# Effect of Light Wavelengths on Photosynthesis

## Introduction

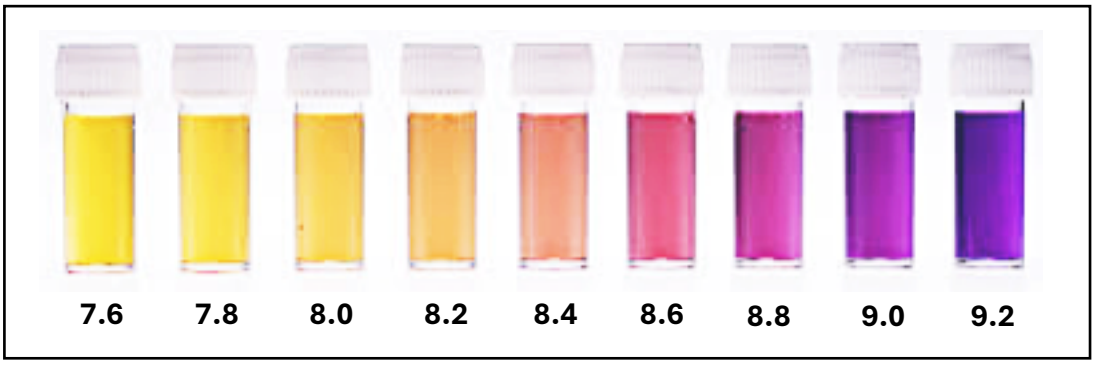
Green plants trap light energy and convert it to chemical energy in the process of photosynthesis. The energy is used to reduce carbon dioxide molecules to produce glucose. Glucose is the source of energy for virtually all cellular functions. The chemical energy of glucose is transferred to ATP molecules during cellular respiration, and carbon dioxide and water are released as by-products.

It is possible to demonstrate that photosynthetic cells take in carbon dioxide during photosynthesis and release carbon dioxide when photosynthesis is not taking place. Whenever carbon dioxide is dissolved in water, carbonic acid will subsequently be formed according to the following reaction:

$$CO_2 + H_2O \rightleftharpoons H_2CO_3$$

Carbon dioxide + Water  Carbonic acid

Photosynthetic algae can be immobilised into small balls (or beads) of calcium alginate and added to a solution containing pH indicator. If the algae undergo photosynthesis, carbon dioxide will be removed from the solution and the pH level will rise (become more alkaline). If the algae do not photosynthesise, carbon dioxide is produced via cell respiration and the pH level will fall (become less alkaline). The pH indicator allows for this change to be visualised according to a colour scale:




## Aim

To investigate the effect of different wavelengths of light (colours) on the rate of photosynthesis

## Materials

- 7 plastic vials
- 60 algal balls
- 35ml indicator
- coloured boxes
- lamp

## Methodology

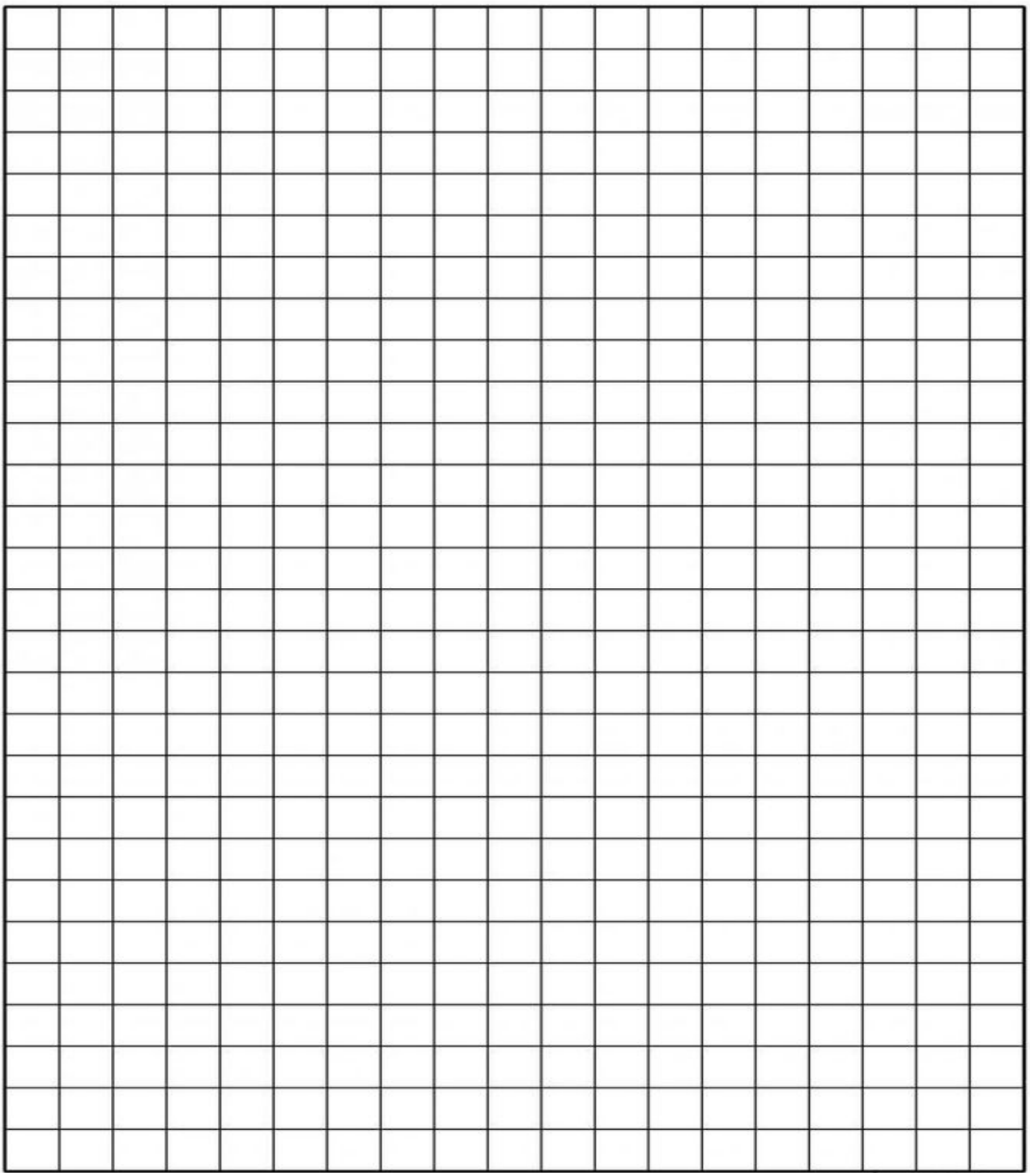
1. Add 5ml of hydrogen carbonate indicator to seven plastic vials (labelled 1–7).
2. Add 10 algae balls to vials 1–6 and then seal all the vials with stoppers.
3. Set up four boxes with an opening covered by coloured cellophane (red, blue, green, yellow).
4. Place vials 1–4 in each of the four boxes and ensure a continuous light source (using a lamp).
5. Place vial 5 in the open light and cover vial 6 with aluminium foil (no light exposure).
6. Leave vials for 24 hours (or until next lesson) and then assess the pH level in each vial.

## Results

| Vial | Red | Blue | Green | Yellow | White | No light | No algae |
|---|---|---|---|---|---|---|---|
| pH | | | | | | | |

## Graph

Construct an absorption spectrum based on the results for the four different colours of light.



## Discussion

**1.** What was the purpose of vial 7?

**2.** What was the purpose of vials 5 and 6?

**3.** Why was it important to immobilise the algae into balls prior to experimentation?

**4.** Do the results match the expected trend? If not, suggest reasons for the discrepancy.