

(Rate of photosynthesis (practical, light intensity calculations – inverse square law is Higher))

Q1.a)(2019)

This question is about photosynthesis.

Complete the word equation for photosynthesis:

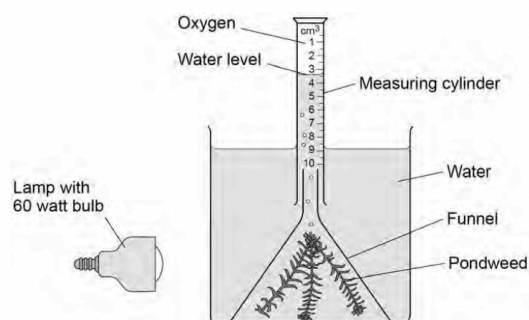
[2 marks]

_____ + _____ → _____ + oxygen

A student investigated photosynthesis using pondweed.

Figure 14 shows the apparatus the student used.

Figure 14



This is the method used.

1. Set up the apparatus as shown in Figure 14.
2. Switch on the lamp.
3. After 20 minutes, record the volume of oxygen collected in the measuring cylinder.
4. Repeat steps 1–3 using bulbs of different power output.

Q1.b)(2019)

What was the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

Power output of bulb

☐

Rate of photosynthesis

☐

Time to collect oxygen

☐

Volume of oxygen collected

☐

Q1.c)(2019)

Suggest **two** ways the method could be improved so the results would be more valid.
[2 marks]

1 _____

2 _____

Q1.d)(2019)

Table 9 shows the student's results.

Table 9

Power output of bulb in watts	Volume of oxygen collected in 20 minutes in cm ³	Rate of photosynthesis in cm ³ /hour
60	0.5	1.5
100	0.8	2.4
150	1.1	X
200	1.2	3.6
250	1.2	3.6

Calculate value **X** in **Table 9**.

[1 mark]

X = _____ cm³/hour

Q1.e)(2019)

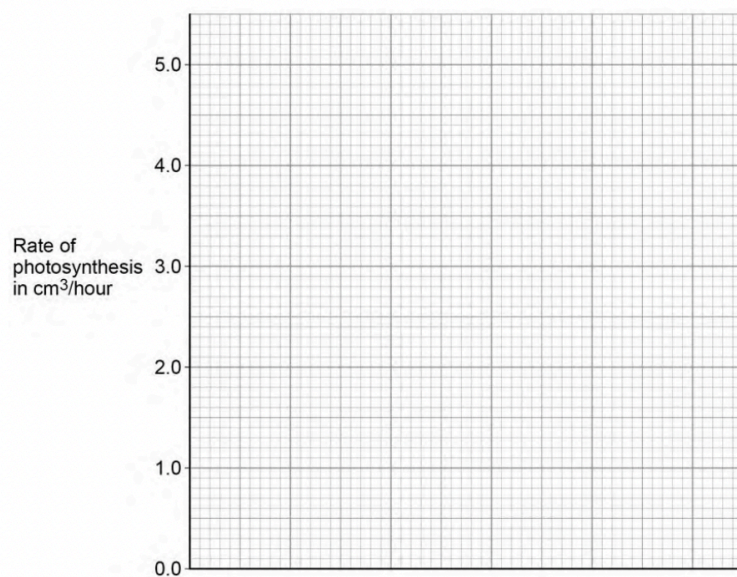
Complete **Figure 15**.

[4 marks]

You should:

- label the x-axis
- use a suitable scale
- plot the data from **Table 9** and your answer to Question 09.4
- draw a line of best fit.

Figure 15



Q1.f)(2019)

Determine the expected rate of photosynthesis with a bulb of power output 75 watts.

Use **Figure 15**.

[1 mark]

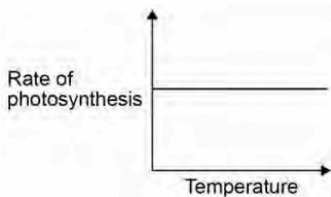
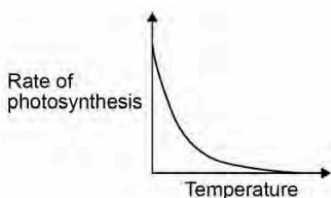
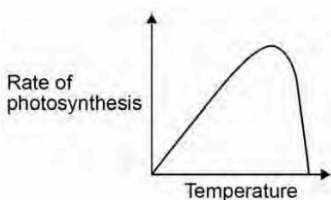
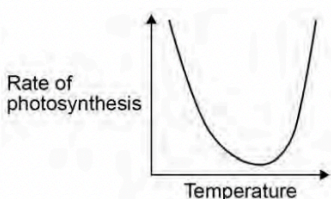
Rate of photosynthesis at 75 watts = _____ cm³/hour

Q1.g)(2019)

Which graph shows the effect of temperature on the rate of photosynthesis?

[1 mark]

Tick (✓) **one** box.


☐

☐

☐

☐

Q2.a)(2020)

Students investigated the effect of temperature on the rate of photosynthesis.

The students shone light from a lamp onto pondweed and measured the volume of oxygen produced per hour.

Table 3 shows the results.

Table 3

Temperature in °C	Rate of photosynthesis in cm ³ /hour			
	Test 1	Test 2	Test 3	Mean
20	18.5	19.3	19.5	X
25	32.6	34.1	32.9	33.2
30	41.9	45.2	44.9	44.0
35	38.6	39.8	44.0	40.8
40	23.1	20.5	22.4	22.0
45	1.9	14.2	2.2	2.1

Calculate mean value **X**.

[2 marks]

X = _____ cm³/hour

Q2.b)(2020)

The students identified one anomalous result in **Table 3**.

Draw a ring around the anomalous result in **Table 3**.

[1 mark]

Q2.c)(2020)

Suggest **one** possible cause of the anomalous result.

[1 mark]

Q2.d)(2020)

How did the students deal with the anomalous result?

[1 mark]

Q2.e)(2020)

Give **one** factor the students should have kept constant in this investigation.

[1 mark]

Q3.a)(2023)

A student investigated the effect of light from different coloured light bulbs on photosynthesis.

The student:

- used pondweed in a beaker of water
- used different coloured light bulbs in a lamp
- counted the number of bubbles of oxygen the pondweed produced in 2 minutes for each colour of light bulb.

Give **one** hazard the student would need to consider when using the apparatus in this investigation.

Give the risk the hazard would cause.

[2 marks]

Hazard _____

Risk _____

Q3.b)(2023)

The student needed to keep the temperature of the water in the beaker the same throughout the investigation.

Describe how the student could keep the temperature of the water the same.

[1 mark]

Q3.c)(2023)

The beaker of water contained the pondweed.

Explain why the temperature of the water in the beaker needed to be kept the same throughout the investigation.

[2 marks]

Q3.d)(2023)

Table 3 shows the results.

Table 3

Colour of light bulb	Number of bubbles of oxygen produced in 2 minutes
Blue	46
Green	8
Red	38
Yellow	29

Which colour of light caused the highest rate of photosynthesis in the pondweed?

[1 mark]

Tick (✓) **one** box.

Blue ☐

Green ☐

Red ☐

Yellow ☐

Q3.e)(2023)

What is the best way to display the data in Table 3?

[1 mark]

Tick (✓) **one** box.

Bar graph ☐

Line graph ☐

Scatter graph ☐

Q3.f)(2023)

The student wanted to measure the **volume** of oxygen the pondweed produced in 2 minutes.

Name **one** piece of apparatus the student could use to measure the volume of oxygen.

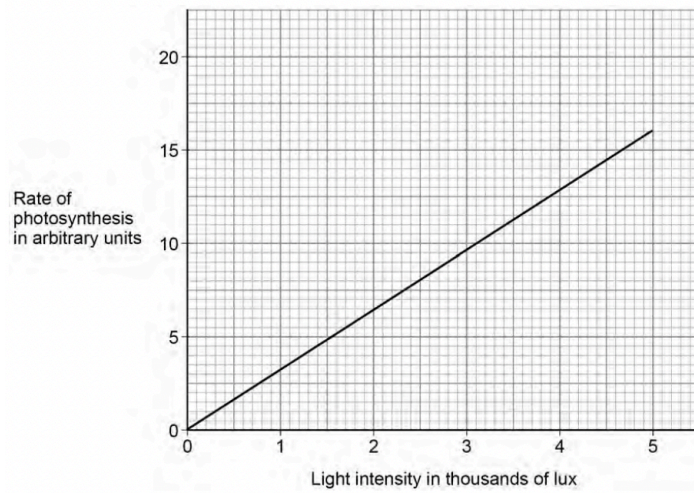
[1 mark]

Q3.g)(2023)

Another student investigated the effect of light intensity on the rate of photosynthesis.

Figure 1 shows the results.

Figure 1



Describe what **Figure 1** shows about the relationship between light intensity and the rate of photosynthesis.

[2 marks]
