Summary

- Biomolecules are chemicals that are made by living things.
- The elements that make up about 96% of the mass of living matter are carbon, oxygen, hydrogen, nitrogen, phosphorus and sulfur.
- The elements that are present as dissolved salts are sodium, chlorine, potassium, magnesium and calcium.
- Trace elements are those elements that are only required by living things in tiny amounts, e.g. iron, copper, zinc and iodine.
- The biomolecules found in food are:
  - Carbohydrates
  - Lipids (fats and oils)
  - Proteins
  - Nucleic acids.

Carbohydrates

- The elements found in carbohydrates are carbon, hydrogen and oxygen, in the ratio $C_x(H_2O)_y$.
- There are three types of carbohydrates:
  - Monosaccharides are composed of a single sugar unit (e.g. glucose, fructose, ribose). Monosaccharides are the basic unit of carboyhdrates.
  - Disaccharides are composed of two sugar units joined together (e.g. maltose, sucrose, lactose).
  - Polysaccharides are composed of many sugar units (e.g. starch, glycogen, cellulose).
- Metabolic roles:
  - Glucose is used in respiration (catabolic).
  - Glucose is made in photosynthesis (anabolic).

Lipids

- The elements found in lipids are: carbon, hydrogen and oxygen.
- Fats are lipids that are solid at room temperature.
- Oils are lipids that are liquid at room temperature.
- A triglyceride is made up of one molecule of glycerol and three attached molecules of fatty acids. Triglycerides are the basic unit of lipids.
- A phospholipid is made up of one molecule of glycerol, two attached molecules of fatty acids and a phosphate group.
- Metabolic roles:
  - Lipids can be used in respiration to release energy (catabolic).
  - Steroids, such as cholesterol, are used to make hormones.

Proteins

- The elements found in proteins are: carbon, hydrogen, oxygen, nitrogen and sometimes sulfur or phosphorus.
- Amino acids are the basic unit of proteins.
- There are 20 common amino acids in the formation of proteins.
- A peptide is a short chain of amino acids (up to 50 amino acids).
- A polypeptide consists of a long chain of amino acids bonded together (more than 50 amino acids).
- A protein forms when over 200 amino acids are joined in a chain. When proteins form, they fold into complex three-dimensional shapes.
- Fibrous proteins show very little folding, e.g. keratin, myosin.
- Globular proteins show a lot of folding, e.g. haemoglobin, enzymes.
- Metabolic roles:
  - Enzymes control reactions.
  - Hormones regulate processes.
  - Proteins are essential to the structure and functions of membranes.
  - Antibodies fight infection.

Minerals

- Minerals are inorganic nutrients that plants and animals require in small amounts.
- Minerals include calcium, phosphorus, sulfur, potassium, chlorine, sodium, magnesium, iron, fluorine and iodine.
- Minerals are needed for:
  - Controlling pH
  - Controlling enzyme systems
  - Transmission of nerve impulses
  - Muscle contraction
  - Forming structures like bones and teeth.

Vitamins

- Vitamins are complex biomolecules that are not made in the body but are needed in tiny amounts.
- There are 13 vitamins required in our diet. They can be subdivided into two categories:
  - Water-soluble: vitamins B and C. Vitamin C is necessary for the formation of collagen, growth and maintenance of bone and teeth, helping wounds to heal and immune function.
  - Fat-soluble: vitamins A, D, E and K. Vitamin D helps absorb calcium for healthy bone and tooth formation.
- Deficiency:
  - A lack of vitamin C causes scurvy.
  - A lack of vitamin D causes rickets.

Water

- Water makes up about 60% of the mass of the human body.
  - Main component of cytoplasm and body fluids
  - Good solvent
  - Maintains neutral pH
  - Participates in chemical reactions
  - Moves easily through membranes
  - Helps to regulate temperature.

To investigate qualitatively the presence of starch in a range of food samples

1. Add iodine solution to a range of food samples.
2. If the colour remains red-yellow, then starch is not present.
3. If the colour turns blue-black, then starch is present.

To investigate qualitatively the presence of reducing sugar in a range of food samples

1. Add Benedict's (or Fehling's) qualitative solution to a range of food samples.
2. Place in a very hot water bath.
3. If the colour remains blue, then reducing sugar is not present.
4. If the colour turns brick-red, then reducing sugar is present.

To investigate qualitatively the presence of protein in a range of food samples

1. Add Biuret reagent to a range of food samples.
2. If the colour remains blue, then protein is not present.
3. If the colour turns purple-violet, then protein is present.

To investigate qualitatively the presence of lipids in a range of food samples

1. Rub the food samples on a piece of brown paper.
2. Leave to dry.
3. If a permanent stain (or translucent spot) remains, then lipid is present.
4. If a permanent stain does not remain, then lipid is not present.

To investigate quantitatively the level of reducing sugars in a range of food samples

1. Add Benedict's (or Fehling's) quantitative solution to a range of food samples.
2. Place in a very hot water bath.
3. If the colour remains blue, then reducing sugar is not present.
4. If the colour turns green, yellow, orange or red, then increasing concentrations of reducing sugar are present.