Bio 151 Study Guide: Exam 1

Note: This is a general rework of the study guides for Dr. Ellis's Bio 151 class for my own use.

Objectives

Atoms, Elements and Molecules (Chapter 2)

- Describe:
  - Structure of an atom: _____
  - **atomic number:** _____
  - **atomic mass:** _____
  - **valence electrons:** _____
  - **isotopes**: _____
- Distinguish between: _____
  - Molecules: _____
  - Compounds: _____
- Essential elements required for life: _____
- Distinguish between
  - **covalent bonds**:
    - relative strength: _____
    - molecule found in: _____
    - example in a biological system: _____
  - **ionic bonds**:
    - relative strength: _____
    - molecule found in: _____
    - example in a biological system: _____
  - **hydrogen bonds:**
    - relative strength: _____
    - molecule found in: _____
    - example in a biological system: _____
- Define a chemical reaction: _____
- **Reactants**: _____
- **products:** _____

The Life Supporting Properties of Water (Chapter 3)

- Describe the special properties of water that make it vital to living systems:
  _____
  _____
  _____

- Explain how these properties are related to hydrogen bonding:
  _____
  _____

_____
_____

- **solute:** _____
- **solvent**: _____
- **solution**: _____
- **hydrophobic:** _____
- **hydrophilic** : _____
- Explain how acids and bases affect the hydrogen or hydroxide ion concentration of a solution:

  _____
  _____
- Explain the basis for the pH scale:

  _____
  _____
- Which is more acidic: pH 2 or pH 12? _____
- By what factor are they different?
- What is the pH of:
  - Blood: _____
  - Water: _____
  - stomach acid: _____
- Define **buffer**: _____

Organic Compounds (Chapter 4)

- Distinguish between an organic and inorganic compound:

  _____
  _____
- Define **functional group:**

  _____
  _____
- Describe the various classes of functional groups and in which organic molecules you find them.

  (See Chart 1)

- Describe three types of **isomers**
  - _____
    _____
    _____
  - _____
    _____
  - _____
    _____
- How isomers impact biomolecules:

  _____
  _____
  _____
  _____

Biological Macromolecules (Chapter 5)

- **Monomers:** _____
- **Polymers**: _____
- **Dehydration synthesis:**
  _____
  _____
  _____
  - describe how it helps to form macromolecules: _____
    _____
    _____
    _____
  - how it helps to degrade macromolecules:
    _____
    _____
    _____
    _____
    _____
- **Hydrolysis**:
  _____
  _____
  - describe how it helps to form macromolecules: _____
    _____
  - how it helps to degrade macromolecules: _____
    _____
- Describe the four classes of macromolecules:
  - 1) _____
    - Monomers its composed of: _____
    - Examples of macromolecule: _____
    - Celular Function: _____
  - 2) _____
    - Monomers its composed of: _____
    - Examples of macromolecule: _____
    - Celular Function: _____
  - 3) _____
    - Monomers its composed of: _____
    - Examples of macromolecule: _____
    - Celular Function: _____
  - 4) _____
    - Monomers its composed of: _____
    - Examples of macromolecule: _____
    - Celular Function: _____

- Glucose
  - Structure: _____
  - Function: _____
- Starch
  - Structure: _____
  - Function: _____
- Glycogen

    - Structure: _____
    - Function: _____
- Cellulose
    - Structure: _____
    - Function: _____
- Saturated fats: _____
- unsaturated and trans fats: _____
- hydrogenation: _____
    - How does it affect the structure of a fat?:
      _____
      _____
      _____
    - how this relates to human health:
      _____
      _____
      _____
- Describe the four levels of protein structure
    - 1) _____
    - 2) _____
    - 3) _____
    - 4) _____
- **chaperonins** contribute to protein structure:
  _____
  _____
  _____
- Compare and contrast the structures and functions of DNA and RNA:
  _____
  _____
  _____
- Describe the significance of hydrogen bonding in the structure of DNA:
  _____
  _____
  _____

Microscopy (Chapter 6)

- light microscope: _____
    - When would you use this: _____
- scanning electron microscope: _____
    - When would you use this: _____
- transmission electron microscope: _____
    - When would you use this: _____
- **Magnification:** _____
- **Resolution:** _____
- **Contrast**: _____

Introduction to Cells and Viruses (Chapter 6 and Chapter 19.1)

- Prokaryotic cells: _____
  - Main internal structures: _____
  - Main external structures: _____
- Eukaryotic cells: _____
  - Main internal structures: _____
  - Main external structures: _____
- Describe what bacterial structures help them to cause infections in humans: _____
- Compare the structures of plant and animal cells: _____
- Describe the structure of a virus: _____
- **Capsid:** _____
- **Envelope**: _____

Eukaryotic Organelles (Chapter 6)

- Nucleus: _____
  - Structure: _____
  - Function: _____
- Endomembrane system: _____
  - Structure: _____
  - Function: _____
- Smooth endoplasmic reticulum: _____
  - Structure: _____
  - Function: _____
- Smooth endoplasmic reticulum: _____
  - Structure: _____
  - Function: _____
- Golgi apparatus: _____
  - Structure: _____
  - Function: _____
- Ribosomes: _____
  - Structure: _____
  - Function: _____
- Lysosomes: _____
  - Structure: _____
  - Function: _____
- Peroxisomes: _____
  - Structure: _____
  - Function: _____
- Describe the route of an exported protein from its production to its exit from the cell: _____
- Mitochondria: _____
  - Structure: _____
  - Function: _____
- Chloroplast: _____

- Structure: _____
- Function: _____

The Cytoskeleton and Related Structures (Chapter 6)

- Microtubules
  - Structure: _____
  - Function: _____
- intermediate filaments
  - Structure: _____
  - Function: _____
- Microfilaments
  - Structure: _____
  - Function: _____
- **Actin:** _____
- **myosin:** _____
- **dynein:** _____
- **tubulin:** _____
- Centrioles
  - Structure: _____
  - Function: _____
- Cilia
  - Structure: _____
  - Function: _____
- Flagella
  - Structure: _____
  - Function: _____
- Describe the three different types of **cell junctions** found in animal cells.
  - 1) _____
  - 2) _____
  - 3) _____
- Describe the role of the **extracellular matrix** in regulating cell behavior and cell-cell communication.

  _____
  _____
  _____

Complete the Following Chart

Organelle	Location	Function(s)
Nucleus		
Nucleolus		
Nuclear Pore		
Ribosome		
Mitochondria		
Nuclear envelope		
Plasma Membrane		
Lysosome		
Rough Edoplasmic Reticulum		
Smooth Endoplasmic Reticulum		
Golgi Apparatus		
Cilia		
Flagella		
Chloroplast		
Microtubules		
Intermediate Filaments		
Microfilaments		
Centrosomes		
Peroxisome		

Membrane Structure (Chapter 7)

- **Phospholipids**: _____
- **Cholesterol**: _____
- **integral** proteins: _____
- **peripheral proteins:** _____
- **glycolipids**: _____
- **glycoproteins**: _____
- Explain the **fluid-mosaic model** of cell membranes:
  _____

Membrane Function (Chapter 7)

- Explain how membranes organize the various chemical activities of a cell:
  _____
  _____
  _____
- Explain why the plasma membrane is selectively permeable:
  _____
  _____
  _____
- Describe the diverse functions of membrane proteins:
  _____
  _____
  _____

Movement Across Membranes (Chapter 7)

- **diffusion:** _____
- **passive transport**: _____
- **active transport**: _____
- **pump proteins**: _____
- Describe an example of active transport found in most cells:
  _____
- **faciliated diffusion**: _____
- **osmosis**: _____
- **hypertonic**: _____
- **hypotonic**: _____
- **isotonic**: _____
- What happens to **<u>animal cells</u>** when they are placed in each of these types of solutions:
- **exocytosis**: _____
- **endocytosis**: _____
- **pinocytosis**: _____
- **phagocytosis**: _____
- **receptor-mediated endocytosis**: _____

Energy and the Cell (Chapter 8)

- metabolism: _____
  - biological example: _____

- catabolism: _____
    - biological example: _____
- anabolism: _____
    - biological example: _____
- kinetic energy: _____
- thermal energy: _____
- chemical energy: _____
- potential energy: _____
- Describe the circumstances under which a chemical reaction would occur spontaneously: _____
- Endergonic reaction : _____
    - Energy coupling: _____
    - ATP: _____
    - Flow of energy: _____
- exergonic reactions: _____
    - Energy coupling: _____
    - ATP: _____
    - Flow of energy: _____
- How ATP is both formed and used in reactions:

  _____

  _____
- Explain how:
    - cells use the hydrolysis of ATP to do work:

      _____

      _____

      _____
    - describe examples:

      _____

      _____

      _____

      _____

Enzymes (Chapter 8)

- Define enzyme: _____
- explain how enzymes speed up chemical reactions:

  _____

  _____

  _____
- Describe “activation energy”: _____
    - how it relates to enzymes:

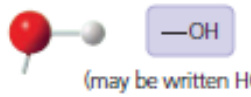
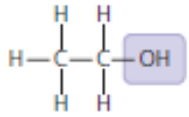
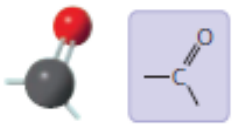
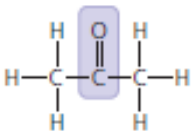
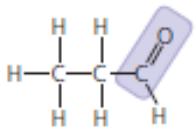
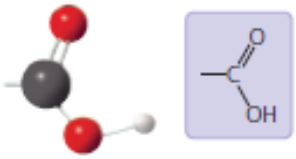
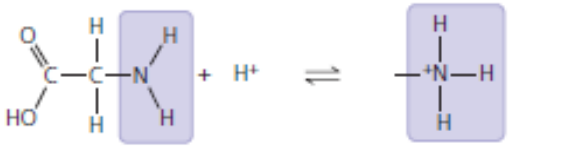
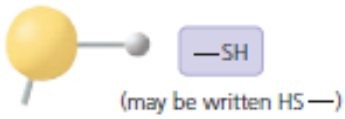
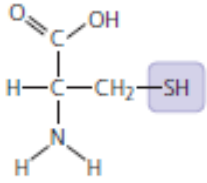
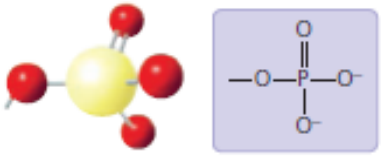
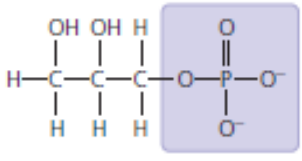
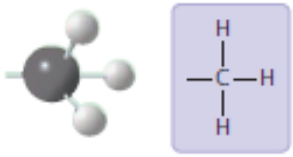
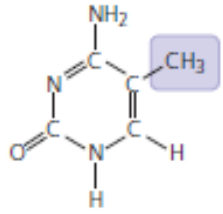
      _____

      _____

      _____
- Define substrate site:

  _____

- active site:
  _____
- "Induced Fit" model of enzyme-substrate interactions:
  _____
- Explain how different factors in the cellular environment affect enzyme activity:
  - enzyme: _____
  - substrate concentration: _____
  - pH: _____
  - temperature: _____
  - Etc. : _____
- competitive inhibitor: _____
  - How it alters an enzyme's activity: _____
  - real example: _____
- non-competitive: _____
  - How it alters an enzyme's activity: _____
  - real example: _____
- feedback inhibition: _____
  - example: _____
- Explain how the following inhibit enzyme activity.
  - certain poisons: _____
  - pesticides: _____
  - drugs: _____

Chemical Group	Group Properties and Compound Name	Examples
Hydroxyl group (—OH)  (may be written HO—)	Is polar due to electronegative oxygen. Forms hydrogen bonds with water, helping dissolve compounds such as sugars. Compound name: Alcohol (specific name usually ends in *-ol*)	 **Ethanol**, the alcohol present in alcoholic beverages
Carbonyl group (>C=O) 	Sugars with ketone groups are called ketoses; those with aldehydes are called aldoses. Compound name: Ketone (carbonyl group is within a carbon skeleton) or aldehyde (carbonyl group is at the end of a carbon skeleton)	 **Acetone**, the simplest ketone  **Propanal**, an aldehyde
Carboxyl group (—COOH) 	Acts as an acid (can donate H^+) because the covalent bond between oxygen and hydrogen is so polar. Compound name: Carboxylic acid, or organic acid	 **Acetic acid**, which gives vinegar its sour taste Ionized form of —COOH (carboxylate ion), found in cells
Amino group (—NH_2) 	Acts as a base; can pick up an H^+ from the surrounding solution (water, in living organisms). Compound name: Amine	 **Glycine**, an amino acid (note its carboxyl group) Ionized form of —NH_2, found in cells
Sulfhydryl group (—SH)  (may be written HS—)	Two —SH groups can react, forming a "cross-link" that helps stabilize protein structure. Hair protein cross-links maintain the straightness or curliness of hair; in hair salons, permanent treatments break cross-links, then re-form them while the hair is in the desired shape. Compound name: Thiol	 **Cysteine**, a sulfur-containing amino acid
Phosphate group (—OPO_3^{2-}) 	Contributes negative charge (1– when positioned inside a chain of phosphates; 2– when at the end). When attached, confers on a molecule the ability to react with water, releasing energy. Compound name: Organic phosphate	 **Glycerol phosphate**, which takes part in many important chemical reactions in cells
Methyl group (—CH_3) 	Affects the expression of genes when on DNA or on proteins bound to DNA. Affects the shape and function of male and female sex hormones. Compound name: Methylated compound	 **5-Methyl cytosine**, a component of DNA that has been modified by addition of a methyl group