Name:_____ Date:_____ Period:_____

AP Biology Summer Preparation

Welcome to AP Biology!

This course is designed to be the equivalent of a two-semester introductory biology course usually taken in the first year of college. Throughout the course, we will be using recurring themes that persist throughout all topics and materials. The major themes of AP Biology are:

I. Science as a Process
II. Evolution
III. Energy Transfer
IV. Continuity and Change
V. Relationship of Structure and Function
VI. Regulation
VII. Interdependence in Nature
VIII. Science, Technology and Society

These overarching concepts are critical to understanding the interrelationships between all aspects of the study of life. They are applied to every unit we cover.

Please visit: https://apstudents.collegeboard.org/courses/ap-biology
Note the AP Biology Course Outline.

With the entire first marking period focused on the interactions of molecules found in living things, it is important that you begin this double period course (which counts twice on your transcripts) with a solid foundation of the basics principles of chemistry and the importance of water to all living things. The attached document will help you review and refresh your chemistry skills. This document contains information and practice problems that will help prepare you for the first few units of the AP Biology course. While this is only a practice/review tool, answers will be checked for review purposes at the beginning of school next year.

Elements:

1. What is an element?

2. What is a compound?

3. Four elements make up the vast majority of all biological molecules. List them:

Atomic Structure:

4. Atoms are composed of three main subatomic particles. Name them and describe their electric charge and general location within an atom.

5. Complete the chart below:

Element	Atomic #	Mass #	# protons	# neutrons	# electrons
Oxygen	8			8	
Sodium		23	11		
Chlorine		35			17

6. All carbon atoms have 6 protons and most have 6 neutrons and a mass # of 12. A radioactive isotope called carbon-14 has _____ protons and _____ neutrons.

7. Draw electron shell diagrams for these atoms. Label the valence electrons.

Oxygen Carbon

8. The potential energy of an electron _____the further away from the nucleus it travels.

9. To move to a shell farther from the nucleus, an electron must _____ energy; energy is _____ when an electron moves to a shell closer to the nucleus.

10. An atom's ability to bond with other atoms is determined by the number of _____ electrons it has.

Chemical Bonding:

YOU NEED TO KNOW AND UNDERSTAND THIS: **Molecules** are made when atoms connect together by chemical bonds. Examples: O_2 is a molecule of oxygen formed when two oxygen atoms connect together. H_2O is a molecule of water formed when one oxygen atom connects to two hydrogen atoms. $C_6H_{12}O_6$ is a molecule of glucose formed when six carbon, twelve hydrogen, and six oxygen atoms connect together. Proteins, fats, carbohydrates, sugars, amino acids, and nucleic acids like DNA are all molecules.

11. Atoms with _____ valence shells are non-reactive. Atoms with incomplete valence shells will react with other such atoms by sharing, giving, or taking valence electrons.

12. When atoms react, they form an attraction called a chemical bond.
    a. When two atoms form a bond by sharing a pair of electrons equally, the bond is called a _____ _____ bond.
    b. When two atoms form a bond in which a pair of electrons is not shared equally, the bond is called a _____ _____ bond.
    c. When an atom completely transfers (gives away) an electron to another atom, it becomes an ion with a _____ charge.
    d. When an atom gains an electron it becomes an ion with a _____ charge.
    e. The attraction between two oppositely charged ions is called an _____ bond.

13. A covalent bond between two atoms is likely to be polar if:
    a. One of the atoms is much more electronegative than the other.
    b. The two atoms are equally electronegative.
    c. The two atoms are of the same element.
    d. The bond is part of a tetrahedrally shaped molecule.
    e. One atom is an anion.

Chemical Reactions:

14. The equation below describes a chemical reaction. Use coefficients to balance the reaction and then label the reactant(s) and product(s).

    ___H_2 + ___O_2 □ ___ H_2O

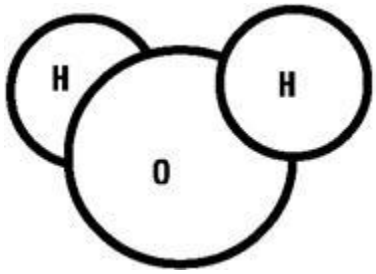
15. Use coefficients to balance the reaction. Then describe in your own words what is happening to the molecules involved (discuss the individual atoms and the chemical bonds involved).

    ___ CH_4 + ___O_2 □ ___ CO_2 + ___ H_2O

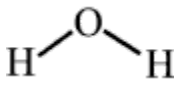
16. In a reaction that has reached equilibrium,
    a. The forward and reverse reactions are occurring at the same rate.
    b. The reactants and products are in equal concentrations.
    c. The forward reaction has gone further than the reverse reaction.
    d. There are equal numbers of atoms on both sides of the equation.
    e. A, B, and D are correct.

Water and its Properties:

17. Water is a polar molecule. The bonds between the oxygen atom and each hydrogen atom are polar covalent bonds. On the diagram of the water molecule shown below, label the area of partial positive charge and the area of partial negative charge.



18. Draw three more water molecules around the one shown below. Use dashed lines to show where hydrogen bonds would form. Also, pick one of the water molecules and use an arrow to label a covalent bond.



19. Please describe the following:
    a. Cohesion –

    b. Adhesion –

    c. Surface Tension –

20. Salt water is example of a solution. In this solution, salt is the _____ and water is the _____.

21. Why is water known as the "universal" solvent? Explain.

22. 20 g of sugar are dissolved in 1 L of water. Calculate the concentration of this solution.

23. The pH scale is a logarithmic scale representing the concentration of H+ ions in a solution.
    a. Describe an 'acid' in terms of H+ ions and pH.

    b. Describe a 'base' in terms of H+ ions and pH.

    c. What does it mean for a solution to be 'neutral'?

Carbon Chemistry – The Chemistry of Life:

24. The molecules of all living things are constructed primarily of carbon. It is a very versatile atom in terms of its ability to form bonds. Look at the diagram you drew for #7. How many bonds can a single carbon atom form at once? _____

25. Four main classes of macro (large) molecules are found in living cells. Three of the four are polymers. In general terms, describe the relationship between polymers and monomers.

26. Complete the chart below:

Polymer:	**Monomer**:
Carbohydrates	
	Amino acids
Nucleic acids	

About the Advanced Placement Program® (AP®)

The Advanced Placement Program® has enabled millions of students to take college-level courses and earn college credit, advanced placement, or both, while still in high school. AP Exams are given each year in May. Students who earn a qualifying score on an AP Exam are typically eligible to receive college credit and/or placement into advanced courses in college. Every aspect of AP course and exam development is the result of collaboration between AP teachers and college faculty. They work together to develop AP courses and exams, set scoring standards, and score the exams. College faculty review every AP teacher's course syllabus.

AP Biology Course Overview

AP Biology is an introductory college-level biology course. Students cultivate their understanding of biology through inquiry-based investigations as they explore the following topics: evolution, cellular processes — energy and communication, genetics, information transfer, ecology, and interactions.

LABORATORY REQUIREMENT

This course requires that 25 percent of the instructional time will be spent in hands-on laboratory work, with an emphasis on inquiry-based investigations that provide students with opportunities to apply the science practices.

PREREQUISITE

Students should have successfully completed high school courses in biology and chemistry.

AP Biology Course Content

The course is based on four Big Ideas, which encompass core scientific principles, theories, and processes that cut across traditional boundaries and provide a broad way of thinking about living organisms and biological systems. The following are Big Ideas:

- The process of evolution explains the diversity and unity of life.
- Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.
- Living systems store, retrieve, transmit, and respond to information essential to life processes.
- Biological systems interact, and these systems and their interactions possess complex properties.

Science Practices

Students establish lines of evidence and use them to develop and refine testable explanations and predictions of natural phenomena. Focusing on these disciplinary practices enables teachers to use the principles of scientific inquiry to promote a more engaging and rigorous experience for AP Biology students. Such practices require that students:

- Use representations and models to communicate scientific phenomena and solve scientific problems;
- Use mathematics appropriately;
- Engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course;
- Plan and implement data collection strategies in relation to a particular scientific question;
- Perform data analysis and evaluation of evidence;
- Work with scientific explanations and theories; and
- Connect and relate knowledge across various scales, concepts, and representations in and across domains.

Inquiry-Based Investigations

Twenty-five percent of instructional time is devoted to hands-on laboratory work with an emphasis on inquiry-based investigations. Investigations require students to ask questions, make observations and predictions, design experiments, analyze data, and construct arguments in a collaborative setting, where they direct and monitor their progress