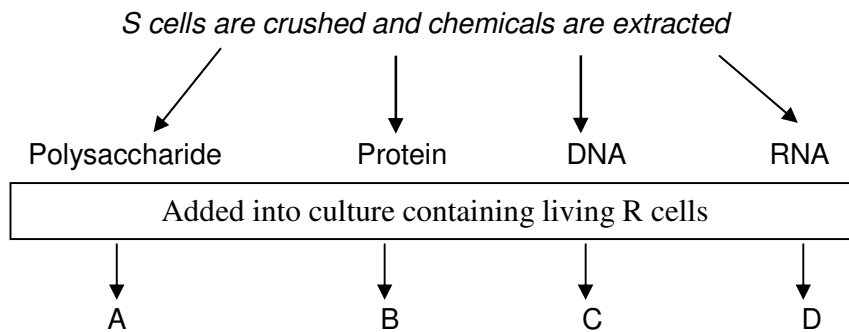


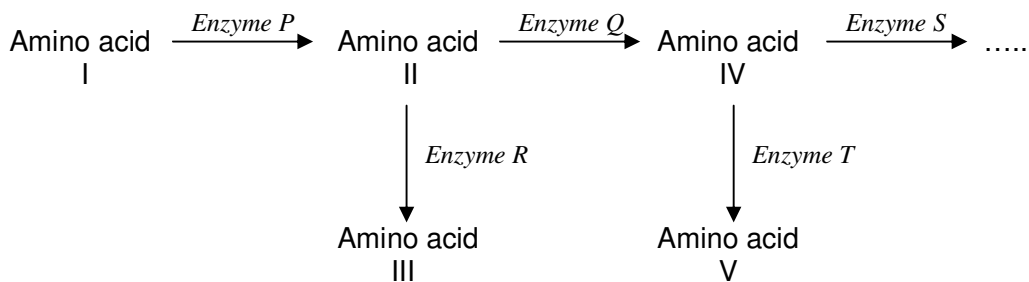
## TUTORIAL QUESTIONS

**TOPIC : EXPRESSION OF BIOLOGICAL INFORMATION**  
**PART A : MULTIPLE CHOICE QUESTIONS**

- Which of the following statements is **NOT** true about Frederick Griffith's experiments?
  - Mice injected with smooth (S) bacteria die.
  - Mice injected with heat-killed smooth bacteria die.
  - Mice injected with heat-killed smooth bacteria and live rough (R) bacteria die.
  - Harmless rough bacteria are transformed into smooth bacteria.
- Cells of the capsulated bacteria *Streptococcus pneumoniae* (S strain) were crushed. Different chemical substances were extracted from the cells and added to a nutrient medium containing living non-capsulated bacteria (R strain). Which of the cells A, B, C or D would be transformed to the S strain?

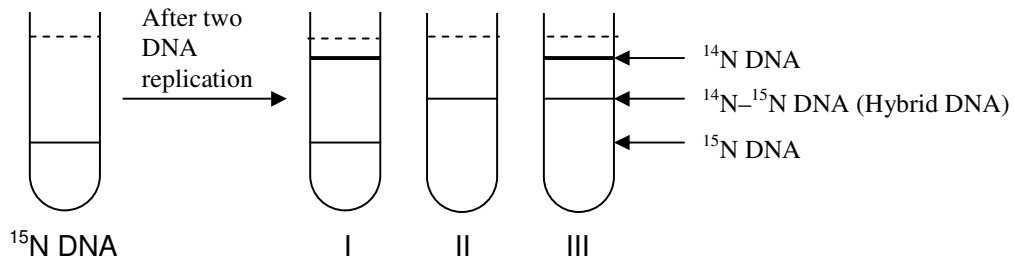


- The diagram below shows that a normal bacterium could live in culture provided that it is supplied with amino acid I.



Mutant bacteria could only live in culture supplied with amino acids I, II, IV and V. The enzyme that could not be coded by the genes of these mutant bacteria is ...

- enzymes P and T.
  - enzymes R and S.
  - enzymes P, Q and T.
  - enzymes Q, R and S.
- Bacteria were grown in a medium containing  $^{15}\text{N}$  and were then transferred to a medium containing  $^{14}\text{N}$ . After two DNA replications occurred, DNA samples were extracted and centrifuged. The diagram below shows the expected outcome according to the three hypotheses.



Which of the following is correctly matched?

- |    | I                 | II                | III               |
|----|-------------------|-------------------|-------------------|
| A. | Dispersive        | Conservative      | Semi-conservative |
| B. | Conservative      | Semi-conservative | Dispersive        |
| C. | Conservative      | Dispersive        | Semi-conservative |
| D. | Semi-conservative | Dispersive        | Conservative      |

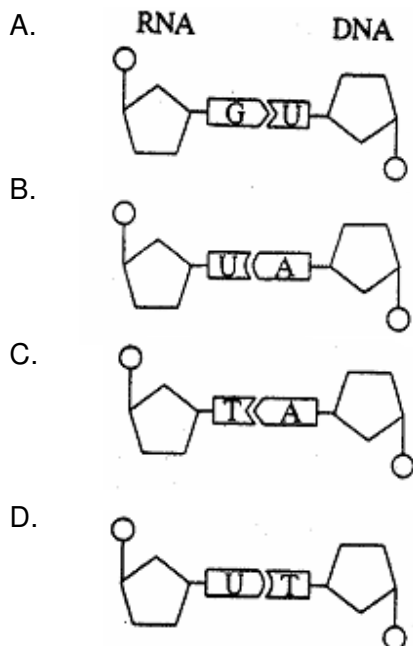
5. The following events occur in the replication of DNA:

- 1 bonds between complementary bases form
- 2 DNA molecule uncoils
- 3 opposite strands separate
- 4 sugar-phosphate bonds form in the new strands
- 5 free nucleotides align with complementary nucleotides on each strand

In which order do these events take place?

- |    |   |   |   |   |   |
|----|---|---|---|---|---|
| A. | 2 | 5 | 3 | 1 | 4 |
| B. | 2 | 3 | 5 | 1 | 4 |
| C. | 2 | 5 | 3 | 4 | 1 |
| D. | 3 | 2 | 5 | 4 | 1 |

6. Which diagrams shows the pairing of DNA nucleotide?



7. The table shows the anti-codon for several tRNA which attached with a particular kind of amino acids as given below.

<b>Anti-codon</b>	<b>Amino acid</b>
3' AGG 5'	<i>ser</i>
3' AUG 5'	<i>tyr</i>
3' CGC 5'	<i>ala</i>
3' CGU 5'	<i>ala</i>
3' GCA 5'	<i>arg</i>
3' GCG 5'	<i>arg</i>
3' UAC 5'	<i>met</i>
3' UCC 5'	<i>arg</i>
3' UGG 5'	<i>thr</i>

Part of the mRNA sequence produced following transcription of the gene for a particular polypeptide is shown.

5' GCA GCG UAC UCC 3'

What is the correct sequence of amino acids produced when this mRNA is translated?

- A. ala-ala-tyr-ser  
 B. ala-ala-tyr-thr  
 C. arg-arg-met-arg  
 D. arg-arg-met-thr
8. A hormone molecule M is made up of two polypeptide chains: one chain contains 20 amino acids and the other chain contains 31 amino acids. What is the minimum number of nitrogenous bases in DNA required to code this molecule?  
 A. 51  
 B. 102  
 C. 153  
 D. 306
9. In the lactose operon, both genes P and Q undergo the transcription process. Gene Q can only undergo transcription with the existence of lactose (absence of glucose). At the same time, protein coded from gene P is released from R.

Which of the following is true about the genes P, Q and R?

- | <i>P</i>           | <i>Q</i>        | <i>R</i>       |
|--------------------|-----------------|----------------|
| A. Regulator gene  | Structural gene | Operator       |
| B. Structural gene | Operator        | Regulator gene |
| C. Operator        | Structural gene | Regulator gene |
| D. Promoter        | Regulator gene  | Operator       |

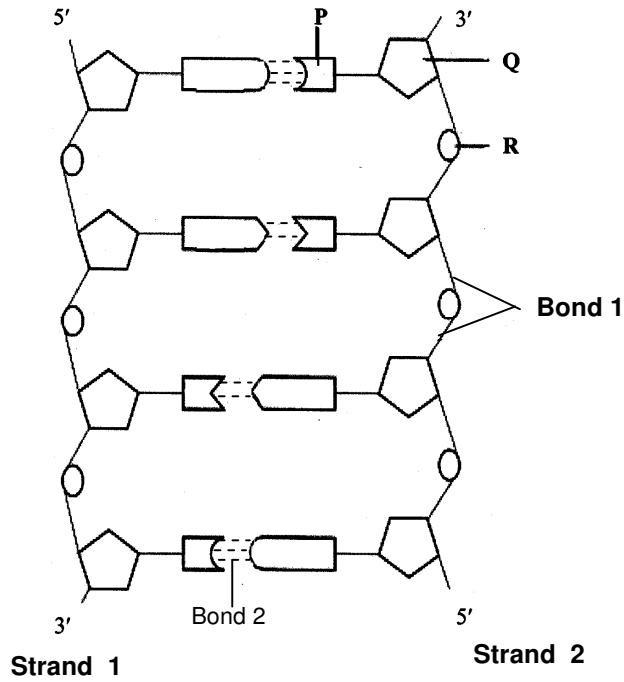
10. Which of the following statements are true about *lac* operon in the presence of lactose?

- I. The regulator gene produces repressor molecule.  
 II. Lactose binds with the repressor molecule.  
 III. The inactive repressor molecule binds to the promoter.  
 IV. The RNA polymerase binds to the operator.  
 V. Structural gene transcription occurs.

- A. I, II and III  
 B. I, II and V  
 C. I, III and IV  
 D. I, II, IV and V

**PART B : STRUCTURED QUESTIONS**

1. **FIGURE 1** shows a part of DNA molecule.



**FIGURE 1**

a. Identify the above molecule.

Molecule P : \_\_\_\_\_

Molecule Q : \_\_\_\_\_

Molecule R : \_\_\_\_\_

[3 marks]

b. Name the basic unit of DNA.

\_\_\_\_\_

[1 mark]

c. Identify the following.

i) Bond 1

\_\_\_\_\_

ii) Bond 2

\_\_\_\_\_

[2 marks]

d. If base sequence for strand 1 is 5' GATC 3', what is the base sequence for strand 2?

\_\_\_\_\_

[1 mark]

e. Give the importance of this macromolecule to living organism.

[1 mark]

f. Give TWO structural differences between a DNA molecule and a RNA molecule.

DNA molecule	RNA molecule

[2 marks]

2. FIGURE 2 represents part of a DNA molecule and a mRNA molecule.

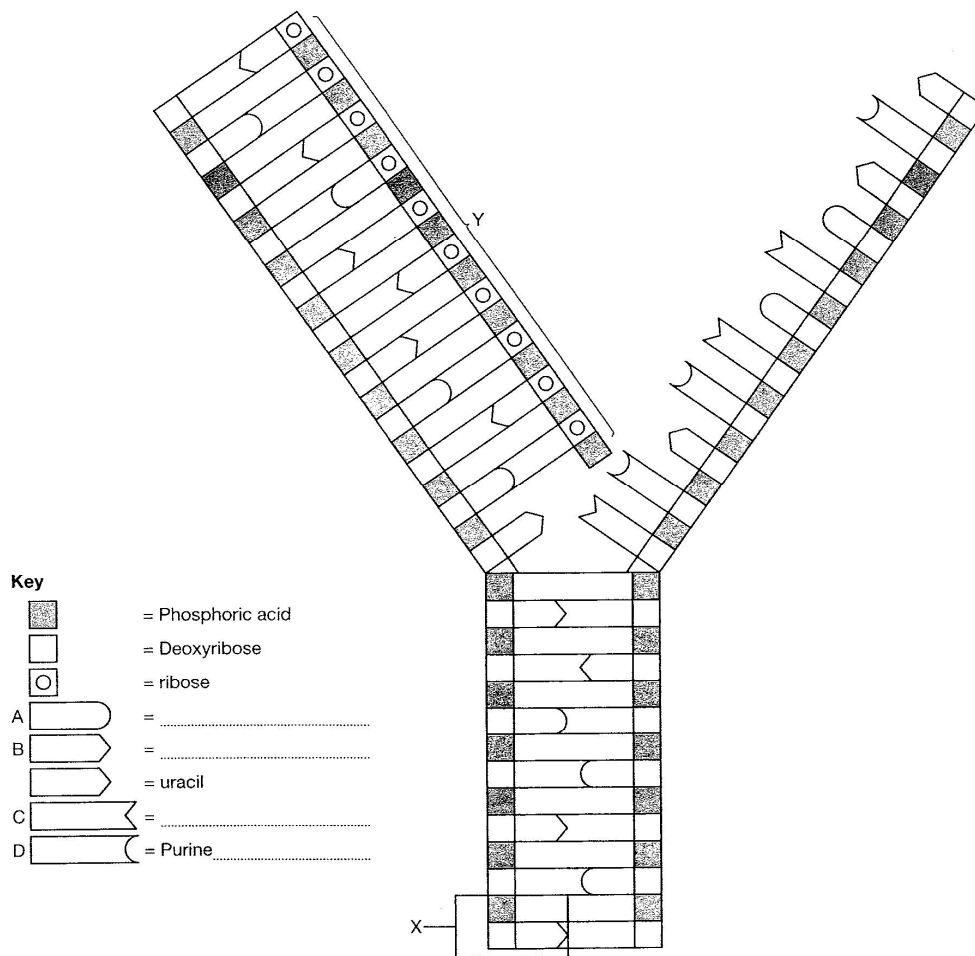


FIGURE 2

a) Name molecules A, B, C and D in the spaces provided in the key. [4 marks]

b) (i) What is the name given to the molecular subunit shown in the box X?

\_\_\_\_\_ [1 mark]

(ii) According to your answer in (b) (i), name two component molecules other than nitrogenous base that make up the molecular subunit.

\_\_\_\_\_ [2 marks]

c) Condensation reactions are involved in the formation of DNA strands. Give the names of **TWO** pairs of molecules which are linked in such a way.

\_\_\_\_\_  
 \_\_\_\_\_ [2 marks]

d) Why the diagram which indicates that the molecule Y is RNA but not half a strand of DNA.

\_\_\_\_\_ [1 mark]

3. The table below shows the base sequence of a particular gene and amino acids coded by the genes to form a polypeptide.

a) Complete the table below.

DNA sense strand	TAC				GCA	ATC
non-template strand		GGA				
mRNA			GUU			
tRNA				CGA		
Amino acid	Start codon/ Met	Gly	Val	Ala	Arg	Stop codon

[4 marks]

b) Give the meaning of translation

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

[3 marks]

c) How is aminoacyl-tRNA formed?

\_\_\_\_\_ [1 mark]

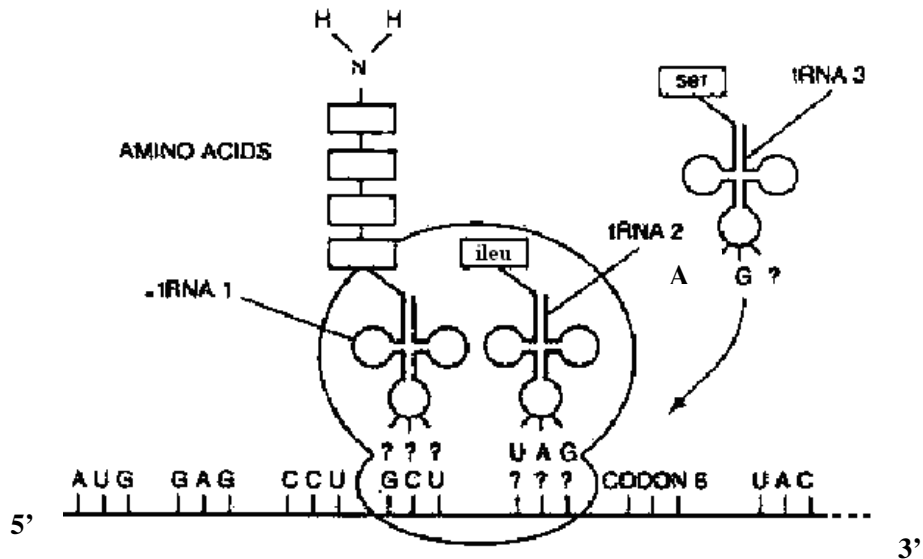
d) Which end of tRNA act as the amino binding site?

\_\_\_\_\_ [1 mark]

e) What are the two stages involved in protein synthesis?

(i) \_\_\_\_\_ (ii) \_\_\_\_\_ [1 mark]

4. **FIGURE 3** summarizes the process of translation.



**FIGURE 3**

a) Name the stage of translation process shown in **FIGURE 3**.

\_\_\_\_\_ [1 mark]

b) What is meant by a codon?

\_\_\_\_\_ [1 mark]

c) Which is the first codon used in protein synthesis from this mRNA?

\_\_\_\_\_ [1 mark]

d) What is the anti-codon sequence in tRNA 1?

\_\_\_\_\_

[1 mark]

- e) tRNA 1 has a 5' – phosphate end and a 3' – hydroxyl end. What is the function of 3'OH end in tRNA 1?

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[1 mark]

- f) According to the diagram, explain what will occur to allow codon 6 to be translated.

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[3 marks]

- g) What is a polyribosome and state its importance.

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[2 marks]

### **PART C : ESSAY QUESTIONS**

1. a) With the aid of labelled diagram, explain the structure of DNA according to the model proposed by Watson and Crick. [10 marks]
- b) Explain the steps involved in DNA replication process. [10 marks]
2. a) Compare between the process of replication and transcription. [8 marks]
- b) By using the *Lac* operon, describe how the operon is regulated. [12 marks]