**Biology Mid-Year Review**

**Chemistry of Life: Chapter 6**

**Draw and label the four major types of macromolecules.**

Lipid: (This one is a tri-glyceride)

Carbohydrate:  (This one is the monosaccharide, glucose)

Protein: (An amino acid monomer of protein. Amine group on left, carboxyl on right, variable chain represented by R)

Nucleic Acid:  (This one is DNA, it is a double helix made from two phosphate backbones and joined by nucleotide bases)

**Describe how each macromolecule is used by an organism.**

Lipids: LONG TERM energy storage, also provide barriers

Carbohydrates: energy to be used immediately, also provide structure

Proteins: Transport substances, decrease reaction times, make hormones, provide structural support

Nucleic Acids: store and communicate genetic information.

**Define enzymes.**

Proteins that are biological catalysts

**Define active site, catalyst, activation energy, and substrate.**

Active site: where substrates bind to an enzyme

Catalyst: something that speeds up a chemical reaction

Activation energy: the amount of energy necessary for a chemical reaction to begin.

Substrate: the reactants that bind to the enzyme

**Explain the function of an enzyme in a cell.**

Enzymes lower the activation energy necessary for a chemical reaction to occur.

**Explain how temperature and pH affect enzyme activity.**

Enzymes have pH levels and temperatures at which they are most efficient. Extreme pH (either very acidic or very basic) along with extreme temperatures can denature proteins (cause them to change their shape) which will keep them from doing their jobs (remember our liver lab?)

**List the properties of water that are important for life.**

Polarity: water is a polar molecule, and bonds with other polar molecules. Because of this, water is an excellent solvent. It is known as “the universal solvent”.

Cohesion: Water molecules stick together using hydrogen bonds, this makes water have high heat capacity, which helps organisms regulate temperature.

**Draw a water molecule and label the parts.**

Your drawing should have two hydrogens, an oxygen, and show relative charges.

**Define polar, covalent bonds, adhesion, and cohesion.**

Polar: molecules that are polar have an uneven distribution of charges.

Covalent bonds: In covalent bonds, electrons are shared between two atoms.

Adhesion: Water molecules form hydrogen bonds with molecules on other surfaces, this allows for capillary action in plants.

Cohesion: Water molecules are attracted to each other and form hydrogen bonds. This property contributes to water’s high heat capacity, high surface tension, and ability to form droplets

**Compare and contrast ionic bonds and covalent bonds.**

In ionic bonds, one atom takes electrons from another atom, leaving both atoms as charged ions. In covalent bonds, two atoms share electrons.

**Cells: Chapter 7**

**What are the three tenets (parts) of cell theory?**

* All living things (plants, animals, unicellular organisms, everything alive!) are made of cells
* Cells only come from other cells
* The cell is the basic unit of life.

**Why did cell theory take so long to develop? Which scientists were most instrumental in its development?**

Cell theory took a long time to develop because theories require many repeated observations from many different scientists over a long period of time to be considered valid. Additionally, cell theory’s progress was slowed by the lack of technology available at the time cells were discovered. As microscope technology improved, so did the strength of the cell theory.

**Draw a diagram of the cell membrane and label the parts, be sure you are not drawing ONLY the phospholipid bilayer.**



**Explain how the cell membrane works (what are the functions of its parts, what does it do as a whole?)**

The cell membrane controls what enters and exits the cell. The phospholipid bi-layer is selectively permeable, only allowing small, uncharged molecules to pass through. Protein channels and pumps inside the membrane allow for active transport in which larger molecules and molecules moving against the concentration gradient are allowed to enter the cell. As a whole, the cell membrane contributes to the cell’s ability to maintain homeostasis.

**Define: Osmosis, Diffusion**

Diffusion: the net movement of particles from an area of high concentration to an area of low concentration (WITH the concentration gradient)

Osmosis: the diffusion of water across a semi-permeable membrane.

**Define and give an example of each: Active Transport, Passive Transport**

Active Transport: movement of molecules in or out of a cell, this movement requires energy and is usually for large molecules, charged molecules, or molecules moving against the concentration gradient. Ex: exocytocis.

Passive transport: the movement of molecules along the concentration gradient, requires no energy from the cell.

**List the organelles that we have learned about along with their functions (see page 199).**

All answers are on p. 199

**Compare and contrast (Venn Diagram works well) plant and animal cells.**

Plant cells have cell walls, chloroplasts, large central vacuoles. Animal cells have centrioles. Everything else is in both, either rarely or always.

**Define Eukaryotic and Prokaryotic, compare and contrast the two cell types.**

Eukaryotic: Cells that contain nuclei and membrane-bound organelles.

Prokaryotic: Cells without a nucleus or other membrane-bound organelles

Eukaryotic cells are much more complex than prokaryotic cells.

**Cellular Energy: Chapter 8**

What is the basic/overall formula for photosynthesis?

 6 CO2 + 12 H2O → C6H12O6 + 6 O2

**How is energy transferred in photosynthesis? (What form of energy does photosynthesis begin with, what kinds of energy is it transferred to during the process)**

In photosynthesis, light energy (from the Sun) is transferred into chemical energy. Eventually, it is stored as chemical energy in the form of glucose.

**Write the basic formula/overall for cellular respiration.**

 C6H12O6 + O2 → CO2 + H2O + “liberated” ATP (38!)

**Define aerobic and anaerobic respiration. What is the difference between the two?**

Aerobic cellular respiration is respiration in the presence of oxygen. Anaerobic respiration is respiration without oxygen.

Aerobic: in the mitochondria of plant and animal cells, produces 36-38 ATP per glucose, CO2 and H2O

Anaerobic: occurs in anaerobic bacteria and muscle cells, produces 2 ATP and either lactic acid(muscle) or alcohol (bacteria)

**How are photosynthesis and cellular respiration related?**

Photosynthesis and cellular respiration are cyclical processes. The energy produced during photosynthesis is a reactant required for cellular respiration, and the products of cellular respiration are the reactants for photosynthesis.



**Define ATP.**

Adenosine Triphosphate or ATP transports chemical energy within cells for metabolism.

**How does ATP contribute to energy transfer within a cell? (How does a cell get energy from ATP?)**

When the third phosphate bond is broken, the chemical energy of ATP is released for use.

**Cell Cycle: Chapter 9**

**Describe what happens in each phase of the cell cycle.**



Additionally: cytokinesis, cell fully divides after mitosis either via a cleaved at the furrow and or a cell plate, resulting in two identical daughter cells.

**Draw and label each stage of mitosis. (Ignore the prometaphase, it DOES exist, but it is beyond the scope of your course)**



**Describe what happens in each stage of mitosis.**

**Pre mitosis: centrosomes appear, genetic material is duplicated. Prophase: Nuclear envelope begins to dissolve, spindle apparatus begins to form, chromatin condenses. Metaphase: chromosomes align on the metaphase plate, spindle fibers attach at the centromeres. Anaphase: sister chromatids are pulled apart and towards the poles. Telophase: nuclear envelope/nucleolus begins to reform, furrow in animal cell, cell plate in plants. Cytokinesis: cells cleave into two.**

**How do mutations affect cells?**

Mutated cells that pass checkpoints and go unrepaired can become cancerous. Mutations in somatic cells in one area of an organism can cause cancer in that area. Eventually, the cancer can metastasize, or move to another part of the organism.

**Compare and contrast healthy and cancerous cells.**

Cancer cells have uncontrolled growth, they also have an abnormal, irregular shape. Cancer cells also spend far less time in interphase than normal, healthy cells.

**If a cell has 46 chromosomes and undergoes mitosis, how many daughter cells are produced from this original cell, and how many chromosomes will each daughter cell have?**

Two identical daughter cells with 46 chromosomes each will be produced.

**What type of reproduction occurs via mitosis?**

Asexual

**Define diploid and haploid. Are somatic (non-sex cells) diploid or haploid?**

Diploid: A cell with two copies of each chromosome (in sexually reproducing organisms, one from mother and one from father), often shown as 2n.

Haploid: A cell with half the number of chromosomes as a diploid cell (sex cells before fusing with other cells, after the process of meiosis has reduced their chromosome numbers by half)

Somatic cells are diploid

**Chapter 10: Sexual Reproduction and Genetics**

**Define sexual reproduction and asexual reproduction. (see page 276)**

Asexual reproduction: an organism inherits all of its chromosomes from a single parent

Sexual reproduction: an organism inherits half of its genetic material from one parent and half from another

**How does sexual reproduction affect genetic diversity?**

**Because organisms that reproduce sexually have two parents from which to inherit DNA, there is more genetic diversity in sexually reproduced organsisms. Crossing over, which occurs in prophase 1 of mitosis ensures that the genetics of resulting cells are even more unique.**

**What is the product of meiosis? How is this product different than the product of mitosis + cytokinesis?**

**Meiosis produces four genetically unique haploid daughter cells, but mitosis produced two genetically identical diploid daughter cells**