

B8- Photosynthesis Exam Practice 1

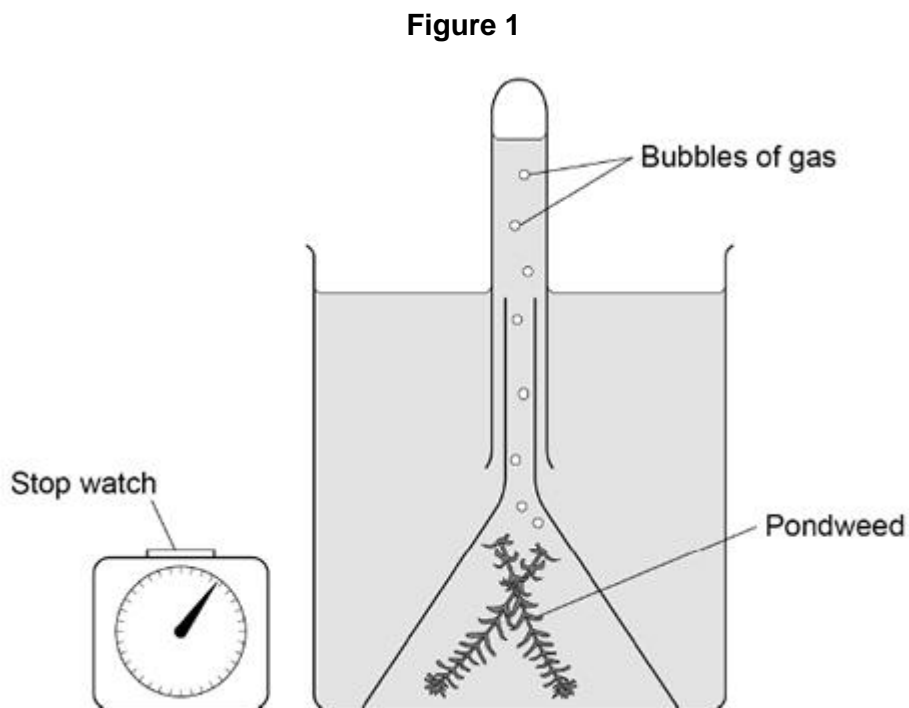
Name:

Score:

Q1.

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

Figure 1 shows some of the apparatus used.



- (a) Name the gas produced by the pondweed in the light.

(1)

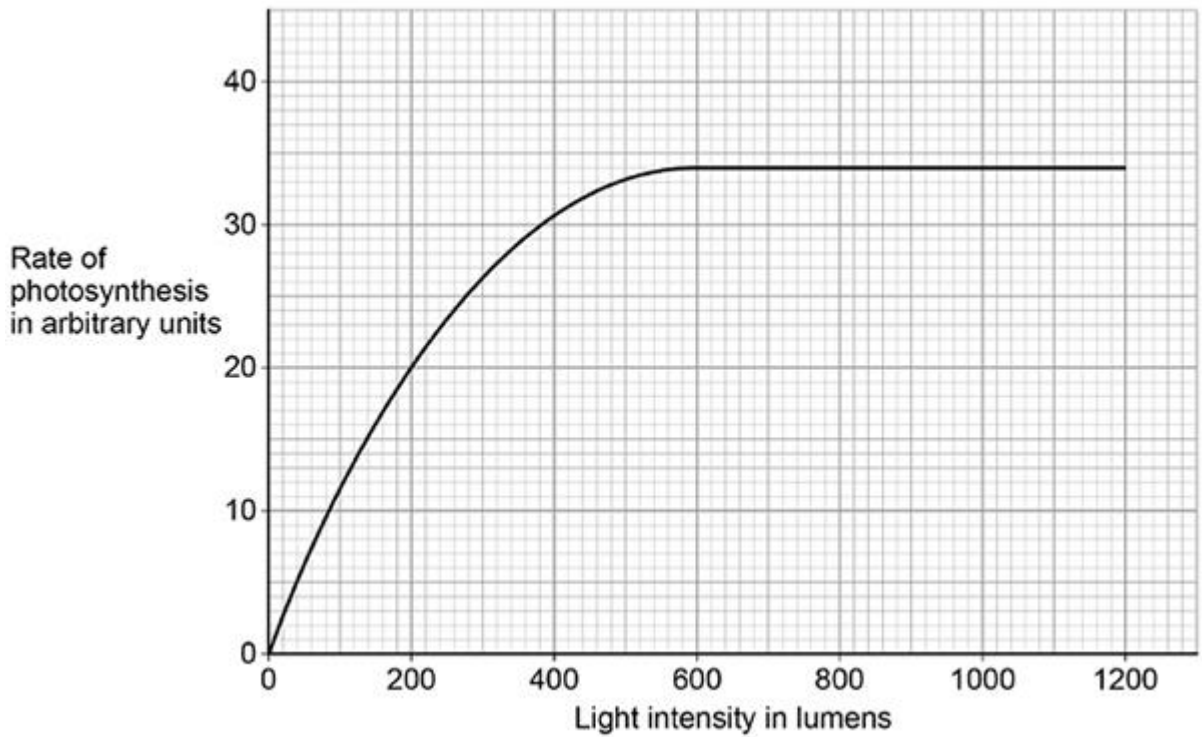
- (b) Describe **one** way the student could change the intensity of light reaching the pondweed.

(2)

- (c) Describe how the student could use the apparatus in **Figure 1** to measure the rate of photosynthesis.

Figure 2 shows the student's results.

Figure 2



(d) What was the maximum rate of photosynthesis?

Maximum rate = _____ arbitrary units

(1)

(e) At which light intensity was light a limiting factor?

Tick (✓) **one** box.

- 200 lumens
- 600 lumens
- 1200 lumens

(1)

(f) Light intensity can affect the rate of photosynthesis.

Give **one** other factor that can affect the rate of photosynthesis.

(1)

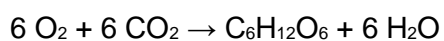
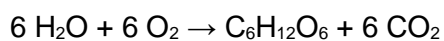
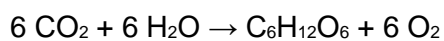
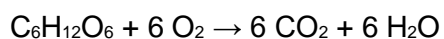
(Total 8 marks)

Q2.

Plants absorb light for photosynthesis.

(a) Which is the equation for photosynthesis?

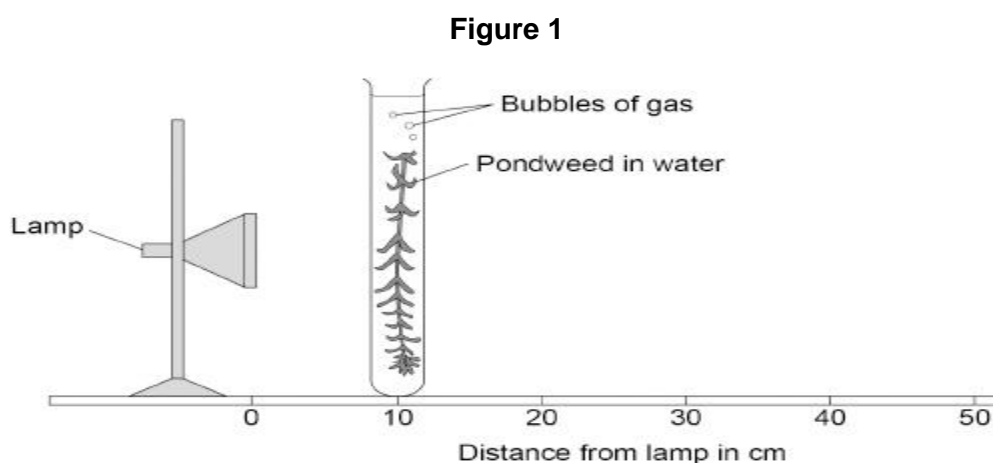
Tick (✓) **one** box.



(1)

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

Figure 1 shows the apparatus.



This is the method used.

1. Set up the apparatus as shown in **Figure 1**.
2. Place the pondweed 10 cm away from the lamp.
3. Switch on the lamp.
4. Record the number of bubbles of gas produced in 5 minutes.
5. Repeat steps 2 to 4 with the pondweed at different distances from the lamp.

(b) What was the independent variable in this investigation?

Tick (✓) **one** box.

Distance of the pondweed from the lamp

Length of the piece of pondweed

Number of bubbles of gas produced

Time taken to collect the gas

(1)

The lamp gets warm when it is on. This causes the temperature of the water to increase.

(c) Explain how an increase in temperature would affect the results of this investigation.

(2)

(d) Suggest **one** way the investigation could be improved so the temperature of the water does **not** increase.

(1)

(e) Suggest **two** improvements to the investigation so the results would be more valid.

Do **not** refer to controlling the temperature of the water.

1 _____

2 _____

(2)

The table below shows the results.

Distance of pondweed from the lamp in cm	Number of bubbles of gas produced in 5 minutes
10	120
20	56
30	31
40	16
50	10

- (f) Calculate the rate of photosynthesis when the pondweed was 40 cm from the lamp.

Give the rate of photosynthesis as the number of bubbles of gas produced per minute.

Rate = _____ bubbles of gas produced per minute

(1)

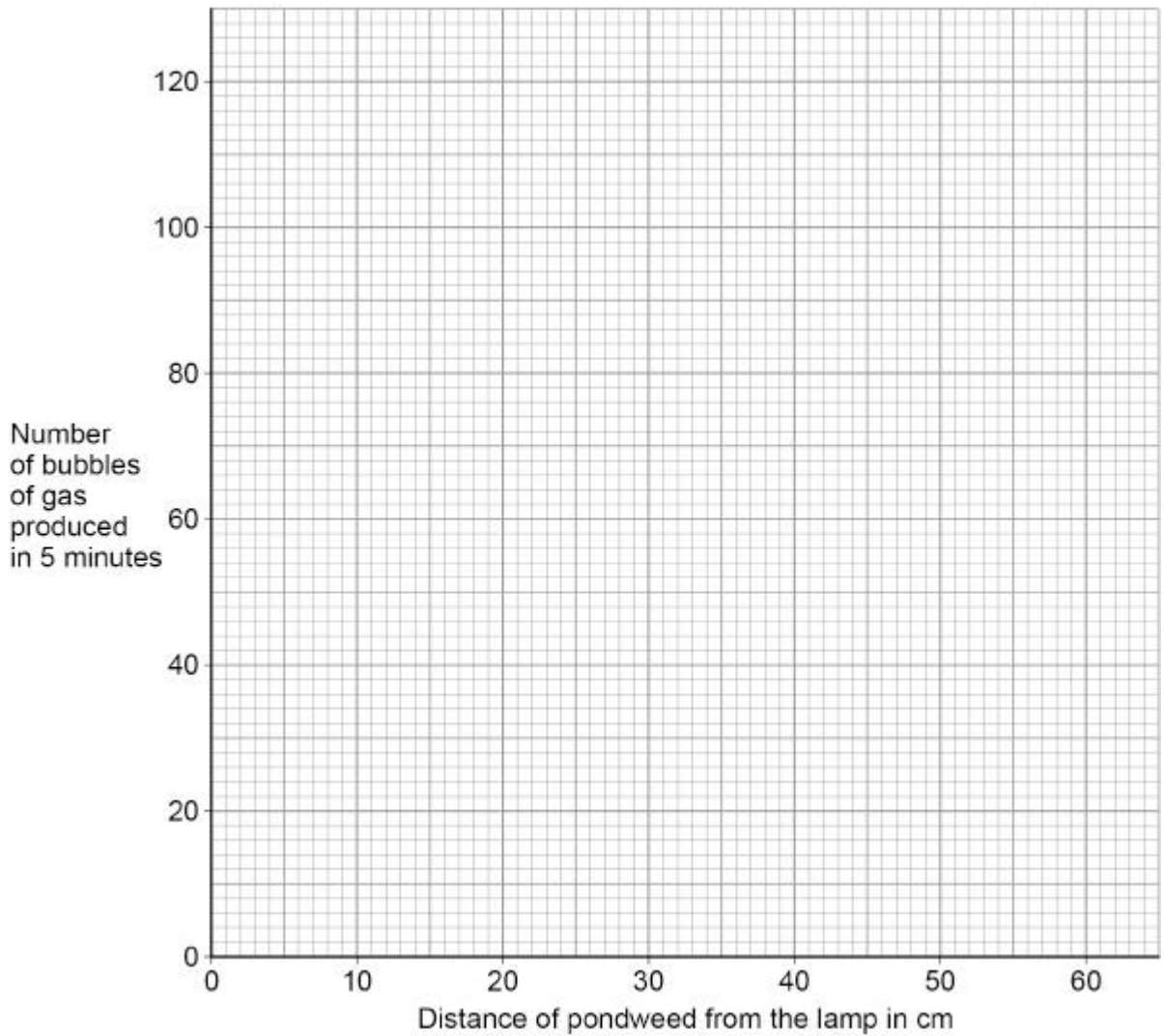
- (g) Give **one** conclusion that can be made from the table above.

(1)

(h) Plot the data from the table above on **Figure 2**.

Draw a line of best fit.

Figure 2



(3)

(i) Predict the number of bubbles that would be produced in 5 minutes if the pondweed was 60 cm from the lamp.

Use **Figure 2**.

Number of bubbles produced in 5 minutes = _____

(1)

(Total 13 marks)

Higher Questions

This question is about photosynthesis and food production.

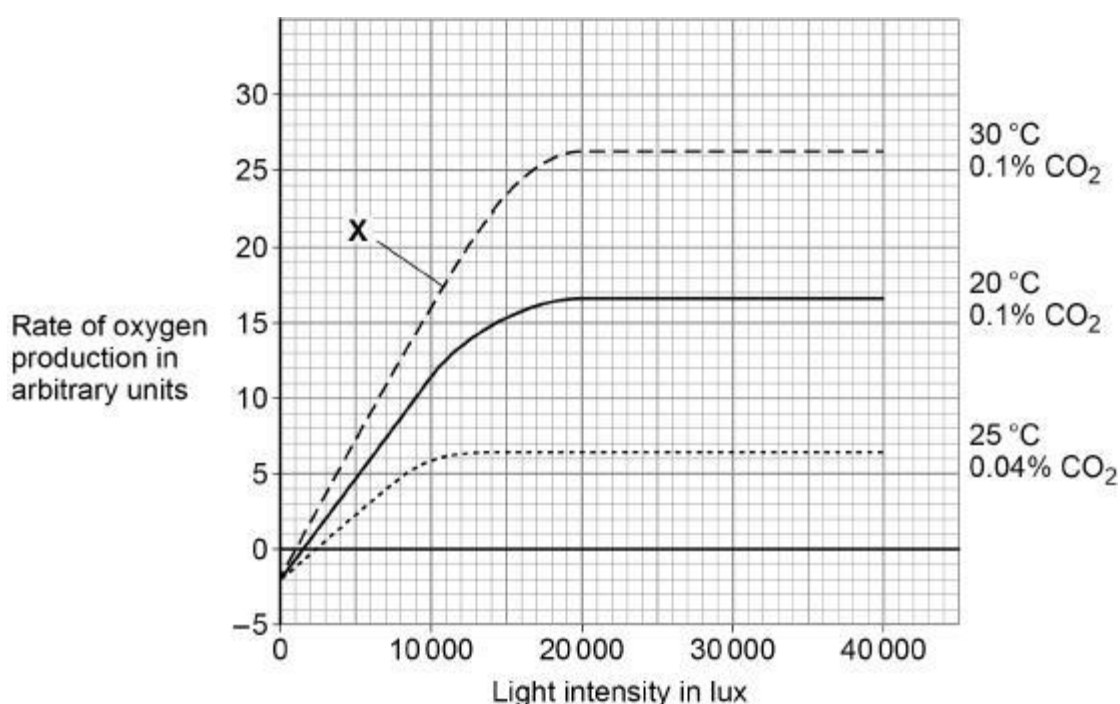
- (a) How can oxygen production be used to show the **rate** of photosynthesis?

(1)

Scientists investigated factors affecting the rate of photosynthesis in tomato plants.

The tomato plants were growing in a commercial greenhouse in the UK during winter.

The graph below shows the results.



The percentage of carbon dioxide in the Earth's atmosphere is 0.04%

- (b) Name the factor that is limiting the rate of photosynthesis at point X.

(1)

Farmers growing tomatoes commercially try to control the rate of photosynthesis and make maximum profit.

A farmer can control the temperature and carbon dioxide concentration in a greenhouse.

- (c) What is the **minimum** light intensity a farmer should use to get the maximum rate of photosynthesis shown in above graph?

Light intensity = _____ lux

(1)

(d) The light intensity you gave in part (c) may **not** give the farmer maximum profit.

Explain why.

(3)

(e) Explain the results when the light intensity was 0 lux.

Use the diagram above.

(4)

(Total 10 marks)

Q4.

Green plants can make glucose.

(a) Plants need energy to make glucose.

How do plants get this energy?

(2)

(b) Plants can use the glucose they have made to supply them with energy.

Give **four** other ways in which plants use the glucose they have made.

(4)

(Total 6 marks)

Mark schemes

Q1.

(a) oxygen

name takes precedence

allow O₂

ignore O² / O / O₂

1

(b) (use) a lamp / light (source)

1

(and) move away and / or towards pondweed

*allow use different power ratings **or** use a dimmer switch*

*allow change the opacity of the beaker for **2** marks*

1

(c) count the number of bubbles

allow measure the volume of gas collected

1

in a given time

*allow for **2** marks measure time taken to collect a specific number of bubbles*

1

(d) 34 (arbitrary units)

allow a value in the range 33.5 – 34.5 (arbitrary units)

1

(e) 200 lumens

1

(f) any **one** from:

- temperature
- carbon dioxide (concentration)
- amount of chlorophyll

ignore light (intensity)

ignore heat

ignore oxygen

allow light colour / wavelength

allow water

ignore pH

1

[8]

Q2.

(a) $6 \text{ CO}_2 + 6 \text{ H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{ O}_2$

1

- (b) distance of the pondweed from the lamp 1
- (c) bubbles (of gas) would be produced faster
allow more / bigger bubbles of gas would be produced (in a given time) 1
- (because) enzymes work faster
allow (because) photosynthesis is controlled by enzymes
allow (because) photosynthesis would be faster 1
- (d) any **one** from:
- use an LED (lamp)
allow use a light that does not emit (a lot of) infrared / thermal radiation
 - place a tank / beaker of water between the lamp and tube / pondweed
 - put the tube in a beaker of water
 - put the tube in a (thermostatically controlled) water bath
 - place a piece of glass between the lamp and tube / pondweed
allow place a heat shield between the lamp and tube / pondweed 1
- (e) any **two** from:
- measure the volume of gas produced
allow amount for volume allow use a cylinder / gas syringe to collect the gas
 - allow the pondweed time to equilibrate
allow a description of this
 - repeat **and** calculate a mean
or
 repeat **and** remove anomalies
ignore repeat unqualified
 - control the concentration of carbon dioxide (in the water)
allow put the pondweed in sodium hydrogen carbonate (solution) or sodium bicarbonate (solution)
 - use the same bulb / lamp
allow use the same type / size / age / piece of pondweed
allow record the number of bubbles of gas produced in a longer period of time 2
- (f) 3 (bubbles of gas produced per minute)
allow 3.2 (bubbles of gas produced per minute)
*do **not** accept 3.0 (bubbles of gas produced per minute)* 1

- (g) as light intensity decreases the rate of photosynthesis decreases
allow as distance from lamp increases rate of photosynthesis decreases
allow as distance from lamp increases number of bubbles produced decreases 1
- (h) all points plotted correctly
allow tolerance of $\pm \frac{1}{2}$ a small square
allow 1 mark for four points plotted correctly 2
- line of best fit through their points
*do **not** accept line extended to 0, 0*
ignore extrapolations of line 1
- (i) 8
allow correct value from their line $\pm \frac{1}{2}$ a small square
allow value in range 6 to 9 if a curved line of best fit is not drawn 1
- [13]

Higher Questions Mark Scheme

Q1.

- (a) measure the volume of oxygen produced in a given time
or
 when more oxygen is produced in a given time the rate of photosynthesis is faster
a reference to rate is needed
allow gas for oxygen
allow when oxygen is produced faster the rate of photosynthesis is faster
ignore the faster the rate of photosynthesis, the more oxygen is produced
allow the slower the oxygen is produced the slower the rate of photosynthesis
or
less oxygen being produced in a given time, the slower the rate of photosynthesis 1
- (b) light (intensity)
ignore temperature 1
- (c) 20 000 (lux)
allow answers in range 19 500 to 20 500 (lux)

- 1
- (d) there is a cost for heating the greenhouse 1
- there is a cost for increasing the carbon dioxide in the atmosphere (of the greenhouse)
- allow there is a cost for lighting (in winter)* 1
- (therefore) the additional costs might exceed the (additional) sale price / profit
or
 (additional) costs could not be recovered by increasing the sale price of the tomatoes
- ignore these additional costs would reduce profits unqualified* 1
- (e) when there is no light there is no photosynthesis 1
- (so) no oxygen is produced 1
- (but) respiration happens (all the time) and oxygen is used 1
- (therefore) the net / overall oxygen production is negative / - 2 (arbitrary units)
*do **not** accept an answer of -2 (arbitrary units) unqualified* 1

[10]

Q4.

- (a) light is trapped / absorbed / used 1
- extra answers cancel mark ignore solar / sunshine*
- by chlorophyll / chloroplasts
- if no other marks awarded, allow 1 mark for photosynthesis / equation for photosynthesis* 1
- (b) (to make) starch (for storage)
- ignore 'for growth' unqualified ignore respiration* 1
- (to make) fat / oil (for storage) 1
- (to make) amino acids / proteins / enzymes 1
- (to make) cellulose / cell walls

allow for active transport
allow any other correct, named organic substances (eg DNA
/ ATP / chlorophyll / hormone)
*if no named examples, allow 'to make **named** cell structures'*
for max. 1 mark

1

[6]