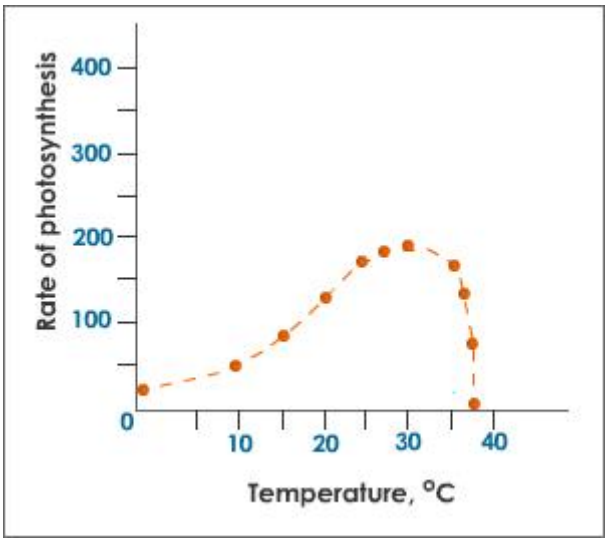
LAB--Factors Affecting Photosynthesis name_____hr___/51

There are several factors that can affect how fast photosynthesis occurs. In this lab you will discover what those factors are. Be sure to make your hypothesis ***before*** analyzing data tables or graphs.

FACTOR 1--TEMPERATURE

1. HYPOTHESIS: I think when temperature is higher, photosynthesis will happen faster / slower
   _____

A group of student scientists performed an experiment with 11 corn plants. Each plant was placed in an area with a different temperature. All plants had the same water, same light, same CO_2, etc. The students kept track of how fast photosynthesis occurred. The results are graphed below:



An optimum temperature ranging from 25°C to 35°C is required for a good rate. At temperatures around 0°C the enzymes stop working, and at very high temperatures the enzymes are denatured (they break, never to be repaired). Since both the stages of photosynthesis require enzyme activity, the temperature has an affect on the rate of photosynthesis.

2. What were the controlled variables in this experiment? (3pts)
   _____ _____ _____

3. What was the independent variable in this experiment? _____

4. If a plant gets down to zero degrees, what happens to photosynthesis? _____

5. What is the best temperature for photosynthesis? _____

6. If a plant is in a greenhouse that gets over 45 degrees Celsius (over 100 Fahrenheit), what will happen?
   _____

7. What is the conclusion for this experiment? _____

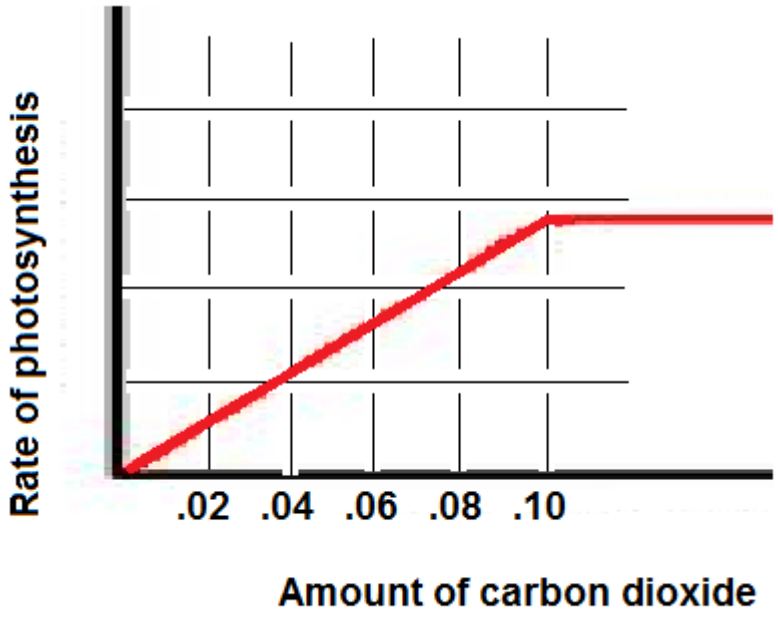
8. How does temperature affect photosynthesis? _____

FACTOR 2--CARBON DIOXIDE CONCENTRATION

9. HYPOTHESIS: I think when there is more carbon dioxide, photosynthesis will happen faster / slower _____

In the atmosphere, the concentration of carbon dioxide ranges from .03 to .04 %. If the carbon dioxide concentration is increased to 0.10%, the rate of photosynthesis increases significantly. This is achieved in greenhouses (enclosed chambers where plants are grown). Owners of greenhouses pump extra CO2 into the greenhouse. Crops like tomatoes and lettuce that are grown in greenhouses are found to be bigger and better-yielding than their counterparts growing in natural conditions.

The following graph shows how different concentrations affect the rate of photosynthesis.



10. At what carbon dioxide level (in percent) is photosynthesis happening fastest?

_____

11. Where would there be more photosynthesis—in a farmer's field or in a farmer's greenhouse? Why? (2 pts) _____ _____

12. If the carbon dioxide level were increased from .10% to .20%, what would happen to the rate of photosynthesis? _____

13. Why are greenhouse crops bigger and better yielding than crops grown in open fields?

_____

14. As the carbon dioxide increases, what happens to the rate of photosynthesis?

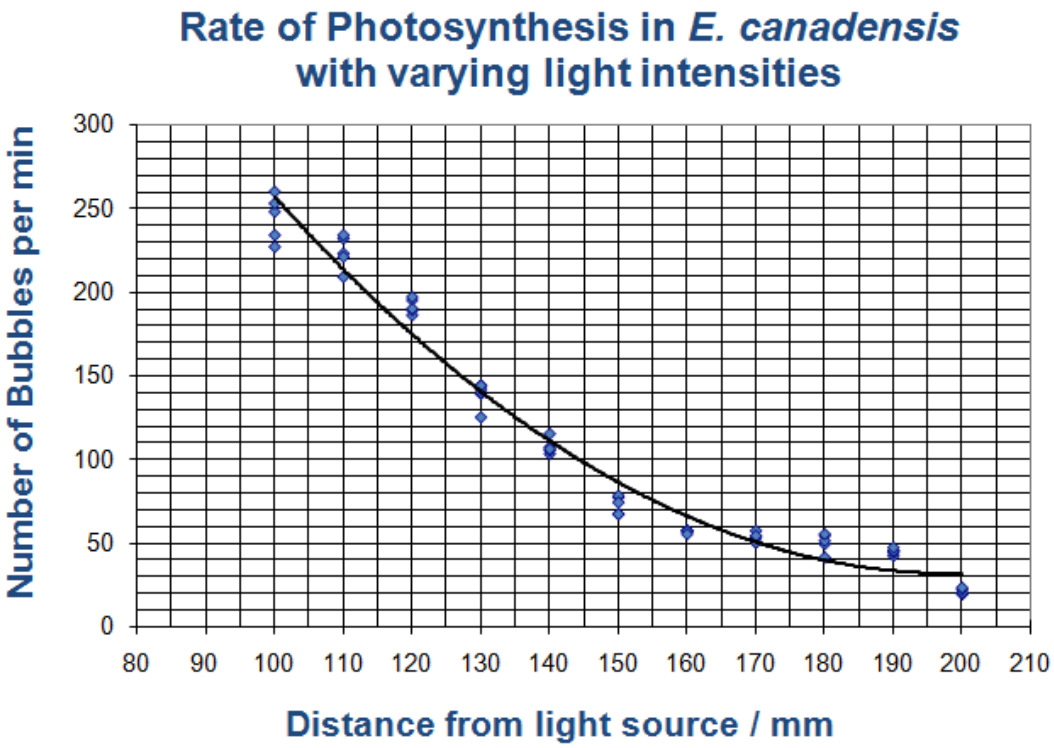
_____

FACTOR 3—LIGHT INTENSITY

15. HYPOTHESIS: I think when light is more intense, photosynthesis will happen faster / slower

_____

Student scientists set up an experiment as follows: Eleven Elodea Canadensis plants were placed next to light sources at varying distances ranging from 100 mm away to 200 mm away. They counted the number of bubbles produced per minute. The bubbles were oxygen. Oxygen was being produced because photosynthesis was happening. Photosynthesis makes oxygen as a waste product, so higher numbers of bubbles mean more photosynthesis was occuring. The students graphed their data below.



16. At which distance were the bubbles the greatest? _____

17. At which distance were the bubbles the least? _____

18. If there are many bubbles, that means what? _____

19. As the light intensity decreases, what happens to the rate of photosynthesis?

_____

Low light intensity lowers the rate of photosynthesis. As the intensity is increased the rate also increases. However, after reaching an intensity of 10,000 lux (lux is the unit for measuring light intensity) there is no effect on the rate. Very high intensity may, in fact, slow down the rate as it bleaches the chlorophyll. Normal sunlight (usually with an intensity of about 100,000 lux) is quite sufficient for a normal rate of photosynthesis.

20. What would be a side effect of having TOO HIGH of a light intensity?

_____

21. Would our plants grow faster if we lived near a brighter star than our sun? Explain.

_____

Factor 4--Chlorophyll Concentration

22. HYPOTHESIS: I think when chlorophyll is in greater concentrations, photosynthesis will happen faster / slower _____

The concentration of chlorophyll affects the rate of reaction as they absorb the light energy without which the reactions cannot proceed. Lack of chlorophyll or deficiency of chlorophyll results in chlorosis or yellowing of leaves. It can occur due to disease, mineral deficiency or the natural process of aging (senescence). Lack of iron, magnesium, nitrogen and light affect the formation of chlorophyll and thereby causes chlorosis.

Make a fake line graph that would show how Chlorophyll concentration affects the rate of photosynthesis. Consider "chlorophyll concentration" to be the independent variable, and "rate of photosynthesis" to be the dependent variable. Include x and y axis labels and a title (4 points)

Factor 5 – Amount of Water

23. HYPOTHESIS: I think when water is lower, photosynthesis will happen faster / slower

_____

Water is an essential factor in photosynthesis. The effect of water can be understood by studying the yield of crops which is the direct result of photosynthetic activity. It is found that even slight deficiency of water results in significant reduction in the crop yield. The lack of water not only limits the amount of water but also the quantity of carbon dioxide. This is because in response to drying, the leaves close their stomata in order to conserve water being lost as water vapor through them. Notice that water is necessary in the formula for photosynthesis.

Make a fake line graph that would show how water concentration affects the rate of photosynthesis. Consider "amount of water" to be the independent variable, and "rate of photosynthesis" to be the dependent variable. Include x and y axis labels and a title (4 points)

FACTOR 6 – AMOUNT OF POLLUTION

24. HYPOTHESIS: I think when pollution is higher, photosynthesis will happen faster / slower

_____

Pollution of the atmosphere with industrial gases has been found to result in as much as 15% loss in the rate of photosynthesis. Soot can block stomata and reduce the transparency of the leaves. Some of the other pollutants are ozone and sulfur dioxide. Pollution of water affects the hydrophytes (plants that live in water). The capacity of water to dissolve gases like carbon dioxide is greatly reduced when pollution is present in the water.

Make a fake line graph that would show how the amount of pollution affects the rate of photosynthesis. Consider "amount of pollution" to be the independent variable, and "rate of photosynthesis" to be the dependent variable. Include x and y axis labels and a title (4 points)

25. Why does pollution slow photosynthesis? (what does it do to leaves?) (2pts)
1 _____ 2 _____

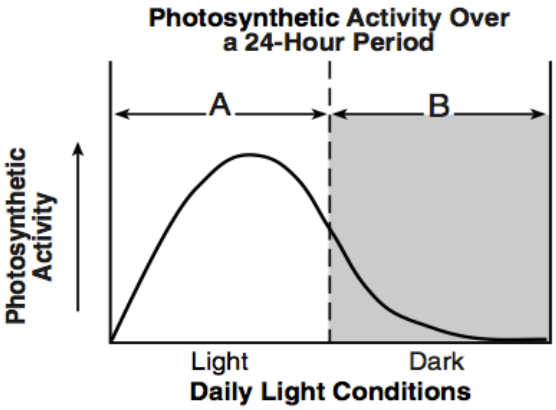
26. What is a hydrophyte? _____

27. How does water pollution slow down photosynthesis for water plants?
_____

FACTOR 7– TIME OF DAY

28. What does this graph show about the rate of photosynthesis?

_____
_____
_____
_____



29. What things can affect the speed that photosynthesis occurs? (7pts)

_____ _____
_____ _____
_____ _____
_____