

Grade 12 – CHM 71

Topic 6 (6.2-6.4) – Practice Questions – AK

❖ Subtopic 6.2 – Amino Acids & Their Polymers

1. Which of the following groups surrounds the central carbon of an amino acid?
 - I. Amino group
 - II. Carboxyl group
 - III. Hydroxyl group
 - A. I only
 - B. II only
 - C. III only
 - ✓ D. I and II only
 - E. I, II and III
2. Which of the following functional groups is/are **not** present in an amino acid molecule?
 - I. Amino
 - II. Amide
 - III. Carboxyl
 - A. I only
 - ✓ B. II only
 - C. I and III only
 - D. II and III only
 - E. I, II and III
3. Which of the following functional groups are present in an amino acid?
 - I. Carbonyl
 - II. Hydroxyl
 - III. Carboxyl
 - IV. Amino
 - A. I and IV only
 - B. II and IV only
 - C. II and III only
 - ✓ D. III and IV only
 - E. I, III and IV only
4. Which of the following atoms or groups of atoms is generally **not** present in a molecule of amino acid?
 - A. Hydrogen
 - B. Oxygen
 - C. Amino
 - D. Carboxyl
 - ✓ E. Phosphorus
5. Which of the following is a non-essential amino acid?
 - A. Lysine
 - B. Valine
 - C. Leucine
 - ✓ D. Alanine
 - E. Tryptophan

6. How many peptide bonds does the tripeptide below have?

Glycine	Alanine	Valine
Gly, G	Ala, A	Val, V

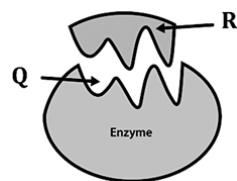
- A. 1
- ✓ B. 2
- C. 3
- D. 5
- E. 6

7. Which of the following accounts for the difference in the properties of the amino acids?

- I. The alkyl group attached to the central atom
- II. The carboxyl group attached to the central atom
- III. The positions of the different groups attached to the central atom

- ✓ A. I only
- B. II only
- C. III only
- D. I and III only
- E. I and III only

8. Which of the following correctly describes the structure of the enzyme below?



- | | <i>Q</i> | <i>R</i> |
|------|--------------------------|-------------|
| A. | Substrate | Active site |
| ✓ B. | Active site | Substrate |
| C. | Reactant | Product |
| D. | Product | Reactant |
| E. | Enzyme-substrate complex | Active site |

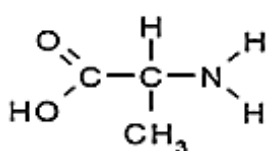
12. Which of the following statements is generally **true** about proteins?

(Tick (✓) ALL the correct boxes)

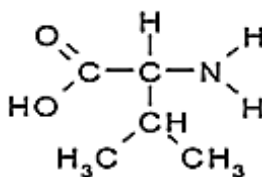
- They all contain nitrogen atoms
- They contain ($-C=O$)
- They do not share the same properties
- The sequence of amino acids is unique for each protein

✓
✓
✓
✓

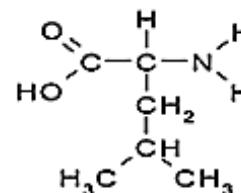
13. The structure of three different amino acid; alanine, valine and leucine, are represented in the figure below. Answer questions **a** and **b**.



alanine



valine



leucine

a) What is the feature that differentiates among the properties of the three amino acids?

The alkyl group attached to the central carbon of the amino acid.

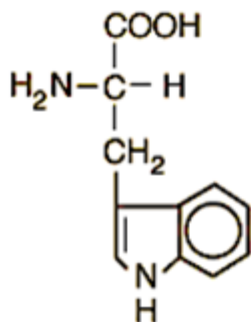
b) Different proteins can be formed from the given amino acids. Will the proteins formed have same or different properties? Explain your answer.

Different properties since the sequence of amino acids is different in each protein molecule formed

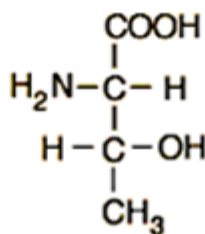
14. Two proteins (**X** and **Y**) are made up of the same amino acids but in different orders. Do proteins (**X** and **Y**) have the same properties? Explain your answer.

No, the sequence of amino acids in the chain accounts to the unique properties of each protein.

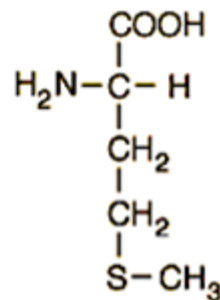
15. Use the structures below that represent three different amino acids to answer questions a – f.



Tryptophan (trp)



Threonine (thr)



Methionine (met)

a) Describe what the amino acids above have in common.

They all consist of an amino group, a hydrogen, a carboxyl group and an R group side chain that are all covalently bonded to a central carbon atom.

b) Do the above amino acids above have the same properties? Justify your answer.

No

They have different side chain (R)

c) The above amino acids can combine to form different proteins. Will the formed proteins have the *same* or *different* properties? Justify your answer.

Different properties

The sequence of amino acids is different in each protein molecule

d) A student claimed that all the amino acids given above are essential amino acids. Do you agree with this claim?

Yes

e) Different amino acids can combine to form a polypeptide. What is a polypeptide?

A polypeptide is a peptide with more than ten amino acids.

f) How many peptide bonds does the tripeptide Trp – Thr – Met have?

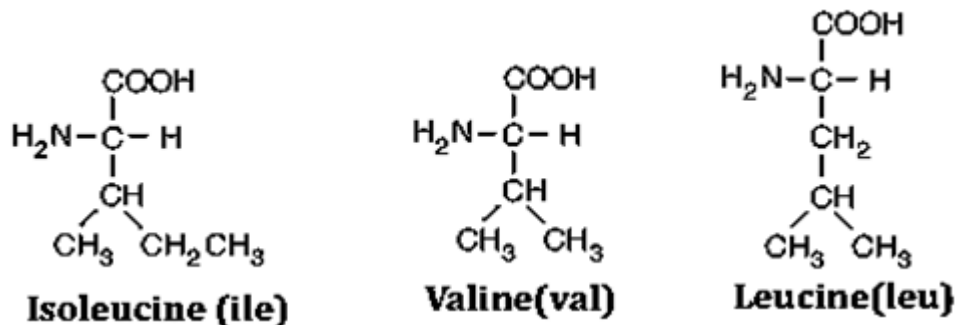
2 or Two

16. Use the information below and your knowledge about amino acids and proteins to answer questions **a – f**.

Amino acids are the building blocks of life. They combine to form proteins that help human body to grow, break down food, repair body tissues, and perform many other body functions.

Amino acids can be classified into different groups; essential amino acids and non-essential amino acids. The essential amino acids cannot be made by the body, they must come from food while non-essential amino acids are made in our body and we do not get them from the food we eat.

The following structures represent three essential amino acids; isoleucine, valine, and leucine



- a) Describe the structure of an amino acid.

It contains an amino group, a hydrogen, a carboxyl group, and a side chain R group all covalently bonded to a central carbon atom.

- b) Describe what feature accounts to the variety of amino acids.

The nature of the side -chain group (R) Or The alkyl group attached to the central atom

- c) A student claimed that all the amino acids given above are non-essential amino acids. Do you agree with this claim?

No

- d) A student claimed that only one protein can be formed from the above three amino acids. Do you agree with this claim?

No

- e) How many peptide bonds does the dipeptide Trp – Thr have?

1 or One

- f) Different amino acids can combine to form a protein. What is a protein?

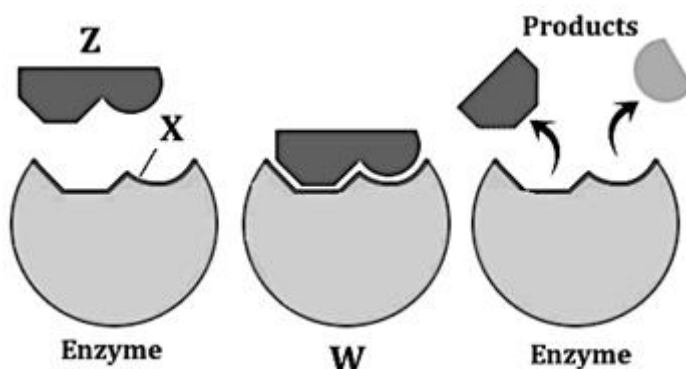
A protein is a peptide with more than 100 amino acids.

17. Your muscles are constantly in use. The muscles in your fingers allow you to turn pages in a book or use your computer mouse. All of this could not happen without amino acids that are arranged in a specific pattern to have the amino acid sequence for a protein.
Explain what is meant by the amino acid sequence of a protein.

The order of amino acids of a peptide are linked.

18. Read the passage below about enzymes to answer questions **a** and **b**.

Enzymes are special proteins that are found in the cells of living organisms. They are made up of long chains of amino acids held together by peptide bonds. Enzymes play a very important role in chemical reactions. There are various types of enzymes. Some are responsible for a particular chemical reaction only, while most of them are associated with metabolic processes like digestion and breathing. The structure and function of each enzyme is different. Each acts upon a specific target, which is transformed into usable product through the action of the enzyme. Each enzyme has a specific area that is meant for a particular substrate to get attached. The diagram below shows how an enzyme works.



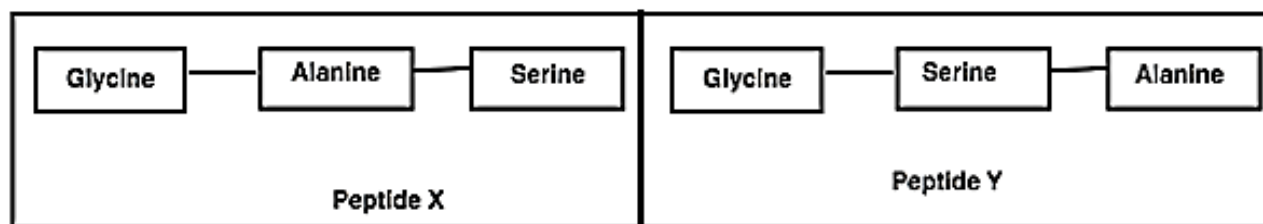
- a) Identify what does each letter in the diagram above (**Z**, **X**, **W**) represent.

Z:		Substrate
X:		Active site
W:		Enzyme-substrate complex

- b) Explain how enzymes affect the reaction rate of chemical reactions in living things.

Enzymes increase the rates of chemical reaction in living things without affecting the position of chemical equilibrium.

19. The following diagram shows the structures of two peptides (X and Y) formed by the same amines (Glycine, Serine and Alanine). Do structures X and Y share the same properties? Explain your answer.



No, the sequence of the amino acids is different which results in different properties.

20. A student wrote the following statement in his Chemistry notebook:

“Nitric acid, HNO_3 , is an amino acid because it is an acid that contains nitrogen”.

Is this statement True or False? Explain your answer.

False

Nitric acid, HNO_3 , is not an amino acid because amino acids are organic compounds that contain an amino group, a hydrogen, a carboxyl group, and a side chain R group all covalently bonded to a central carbon atom

❖ Subtopic 6.3 – Lipids

1. Which of the following molecules is/are classified as a lipid?
 - I. Waxes
 - II. Cellulose
 - III. Triglycerides
 - A. I only
 - B. II only
 - ✓ C. I and III only
 - D. II and III only
 - E. I, II and III

2. Which of the following is/are **true** about lipids?
 - I. Are soluble in water
 - II. Store energy efficiently
 - III. Make up most of the structure of living things
 - A. I only
 - B. II only
 - C. III only
 - ✓ D. II and III only
 - E. I, II and III

3. Which of the following is **true** about waxes?
 - I. Are esters of long-chain fatty acids and long-chain alcohols
 - II. Are tiresters of glycerol with ling chain fatty acids attached
 - III. Contain phosphate groups
 - ✓ A. I only
 - B. II only
 - C. III only
 - D. I and II only
 - E. I, II and III only

4. All of these molecules are soluble in water except _____.
 - A. glucose
 - B. fructose
 - ✓ C. triglycerides
 - D. proteins
 - E. alcohols

5. The water-insoluble compounds that include fats, oils, and waxes are called _____.
 - ✓ A. lipids
 - B. proteins
 - C. amino acids
 - D. nucleic acids
 - E. carbohydrates

6. Which of the following organic substances do not dissolve in polar solvents?
 - I. Lipids
 - II. Sugars
 - III. Proteins
 - ✓ A. I only
 - B. II only
 - C. III only
 - D. I and II only
 - E. I and III only

7. Which of the following is/are **not** a type of lipids?

- I. Waxes
- II. Glucose
- III. Triglycerides

- A. I only
- ✓ B. II only
- C. III only
- D. I and II only
- E. I and III only

8. Which of the following substances is/are classified as lipids?

- A. Starch
- ✓ B. Waxes
- C. Sugars
- D. Alcohol
- E. Aldehyde

9. Which of the following makes most of the structure of the living things?

- A. Starch
- B. Cellulose
- C. Glycogen
- ✓ D. Phospholipids
- E. Carboxylic acids

10. Which of the following is a lipid that is insoluble in water?

- ✓ A. Wax
- B. Protein
- C. Cellulose
- D. Glycogen
- E. Amino acids

11. Which of the following statements is **false** about lipids?

- A. They store energy efficiently
- B. They are non-polar substances
- C. They are organic compounds
- D. They are highly insoluble in water
- ✓ E. They are made up of amino acids

12. Which of the following is/are function of lipids?

- I. They are catalysts
- II. Store energy efficiently
- III. Make up most of the structure of living things

- A. I only
- B. II only
- C. III only
- D. I and II only
- ✓ E. II and III only

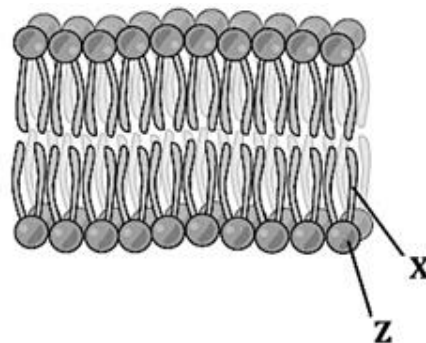
13. The product(s) of a saponification reaction is/are _____.

- I. soap
- II. water
- III. glycerol

- A. I only
- B. II only
- C. III only
- ✓ D. I and III only
- E. I, II and III

14. Which of the following is/are **true** about the structure below?

- I. Is a phospholipid found in the cell membrane
- II. Represents triesters of glycerol with long chains of fatty acids
- III. X is a hydrophobic tail and Z is a hydrophilic head
- IV. X is a hydrophilic tail and Z is a hydrophobic head



- A. I only
- B. II only
- C. III only
- ✓ D. I and III only
- E. I and IV only

15. The information below is about three different organic substances; **X**, **Y** and **Z**.

- **X** is soluble in water
- **X** is a polymer made up of glucose
- **Z** does not dissolve in polar solvents
- **Y** is a polymer made up of amino acids

Identify which substance is a phospholipid and justify your answer.

Substance Z is a phospholipid

Because phospholipid is insoluble in water while X and Y are biological molecules that are soluble in water

16. Which of the following correctly lists some of the properties of phospholipids?

(Tick (✓) ALL the correct boxes)

- They are non-polar molecules
- They store energy
- They carry the genetic information
- They dissolve easily in water

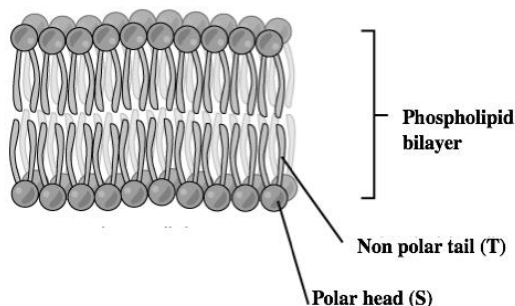
✓
✓

17. List **three** main types of lipids and identify the physical property of lipids that distinguishes them from carbohydrates and proteins.

The three main types of lipids are: Triglycerides, phospholipids and waxes

The physical property is that lipids do not dissolve in highly polar solvents as water

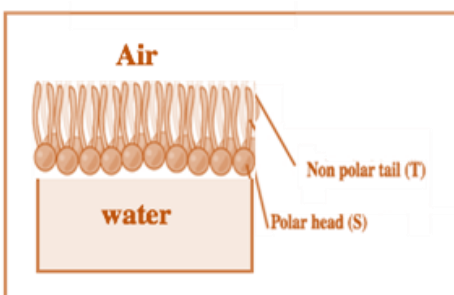
18. Phospholipids are molecules that make the structure of cell membranes. Phospholipids are formed of a polar head, **S**, and non polar head, **T**, as shown in the figure below. Answer questions **a** and **b**.



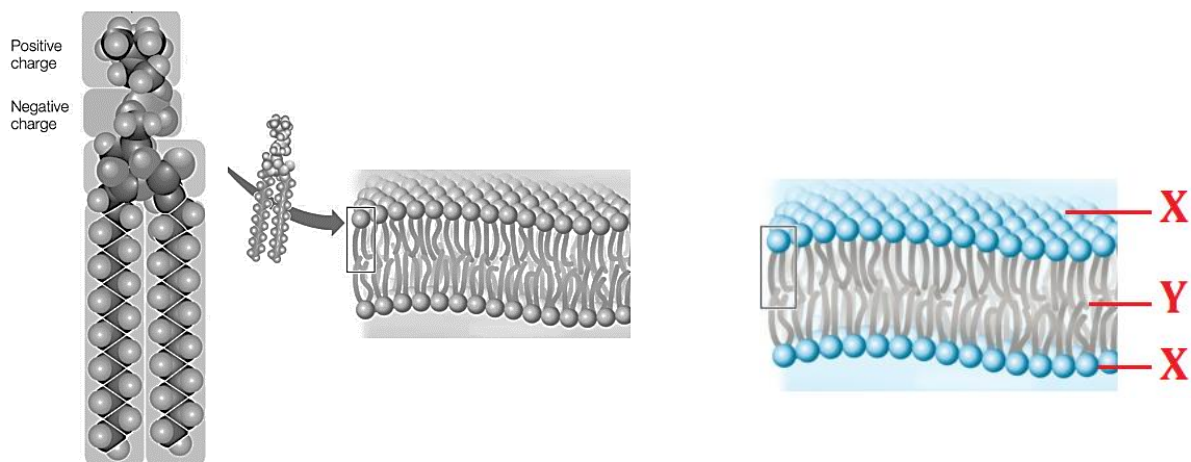
- a) Which structure (**S** or **T**) is responsible for a phospholipid being insoluble in water?

T or non-polar tail

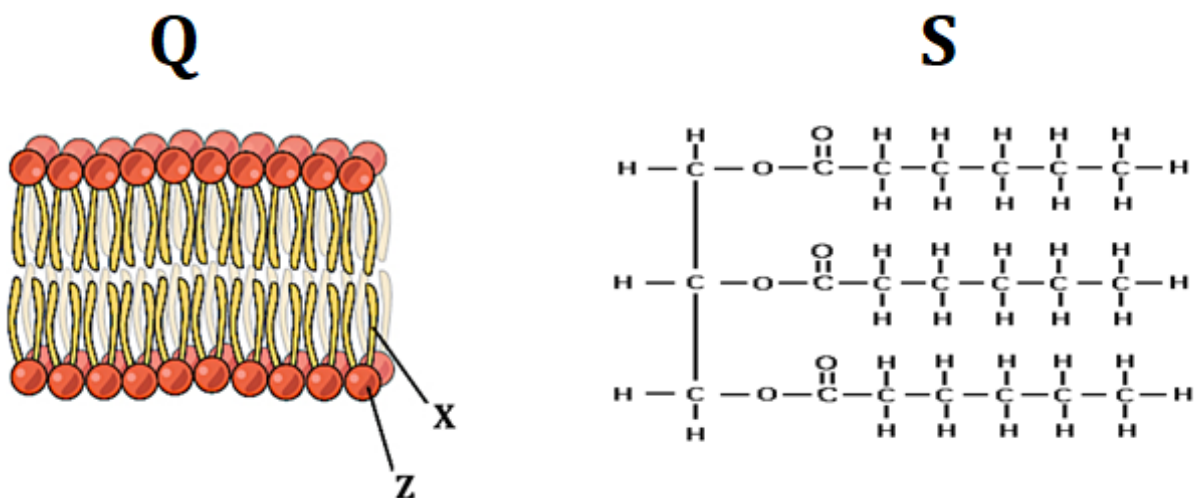
- b) A phospholipid layer is in contact with water. Draw a diagram showing the expected arrangement of this layer in water.



19. Phospholipids are lipids that contain phosphate group. Phospholipids are abundant in cells. The figure below shows a typical phospholipid molecule know as *Lecithin*. This molecule has a hydrophilic ionic head and a hydrophobic oily hydrocarbon tail. On the figure below, label the hydrophilic part as **X** and the hydrophobic part as **Y**.



20. Use the biological structures **Q** and **S** given below that represent two types of lipids to answer questions **a** and **b**.



a) Compare between the two types of lipids in the table below.

	Name	What does the structure consist of?
Q	Phospholipid	It is a lipid that contains phosphate groups
S	Triglyceride	Consist of glycerol with fatty acids

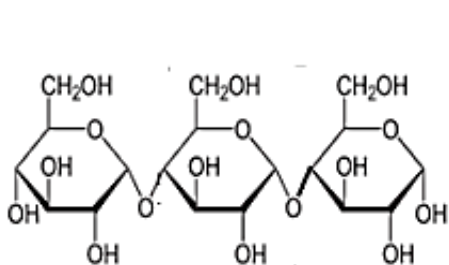
b) In structure **Q**, name the parts labelled by letters **X** and **Z** and describe their behavior in water.

X is a hydrophobic tail
Z is a hydrophilic head

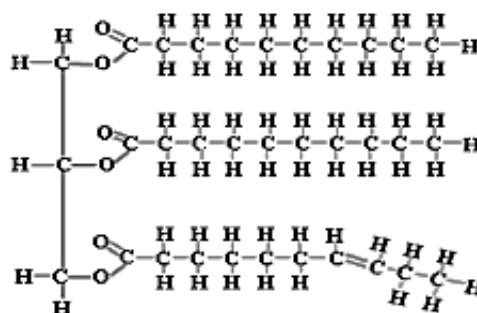
In water, the hydrophobic (water- hating) carbon chains of aggregate to exclude water, while the hydrophilic part (water-loving) is drawn to water, which can solvate it.

21. Read the following passage about biomolecules and answer questions **a** and **b**.

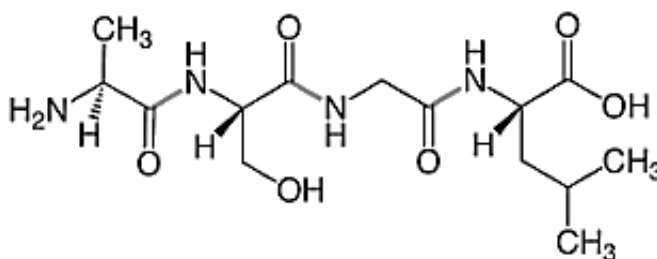
Biological molecules are molecules that are present in living organisms and are essential to some typically biological processes such as respiration, metabolism and development. The diagram below shows the structures of three different examples of biological molecules.



X



Y



Z

- a) For each biological molecule, identify the class (**carbohydrate**, **protein** or **lipid**) to which it belongs and the polarity (**polar** or **non-polar**)

Diagram	Class to which it belongs (Carbohydrate, Protein or Lipid)	Polarity (Polar or Non-polar)
X	Carbohydrate	Polar
Y	Lipid	Non-polar
Z	Protein	Polar

- b) Identify the monomer that forms substance **X** and **Z**.

X: _____

Monosaccharide (glucose)

Z: _____

Amino acid

22. Based on your knowledge about biological molecules answer question **a – c**.

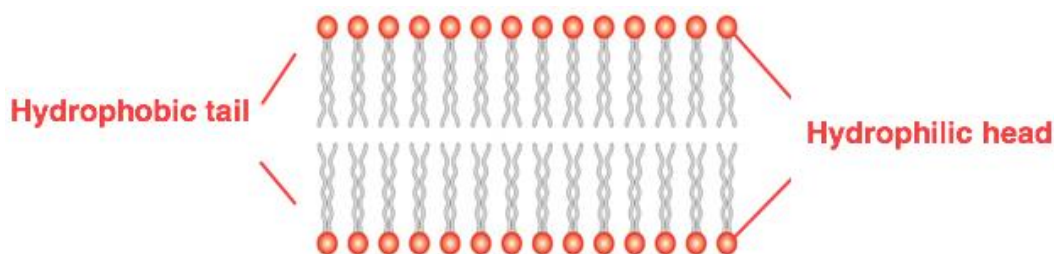
a) Which element is generally **not** found in an amino acid molecule? (**Tick ALL the correct boxes**)

Oxygen	<input type="checkbox"/>
Nitrogen	<input type="checkbox"/>
Neon	<input checked="" type="checkbox"/>
Phosphorus	<input checked="" type="checkbox"/>
Hydrogen	<input type="checkbox"/>

b) How does the carbonyl functional group differ in glucose and fructose?

Glucose is an aldehyde while fructose is a ketone.

c) Draw and label a simple representation of a lipid bilayer.



23. Use your knowledge about wax to answer questions **a** and **b**.

a) What are the **two** classes of organic compounds that form a wax when combined?

Long chain fatty acids and long chain alcohols

b) Explain the function of waxes in **plants** and **animals**.

In plants, wax protects the surface of leaves from water loss and attack by microorganisms.

In animals, wax coat the skin, hair, and feathers to help keep these structures pliable and waterproof.

24. Use the information below about substances **M**, **K**, and **W** to answer questions **a – d**.

M	<i>Contains phosphate group and has a hydrophilic head and a hydrophobic tail</i>
K	<i>Triesters of glycerol with long chains of fatty acids attached</i>
W	<i>Made up of long-chain fatty acids and long-chain alcohols</i>

a) Which of the above substances is/are classified as lipids?

M, K, and W

b) Write the name of the substances **M**, **K** and **W**.

<i>M:</i>		Phospholipid
<i>K:</i>		Triglyceride
<i>W:</i>		Wax

c) **Name** the process of hydrolysis of substance **K** with an alkali metal hydroxide and **write its products**.

<i>Name of Process:</i>		Saponification
<i>Products:</i>		Glycerol and soap

d) **Describe** the behavior of compound **M** in water. **Explain** your answer.

It behaves in water like an insoluble hydrocarbon and soluble ionic compound
The hydrophobic tail aggregate to exclude water (water-hating) while the hydrophilic head is drawn to water (water-loving)

❖ Subtopic 6.4 – Nucleic Acids

1. Which of the following is/are **true** about nucleic acids?

- I. Nitrogen-containing polymers
- II. Found in the nucleus of the cell
- III. Known as polynucleotides

- A. I only
- B. II only
- C. III only
- D. I and II only

✓ E. I, II and III

2. Which of the following is/are **not** a function of nucleic acids?

- I. Transmission of the information stored in DNA
- II. Synthesis of proteins
- III. Storage of energy

- A. I only
- B. II only
- ✓ C. III only
- D. I and II only
- E. I, II and III

3. Which of the following substances governs the growth of cells and new organisms?

- A. RNA
- ✓ B. DNA
- C. Protein
- D. Amino acids
- E. carbohydrates

4. Which of the following has a key role in the transmission of information and synthesis of proteins?

- ✓ A. RNA
- B. DNA
- C. Lipids
- D. Peptides
- E. Enzymes

5. A nucleotide consists of _____.

- I. sugar unit
- II. nitrogen base
- III. phosphate group

- A. I only
- B. II only
- C. III only
- D. I and II only

✓ E. I, II and III

6. RNA and DNA are _____.

- A. lipids
- ✓ B. nucleic acids
- C. mineral acids
- D. carbohydrates
- E. carboxylic acids

7. Which of the following is/are the main function(s) of DNA?

- I. Storage of the genetic information
- II. Governs reproduction
- III. Storage of energy

- A. I only
- B. II only
- ✓ C. III only
- D. I and II only
- E. I, II and III

8. DNA and RNA are found in _____.

- ✓ A. cells
- B. food
- C. waxes
- D. proteins
- E. carbohydrates

9. Which of the following is a polymer of deoxyribonucleotides found primarily in the nucleus of the cell?

- A. RNA
- ✓ B. DNA
- C. Enzymes
- D. Peptides
- E. Polysaccharides

10. The monomer that makes up DNA and RNA is called _____.

- A. glucose
- B. protein
- ✓ C. nucleotide
- D. amino acid
- E. carboxylic acid

11. Which of the following is a type of nucleic acid?

- I. DNA
- II. RNA
- III. Lipids

- A. I only
- B. II only
- C. III only
- ✓ D. I and II only
- E. I, II, and III

12. A nucleotide consists of _____, _____ and _____.

- A. sugar phosphate enzyme
- B. base phosphate ester
- C. sugar base triglyceride
- ✓ D. phosphate sugar nitrogen base
- E. ester sugar nitrogen base

- Refer to the following to answer questions 13 – 15.

- A. Nucleic acids
- B. Carbohydrates
- C. Lipids
- D. Amino acids
- E. Enzymes

13. Monomers and polymers of aldehydes and ketones that are made up of C, H, and O. _____. **B**

14. Polymers found primarily in the nucleus of the cell _____. **A**

15. Type of proteins that act as biological catalysts _____. **E**

16. List the two types of nucleic acids found in living cells and the main function of each.

Types of Nucleic acid	Main Function
DNA	Stores the information needed to make proteins and governs the reproduction and growth of cells and new organisms.
RNA	RNA has a key role in the transmission of the information stored in DNA and in the synthesis of protein.

17. Write the type of biological molecule (**carbohydrates, lipids, proteins** or **nucleic acids**) that would best fit each statement.

(Each molecule may be used once, more than once or not at all)

- Their molecules contain carbon, hydrogen and oxygen atoms in the ratio of 1:2:1
- They are formed by peptide bonds between their monomers
- Their molecules have hydrophobic tails and hydrophilic heads

Carbohydrates

Proteins

Lipids

18. A student wrote the following statement in his Chemistry notebook:

"Lipids have similar physical properties to carbohydrates and proteins".

Is this statement True or False? Explain your answer.

False

Lipids are different from carbohydrates and proteins because they do not dissolve in highly polar solvents as water.

19. Nucleic acids are polymers found primarily in the nucleus of the cell. **Name** the **monomer** from which a nucleic acid is made and state its **components**.

The monomer is called nucleotide

It consists of a phosphate group, a five-carbon sugar, and a nitrogen base.