Question Paper

Exam Date & Time: 01-Jul-2022 (09:00 AM - 12:00 PM)

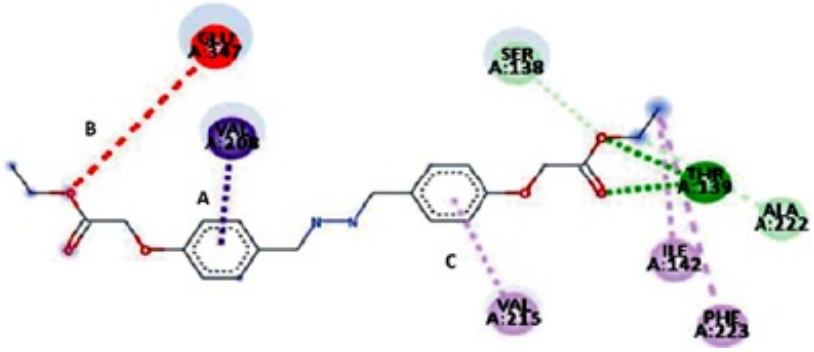
MANIPAL ACADEMY OF HIGHER EDUCATION

SECOND SEMESTER B.TECH. EXAMINATIONS (MIT MANIPAL) - JUNE/JULY 2022
SUBJECT : BIO 1051 - BIOLOGY FOR ENGINEERS

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A) (3)



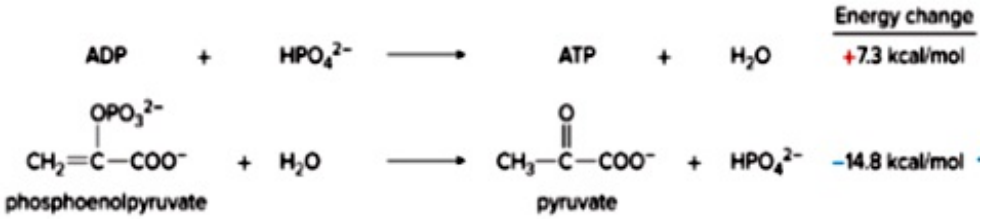
i) Determine the interactions that can occur at the sites labelled A, B.
ii) What would be the consequence of substituting Val with Phe or Lys? Explain.

1B) (3)

i) In the absence of transpiration, design the process adopted by plants to allow the water molecules to stay in the xylem tissue.
ii) Describe the contribution of hydrophobic forces in protein folding.

1C) (4)

i) Determine whether the following coupled reaction will be spontaneous or not? Justify.



ii) For a given chemical reaction the ΔG^{O} value was found to be 15 kJ/mol. Determine the Keq for the reaction at $25^{O}C$ and analyse how the value varies with change of temperature.

2A) (3)

An arthropod called a Cyclops has antennae that are either smooth or Rough. The allele for Rough (R) is dominant over smooth (r). In the same organism Non-resistance to pesticides (P) is dominant over resistance to pesticides (p).
i) Pesticide resistant smooth antennae cyclops is crossed to the double heterozygous one. Write the genotypes of the parents, show the crosses with the help of Punnett square and write the phenotype and genotype ratio for the crosses.
ii) How many genotypes are possible for pesticide resistance irrespective of the antennae texture? Write all genotypes.

2B) (3)

The Duchenne's Muscular Dystrophy (DMD) is an X-linked recessive trait due to deletion or point mutation in the dystrophin gene leading to its defective production.
i) If affected male has a child with a carrier woman, what is the probability that the child will be affected daughter? Show the crosses and Write the genotype for both the cases if she is affected.
ii) If unaffected male marries a carrier woman what is the probability that the child will be affected

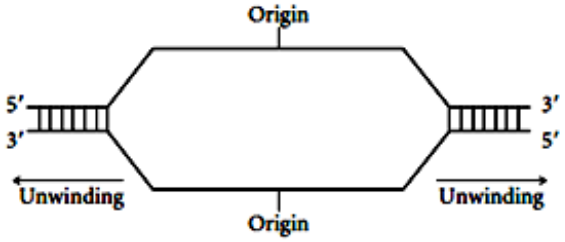
daughter? Show the crosses and write the genotype of the child.

2C) A brown-eyed woman whose father had blue eyes and mother had brown eyes marries a brown-eyed man, whose parents are also brown-eyed. But they have a daughter who is blue-eyed. (4)
i) Draw a pedigree chart for both the family (the two parents) using proper symbol.
ii) Indicate each individual's possible genotypes.
iii) Identify the mode of inheritance for the blue eyes.

3A) Nucleic acid composition of two organism is given below. Can you predict the type of nucleic acid - double stranded, single stranded DNA, double stranded DNA, single stranded RNA or double stranded RNA Justify. (3)

	A%	U%	C%	G%	T%
Organism 1	20	Nil	30	30	20
Organism 2	25	10	20	45	Nil

3B) Draw the newly synthesized DNA strands and identify the following. (3)
i) Directions of newly synthesized strands.
ii) Leading and lagging strands.
iii) RNA primers.



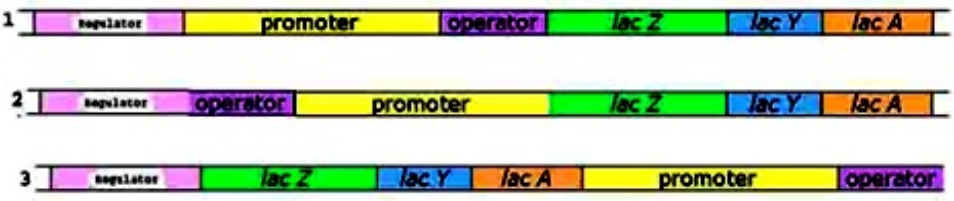
3C) A double stranded DNA sequence in an eukaryotic cell, which produces a polypeptide chain is given below. Assuming all the regions are coding, Answer the following questions. (4)
5'ATGTTTTTTTACGGGTAAATGTTTGTACAT 3'
3' TACAAAAAAATGCCCATTTACAAACATGTA 5'
i) Predict the mRNA produced from the DNA and label the ends.
ii) Determine the polypeptide sequence and label the ends of the polypeptide chain.

4A) i) Cetaceans, a group of marine mammals include whales and dolphins. It was observed that over the years there has been a forward pointing nose has shifted to a blowhole. How would you explain it as an evolutionary trend? (3)
ii) Describe the natural selection concept with an example.

4B) Identify the associations in the examples and also mention it in +/+, +/0 or +/- notation. (3)
i) The huge whales transport the tiny barnacles to plankton-rich waters, where both species feast upon the abundant microorganisms that live there.
ii) A barnacle may root itself within a crab's reproductive system. While the crab does not die from this interaction, its reproductive capabilities are greatly diminished.
iii) The lichens where there is an association between the fungus and algae.

4C) Nature always inspires us and implementing its design would help us life better with lesser resources. Identify the bioinspired designs from the following: (4)
(1) Kingfisher (2) Termite moulds (3) Gecko foot (4) Shark skin dendric

5A) In the given picture three different models of Lac operon is given. Explain the fate of operon in each case in presence of lactose in the medium (3)



5B) What is the significance of Vaccination? Explain the concept involved in Vaccination. (3)

5C) In the hemoglobin gene, in one of the instance, the GAG codon was mutated into GAT. Answer the questions pertaining to this mutation: (4)
i) What is the class of mutation incorporated?

ii) In the oxygen deficient condition, will the red blood cells form a sickle shape?

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