Bio CP6 How light intensity affects photosynthesis

Your teacher may watch to see if you can…

- follow instructions carefully
- work safely.

Introduction

Microscopic algae have cells that contain chloroplasts, like plant leaf cells. The algae can be trapped in jelly balls to make them easier to handle. You will put algal balls in an indicator that changes colour as carbon dioxide levels change. Under normal conditions the indicator is a red colour, but this changes to yellow at higher carbon dioxide **concentrations** and purple at lower carbon dioxide concentrations.

Aim

To find out how light intensity affects the **rate** of photosynthesis.

Method

Apparatus

- eye protection
- bijou bottles and caps
- beaker of algal balls
- hydrogen carbonate indicator
- lamp and heat filter
- metre rule
- measuring cylinder
- kitchen foil
- clock/stop clock
- plastic forceps/spoon

⚠ Safety

Wear eye protection.

Wash your hands after setting up the experiment.

Avoid touching the hot lamp.

A Decide the different distances you are going to use between the algae and the lamp. For each distance you will need one clear glass bottle. You will also need one extra bottle.

B Add 10–15 algal balls to each bottle.

C Add the same volume of indicator solution to each bottle and put on the bottle caps.

D Your teacher will have a chart or a range of bottles showing the colours of the indicator at different pHs. Compare the colour in your tubes with this pH range to work out the pH at the start.

E Set up a heat filter between the lamp and where you will place your tubes. The heat filter is a water-filled bottle or other clear container. Take great care not to spill water near the lamp.

F Cover one bottle in kitchen foil, so that it is in the dark.

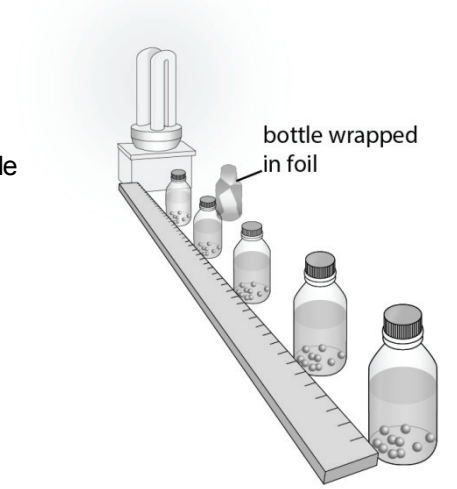
G Place your bottles at measured distances from the lamp. Put the bottle covered in kitchen foil next to the bottle that is closest to the lamp.

H Turn on the lamp and time 60 minutes (or longer).

I Compare the colours of all your bottles with those of the pH range bottles.

J Record the pHs of the solutions in your bottles in a suitable table.

K For each bottle, calculate the change in pH per hour. Add these calculations to your table.



Considering your results/conclusions

1 Plot your results on a scatter graph.

2 Describe the pattern shown on your graph and explain why this pattern is observed.

3 H Explain whether the pattern on your graph obeys the **inverse square law**.

Evaluation

4 What is the purpose of the tube covered in foil?

Name _____ **Class** _____ **Date** _____

Recording your results

1 Record your results in this table.

Distance from lamp to bottle (cm)		pH at start	pH at end	Rate of photosynthesis (change in pH/hour)

Considering your results/conclusions

2 **a** For each bottle, calculate the rate of photosynthesis as the change in pH per hour.

change in pH = pH at end – pH at start

$$\text{rate} = \frac{\text{change in pH}}{\text{time (in hours)}}$$

b Use your calculations to complete the last column of the table above.

3 Plot your results on a scatter graph. Plot the variable that you have changed (the independent variable) on the horizontal axis. Plot the rate of photosynthesis on the vertical axis.

4 **a** Describe the pattern shown on your graph. _____

_____

b Explain why this pattern is observed. _____

_____

_____

Evaluation

5 Complete the missing words in the sentences below to explain the point of the tube covered in foil.

The part of an experiment in which the _____ variable is not applied is called the control.

A control is used to check that the _____ variable has an effect (and that the effect is not due to another variable). In this experiment, the independent variable is the _____ intensity. The control is the _____. We know that the independent variable has a direct effect on the final pH of the indicator because _____

_____.