



Food and Biomolecules

Biology – Leaving Cert

Quick Notes

Food and Biomolecules

Function

Food **source of materials** required by an organism **to provide the energy** to stay alive and reproduce.

Chemical Elements

The following chemical elements are required by all living organisms

- Six common elements present **in food** – **C, H, N, O, P, S**
- Five elements present in **dissolved salts** - **Na, Mg, Cl, K, Ca**
- **Trace Elements:** *Elements needed in very small quantities*
 - **iron (Fe), copper (Cu) and zinc (Zn)**

Biomolecular Structures, Sources and the Components of Food

- **Carbohydrates**
 - Consist of **C, H** and **O** with ratio of **2H : 1O** i.e. $C_x(H_2O)_y$
 - **Monosaccharides: single sugar units** e.g. **glucose**, fructose and galactose, as well as deoxyribose and ribose found in DNA and RNA respectively
 - **Disaccharides: two sugar units joined** e.g. **sucrose**, maltose and lactose
 - **Polysaccharides: macromolecules** [large molecules] made up of **many sugar units** e.g. **starch** in plants, **glycogen** in animals, **chitin** in insect exoskeletons and cellulose in plants
 - **Sources: bread, rice, pasta and sugars**
 - **Functions: sources of quickly available energy and fibre**
- **Fats and Oils (Lipids)**, at room temperature **fats solids; oils liquids**
 - Consist of **C, H and O**, but H and O **not in 2:1 ratio**
 - Basic units are **triglycerides** which consist of **glycerol and three fatty acids**
 - **Phospholipids** make up **cell membranes**
 - **Sources: butter, vegetable oil, cheese and nuts**
 - **Functions: component of cell membranes, storage of energy, heat insulation**
- **Proteins**
 - Consist of **C, H, O** and **N**. Many also contain **S** and **P**.
 - Basic units are **amino acids** [of which there are **20 different types**]
 - **Long chains** of amino acids joined by **peptide bonds**
 - Folded into **complex shapes** which gives them their properties
 - **Sources: - meat, fish egg white, milk and seeds**
 - **Functions: enzymes** *biological catalysts*
- **Vitamins:**
 - Substances **needed in tiny quantities** for proper
 - **Tissue growth**
 - **Cell production**
 - **Health maintenance**
 - **Vitamin D** [fat soluble]
 - **Function:** absorption of **Ca in gut**
 - **Source:** dairy products and formed by skin in sunlight
 - **Vitamin C** [water soluble]
 - **Function:** formation of skin and blood vessels



Monosaccharide: e.g. glucose, fructose

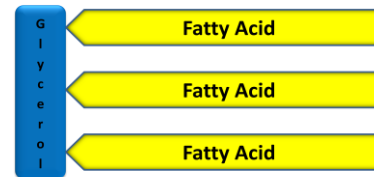


Disaccharide: e.g. sucrose, lactose

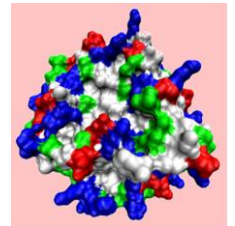


Polysaccharide: e.g. Starch, glycogen, cellulose

Types of Carbohydrates



Lipid Structure



Folded protein

- **Source:** citrus fruits and green vegetable

Structural Role of Biomolecules

- **Carbohydrates:** e.g. cellulose as a component of plant cell walls
- **Protein:** e.g. fibrous proteins – as keratin in hair and skin, myosin in muscles
- **Lipid:** e.g. component of cell membranes, protective by insulation and cushioning

Energy Transfer Reactions

- **Metabolism** is the sum of all the chemical reactions carried out by a living cell or organism
- **Anabolic** reactions use energy to build up more complex molecules out of simple molecules e.g. photosynthesis and protein synthesis
- **Catabolic** reactions break down complex molecules into simpler molecules and release energy in the process e.g. respiration [and digestion]

Metabolic Role of Biomolecules

- **Carbohydrates:** primary sources of energy for metabolic activity
- **Lipids:** primary sources of energy for metabolic activity.
- **Proteins**
 - Enzymes as biological catalysts.
 - Hormones as regulators of metabolic activity.
- **Vitamins**
 - C and D are required for tissue growth, cell production and health maintenance.
 - Lack of vitamins cause diseases called deficiency diseases
 - **Vitamin D:** deficiency disease rickets – symptoms soft bones leading to bow legs
 - **Vitamin C:** deficiency disease scurvy – symptoms loose teeth and bleeding gums.
- **Minerals**
 - **Plants**
 - Calcium to form middle lamella which sticks cells together
 - Magnesium forms chlorophyll
 - **Animals**
 - Calcium – formation of teeth and bones
 - Iron formation of haemoglobin
 - **Trace Element:** Elements needed in very small amounts (e.g. Fe, Cu, Zn)
- **Hormones**
 - Secreted by endocrine [ductless] glands
 - Regulate metabolic activity

Importance of Water for Organisms

- **Component of Cytoplasm:** and body fluid such as blood and semen
- **Solvent:** dissolves minerals e.g. Na and Cl
- **Transport Medium:** carries minerals, amino acids, glucose, hormones, CO₂ and heat around body
- **Chemical Reagent:** used in chemical reactions e.g. digestion and photosynthesis
- **Controls Cell Shape:** e.g. turgidity of plant cells
- **High Heat Capacity:** i.e. it holds a lot of heat and carries it around the body

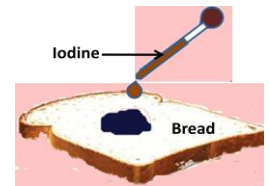
Conduct Qualitative Tests for Food Types

- **Starch:** e.g. **potato**, bread and pasta.
 - Add **iodine**
 - If **starch present** turns **blue black**
 - If **no starch present** stays **brown**.

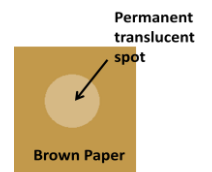
- **Lipid [Fat or Oil]:** e.g. **butter** or vegetable oil
 - Rub on **brown paper**,
 - If **lipid present** brown paper **remains translucent**

- **Reducing Sugar:** e.g. **glucose**
 - Mix with **Benedict's Solution** and **heat gently (do not boil)**
 - If **reducing sugar present** turns from **blue to red**

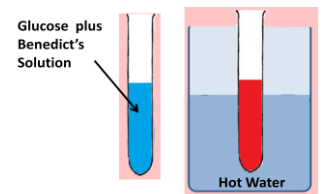
- **Protein:** e.g. **egg white**
 - Add **Biuret Solution** and shake
 - If **protein present** turns from **blue to violet**



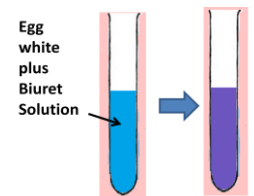
Starch Test



Fat Test



Reducing Sugar Test



Protein Test