

Chapter 2: The Chemistry of Life

- All living things consist of atoms bonded together in molecules, or compounds.
- There are several types of bonds to know – ionic, covalent, hydrogen, and peptide bonds.
- Water is essential to life. Hydrogen bonds allow water to have 3 important properties – high specific heat, cohesion, and adhesion.
- Solutions are mixtures composed of solvents and solutes.
- Acids release protons (pH 0 – 6), bases gain protons (pH 8 – 14). Most living things must maintain a neutral pH, near 7.
- Carbon atoms are unique in that they can bond with up to 4 other atoms.
- Monomers are the subunits that make up polymers.
- There are 4 classes of organic molecules – carbohydrates, lipids, proteins, and nucleic acids.
- Carbohydrates are sugars and starches. Most are detected by using a Benedict's test, though starches can be tested using an iodine (IKI) solution.
- Lipids are fats, oils, and waxes. They are tested with a brown paper lipid test.
- Proteins are the “workhorses” of our cells. They are detected using a Biuret test.
- Nucleic acids work together to form proteins.
→ You MUST know the structures, functions, and several examples of these organic molecules!
- Chemical reactions involve the breaking / forming of chemical bonds.
- Activation energy is the amount of energy that's needed to start a chemical reaction.
- Endothermic reactions absorb more energy than they release; exothermic reactions release more energy than they absorb.
- Enzymes are catalysts that lower the activation energy of a reaction. Substrates (reactants) bind to enzymes at specific locations, called active sites, after which the reaction is catalyzed, forming the product.

Chapter 3: Cells

- Hooke, Leeuwenhoek, Schleiden, Schwann, and Virchow all greatly contributed to the development of the cell theory.
- The cell theory states that – (1) all organisms are made of cells, (2) cells come from pre-existing cells, and (3) the cell is the most basic unit of life.
- Prokaryotic (meaning, “before a nucleus”) cells are the most primitive and ancient type of cells. They lack a nucleus and membrane-bound organelles. Prokaryotic organisms are found in domains Bacteria and Archaea, and are always unicellular.
- Eukaryotic (meaning, “true nucleus”) cells are more complex and contain a nucleus and membrane-bound organelles. Eukaryotic organisms are found in domain Eukarya (and in kingdoms Protista, Fungi, Plantae, and Animalia), and may be uni- or multicellular.
- Organelles are structures specialized to perform distinct processes within a cell. The only organelle NOT surrounded by a membrane is the ribosome.
→ You MUST know the functions and locations (prok./euk.; plant/animal cells) of ALL organelles.
- The cell membrane is composed of a phospholipid bilayer, which orients hydrophilic (water-loving) parts on the outside, and hydrophobic (water-fearing) parts on the inside. Cholesterol, carbohydrates, and transport proteins are also found in the membrane.
- The fluid mosaic model describes the characteristics of the cell membrane.
- The membrane is said to be selectively permeable.
- Passive (diffusion, osmosis, facilitated diffusion) VS. active transport (endocytosis (phago- and pinocytosis), exocytosis) processes, their energy requirements, and their relationships to concentration gradients.

- Solutions may be isotonic, hypertonic, or hypotonic when compared to a given cell. This can cause cells to swell and burst, or shrivel.
→ You MUST be able to predict the movement of water (osmosis) when given concentrations of a solution and a cell found within that solution.

Chapter 5:

- The cell cycle includes periods of growth (G1, G2), synthesis of DNA (S), and division (M). Cells go through the cell cycle at different rates, depending on cell type and size.
- Chromosomes are condensed DNA and histone proteins. They are made up of 2 identical sister chromatids held together at a centromere.
- Mitosis (M stage) includes PMAT and cytokinesis, and results in the formation of 2 identical, diploid daughter cells (each has 46 chromosomes). This occurs in body (somatic) cells, but NOT in sex cells (gametes).
- Asexual reproduction includes: binary fission (ex. prokaryotes), fragmentation (ex. starfish), budding (ex. yeast), and vegetative reproduction (ex. potatoes).
- Cancer is caused by uncontrolled cell division. Tumors may be benign (localized) or malignant (spreading).
- Stem cells may be totipotent, pluripotent, or multipotent.