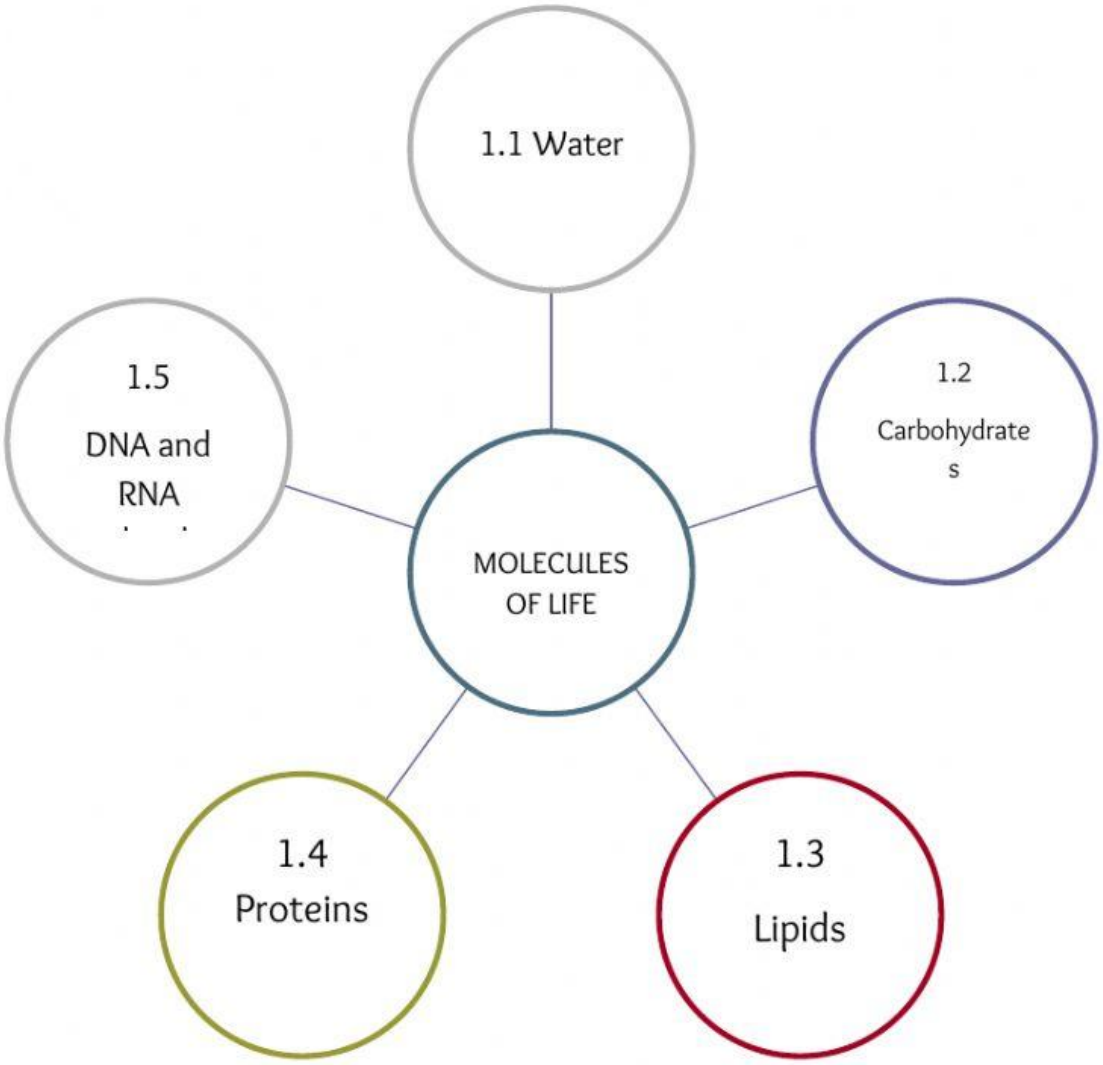
BioAct_DB014
2021/2022

CHAPTER 1 :

MOLECULES OF LIFE



LIVEWORKSHEETS

1.1 WATER

LEARNING OUTCOMES:

At the end of this topic, students should be able to:

a) Illustrate the structure of water molecule.
b) State the properties of water.

Exercise 1.1 (a): Draw the structure of water moelcules. Use the information given to label and complete the structure of a water molecule.

Exercise 1.1 (b): Fill in the blanks below to complete the explanation of water structure.



Key:

Covalent bond

104.5 ^{o}

δ^+

δ^+

$2\delta^-$

Oxygen atom

Hydrogen atom

STRUCTURE OF WATER

Consists of _____ oxygen atom and two hydrogen atoms.

The three atoms of water molecule form wide _____shaped structure.

Two hydrogen atoms joined to the oxygen atom by _____ bond. Thus, one water molecule, has two covalent bonds.

The bond angle in water molecule between two covalent bonds is 104.5 ^{o}.

Water is **polar molecule**.

Universal Solvent

Defined as a molecule that carry an _____ distribution of electrical charge such as the opposite ends of the molecule have opposite charge.

The oxygen region of molecule has a _____ (δ^-) and each hydrogen has a partial positive charge (δ^+).

This unequal sharing of electrons occurs where oxygen atom is more electronegative than hydrogen.

The polarity of the water molecule can attract other _____molecules (hydrophilic or water-loving substances e.g. sugar, salt) but

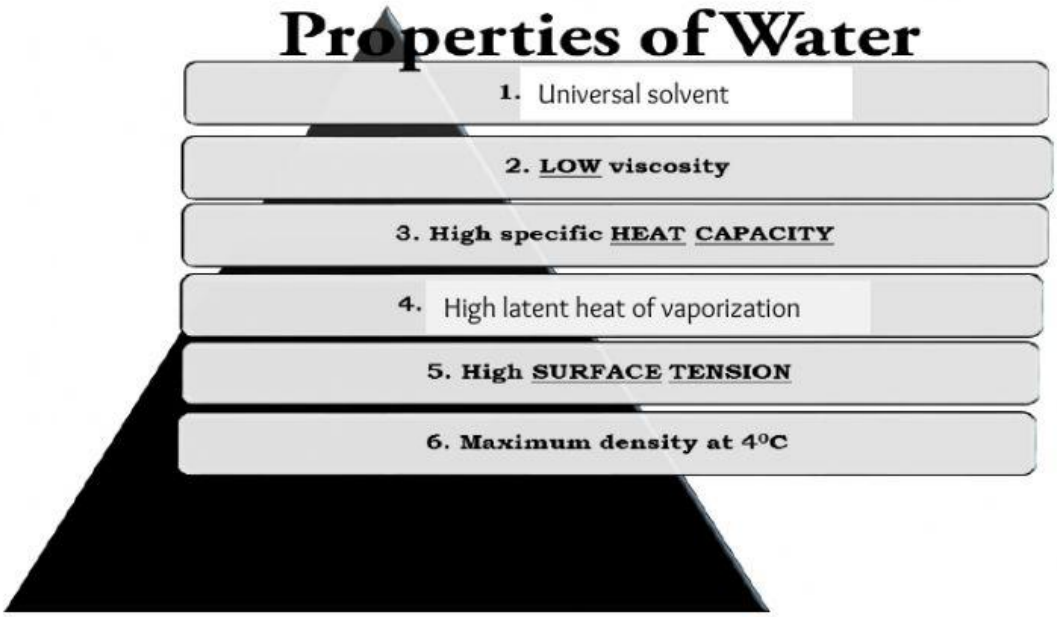
it _____ non-polar molecules (hydrophobic or water-hating substances) e.g. oil.

Polarity of water molecule allows it to form hydrogen bonds with each other.

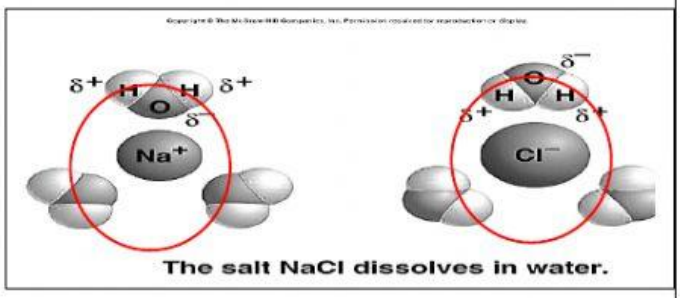
One water molecule able to form _____ hydrogen bonds with another four water molecules.

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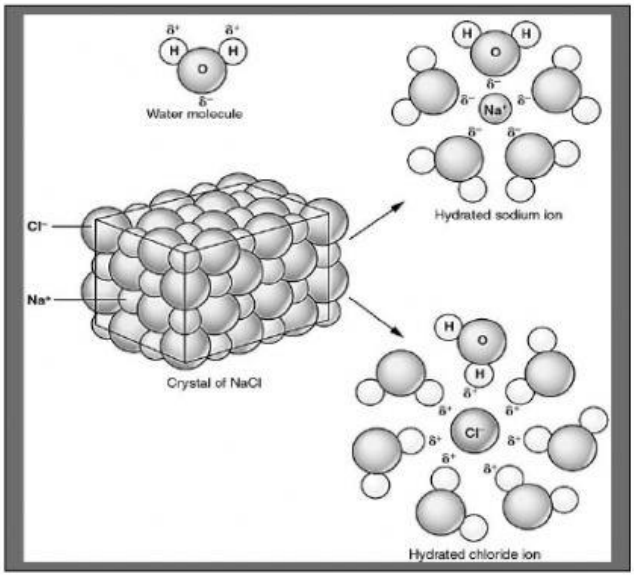
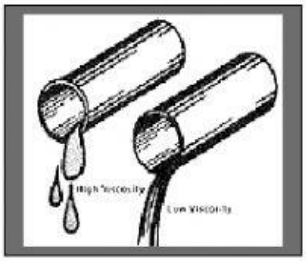
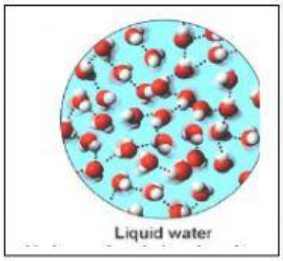
b) State the properties of water.



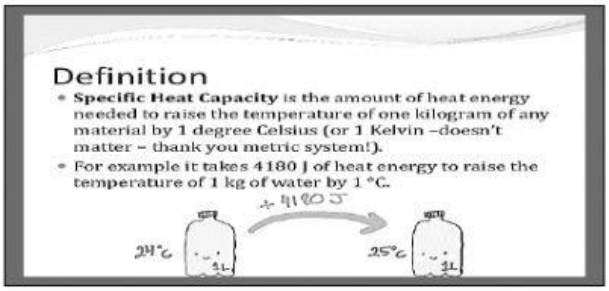
➢ Describe the properties of water and its importance.

No.	Properties of Water	Description
1.	_____	➢ Solvent is dissolving agent of a solution. ➢ Water is a _____ molecule; ➢ that makes it suitables as universal solvent for ions (e.g. Na^+ and Cl^-) and polar molecules. ➢ **Example : NaCl can dissolve in water** ➢ Oxygen atoms of water are attracted to the positively charged _____ ions while, ➢ Hydrogen atoms of water are attracted to the negatively charged chloride ions.  The salt NaCl dissolves in water. ➢ Water molecules gather around the Na^+ and Cl^- to form _____ separating them from one another.

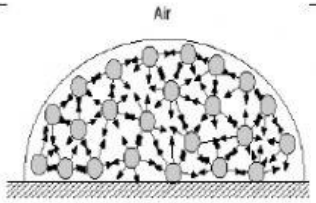
LIVEWORKSHEETS

		➢ Pulling these ions away from the salt crystal ➢ Causes these ions to separate & dissolve.  **Importance of universal solvent:** 1. _____ for most solutes 2. Provides an aqueous medium for biochemical reactions. 3. Serves as the body's major transport medium e.g. in blood capillaries and xylem.
2.	_____ EMBED PBrush	➢ Viscosity is a measure of _____ to flow. ➢ Water has low viscosity because hydrogen bonds between water molecules are being continually broken & reformed. ➢ The less viscous of the fluid the greater its movement (fluidity).   **Importance of low viscosity:** • _____ • Foods could move easily down the alimentary canal. • Synovial fluid within the joints reduces _____ between bone surfaces, thus enables free easy movement.

LIVEWORKSHEETS

		Blood and lymph flow easily in the circulatory system.
3.	_____ _____	**Definition:** The amount of heat must be _____, to raise the temperature of 1g of water, by 1˚C, per calorie (cal) or 1 cal/g/˚C. ➢ Large amount of _____ is needed to increase the temperature of 1g of water by 1°C.  ➢ As water absorb heat, _____ bonds between water molecules are broken. ➢ Only after hydrogen bonds are broken does heat absorption increase the motion of water molecules, thus the temperature of water increase. **Importance of high specific heat capacity:** • Acts as _____ buffer to prevent sudden body temperature changes in cells of organisms. • Allow ocean to _____ relatively constant temperature.
4.	_____ _____ 	**Definition:** Quantity of heat must be _____ for 1g of water to vaporize liquid to _____. ➢ Large amount of heat/energy is used to _____ the hydrogen bonds that link individual water molecule. **Importance of high latent heat of vaporization:** 💧 _____ effect; ✔ _____ of water in sweat on skin or in transpiration from green leaves or panting in animals e.g. dog.
5.	_____ _____	**Definition:** A measure of how _____ it is to break the surface of a liquid. ➢ The stronger the bonds between the molecules in liquid, the _____ the surface tension. ➢ Surface tension is related to _____ forces between water molecules.

LIVEWORKSHEETS

<table>
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<td>➢ <u>In the body of water</u>, water molecules within are attracted _____ by cohesion.

➢ <u>At the air-water interface</u>, cohesive force only from interior.
➢ Thus, the _____ attraction causes the inwardly forces that cause high surface tension at the surface of water.

Importance of high surface tension:

• Many small organisms rely on surface tension to settle on water. E.g.: _____
• Helps in _____ of water in plants.</td>
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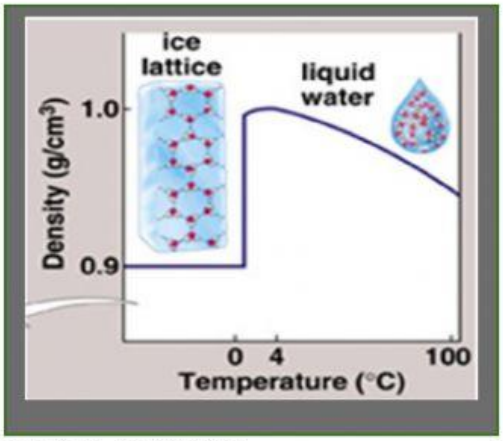
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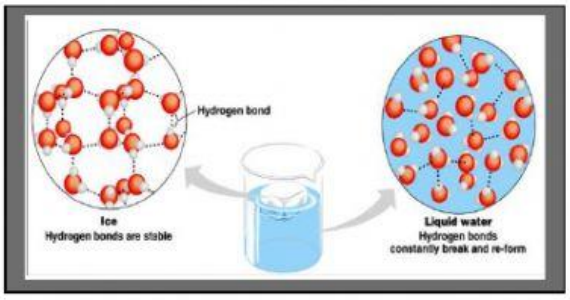
How do aquatic organisms in ponds and lakes can survive in liquid water during the winter

○ Water achieves its highest density at _____.

○ Therefore, ice (0⁰C) is less dense than water and floats on top of water.

○ Water _____ on top of lakes and insulates the layers below from further cooling and freezing.

○ Thus allowing life forms to thrive in the water beneath the ice.</td>
<td>➢ Water achieves its highest density at 4⁰ C.


➢ Therefore, ice (0⁰C) is _____ than water and floats on top of water.
➢ Water is the only substances whose solid form is less dense than its liquid form.

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LIVEWORKSHEETS

1.2 CARBOHYDRATES

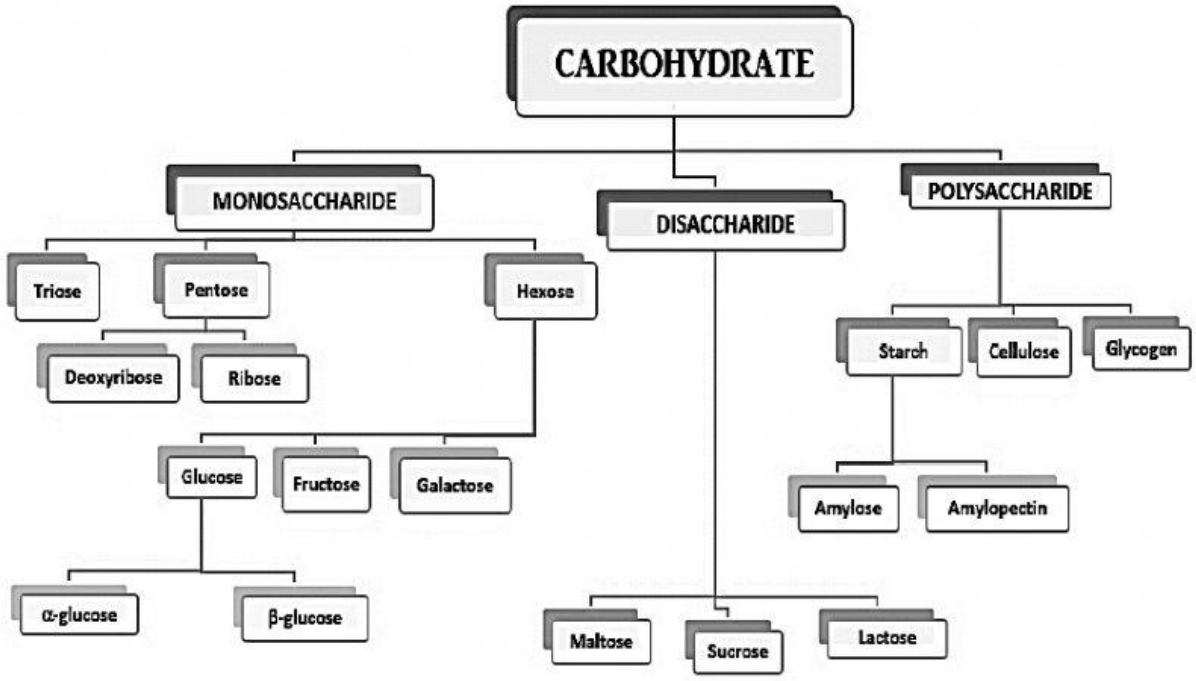
Learning outcomes

At the end of the lessons, students should be able to:

Carbohydrates

a) State the classes of carbohydrates such as monosaccharide, disaccharides and polysaccharides.
b) Identify the structures α-glucose & β-glucose (monosaccharide), maltose (disaccharides) and cellulose (polysaccharides).
c) Describe condensation and hydrolysis.
d) Illustrate the formation and breakdown of maltose.

a) State the classes of carbohydrates such as monosaccharide, disaccharides and polysaccharides.



- Carbohydrates are organic molecules containing the element of **Carbon**, **Hydrogen** and **Oxygen**.
- The ratio of those elements: **1**Carbon: **2**Hydrogen: **1**Oxygen
- The empirical formula: _____

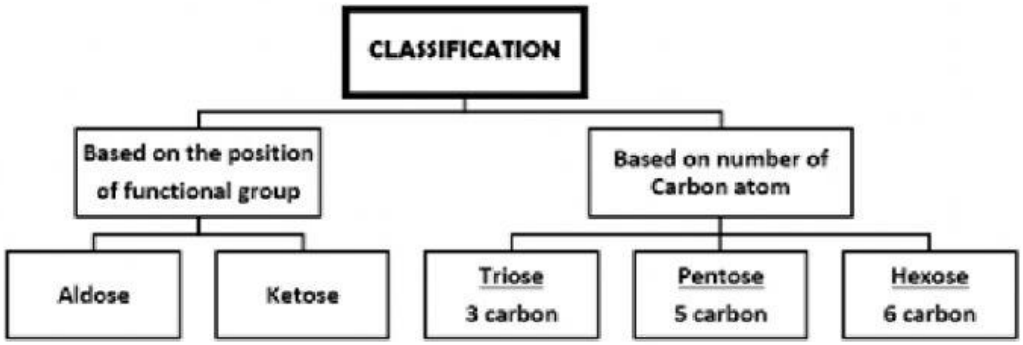
Monosaccharides

1. **Characteristics of Monosaccharides:**

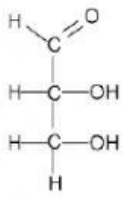
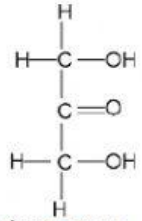
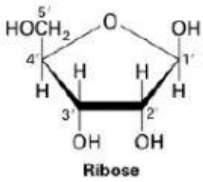
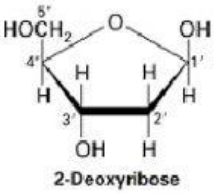
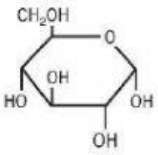
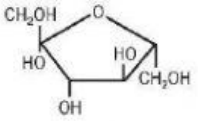
All monosaccharides are:

- sweet-taste soluble in water
- can be crystallized reducing sugars
- The molecule has functional group: aldehydes and ketone

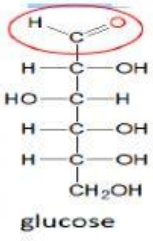
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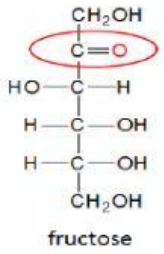
a) Classification of Monosaccharide based on the **number of carbon atom:**

3 classes: 1. _____ sugar (3C sugar) Eg: glyceraldehyde & dihydroxyacetone; $C_3H_6O_3$ Extra reading exercise: State the **importance** of glyceraldehyde and dihydroxyacetone.	 Glyceraldehyde  Dihydroxyacetone
2. _____ sugar (5C sugar) Eg: ribose, ribulose; $C_5H_{10}O_5$, & deoxyribose; $C_5H_{10}O_4$ Extra reading exercise: State the functions of Pentose Sugars. • Component of ATP / AMP / ADP • Component of DNA • Component of RNA	 Ribose  2-Deoxyribose
3. _____ sugar (6C sugar) Eg: glucose, galactose, fructose; $C_6H_{12}O_6$	Glucose  Fructose 

b) Classification of Monosaccharide based on the **position of functional group**:

i. **Aldose sugar** • Carbonyl group is located at the _____ of carbon chain. • Eg: glucose	 glucose

LIVEWORKSHEETS

i. **Ketose sugar** • Carbonyl group is located in the _____ of carbon chain. • Eg: fructose	 fructose

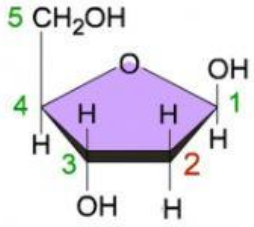
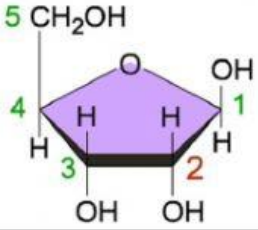
2. **Importance of monosaccharides:**

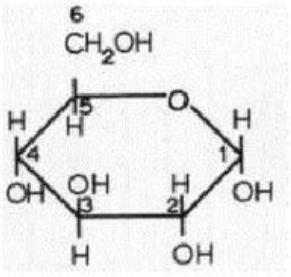
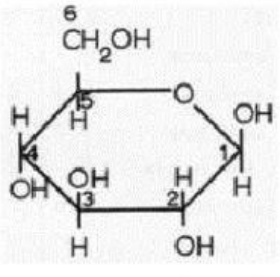
You can refer to books[1] or go to websites[2] for extra readings. Here are some informations on the main importance of monosaccharides.

a) **Energy source**; ~ major respiratory substrate, primary energy source
Eg: Glucose

b) **Basic building units** ~ as monomers for disaccharide & polysaccharide

Exercise 1.2 (a): Examine these diagrams in the tables given and identify the difference(s) between **X** and **Y**. Circle the difference(s).

i. Pentose Sugar	
X	**Y**
	

ii. Hexose Sugar	
X	**Y**
	

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