Question Paper

Exam Date & Time: 23-Dec-2018 (08:30 AM - 11:30 AM)

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

FIRST SEMESTER B.TECH END SEMESTER EXAMINATIONS (MAKE UP), DECEMBER 2018

Biology for Engineers [BIO 1051 - 2018 -CHM]

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

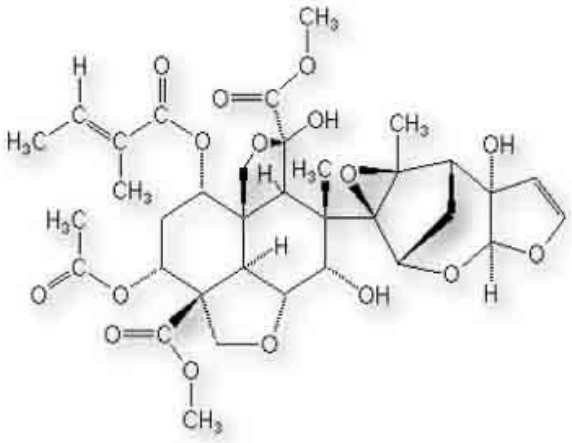
A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

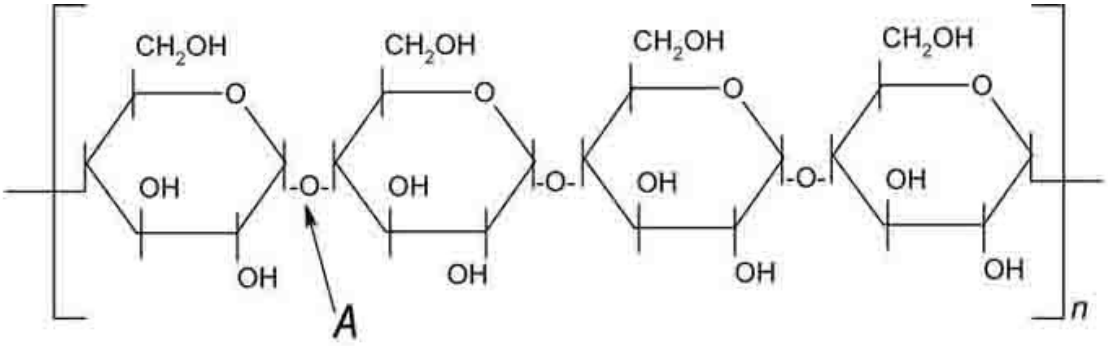
1) Chemical structure of azadirachtin compound from neem tree is given below. (3)

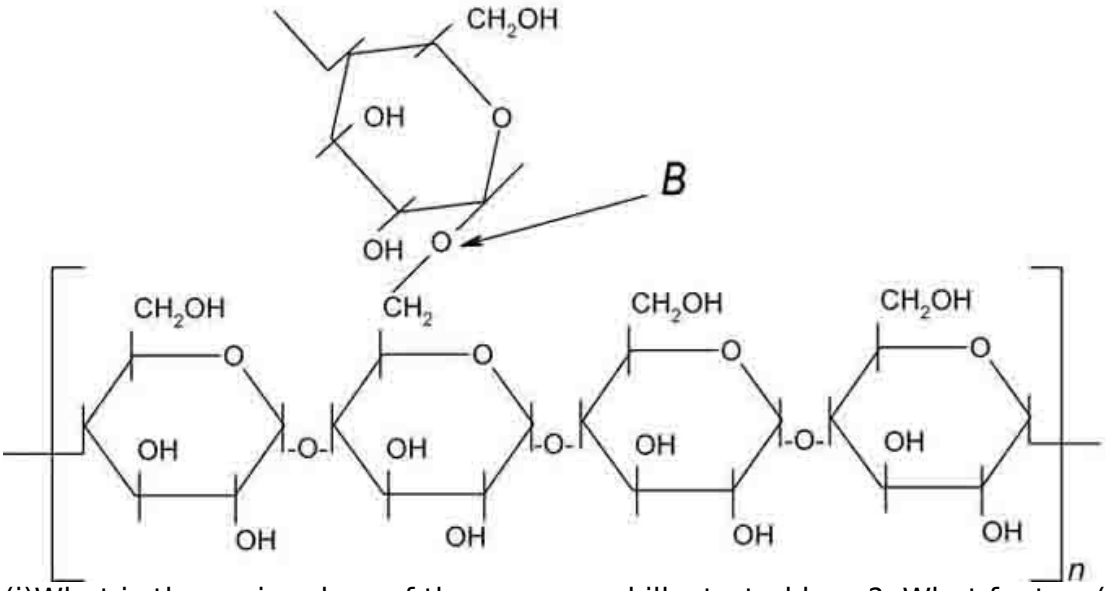
A)



(i)Ankita took neem leaves and crushed with little water and filtered it. Does the filtrate contain all the azadirchatin present in the leaf? Justify. 1 Mark
(ii) Does the azadirachtin form hydrogen bonds with coconut oil? Justify. 1 Mark
(iii) Copy the figure and label the hydrophobic part and hydrophilic part. 1 Mark

B) Analyse the structure of the compound illustrated here and answer the following questions. (3)





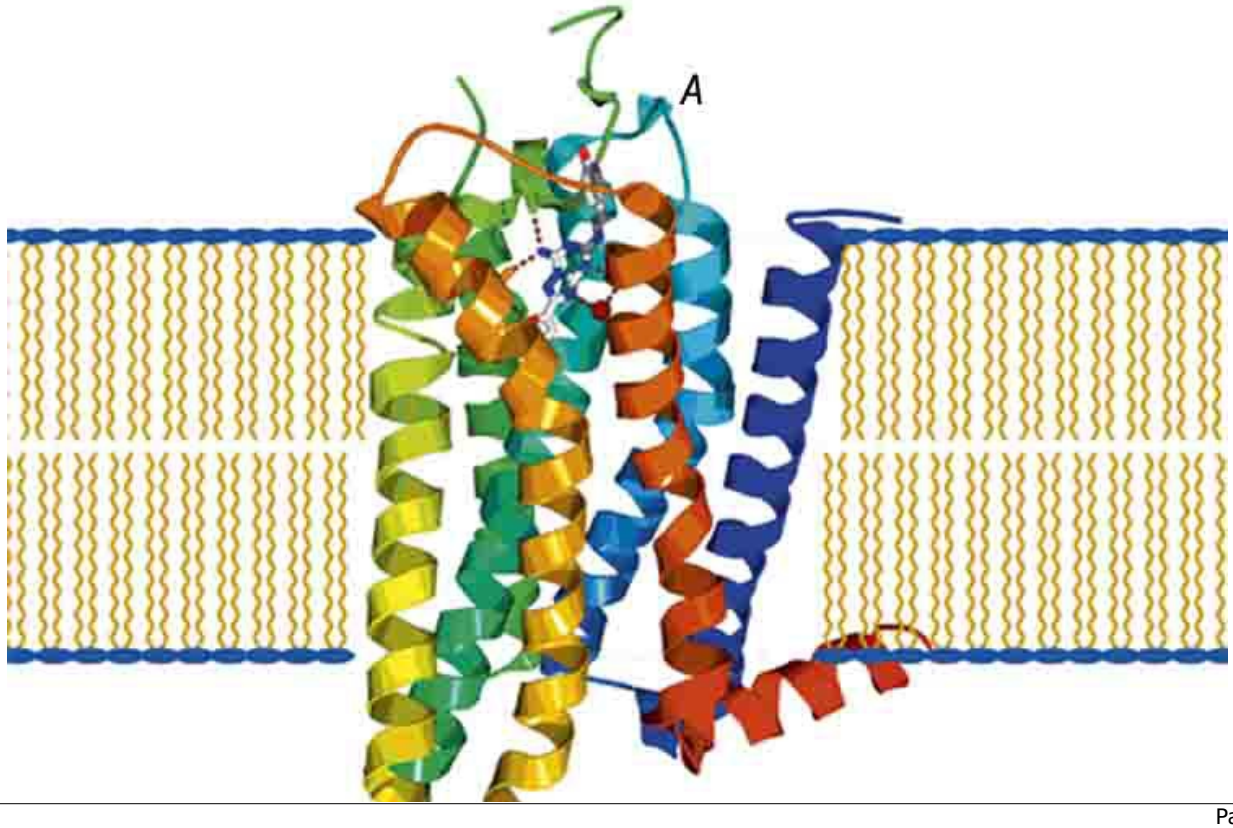
(i)What is the major class of the compound illustrated here? What feature(s) of the compound made you to choose your answer? (1 mark)
(ii)Identify the type of bond present at the label A and B (1 Mark)
(iii)Githa took 5 grams of the compound A and dissolved in water. Can she use this solution as an energy source for her pet cat? Justify. (1 Mark)

C) (i) (1 mark) (4)

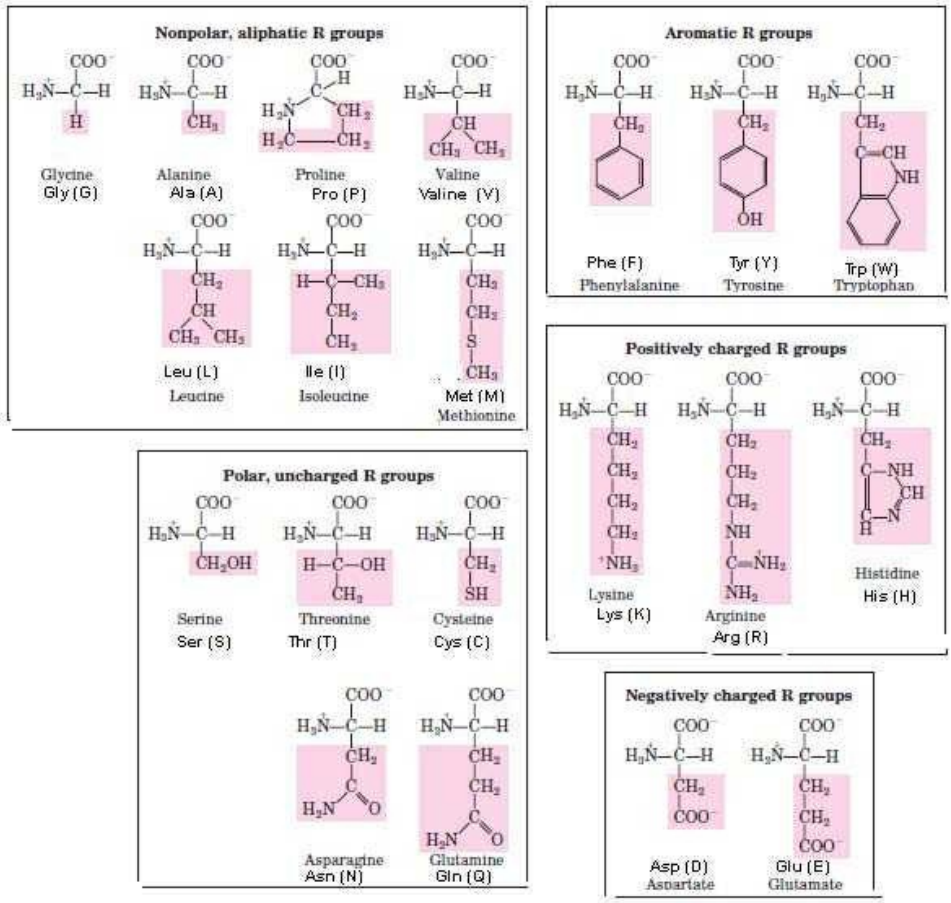
Calculate the standard free-energy changes of the following metabolically important enzyme-catalyzed reactions at 25°C and pH 7.0 from the equilibrium constants given.

Glutamate + oxaloacetate ↔ aspartate + α-ketoglutarate $K'_{eq} = 6.8$

(ii)



(II)Analyse the above structural illustration of a protein embedded in a cell membrane and answer the following questions
(a)What is the protein structure at the labelled position A? 1 Mark
(b)Nature has selected a strongest bond to stabilize the tertiary structure in proteins. What is that bond and which amino acid is required for it? Justify. 1 Mark
(c)If all the valine residues of this protein are replaced with isoleucine, does the structure remains the same? Justify. 1 Mark



2) A heterozygous tall pea plant is crossed with another heterozygous tall pea plant. (i) Construct a Punnett square representing the F1 outcomes. (ii) What is the phenotypic ratio obtained? (iii) A dwarf pea plant was test crossed. What is the probability of getting a tall pea plant? Show your calculation (3 Marks) (3)

A)

B) (i)Factor for eye color in Drosophila is located on sex chromosomes. Develop an experiment to prove this. Show your cross and outcomes in the F1 generation (2 Marks) (3)
(ii) If a double homozygous tall and round seeded pea plant is crossed with a

(ii) If a double homozygous tall and round seeded pea plant is crossed with a double homozygous dwarf and constricted seeded pea plant, what will be the genotypic and phenotypic ratio in the F2 generation? Show your calculations. (Tall and Round seeded are dominant characters) (1 Mark)

C) Anitha was curious in identifying the mode of inheritance of a character found in humans. She noted that the character she was looking is only found in males and an affected father is always transmitting the character to all of his sons but no daughters. (4)

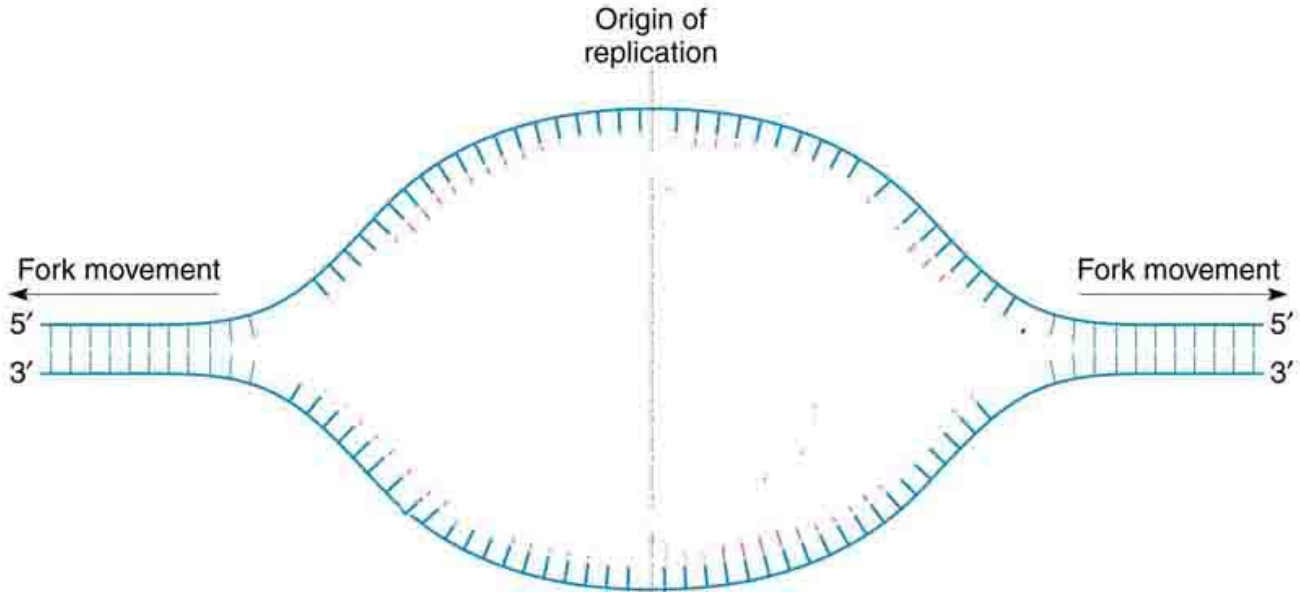
(i)What is the mode of inheritance? Justify. 1 Mark
(ii)Construct a pedigree chart representing three generations in a family. You are free to choose the number of individuals 2 Marks
(iii)How will you represent the genotype of a male showing the character? 1 Mark

3) Assume you are performing one round of DNA replication in a test tube using single stranded (3)

A) linear DNA as the template and the appropriate DNA primer. Complete the following table for one round of DNA replication (3 marks)

Protein/Enzyme	Function	Requirement for **one round** of replication either YES or NO. Justify
Primase		
DNA Polymerase		
DNA Helicase		
Topoisomerase		
DNA Ligase		
Restriction enzyme		

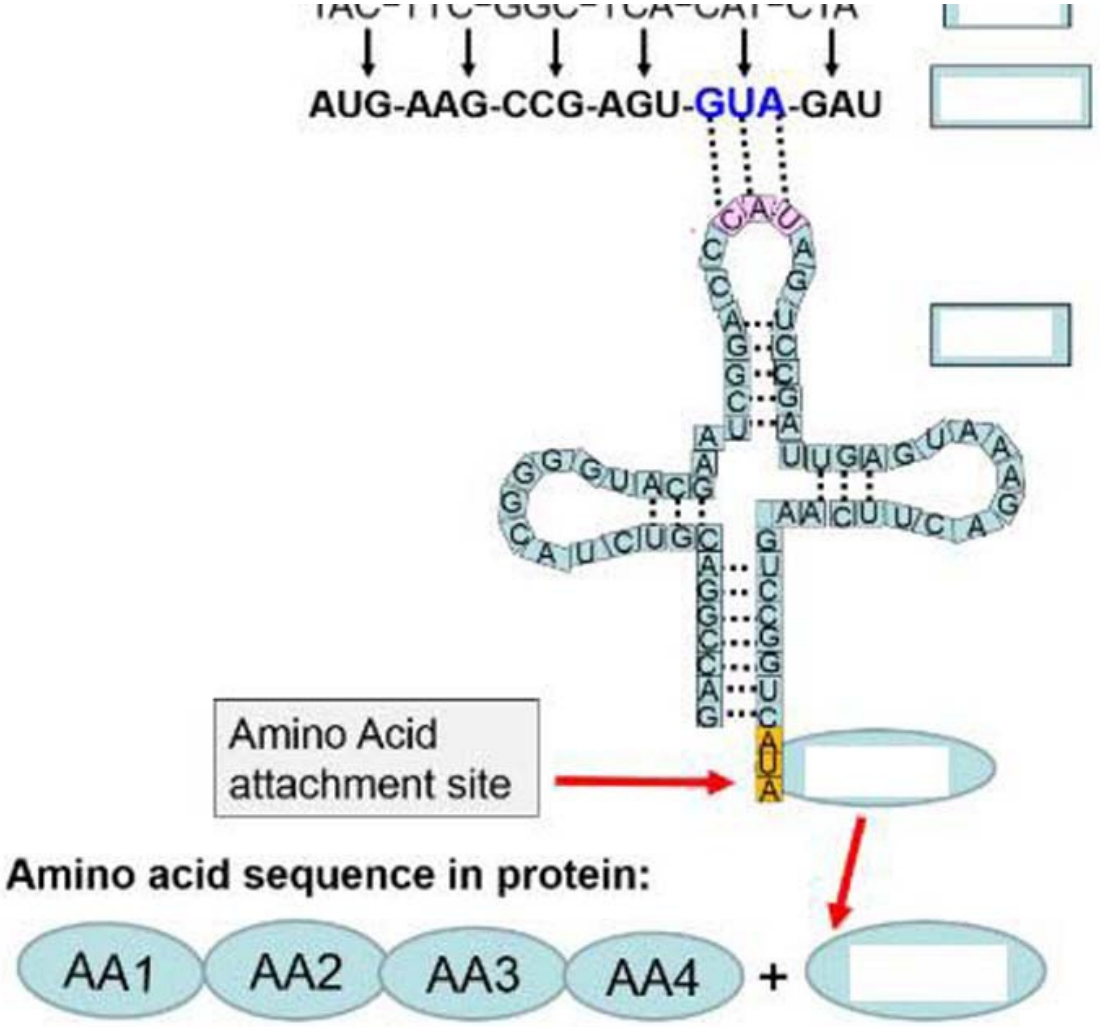
B) (3)

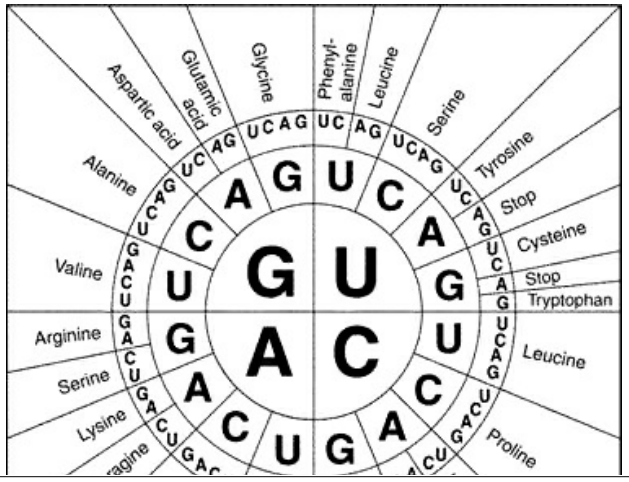


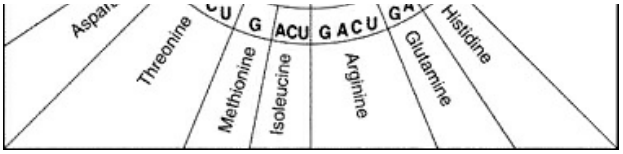
Given is a replication fork. (i) Label the leading strands and the lagging strands (ii) Label the ends of new strands (iii) Label the position of primers and justify the necessity of a primer. (3 Marks)

C) (4)

TAC-TTC-GGC-TCA-CAT-CTA


AUG-AAG-CCG-AGU-GUA-GAU
Amino Acid attachment site
Amino acid sequence in protein:
AA1
AA2
AA3
AA4
+


Glycine
Glutamic acid
Aspartic acid
Alanine
Valine
Arginine
Serine
Lysine
Phenyl-alanine
Leucine
Serine
Tyrosine
Stop
Cysteine
Stop
Tryptophan
Leucine
Proline



Given is the illustration of a protein synthesising system.

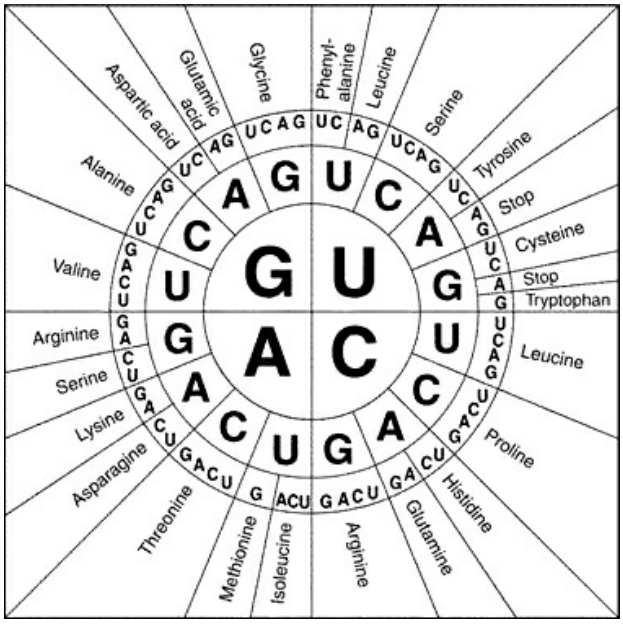
(i)Label the empty white boxes (2 Marks)
(ii)What is the amino acid represented in AA2? (0.5 Mark)
(III)Where you will find carboxyl terminus in this protein? (0.5 Mark)
(IV)Which signal you will add after CTA for a stop of protein synthesis? (1 Mark)

4) (3)

A) (i) How will you design a lac operon? show your design as an illustration. (3 Marks)
(ii) If we interchange the positions of operator and lac z, does the lac operon will work as expected? Justify.

B) (3)
(i) Find the logic: We could able to develop a vaccine against small pox virus but not in common cold virus. (1 Mark)
(ii) Sharks, Penguins, Dolphins and seals are fast swimmers. All these animals have a streamlined body. How does this form help them to survive in the environment? (1 Mark)
(iii) How will you logically explain "Lamarck model of evolution"? (1 Mark)

C) (4)
(i) Give an example of a +/+ interaction from nature. (1 Mark)
(ii) A DNA signal "CTT" is changed to "CTG". How it will affect the organism? (1 Mark)
(iii) How will you convince haemoglobin, myoglobin and chlorophyll as examples of evolutionary engineering? (1 Mark)
(iv) How the life systems are equipped to modify by itself? (1 Mark)



5) (3)

A) The plants are able to absorb water, but not coconut oil. Justify. (1 Mark).
Develop a working model to produce a DNA from an RNA fragment. (1 Mark)
"Xylem is an engineering marvel." Justify. (1 Mark)

B) (3)
(I)You got a DNA fragment consisting of 50 nucleotides. How will you make multiple copies of it? Give a design of your plan. (2 Marks)
(II)Give an example of an enzyme with "No known animal equivalent"? Where

you will find it? (1 Mark)

C) (i) Suggest **four** examples of bioinspiration of your choice and construct convincing ideas from them. (2 Marks) (4)
(ii) " DNA the informational macromolecule is a spectacular design for the blue print of life" How will you justify this statement? (2 Marks)

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