

Topical test chemicals of life

1. Lack of iodine in the diet causes cretinism because iodine
 - A. Controls metabolism
 - B. Is essential in the formation of metabolic enzymes D
 - C. Influence growth of bones
 - D. Is required for synthesis of thyroxine

2. In the body, proteins combine with acids or bases depending on the
 - A. Temperature of the medium
 - B. Hydrogen ion concentration in the medium B
 - C. Number of solvent molecules present in the medium
 - D. Number of amino acid molecules in the protein

3. Starch, glycogen and cellulose are all composed of
 - A. α -glucose
 - B. β -glucose D
 - C. monosaccharides
 - D. polysaccharides

4. Some amino acids are known as essential because they are
 - A. more important in the body metabolism than other
 - B. not made by the body B
 - C. contained in first class proteins
 - D. required in larger amounts than others.

5. Which of the following sugars is not reducing?
 - A. Maltose
 - B. Fructose
 - C. Galactose D
 - D. Sucrose

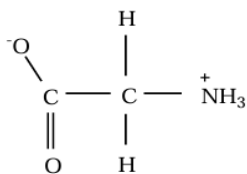
6. Among the following compounds, one cannot be hydrolyzed is
 - A. Glycogen
 - B. Galactose B
 - C. Lactose
 - D. Maltose

7. Which one of the following is the correct formula of a polysaccharide?
 - A. $(C_6H_{10}O_5)_n$
 - B. $(CH_2O)_n$
 - C. $(C_6H_{12}O_6)_n$ A
 - D. $C_{12}H_{22}O_{11})_n$

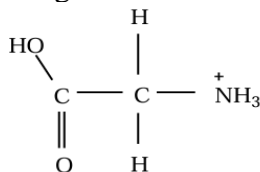
8. Which one of the following statements is true of essential fatty acids? They
 - A. They are the most required lipids in the body
 - B. Are required in the body in large quantities C
 - C. Cannot be synthesized in the body
 - D. Are most abundant in animal tissues

9. Which one of the following properties of water facilitates its efficient transportation of glucose?
- A. Forms hydrogen bonds with other molecules
 - B. Has high surface tension
 - C. Has low freezing points
 - D. Has high boiling point
- A**
10. Which of the following vitamins is water soluble?
- A. A
 - B. K
 - C. D
 - D. C
- D**
11. A property of water that makes it suitable component of a hydrostatic skeleton is it
- A. High density
 - B. High surface tension
 - C. Low viscosity
 - D. Incompressibility
- D**
12. 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 4⁰C
 - C. Cold water is more dense than hot water and falls to the bottom
 - D. Warm water floats on top of cold water
- B**
13. Which one of the following is not a fibrous protein?
- A. Keratin
 - B. Globulin
 - C. Elastin
 - D. Collagen
- B**
14. Sucrose is a non-reducing sugar because it
- A. It is not fully digested
 - B. It lacks reducing groups
 - C. Is a disaccharide molecule
 - D. Is a ketose sugar
- D**
15. green plant develops yellow leaves as a result of being deficient in
- A. Magnesium
 - B. Manganese
 - C. Phosphorous
 - D. Calcium
- A**
16. Which of the following elements is **not** required by plants?
- A. copper
 - B. iodine
 - C. iron
 - D. zinc
- B**

17. In the blood plasma, proteins can act as bases or acids depending on the
- Temperature of the medium
 - Hydrogen ion concentration of the medium B
 - Nature of the protein
 - Concentration of the solute in the plasma
18. Which of the following is the function of manganese in the human body?
- Essential for formation of erythrocytes
 - Activate enzymes B/C
 - Acts as growth factor in bone development
 - Utilized as a component of bone and teeth
19. Which of the following substances consists of globular proteins?
- Enzymes
 - Keratin A
 - Elastin
 - collagen
20. Which one of the following symptoms is likely to be caused by magnesium deficiency in plants?
- green leaves and stunted growth D
 - Poor root growth
 - Weak stems
 - Yellow spotted leaves
21. Which one of the following is not a function of globular proteins in the body?
- Acts as buffers in blood plasma
 - Form structural proteins B
 - Are vital constituents of plasma membrane
 - Form enzymes
22. The following structural formula is for an amino acid in solution



A substance was added to this solution and the structure of the amino acid molecule changed to



What substance was added and what effect would this have had on the final pH of the solution?

- Salt added, pH unchanged
- Acid added, pH lowered
- Acid added, pH unchanged C
- Base added, pH higher

23. We need to eat iodized salt in order to
- A. Prevent obesity
 - B. Get a balanced diet
 - C. Improve vision
 - D. Avoid goiter
- D**
24. Water has comparatively high surface tension and boiling point in relation to other substances of similar sized molecules because its molecules are
- A. doubly bonded
 - B. polar
 - C. ionic
 - D. covalent
- B**
25. Evaporation of water from the body surface causes cooling because water has a high
- A. Latent heat of vaporization
 - B. Latent heat of fusion
 - C. Boiling point
 - D. Specific heat capacity
- A**
26. The complexity and variety of organic molecules is due to the ability of the carbon atom to
- A. form covalent and ionic bond
 - B. form covalent bonds in three dimensions
 - C. form strong chemical bonds
 - D. bonds with very many other elements
- D**
27. When a lipid is combined with a phosphate group, it becomes
- A. saturated
 - B. a complex molecule
 - C. water soluble
 - D. amphoteric
- C**
28. When a lipid is combined with a phosphate group, it becomes
- A. saturated.
 - B. a complex molecule.
 - C. water soluble.
 - D. amphoteric.
- C**
29. Starch and glycogen are suitable storage molecules because they
- A. are large in size which makes them less soluble in water
 - B. are chemistry reactive in the cell
 - C. can easily be hydrolyzed
 - D. exert an osmotic pressure in the cell
- C**
30. The high heat capacity of water has biological importance of
- A. minimizing temperature changes in animal fluids
 - B. cooling animals
 - C. Preventing freezing of cell contents
 - D. controlling heat loss in animals

Section B: structured questions

31. Fat and glycogen are energy storage compounds in animals

(a) Compare the suitability of the two substances as storage compounds. (04 marks)

Similarities

- They are both compactly arranged to take up little space.
- they are both less soluble in water and little or none can be lost in solution

Differences

<i>Fat</i>	<i>Glycogen</i>
• <i>Has a high calorific value.</i>	• <i>Has a lower calorific value.</i>
• <i>Has a higher hydrogen- oxygen content and can yield more metabolic water?</i>	• <i>Has a lower hydrogen- oxygen content and yield less metabolic water</i>
• <i>Has less weight and keeps body weight to a minimum which allows buoyancy</i>	• <i>Is heavier and can lead to overweight.</i>

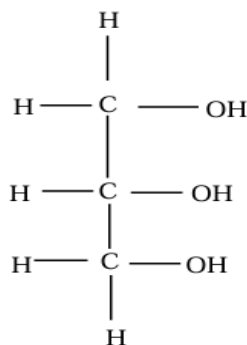
(b) State advantage of storing fat over glycogen. (03 marks)

- *Fat is completely insoluble in water and more cannot be lost in solution.*
- *It prevents desiccation.*
- *Fat forms an insulating layer under the skin that helps in temperature regulation.*
- *Fat has a low density hence provide buoyancy in aquatic animals.*

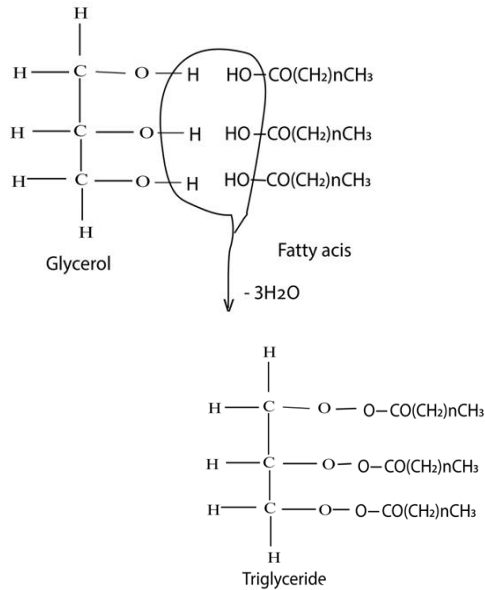
(c) Why is glycogen more suitable energy compound in muscle than fat? (3marks)

- *Muscles have a high content of glycolytic enzymes which readily breakdown glycogen to utilizable glucose. The glycolytic enzymes, glycogen phosphorylase, has an allosteric site for binding AMP. When content is low in muscle, AMP content rises and activates this glycolytic enzyme which readily break down glycogen to glucose that can be used by the muscle.*
- *Break down of fat to free fatty acids which can be utilized by the muscle is a slow process because it is hormone- mediated.*

32. (a) Using the structural formula



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)



(b) What properties do lipids possess as storage food substances? (2marks)

- *Has high energy content than carbohydrates*
- *It is lighter*
- *It is compact and requires less space*
- *Insoluble in water since they have low osmotic value*

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

(i) Structural. (3marks)

- Make up cell membrane
- Protection: lipids are constituents of the waxy cuticle of plants and insects
- Lipids are water repellant thus prevent water loss from or entry into an animal skin
- Their spongy nature protects delicate organs as shock absorbers.
- Being bad conductors, they reduce water loss from the body when deposited beneath the skin for insulation
- Storage; they are better storage compounds than carbohydrates due high calories value, due to high hydrogen content, they are light, insoluble in water, compact to fit in a small volume and are easily used when required.

(ii) Physiological. (2marks)

- *Source of metabolic water*
- *Store fat soluble vitamins (ADEK)*
- *Raw materials for hormones*

33. The diagram below shows the structure of a lipid molecule.



(a) (i) Name the parts labelled A and B. (02 marks)

glycerol

(ii) Name this type of lipid. (01 mark)

saturated lipid

(iii) Name the chemical reaction used to form the bonds between A and B. (01 mark)

Condensation reaction

(b) (i) state one function of these type of lipid in living organism. (01 mark)

storage

(iii) State one feature of the molecules of this type which makes them suitable for the function you have named. (01 mark)

- *They are compact taking up little space.*
- *They are insoluble in water hence cannot be lost in solution.*
- *They are light to keep the weight to a minimum and allow buoyancy.*
- *They have a high calorific energy value.*
- *They have a high hydrogen-oxygen content hence can yield a lot of water on oxidation.*

34. (a) state three ways in which water has similar functions in both plants and animals. (03 marks)

- *It is a solvent and medium for transport*
- *It is a medium of fertilization*
- *Evaporation cools the body*
- *Provides support to aquatic organism*
- *Component of the cell membrane*
- *A reagent in hydrolytic reaction*
- *A medium in which biological reaction occur.*

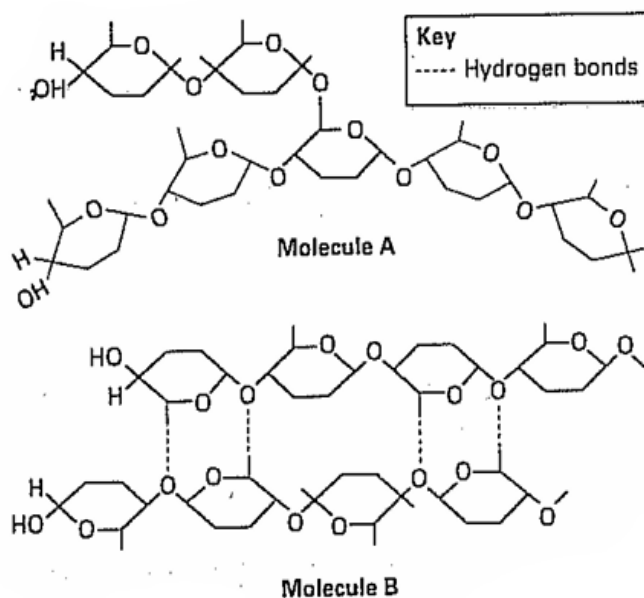
(b) Give two ways, in which flowering plants minimize water loss through (i) behavioral means. (04 marks)

- *Folding or rolling of leaves on a hot day*
- *Reduction of number of stomata*
- *Storage of water in leaves*
- *Sunken stomata*

(ii) physiological means. (04 marks)

- *Shedding leaves in hot season*
- *Reversal of normal stomata rhythm*
- *Thickening of waxy cuticle*

35. The diagram below shows part of the molecular structures of two polysaccharides. The hexagonal shapes represent hexose sugars.



- (a) Give the name of molecule A. (01 mark)

Amylopectin/starch

- (b) Give three difference between hexose sugars in molecule A and B. (03 marks)

B. is cellulose

<i>Amylopectin(starch)</i>	<i>cellulose</i>
<i>Consists of long chains of alpha glucose.</i>	<i>Straight chain of beta glucose</i>
<i>It's a storage polysaccharide.</i>	<i>It's a structural polysaccharide</i>
<i>Hydroxyl groups in the polysaccharide chain project into the interior.</i>	<i>Hydroxyl groups project in all directions of the chain.</i>
<i>Consists of branched chains in amylopectin.</i>	<i>Consists of unbranched chains.</i>
<i>Does not form linkages between neighboring chains.</i>	<i>Neighboring chains form cross linkages (hydrogen bonds)</i>
<i>It is easily hydrolysed into constituent monosaccharides and disaccharides.</i>	<i>It is not easily hydrolysed into constituent monosaccharides and disaccharides.</i>
<i>The polysaccharide forms are coiled to form helices.</i>	<i>The polysaccharide chains are straight and parallel.</i>

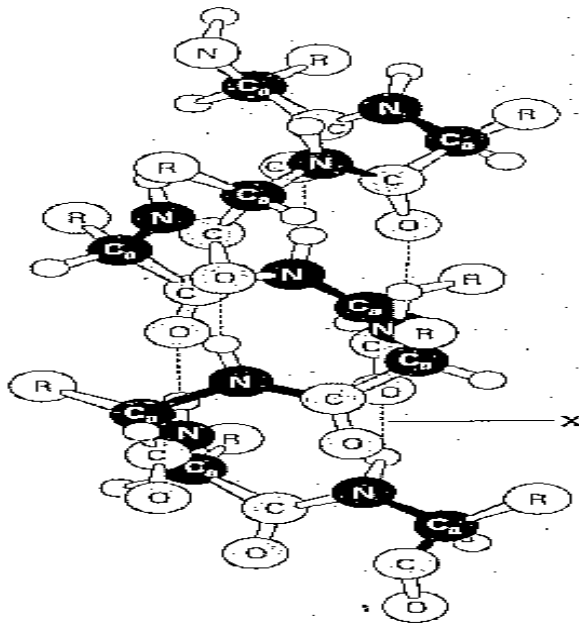
- (c) Both polysaccharides contain hexose sugars joined by 1-4 glycosidic bonds.

- (i) Explain, using an annotated diagram, how these bonds in molecule A are hydrolyzed in the process of the human digestion. (02 marks)

- (ii) Using information in the diagram of molecule B, suggest one reason why it cannot be digested by humans. (02marks)

Human digestive system lack Enzyme cellulase that catalyzes the digestion of cellulose to glucose

36. The figure above right shows a diagram of part of a polysaccharides chain. This type of twisted structure is commonly found in proteins of many different types.



- (a) (i) name the repeating unit of a polysaccharides chain. (01 mark)
Amino acids
- (ii) State the name given to the twisted structures shown in the figure. (01 mark)
Secondary structure
- (iii) Identify the type of bond in the structure shown x in the figure
Hydrogen bond
- (iv) Explain briefly what happen to the polysaccharide chain if it is heated to 70°C. (03 marks)

It leads to the loss of the three-dimensional shape of the protein molecule, by causing the atoms of the protein to vibrate more thus breaking the hydrogen and ionic bond., the molecules unfolds and no longer performs its normal biological function but the amino acid sequence remains unaffected

- (v) The twisted arrangement seen in the figure above is referred to as a secondary structure. Explain what is meant by a secondary structure. (02 marks)
Secondary structure is when amino acids join up in the polypeptide chain, and a variety of forces between different parts of the molecule and hydrogen bonding causes the chain or region of the chain to either coil into alpha-helix or to fold into a beta-pleated sheet.

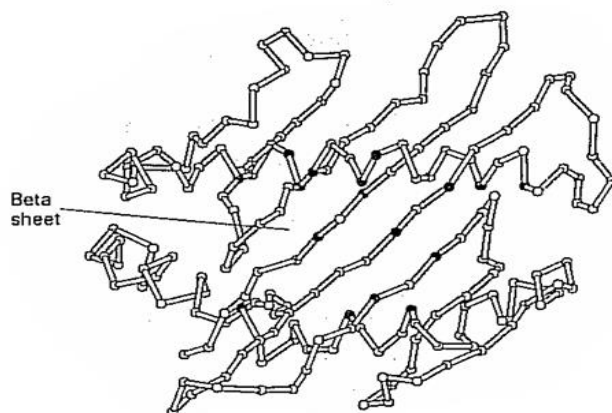
- (b) Another common secondary structure is known as the beta sheet. state one difference between the beta sheet and the structure shown in in the figure in part (a). (01 marks)

<i>Beta-pleated sheet</i>	<i>Spiral/alpha-helix</i>
<i>Hydrogen bonds are formed between amino acids in adjacent rows</i>	<i>Hydrogen bonds are formed between amino acids in the same rows</i>
<i>Flat, pleated structure</i>	<i>Coiled structure</i>
<i>More flexible</i>	<i>More rigid</i>
<i>Side chains of amino acids projects above and below the sheet</i>	<i>Side chains of amino acids projects outward from the sheet</i>

- (c) (i) proteins can be classified as fibrous or globular. Name one example of each type of the protein. (01 marks)

Fibrous protein e.g. -Collagen in bone and cartilage, Keratin in fingernails and hair.
Globular proteins e.g.- enzymes, antibodies, hormones.

Globular proteins such as that shown in the figure below are often described as tertiary structures. However, as indicated in the diagram, any globular proteins may also have sections of secondary structures



- (ii) Explain what is meant by the term tertiary structure. (02 marks)

The tertiary structure of a protein refers to its overall 3D shape, resulting from the interactions between amino acids and their spatial arrangement(alpha helices, beta-sheets, and loops)

- (d) Monosaccharides can also be linked to form long chain molecules called polysaccharides. Give three difference between a polypeptides and polysaccharides chain. (03 marks)

<i>polypeptides</i>	<i>polysaccharides</i>
<i>Amino acids (glycine, alanine)</i>	<i>Monosaccharides (glucose, fructose)</i>
<i>Peptide bonds</i>	<i>Glycosidic bonds</i>
<i>Enzymes, hormones, antibodies, transport proteins</i>	<i>Energy storage, structural support</i>

37. Distinguish between the following

(a) Monosaccharide and polysaccharide.

(05 marks)

Monosaccharide	Polysaccharide
<i>Eg. Glucose, fructose, galactose</i>	<i>e.g Starch, glycogen, cellulose, chitin</i>
<i>Sweet taste</i>	<i>No distinct taste sweet</i>
<i>Made of 3 to 6 carbon atoms</i>	<i>Many carbon atoms</i>
<i>Composed of one sugar unit</i>	<i>Composed of many sugar units</i>
<i>Low molecular mass</i>	<i>High molecular mass</i>
<i>Soluble</i>	<i>Insoluble</i>
<i>Used for respiration</i>	<i>Used for storage</i>
<i>Low energy content</i>	<i>High energy content</i>

(b) Starch and cellulose.

(04 marks)

Starch	cellulose
<i>Plants roots, tubers, seeds</i>	<i>Plant cell walls (cellulose fibre)</i>
<i>Polymer of alpha glucose</i>	<i>Polymer of beta glucose</i>
<i>Stores energy</i>	<i>Provide structural support</i>
<i>Soluble or partially soluble</i>	<i>insoluble</i>

(c) Saturated and unsaturated fats.

(05 marks)

Saturated fatty acids lack double bonds **between** the individual carbon atoms, while in **unsaturated fatty acids** there is at least one double bond **in the** fatty acid chain. **Saturated fats** tend to be solid at room temperature and from animal sources, while **unsaturated fats** are usually liquid and from plant sources.

(d) Globular and fibrous proteins.

(06 marks)

Fibrous.	Globular.
<i>insoluble in water, weak acids and weak bases</i>	<i>soluble in water, acids and bases.</i>
<i>highly resistant to digestion by enzymes and are extremely tensile</i>	<i>Less resistant to digestion</i>
<i>Long, rod-like, filamentous</i>	<i>spherical, oval, compact </i>
<i>Mechanical support, elasticity</i>	<i>Enzymes, hormones, antibodies, transport</i>
<i>Low flexibility</i>	<i>High flexibility</i>
<i>Location. Connective tissue, skin, hair, muscles</i>	<i>Location. Blood, muscles, various tissues</i>
<i>Hydrophobic surface</i>	<i>Hydrophilic surface</i>
<i>High molecular weight</i>	<i>Lower molecular weight</i>

END