Question Paper

MANIPAL ACADEMY OF HIGHER EDUCATION

B.Tech. First Semester Mid Term Examination - September 2024

BIOLOGY FOR ENGINEERS [BIO 1071]

Marks: 30 **Duration: 90 mins.**

MCQ

Answer all the questions. Section Duration: 20 mins

1) Assertion: The linkages in water molecules makes it more structured than other liquids
Reasoning: Water molecules stay close to each other as a result of hydrogen bonding

Select the best option (0.5)

Assertion and reasoning are true, reasoning best explains assertion | Assertion and reasoning are true, reasoning NOT explains assertion | Assertion is true, reasoning is false | Assertion is false, but reasoning statement is true

2) Which of the following statement is correct with regard to enzymes

The catalytic power of enzyme is contributed because of the hydrogen bonding and disulfide bonding only | Enzymes doesn't prevent the side reaction to occur | The activation energy remains unchanged with the enzymes | Few amino acids in the active site help to convert substrate to product (0.5)

3) Amino acid interaction in proteins can occur through
1. Hydrogen bonding
2. Ionic bonding
3. Covalent bonding
4. Hydrophobic interaction
5. van der Walls interaction (0.5)

1,2 and 3 | 3,4 and 5 | Only 1 | 1,2,3,4 and 5

4) The general molecular formula for a carbohydrate is (0.5)

C_2HO_6 | C_2H_2O2 | CH_2O | $C(HO)_2$

5) Carbohydrates is a polymer. How they attained various structures? Select the BEST option (0.5)

Difference in the glycosidic linkages | Modification of ester linkages | Difference in disulfide linkages | Modification of peptide linkage

6) Choose the option representing the correct statements with regard to Mendelian experiments
1. Small sample sizes in Mendel's experiments increased the reliability of the results
2. A pure breeding line exhibits steady trait expression and inheritance over numerous generations.
3.A pea plant have many easily distinguisable traits
4. Logical learning of the Mendelian pattern of inheritance can be achieved through a simple coin toss (0.5)
5. Mendel predicted that meiosis results in the reduction of chromosome number by half
6. Mendel has proved that a factor is located on sex chromosomes

1,2,3,4,5 and 6 | 2,3,4,5 and 6 | 1,4 and 6 | 2,3 and 4

7) Mendel confirmed that the inheritance of information occur through (0.5)

factors | genes | proteins | DNA

8) Mr Anand came across a dog's hair color with black phenotype (dominant) and a white phenotype (recessive)

He crossed them and produced a black and white in the ratio 1:1. If the inheritance of the color follows a typical mendelian pattern, the parent's genotypes for color must be (0.5)

Heterozygous for black, homozygous for white | Heterozygous for black as well as white | Homozygous for black as well as white | Homozygous for black and heterozygous for white

9) Which of the following logics were applied by Mendel in his experiments to identify the mechanism of inheritance for characters in living systems?
1. Mendel selected characters which varies across generations
2. Mendel used true breeding plants to start his experiments
3. The characters which exhibits only two phenotypes for a character was selected by Mendel
4. Mendel carefully selected male and female pea plants for easily distinguishable characters (0.5)

Only 2 and 3 are correct | 2, 3 and 4 are correct | Only 4 is correct | Both 1 and 4 are only correct

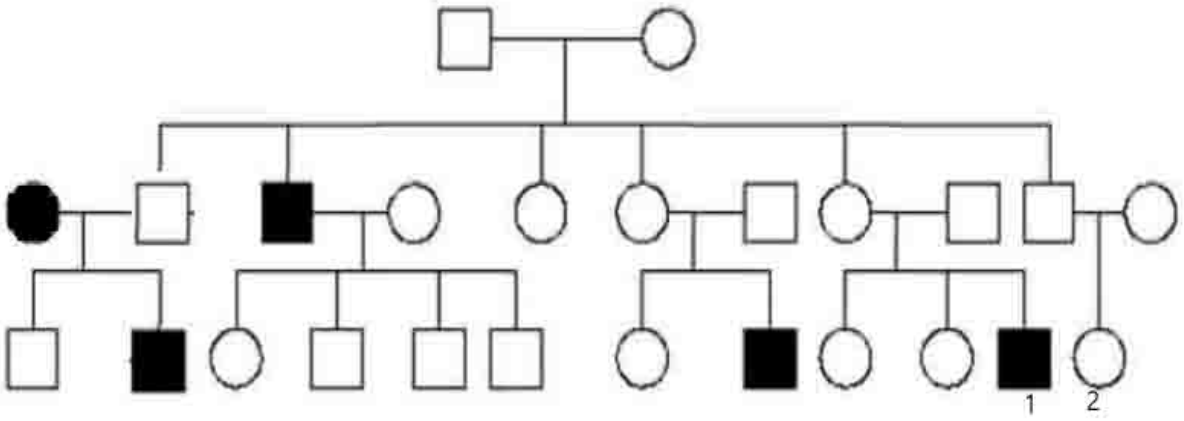
10) Calculate the probability of getting a homozygous recessive phenotype when you cross a heterozygous Mendel's tall plant with a pure breeding tall plant (0.5)

0 | 1/4 | 3/4 | 100

DESCRIPTIVE

Answer all the questions.

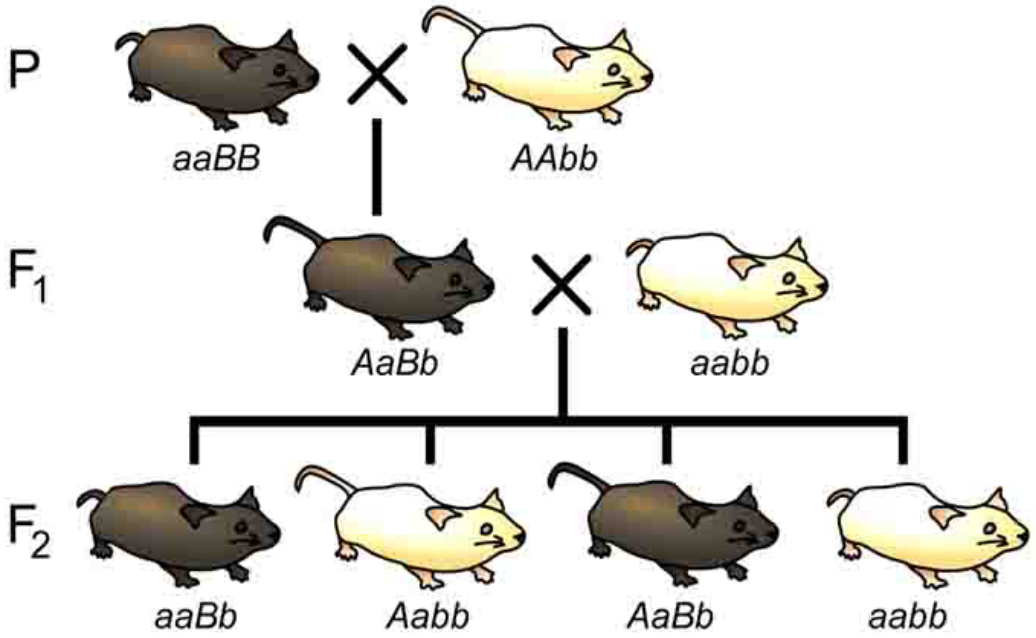
11) Analyze the following chart and answer the following



(4)

(1) Find out the most probable mode of inheritance. 1 mark
(2) Give a CONVINCING justification for your answer in **one sentence** for the inheritance pattern you identified 1 mark
(3) Individuals 1 and 2 decided to marry. Now calculate the probability of their first child be expressing the character? 1 mark
(4) Predict the phenotype of the elder male and female members of this family 1 mark

12) Given below is an illustration of a cross.



(3)

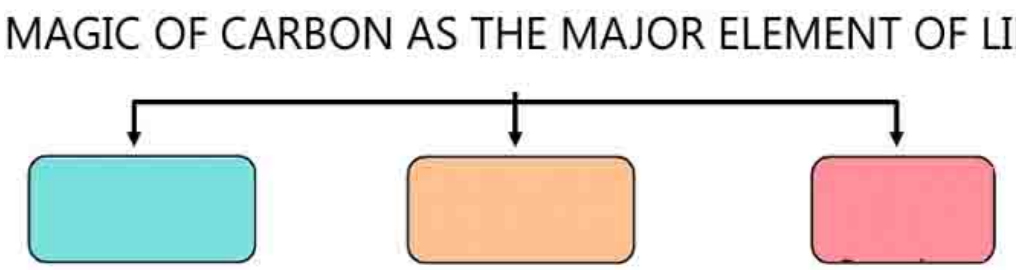
Tail Phenotype	Fur Phenotype	Number of Progeny
Short	Brown	48
Long	White	42
Short	White	13
Long	Brown	17

Calculate the recombination frequency. Show the steps of the calculation. 2 marks
What kind of cross is this? Justify 1 mark

13) In Drosophila, two autosomal genes (factors) have alleles as follows: Gray body color (G) is dominant over black (g); Full wings (A) is dominant over vestigial (a). Following cross was performed, and results are shown below
True breeding Parents: gray, full wings X black, vestigial

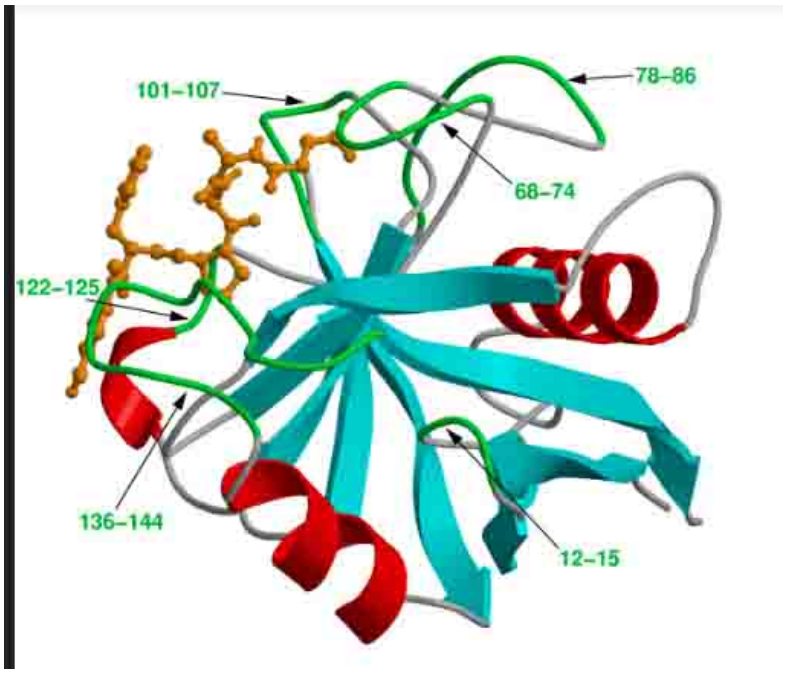
Offspring F2: 2700 gray, full wings; 902 gray, vestigial; 899 black, full wings; 302 black, vestigial (3)
(a) Whether these factors are located on same chromosome or different chromosome? Justify (1 Mark)
(b) Construct a punnett square explaining the cross in F2 (2 Mark)

14) Complete the following illustration by filling in the space. Also provide a **very brief** justification below that



(3)

15)



(3)

Given above is a structure of a protein

(1) Copy the figure and mark the alpha helical region? What makes it stable 1 mark

(2) Identify the structure "12-15". Find the stabilizing force here 1 mark

(3) If you heat a protein, which bond will break first? Can the protein no function? 1 mark

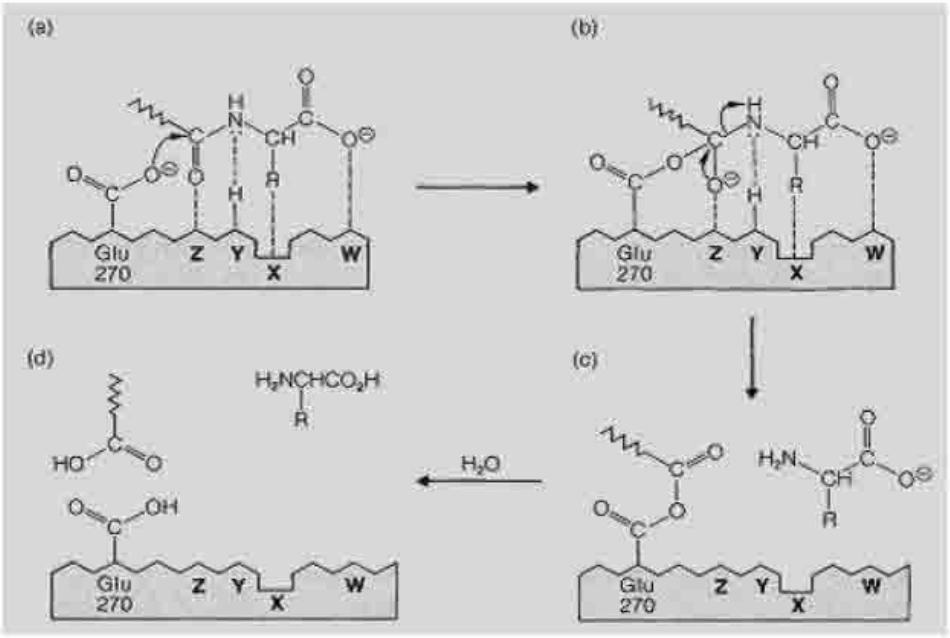
16)

Copy the table and fill the required part (3 marks)

Carbohydrate	Nature of bond	Remarkable engineering
Amylose		
Amylopectin		
Cellulose		

(3)

17) The figure shows carboxypeptidase enzymatic activity that involves the mechanism of peptide bond cleavage.
(a) The amino acid at location Y is substituted with Glycine. Will the enzyme work? Justify (1 mark)
(b) Glu at 270 is replaced with Asp. How the enzyme activity is going to change? (1 mark)



(2)

18) Ms Pallavi has discovered a single cell from an asteroid planet whose atmosphere is hydrophobic. The cell contents are also hydrophobic.

1. Model a cell membrane suitable for this cell? 1 mark
2. Can this living form survive on earth? Justify 1 mark

(2)

19) A fly homozygous for red eyes and banded wings (RRHH) is crossed with a fly of type (RrHh). Recessive

	phenotypes are white eyes and bandless wings 1. Predict the F1 genotype and phenotype 1 mark 2. Illustrate a Punnett square for the above cross 1 mark	(2)

^ Top