

**TOPIC: CHEMICALS OF LIFE, NATURE OF GENETIC CODE & ENZYMES**

Time: 2 ½ hours

Attempt all questions in this paper

SECTION	MARKS
A	
B	
TOTAL	

**SECTION A (40 MARKS)**

- Lack of iodine in the diet causes cretinism because iodine
  - Controls metabolism
  - Is essential in the formation of metabolic enzymes
  - Influence growth of bones
  - Is required for synthesis of thyroxine
- Chloride ions are vital for efficient functioning of salivary amylase because ion
  - Activator
  - Are coenzyme
  - Are co factor
  - For alkaline medium
- In a DNA strand, the nucleotides are linked together by:
  - glycosidic bonds
  - phosphodiester bonds
  - peptide bonds
  - hydrogen bonds
- In the body, proteins combine with acids or bases depending on the
  - Temperature of the medium
  - Hydrogen ion concentration in the medium
  - Number of solvent molecules present in the medium
  - Number of amino acid molecules in the protein
- Enzyme that catalyze the removal of water molecules from a substrate are known as
  - Reductase
  - Dehydrase
  - Hydrolase
  - hydrase
- A nucleoside differs from a nucleotide. It lacks the:
  - Base
  - Sugar
  - Phosphate group
  - Hydroxyl group
- Starch, glycogen and cellulose are all composed of
  - $\alpha$ -glucose
  - $\beta$ -glucose
  - monosaccharides
  - polysaccharides
- $$\text{C}_6\text{H}_{12}\text{O}_6 + \text{C}_6\text{H}_{12}\text{O}_6$$

Glucose      Fructose

↓ Enzyme

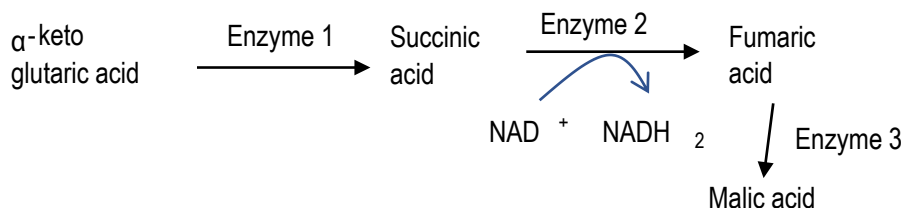
$$\text{C}_{12}\text{H}_{22}\text{O}_{11} + \text{H}_2\text{O}$$

What is the above called?

  - Dehydration synthesis
  - Hydrolysis
  - Dehydration process
  - Condensation reaction
- Both deoxyribose and ribose belong to a class of sugars called:
  - trioses
  - hexoses
  - pentoses
  - polysaccharides
- Some amino acids are known as essential because they are
  - more important in the body metabolism than other
  - not made by the body
  - contained in first class proteins
  - required in larger amounts than others.
- When a piece of liver is dropped into containing  $\text{H}_2\text{O}_2$ , there is vigorous reaction. this is due to enzyme
  - Catalase
  - Amylase
  - Trypsin
  - Carbonic anhydrase
- The fact that a purine base always pairs through hydrogen bonds with a pyrimidine base in the DNA double helix leads to:
  - the antiparallel nature
  - the semiconservative nature
  - uniform width throughout DNA
  - uniform length in all DNA
- Which of the following sugars is not reducing?
  - Maltose
  - Fructose
  - Galactose
  - Sucrose
- In the lock and key hypothesis for the mechanism of enzyme the mechanism of enzyme action, how does inhibitor substance stop enzyme action? By
  - Raising activation energy
  - Distorting substrate molecule
  - Destroying coenzyme
  - Occupying active sites on substrate and enzyme
- The promoter site and the terminator site for transcription are located at:
  - 3' (downstream) end and 5' (upstream) end respectively of the transcription unit
  - 5' (upstream) end and 3' (downstream) end, respectively of the transcription unit
  - the 5' (upstream) end
  - the 3' (downstream) end
- Among the following compounds, one cannot be hydrolyzed is
  - Glycogen
  - Galactose
  - Lactose
  - Maltose
- When the extent of inhibition in an enzyme controlled reaction depends entirely on the concentration of the inhibitor, it indicates that the inhibition is
  - Competitive
  - Reversible
  - Non-competitive
  - Irreversible.
- Which of the following statements is the most appropriate for sickle cell anaemia?
  - It cannot be treated with iron supplements
  - It is a molecular disease
  - It confers resistance to acquiring malaria
  - All of the above

19. Which one of the following is the correct formula of a polysaccharide?
- $(C_6H_{10}O_5)_n$
  - $(CH_2O)_n$
  - $(C_6H_{12}O_6)_n$
  - $C_{12}H_{22}O_{11})_n$
20. Which **one** of the following is not true about the lock and key theory in enzyme-catalyzed reaction?
- A small change in the active site alter the enzyme
  - The substrate and active site are complementary
  - Enzyme catalyzed action go through the enzyme-substrate complex stage
  - A molecule which fits in the active site is a substrate
24. Which of the following is true with respect to AUG?
- It codes for methionine only
  - It is an initiation codon
  - It codes for methionine in both prokaryotes and eukaryotes
  - All of the above
21. Which one of the following statements is true of essential fatty acids? They
- They are the most required lipids in the body
  - Are required in the body in large quantities
  - Cannot be synthesized in the body
  - Are most abundant in animal tissues
22. Which one of the following does not have an effect on a non-competitive inhibition?
- Temperature change
  - pH change
  - enzyme concentration
  - substrate concentration
23. The first genetic material could be:
- Protein
  - Carbohydrates
  - DNA
  - RNA
24. Which one of the following properties of water facilitates its efficient transportation of glucose?
- Forms hydrogen bonds with other molecules
  - Has high surface tension
  - Has low freezing points
  - Has high boiling point
25. Which one of the following describes the turnover number of an enzyme?
- Number of molecules affected by the enzyme
  - Number of substrate molecules turned into its product per minute
  - Number of product molecules formed
  - Number of substrate molecules catalyzed per minute
26. With regard to mature mRNA in eukaryotes:
- exons and introns do not appear in the mature RNA
  - exons appear but introns do not appear in the mature RNA
  - introns appear but exons do not appear in the mature RNA
  - both exons and introns appear in the mature RNA
27. Which of the following vitamins is water soluble?
- A
  - B
  - D
  - C
28. 
$$A \xrightarrow{E_1} B \xrightarrow{E_2} C \xrightarrow{E_3} X$$
- If an excess X controls the metabolic pathway of the reaction, the control mechanism is known as,
- Multi-enzyme control
  - Excess inhibition
  - End product inhibition
  - Negative feedback
29. DNA is a polymer of nucleotides which are linked to each other by 3'-5' phosphodiester bond. To prevent polymerization of nucleotides, which of the following modifications would you choose?
- Replace purine with pyrimidines
  - Remove/Replace 3' OH group in deoxyribose
  - Remove/Replace 2' OH group with some other group in deoxyribose
  - Both 'b' and 'c'
30. Lack of iodine in diet causes cretinism because iodine
- Controls metabolism
  - Is essential for formation of metabolic enzymes
  - Influence growth of bones
  - Is required for synthesis of thyroxine
31. Which one of the following environmental factors has a direct effect on all organisms?
- Light.
  - Humidity.
  - Temperature.
  - Rainfall
32. Discontinuous synthesis of DNA occurs in one strand, because:
- DNA molecule being synthesized is very long
  - DNA dependent DNA polymerase catalyzes polymerization only
  - In one direction (5' → 3') it is a more efficient process
  - DNA ligase joins the short stretches of DNA
33. Rainfall A property of water that makes it suitable component of a hydrostatic skeleton is it
- High density
  - High surface tension
  - Low viscosity
  - Incompressibility
34. The activity of an enzyme in a chemical reaction depends on the
- Molecular weight of the enzyme
  - Protein nature of the enzyme
  - Activation energy of the enzyme
  - Surface configuration of the enzyme
35. While analyzing the DNA of an organism a total number of 5386 nucleotides were found out of which the proportion of different bases were: Adenine = 29%, Guanine = 17%, Cytosine = 32%, Thymine = 17%. Considering the Chargaff's rule it can be concluded that:
- it is a double-stranded circular DNA
  - It is single-stranded DNA
  - It is a double-stranded linear DNA
  - No conclusion can be drawn

36. Aquatic organism survives under solidified water body because
- A. Water solidifies from bottom to top of lakes
- B. Ice is less dense than water at 4°C
- C. Cold water is denser than hot water and falls to the bottom
- D. Warm water floats on top of cold water
37. Use the figure below, the part of reaction of the Krebs cycle to answer the question that follows.

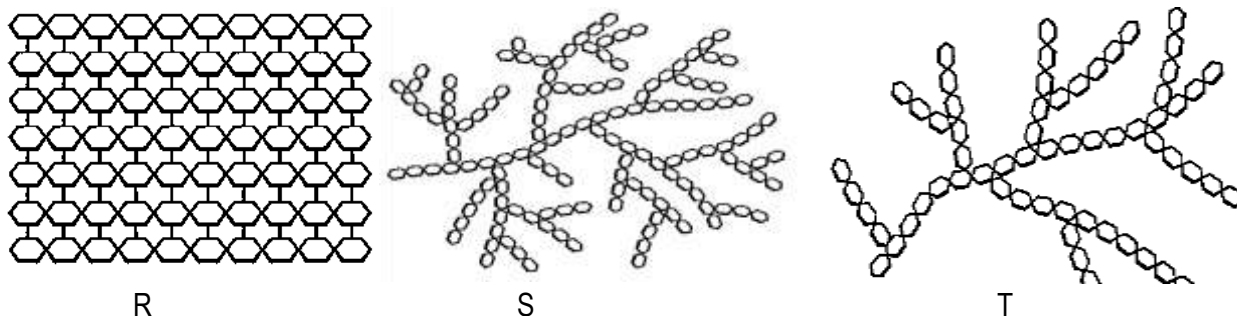


Succinic acid accumulates when malic acid is added to the reaction medium. Which one of the following statement best describes the role of malic acid?

- A. Malic acid is an inhibitor of enzyme 1
- B. Malic acid reacts with  $\alpha$ -keto-glutaric acid to form succinic acid
- C. Malic acid is an inhibitor of enzyme 2
- D. Malic acid acts as coenzyme of enzyme 1
38. If the sequence of nitrogen bases of the coding strand of DNA in a transcription unit is: 5' – A T G A A T G – 3', the sequence of bases in its RNA transcript would be;
- A. 5' – A U G A A U G – 3'
- B. 5' – U A C U U A C – 3'
- C. 5' – C A U U C A U – 3'
- D. 5' – G U A A G U A – 3'
39. In the body, proteins combine with acids or bases depending on the
- A. Temperature of the medium
- B. Hydrogen ion concentration in the medium
- C. Number of solvent molecules present in the medium
- D. Number of amino acid molecules in the protein
40. The amino acid attaches to the tRNA at its:
- A. 5' – end
- B. 3' – end
- C. Anticodon site
- D. DHU loop

## SECTION B. (60MARKS)

41. Different carbohydrates possess unique arrangements of the monomer units that give them special functions in cells of different organisms. The figure below shows three examples of carbohydrates. Study them carefully and answer the questions that follow.



(a) Name the examples of carbohydrates represented as:

(1½marks)

R.....

S.....

T.....

(b) State the difference in structure of

(i) R and S.

(3marks)

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(ii) R and chitin.

(1mark)

(c) State the precise role of each molecule in organisms.

(1½marks)

R.....

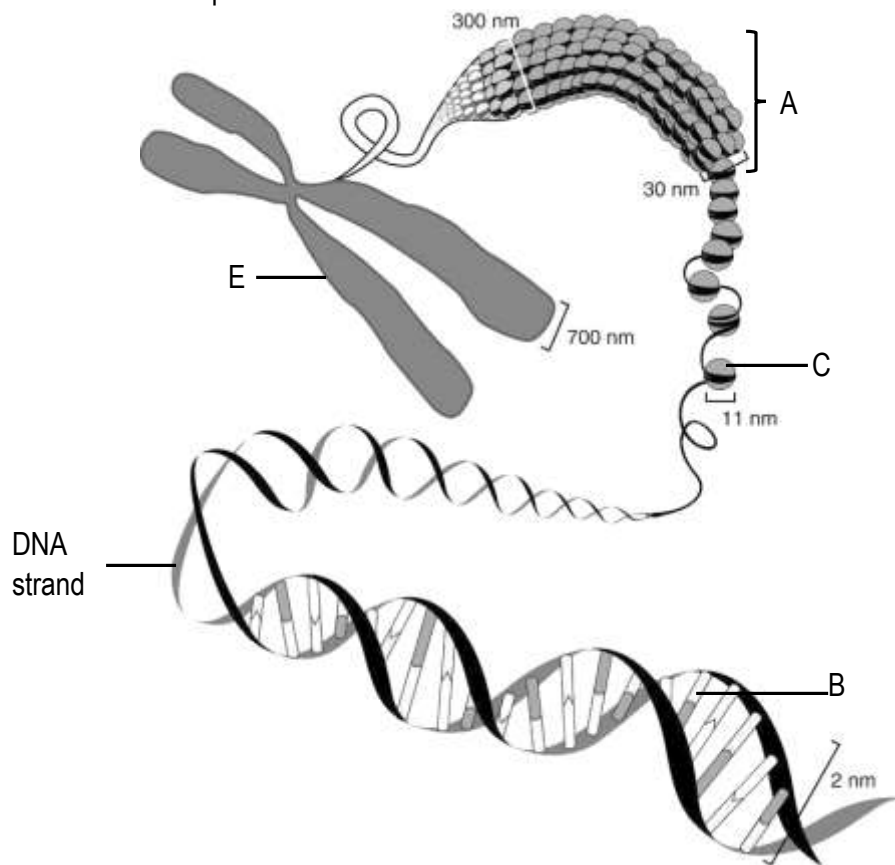
S.....

T .....

(d) State how the structure of S suit to its function in cells.

(3marks)

42. The figure below an extension of organic compounds that form the chromosome in many eukaryotic cells. Study the figure provided and use it to answer question that follow



(a) Name the molecule labeled with letter C and state its function.

(1½marks)

(b) Describe the composition of the molecules in part A.

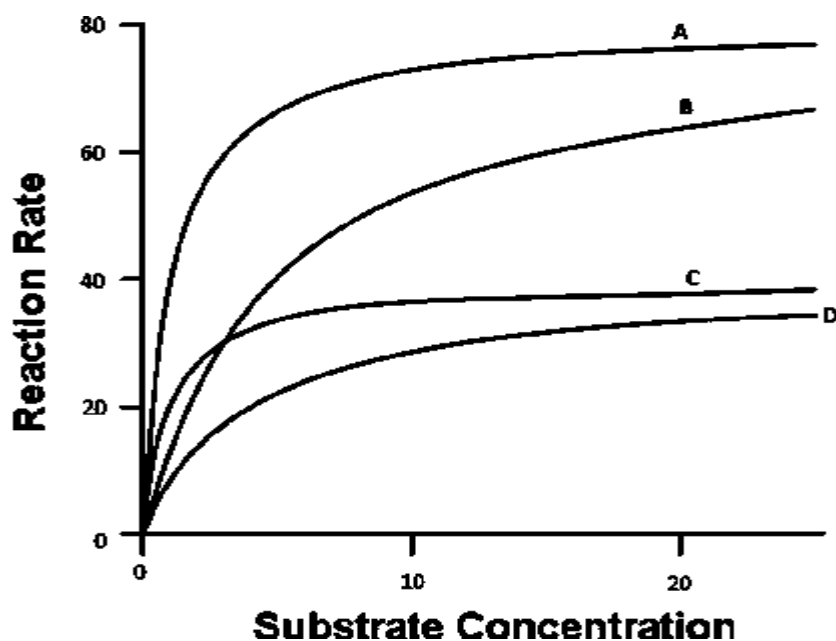
(2marks)

(c) (i) State the rule that governs the formation of B in the DNA molecule. (2marks)

(ii) in analysis of the NA molecule, it was observed to contain 14% of its bases being adenine. Determine the percentage composition of guanine in the same molecule. (1½marks)

(d) How is DNA adapted to store large amounts of genetic information in organisms? (3marks)

43. Figure below shows the effect of increasing the concentration of a substrate on the rate of an enzyme controlled reaction in presence of inhibitors A and B, in relation to the control experiment without an inhibitor.



By giving the explanation for each case, identify the curve that represents. (10marks)

Enzyme with competitive inhibitor

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Enzyme without inhibitor

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Enzyme with irreversible inhibitor

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Enzyme with non-competitive inhibitor

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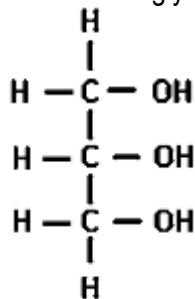
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44. Using the structural formula below for glycerol, and molecular formula  $\text{CH}_3(\text{CH}_2)_n\text{COOH}$  for a fatty acid show the formation of triglyceride from fatty acids and glycerol. (2marks)



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(b) What properties do lipids possess as storage food substances?

(2marks)

(c) Outline the structural and physiological functions of lipids in living organisms.

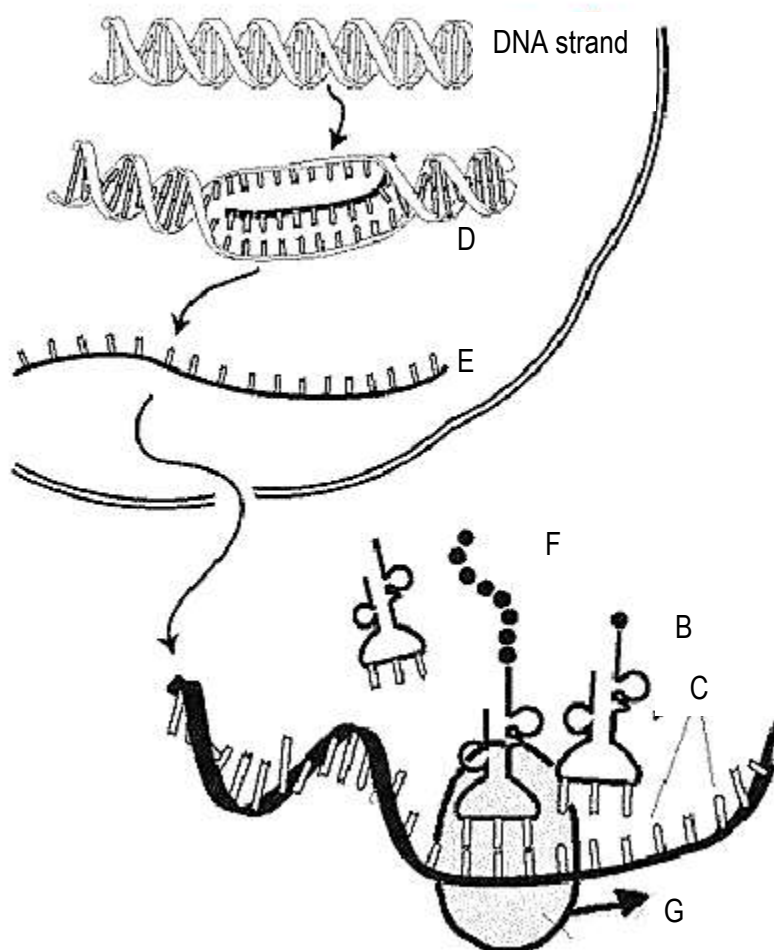
(i) Structural

(3marks)

(ii) Physiological

(2marks)

45. The figure below shows biochemical reactions and compounds that occur during protein synthesis.



(a) (i) Name the following components in the biochemical reaction. (2marks)

A.....

B.....

D.....

F.....

(ii) State two properties of component C. (1mark)

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(iii) Mention the role of structure G. (1mark)

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(b) Describe what happens in the formation of E.

(3marks)

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(c) Explain the fate of F in the cell.

(1mark)

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(d) State the adaptations of the nucleus for protein synthesis in the cell.

(2marks)

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46. (a) Explain the property of enzymes that is described by the lock and key hypothesis.

(2marks)

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(b) (i) Giving an example in each case, distinguish between an activator and a coenzyme in enzyme activities. (5marks)

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(ii) Mention two ways in which the working of enzymes is regulated in cells.

(2marks)

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(c) State the economic application of enzymes.

(3marks)

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**END**