

**Bioenergetics part 2 AQA Triple Biology**

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

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Time: **92 minutes**

Marks: **84 marks**

Comments:

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1.

Plants are made of different tissues.

(a) Which term describes a group of tissues working together?

Tick (✓) **one** box.

Organ

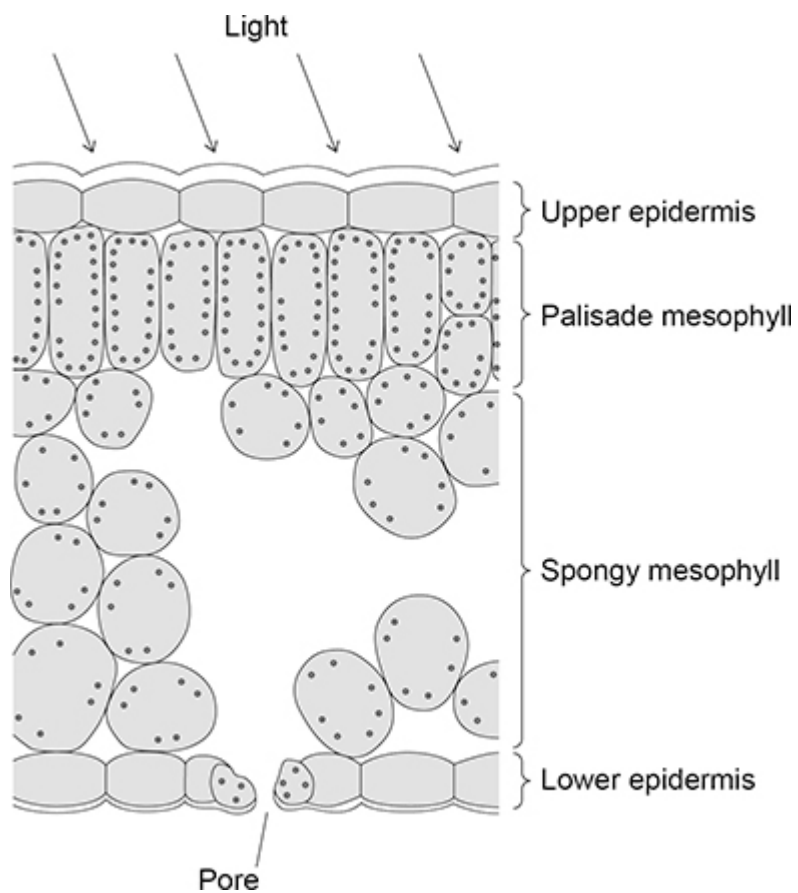
Organism

Organ system

(1)

Figure 1 shows the tissues in a leaf.

Figure 1



(b) Draw **one** line from each leaf tissue to an important feature of the tissue.

Leaf tissue	Feature
Palisade mesophyll	Contains many air spaces
Spongy mesophyll	Contains the most chloroplasts
	Made of dead cells

(2)

(c) Xylem tissue transports water to the leaves.

Which term describes the loss of water from the leaves?

Tick (✓) **one** box.

Photosynthesis	
Respiration	
Transpiration	

(1)

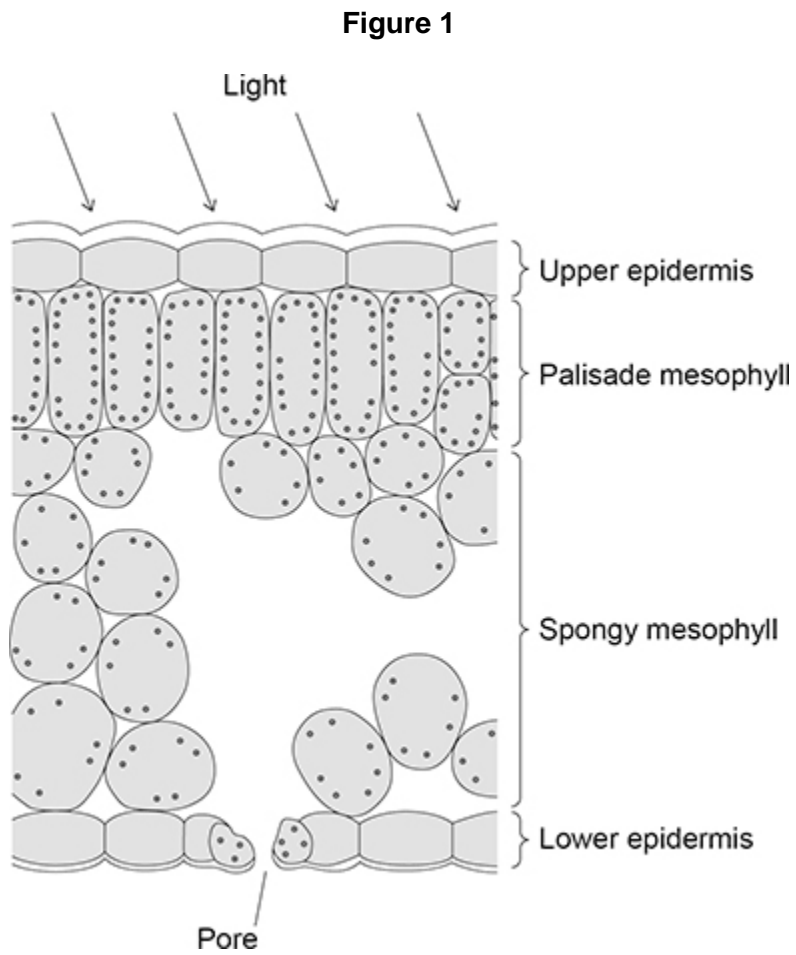
(d) Which substance strengthens xylem tissue?

Tick (✓) **one** box.

Glucose	
Lignin	
Starch	

(1)

Figure 1 is repeated below.



(e) The upper epidermis is transparent.

Explain why the upper epidermis needs to be transparent.

Use **Figure 1**.

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(2)

(f) Complete the sentences.

Choose answers from the box.

<b>chloroplasts</b>	<b>guard cells</b>	<b>meristems</b>	<b>stomata</b>
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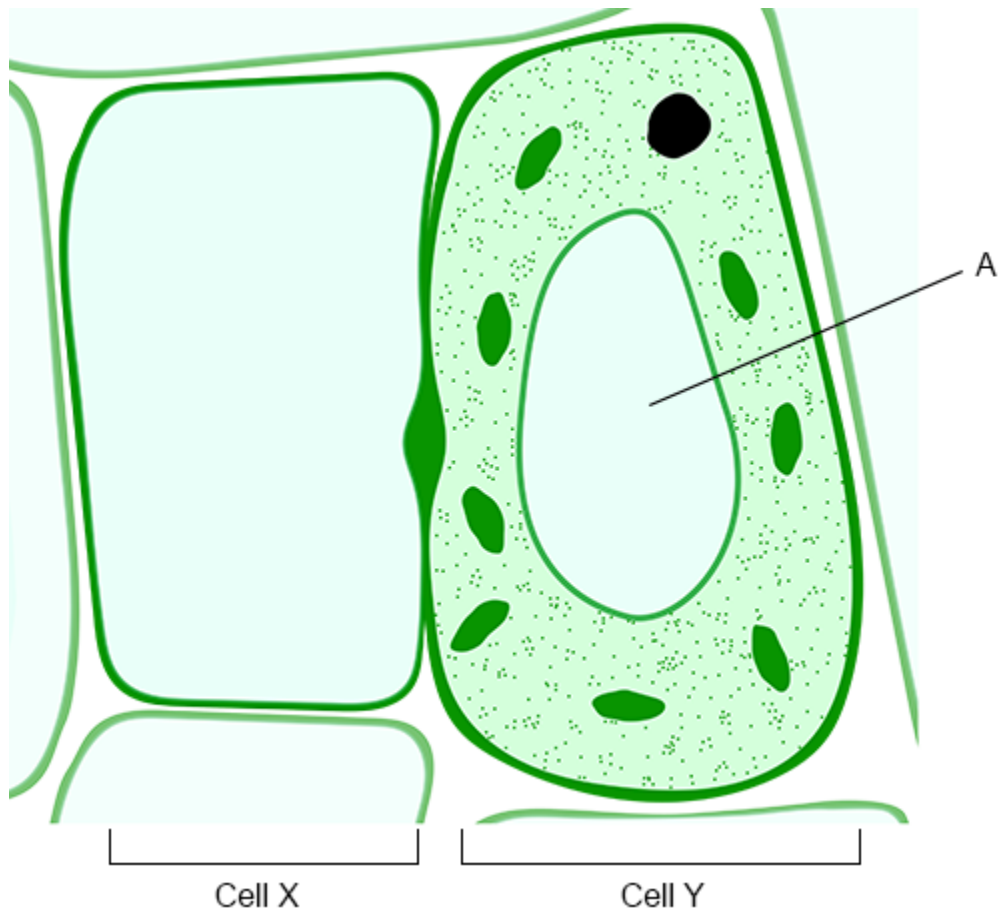
The pores in the lower epidermis of a leaf are called \_\_\_\_\_ .

The opening and closing of the pores in the lower epidermis is controlled  
by \_\_\_\_\_ .

(2)

**Figure 2** shows two cells from phloem tissue.

**Figure 2**



(g) Part **A** in **Figure 2** contains cell sap.

Name part **A** in **Figure 2**.

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(1)

Sugars move from cell **Y** into cell **X** against the concentration gradient.

Energy is needed to move sugars against the concentration gradient.

(h) Which process moves sugars against the concentration gradient?

Tick (✓) **one** box.

Active transport

Diffusion

Osmosis

(1)

(i) Which cell structures are needed to provide energy to move sugars?

Tick (✓) **one** box.

Chloroplasts

Chromosomes

Mitochondria

(1)

(Total 12 marks)

2.

A person has coronary heart disease.

(a) Which blood vessels are affected by coronary heart disease?

Tick (✓) **one** box.

Arteries

Capillaries

Veins

(1)

A person's heart stops beating.

The person stops breathing.

A first-aider pushes down on the person's chest.

Pushing down on the person's chest puts pressure on the heart.

(b) Explain why putting pressure on the heart helps the person.

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(2)

(c) The first-aider also forces air into the person's lungs by blowing into their mouth.

Describe how forcing air into the person's lungs helps the person.

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(1)

(d) The person's heart starts to beat again and the person starts breathing.

The person has a high level of cholesterol in their blood.

Name **one** type of drug that would decrease the level of cholesterol in the person's blood.

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(1)

(e) A doctor decides that the person needs to have a stent fitted.

Explain how a stent works to treat coronary heart disease.

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(2)

The table below shows the effect of smoking on the risk of developing different cardiovascular diseases.

Cardiovascular disease	Percentage (%) increase in risk compared to people who have never smoked
E	14
F	20
G	29
H	70

(f) Give **two** conclusions that can be made from the data in the table above.

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

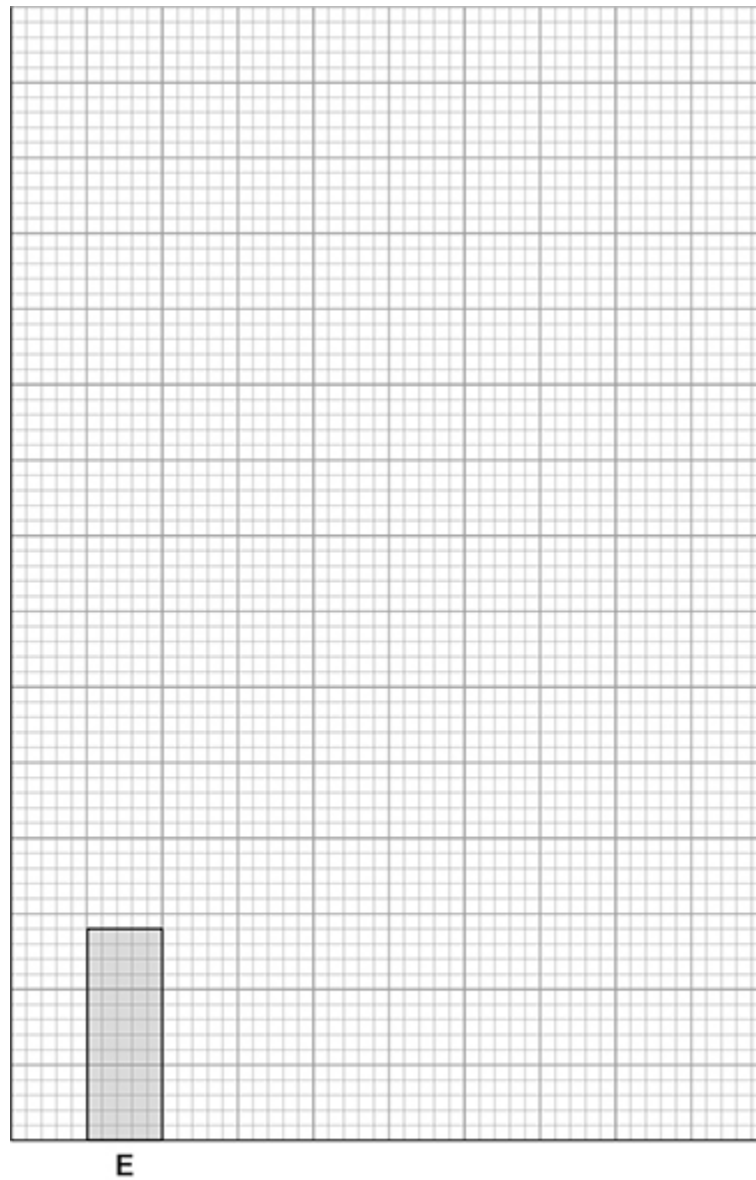
(2)

(g) Complete the graph below.

You should:

- label the y-axis
- add the correct scale to the y-axis
- plot the data from the table above
- label each bar.

The bar for cardiovascular disease **E** has been plotted for you.



Cardiovascular disease

(4)

(h) Describe **one** lifestyle factor that can increase the risk of cardiovascular disease.

Do **not** refer to smoking in your answer.

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(1)

(Total 14 marks)

3.

Plants contain many different tissues.

(a) Complete the sentences.

The leaf tissue that contains the most chloroplasts is

the \_\_\_\_\_ .

The leaf tissue that contains many air spaces is

the \_\_\_\_\_ .

The plant tissue that can differentiate throughout the life of the plant is

the \_\_\_\_\_ .

(3)

(b) Xylem tissue transports water through a plant.

The walls of xylem cells contain cellulose.

Name **one other** substance that strengthens xylem tissue.

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(1)

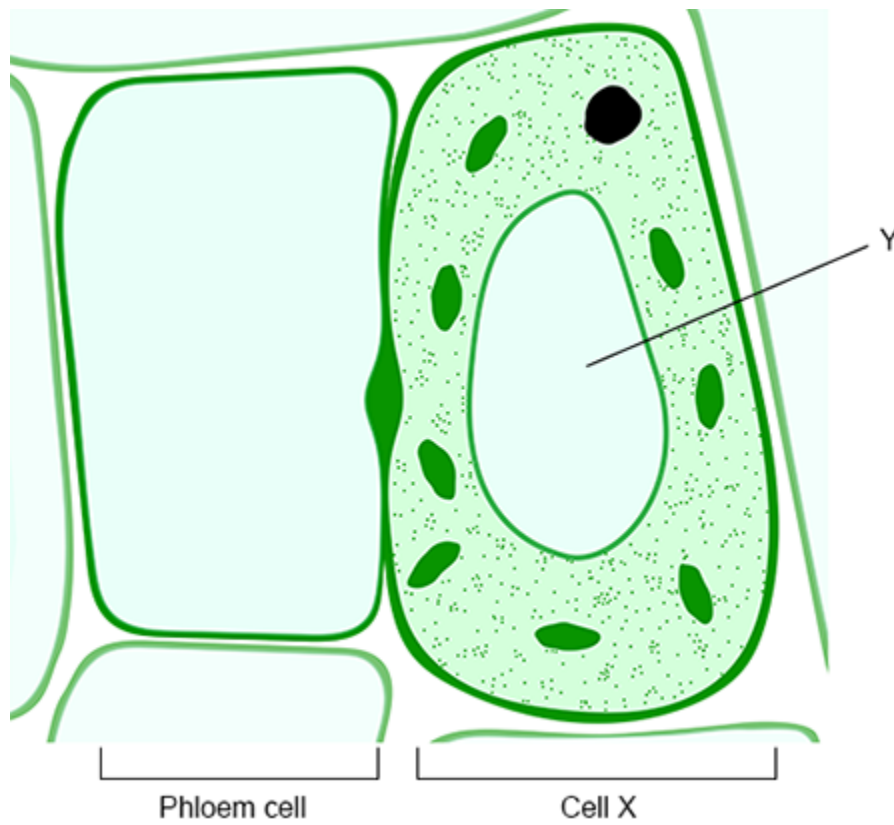
(c) Phloem tissue transports dissolved sugars around a plant.

Name the process that transports dissolved sugars around a plant.

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(1)

The figure below shows two plant cells.



(d) Name part Y in the figure above.

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(1)

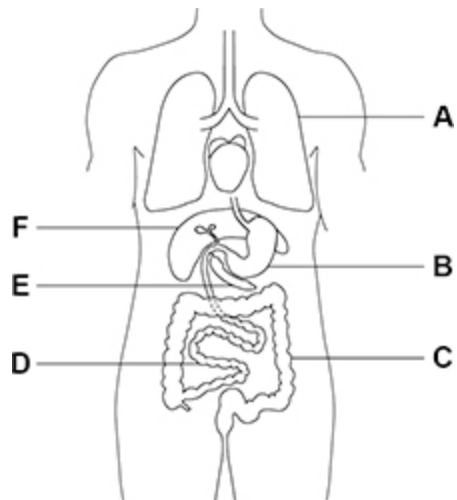


CF affects many organs in the body.

The main organs affected are:

- the lungs
- the pancreas
- the small intestine.

(b) The figure below shows organs of the human body.



Which letters in the figure above show the lungs, the pancreas and the small intestine?

Tick (✓) **one** box.

**A, D and E**

**A, E and F**

**B, C and D**

**B, C and F**

(1)



(d) Gas exchange happens in the alveoli in the lungs.

Describe **three** features of the alveoli that help maximise gas exchange.

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

3 \_\_\_\_\_

\_\_\_\_\_

**(3)**

(e) CF reduces the amount of oxygen that can enter the blood from the alveoli.

Explain how a reduced amount of oxygen entering the blood will affect the human body.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**(3)**

**(Total 14 marks)**

5.

A student investigated the effect of different factors on photosynthesis.

The student used three leaves growing on the same plant.

Each leaf was treated in a different way.

After 48 hours the student tested each leaf for starch.

Table 1 shows the results.

Table 1

Leaf tested	Treatment	Result after 48 hours
1	Upper and lower surfaces covered with black paper	No starch present
2	Upper and lower surfaces covered and sealed with transparent plastic	No starch present
3	<b>Not covered</b>	Starch present

(a) Explain the results for the three leaves.

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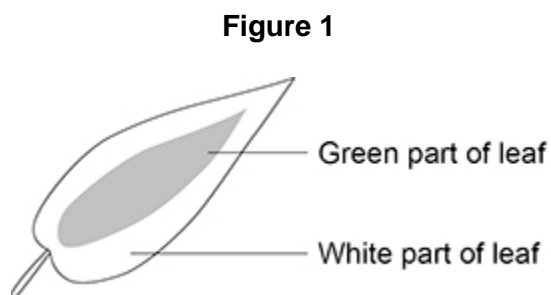
(5)

In another investigation the student used a different type of plant.

The plant was left uncovered in the light for 48 hours.

After 48 hours the student tested a leaf from the plant for starch.

**Figure 1** shows the leaf before it was tested for starch.



(b) Complete **Table 2** to show the results you would expect for the starch test on the leaf in **Figure 1**.

**Table 2**

Part of leaf tested	Result after 48 hours
Green	
White	

(1)

(c) Explain the results you gave in part (b).

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(2)

In some leaves, the green parts become yellow because of an ion deficiency.

(d) Which ion is deficient in a plant with yellow leaves?

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(1)

(e) Give the scientific term that describes the yellow colour of the leaves.

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(1)

(f) The rate of photosynthesis is affected by different factors.

How could the oxygen produced during photosynthesis be used to measure the **rate** of photosynthesis?

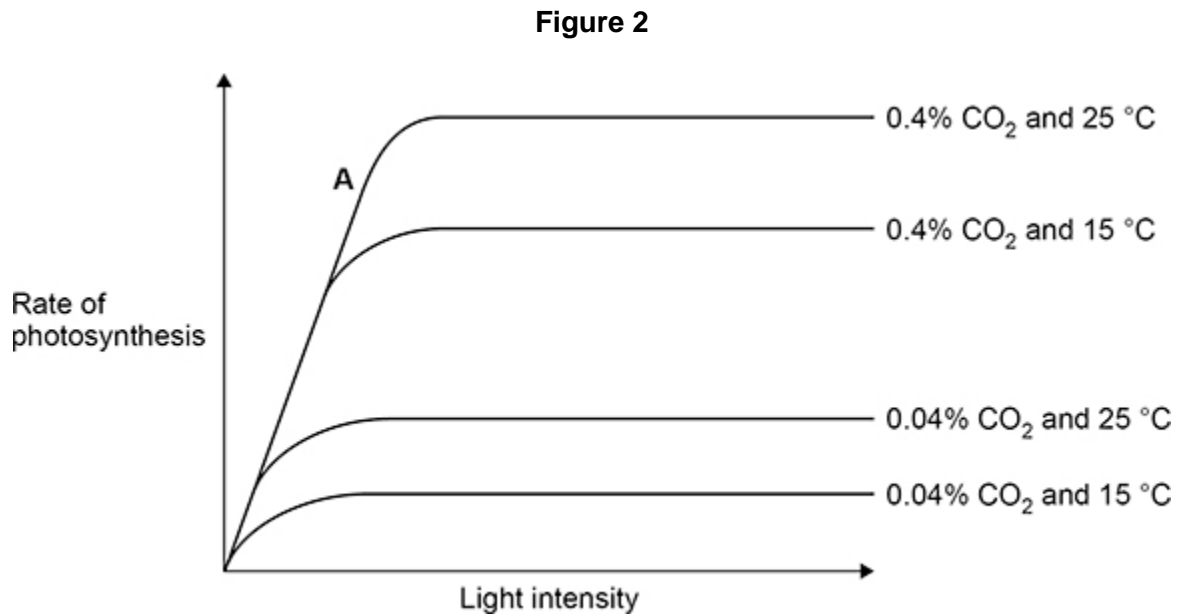
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(1)

Light, carbon dioxide and temperature are limiting factors of photosynthesis.

**Figure 2** shows how the rate of photosynthesis is affected by light, carbon dioxide and temperature.



(g) At point **A** on **Figure 2**, light is a limiting factor.

What is meant by a 'limiting factor'?

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(1)

- (h) Explain the effect of increasing temperature and increasing carbon dioxide concentration on the rate of photosynthesis shown in **Figure 2**.

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(4)

- (i) Photosynthesis investigations often use a light source.

The spreading out of light from a source obeys the inverse square law.

The inverse square law links light intensity to distance from the light source.

Which of the following shows the inverse square law?

Tick (✓) **one** box.

light intensity  $\propto \frac{1}{\text{distance}^2}$

light intensity  $\propto \text{distance}^2$

$\frac{1}{(\text{light intensity})^2} \propto \text{distance}^2$

$\frac{1}{(\text{light intensity})^2} \propto \frac{1}{\text{distance}^2}$

(1)

(Total 17 marks)

6.

Photosynthesis produces oxygen.

(a) Complete the word equation for photosynthesis.

Choose answers from the box.

<b>carbon dioxide</b>	<b>fat</b>	<b>glucose</b>
<b>nitrogen</b>	<b>protein</b>	<b>water</b>

\_\_\_\_\_ + \_\_\_\_\_ → \_\_\_\_\_ + oxygen

(3)

(b) Explain how oxygen is used in cells.

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(2)

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.

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

Give the risk the hazard would cause.

Hazard \_\_\_\_\_

\_\_\_\_\_

Risk \_\_\_\_\_

\_\_\_\_\_

(2)

- (d) 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.

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(1)

- (e) 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.

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(2)

The table below shows the results.

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

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

Tick (✓) **one** box.

Blue

Green

Red

Yellow

(1)

(g) What is the best way to display the data in the table above?

Tick (✓) **one** box.

Bar graph

Line graph

Scatter graph

(1)

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

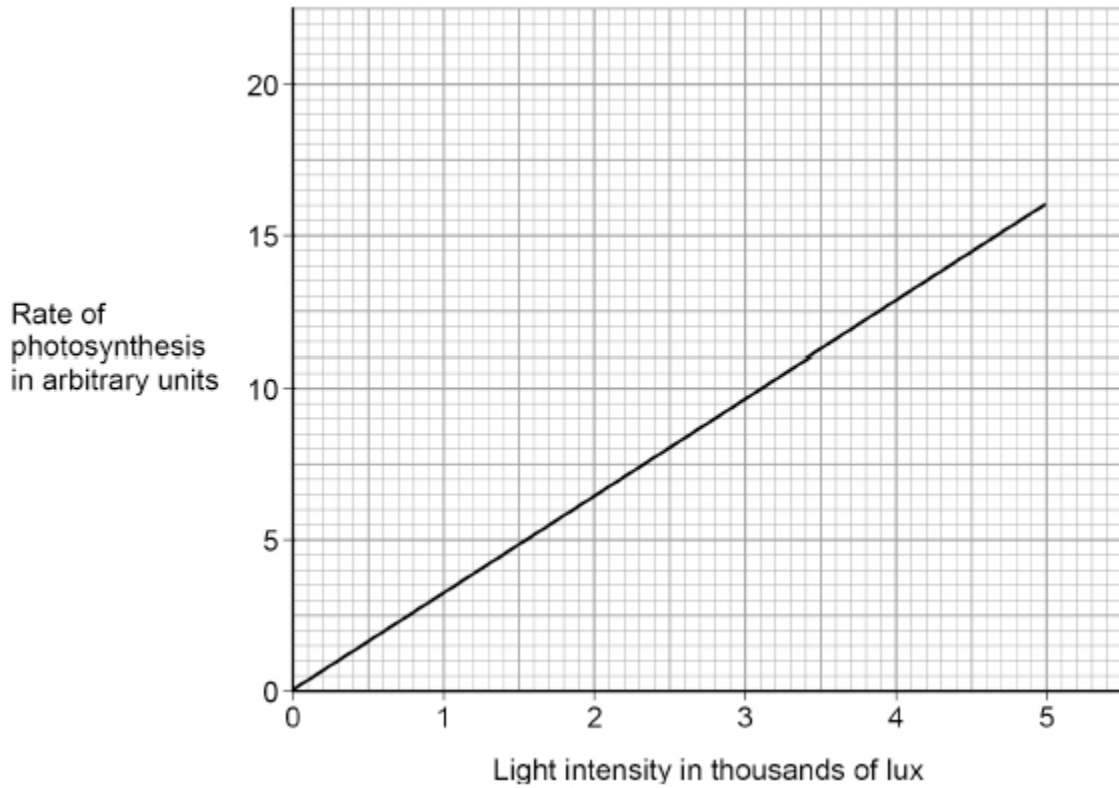
Name **one** piece of apparatus the student could use to measure the volume of oxygen.

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(1)

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

The figure below shows the results.



Describe what the figure shows about the relationship between light intensity and the rate of photosynthesis.

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(2)  
(Total 15 marks)

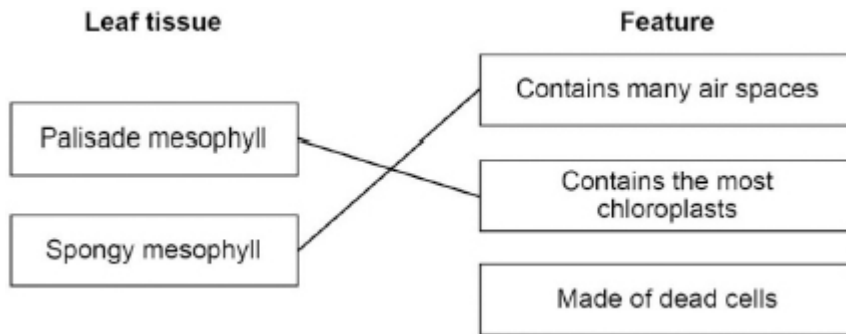
Mark schemes

1.

(a) organ

1

(b)



1

do **not** accept more than one line from a box on the left

1

(c) transpiration

1

(d) lignin

1

(e) (so) light can reach (palisade / spongy) mesophyll

*allow (so) light can reach (other / lower) layers / tissues*

*allow (so) light can reach other / lower cells*

*allow (so) light can reach chloroplasts / chlorophyll*

*ignore (so) light can get through*

1

for photosynthesis

1

(f) stomata

*must be in this order*

1

guard cells

1

(g) (permanent) vacuole

1

(h) active transport

1

(i) mitochondria

1

[12]

- 2.** (a) arteries 1
- (b) pushes / moves blood 1
- to get oxygen around the body  
*allow description of getting oxygen around the body, such as through blood vessels*  
**or**  
*to get oxygen to a named organ*  
*do **not** accept to get oxygen to the lungs*  
*ignore reference to restarting the heart*  
*ignore reference to the pacemaker* 1
- (c) provides oxygen (for respiration)  
*allow idea of carbon dioxide triggering breathing to restart* 1
- (d) statin(s)  
*allow named statin* 1
- (e) (stent) opens / widens (blocked blood) vessel  
*allow (stent) keeps (blocked blood) vessel open*  
*allow a description of the blood vessel being opened*  
*ignore type of blood vessel*  
*ignore unblocks (blood) vessel* 1
- to allow (more) blood to flow  
**or**  
to allow (more) glucose / oxygen  
to the heart (cells / tissue / muscle) 1

(f) any **two** from:

- smoking increases the (%) risk of **all** types of (cardiovascular) disease
- smoking increases the (%) risk of having (disease) **H** more than any other type of (cardiovascular) disease
- smoking increases the (%) risk of having (disease) **E** less than any other type of (cardiovascular) disease

*ignore smoking causes (cardiovascular) disease*

*allow not smoking decreases the risk of **all** types of (cardiovascular) disease*

*allow if you smoke, you are **most** likely to get (disease) **H***

*allow if you smoke, you are **least** likely to get (disease) **E***

*allow a comparison of the effect of smoking on the risk of two (cardiovascular) diseases*

*allow two comparisons of the effect of smoking on the risk of two (cardiovascular) diseases for **2** marks*

2

(g) y-axis labelled 'Percentage / % increase in risk (compared to people who have never smoked)'

1

correct scale of 1 cm = 5% on y-axis

1

all bars plotted correctly

*allow a tolerance of  $\pm 1/2$  small square*

*ignore bars touching*

*ignore width of bars*

1

all bars correctly labelled

1

(h) any **one** from:

- poor diet

*ignore obesity*

*allow descriptions of poor diet eg diet high in (saturated) fat / cholesterol*

*ignore diet unqualified*

- lack of exercise

*allow descriptions of lack of exercise*

*allow high alcohol intake*

*allow other correct lifestyle factors such as having a stressful job*

1

[14]

<b>3.</b>	<p>(a) palisade (mesophyll / layer / cells)</p> <p style="padding-left: 20px;">spongy mesophyll / layer</p> <p style="padding-left: 20px;">meristem</p> <p style="padding-left: 40px;"><i>must be in this order</i></p> <p style="padding-left: 40px;"><i>do <b>not</b> accept reference to a single cell, once only</i></p>	<p>1</p> <p>1</p> <p>1</p>
(b)	<p>lignin</p> <p style="padding-left: 20px;"><i>ignore cellulose</i></p>	<p>1</p>
(c)	<p>translocation</p> <p style="padding-left: 20px;"><i>ignore active transport</i></p>	<p>1</p>
(d)	<p>(permanent) vacuole</p>	<p>1</p>
(e)	<p>(cell <b>X</b> contains) mitochondria</p> <p style="padding-left: 20px;">for (aerobic) respiration</p> <p style="padding-left: 40px;"><i>do <b>not</b> accept anaerobic respiration</i></p> <p style="padding-left: 20px;">(mitochondria / respiration) releases energy</p> <p style="padding-left: 40px;"><i>do <b>not</b> accept energy produced / made / created</i></p> <p style="padding-left: 20px;"><u>energy</u> needed to move (dissolved) <b>sugar(s)</b> against / up the concentration gradient</p> <p style="padding-left: 40px;"><i>allow <u>energy</u> needed to move (dissolved) <b>sugar(s)</b> from a low concentration to a high concentration</i></p> <p style="padding-left: 20px;">by active transport</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>

(f) any **one** from:

- loss of cytoplasm
- loss of nucleus
- loss of mitochondria
- loss of ribosomes
- loss of sub-cellular structures
- end walls become perforated

*ignore description of a phloem cell*

*allow reference to sieve plate formation*

*allow cell walls form*

*allow (larger) vacuole forms*

*ignore reference to change in size / shape*

1

[12]

4.

(a) nucleus

*allow chromosome*

*ignore in the DNA*

1

(b) **A, D and E**

1

(c) **Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

5–6

**Level 2:** Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3–4

**Level 1:** Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

**No relevant content.**

0

**Indicative content:**

### **Difficulty digesting food**

- less / no lipase
- (so) less / no fat broken down
  - into fatty acids
  - into glycerol
- less / no carbohydrase / amylase
- (so) less / no carbohydrate / starch broken down
  - into glucose / sugar
- less / no protease
- (so) less / no protein broken down
  - into amino acids

### **Difficulty gaining body mass**

- less / no absorption
  - of small / soluble molecules
  - of fatty acids
  - of glycerol
  - of glucose / sugar
  - of amino acids
- fewer molecules **or** fewer amino acids available for building protein / muscle / cells / tissues
- less fat stored
- less respiration
- less energy
- (so less energy) for building new molecules / cells / tissues

For **Level 3** details of difficulty digesting food **and** difficulty gaining body mass are needed.

(d) large surface / area

*allow large surface / area to volume (ratio)*

1

(large) capillary network

**or**

good / efficient blood supply

*allow many capillaries*

1

walls are thin

**or**

walls are one cell thick

*ignore references to membranes*

*ignore alveoli are thin*

*ignore alveoli are one cell thick*

*do **not** accept thin cell walls*

*ignore references to alveoli*

*being moist*

*ignore steep concentration*

*gradient*

1

(e) less (aerobic) respiration

*allow (more) anaerobic respiration*

1

(so) less energy (released)

*do **not** accept less energy produced / made / created*

1

(results in) less muscle contraction

**or**

(results in) reduced metabolism

**or**

*allow relevant named metabolic processes*

(results in) increased breathing rate / depth

**or**

(results in) increased heart rate

*allow (results in) person getting out of breath*

**OR**

(more) anaerobic respiration (1)

(so) lactic acid produced (1)

(results in) muscle fatigue

**or**

(results in) less muscle contraction

**or**

(results in) increased breathing rate / depth

**or**

(results in) increased heart rate (1)

*allow muscle ache / cramp / tiredness / pain*

*allow (results in) person getting out of breath*

1

[14]

5.

- (a) **Leaf 1 or covered with black paper**  
no light so no photosynthesis (occurs)

*ignore reference to water*

*ignore reference to carbon dioxide*

1

**Leaf 2 or covered with transparent plastic**

no carbon dioxide so no photosynthesis

1

**Leaf 3 or not covered**

light and carbon dioxide present so leaf can photosynthesise

*ignore no limiting factors*

1

**for either Leaf 1 / 2**

(so) glucose not made

1

(and therefore) glucose / sugar cannot be converted to starch

*allow converse for Leaf 3*

*if neither marking points 4 and 5 awarded, allow starch (previously present) has been broken down for 1 mark*

1

- (b) (green) starch / present / positive

*allow blue-black / black or dark blue*

**and**

(white) no starch **or** not present **or** negative

*allow yellow / orange / brown*

*both required for 1 mark*

1

- (c) green part contains chlorophyll **and** white part does not

*ignore chloroplasts*

1

(so) light is absorbed by green part (but not by white part) so photosynthesis occurs and starch can be formed

*allow (so) light is absorbed by chlorophyll / chloroplasts so photosynthesis occurs and starch can be formed*

*allow converse for white part*

*ignore colours of starch test if referenced*

1

- (d) magnesium

*allow Mg / Mg<sup>2+</sup>*

*allow nitrate / iron*

*allow other correct named ions*

1

- (e) chlorosis 1
- (f) (measure the) volume (of oxygen) released / produced in a given time  
**or**  
(count / number of) bubbles released / produced in a given time  
*allow answers in terms of a specific time*  
*ignore measure the amount (of oxygen) released in a given time* 1
- (g) (a factor that) if increased would increase the rate (of a reaction)  
**or**  
(a factor that) prevents the rate (of a reaction) increasing  
*allow answers in terms of (a) named factor(s)*  
*allow (a factor that) prevents the maximum rate (of a reaction) being reached* 1
- (h) increasing temperature while keeping the carbon dioxide (concentration) constant increases the rate (of photosynthesis)  
*allow increasing the carbon dioxide (concentration) while keeping temperature constant increases the rate (of photosynthesis)* 1
- increasing the temperature increases the movement of the molecules / particles / substrate  
**or**  
increasing the temperature increases the rate of enzyme activity  
*allow increasing the temperature increases the kinetic energy of the molecules / particles / substrate*  
*allow increasing the temperature increases the frequency of collisions between molecules / particles* 1
- increasing carbon dioxide concentration increases (the concentration of) substrate / reactants 1
- all rates plateau at a certain point due to another factor being limiting  
*allow all rates plateau at a certain point due to chlorophyll being limiting*  
*do **not** accept all rates plateau at a certain point due to light being limiting* 1
- (i) light intensity  $\propto \frac{1}{\text{distance}^2}$  1

[17]

6.

(a) (lhs)

*allow word(s) take precedence over formulae*

carbon dioxide

1

water

1

*in either order*

(rhs)

glucose

1

(b) (used in aerobic) respiration

*do **not** accept anaerobic*

1

to release / transfer energy

*allow for energy*

*allow (respiration) by mitochondria*

*do **not** accept energy created / made / produced*

1

(c) any **one** pair from:

- bulb / lamp is hot

1

(so) may burn you / skin

1

- glassware is breakable (1)

(so) may cut skin (1)

- electricity in close proximity to water (1)

*allow named example of electrical item in close proximity to water*

(so) may get electric shock (1)

- scissors / scalpel (to cut pondweed) are sharp (1)

may cut skin (1)

*mark in pairs*

(d) (use a) water bath

*allow put beaker into (another) beaker of water*

*allow other correct methods eg heat shield*

*allow use an LED*

1

- (e) (change in) temperature affects / changes (the rate of) photosynthesis  
*allow temperature is a limiting factor (of photosynthesis)*  
*allow temperature affects enzyme (activity)*  
*allow temperature affects rate of reaction*

1

(so) will affect / change the number of bubbles (produced)

*allow (so) will affect results*

*allow (so) will affect validity*

*ignore to make it fair*

*ignore so the results will be the same*

1

- (f) blue

1

- (g) bar graph

1

- (h) any **one** from:

- measuring cylinder
- (gas) syringe
- burette

1

- (i) as light (intensity) increases, rate / photosynthesis increases

*allow positive correlation*

1

(rate / photosynthesis increases) at the same rate as light (intensity)

*allow rate / photosynthesis increases linearly / evenly*

*allow description of shape of line eg straight / linear*

*allow rate is (directly) proportional to light (intensity) for*

**2 marks**

1

**[15]**