Exploring Photosynthesis Lab Test

Instructions:

This is a test to see how well you can design and carry out a scientific investigation. This test presents a problem. It's divided into two parts. In Part I your task is to plan and design an experiment on your own. You have one class period to complete Part I. Your teacher will review your design and check for safety issues. Once Part I is approved by your teacher you will go on to Part II. In Part II, you will carry out the experiment you designed in Part I. You will have one class period to complete your experiment and one additional class period to complete your laboratory report. The scoring rubric that is included with this packet will be used to determine how well you have completed your lab test. You may want to use the rubric as a guide as you complete Parts I and II.

Background:

Life needs energy. For much of the earth's living systems that energy is supplied by photosynthesis. The fact that photosynthesis can convert light energy into food energy makes photosynthesis in plants one of the most important of life's processes to understand. Plants use the energy from light to build food molecules of sugar that are rich sources of energy. The chemical equation that summarizes the process of photosynthesis is:

$6\ CO_2 + 6\ H_2O + \text{light energy} \rightarrow C_6H_{12}O_6 + 6\ O_2$

Earlier you completed the investigative lab, Photo Finish. In this lab you were introduced to a technique called the floating disk assay. The floating disk assay provides a way to indirectly measure the rate of photosynthesis. It works by timing how long it takes to float leafs disks that have sunk. They sunken leaf disks begin to rise as they accumulate oxygen gas in the spaces between the cells of the leaf as photosynthesis proceeds. In Photo Finish you investigated the differences between the rates of photosynthesis in young leaves versus older leaves. You can review the floating disk assay techniques online in Chapter 8 Investigative Lab or your teacher may have a separate page that reviews the procedure.

Your Problem to Investigate:

Using the floating disk assay, your problem is to design and carry out an experiment to test the effect of a variable on the rate of photosynthesis. You chose which variable you will investigate. However, don't choose the variable of leaf age. It was the variable investigated in the Photo Finish Lab.

Possible Variables to Investigate:

Below is a table of possible variables that provides a starting point for developing questions about photosynthesis to investigate. Of course, you may think of other variables to investigate. Look these variables over. Think about how each of these variables might affect the rate of photosynthesis.

Environmental Variables	**Plant or Leaf Variables**	**Method Variables** (These variables may not effect photosynthesis but are still important to investigate)
▪ Light intensity (brightness) ▪ Light color ▪ Temperature ▪ Bicarbonate concentration (CO_2 source) ▪ Direction of incoming light ▪ pH of solution	▪ Leaf color (chlorophyll amount) ▪ Leaf size ▪ Stomata density ▪ Stomata distribution ▪ Light starved leaves vs leaves kept in bright light ▪ Type of plant	▪ Size of leaf disk ▪ Depth of bicarbonate solution ▪ Methods of cutting disks ▪ Leaf disk overlap ▪ Soap amount ▪ How many times can the procedure be repeated with the same disks? ▪ How long can the disks remain sunk in the solution—can they be stored overnight? ▪ Method of data collecting

Questions:

Asking good questions is an important skill. It is important to ask the right question in the right way. A good question for scientific inquiry is asked in a way that actually suggests how the question can be answered. A good question should be focused on how one variable affects another. The resources that are available will also limit your question. Also, for this lab test, remember that you only have one day to do the actual lab work. Make sure your question is answerable in one hour of work.

Hypothesis:

Your research question can now aid you in developing a good hypothesis to guide your research or experimental design. A good, working hypothesis helps the investigator limit his or her investigation to the effect of one variable at a time. This allows the results to be clearly interpreted. To develop a working hypothesis, you need to establish the variables that you are studying and make a prediction on how those variables interact. Forming a hypothesis is a two-step process.

1. Define your variables. Determine which variable will change as you manipulate another. Consider the following question. "Does the temperature of germinating seeds affect the rate of cellular respiration?" The temperature of the germinating seeds is the manipulated variable (independent variable) and the rate of respiration is the experimental, or changing, variable (dependent variable).

2. State the relationship between the two variables in an "**If... then**" format. *If* the manipulated variable effects the experimental variable in such and such a way, *then* the experimental variable should change in such and such a manner when the manipulated variable is changed.

Minimal Materials:

- Plant leaves
- Two syringes
- Marker
- Bicarbonate/detergent solution in a plastic cup
- Single hole punch
- Strong light source
- Clock or watch
- Safety glasses or goggles (as recommended by your instructor)

Part I:

Your Problem to Investigate:

Using the floating disk assay, your problem is to design and carry out an experiment to test the effect of a variable on the rate of photosynthesis. You chose which variable you will investigate. However, don't choose the variable of leaf age. It was the variable investigated in the Photo Finish Lab.

a) What is the question you will be investigating?
b) Describe the variable you are investigating.
c) State your hypothesis.
d) Generate a materials list that includes the special items you would need for your investigation.
e) Describe the procedure you will use to investigate your hypothesis. Use the rubric as a guide for what to include. List the steps you will use. Describe the type of data that you will collect. You may want include diagrams or illustrations. Be sure to include any safety procedures you will need to follow.
f) Construct a data table that you will use to record your observations. Be sure to correctly label this table and include any important instructions.

Submit your lab test to your teacher after you complete Part I. Do not proceed to Part II until you have your teacher's approval.

Part II:

With your teacher's approval carry out the investigation that you have proposed in part I. You may find that you will need to modify your original procedure and data table as you begin to investigate your hypothesis. After completing your lab work complete the Part II worksheet as a lab report. Again, use the scoring rubric as a guide for what is expected in each section of the report.

Photosynthesis Lab Test, Part I	Your Name:

Question:

Identification of Variables:

Hypothesis:

Materials:

Procedure:

Data Collection & Presentation:

Photosynthesis Lab Test, Part II	Your Name:

Question:

Identification of Variables:

Hypothesis:

Materials:

Procedure:

Data Collection & Presentation:

Conclusion: