# Required Practical Review

Biology Practical - Photosynthesis

Video link: https://www.youtube.com/watch?v=cBCKedXdFeE&list=PL9IouNCPbCxU6sNg_x5rvlsLwA6gNCVzj&index=7&t=0s

GCSEpod video: https://members.gcsepod.com/shared/podcasts/title/11590

Know it

Read the summary of the practical below.

1. Set up a test tube rack containing a boiling tube at a distance of 10 cm away from the light source

2. Fill the boiling tube with the sodium hydrogen carbonate solution.

3. Put the piece of pondweed into the boiling tube with the cut end at the top. Gently push the pondweed down with the glass rod.

4. Leave the boiling tube for 5 minutes.

5. Start the stop watch and count the number of bubbles produced in one minute.
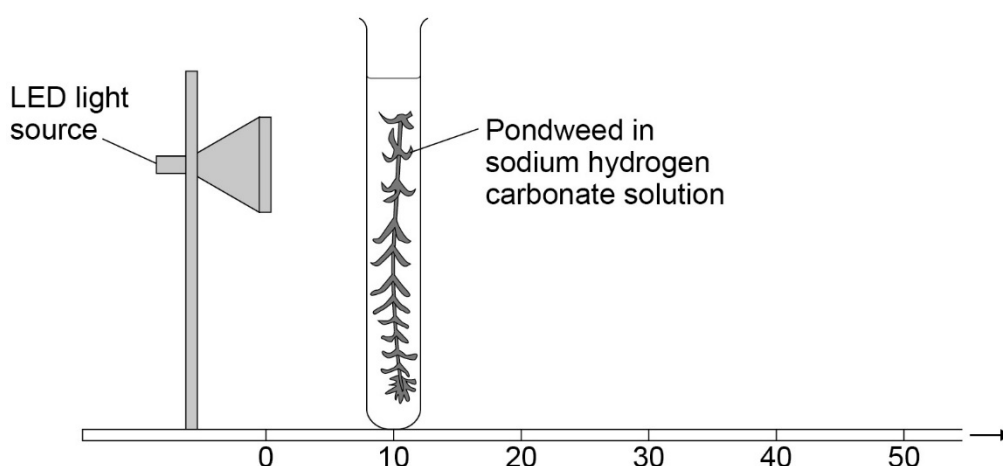
6. Record the result.

7. Repeat the count twice more. Then use the data to calculate the mean number of bubbles per minute.

8. Repeat steps **1–7** with the test tube rack and boiling tube at distances of 20 cm, 30 cm and 40 cm from the light source.

Review it

Up to grade 4

1. Name the: independent, dependent and 2 control variables.

2. Bullet point a method for how to complete this practical.

3. Calculate the means for data below.

Distance (cm)	Light Intensity	Number of bubbles per minute			
		1	2	3	Mean
10		94	97	83	
20		69	67	68	
30		29	61	33	
40		2	2	2	
50		1	20	1	

Grade 5-7

1. What is an anomaly and are there any in the table above?

2. If you identified an anomaly how did you process your data as a result?

3. Calculate the light intensity using this equation: light intensity = $1000/distance^2$

4. What does the data above show?

5. Can you explain the reason for this.

Grade 7+

1. Why was it important to put a beaker of water between the lamp and the boiling tube.

2. How would you modify this practical to investigate the effect of the wave length of light (colour).

Test it

Question 1

A student investigated the effect of red, green and blue light on the rate of oxygen production of a water plant. She used the apparatus shown.
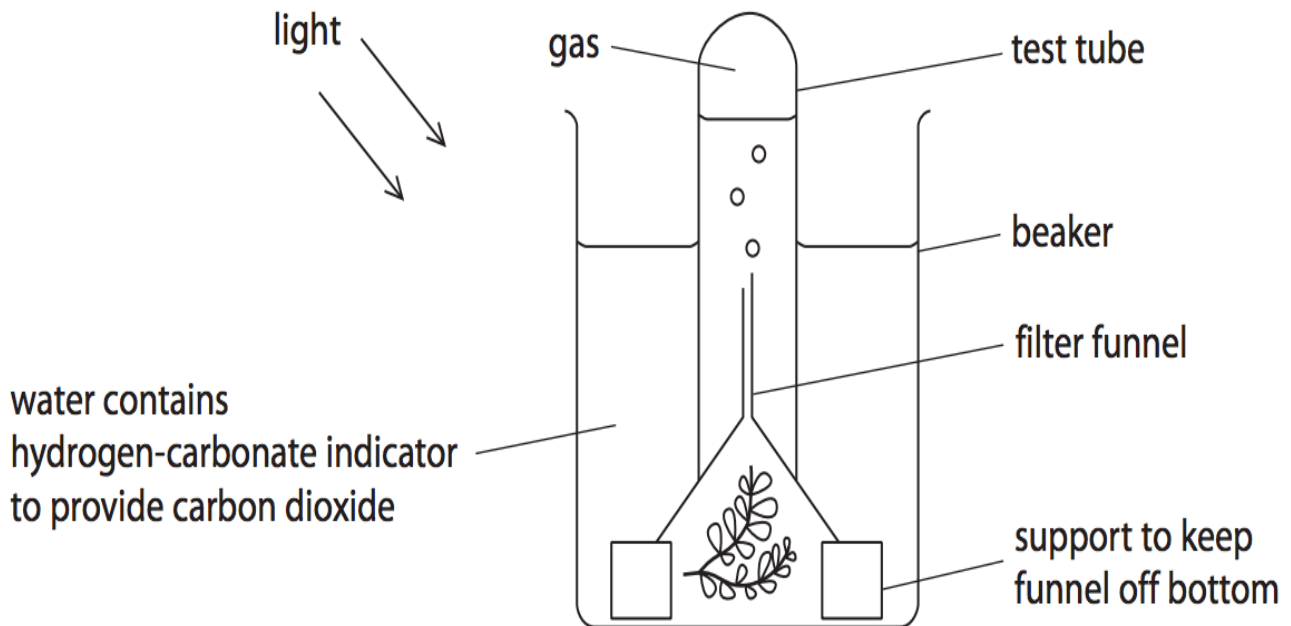
The student shone different coloured lights on the plant. She measured the rate of oxygen production, for each colour, by counting the number of bubbles released per minute.

The results are shown in the table.

Reading	Rate of oxygen production in bubbles released per minute		
	Red light	Green light	Blue light
1	10	1	12
2	11	1	10
3	9	1	2
Average	10	1	11

(a) Give two reasons why the data in the table are reliable.

(2)

1 ....

....

2 ....

....

(b) Suggest how the student could modify the apparatus to measure the rate of oxygen production more accurately.

(1)

....

....

....

....

(c) Name the independent variable in this investigation.

(1)

....

(d) The student changed the colour of the light but kept the intensity the same.

Give three other variables that she should keep the same in order to make the comparison of oxygen production valid.
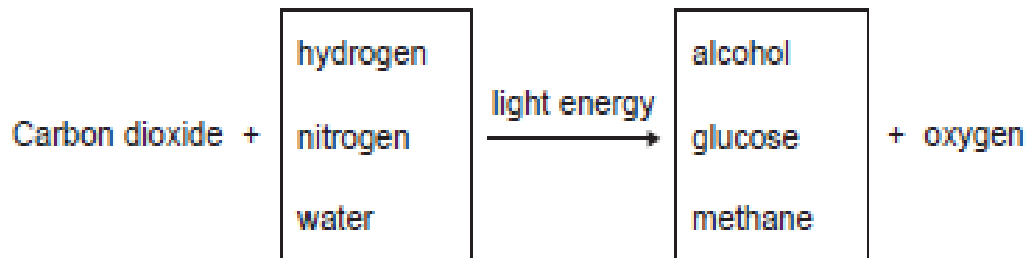
(3)

1 ....

....

2 ....

....

3 ....

....

(Total for Question 2 = 7 marks)

Question 2

3 (a)   Complete the equation for photosynthesis. Draw a ring around each correct answer.

	hydrogen		alcohol	
Carbon dioxide +	nitrogen	light energy →	glucose	+ oxygen
	water		methane	

(2 marks)

Some students investigated the effect of light intensity on the rate of photosynthesis in pondweed.

The diagram shows the apparatus the students used.
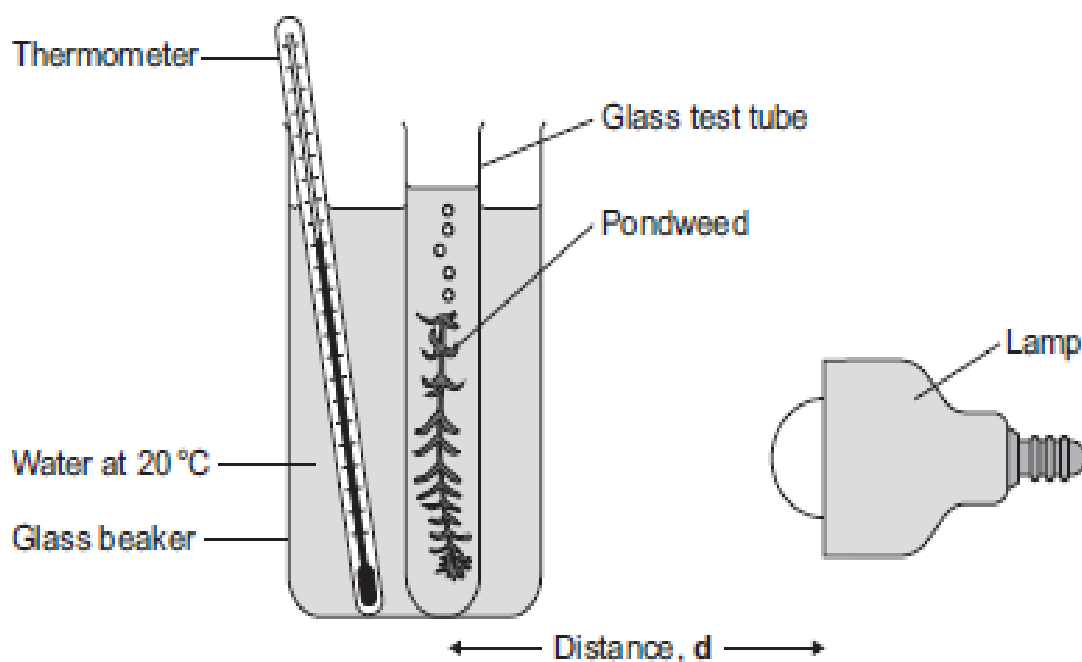
The closer the lamp is to the pondweed, the more light the pondweed receives.

The students placed the lamp at different distances, d, from the pondweed.

They counted the number of bubbles of gas released from the pondweed in 1 minute for each distance.

3 (b)   A thermometer was placed in the glass beaker.

Why was it important to use a thermometer in this investigation?

....

....

....

....

....

....

(3 marks)

3 (c)   The students counted the bubbles four times at each distance and calculated the correct mean value of their results.

The table shows the students' results.

Distance d in cm	Number of bubbles per minute				
	1	2	3	4	Mean
10	52	52	54	54	53
20	49	51	48	52	50
30	32	30	27	31	30
40	30	10	9	11	

3 (c) (i)   Calculate the mean number of bubbles released per minute when the lamp was 40 cm from the pondweed.
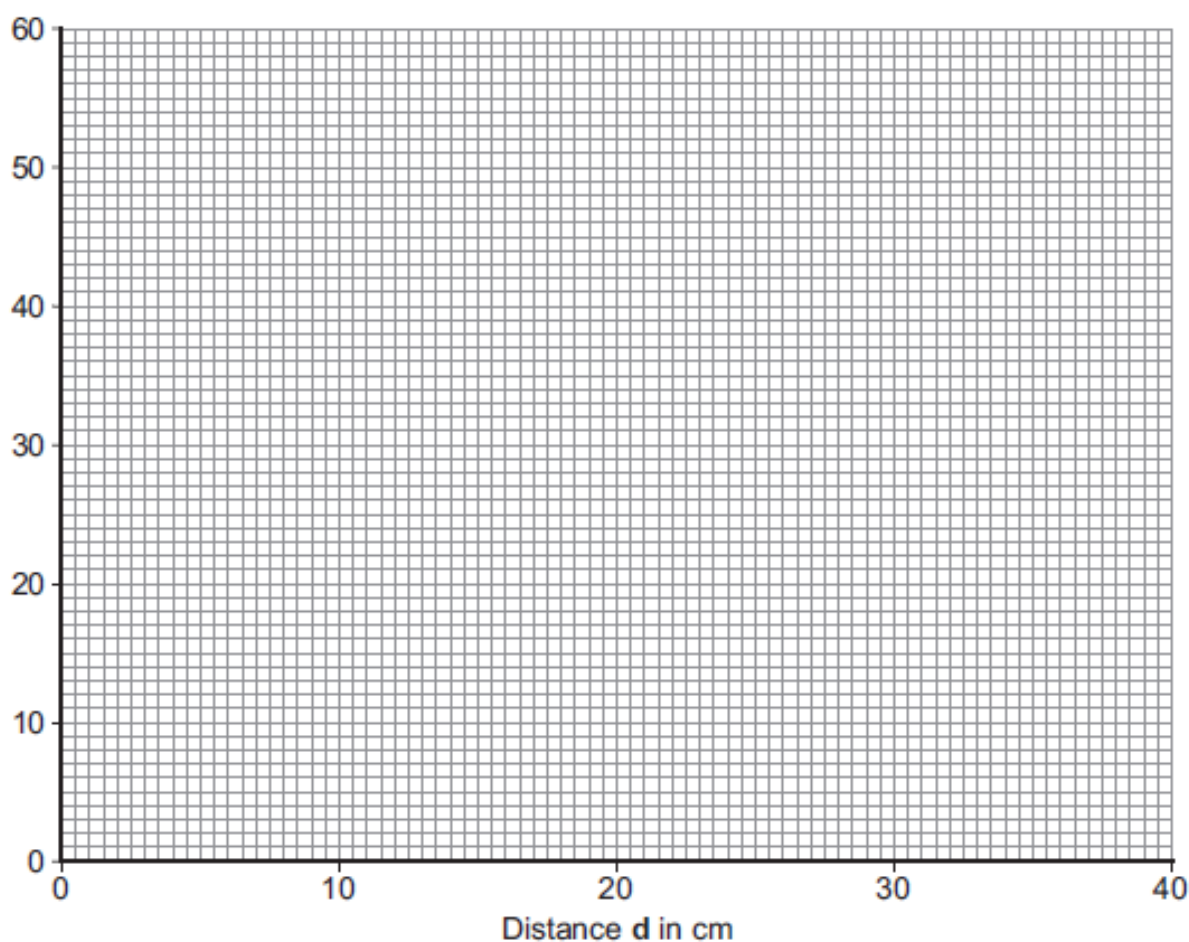
....

....

Mean number of bubbles at 40 cm = ...

(2 marks)

3 (c) (ii) On the graph paper below, draw a graph to show the students' results:

- add a label to the vertical axis
- plot the **mean values** of the number of bubbles
- draw a line of best fit.

Distance **d** in cm

3 (c) (iii) One student concluded that the rate of photosynthesis was inversely proportional to the distance of the lamp from the plant.

Does the data support this conclusion?
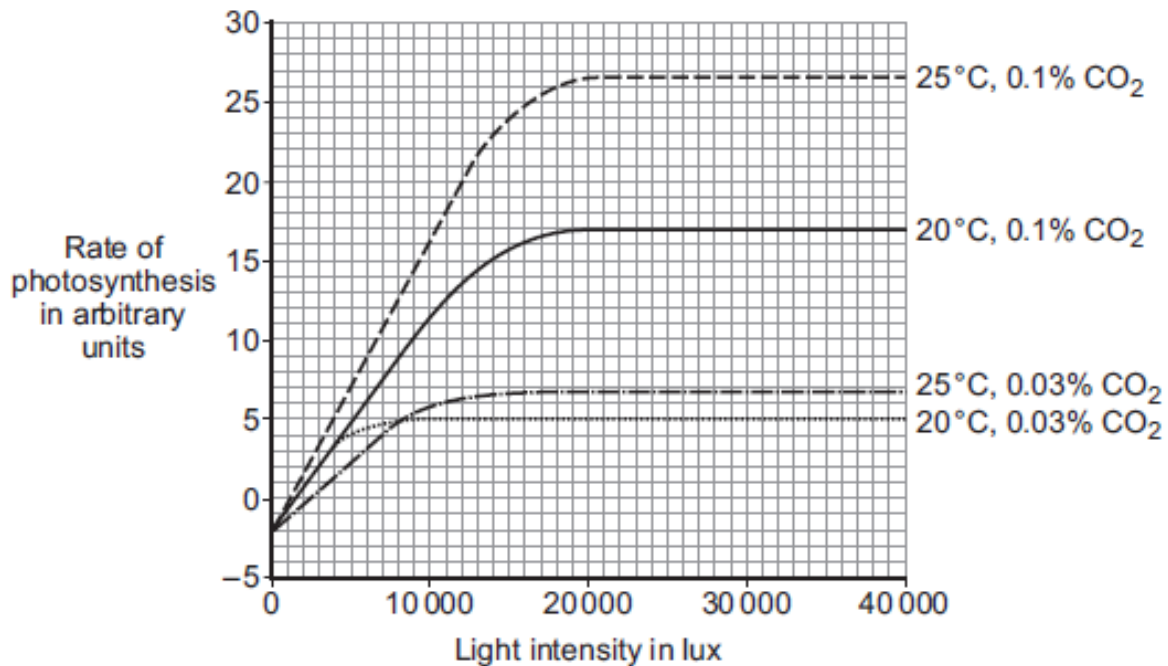
Explain your answer.

....

....

....

....

....

....

(2 marks)

3 (d)   Light intensity, temperature and concentration of carbon dioxide are factors that affect the rate of photosynthesis.

Scientists investigated the effects of these three factors on the rate of photosynthesis in tomato plants growing in a greenhouse.

The graph below shows the scientists' results.

A farmer in the UK wants to grow tomatoes commercially in a greenhouse.

The farmer read about the scientists' investigation.

During the growing season for tomatoes in the UK, natural daylight has an intensity higher than 30 000 lux.

The farmer therefore decided to use the following conditions in his greenhouse during the day:

- 20 °C

- 0.1% CO_2

- no extra lighting.

Suggest why the farmer decided to use these conditions for growing the tomatoes.

You should use information from the scientists' graph in your answer.

....

....

....

....

....

....

....

....

....

....

....

(4 marks)

Mark it

Question 1

Question number	Answer	Notes	Marks
2 (a)	1. repeated / 3 readings / 3 times / average / more than once / eq; 2. similar (pattern for red / for green); 3. anomaly ignored in calculation of average for blue light;		Max 2
(b)	measuring cylinder / syringe / scale on the side / eq;	Ignore measure volume	1
(c)	colour / wavelength of light;	Light alone = 0	1
(d)	1. mass of plant / size of plant / length of plant / amount of plant; 2. species of plant / type of plant / same plant; 3. age of plant; 4. temperature (of water) / room temperature; 5. mass/amount of sodium hydrogen carbonate / conc. of carbon dioxide / eq; 6. volume/amount of water / volume of indicator / eq; 7. light intensity / light duration / eq;	Ignore heat Same size test tube/beaker = 0 Ignore time Ignore same funnel exit	max 3
			Total 7 marks

Question 2

Question	Answers	Extra information	Mark	Spec/AO
3(a)	LHS = water RHS = glucose		1 1	6.1.a AO1
3(b)	any **three** from: • (measure) temperature • to check that the temperature isn't changing • rate of reaction changes with temperature • temperature is a variable that needs to be controlled	ignore reference to fair test allow lamp gives out heat	3	6.1.c/ 3d.d AO2+3
3(c)(i)	10	correct answer = **2 marks** allow **1** mark for: $\dfrac{(10+9+11)}{3}$ allow **1** mark for correct calculation without removal of anomalous result ie 15	2	6.1.b/ 3d.i AO2+3

3(c)(i)	10	correct answer = **2 marks** allow **1** mark for: $\dfrac{(10+9+11)}{3}$ allow **1** mark for correct calculation without removal of anomalous result ie 15	2	6.1.b/ 3d.i AO2+3
3(c)(ii)	graph: label on y-axis as 'number of bubbles per minute' **three** points correct = **1 mark** **four** points correct = **2 marks** line of best fit = smooth curve	allow ecf from 3(c)(i) allow ± 1 mm	1 2 1	6.1.bc/ 3.d.g AO2
3(c)(iii)	as distance increases, rate decreases – pro but should be a straight line / but line curves – con / not quite pro	allow yes between 20 – 40 allow not between 10 – 20 if line of best fit is straight line, allow idea of poor fit	1 1	6.1.c/ 3d.k AO3

Question	Answers	Extra information	Mark	Spec/AO
3(d)	any **four** from: make more profit / cost effective • raising temp. to 25 °C makes very little difference at 0.03% CO_2 • (at 20 °C) with CO_2 at 0.1%, raises rate • (at 20 °C with CO_2 at 0.1%) → >3x rate / rises from 5 to 17 • although 25 °C → higher rate, cost of heating not economical • extra light does not increase rate / already max. rate with daylight	accept ref to profits c.f. costs must be favourable	4	6.1.c AO3
Total			17	