Name: _____ Student ID: _____

Biology 11 Laboratory Exercise

Laboratory Exercise 7:
Photosynthesis & Respiration

1. **Photosynthesis**. In the presence of light (the energy source), green plants take CO_2 and use the carbon to make sugars such as glucose by the process of photosynthesis. All plants and eukaryotic algae have chloroplasts (plastids that contain chlorophyll and other photosynthetic pigments) to produce sugars. In most plants, photosynthesis takes place in the leaf.

   Today we will review the structure of plant cells to relate structure to function in photosynthesis. If possible, we will also demonstrate a technique called paper chromatography, which is used to separate pigments, such as those pigments found in plant photo-systems. The *absorption spectra* of some of these pigments can be measured using a device called a *spectrophotometer*.

   We will determine *photosynthetic rate* at different light intensities by examining the CO_2 uptake by an aquatic plant (*Elodea*). Thus, we must detect changes in the water's CO_2 level, using an *indicator* (phenol red). Phenol red is pink in alkaline solutions (pH > 7) and yellow in acidic solutions (pH < 7).

$$H_2O + CO_2 \rightleftharpoons H_2CO_3 \quad \text{(carbonic acid)}$$

   a. Consider the reaction above.

      i. Does carbon dioxide make a solution alkaline or acidic? _____

      ii. When phenol red is the indicator, what color is a solution high CO_2? _____

      iii. If a plant in water is in bright light, will it do photosynthesis? _____ Will it increase or decrease the amount of CO_2 in solution? _____ What color will phenol red turn if it contains a plant and is in the light? _____ Why? _____

      iv. If a plant in water is in the dark, will it do photosynthesis? _____ Will it do aerobic respiration? _____ Will it increase or decrease the amount of CO_2 in solution? _____ What color will phenol red turn if it contains a plant and is in the dark? _____ Why? _____ _____

      v. Why are carbonated soft drinks acidic? _____

2. **A Plant Cell**. Study the structure of a plant cell using the diagram in your text and the diagrams available in the classroom. Note the location, structure, and function of the **cell wall, cell membrane, cytoplasm, nucleus, chloroplasts,** and **mitochondria.**

   a. What process is completed by the mitochondria? _____

      _____ What gas is used by this process? _____What gas is produced from this process? _____

   b. What process is completed by the chloroplasts? _____

      _____ What gas is used by this process? _____What gas is produced from this process? _____

      i. What pigments are found in chloroplasts (see text section on pigments)? _____ _____ _____

3. **Photosynthetic Rate at Differing Light Intensities**.

   a. Procedure

      i. Fill two small flasks with ~75 mL of *tap water*, and add sufficient drops of phenol red indicator solution to each until a deep pink color is obtained. Is the tap water slightly acidic or slightly alkaline? _____ Does that mean that CO_2 is high or low in tap water? _____. Pour the solutions back and forth between the two flasks until the solution is exactly the same color in both flasks.

      ii. With a straw, gently blow into *one* of the flasks until a pale yellow color is obtained. Now is this water slightly acidic or slightly alkaline? _____ Does that mean that CO_2 is high or low in the water? _____. What caused this change? _____ _____

      iii. Fill 6 large test tubes about ⅔ full with the pink solution, and another 6 large test tubes about ⅔ full with the yellow solution. All tubes should have equal volumes of solution.

      iv. Obtain and *keep submerged* 6 sprigs of the aquatic plant *Elodea* which have been pre-cut by your instructor. Insert one sprig each into 3 pink and 3 yellow tubes. Push the sprigs to the bottom of each tube using the straw.

      v. You should now have 6 pink tubes: 3 *experimental* (with sprigs) and 3 *control* (without sprigs); and 6 yellow tubes: 3 experimental and 3 control. Place one pink experimental,

one yellow experimental, one pink control, & one yellow control in the rack labeled "BRIGHT LIGHT." Place the same combination of tubes in the racks labeled "ROOM LIGHT" and "DARK." Your instructor will place each set of tubes in the appropriate environment.

vi. At the end of the lab period, the tubes from bright light and dark will be returned to the lab. One group at a time, *starting with the dark tubes*, **remove the plants from the experimental tubes** and compare the colors of the solutions in the tubes. Do not mix up the tubes after you remove the plants! Fill in the chart below.