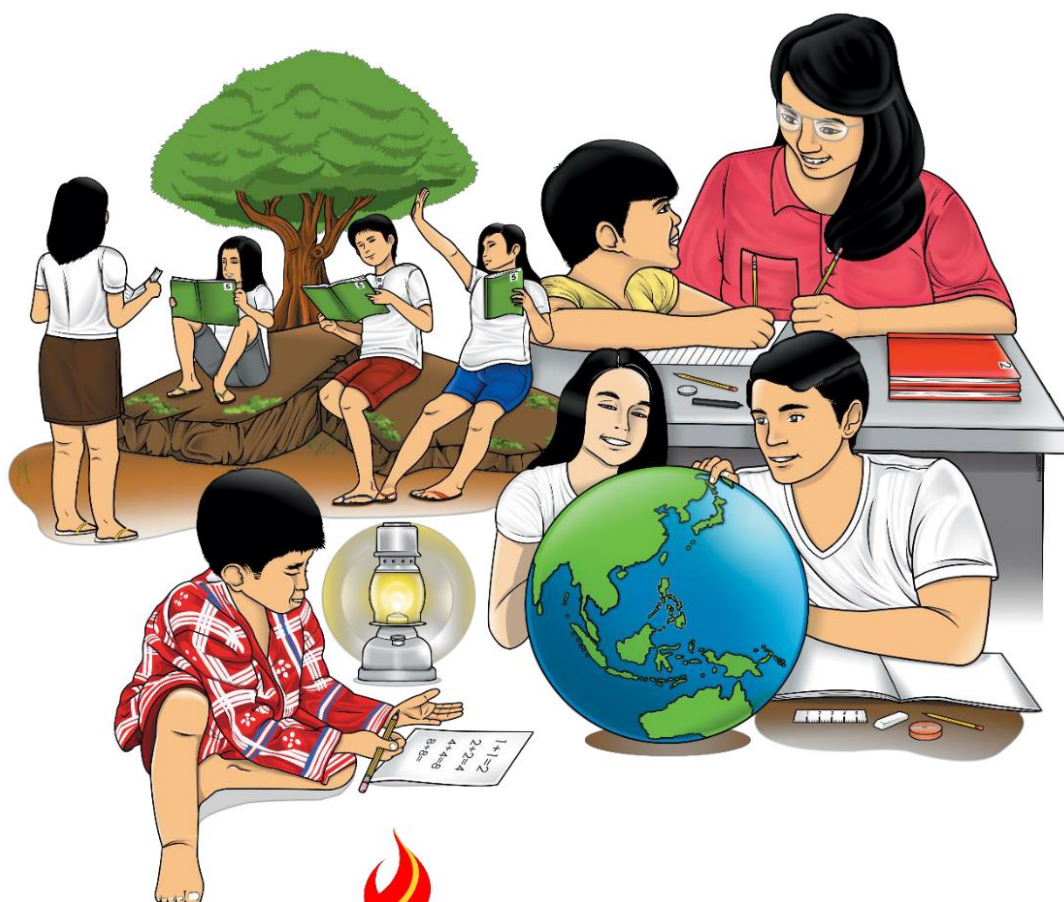


Senior High School

# Physical Science

## Quarter 1 – Module 5:

### Exploring the Structure and Function of Biological Molecules



**Physical Science**  
**Alternative Delivery Mode**  
**Quarter 1 –Module 5: Exploring the Structure and Function of Biological Molecules**  
**First Edition, 2020**

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Senior High School

# **Physical Science**

## **Quarter 1 – Module 5:**

### **Exploring the Structure and Function of Biological Molecules**

# Introductory Message

For the facilitator:

Welcome to Physical Science Grade 11/12 Alternative Delivery Mode (ADM) Module on Biological Macromolecule Structure and Function!

This module was collaboratively designed, developed, and reviewed to assist the teachers/facilitators in helping the learners meet the standards set by the K to 12 Curriculum while overcoming their personal, social, and economic constraints in schooling.

This learning resource hopes to engage the learners in guided and independent learning activities at their own pace and time. Furthermore, this also aims to help learners acquire the needed 21st - century skills while taking into consideration their needs.

In addition to the material in the main text, you will also see this box in the body of the module:



### ***Notes to the Teacher***

This contains helpful tips or strategies that will help you in guiding the learners.

As a facilitator, orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their learning. Furthermore, please encourage and assist the learners as they do the tasks included in the module.

For the learner:

Welcome to Physical Science 11/12 Alternative Delivery Mode (ADM) Module on Biological macromolecule structure and its function!

Our hands are the most represented parts of the human body. They are often used to depict skill, action, and purpose. With our hands, we create, accomplish, and learn. Hence, you are capable and empowered to successfully achieve the relevant competencies and skills at your own pace and time. Your academic success lies in your own hands!

This module was designed to provide you with fun and meaningful opportunities for guided and independent learning at your own pace and time. You will be able to process the contents of the learning resource while being an active learner.

This module has the following parts:



***What I Need to Know***

This part will give you an idea of the skills or competencies that you are expected to learn in the module.



***What I Know***

This part includes an activity that will check what you already know about the lesson. If you get all the correct answers (100%), you may decide to skip this module.



***What's In***

This drill or review to help you link the current lesson with the previous one.



***What's New***

In this portion, the new lesson is introduced to you in various ways through a story, a song, a poem, a problem opener, an activity, or a situation.



***What is It***

This section provides a brief discussion of the lesson. It aims to help you discover and understand new concepts and skills.



***What's More***

This part comprises activities for independent practice to solidify your understanding and skills of the topic. You may check the answers to the exercises using the Answer Key at the end of the module.



***What I Have Learned***

This part includes questions or blank sentences/paragraphs to be filled in to process what you learned from the lesson.



***What I Can Do***

This section provides an activity that will help you transfer your new knowledge or skills into real-life situations.



### **Assessment**

This part is a task that aims to evaluate your level of mastery in achieving the learning competency.



### **Additional Activities**

In this portion, another activity will be given to you to enrich your knowledge or skill of the lesson learned.



### **Answer Key**

This part contains answers to all activities in the module.

At the end of this module you will also find:

### **References**

This part is a list of all sources used in development of this module.

The following are some reminders in using this module:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *What I Know* before moving on to the other activities in the module.
3. Read the instruction carefully before doing each task.
4. Observe honesty and integrity in doing the module and in checking your answers.
5. Finish the task at hand before proceeding to the next activity.
6. Return this module to your teacher/facilitator once done.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone.

We hope that through this material, you will experience meaningful learning and gain a deep understanding of the relevant competencies. You can do it!



## ***What I Need to Know***

This module was designed and written with you in mind. It aims to help you master the principles governing the structures and functions of biological macromolecules. The language used recognizes the diverse vocabulary level of students. The lessons follow the standard sequence of the course.

This module consists of one lesson:

- Lesson 1 – Structure and Function of Biological Macromolecules

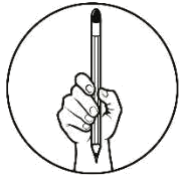
By the end of this module, you can:

1. Describe the different biological molecules;
2. Compare and contrast the biological macromolecule in terms of structure; and
3. Appreciate the importance of biological macromolecules in our life by citing their functions.



### ***Notes to the Teacher***

This module provides learning activities that encourage self-directed learning. Moreover, your role is to facilitate the learning process by providing a clear understanding of how to maximize the use of this module, monitor the development of our learners, scaffold the acquisition of learning to achieve target mastery level, and provide positive feedback regarding their progress.



## ***What I Know***

**DIRECTIONS:** Read each question carefully. Choose the letter of the best answer. Write your answer on a separate sheet of paper.

- Which macromolecules contain carbon, oxygen, and hydrogen?  
a. Carbohydrates    b. Lipids    c. Protein    d. Nucleic acid
- Which type of bond exists between amino acids?  
a. Ester    b. Glycosidic    c. Phosphodiester    d. Peptide
- Which macromolecules contain a nitrogen base?  
a. Carbohydrates    b. Lipids    c. Protein    d. Nucleic acid
- Which is NOT an example of carbohydrates?  
a. Cellulose    b. Chitin    c. Starch    d. Sugar
- Which is NOT an example of an amino acid?  
a. Alanine    b. Ascorbic acid    c. Lysine    d. Valine
- What year did Nobel Laureate Staudinger coin the word “macromolecule”?  
a. 1910    b. 1920    c. 1930    d. 1940
- Which refers to the smallest unit of macromolecule?  
a. Amino acid    b. Monomer    c. Polymer    d. Sucrose
- Which of the following type of bonds links monomers of macromolecule?  
a. Covalent    b. Ionic    c. Hydrogen    d. Peptide
- Which is NOT an example of polymers of carbohydrates?  
a. Galactose    b. Lactose    c. Maltose    d. Sucrose
- Which is NOT an example of monomers of carbohydrates?  
a. Galactose    b. Glucose    c. Fructose    d. Lactose
- Which of the following serves as storage of energy for plants?  
a. Chitin    b. Cellulose    c. Glycogen    d. Starch
- Structural and contractile are functions being performed by what molecule?  
a. Carbohydrates    b. Lipids    c. Protein    d. Nucleic acid
- Which is NOT an example of lipids?  
a. Fats    b. Starch    c. Steroid    d. Wax
- Which of the following is a function being performed by lipids in our body?  
a. Contractile    b. Insulation    c. Structural    d. Transport
- Carrying genetic materials is performed by what biological macromolecule?  
a. Carbohydrates    b. Lipids    c. Protein    d. Nucleic acid



# Lesson

# 1

# Structure and Function of Biological Molecules

*“Biochemistry is the science of life. All our life processes-walking, talking, moving, feeding- are essentially chemical reactions. So, biochemistry is the chemistry of life, and it’s supremely interesting.” – Aaron Ciechanover*



## What’s In

**Directions:** Identify the polarity and type of intermolecular forces of the compounds below:

COMPOUND	POLARITY	TYPE OF IMFA
Water (H <sub>2</sub> O)		
Ammonia (NH <sub>3</sub> )		
Carbon monoxide (CO)		



## What’s New

### Macromolecule Word Puzzle

**Directions:** Study the table below. Encircle the words which are related to biological macromolecules. Look for the meaning of the encircled words and add them to your prior knowledge.

A	P	O	L	Y	M	E	R	C	O	V	A	L	E	N	T	L	P	L
D	C	A	R	B	O	H	Y	D	R	A	T	E	S	U	I	I	R	S
M	A	C	R	O	M	O	L	E	C	U	L	E	S	H	O	P	O	A
G	F	R	M	O	N	O	M	E	R	E	T	N	Y	O	L	I	T	N
F	O	R	G	A	N	I	C	R	N	A	G	Z	W	A	X	D	E	G
A	M	I	N	O	A	C	I	D	T	T	F	Y	C	I	P	S	I	T
T	M	O	L	E	C	U	L	E	D	W	A	M	D	N	A	R	N	E
S	S	U	G	A	R	O	I	L	J	D	E	E	V	S	G	D	D	W



## What is It

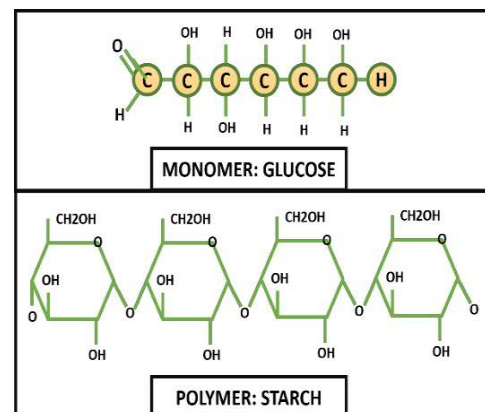
### Structure and Functions of Biological Macromolecules

Biological macromolecules are large molecules that are important components of living systems. Performing a variety of functions, they are vital to sustaining life. The term “macromolecule” was coined in 1920 by Nobel Laureate Hermann Staudinger. Staudinger was also the first to assert that large biological molecules are made up and formed by covalently bonded sub-units.

#### Monomers and Polymers

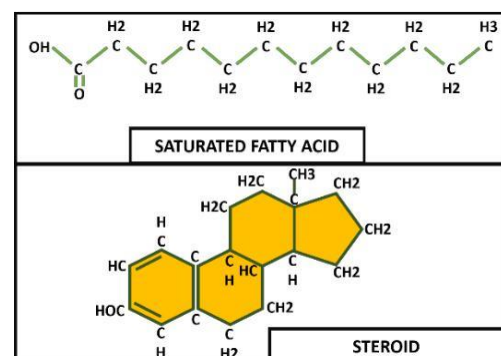
Macromolecules perform a crucial role in our cell structure and processes. Majority of biological macromolecules are polymers and are made of covalently linked basic units called monomers. All the monomers which made up a polymer are typically similar or at least highly similar to one another, and are bonded to form a larger unit or larger macromolecule. Monomers that link with other monomers in various combinations result in the formation of polymers, which have different structures and functions.

**Carbohydrates** are composed of carbon and hydrate (H + O). They are classified as simple or complex sugars. Simple sugars are monosaccharides and disaccharides, while complex sugars are polysaccharides. Carbohydrates serve as primary source of energy for man, storage of energy (glycogen), structural support for cell (cellulose & chitin), food (starch).



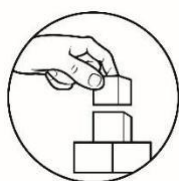
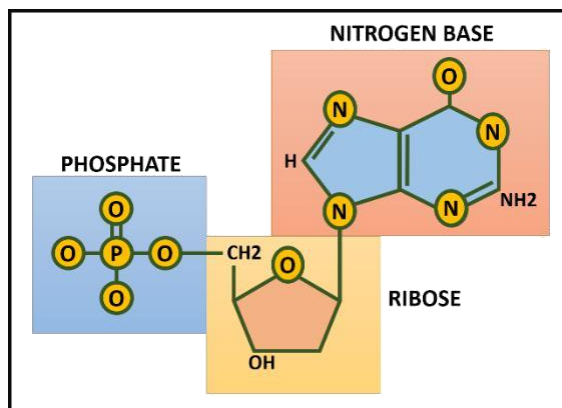
**Proteins** are polymers of amino acids arranged in a linear sequence of amino acid which is also consist of a central carbon atom (alpha) attached to an amino acid group, a carboxyl group, hydrogen atom and variable component known as side chain. It is known as the most abundant organic molecules in living systems, and have the most diverse functions which include regulatory, structural, protective, contractile, transport, and storage.

**Lipids** are hydrophobic, nonpolar molecules containing carbon-hydrogen bonds. They are insoluble in water. Lipids include fats, oils, waxes, phospholipids, and steroids and perform many different functions such as energy storage (fats), provide insulation, building blocks of hormones, and a major constituent of the plasma membrane.



## Nucleic acids

Nucleic acids are biological macromolecules vital in the continuity of life. Nucleic acid carries the genetic material of a cell and provides instructions for the functioning of the cell. There are two main types of nucleic acids the deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). DNA carries genetic material found in all living organisms.



## What's More

### Activity 1 Fill Me Up

**Objective:** Demonstrate an understanding of the composition, function, and sources of different biological macromolecules.

**Directions:** Complete the table below.

	Lipids	Proteins	Nucleic Acid	Carbohydrates
<b>Monomer</b>				
<b>Polymer</b>				
<b>Function</b>				
<b>Composition</b>				
<b>Example</b>				
<b>Source</b>				

### Activity 2 Molecular

**Objective:** Identify the polymers and monomers of the different macromolecules.

**Directions:** Match the monomers on the left with the macromolecules on the right. Write the letter of your answer on the space provided.

- |                                   |                 |
|-----------------------------------|-----------------|
| _____ 1. Fatty acids and glycerol | A. Protein      |
| _____ 2. Monosaccharide           | B. Lipid        |
| _____ 3. Nucleotide               | C. Nucleic acid |
| _____ 4. Amino acid               | D. Carbohydrate |

**Directions:** Match the monomers on the left with the polymers on the right. Write the letter of your answer on the space provided.

\_\_\_\_\_ 1. Amino acid

A. DNA

\_\_\_\_\_ 2. Fatty acids and glycerol

B. Triglyceride

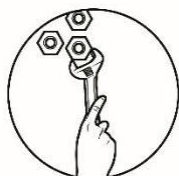
\_\_\_\_\_ 3. Glucose

C. Starch



## ***What I Have Learned***

1. Biological macromolecules are composed of organic molecules. They are essential in different biological processes as they perform a wide variety of functions.
2. Hydrophobic means “fear of water”. Hydrophobic molecules repel water because they are non-polar.
3. Polymers are substances that contain a large number of similar units known as monomers which are bonded together.
4. Monomers are basic molecules. Monomers interact and react with other molecules to form a polymer chain or three-dimensional structure. This process is known as polymerization.
5. Phospholipids are a class of lipids whose molecules contain a phosphate group. Phospholipids are major components of the cell membrane where they form the so-called “lipid bilayer”.



## ***What I Can Do***

**Directions:** Based on your understanding of this module, briefly answer the following questions regarding the functions and importance of biological macromolecules to us.

1. Explain why an enzyme may be capable of breaking down starch but may not be able to break down cellulose.
2. Why do plant cells contain cellulose but animal cells do not?
3. How does the structure of macromolecules relate to their respective functions?
4. Why can't most animals digest cellulose?
5. Differentiate saturated and unsaturated fat.
6. Discuss the role of fats in various health-related problems.



## Assessment

DIRECTIONS: Read each question carefully. Choose the letter of the best answer. Write your answer on a separate sheet of paper.

- Which elements serve as the main composition of carbohydrates?
  - C, O, H
  - C, N, H
  - C, O, N
  - C, P, O
- Which of the following element is part of Nucleic acids composition?
  - He
  - N
  - S
  - S
- Which type of bond exists between amino acids?
  - Ester
  - Ionic
  - Glycosidic
  - Peptide
- Which macromolecule contains a nitrogenous base?
  - Carbohydrates
  - Lipids
  - Nucleic acid
  - Protein
- Which is an example of protein?
  - Adenine
  - Chitin
  - Steroids
  - Wax
- Which is NOT an example of polymers of carbohydrates?
  - Galactose
  - Lactose
  - Maltose
  - Sucrose
- Which of the following is a function of lipids in our body?
  - Contractile
  - Insulation
  - Structural
  - Transport
- Which is NOT an example of lipids?
  - Fats
  - Starch
  - Steroid
  - Wax
- What year did Nobel Laureate Staudinger coined "Macromolecule"?
  - 1910
  - 1920
  - 1930
  - 1940
- Which refers to the smallest unit of macromolecule?
  - Amino acid
  - Monomer
  - Polymer
  - Sucrose
- Carrying genetic materials is performed by what biological macromolecule?
  - Carbohydrates
  - Lipids
  - Protein
  - Nucleic acid
- Structural and contractile are functions being performed by what molecule?
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- Which is NOT an example of monomers of carbohydrates?
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  - Glycogen
  - Starch

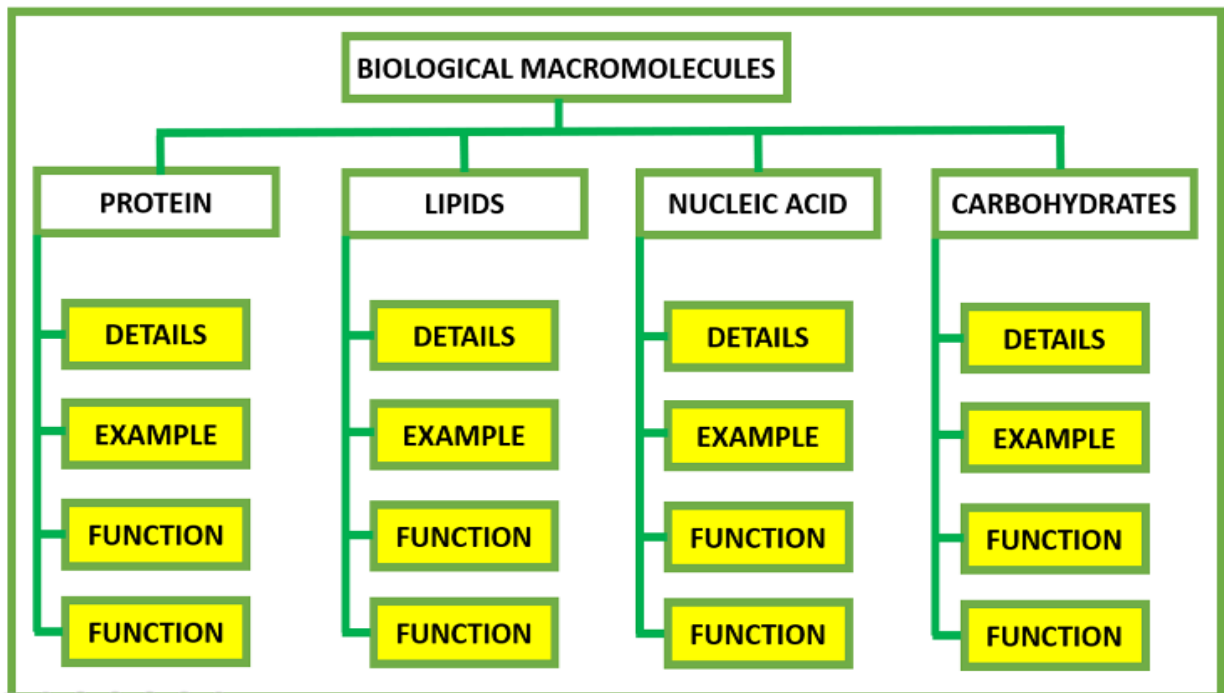


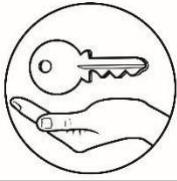
## *Additional Activities*

### **Building My Macromolecule Concept**

**Objective:** Demonstrate mastery of the biological macromolecule structure and composition by completing the graphic organizer.

**Directions:** Based on your understanding of our lesson, complete the graphic organizer by writing the appropriate word/s that will complete the concept of biological macromolecules.





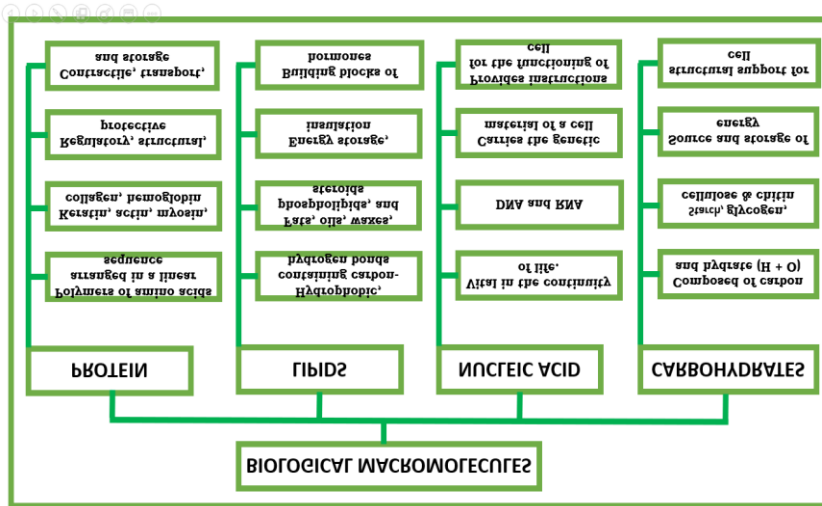
# Answer Key

- .15 C B .7
- .14 D A .6
- .13 A B .5
- .12 C C .4
- .11 D D .3
- .10 B B .2
- .9 B A .1

## Assessment

- .15 D B .7
- .14 B B .6
- .13 B A .5
- .12 C B .4
- .11 C D .3
- .10 D D .2
- .9 A A .1

## Know What I



- .7 C
  - .6 B
  - .5 A
  - .4 A
  - .3 C
  - .2 D
  - .1 B
- Activity 2**

Source	Examples	Composition	Function
Fruits, starch	DNA RNA	Meat products	Fats, nuts, oils
Cellulose Sugar, starch,	DNA RNA	Myosin, Keratin	Fats, steroids
Oxygen, Carbon, Hydrogen	Nitrogenous base, Ribose (RNA), Deoxyribose (DNA), Phosphate group	Consist of a central carbon atom (alpha) attached to an amino acid group, a carboxyl group, hydrogen atom and variable component known as side chain	Hydrocarbon chain  Glycerol molecules,
Serve as primary source of energy for man, storage of energy (glycogen), structural support for cell (cellulose & chitin), food (starch).	Nucleic acid carries the genetic material of a cell and provides instructions for the functioning of the cell	Storage, or Transport, Contractile, Protective, Structural, Regulatory	Provide insulation, building blocks of hormones, and a major constituent of the plasma membrane
Polysaccharide	DNA, RNA		Waxes
Monosaccharide	Nucleotides	Amino Acid	Glycerol
<b>Carbohydrates</b>	<b>Nucleic Acid</b>	<b>Proteins</b>	<b>Lipids</b>
			<b>Polymer</b>
			<b>Monomer</b>
			<b>Activity 1</b>

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