical region where these organisms are found.

(b) Name and explain the phenomenon that has resulted in the evolution of such diverse

species in the region.



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**43.** Branching descent and natural selection are the two key concepts of Darwinian Theory of Evolution. Explain each concept.





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**44.** With the help of one suitable examples explain the effect of anthropogenic actions on organic evolution.



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**45.** Explain the increases in the numbers of melanic(dark winged) moths in the urban

areas of post-industrialisation period in England.



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## Section D

1. Give reason for -

(i) Both strands of DNA are not copied during transcription.

(ii) Transcription and translation in bacteria can be coupled.



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2. Name the type of mutation that causes sickle cell anemia.



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3. One chromosome contains one molecule of DNA. In eukaryotes the length of the DNA molecule is enormously large. Explain how such a long molecule fits into the tiny chromosomes seen at Metaphase.



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4. With the advent of DNA technology tool is available to identify a criminal or to the real parents. (a) Name this technique. (b) Write the missing steps in the procedure given below.

Three of these steps are mentioned in the flow chart. (i) Extraction of DNA from the cells (ii)

.....(iii) DNA is cut into fragments by restriction

enzyme (iv) ..... (v)..... (vi). ....(vii)

Autoradiography



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5. Name the scientists responsible for determining the biochemical nature of "transforming principle" in Griffith's experiments.



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6. Define transcription. Where does transcription in eukaryotes takes place?



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7. Define:

Evolution

Gene pool



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8. Two blood samples A and B picked up from the crime scene were handed over to the forensic department for genetic finger printing. Describe how the technique of genetic finger printing is carried out.



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9. Name the scientist who proved DNA as a hereditary material.



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10. With the help of one example each provide genetic explanation for the following observations: brgt (i)  $F_1$ -generation resembles both the parents.

$F_1$ -generation does not resemble either of the parents



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**11.** Name any two chromosomal disorders.



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**12.** Name any two mendelian disorder.



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**13.** Define Fossil. Mention its types.



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**14.** (a) State the central dogma in molecular biology. Who proposed it? Is it universally applicable? Explain.

(b) List any four properties of a molecule to be able to act as a genetic material



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**15. (a)** Write what DNA replication refers to.

**(b )** List any three enzymes involved in the process along with their functions.



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**16.** Explain inheritance of flower colour in *Mirabilis jalapa*. Mention the mechanism involved.



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**17.** A child suffering from Thalassemia is born to a normal couple. But the mother is being blamed by the family for delivering a sick baby.

a) What is Thalassemia ?

b) Mention the type of inheritance.



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**18.** Explain the mechanism of sex-determination in humans.

b) Differentiate between male heterogamety

and female heterogamety with the help of an example of each.



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**19.** Explain Mendel's law of independent assortment by taking a suitable example.



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**20.** Name the species evolved post Industrialization in England.



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21. Who discovered mutation? Mention any two types.



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22. Fitness is the end result of the ability to adapt and get selected by Nature. Explain with suitable example.



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**23.** The rate of appearance of new forms is linked to the life span of an organism. Explain with the help of a suitable example.



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**24.** Define isolation. Mention its types.



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**25.** To which phylum does Trilobite belongs to?

Name the period they evolved.



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