OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



EXAM QUESTION PACK

B1.4 PHOTOSYNTHESIS

SCORE	PERCENTAGE
/164	%

STEMUP

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Gateway Biology A (9-1)

Photosynthesis

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

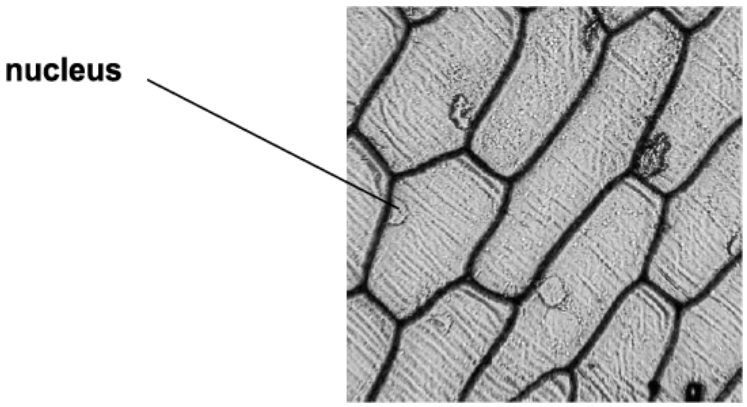
- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **164**.
- The total number of marks may take into account some 'either/or' question choices.

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1 Look at the image below of some onion cells.



(i) Explain how the contents of the nucleus allow it to carry out its function.

---

[2]

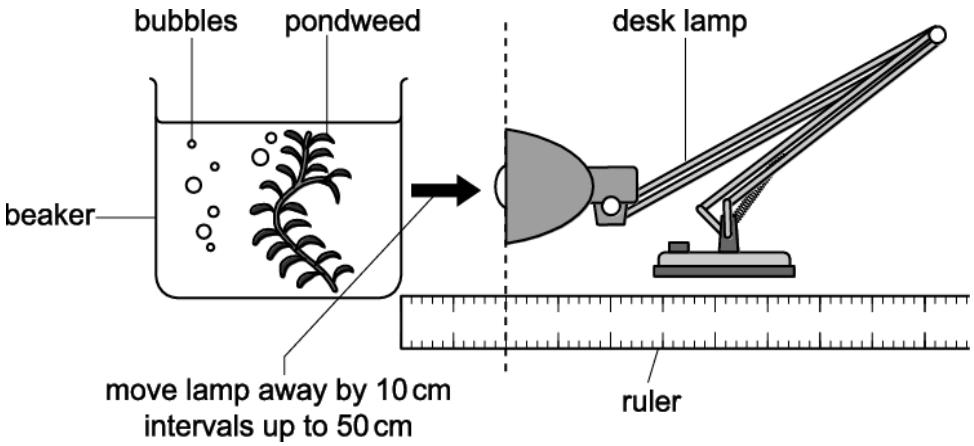
(ii) Explain why there are **no** chloroplasts in these onion cells.

---

[2]

2 Puj investigates how light intensity affects the rate of photosynthesis in pondweed.

The diagram shows how he sets up his investigation.



Puj plans to place the lamp at distances 10 cm, 15 cm and 20 cm from the beaker.

Puj plans to measure how much gas the pondweed gives off in 10 seconds.

His teacher says he could improve his plan.

Write down two improvements he could make to his plan.

---

[2]

3 What type of reactions are photosynthesis and respiration?

	photosynthesis	respiration
A	endothermic	endothermic
B	endothermic	exothermic
C	exothermic	endothermic
D	exothermic	exothermic

Your answer ☐

[1]

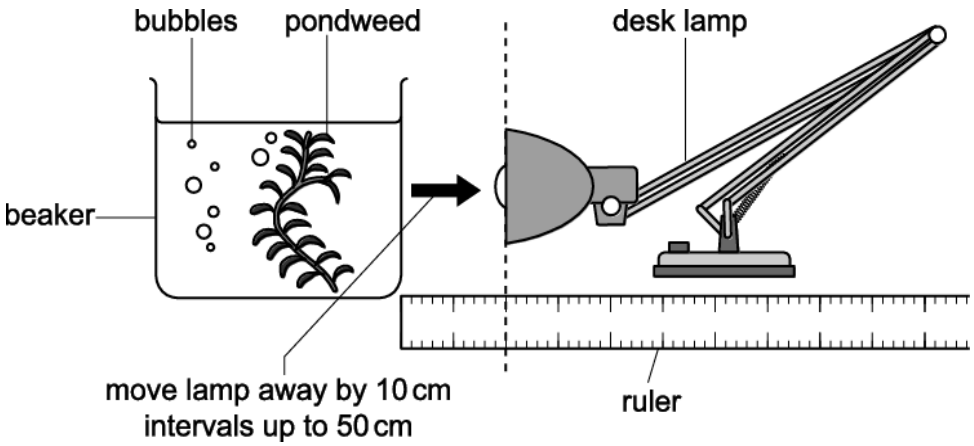
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4(a) Puj investigates how light intensity affects the rate of photosynthesis in pondweed.

The diagram shows how he sets up his investigation.



Puj plans to place the lamp at distances 10 cm, 15 cm and 20 cm from the beaker.

Puj plans to measure how much gas the pondweed gives off in 10 seconds.

Puj counts the number of bubbles to get a measure of the amount of gas given off in photosynthesis.

Give **two** reasons why counting bubbles is **not** an accurate way of measuring the amount of gas given off.

---

[2]

(b) What is the gas given off in photosynthesis?

---

[1]

(c) Explain why the amount of this gas given off is **not** a true measure of the rate of photosynthesis.

---

[2]

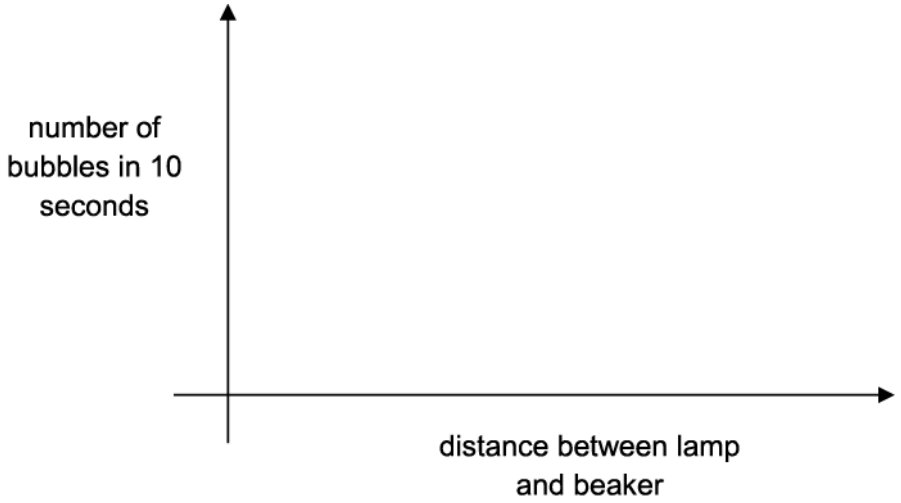
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(d)

(i) Sketch a line on the axes below to show the results you would expect.



[2]

(ii) Explain the shape of the graph. **Two** explanations are required.

---

[2]

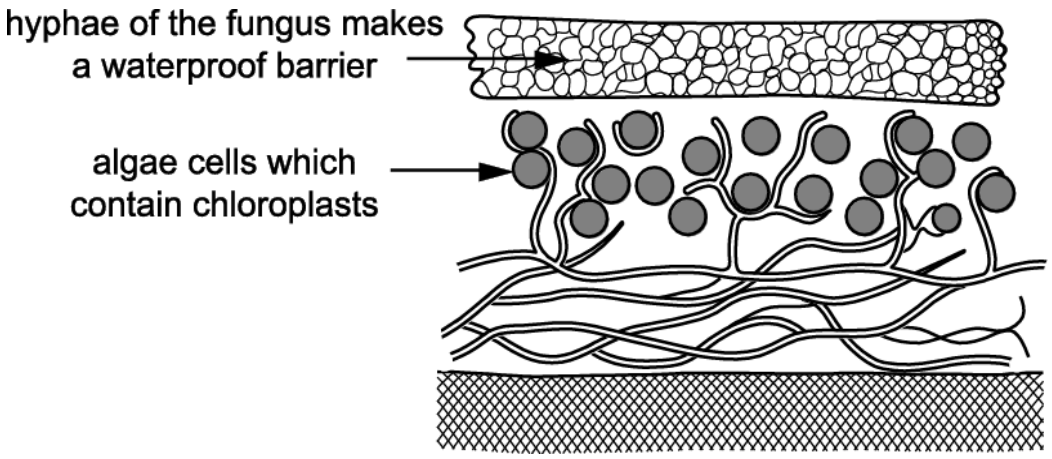
5 Some students are investigating lichens.

Lichens are often studied because they are sensitive to pollution.

Lichens are made up of two different organisms: fungi and algae.

Both the fungus and the algae gain from living together.

The students find a diagram of a lichen.



Using the information from the diagram suggest what the algae and fungi each gain from their relationship.

algae

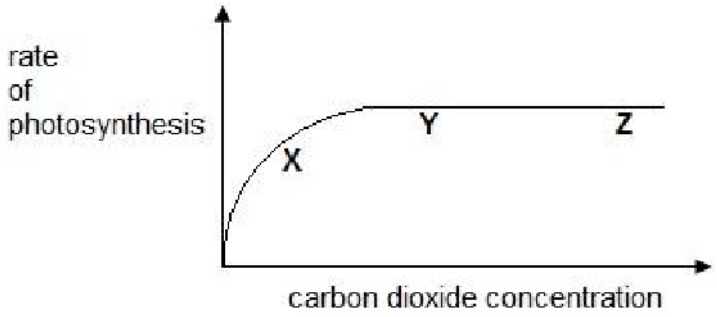
---

fungus

---

[2]

6 The graph shows the effect of carbon dioxide concentration on the rate of photosynthesis.



Where on the graph is carbon dioxide a limiting factor?

A **X** only
B **X** and **Y**
C **Z** only
D **Y** and **Z**

Your answer ☐

[1]

7 The inverse square law in relation to light intensity (i) and distance (d) from the light source is shown by:

A $i \propto d^2$
B $i \propto 1/d^2$
C $i^2 \propto 1/d$
D $i^2 \propto d$

Your answer ☐

[1]

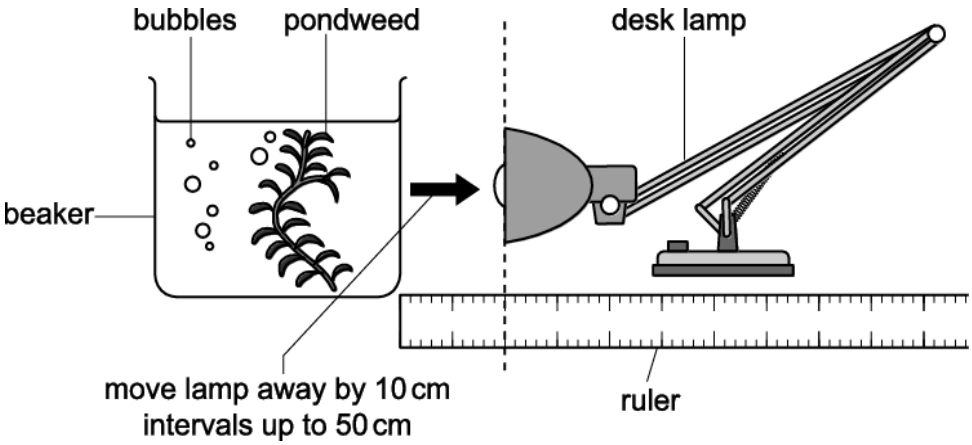
8(a) Puj investigates how light intensity affects the rate of photosynthesis in pondweed.

The diagram shows how he sets up his investigation.

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Puj places the lamp at distances 10 cm, 30 cm, 50 cm, 70 cm and 90 cm from the beaker.

At each distance he counts how many bubbles of oxygen gas the pondweed gives off in 1 minute.

(i) Puj counts the number of bubbles to get a measure of the amount of gas given off in photosynthesis.

Why is counting bubbles **not** an accurate way of measuring the amount of gas given off?

---

[2]

(ii) Bob's teacher says that collecting the gas, for example in a gas syringe, would give a more accurate measurement.

Explain why.

---

[1]

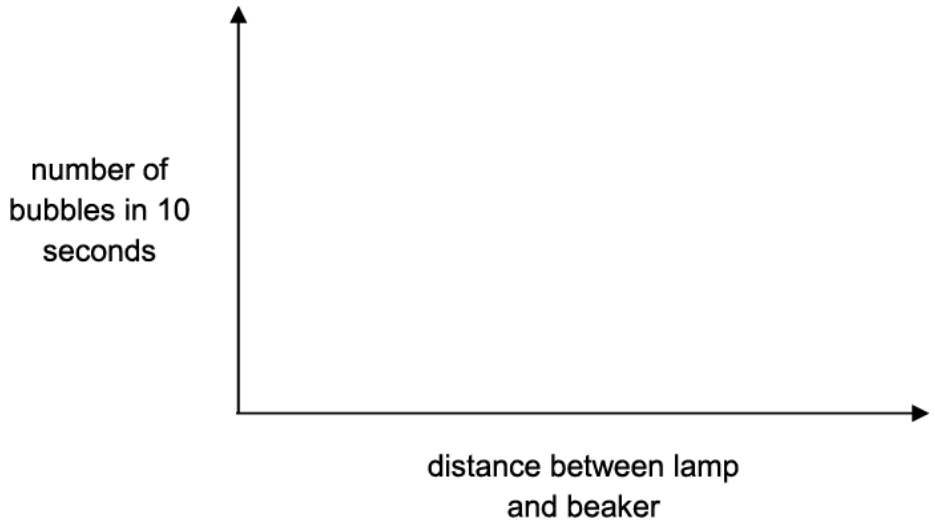
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(b)

(i) Sketch a line on the axes below to show the results you would expect.



[2]

(ii) Explain the shape of the graph. **Two** explanations are required.

---[2]

(c)

(i) Describe how and where oxygen is produced in photosynthesis.

---[3]

(ii) Explain why the amount of oxygen gas given off is **not** a true measure of the rate of photosynthesis.

---[2]

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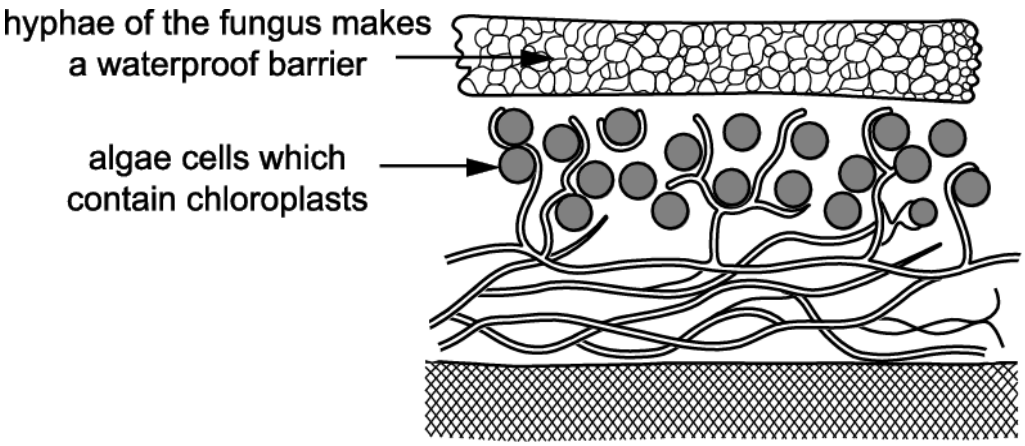
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9 Some students are investigating lichens.

Lichens are often studied because they are sensitive to pollution.

Lichens are made up of two different organisms: a fungi and algae.

Both the fungus and the algae gain from living together.
The students find a diagram of a lichen.



Using the information from the diagram suggest what the algae and fungi each gain from their relationship.

algae _____

_____

fungus _____

_____ [2]

10(a) Green plants contain chlorophyll.

The molecular formula of chlorophyll is $C_{55}H_{72}O_5N_4Mg$.

Plants get the magnesium (Mg) they need in the form of compounds, such as magnesium sulfate, through their roots.

How do plants get the carbon (C) they need to make chlorophyll?

_____

_____ [1]

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(b) How do plants get the hydrogen (H) they need to make chlorophyll?

---

[1]

(c) How do plants get the oxygen (O) they need to make chlorophyll?

---

[1]

11(a) Carbon dioxide and water are needed for photosynthesis.

Finish the **balanced symbol equation** for photosynthesis.

$$6CO_2 + 6H_2O \rightarrow \text{.....} + \text{.....}$$

[1]

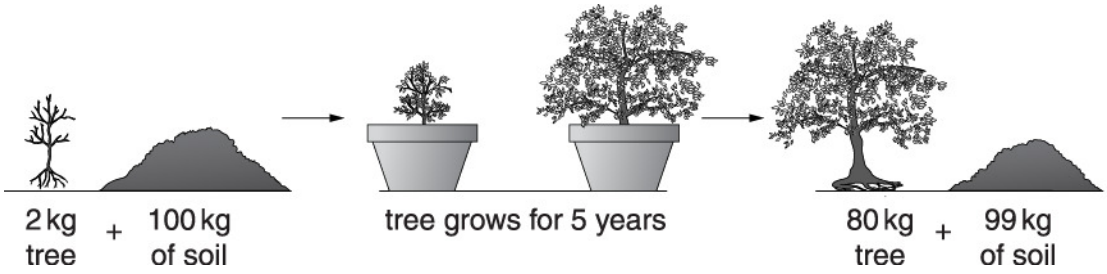
(b) In 1649, scientists thought that plants grew by **only** taking in solid materials from the soil.

A scientist called van Helmont did an experiment to test this idea.

He grew a tree in a large pot of soil.

He measured the mass of the soil and the tree before the experiment.

He measured them again, five years later.



Explain how van Helmont's experiment proved the scientists wrong.

---

[2]

12(a) This question is about photosynthesis.

Complete the word equation for photosynthesis.

carbon dioxide + ... $\xrightarrow[\text{(chlorophyll)}]{\text{(light)}}$ glucose + ...

[2]

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(b) Most photosynthesis happens in leaves.

How does carbon dioxide get into leaves?

---

[2]

(c) Many plants that grow on the ground in forests have darker green leaves than plants that grow in open spaces.

Suggest why they have darker green leaves.

---

[2]

13 Carbon dioxide and water are needed for photosynthesis.

Finish the **word** equation for photosynthesis.

carbon dioxide + water → _____ + _____

[1]

14 Carbon dioxide and water are needed for photosynthesis.

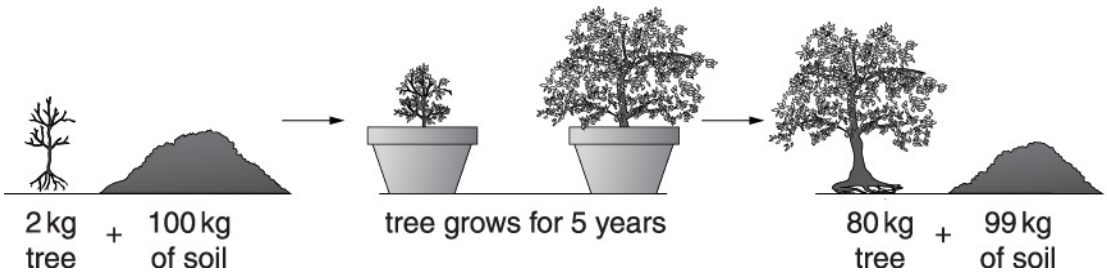
In 1649, scientists thought that plants grew by **only** taking in solid materials from the soil.

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He grew a tree in a large pot of soil.

He measured the mass of the soil and the tree before the experiment.

He measured them again, five years later.



(i) Explain how van Helmont's experiment proved the scientists wrong.

---

[2]

(ii) During the five years, van Helmont watered the soil.

Describe how water enters the tree and what happens to the water once it has entered.

---

[3]

15(a) Bristlecone pine trees are among the longest living things on Earth.

One of them, called Methuselah, is in California and is over 4 800 years old.

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Methuselah

Bristlecone pine trees live high up in the mountains.

The low temperature, dry soil and strong wind make the trees grow very slowly.

This is because these conditions affect both transpiration and photosynthesis.

Explain how and why these conditions affect both transpiration and photosynthesis.

The quality of written communication will be assessed in your answer to this question.

[6]

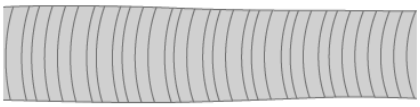
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(b) Scientists worked out Methuselah's age.

They drilled a narrow core from the trunk and then counted the rings.

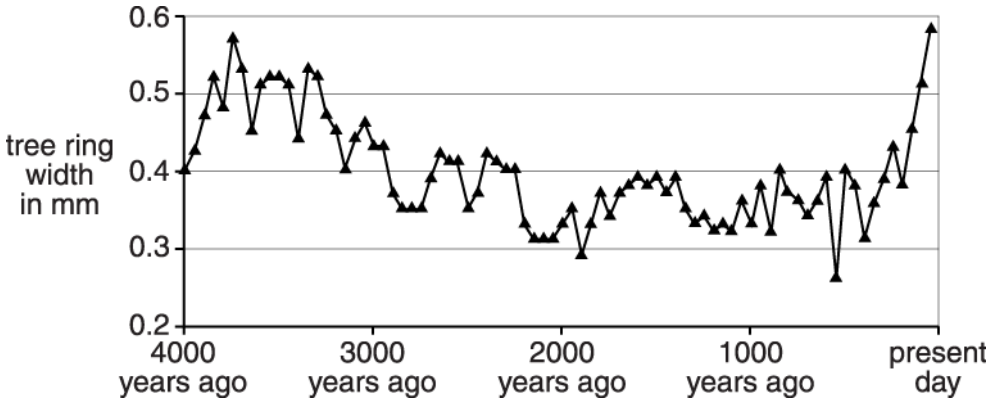
Each ring shows one year's growth.

The wider a ring, the more growth in that year.



core showing tree rings

The graph shows the average tree ring widths from a sample of bristlecone pine trees in California.



(i) A scientist concludes that the graph shows an increase in tree ring width.

Look at the graph.

How well does the data support the scientist's conclusion?

Explain your answer.

---

[2]

(ii) Many factors affect the width of the tree rings.

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One of these factors is temperature. Higher temperatures mean wider rings.

The scientist says, “The data from this sample **proves** global warming has happened”.

Do you agree?

Explain your answer.

---

[2]

16(a) Bristlecone pine trees are among the longest living things on Earth.

One of them, called Methuselah, is in California and is over 4 800 years old.



Methuselah

Bristlecone pine trees live high up in the mountains.

The temperature, dry soil and strong wind make them grow very slowly.

Explain why these extreme conditions make the bristlecone pine trees grow very slowly.

The quality of written communication will be assessed in your answer to this question.

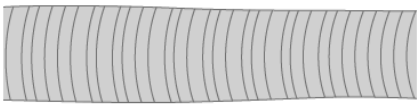
[6]

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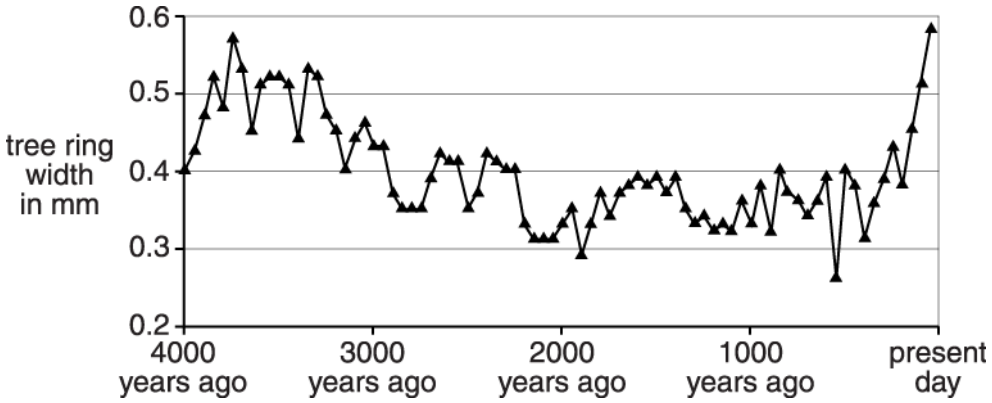
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---

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One of these factors is temperature. Higher temperatures mean wider rings.

The scientist says, “The data from this sample **proves** global warming has happened”.

Do you agree?

Explain your answer.

---[2]

17 Jo planted a tree away from her house so it was **not** in the shade.

Explain why this is important for the tree.

---[2]

18(a) Wilson grows tomatoes in a glasshouse.

The more the tomato plants photosynthesise, the bigger the crop of tomatoes.

(i) What is the word equation for photosynthesis?

Put a tick (✓) next to the correct equation.

carbon dioxide + water → glucose + oxygen ☐

carbon dioxide + glucose → water + oxygen ☐

water + oxygen → glucose + carbon dioxide ☐

glucose + oxygen → water + carbon dioxide ☐

[1]

(ii) Which of the following statements is correct?

Put a tick (✓) next to the correct statement.

plants photosynthesise only when it is light ☐

plants respire only when it is light ☐

plants respire only when it is dark ☐

plants photosynthesise only when it is dark ☐

[1]

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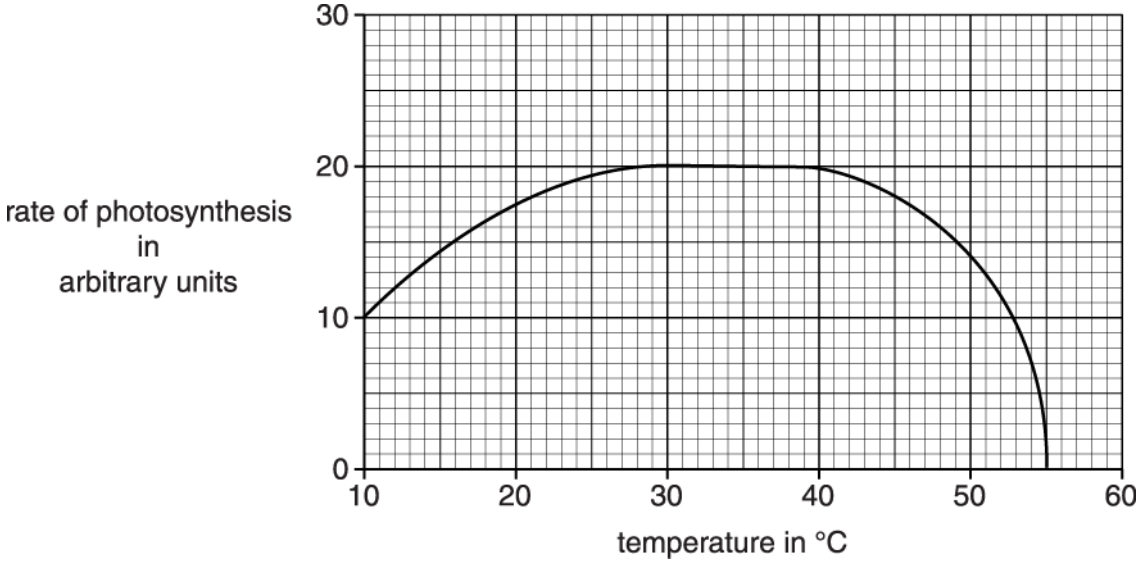
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(b) Wilson knows that the rate of photosynthesis depends on temperature.

He wants to use heaters in his glasshouse to make his tomato plants photosynthesise faster.

He wants to find out the best temperature to have in his glasshouse.

Look at the graph.



(i) **Describe** what the graph shows. Use data in your answer.

---

[3]

(ii) According to the graph, what is the best temperature for Wilson to have in his glasshouse?

---- °C

Explain your answer.

---

[2]

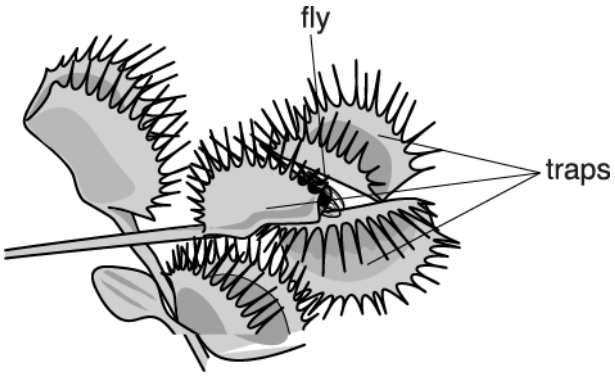
(iii) Before Wilson decides to use heaters in his glasshouse, suggest what else he should consider, apart from the increased rate of photosynthesis.

[2]

19 The venus flytrap is a plant that lives in very wet ground, such as bogs.

Bogs contain very low levels of minerals, such as nitrates, that plants need for growth.

The venus flytrap catches insects which it digests to get minerals.



The traps on the venus flytrap are modified leaves.

The traps are green.

Suggest why they are green.

[2]

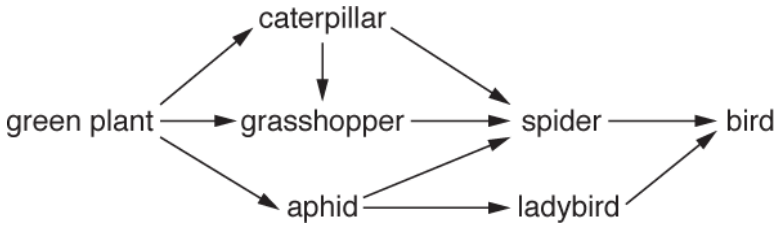
20

The diagram shows a garden food web.

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(i) What is the source of energy for this food web?

---

[1]

(ii) The grasshopper is **both** a primary and a secondary consumer.

Explain why it is both.

---

[2]

(iii) The people who own the garden buy a cat.

The cat spends a lot of time in the garden and frightens away birds.

Explain what might happen to the numbers of ladybirds in the garden.

---

[2]

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21 Wilson grows tomatoes in a glasshouse.

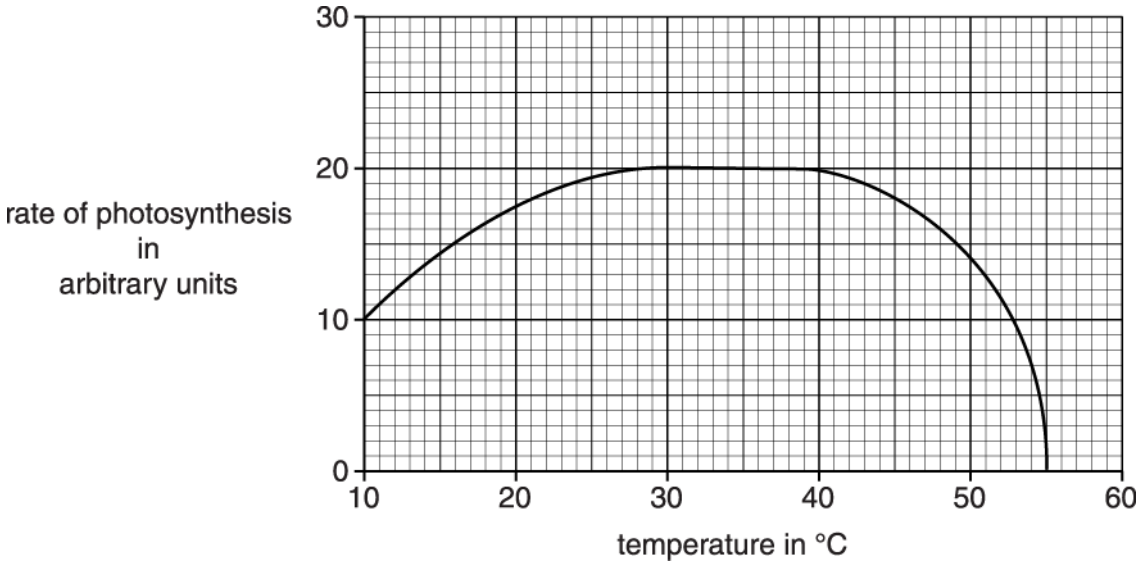
The more the tomato plants photosynthesise, the bigger the crop of tomatoes.

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He wants to find out the best temperature to have in his glasshouse.

Look at the graph.



(i) **Describe** what the graph shows. Use data in your answer.

---

[3]

(ii) **Explain** the shape of the graph.

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[3]

(iii) According to the graph, what is the best temperature for Wilson to have in his glasshouse?

____________________ °C

Explain your answer.

[2]

22(a) Look at the equation for a process that occurs in plants.

$$\text{carbon dioxide} + \text{water} \xrightarrow[\text{(chlorophyll)}]{\text{(light energy)}} \text{glucose} + \text{oxygen}$$

What is the name of the process shown in the equation?

[1]

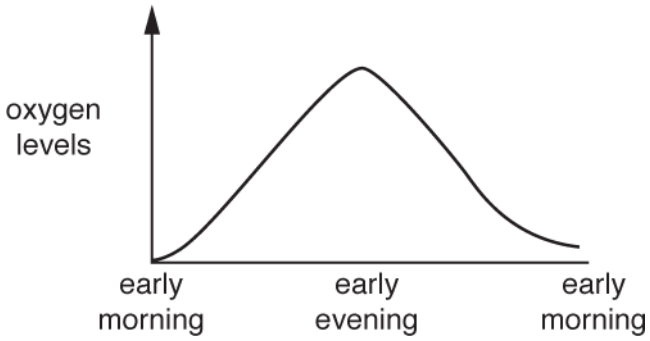
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(b) Josh investigates how oxygen levels change in a pond.

He uses a probe to measure the levels of oxygen in the pond at different times of the day.

The graph shows his results.



The pond is full of plant life.

Use the equation to explain the pattern in the graph.

---

[2]

23(a) Look at the equation for a process that occurs in plants.

$$6CO_2 + 6H_2O \xrightarrow[\text{(chlorophyll)}]{\text{(light energy)}} C_6H_{12}O_6 + 6O_2$$

Write down the name of this process.

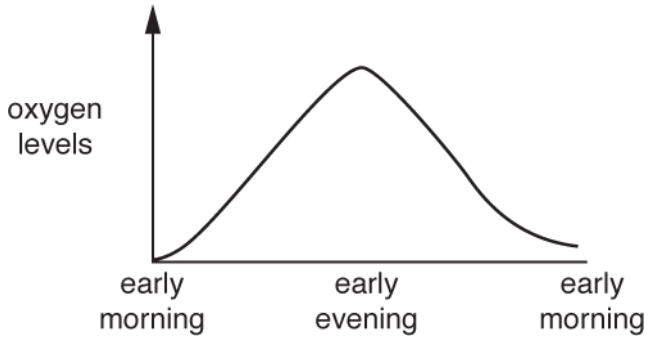
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[1]

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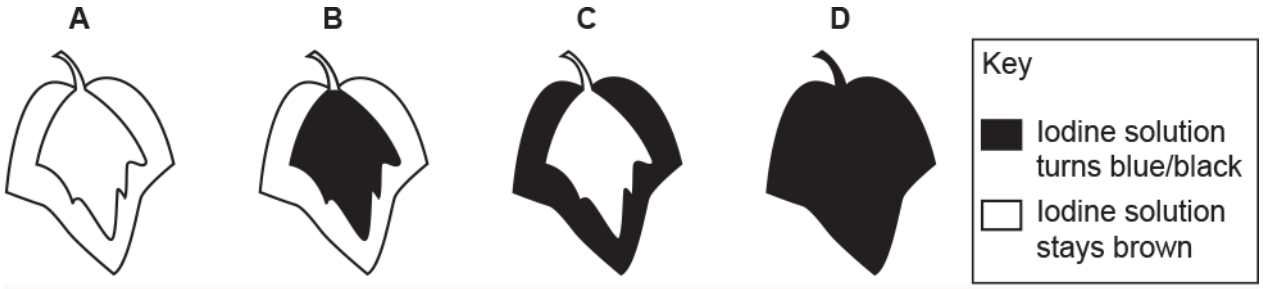
---

[2]

24 The diagram shows a variegated leaf.



Which diagram shows the correct starch test results for the variegated leaf?



Your answer ☐ [1]

25(a) Photosynthesis takes place inside chloroplasts.

(i) Complete the chemical equation for photosynthesis.

$6CO_2$ + ---------- → $C_6H_{12}O_6$ + ---------- [2]

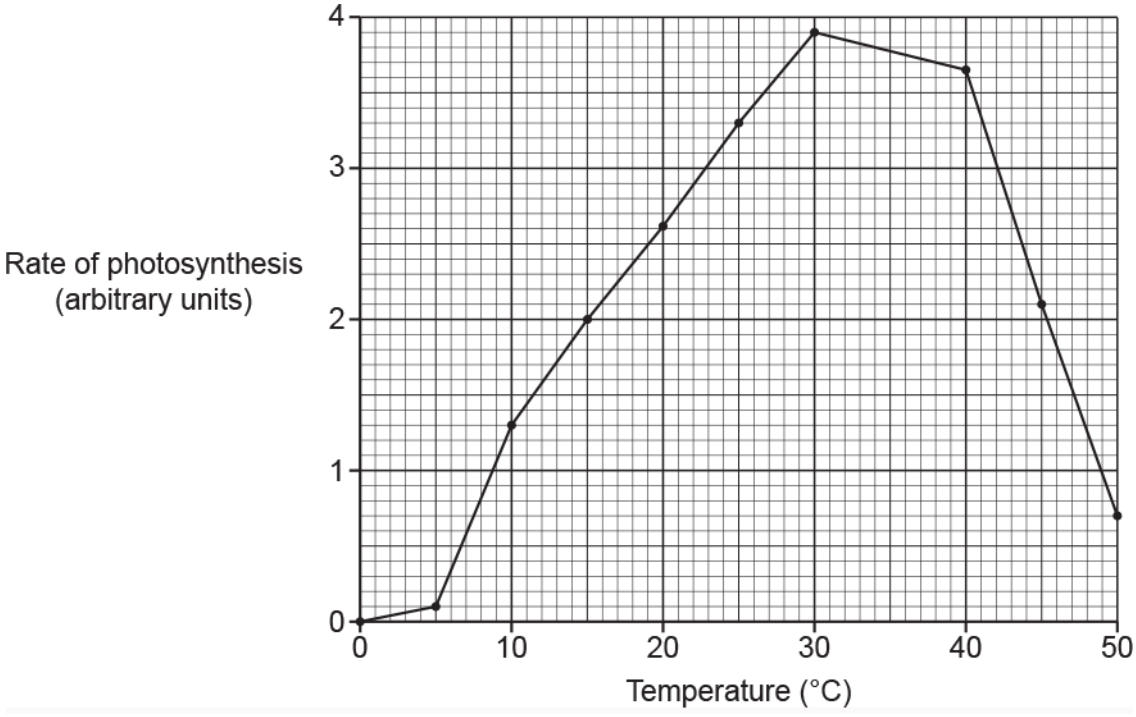
(ii) Energy is taken in from the surroundings for photosynthesis to take place.

What name is used to describe reactions that take in energy?

---------- [1]

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(b) The graph is from an experiment to show the effect of temperature on the rate of photosynthesis.



(i) What is the optimum temperature for photosynthesis in this experiment?

---

[1]

(ii) The rate of photosynthesis was recorded in 5°C intervals.

The experiment could be improved to get a more **precise** value for the optimum temperature.

Explain how.

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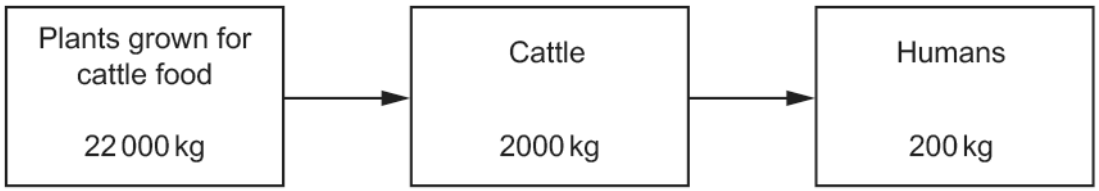
[2]

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26 The diagram shows the flow of biomass through an agricultural food chain.



The plants grown for cattle food often have their leaves eaten by insects.

Scientists have produced genetically modified (GM) plants that make insecticide in their leaves.

(i) Explain why these GM plants would make more biomass available to humans.

In your answer use the diagram of the agricultural food chain and ideas about photosynthesis.

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[6]

(ii) Suggest **two** reasons why some people are against this type of genetic engineering.

1 ----------

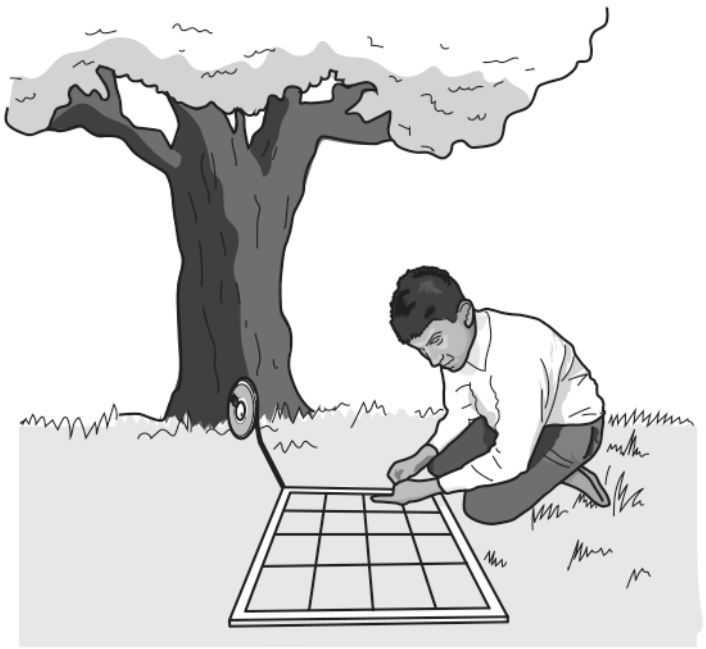
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2 ----------

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[2]

27 A student investigates plants growing underneath a tree.



He lays out a tape measure on the ground, starting at the tree. He then places a quadrat on the ground.

He measures the percentage of the ground in the quadrat that is covered by plants. He repeats this every metre away from the tree.

The table shows his results.

Distance from the tree (m)	Percentage of ground covered by

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	plants (%)
1	10
2	15
3	18
4	22
5	50
6	58
7	62
8	64

The student thinks that shade from the tree is affecting the plants.

Explain how the student's results show this.

[4]

28 A light source is placed 0.5 m from a plant. The relative light intensity falling on the plant is 2 units.

The light source is moved to 1 m away.

What is the relative light intensity falling on the plant now?

A 0.125

B 0.25

C 0.5

D 1.0

Your answer ☐ [1]

29(a)

Photosynthesis involves reactions that are endothermic.

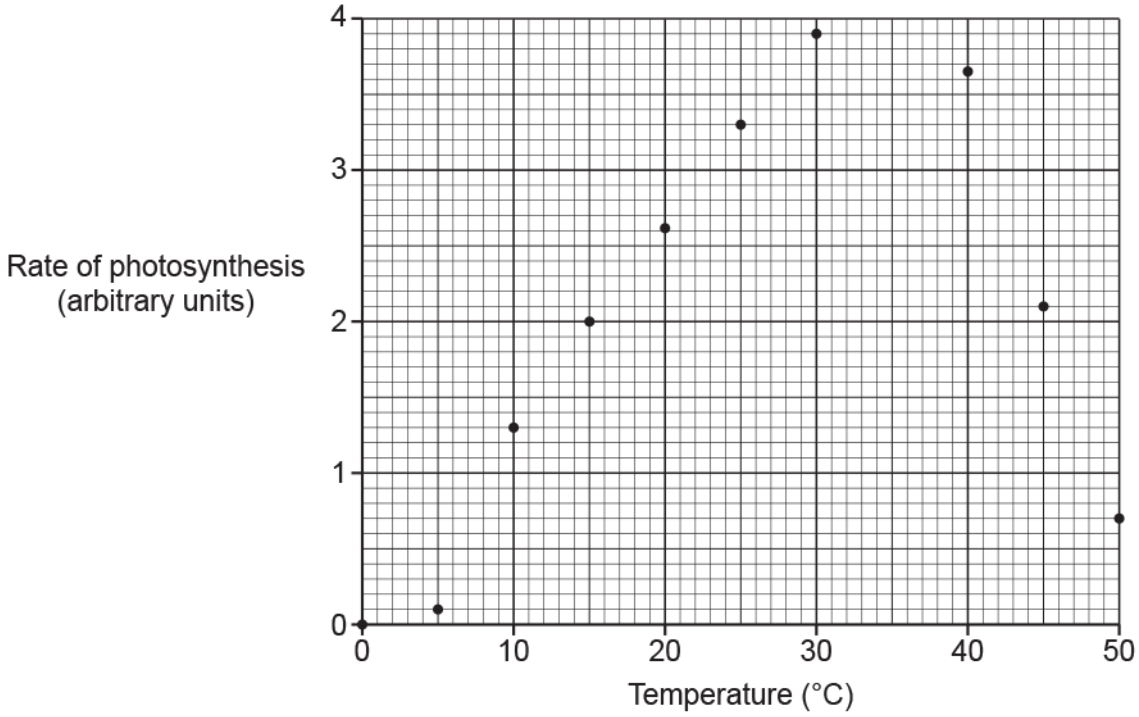
What is meant by the term endothermic reaction?

---

[1]

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(b) The graph is from an experiment to show the effect of temperature on the rate of photosynthesis.

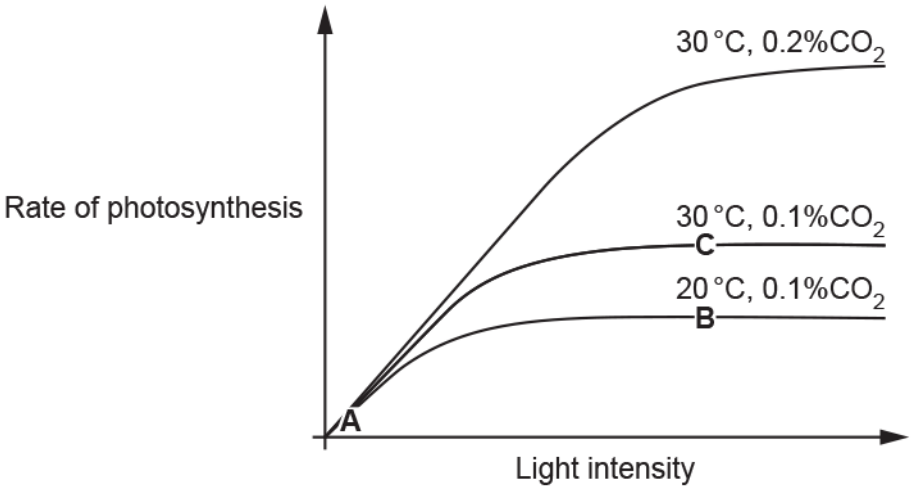


Draw a line of best fit. **[1]**

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(c) Look at the graph. It shows how light intensity affects the rate of photosynthesis.

The lines show different carbon dioxide concentrations and temperatures.



Explain what is limiting the rate of photosynthesis at the three points **A, B** and **C** on the graph.

Use evidence from the graph in your answer.

---

[3]

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30 A student investigates the plants growing underneath a tree.



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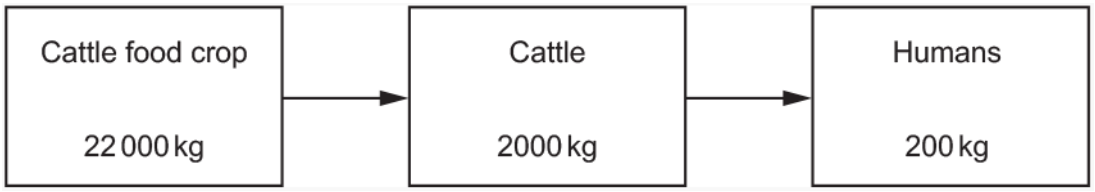
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The student thinks that shade from the tree is affecting the plants.

Explain how the student's results show this.

[4]

31 The diagram shows the flow of biomass through an agricultural food chain.



High levels of light intensity can damage plants. To prevent damage, plants have a protection mechanism.

When light intensity levels get **too high**, the protection mechanism switches on. This stops the plant absorbing too much light.

When the light intensity drops to safe levels, the protection mechanism switches off **slowly**.

Explain why this mechanism would **reduce** the biomass available to humans.

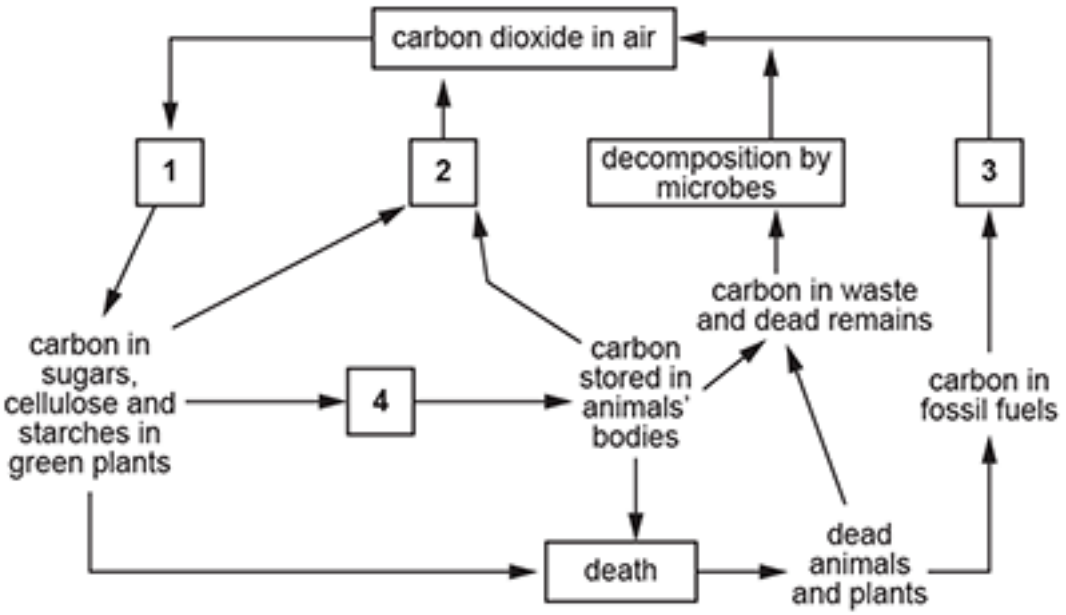
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[6]

32 The diagram shows the carbon cycle.



Scientists investigated if crops can be grown on the planet Mars.

They used a soil that was similar to the soil found on Mars. The soil contained some minerals but no living organisms.

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(i) The scientists managed to grow crops in the soil. However on Mars, the minerals in the soil would soon run out.

Explain why.

[2]

(ii) Living organisms could be added to the soil but there is no air on Mars. The plants would need to be grown in an enclosed structure.

At first, air would need to be added, but after a while the organisms in the soil and the plants would supply each other with the gases they need.

Explain how this would happen.

[2]

33 Scientists investigated if crops could be grown on the planet Mars.

They used a soil that was similar to the soil found on Mars. The soil contained some minerals but no living organisms.

(i) The scientists managed to grow crops in the soil. However on Mars, the minerals in the soil would soon run out.

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---

[2]

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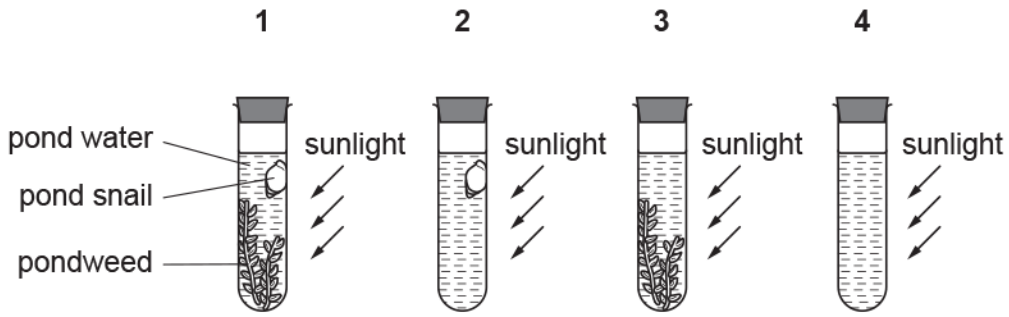
[2]

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34 Pond snails and pondweed are living in water in sealed test tubes.



Carbon dioxide dissolves in water and forms an acid.

In which test tube would the water become most acidic?

A 1
B 2
C 3
D 4

Your answer [1]

35 Aerobic respiration occurs all the time in plant cells but photosynthesis only occurs in daylight.

Why is more energy released by a plant cell during the night?

A Photosynthesis is endothermic taking in energy and aerobic respiration is exothermic.
B Photosynthesis is exothermic taking in energy and aerobic respiration is endothermic.
C Aerobic respiration is exothermic taking in energy and photosynthesis is endothermic.
D Aerobic respiration is endothermic taking in energy and photosynthesis is exothermic.

Your answer [1]

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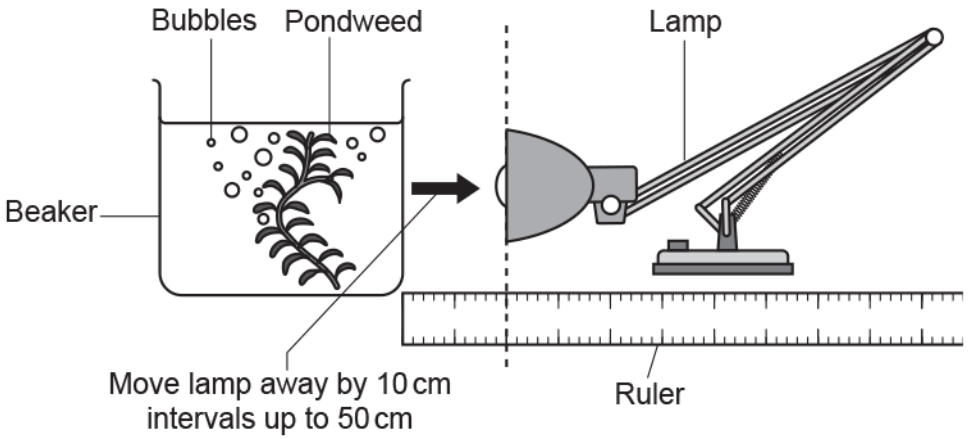
36(a) Two students investigate photosynthesis. Look at the notes from their investigation.

Aim of the experiment

To use pondweed to see how light intensity affects the rate of photosynthesis.

Method

1. Set up the apparatus as in the diagram.
2. Leave the pondweed for five minutes so it can adjust to the new light intensity.
3. Count the number of bubbles given off by the pondweed in one minute.
4. Move the lamp 10 cm further away from the beaker.
5. Leave the pondweed for five minutes so it can adjust again.
6. Count the number of bubbles given off by the pondweed in one minute.
7. Repeat by moving the lamp further away from the beaker by 10 cm intervals until 50 cm is reached.



What is the **independent** variable in their investigation?

[1]

(b)

(i) Explain why counting the number of bubbles will not give an **accurate** measure of the rate of photosynthesis.

---

[2]

(ii) Describe how the students could develop their investigation to improve the **accuracy** of their results.

---

[2]

(c) The table shows the results.

Distance from lamp to beaker (cm)	Number of bubbles given off (per minute)
10	30
20	14
30	6
40	2
50	0

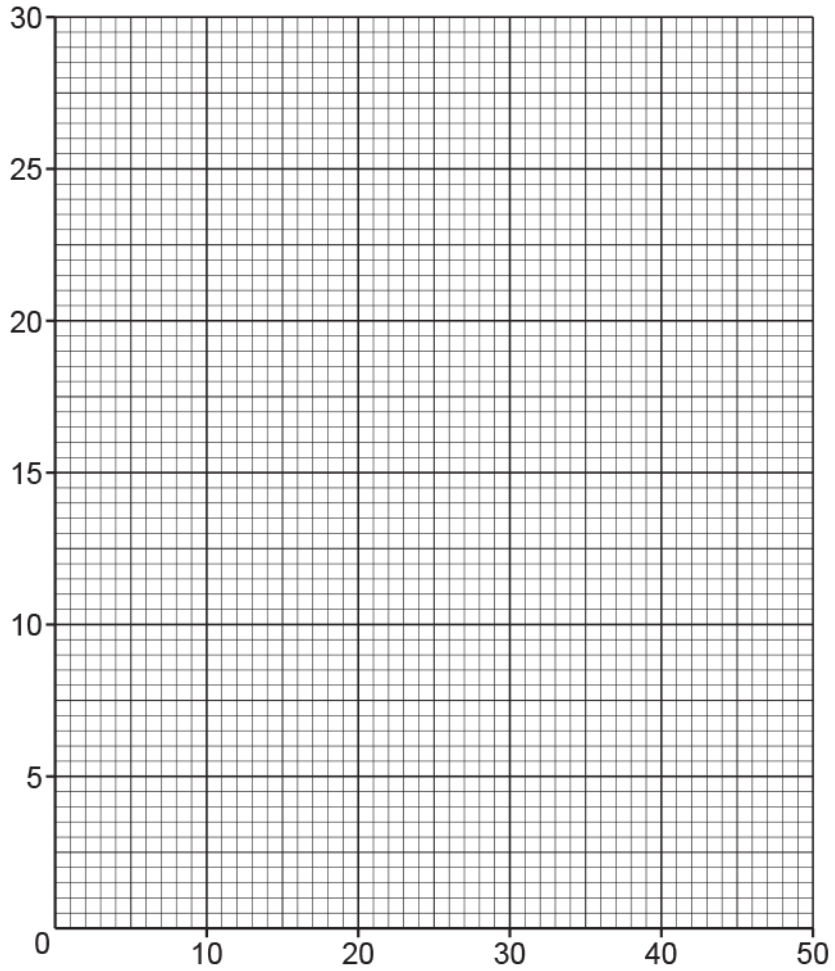
(i) One student started to draw a graph but did not finish.

Complete the graph using the results in the table and draw a curve of best fit.

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[4]

(ii) Write down what the students could conclude from their investigation.

Include data from the results table in your answer.

---

[2]

37 **Fig. 16.1** shows a plant that grows in South America called stevia.



Fig. 16.1

(i) Write down the number of trophic levels in this food web.

[1]

(ii) What is the source of energy for this food web?

[1]

(iii) Septoria fungus is a parasite of stevia.

Explain what is meant by the term **parasite**.

[2]

END OF QUESTION PAPER

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