AP Biology Essential Chemistry

This is a review of basic chemistry – we will not spend any class time on these concepts as they should have been learned in chemistry. Please make sure that you know them and if not, be sure to study through them. Please put this all in your AP Biology three ring (1 ½ or 2 in.) binder!

1. Contrast the term element with compound.

2. Know the symbols of the following elements and their charge:
   a. Carbon
   b. Hydrogen
   c. Oxygen
   d. Nitrogen
   e. Phosphorus
   f. Sulfur

3. Label the diagram below and define the terms that you label.
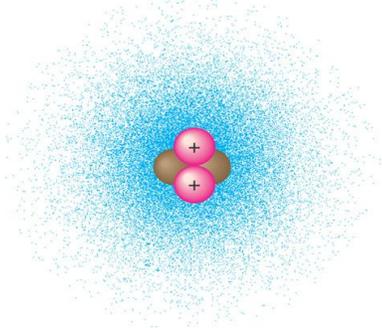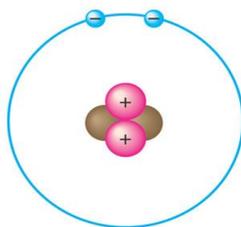
(a)   (b)

4. Contrast the terms atomic mass and atomic number.

5. What is an isotope and what is "special" about radioactive isotopes?

6. What determines interactions between atoms? Why are valence electrons important?

7. Define the following terms:
   a. Chemical bond

   b. Covalent bond

   c. Single bond

   d. Double bond

   e. Electronegativity

   f. Nonpolar covalent bond

   g. Polar covalent bond

8. What is the difference between a structural and molecular formula?

9. Know the molecular formulas for the following compounds.
   a. Oxygen gas
   b. Carbon dioxide
   c. Glucose
   d. Phosphate
   e. Ammonia
   f. Water (you would be surprised at how many people missed this!!!)
10. How do ionic bonds compare with covalent bonds?

11. Compare and contrast hydrogen bonds and van der Waals interactions.

12. Define a dynamic chemical equilibrium in terms of quantities of reactants and products. This is a critical concept!

13. Why is water considered a polar molecule?

14. For each of the below listed properties of water – briefly define the property and then explain how water's polar nature and polar covalent bonds contribute to the water special property.
   a. Cohesion

   b. Adhesion

   c. Surface tension

   d. High specific heat

   e. Heat of vaporization

   f. Evaporative cooling

15. What is special about water and density?

16. Explain how these properties of water are related to the phenomena described in the statements below. More than one property may be used to explain a given phenomenon.

   a. During the winter, air temperatures in the northern United States can remain below 0°C for months; however, the fish and other animals living in the lakes survive.

   b. Many substances—for example, salt (NaCl) and sucrose—dissolve quickly in water.

   c. When you pour water into a 25-ml graduated cylinder, a meniscus forms at the top of the water column.

   d. Sweating and the evaporation of sweat from the body surface help reduce a human's body temperature.

   e. Water drops that fall on a surface tend to form rounded drops or beads.

   f. Water drops that fall on your car tend to bead or round up more after you polish (or wax) the car than before you polished it.

   g. If you touch the edge of a paper towel to a drop of colored water, the water will move up into (or be absorbed by) the towel.

17. Define the following terms:
   a. Solute

   b. Solvent

   c. Aqueous solution

   d. Hydrophilic

   e. Hydrophobic

   f. Molarity

18. MOLARITY
A. Concentration – *comparison of solute to solvent*   *(solute : solvent)*
   a. Concentrated – *large ratio of solute to solvent*
   b. Dilute – *small ratio of solute to solvent*

B. Molarity – http://www.wikihow.com/Calculate-Molarity
   a. Symbol – M

   b. Equation – in reference table $M = \dfrac{\text{moles of solute}}{\text{L of solution}}$ $M = \dfrac{\frac{\text{mass}}{\text{molar mass}}}{\text{L of solution}}$

C. Example Problems

1. What is the molarity of a solution formed by mixing 10.0 g of H_2SO_4 with enough water to make 0.100 L of solution?	2. To prepare 10.5 L of a 2.50 M solution of KOH, how many grams of potassium hydroxide must be used?
3. How many moles of LiBr must be added to .650 L of water to make a 2.0 M solution?	4. What is the molarity of the solution produced when 145 g of NaCl is dissolved in sufficient water to prepare 2.75 L of solution?
5. How many grams of KCl are needed to prepare 0.750 L of a 1.50 M solution?	6. What is the molarity of the solution produced when .594 mol of HCl is dissolved in 0.385 L of water?
7. To produce 3.00 L of a 1.90 M solution of sodium hydroxide, how many grams of NaOH must be dissolved?	8. If 8.77 g of KI are dissolved in enough water to make 4.75 L of solution, what is the molarity of the solution?

19. Label the diagram below to demonstrate the dissociation of the water molecule and then relate this diagram to the term pH.
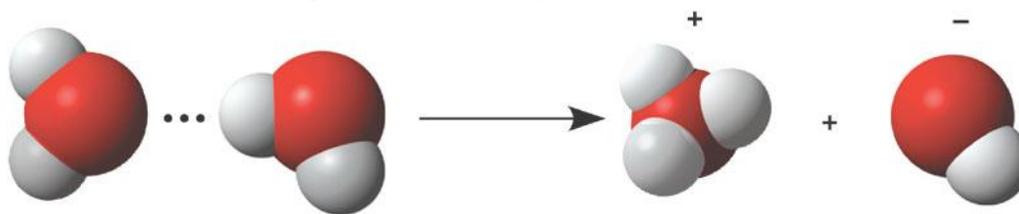
20. What defines an acid and a base?

21. Why are small changes in pH so important in biology?

22. What is a buffer? Give an example on how they would work in a living organism.

23. What is acid precipitation and how does it affect living organisms?

24. Why is organic chemistry so important in the study of biology?

25. What is special about carbon that makes it the central atom in the chemistry of life?

26. Describe and contrast the three types of isomers. Draw a sketch of each
    a. Structural –

    b. Geometric –

    c. Enantiomers –

27. Be familiar with each of the following functional groups – know it's chemical compound and the functional properties
    a. Hydroxyl

    b. Carbonyl

    c. Carboxyl

    d. Amino

    e. Sulfhydryl

    f. Phosphate