LO: State the roles of water in living organisms

In animals:

- Medium in which chemical reactions occur.
- Transport dissolved substances around the body eg. digested products, metabolic waste products, hormones.
- Key component of protoplasm, lubricants, digestive juices, blood and tissue fluid.
- Needed in hydrolysis reactions.
- A component of sweat to be evaporated to remove latent heat of vaporisation to cool the body down.

In flowering plants:

- Raw material for photosynthesis.
- Needed for turgor pressure to maintain cell structure.
- Transport of mineral salts and sucrose in xylem vessels and phloem vessels.

Types of chemical reactions:

- **Condensation reaction**: a chemical reaction in which two smaller, simple molecules are joined together to form a larger and complex molecule with the removal of one molecule of water.

- **Hydrolysis/ Hydrolytic reaction**: a reaction in which a water molecule is needed to break down a larger, complex molecule into smaller, simple molecules.

LO:
List the chemical elements which make up
- ***carbohydrates***
- ***fats***
- ***proteins***

State that large molecules are synthesised from smaller basic units.
- ***glycogen from glucose***
- ***polypeptides and proteins from amino acids***
  lipids such as fats from glycerol and fatty acids

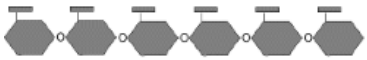
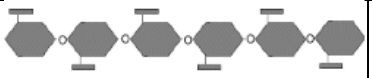
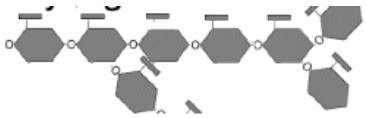
Carbohydrates:

1. Carbohydrates are organic molecules made up of:
   - carbon
   - hydrogen
   - oxygen

2. Ratio of hydrogen to oxygen atoms in carbohydrates: 2:1.

Examples of carbohydrates		
Monosaccharides (cannot be further digested into smaller molecules) $C_6H_{12}O_6$	Disaccharides (made up of 2 molecules of monosaccharides bonded together) $C_{12}H_{22}O_{11}$	Polysaccharides (made up of many monosaccharide molecules bonded together)
glucose	Maltose (glucose + glucose)	Starch
fructose	Sucrose (glucose + fructose)	Cellulose
galactose	Lactose (glucose + galactose)	Glycogen

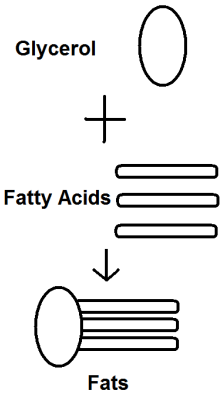
*All monosaccharides and disaccharides (except sucrose) are **reducing sugars**.

Types of complex carbohydrates (made of glucose molecules bonded differently)	Structure	Function	Occurrence
 Starch	linear	Storage (large molecules, insoluble in water, compact shapes, easily hydrolysed)	Storage organs in plants
 Cellulose	linear	Protection from mechanical damage	Cell walls of plants
 Glycogen	branched	Storage (large molecules, insoluble in water, compact shapes, easily hydrolysed)	Stored in the liver and muscles of mammals

3. Functions of carbohydrates:

- Substrate for respiration to release energy for cell activities
- Form supporting structures such as cell walls in plants
- Converted into other organic compounds such as amino acids and fats
- Form part of nucleic acids such as DNA
- Used to synthesise lubricants such as mucus
- Used to synthesise nectar in flowers

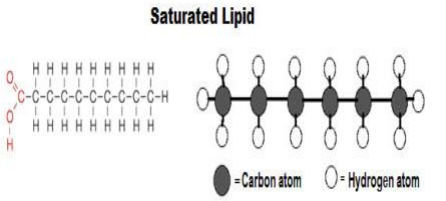
Fats



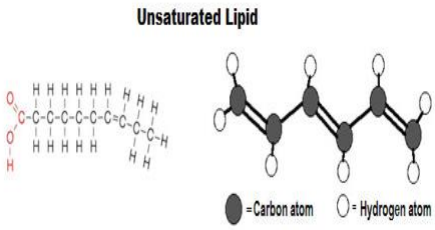
1. Fats are organic molecules made up of:
   - carbon
   - hydrogen
   - oxygen

2. Fats contain much less oxygen in proportion to hydrogen and the proportions of the elements in fats are not fixed.

3. Fats can be broken down into simpler compounds by hydrolysis and it produces fatty acids and glycerol.



4. Functions of fats:
   - a source and store of energy
   - act as an insulating layer to prevent excessive heat loss
   - a solvent for fat soluble vitamins and some hormones
   - form the main part of protoplasm such as cell membrane
   - reduce water loss from the skin surface

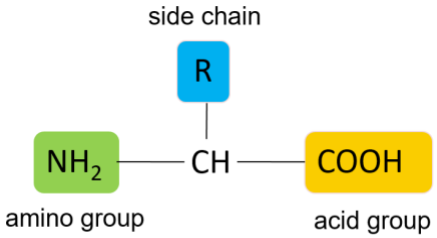


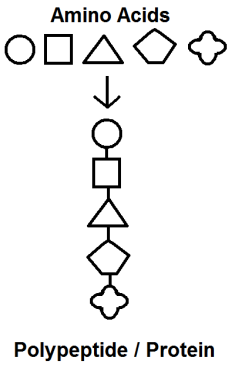
Proteins

1. Proteins are organic molecules made up of:
   - carbon
   - hydrogen
   - oxygen
   - nitrogen
   - sulfur (may or may not be present)

2. Each protein molecule is made up of smaller basic units called amino acids.

3. Amino acids are made up of:
   - amino group
   - acid group
   - side chain





4. Peptide bonds link up amino acids to form a polypeptide.

5. One or more polypeptide chains fold to form a three dimensional structure held by hydrogen bonds called proteins.

6. Function of proteins:
   - Synthesis of new protoplasm for growth and repair of worn out body cells
   - Synthesis of enzymes and some hormones
   - Synthesis of antibodies

LO: Describe and carry out tests for

- ***starch (iodine in potassium iodide solution)***
- ***reducing sugars (Benedict's solution)***
- ***protein (biuret test)***
- ***fats (ethanol emulsion)***

Nutrient	Test and reagent	Observation and conclusion
Starch	• Iodine test • Add a few drops of iodine solution	**Positive:** Blue-black colouration observed **Negative:** Solution remains brown
Reducing Sugars	• Benedict's test • Add equal volume of Benedict's solution to sample solution. • Leave test tube in boiling water bath for 5 minutes	**Positive:** • green precipitate – trace amount • yellow / orange precipitate – moderate amount • orange red precipitate – large amount **Negative:** Solution remains blue
Proteins	• Biuret test • Add 1 cm^3 sodium hydroxide solution to 2 cm^3 of sample solution. • Add 1% copper sulfate solution drop by drop, shaking after every drop.	**Positive:** Violet colouration observed **Negative:** Solution remains blue
Fats	• Ethanol-Emulsion test • Add 2 cm^3 of ethanol to sample and shake thoroughly. • Decant ethanol into another test tube with 2 cm^3 of water.	**Positive:** Cloudy white emulsion observed **Negative:** Solution remains clear and colourless