

Biology 1308 Common Course Objectives

A. Overview

1. Describe the levels of organization in multicellular organisms starting with *atoms* and ending with *organisms*.
2. Define the term *homeostasis*.
3. Describe, in general terms, how negative and positive feedback mechanisms are used by organisms to maintain homeostasis.

B. The Metric System

1. State the basic units of the metric system for length, mass, time and volume.
2. Identify the fraction or multiple associated with each of the following prefixes: *kilo*, *deci*, *centi*, *milli*, *micro*, and *nano*.
3. Combine the prefixes above with a metric unit and know the correct abbreviation of the combined prefix and unit.
4. Convert quantities between the metric units.
5. Convert between metric and English units (weight, volume, length, and temperature).

[Note: Objective #B5 is NOT a Human Anatomy or Human Physiology Assessment Test Objective.]

C. Atoms, Molecules, Bonds and Properties of Matter

1. Define the term *element*.
2. Identify the common chemical symbols for: oxygen, carbon, hydrogen, nitrogen, calcium, potassium, sodium, chlorine, iron, and phosphorus.
3. Identify the chemical formulas for carbon dioxide, carbon monoxide, water, hydrochloric acid, sodium chloride, glucose, and sodium bicarbonate (also known as sodium hydrogen carbonate).
4. Define the term *atom*.
5. Describe the basic structure of an atom (protons, neutrons, and electrons).
6. Identify the charge and the location in an atom of protons, neutrons and electrons.
7. Define the term *isotope*.
8. Recognize that isotopes are used in diagnosis and treatment in medicine.
9. Define the terms *molecule* and *ion*. Explain the role of electrons in chemical bonding.
10. Compare how covalent and ionic bonds hold atoms together and how each type of bond is shown in a diagram.
11. Discuss the relative strengths of covalent and ionic bonds (how easily the bonds can be broken).
12. Compare polar and nonpolar bonds. Compare and contrast the characteristics of polar and nonpolar molecules.
13. Identify the type of bond (polar covalent, nonpolar covalent, or ionic) found in the following molecules: carbon dioxide, water, hydrochloric acid, sodium chloride, oxygen gas, and sodium bicarbonate.
14. Define the term hydrogen bond. Describe the characteristics of hydrogen bonds.

15. Identify how hydrogen bonds are shown in a diagram.
16. Define the terms *matter* and *mass*.
17. Identify and describe the properties of the 3 states of matter.
18. Compare and contrast the random motion of particles in a liquid, solid, and gas and the effect of temperature on the motion.
19. Describe the relationships between temperature, pressure and volume in a closed system. (Note: You do NOT need to know the formulas-just the relationships.)

D. Water

1. Describe the polarity of water.
2. List and describe the properties of water (high heat capacity, essential reactant, excellent solvent, cohesion (also called surface tension) and how they benefit organisms.
3. Explain the biological importance of hydrogen bonds between water molecules and between other polar covalent molecules.
4. Distinguish between hydrophilic & hydrophobic substances and describe their interactions.

E. Acids, Bases, pH, and Buffers

1. Define the terms *acid*, *base*, and *hydrogen ion* (also called a *proton*).
2. Define pH and relate pH to the concentration of hydrogen ions/protons.
3. Read a pH scale and determine whether the solution is acid, basic, or neutral.
4. Compare the properties of salts, acids, and bases.
5. Define the term *buffer*.
6. Describe how buffers work to keep the pH within a narrow range to maintain homeostasis.
7. Define the term *dissociation*.
8. Describe the effect of dissociation in producing anions and cations.
9. Describe the effect of dissociation on the strength of an acid or base.
10. Identify the characteristics of a neutralization reaction.
11. Be able to use a pH meter or pH paper to measure the pH of a solution.

[Note: Objective #E11 is NOT a Human Anatomy or Human Physiology Assessment Test Objective.]

F. Chemical Reactions

1. Differentiate between kinetic energy and potential energy and know their characteristics.
2. Recognize examples of kinetic energy and potential energy.
3. Explain how organisms use chemical reactions to capture and release energy and to make new compounds and break down compounds.
4. Write a simple chemical reaction using proper chemical notation (Note: See "Rules of Chemical Notation posted on the Biology Department website, www.austincc.edu/biology .)
5. Interpret a simple chemical reaction, identifying reactants, products, and enzyme involved.
6. Recognize that in a reaction at equilibrium the forward and reverse reactions are occurring at the same rate.
7. Define the following terms: *catalyst*, *enzyme*, *substrate*, *products*, *activation energy*, and *active site*.
8. Explain the characteristics of enzymes, including their specificity and that enzymes are not altered or used up in a reaction.
9. Describe how enzymes work, including how they affect the activation energy of a reaction and the rate of a reaction.
10. Identify the factors that affect enzyme activity (pH and temperature).

G. Biomolecules

1. Describe why carbon is a versatile element and found in the structure of all biomolecules.
2. Identify the following functional groups and describe their properties: hydroxyl, carbonyl, carboxyl, amine, phosphate, and sulfhydryl.
3. Define the terms *monomer* (also called *subunit* or *building block*) and *polymer*.
4. Describe the reactions (dehydration/synthesis or condensation/hydrolysis) used to make and break down polymers.

Carbohydrates:

5. Define the terms *monosaccharide*, *disaccharide*, and *polysaccharide*. Identify monosaccharides as the monomers/subunits joined to make disaccharides and polysaccharides.
6. Name and classify the following common carbohydrates as either *monosaccharides*, *dissaccharides*, or *polysaccharides*: glucose, fructose, galactose, ribose, deoxyribose, sucrose, lactose, glycogen, starch, and cellulose.
7. Describe the function of each of the common carbohydrates listed above.

Proteins:

8. Identify amino acids as the monomers/subunits joined to make proteins/polypeptides.
9. Name the parts of an amino acid: (central carbon, amino group, carboxyl group, R group, and H atom).
10. Describe how the R group in each of the 20 different amino acids determines each amino acid's characteristics.
11. Describe the four levels of a protein's structure, including at which level of structure covalent bonds are important and at which level of structure hydrogen bonds are important.
12. Describe the importance of shape to protein function.
13. Define the term *denaturation*.
14. Explain how denaturation affects the function of a protein.
15. Describe how pH and temperature affect protein function.
16. List examples of the functions of proteins in cells.
17. Identify the various ways in which proteins are shown in a diagram.

[Note: Objective #G17 is NOT in a Human Anatomy or Human Physiology Assessment Test Objective.]

Nucleic acids

18. Name the two major nucleic acids found in cells.
19. Identify nucleotides as the monomers/subunits joined to make nucleic acids.
20. Identify the three main parts of a nucleotide.
21. Distinguish between the four nucleotides used to make RNA and the four nucleotides used to make DNA.
22. Identify genes as pieces of DNA with the instructions for making a specific protein.
23. Describe how two DNA strands are complementary to each other.
24. Identify ATP (adenosine triphosphate) as the RNA "A" nucleotide with two extra phosphate groups.

Lipids:

25. Identify lipids as molecules that are hydrophobic or at least partially hydrophobic.
26. List three types of lipids (triglycerides, phospholipids, and steroids).
27. Compare the structure of triglycerides, phospholipids, and steroids.
28. Compare the function of triglycerides, phospholipids and the steroid cholesterol, including the role of cholesterol as a precursor to other steroids.

H. DNA, RNA, and Protein Synthesis

1. Define the term *DNA replication* and state where in the cell DNA replication occurs.
2. Describe how DNA is replicated using complementary base pairing. (Note: You do NOT need to know the enzymes involved in DNA replication.)
3. Define and describe the relationship between genes, DNA, and chromosomes.
4. Define the term *mutation*. Understand that mutations to a gene (piece of DNA) can change the structure and function of the protein that the gene codes for.
5. Define the terms *transcription* and *translation* and state where in the cell transcription and translation occur.
6. Describe the processes of transcription and translation in the making of proteins. (Note: You do NOT need to know the enzymes involved in transcription and translation).
7. *Briefly* describe the role of mRNA, tRNA, and rRNA in translation.

I. Structure and Function of Cells

1. State the three tenets of the cell theory.
2. Describe the basic structure of eukaryotic cells: plasma membrane, nucleus, and cytoplasm.
3. Describe the location of intracellular and extracellular fluids and the relationship between the two.
4. Describe the structure and function of the cytoskeleton of the cell. (Note: You do NOT need to differentiate between microtubules, microfilaments, and intermediate filaments.)
5. Describe the structure and function of ribosomes, the rough endoplasmic reticulum (RER), and the Golgi apparatus (also called Golgi body or Golgi complex).
6. Describe how ribosomes, the rough endoplasmic reticulum and the Golgi apparatus work together in protein synthesis and packaging.
7. Describe the structure and function of the smooth endoplasmic reticulum (SER).
8. Describe the structure and function of lysosomes.
9. Describe the structure of the mitochondrion and its role in energy capture in the cell.
10. Describe the structure and function of the nucleus.
11. Describe the structure and function of cilia and flagella.

J. The Plasma Membrane

1. Describe the structure of the plasma membrane (phospholipid bilayer, cholesterol, proteins, and carbohydrates) and its overall functions.
2. Identify the function of each following parts of the plasma membrane: phospholipid bilayer, cholesterol, proteins, and carbohydrates.
3. Explain how protein receptors in the plasma membrane allow cells to communicate with each other.
4. Explain how the size, electric charge, and lipid solubility of molecules affects their movement across the plasma membrane.
5. Compare how substances are moved into and out of the cell by each of the following: simple diffusion, osmosis, facilitated diffusion, active transport/solute pumping, endocytosis, and exocytosis.

6. Identify the energy needs of simple diffusion, osmosis, facilitated diffusion, active transport/solute pumping, endocytosis, and exocytosis.
7. Define each of the following terms: *isotonic solution*, *hypotonic solution*, and *hypertonic solution*.
8. Describe the effects on cell volume when cells are exposed to isotonic, hypotonic, and hypertonic solutions.
9. Determine whether a cell's environment is hypotonic, hypertonic, or isotonic with respect to the cell when given the concentration of solutes in the environment and in the cell.
10. Determine which way water will move by osmosis and whether the cell will shrink, stay the same shape, or swell, when given the concentration of solutes in the cell and in the environment.

K. Energy and Cells

1. Explain the role of ATP (adenosine triphosphate) and ADP (adenosine diphosphate) in energy transfer.
2. Define each of the following terms: *cellular respiration*, *glycolysis*, *citric acid cycle* (also called *Krebs cycle* or *tricarboxylic acid cycle*), *oxidative phosphorylation*, and *electron transport chain*.
3. Recognize that breaking the bonds in glucose and other food molecules releases the energy used to make ATP during cellular respiration.
4. Name the location in the cell where glycolysis occurs.
5. Describe the purpose of glycolysis and its benefit to cells.
6. Identify the reactants and products of glycolysis.
7. Name the location in the cell where the citric acid cycle occurs.
8. Identify the products of the citric acid cycle.
9. Name the location in the cell where oxidative phosphorylation occurs, including the specific structure (electron transport chain).
10. Identify the products of oxidative phosphorylation.
11. Describe the role of oxygen in oxidative phosphorylation.
12. Compare and contrast the relative amount of ATP production in glycolysis, the citric acid cycle, and oxidative phosphorylation.
13. Recognize that lactic acid fermentation (not the citric acid cycle) occurs after glycolysis whenever oxygen is not present in the cell's environment.

[Note: You do NOT need to know the intermediate steps of glycolysis, the citric acid cycle, or oxidative phosphorylation.]

L. Mitosis and Meiosis

1. Define the term *mitosis*.
2. Describe the outcome of mitosis in terms of the number of daughter cells that result after the parent cell divides and in terms of the number of chromosomes in each of the resulting daughter cells. (Note: You do NOT need to know each of the phases of mitosis.)
3. Compare when mitosis occurs (during growth and repair) and when meiosis occurs (during gamete production).
4. State the function of mitosis and distinguish it from cell division.
5. Define the term *meiosis*.
6. Define the terms *crossing over* and *independent assortment*.
7. Identify crossing over and independent assortment as two processes that contribute to genetic variation.
8. Describe the outcome of meiosis in terms of the number of daughter cells that result and in terms of the number of chromosomes in each of the resulting daughter cells. (Note: You do NOT need to know each of the phases of meiosis.)
9. Define the term *gamete* and explain why meiosis is necessary to maintain proper chromosome number after fertilization.

M. Body Systems

1. Describe the overall functions of the circulatory, digestive, nervous, endocrine, reproductive, integumentary, skeletal, respiratory, muscular, urinary, and immune systems.

N. Reading Skills

1. Read a short science article that relates in some fashion to the objectives above. After reading the article, answer a series of questions concerning the information covered in the article.

O. Study Skills

1. Identify the different learning styles.
2. Determine which learning style(s) is most effective for you when learning biology topics.
3. Determine which text-reading techniques correspond to your learning style when reading biology textbooks.
4. Determine the test-studying techniques that correspond to your learning style when studying biology topics.
5. Describe techniques to reduce test anxiety.
6. Describe time management techniques for studying and test-taking when studying biology topics.
7. Avoid self-deception when evaluating how prepared you are for upcoming exams.
8. Be able to write a useful lecture notes during a science lecture class.

[Note: Objectives O1 through O6 are NOT Human Anatomy or Human Physiology Assessment Test Objectives.]

P. Critical Thinking Skills

1. Describe Bloom's Taxonomy.
2. Identify where a given problem or activity is situated on Bloom's taxonomy.
3. Demonstrate proficiency in answering problems at the analysis, synthesis and evaluation levels of Bloom's taxonomy.

[Note: Objectives P1 through P3 are NOT Human Anatomy or Human Physiology Assessment Test Objectives.]

Q. Math Skills

1. Be able to use dimensional analysis to solve a unit conversion problem.
2. Be able to calculate a percent.
3. Be able to solve for one variable in a linear equation.
4. Be able to create bar, line, and pie graphs when given a set of data.
5. Be able to interpret a bar, line, or pie graph.
6. Be able to calculate a ratio.
7. Be able to describe the relationship between two variables in an equation.

[Note: Objectives Q1 through Q3 are NOT Human Anatomy or Human Physiology Assessment Test Objectives.]