

➤ **ATOMS & BIOLOGICALLY IMPORTANT MOLECULES AND MACROMOLECULES**

➤ **ATOMS**

- As with everything in the universe, life is made of matter. **Matter is anything that occupies space and has mass. Matter is formed from various chemical elements.**
- A **chemical element** is a substance that cannot be broken down into another substance. There are at least 92 naturally occurring chemical elements. There are more than 12 more elements which have been made artificially in the laboratory (these do not exist for a very long time). Each chemical element is assigned a one or two letter abbreviation and the elements are arranged on the periodic table each according to their unique structure (number of protons, neutrons, and electrons).
- Each element consists of a single type of atom. An **atom** is the smallest unit of an element. Atoms are made of many different subatomic particles. There are three basic subatomic particles that make up an atom: **protons, electrons, and neutrons.**
- **Chemical reactions involve the interactions of atoms.** When two atoms with incomplete outer shells react, each atom gives up or takes electrons in a way so that each atom ends up with outer shells that are full. These interactions eventually cause the atoms to be held together by a chemical bond. A chemical bond can be an ionic bond or a covalent bond.
- **Atoms** can combine or bind together to form compounds or **molecules**. A compound or a **molecule** is a substance that contains two or more atoms. Most of the mass of living organisms is made of thousands of different compounds.

➤ **ORGANIC COMPOUNDS**

- **Compounds containing the element carbon, called organic compounds, are the most important substances that make up living organisms.** There are thousands and thousands of different organic compounds. The tremendous diversity of carbon-containing compounds comes from carbon's ability to share electrons with four other atoms. That is, **each carbon atom can make four covalent bonds.**
- Many of the important molecules necessary for life are large molecules or macromolecules that are made up of smaller molecules. **Macromolecules** are a type of polymer. Polymers are big molecules made of many smaller units called **monomers**. Living cells produce many types of polymers. **For example, DNA, is a polymer of smaller monomers called nucleotides. Proteins and fats are also types of polymers.**

➤ **BIOLOGICALLY IMPORTANT MOLECULES & MACROMOLECULES**

• **CARBOHYDRATES**

Carbohydrates are compounds that contain carbon, hydrogen and oxygen usually in a multiple of **CH₂O** (that is, most carbohydrates have two hydrogen atoms for each carbon and each oxygen atom). **Monosaccharides** are simple sugars and they are the simplest carbohydrates. **Glucose** is an example of a monosaccharide. **Disaccharides** are made of two simple sugars linked together. **Lactose** (milk sugar) and **sucrose** (table sugar) are disaccharides. Many ingested carbohydrates are **polysaccharides**. **Polysaccharides** are chains of interconnected simple sugars such as glucose. **Cellulose, Starch, and Glycogen are polysaccharides each of which is made up of many glucose sugars bonded together.**

- **LIPIDS (FATS are an example)**

Lipids are diverse compounds that consist mainly of hydrogen and carbon atoms in long chains.

Lipids are hydrophobic = they are not soluble with and don't mix into water.

Triglycerides (or Fatty Acid Triglycerides (**FATS**)) consist of a molecule of glycerol linked to three fatty acid molecules. A **monoglyceride** is made up of a molecule of glycerol with one fatty acid molecule attached to it. A **diglyceride** is made up of a molecule of glycerol with two fatty acids bonded to it.

- **Waxes, oils, and steroids are lipids and are thus hydrophobic (water-fearing).**

- **Phospholipids are a major component of cell membranes. They contain the element phosphorus. A phospholipid is made of a molecule of glycerol, two fatty acid molecules and a phosphorus containing molecule.** So, one portion, the head, of the phospholipid is polar or hydrophilic (water-loving) and the fatty acid tails of the phospholipid are non-polar or hydrophobic (water-hating).

- **PROTEINS**

Proteins are large chains of amino acids held together by peptide bonds. Naturally occurring proteins are made of just 20 different kinds of amino acids. **Amino acids** are a special type of organic compound that contain carbon, nitrogen, hydrogen, and oxygen. A **peptide bond** forms between two amino acids to link them together and make a protein. Small proteins made up of only a few amino acids are called **peptides**. Larger proteins made up of many amino acids are called **polypeptides**.

- **NUCLEIC ACIDS**

Nucleic acids are polymers of smaller monomer units called nucleotides. **DNA (deoxyribonucleic acid)** and **RNA (ribonucleic acid)** are the nucleic acids found in living organisms. DNA contains the genes (found in the cell nucleus) that are the genetic blueprint for life. RNA is an intermediary molecule that puts the DNA genetic information to work in the cell.