Carbon, **Hydrogen**, and **Oxygen** are most frequently occurring chemical elements in living things.
A variety of other elements are needed by living organisms including nitrogen, calcium, phosphorus, iron and sodium.
Nitrogen – Component of proteins and nucleic acids; component of chlorophyll in plants.
Calcium – Structural component of bones and teeth. Calcium ion is important in muscle contraction, conduction of nerve impulses, and blood clotting; associated with plant cell wall.
Phosphorous – Component of nucleic acids and of phospholipids in membranes; important in energy transfer reactions; structural component of bone.
Iron – Component of hemoglobin in animals; activates certain enzymes
Sodium – Sodium ion is a principal positive ion (cation) in interstitial (tissue) fluid of animals; important in fluid balance; essential for conduction of nerve impulses; important in photosynthesis in plants.

Atom	Ion
Atom is composed of nucleus containing protons and neutrons.	A particle with one or more units of electrical charge is called an ion.
Neutral	Charged (cations and anions)

The difference between an atom and its ions is the number of electrons that surround the nucleus.

Properties of Water:

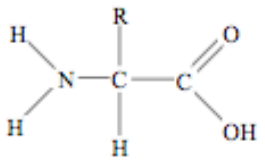
1. Solvent for most biological reactions, can be either the reactant or the product in chemical reactions.
2. Water is polar, has a positive charge
3. Each water molecule can form hydrogen bonds with as many as four neighboring water molecules.
4. Is a principal solvent
5. Hydrophilic – "water-loving" interacts readily with water (i.e. sugar, salt)
6. Hydrophobic – "water-fearing"
7. Cohesive – water sticks to itself because of hydrogen bonding
8. Adhesive – sticks to other things, making them wet
9. Has high surface tension
10. Homeostasis – helps to maintain a stable body temp – between 97 F and 99 F
11. Calorie – heat needed to raise one gram of water 1C

Thermal properties—large amounts of energy required to heat up water and change its state (and the reverse).
Solvent properties—water is capable of dissolving many organic and inorganic substances.
Hydrogen bonding between water molecules is responsible for the surface tension of water, which is strong enough to support water striders—they are able to walk on the pond.
A lot of heat input is required to raise the temperature of water (and so much heat is lost when the temperature is lowered), therefore oceans have constant temperatures making it easier for aquatic life

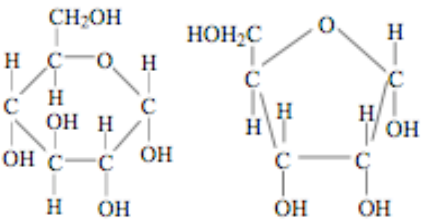
Water is used in organisms as a coolant, a transport agent, and a habitat. Water acts as a coolant because it has a very high specific heat value. This means that it takes a large amount of energy to break the hydrogen bonds between molecules to increase the temperature of water. Water, therefore, remain relatively constant in temperature. The relatively constant temperature allows an organism to remain at a relatively constant temperature. It acts as a transport agent in plants by carrying nutrients to the cells of the plant via diffusion. In animals, it allows blood to be more fluid and transport nutrients and oxygen to body cells. It acts as a habitat for many plants and animals, allowing an easy was for organisms to move and carrying nutrients in the water.

Carbohydrates, Lipids, and Proteins

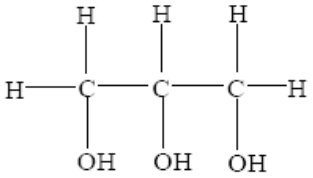
Organic compounds are compounds that contain carbon and are found in living organisms.
Amino acids contain an amino group (NH_2) and a carboxyl group (COOH) bounded to a carbon atom. The structure below is a basic amino acid (you do need to know the drawing)



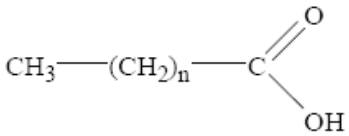
Glucose and ribose are sugars containing carbons. Glucose has 6 carbon atoms and ribose has 5. The structures are as follows:



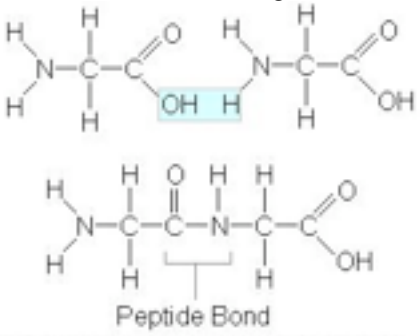
2.2.4 Draw the structure of glycerol and a generalized fatty acid.
Glycerol:



Glycerol is a three-carbon alcohol that contains three hydroxyl (-OH) groups.
Fatty acid:



A fatty acid is a long unbranched hydrocarbon chain with a carboxyl group (-COOH) at one end. See page 56 for pictures of both of these and more explanation on both 55 and 56.
A glycerol bonded to three fatty acids creates a triacylglycerol.
2.2.5 Outline the role of condensation and hydrolysis in the relationships between monosaccharides, disaccharides and polysaccharides; fatty acids, glycerol and glycerides; amino acids, dipeptides and polypeptides.
Condensation – the removal of water to create links. A water molecule is removed, linking monomers covalently.
Hydrolysis – to break with water. Polymers degraded to component monomers.
a. monosaccharides, disaccharides and polysaccharides: Through hydrolysis, or the addition of water, disaccharides and polysaccharides can be broken into monosacchrides. Monosacchrides can combine to create disaccharides and polysaccharides through condensation.
b. fatty acids, glycerol, and glycerides: glycerol and fatty acids combine through condensation to produce glycerides.
c. amino acids, dipeptides, and polypeptides: Condensation causes amino acids to bond to each other, creating dipeptides and polypeptides.
2.2.6 Draw the structure of a generalized dipeptide, showing the peptide linkage.



A molecule of water is removed from two glycine amino acids to form a peptide bond.

The two amino acids on the top can be seen combined into the dipeptide at the bottom.
2.2.7 List two examples for each of monosaccharides, disaccharides and polysaccharides.
The names of the component monomer units of the dissacharide and poly saccharide examples are required, but not the structural formulas.
Monosacchrides: glucose, fructose
Disaccharides: Maltose (glucose + glucose), sucrose (glucose + fructose)
Polysaccharides: starch (many glucose), glycogen (many glucose), cellulose (many glucose)

* One function of a monosaccharide is that it is a major nutrient for the cell. One function of a polysaccharide is that it provides structural support for the cell.

* One function of lipids is that they are great insulators. Also, some lipids function as hormones. In addition, lipids are used for long-term energy storage.

* The use of carbohydrates in energy storage is through its sugar polymers, glycogen in animals and starch in plants. These sugars are released when the demand for sugar increases. Animals use lipids, mainly fats, for long-term energy storage.

* An enzyme is a globular protein functioning as a biological catalyst. An active site is the site on the surface of an enzyme to which substrate or substrates bind.