Honors Biology
Unit 1 Objectives: The Chemistry of Life

1. Vocabulary: organism, molecule, element, atom, electron, proton, neutron, isotope, chemical bond, chemical reaction, law of conservation of matter, activation energy, ion, ionic bond, covalent bond, hydrogen bond, pH, acid, base, organic, macromolecule, monomer, polymer, carbohydrate, monosaccharide, disaccharide, polysaccharide, starch, cellulose, lipid, fatty acid, glycerol, saturated f. a., unsaturated f. a., triglyceride, protein, amino acid, polypeptide, peptide bond, primary through quaternary protein structure, polar, nonpolar, nucleic acid, nucleotide, RNA, DNA, gene, double helix.

2. Explain the relationship(s) among atoms, molecules, elements, and compounds.

3. Describe the three types of chemical bonds and their relative strengths.

4. Explain what causes a solution to have an acidic or basic pH and/or calculate how many times more acidic/basic one solution is than another. (ex: pH 3 vs. pH 6) Given a starting pH and a target pH, compose a procedure to produce a solution of target pH.

5. Identify and/or describe the characteristics (use functional groups and other clues) and functions of the four classes of macromolecules (this includes 3D models).

6. Describe how the processes of dehydration synthesis and hydrolysis are related to the formation of monomers and polymers. (Which functional groups are used during the formation/breaking of proteins and triglycerides in particular?)

7. Describe the relationship between genes, nucleic acids, amino acids, and proteins.

8. Explain the importance of hydrogen bonding for nitrogenous base pairing in DNA.

9. Given a series of nucleotides, create a matching set to complete a model of DNA.

Honors Biology – Chapter 2 Objectives

1. Vocabulary: chemical energy, free energy, nutrients, heterotroph, autotroph, first law of thermodynamics, second law of thermodynamics, entropy, catalyst, enzyme, active site, substrate, metabolism, synthesis, decomposition, ATP, ADP, P_i, physical digestion, chemical digestion, extracellular digestion, intracellular digestion, ingestion, saliva, peristalsis, esophagus, stomach, liver, bile, pancreas, pancreatic juice, amylase, gall bladder, duodenum, small intestine, large intestine, rectum, anus, gastrin, amylase, pepsin, pepsinogen, trypsin, lipase, villi, bolus, chyme, and capillaries.

2. In terms of energy conversions, order, dissipated energy, free energy, and entropy, describe how living systems are able to function despite the first and second laws of thermodynamics.

3. Diagram and describe ATP's role as a universal currency in energy transfer.

4. Explain the reason why enzymes are necessary for organisms, how they function, and why they work well/poorly under various conditions (temperature, salinity, and pH).

5. Analyze and draw meaningful conclusions from graphs depicting enzyme activity in various conditions.

6. Give the functions of and locate the following organs/structures in a drawing and/or dissection specimen: mouth, esophagus, cardiac sphincter, stomach, pyloric sphincter, duodenum, liver, pancreas, gall bladder, small intestine, large intestine, rectum, and anus.

7. List the path of food through your digestive system, indicating major digestion events along the way. (ex: mouth – physical digestion of all food, chemical digestion of starches into simple sugars by amylase, food shaped into a bolus for swallowing)

8. Explain the importance of surface area to chemical digestion and absorption.

Honors Biology – Chapter 3 Objectives

1. Vocabulary: cytoplasm, phospholipid, hydrophilic, hydrophobic, transport protein, selective permeability, fluid mosaic model, diffusion, concentration gradient, equilibrium, osmosis, hypotonic, hypertonic, isotonic, turgor pressure, passive transport, active transport, facilitated diffusion, endocytosis, exocytosis, countercurrent flow, trachea, bronchus, bronchiole, alveolus, capillary, stomate, transpiration, homeostasis, ammonia, urea, uric acid, nephron (glomerulus, Bowman's capsule, proximal convoluted tubule, loop of Henle, distal convoluted tubule, collecting duct) kidney (cortex, medulla, renal pelvis), urine, ureter, urinary bladder, urethra, aldosterone, and antidiuretic hormone.

2. Use the terms: phospholipid, hydrophilic, hydrophobic, transport protein, and fluid mosaic to label an/or describe the plasma membrane.

3. Describe the process of diffusion from unequal concentrations of substances to dynamic equilibrium. Be sure to discuss the role of concentration gradients and how kinetic molecular theory explains the motion of the particles described.

4. Given necessary information regarding the concentration of substances (water, gasses, particles, etc.), predict the direction of diffusion (some particles may not be able to diffuse… why?). If appropriate, label fluid surrounding a cell as hypotonic, hypertonic, and/or isotonic.

5. Compare and contrast the processes of passive and active transport by providing an explanation and an illustration.

6. Explain and/or deduce the process of gas exchange for various organisms indicating various advantages and/or disadvantages for the methods used.

7. Identify significant structures of the respiratory system, urinary system, kidney, and nephron.

8. Explain what happens to filtrate as is passes along the various structures of a nephron, including the effects of aldosterone and antidiuretic hormone.

Honors Biology – Unit 4 Objectives

1. Answer multiple choice and matching questions concerning the name, appearance, and function of the following cell organelles and structures: nucleus, nuclear membrane, DNA (chromatin), mRNA, nucleolus, nucleoid, plasma membrane, endoplasmic reticulum, golgi apparatus, lysosome, vacuole, mitochondrion, chloroplast, cilia, flagellum, ribosome, cell wall, cytosol, cytoskeleton, centriole, plasmid, and vesicle.

2. Other vocabulary: cell theory, prokaryote, eukaryote, bacteria (cocci, bacilli, & spirochetes), protist, organelle, microtubule, intermediate filament, microfilament, colony, biofilm, tissue, organ, and system.

3. Match the names of scientists who contributed to the cell theory with their achievements and / or the approximate time of their work.

4. Describe at least three major advances in technology that have aided in the study of cells. If there are limitations and/or drawbacks to a technology, explain what they are.

5. Recognize and/or describe key differences in prokaryotes and eukaryotes. (Which are *you* made of?) =)

6. Demonstrate an understanding of the coordination of organelles by describing how a cell product (such as a protein) is created, transported, and packaged so it can be used within a cell or excreted to the cell's environment.

7. Compare and contrast the requirements of unicellular and multicellular organisms in relation to the concepts of colonies, specialization, tissues, organs, and systems.

8. (very related to number 7…) Explain why organ systems are a necessity for large, multicellular organisms.

9. Given a light microscope and a variety of slides:
   a) correctly identify the level of cellular organization demonstrated by the specimen. (unicellular, colony, tissue, organ, system, or organism)
   b) explain why that particular level of organization is exhibited.

Honors Biology – Unit 5 Objectives

1. Vocabulary: photoautotroph, pigment, chlorophyll, chloroplast, photosynthesis, thylakoid membrane, stroma, light reactions, Calvin cycle, photosystem, electron transport chain, ATP synthetase, $NADP^+$, NADPH, RuBisCO, RuBP, PGAL (G3P), photoinhibition, limiting factor, photorespiration, PEP carboxylase, C_3 plant, C_4 plant, CAM plant, mesophyll cell, bundle sheath cell, CO_2 fixation, oxidize, and reduce.

2. Given a diagram of the light reactions and/or the Calvin cycle, describe what is happening or the significance of an event at indicated positions.

3. Sketch a picture of a plant cell including important structures for photosynthesis. Indicate the location of the light reactions and Calvin cycle.

4. List the three products of the light reactions and explain their importance.

5. Compare and contrast carbon fixation strategies of C_3, C_4, and CAM plants including potential advantages and/or disadvantages.

6. Describe the importance of the end product of the Calvin cycle. Why is it so important for plants? What can they do with it?

7. Given a limiting factor (CO_2 conc., H_2O uptake, light intensity, etc.) draw/explain a graph communicating its effects on the rate of photosynthesis.

8. Evaluate changes in environmental conditions to predict effects on the rate of photosynthesis.

9. Explain how and/or why the leaves of deciduous trees change colors in the fall.

10. Describe how each of the following materials contributes to the dry mass of a plant : water, air, soil, & light. Descriptions should include any relevant experiments and/or material discussed in class.

Honors Biology – Unit 6 Objectives

1. Vocabulary: cell respiration, glycolysis, pyruvate conversion, Krebs cycle, electron transport system, NAD(H), FAD(H_2), coenzyme A, glucose, pyruvate, fermentation, lactate, alcohol, vinegar, mitochondrion, cytochrome, ATP synthetase, facultative aerobe, obligate anaerobe, obligate aerobe, aerobic respiration, anaerobic respiration, ATP, acetate, oxidation, reduction, concentration gradient.

2. Draw a mitochondrion and indicate the location of glycolysis, pyruvate conversion, the Krebs cycle, and the electron transport system.

3. Given a diagram of glycolysis, pyruvate conversion, the Krebs cycle, and/or the electron transport system, describe the origin, purpose, and/or destination of anything entering, involved in, or leaving the diagram.

4. Compare the net amount of ATP gained between the four main steps of aerobic respiration and the methods by which the ATP is generated.

5. Contrast the events that take place after glycolysis when O_2 is available to when it is not available and explain their significance.

6. Interpret laboratory data concerning energy processes to reach meaningful conclusions. You will want to remind yourself of what we did in lab.

7. Compare and contrast the structures and functions of chloroplasts and mitochondria.

8. Explain how lipids and proteins can be used for respiration. What must they be made into? Where do they enter the biochemical pathways/cycles? Aerobic? Anaerobic? Both?

9. Give examples of and describe the utility of sacrificing ATP output for heat.

10. Analyze given a situations depicting the levels of activity, blood glucose, glycogen, and stored fat. Explain the likely results of the activity level.