

TEACHING WITH PHOTOSYNTHESIS EXPERIMENTS

The 13+ Biology specification includes:

Topic	Learning Outcomes	Recommended Practical Activities	Links to prior learning at 11+
Photosynthesis	Know the word equation for photosynthesis. Understand the importance of carbon dioxide, water and light in the production of biomass. Recognise the importance of photosynthetic organisms as producers in food chains. Recognise the importance of photosynthesis in maintaining the concentrations of oxygen and carbon dioxide in the atmosphere	Investigate photosynthesis in variegated plant leaves using a starch test. Investigate the effect of light intensity on the rate of photosynthesis in <i>Camomba</i> (or other aquatic plant)	Y3: 2a-2d

The traditional plant material for studying the effect of light intensity on photosynthesis has been Canadian pondweed (*Elodea canadensis*). Established ponds may well be stocked with this plant, and it can be used successfully, although it can be temperamental.

Alternative plants, such as *Cabomba caroliniana* have been suggested as alternatives, although *Camomba* is no longer being imported into the UK due to an invasive plant directive. The Schools and Plant Science (SAPs) website provides excellent guidance and resources for teaching this, including video resources.

General guidance would be to find out which oxygenating plants are being sold by local aquarists and to use a sample of these. At the very least it would be possible to observe that the plants produce oxygen when illuminated. An oxygen probe linked to a datalogger might be helpful, here.

The SAPs website provides a useful guide to such plants.

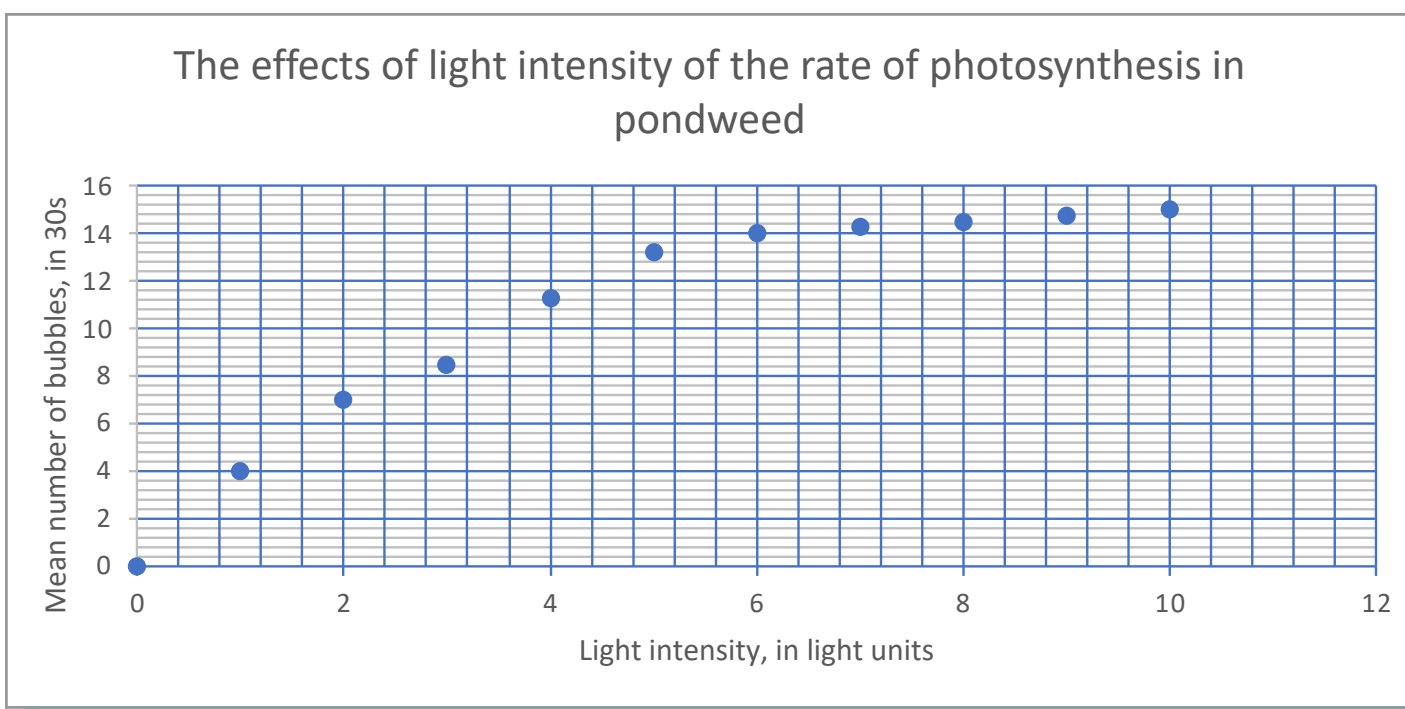
The experiment is best performed in Spring (April/May) although the rate of photosynthesis can be increased by adding sodium hydrogen carbonate (SAPs recommends a 1% solution).

The rate of photosynthesis is the volume of gas/number of bubbles produced in a unit time (eg 30 seconds).

Sample (and rather idealised) data are shown below:

Light intensity, in light units	Mean number of bubbles, in 30 s
0	0.00
1	4.00
2	7.00
3	8.50
4	11.25
5	13.25
6	14.00
7	14.30
8	14.50
9	14.75
10	15.00

Sample (and rather idealised) data are shown below:



This investigation uses light intensity (I) as a dependent variable. Unless we have a light meter, it is easier to use 'distance from the lamp to the plant' (d) as the dependent variable.

The relationship between I and d is complex (I is proportional to $1/d^2$), but this is rarely seen in practice, especially if the bulb has a shade that reflects the light forwards.

Sample (and rather idealised) data are shown below:

Distance from lamp, in cm	Mean number of bubbles, in 30 s
0	58
5	42
10	28
15	15
20	11
25	8
30	6
35	5
40	4

The sample graph is shown below.

