



**4.4 Bioenergetics
Foundation**

Name: _____

Class: _____

Date: _____

Time: **251 minutes**

Marks: **249 marks**

Comments:

Q1.

Respiration can happen aerobically or anaerobically.

Respiration transfers energy from glucose.

- (a) Draw **one** line from each type of respiration in human cells to the correct information.

Type of respiration in human cells	Information
	Produces ethanol
Aerobic respiration	Uses oxygen
Anaerobic respiration	Uses carbon dioxide
	Produces lactic acid

(2)

- (b) The table below shows the amount of energy released by aerobic and anaerobic respiration.

	Energy in kJ transferred from 1 g of glucose
Aerobic respiration	16.1
Anaerobic respiration	1.2

Suggest why human cells might respire anaerobically, even though only a small amount of energy is transferred.

(1)

- (c) Yeast is used in the brewing and baking industries.

Why is yeast used in these industries?

(4)
(Total 7 marks)

Q2.

Muscles need energy during exercise.

Draw a ring around the correct answer in parts (a) and (b) to complete each sentence.

(a) (i) The substance stored in the muscles and used during exercise is

- | |
|--------------|
| glycogen. |
| lactic acid. |
| protein. |

(1)

(ii) The process that releases energy in muscles is

- | |
|----------------|
| digestion. |
| respiration. |
| transpiration. |

(1)

(b) The table shows how much energy is used by two men of different masses when swimming at different speeds.

Speed of swimming in metres per minute	Energy used in kJ per hour	
	34 kg man	70 kg man
25	651	1155
50	1134	2103

(i) When the 34 kg man swims at 50 metres per minute instead of at 25 metres per minute,

the extra energy he uses each hour is

- | |
|---------|
| 36 kJ. |
| 483 kJ. |
| 948 kJ. |

(1)

(ii) When swimming at 50 metres per minute, each man's heart rate is faster than

when swimming at 25 metres per minute.

A faster heart rate helps to supply the muscles with more

carbon dioxide.
glycogen.
oxygen.

(1)

(iii) During the exercise the arteries supplying the muscles would

constrict.
dilate.
pump harder.

(1)

(c) When a person starts to swim, the breathing rate increases.

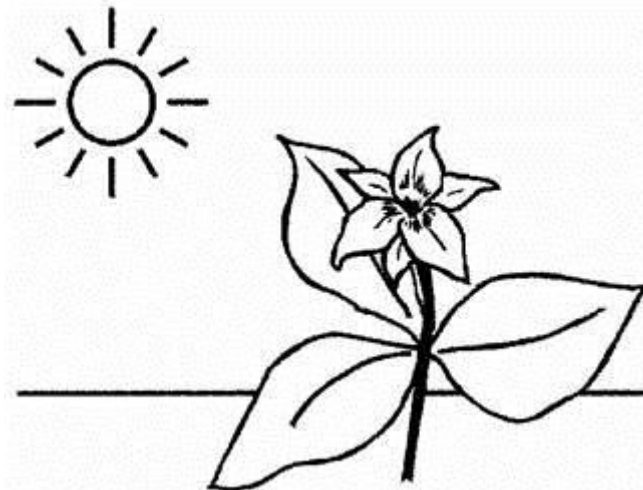
Give **one** way in which this increase helps the swimmer.

(1)

(Total 6 marks)

Q3.

(a) Plants make their own food by photosynthesis.



Use the following words to fill in the gaps. You can use each word once or not at all.

carbon chlorophyll cytoplasm light nitrogen
oxygen sound starch water

During photosynthesis _____ dioxide and _____
are converted into glucose and _____. The energy needed to do

this is _____ energy which is trapped by a green pigment called _____.

The plant can change the glucose into _____ which is insoluble so it can be stored.

(6)

(b) Which part of a plant is adapted for photosynthesis?

(1)

(c) How do the **two** raw materials for photosynthesis get into the plant?

1. _____

2. _____

(2)

(d) Describe **one** way you could speed up photosynthesis.

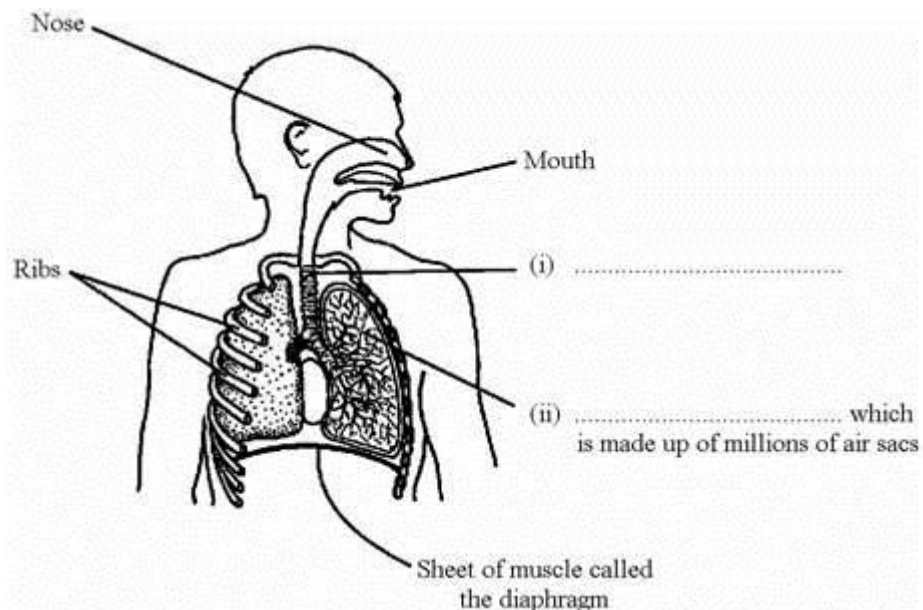
(1)

(Total 10 marks)

Q4.

The diagram shows the human breathing system.

(a) Complete the labels (i) and (ii).



(2)

(b) Complete the following sentence.

When we breathe out, the mixture of gases which leaves the air sacs contains **more** _____ and **less** _____ than the mixture of gases which enters the air sacs.

(2)

(Total 4 marks)

Q5.

A scientist investigated the effect of oxygen concentration and temperature on the rate of decay of leaves in a container.

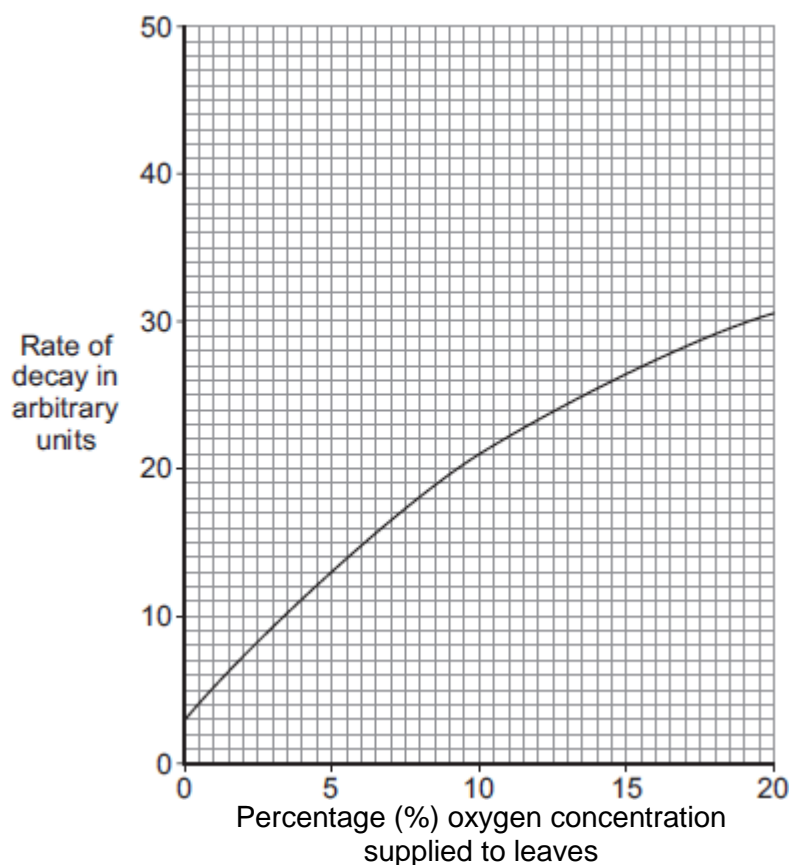
(a) Name equipment that could be used to measure the temperature and the concentration of oxygen in the container of leaves.

Temperature: _____

Concentration of oxygen: _____

(2)

(b) The results for oxygen concentration are shown in the graph.



(i) What was the rate of decay at an oxygen concentration of 5%?

_____ arbitrary units

(1)

(ii) What conclusion can be made from the results shown in the graph?

(1)

- (c) Temperature can affect the rate of decay.

The graph shows the rate of decay at different oxygen concentrations when the temperature was 20 °C.

Draw a line on the graph to show the results you would expect at a temperature of 15 °C.

(1)

- (d) Complete the following sentences about decay processes.

Materials are constantly cycled.

Dead organisms decay because they are broken down and digested by

The decay process releases substances. These substances help the growth of

Carbon dioxide is also released when dead organisms decay. Carbon dioxide

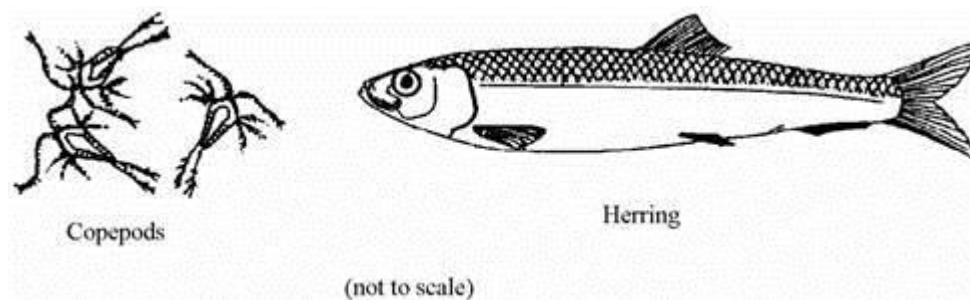
is a waste product of _____.

(3)

(Total 8 marks)

Q6.

Copepods are tiny animals which live in the sea.



During the day they live deep down near the sea bed.
At night they move up to the surface where they feed on tiny plants.
When the sun rises they move down to the bottom again.

- (a) Suggest why the tiny **plants** live near the surface of the sea.

(2)

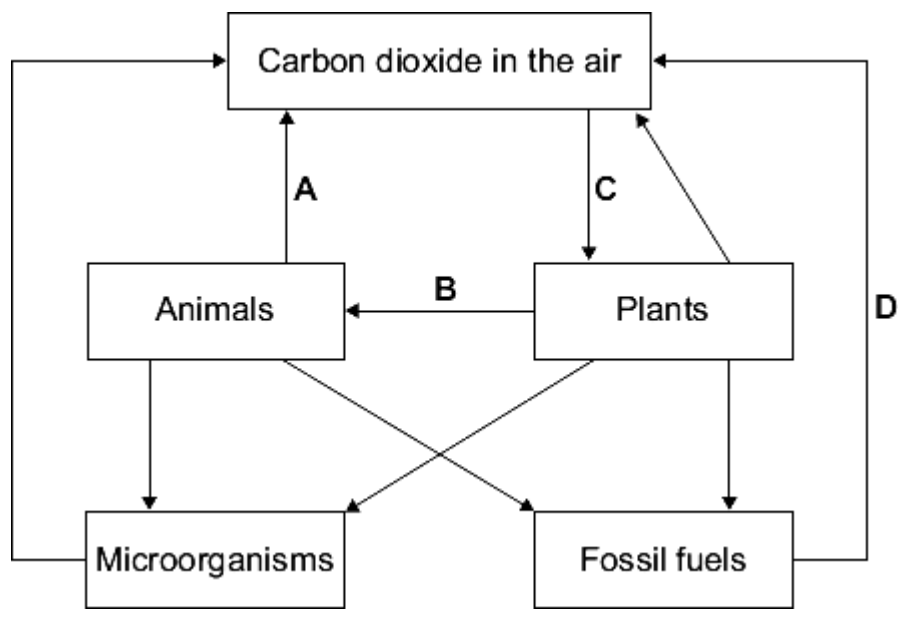
- (b) Herring feed on copepods.

Where will herring be found during the day? Give a reason for your answer.

(2)
(Total 4 marks)

Q7.

The diagram shows part of the carbon cycle.



Name the processes labelled **A**, **B**, **C** and **D**, on the diagram.

A _____

B _____

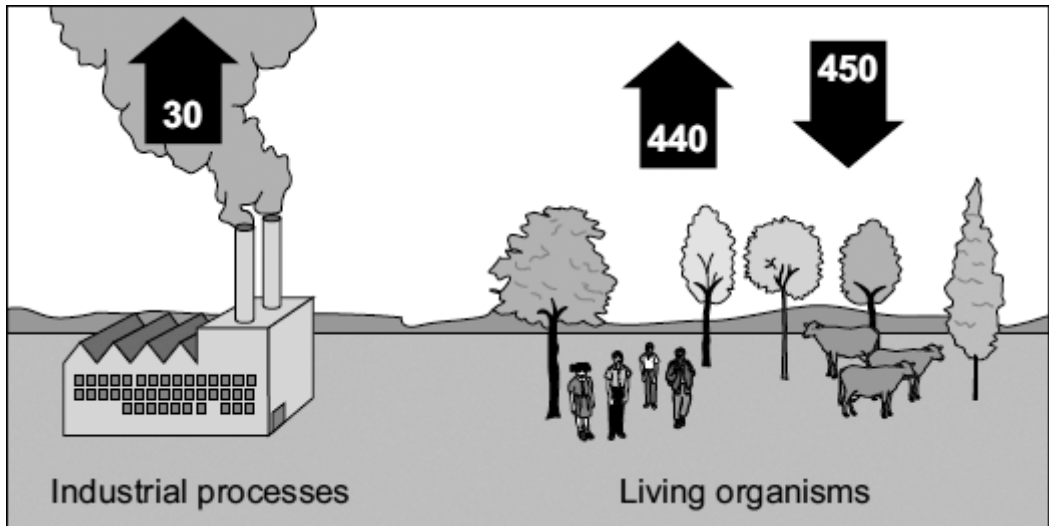
C _____

D _____

(Total 4 marks)

Q8.

The diagram shows the mass of carbon dioxide released into and removed from the air each year in billions of tonnes.



(a) Complete the following sentences.

(i) Plants remove carbon dioxide from the air by a process called _____

(1)

(ii) All organisms produce carbon dioxide during a process called _____

(1)

(b) Too much carbon dioxide in the atmosphere can harm the environment.

Suggest **two different** ways of reducing the amount of carbon dioxide in the atmosphere.

(2)

(Total 4 marks)

Q9.

(a) The air you breathe in and the air you breathe out are different.

Use the names of gases from this box to complete the **three** spaces.

argon	carbon dioxide	nitrogen	oxygen	water vapour
-------	----------------	----------	--------	--------------

Compared to the air you breathe in, the air you breathe out contains:

- **more** _____
- **more** _____
- **less** _____

(3)

(b) The process of aerobic respiration takes place in your cells.

(i) Complete the space in the word equation for this process.

_____ + oxygen → carbon dioxide + water

(1)

(ii) Complete the space to give the main energy transfer which takes place in this process.

chemical energy → _____ energy

(1)

(iii) What is the name of the organ where oxygen from the air passes to your blood?

(1)

(c) The athlete is taking part in vigorous exercise.



Complete the **two** spaces in the passage.

The cells in our muscles respire anaerobically during vigorous exercise. This results in _____ debt and the production of _____ acid.

(2)

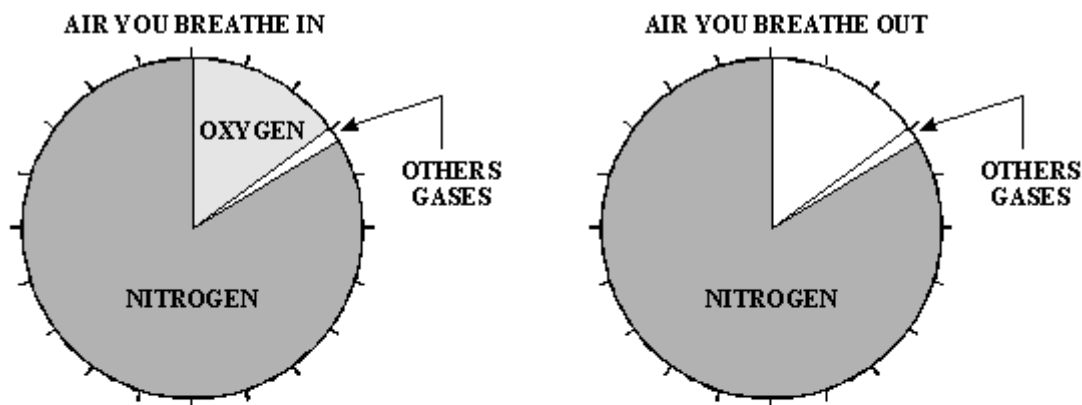
(Total 8 marks)

Q10.

(a) Breathed-out air is different from breathed-in air.

The two pie-charts show the percentages of different gases in each.

Complete the second pie-chart, using the information from the table.



This air contains less than 1% carbon dioxide. (Too little to show)

Gases in breathed-out air	
nitrogen	79%
oxygen	16%
carbon dioxide	4%
other gases	1%

(3)

(b) Use the information above to complete the following sentences.

The air you breathe out contains more _____ than the air you breathe in.

The air you breathe out contains less _____ than the air you breathe in.

(2)

(Total 5 marks)

Q11.

The table shows the percentage of some gases in the air a boy breathed in and out.

Gases	Air breathed in	Air breathed out
carbon dioxide	0.04%	4.0%
oxygen	20.0%	16.0%
water vapour	1.0%	6.0%

(a) What happens in the lungs to change the levels of oxygen and carbon dioxide in this way?

Oxygen _____

Carbon dioxide _____

(4)

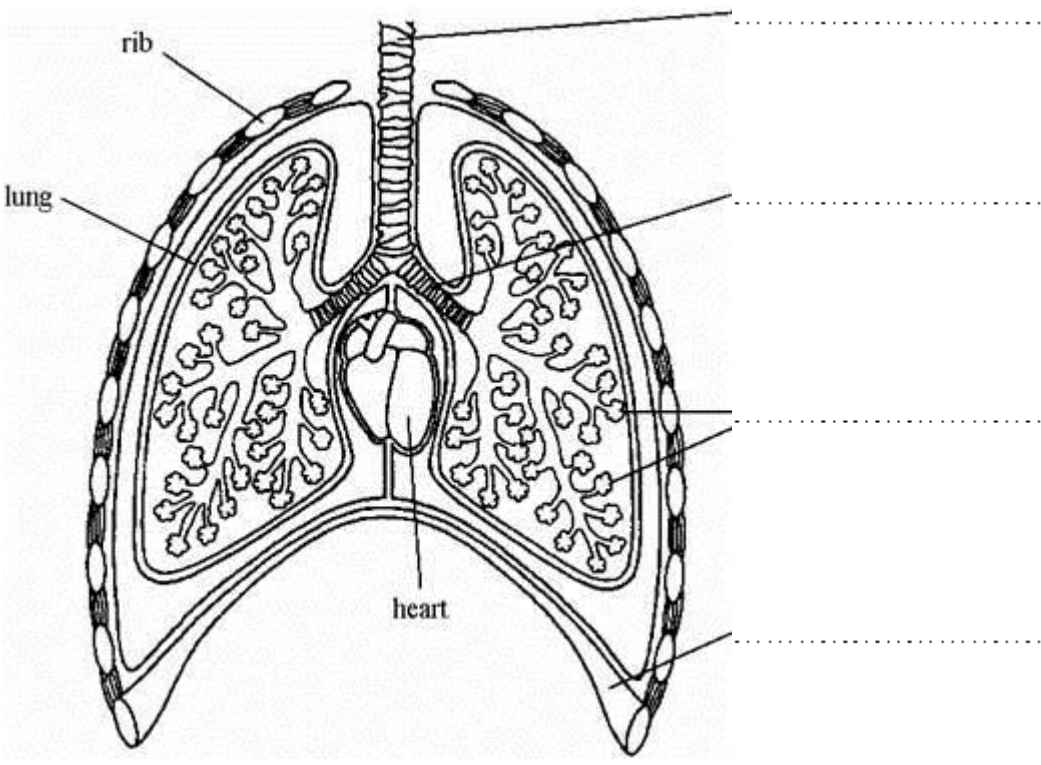
(b) Compare the percentage of water vapour in the air breathed out with the percentage in air breathed in.

(2)

(Total 6 marks)

Q12.

The diagram shows part of the breathing system in a human.



(a) Use words from the list to label the parts on the drawing.

alveoli bronchiole bronchus diaphragm trachea (windpipe)

(4)

(b) Where in the lungs does oxygen enter the blood?

(1)

(c) Which process in cells produces carbon dioxide?

(1)

(Total 6 marks)

Q13.

(a) (i) Complete the word equation for the process of aerobic respiration.

Glucose + _____ → carbon dioxide + water

(1)

(ii) Which organ removes carbon dioxide from your body?

(1)

(b) Use names from the box to complete the **two** spaces in the passage.

carbon dioxide	lactic		
acid	nitrogen	oxygen	water

Anaerobic respiration can occur when an athlete does vigorous exercise.

This is because there is not enough _____ in the body.

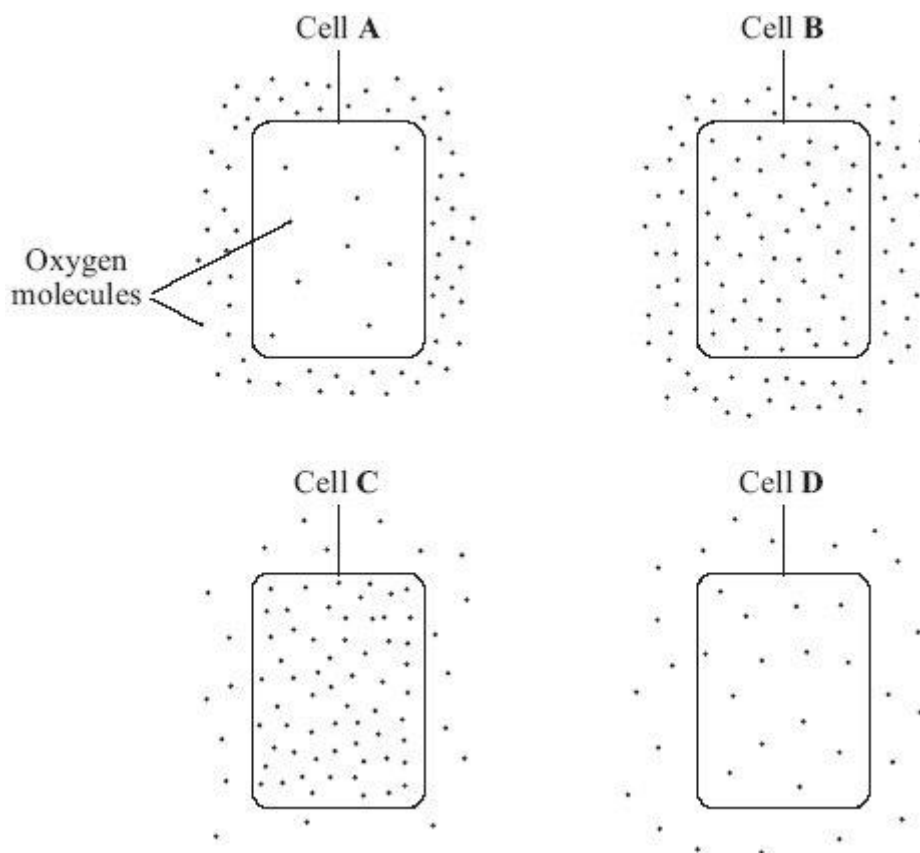
The product of anaerobic respiration is _____.

(2)

(Total 4 marks)

Q14.

(a) The diagrams show cells containing and surrounded by oxygen molecules. Oxygen can move into cells or out of cells.



Into which cell, **A**, **B**, **C** or **D**, will oxygen move the fastest?

Write your answer, **A**, **B**, **C** or **D**, in the box.

(1)

(b) Draw a ring around the correct word to complete each sentence.

(i) Oxygen is taken into cells by the process of

diffusion
osmosis
respiration

(1)

(ii) Cells need oxygen for

breathing
photosynthesis
respiration

(1)

(iii) The parts of cells that use up the most oxygen are the

membranes
mitochondria
nuclei

(1)

(iv) Some cells produce oxygen in the process of

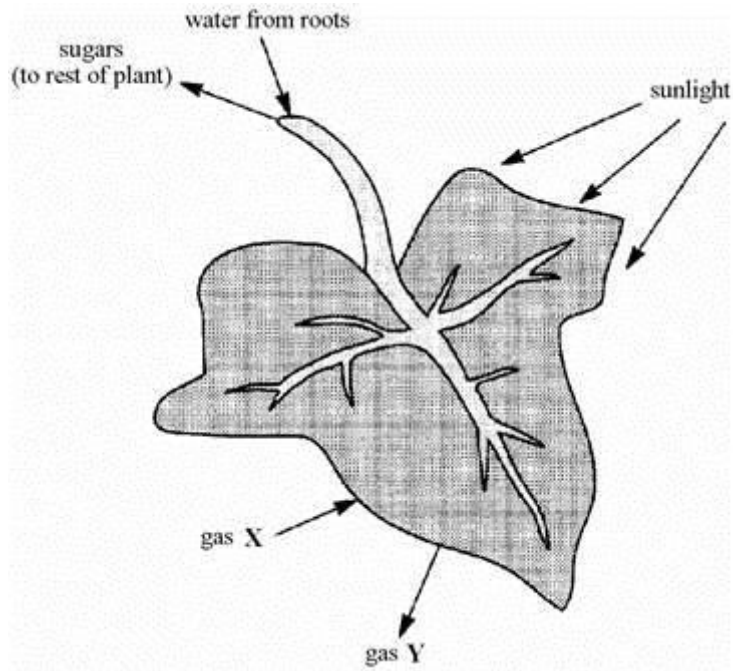
diffusion
photosynthesis
respiration

(1)

(Total 5 marks)

Q15.

The diagram shows a plant leaf during photosynthesis.



(a) Name:

(i) gas X; _____

(ii) gas Y. _____

(2)

(b) Why is sunlight necessary for photosynthesis?

(1)

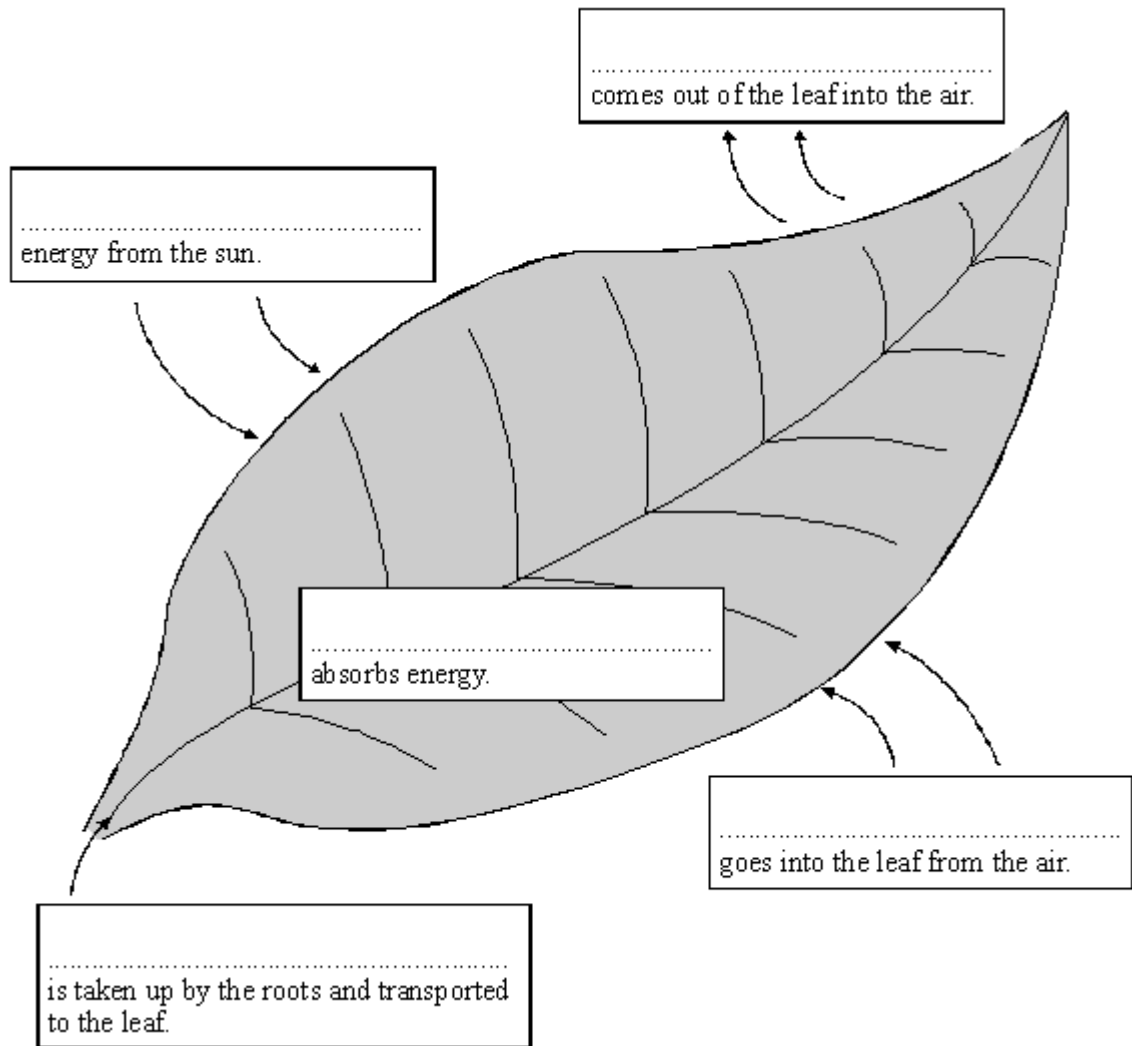
(Total 3 marks)

Q16.

The diagram shows how a leaf of a green plant makes glucose.

(a) Use words from the box to complete the labels on the diagram. You may use each word once or not at all.

carbon dioxide	chlorophyll	glucose	heat
light	oxygen	water	



(5)

(b) (i) Complete the following sentence.

Glucose in food is a type of _____. When we eat it, it gives us energy.

(1)

(ii) The plant turns some of the glucose into starch. Why is starch useful to the plant?

(1)

(iii) What does the plant do with the rest of the glucose?

(1)

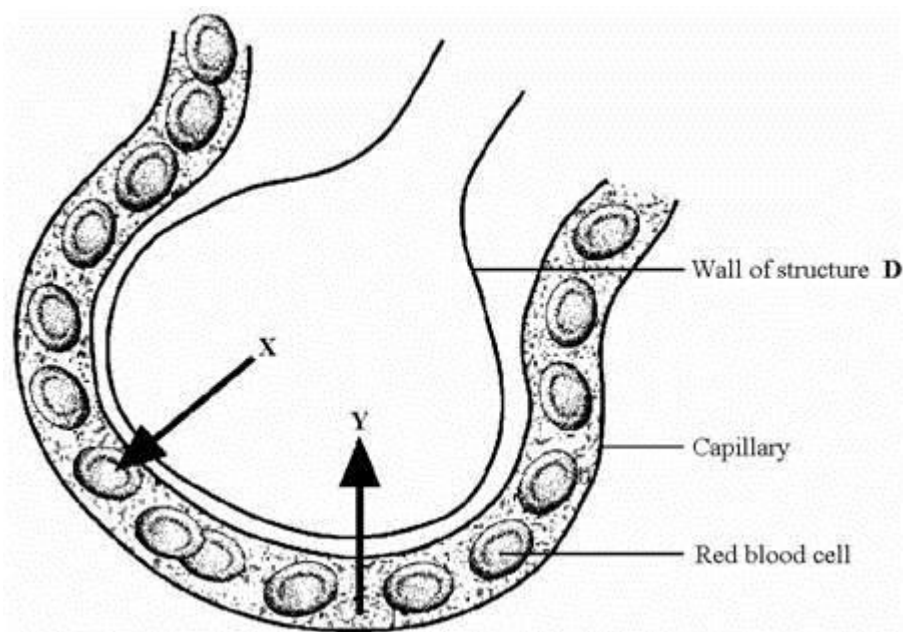
(c) (i) What is the name of the process outlined in the diagram?

(1)

(ii) Give **one** way that leaves are adapted to do this process.

Q17.

The diagram shows an enlargement of structure **D**.



The arrows show the direction of the gases exchanged in this structure. Name gas **X** and gas **Y**.

X _____

Y _____

(Total 2 marks)

Q18.

Photosynthesis takes place in green plants.

(a) Name the substance that combines with water in photosynthesis.

_____ (1)

(b) Where does water enter the plant?

_____ (1)

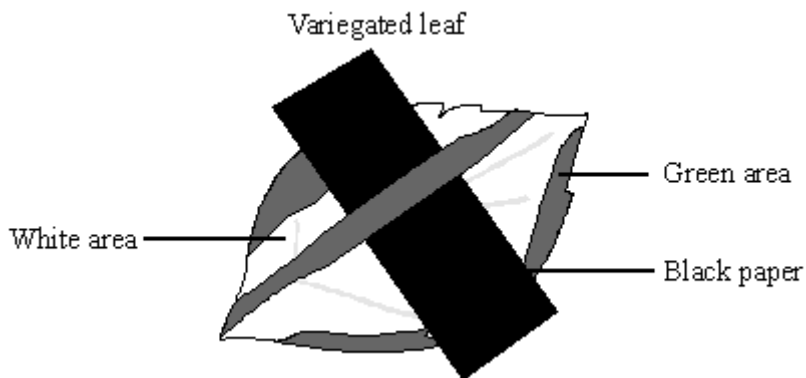
(c) Name **two** products of photosynthesis.

_____ (2)

(d) Variegated leaves have areas that are green and areas that are white. Some students used variegated leaves to investigate photosynthesis.

- They covered a variegated leaf with a black paper shape.
- The leaf was left in a sunny place.

- They tested the leaf for starch.
- The results were compared with a leaf that was not covered.



Area of the leaf tested	Starch present after test	
	covered	uncovered
Green area	no	yes
White area	no	no

Explain why starch was present in only one of the tests.

(4)
(Total 8 marks)

Q19.

Green plants are able to make their own food.

Complete each sentence by drawing a ring around the correct answer in the box.

(a) Green plants make their own food during the process of

diffusion
photosynthesis
respiration

(1)

(b) This process can be summarised by the equation:

carbon dioxide + water → glucose +

mineral salts

light

oxygen

(1)

(c) The energy needed for this process is trapped for the plant by

chlorophyll

glucose

light

(1)

(d) Some of the food made by plants is stored as insoluble

chlorophyll

glucose

starch

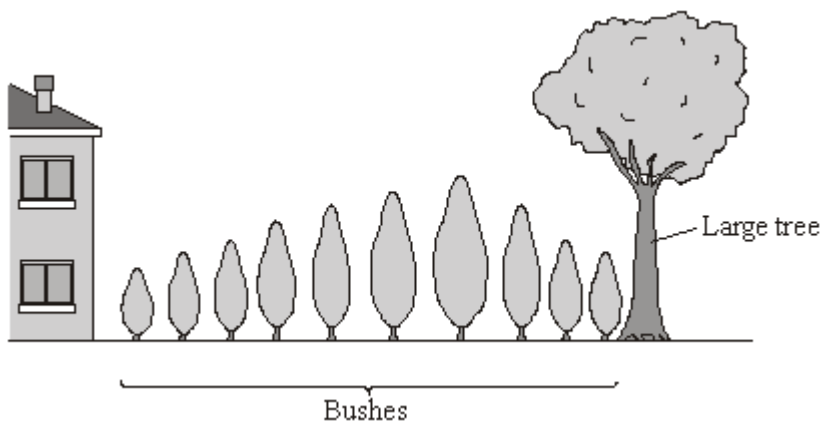
(1)

(Total 4 marks)

Q20.

The diagram shows bushes in a hedge growing near to a house.

The bushes were the same species and the same age.



(a) (i) The student said, "I have noticed that the short bushes grow next to the house. I think that the more light the bushes get, the faster they will grow."

Draw lines to match each of the student's statements to the correct term.

Draw only two lines.

Statement	Term
The short bushes grow next to the house.	A conclusion
Plants will grow faster if they get more light.	A prediction
	An observation

(2)

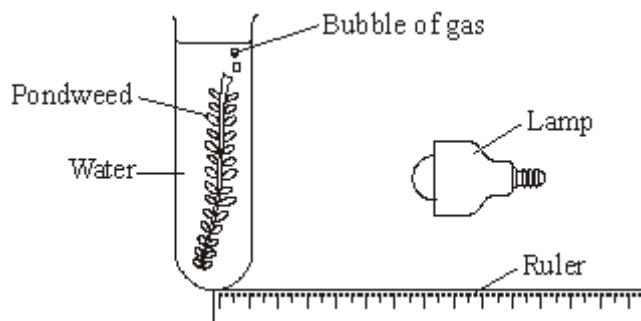
(ii) Complete the word equation for photosynthesis.

_____ + water (+ light energy) → _____ + oxygen

(2)

(b) The student decided to investigate the effect of light intensity on the rate of photosynthesis.

She used the apparatus shown in the diagram.

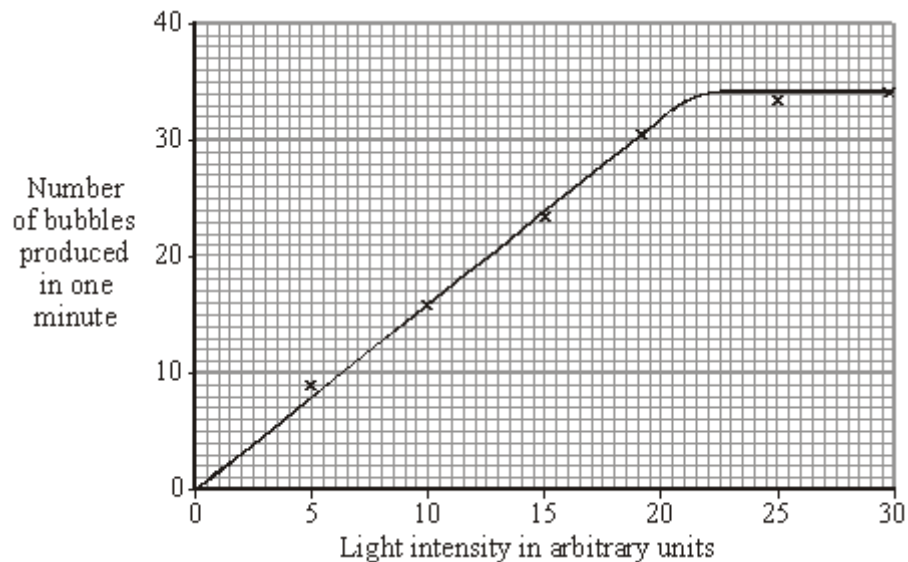


She measured the rate of photosynthesis by counting the number of gas bubbles given off each minute.

(i) Suggest how the student varied the intensity of the light received by the pondweed.

(1)

(ii) The student's results are shown on the graph.



Describe the pattern shown on the graph.

(2)

(iii) This is what the student wrote for her conclusion.

“Increasing the light intensity increases the rate of photosynthesis of the pondweed.”

Why was her conclusion incomplete?

(1)

(Total 8 marks)

Q21.

Paula is training for a marathon. When she runs, her heart beats faster than it does when she is resting.

Complete the sentences, using words from the box.

blood	breathe	carbon dioxide	glucose
heat	nitrogen	oxygen	respire

When she is running, Paula’s muscle activity increases. To do this, her muscle cells _____ at a faster rate to give her more energy. Her muscles need to be supplied with _____ and _____

more quickly. Her heart beats faster to increase the flow of _____
 which carries the products _____ and
 _____ away from her muscles.

(Total 6 marks)

Q22.

Complete the table by writing the correct process next to its description.

Choose your answers from the list in the box

breathing	diffusion	digestion	osmosis	respiration
------------------	------------------	------------------	----------------	--------------------

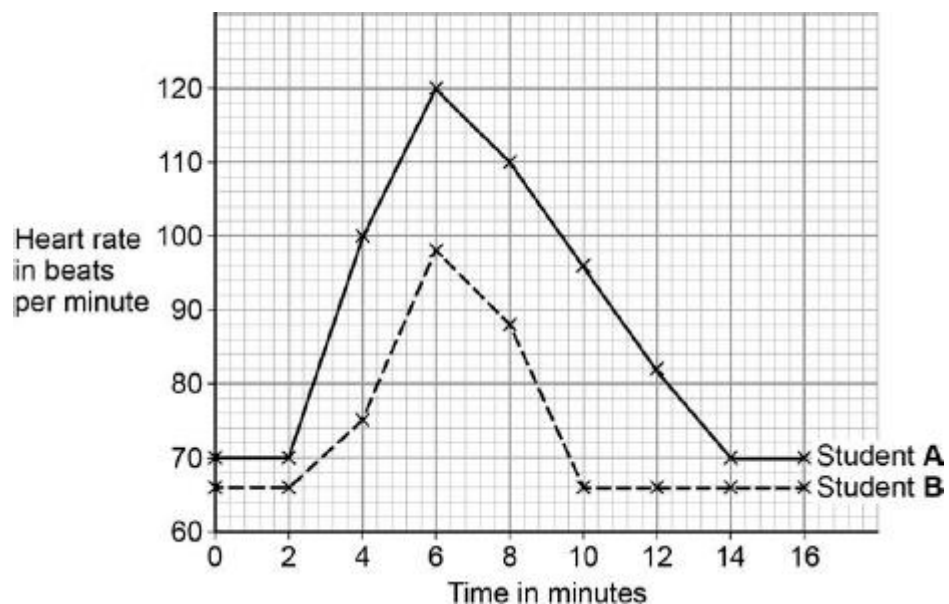
Description	Process
Moving air in and out of the lungs	
The movement of particles of a substance from high to low concentration	
The release of energy from glucose	

(Total 3 marks)

Q23.

Some students investigated how exercise affects heart rate.

The figure below shows their results.



(a) What was Student **B**'s resting heart rate?

Resting heart rate = _____ beats per minute

(1)

(b) The students started running at 2 minutes.

What evidence for this is in the figure above?

(1)

(c) For how many minutes did the students run?

Tick **one** box.

2	<input type="checkbox"/>
4	<input type="checkbox"/>
6	<input type="checkbox"/>
14	<input type="checkbox"/>

(1)

(d) Student **B** is fitter than Student **A**.

Use the figure above to give **two** pieces of evidence that support this statement.

1. _____

2. _____

(2)

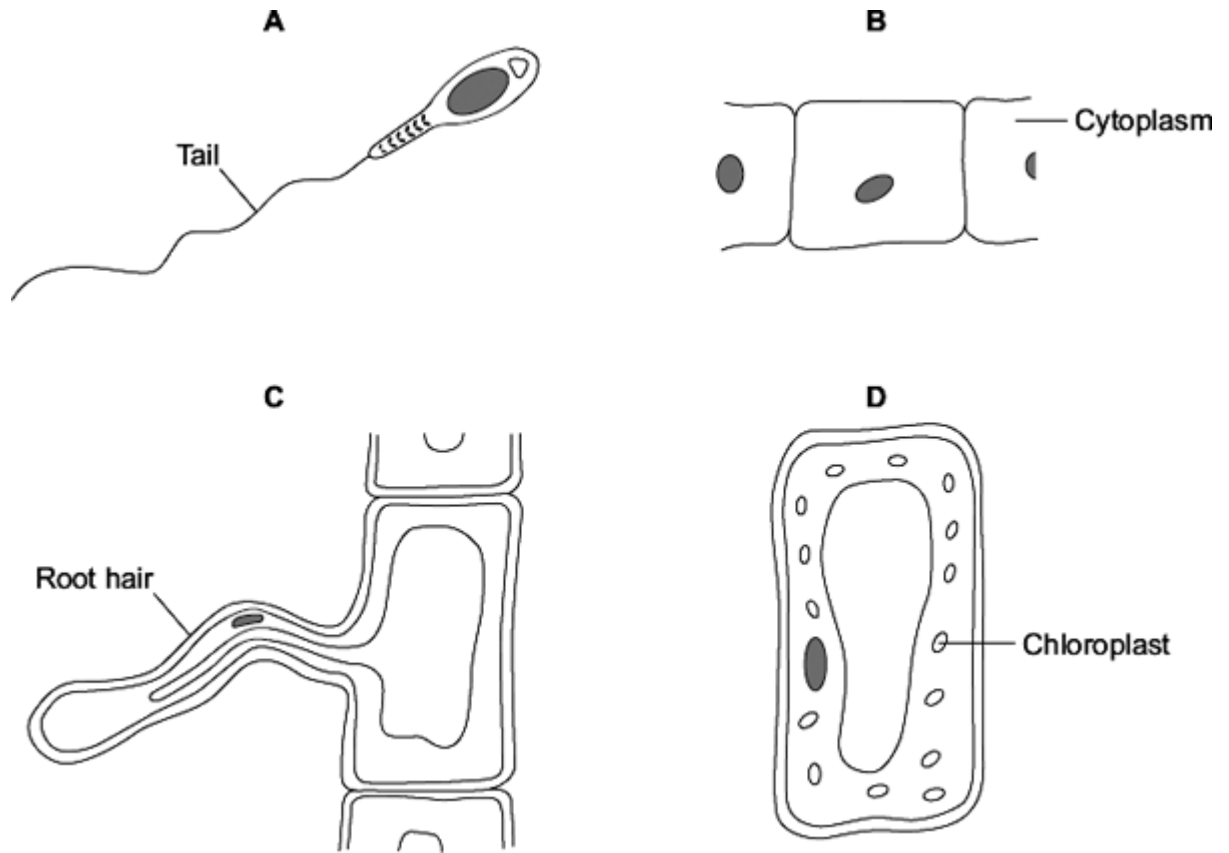
(e) There are other changes in the body during exercise.

Explain why these changes occur.

(4)

Q24.

The diagrams show four types of cell, **A**, **B**, **C** and **D**.
Two of the cells are plant cells and two are animal cells.



(a) (i) Which **two** of the cells are plant cells?

Tick (✓) **one** box.

A and B

A and D

C and D

(1)

(ii) Which part is found **only** in plant cells?

Draw a ring around **one** answer.

cell membrane

cell wall

nucleus

(1)

(b) (i) Which cell, **A**, **B**, **C** or **D**, is adapted for swimming?

(1)

(ii) Which cell, **A**, **B**, **C** or **D**, can produce glucose by photosynthesis?

(1)

(c) Cells **A**, **B**, **C** and **D** all use oxygen.

For what process do cells use oxygen?

Draw a ring around **one** answer.

osmosis

photosynthesis

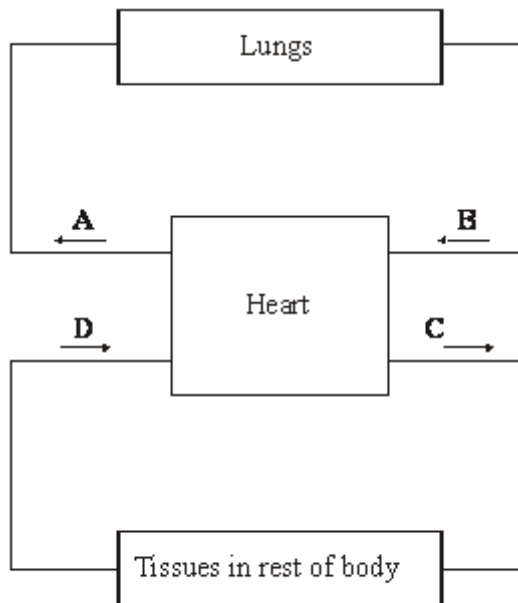
respiration

(1)

(Total 5 marks)

Q25.

The diagram represents the human blood circulation system.



Key: → Direction in which blood flows

(a) **A**, **B**, **C** and **D** are blood vessels.

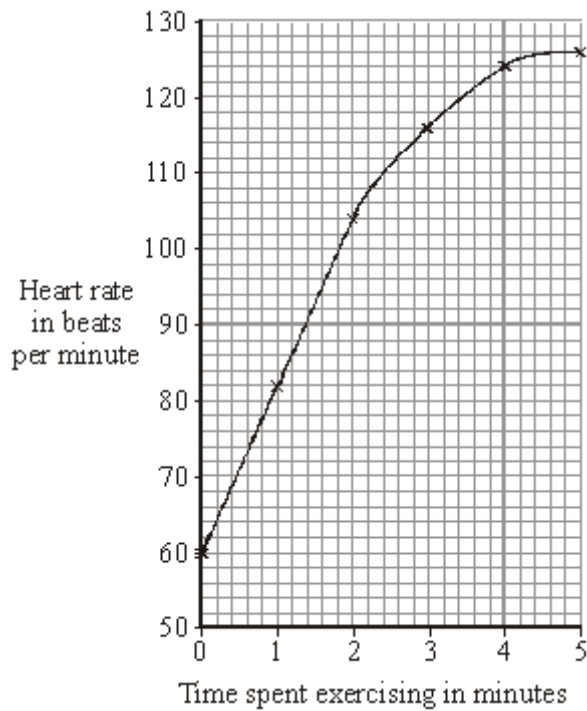
(i) Give the letter of **one** blood vessel that is an artery. _____

(1)

(ii) Give the letter of **one** blood vessel that is a vein. _____

(1)

(b) A student pedalled an exercise cycle at constant speed for 5 minutes. The student's heart rate was recorded at one-minute intervals during the exercise. The results are shown in the graph.



(i) What was the student's heart rate before the exercise began?
 _____ per minute (1)

(ii) How long was it before the student's heart rate reached 124 beats per minute?
 _____ minutes (1)

(c) Which of the following parts of the blood carries most oxygen?

Draw a circle around **one** answer.

plasma

red blood cells

white blood cells

(1)

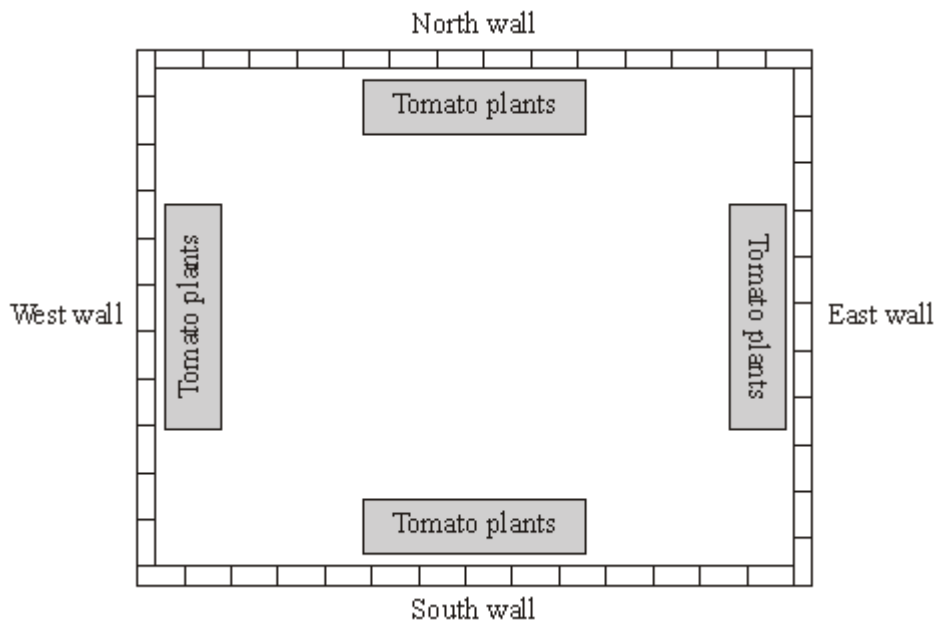
(Total 5 marks)

Q26.

A gardener grows tomatoes.

He wants to find out how to get the biggest mass of tomatoes.

He plants different varieties of tomato against different walls in his garden.



Use these results to answer the questions.

- (a) The gardener wants his test to be fair.

Name **one** condition which he should keep the same for all his tomato plants.

(1)

- (b) The table shows the gardener's results.

Variety of tomato plant	Sungold	Sungold	Sungold	Sungold	Nugget	Champion
Wall they were planted against	North	West	South	East	East	East
Mean mass of tomatoes produced in kilograms per plant	3.5	3.0	1.2	2.5	3.2	2.7

- (i) To obtain the biggest mass of tomatoes, against which wall is it best to grow the tomato plants?

Tick (✓) **one** box.

North wall

South wall

East wall

West wall

(1)

- (ii) To obtain the biggest mass of tomatoes, which variety of tomato plant would it be best to grow?

(1)

- (c) From the information in the table, the gardener's test was **not** fair.

Give **one** way in which the test was **not** fair.

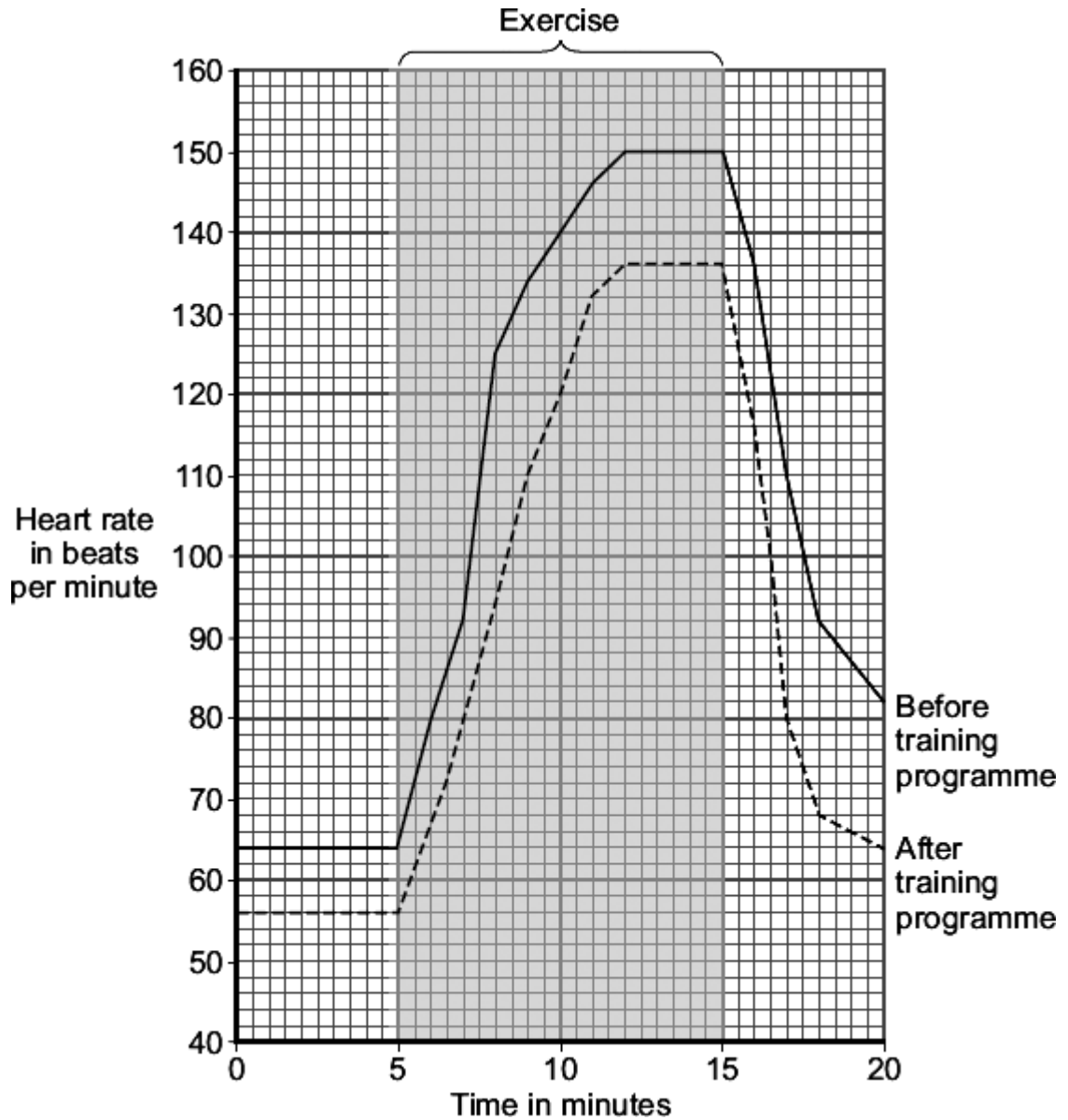
(1)

(Total 4 marks)

Q27.

An athlete did a 6-month training programme.

The graph shows the effect of the same amount of exercise on his heart rate before and after the training programme.



(a) (i) What was the maximum heart rate of the athlete during exercise before the training programme?

_____ beats per minute

(1)

(ii) Give **two** differences between the heart rate of the athlete before and after the training programme.

After the training programme

Difference 1 _____

Difference 2 _____

(2)

(b) Which **two** substances need to be supplied to the muscles in larger amounts during exercise?

Tick (✓) **two** boxes.

Carbon dioxide	<input type="checkbox"/>
Glucose	<input type="checkbox"/>
Lactic acid	<input type="checkbox"/>
Oxygen	<input type="checkbox"/>
Urea	<input type="checkbox"/>

(2)
(Total 5 marks)

Q28.

Pathogens cause infectious diseases in animals and plants.

(a) Draw **one** line from each disease to the type of pathogen that causes the disease.

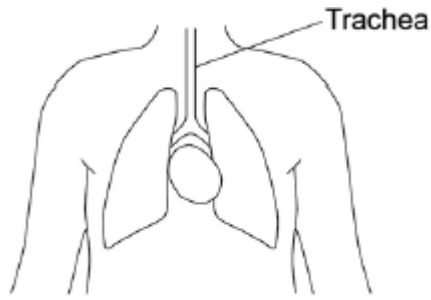
Disease	Type of pathogen
<input type="text" value="Gonorrhoea"/>	<input type="text" value="Bacterium"/>
<input type="text" value="Malaria"/>	<input type="text" value="Fungus"/>
<input type="text" value="Measles"/>	<input type="text" value="Protist"/>
	<input type="text" value="Virus"/>

(3)

(b) Some parts of the human body have adaptations to reduce the entry of live pathogens.

Look at **Figure 1**.

Figure 1



Explain how the trachea is adapted to reduce the entry of live pathogens.

(4)

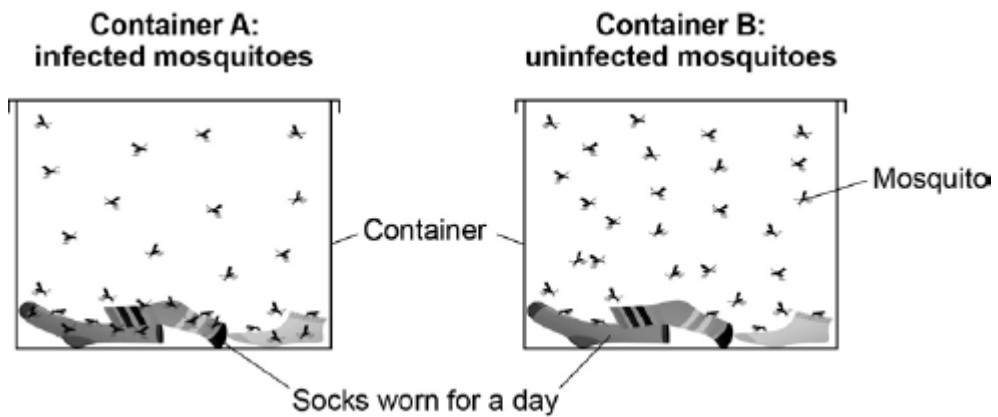
(c) Malaria is a serious disease that can be fatal.

Malaria is spread to humans by infected mosquitoes.

Scientists investigated the behaviour of mosquitoes to understand how the spread of malaria could be controlled.

Figure 2 shows the equipment the scientists used.

Figure 2



This is the method used.

1. 30 mosquitoes **infected with malaria** were placed in Container **A**.
2. 30 **uninfected** mosquitoes were placed in Container **B**.

3. The total number of times the mosquitoes landed on the socks was recorded.

Name the dependent variable and suggest **one** control variable in this investigation.

Dependent variable _____

Control variable _____

(2)

(d) Infected mosquitoes landed on the socks three times more often than uninfected mosquitoes.

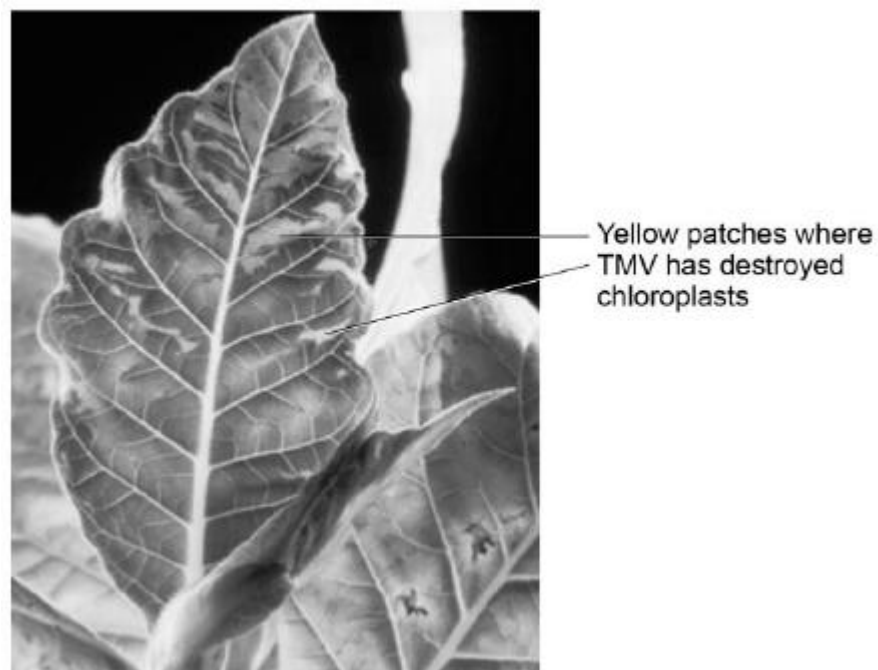
Explain how this information can be used to reduce the spread of malaria.

(2)

(e) Tobacco mosaic virus (TMV) affects many species of plant.

Figure 3 shows a leaf infected with TMV.

Figure 3



© Nigel Cattlin/Getty Images

TMV destroys chloroplasts in the leaf.

Explain how this could affect the growth of the plant.

(3)
(Total 14 marks)

Q29.

The amount of carbon dioxide in the atmosphere is increasing.

The table shows the estimated mass of carbon dioxide exchanged with the atmosphere in one year.

	Mass of carbon dioxide exchanged with the atmosphere in millions of tonnes	
	Passed out into the atmosphere	Taken in from the atmosphere
Plants	30	64
Animals	10	0
Microorganisms	24	0
Combustion	6	0

- (a) (i) Calculate the total mass of carbon dioxide passed out into the atmosphere in one year.

Show clearly how you work out your answer.

Answer _____ million tonnes

(2)

- (ii) Calculate the increase in the mass of carbon dioxide in the atmosphere in one year.

You should use your answer to part (a)(i) in your calculation.

Show clearly how you work out your answer.

Answer _____ million tonnes

(2)

- (b) Draw a ring around the correct answer to complete the sentence.

Plants use carbon dioxide in the process of

decomposition.

photosynthesis.

respiration.

(1)

(Total 5 marks)

Q30.

A gardener grows tomato plants.

The tomato plants develop yellow leaves.

- (a) What would be the best way of improving the growth of these plants?

Tick (✓) **one** box.

Add mineral ions to the soil

Water the plants more

Add glucose to the soil

(1)

- (b) Most tomatoes are grown in greenhouses.



Tomato growers alter the conditions in greenhouses to make tomato plants grow faster.

Which changes in conditions will make tomato plants grow faster?

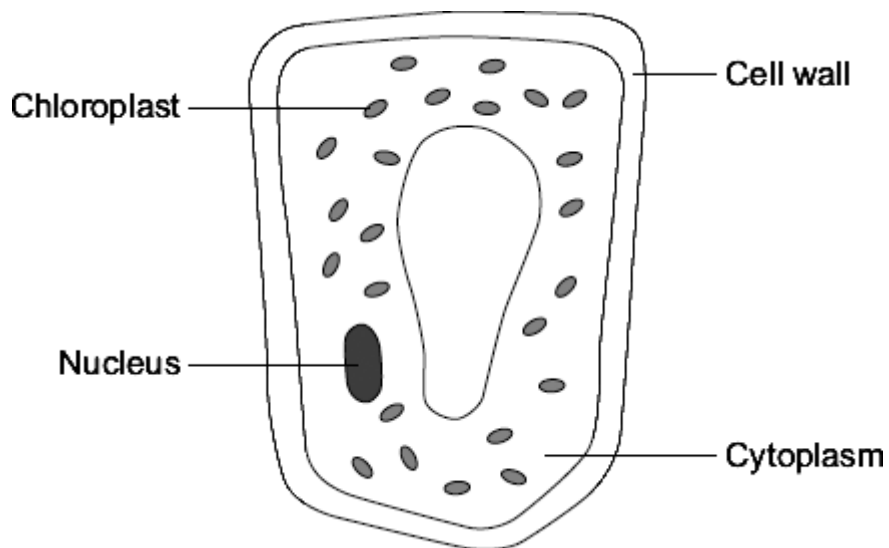
Tick (✓) **two** boxes.

- | | |
|--------------------------------------------------|--------------------------|
| Increasing the temperature | <input type="checkbox"/> |
| Increasing the oxygen concentration in the air | <input type="checkbox"/> |
| Increasing the nitrogen concentration in the air | <input type="checkbox"/> |
| Turning lights on at night | <input type="checkbox"/> |

(2)
(Total 3 marks)

Q31.

The diagram shows a plant cell from a leaf.



- (a) **List A** gives the names of three parts of the cell.
List B gives the functions of parts of the cell.

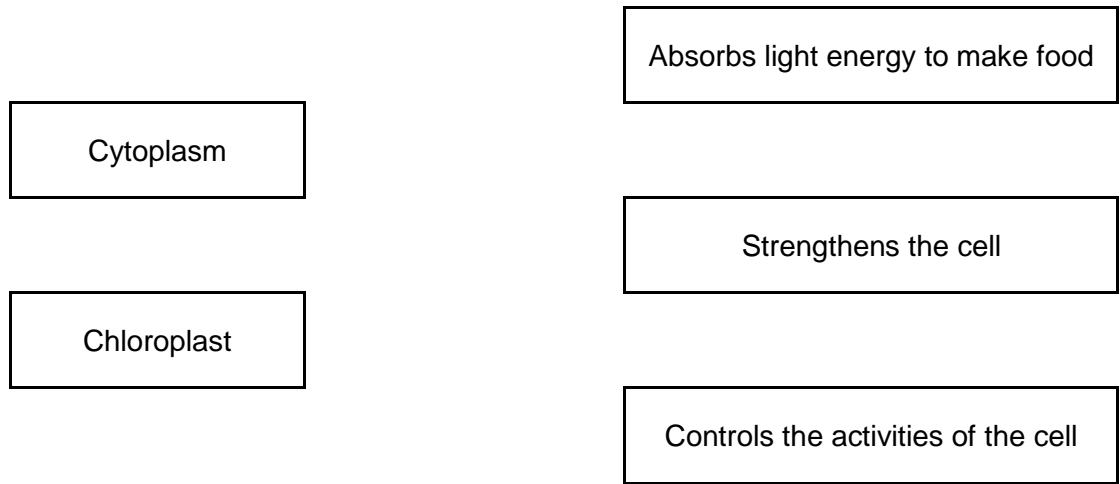
Draw a line from each part of the cell in **List A** to its function in **List B**.

List A
Parts of the cell

List B
Functions

Nucleus

Where most of the chemical reactions take place



(3)

(b) Respiration takes place in the cell.

Draw a ring around the correct answer to complete the sentence.

All cells use respiration to release

energy
oxygen.
sugar.

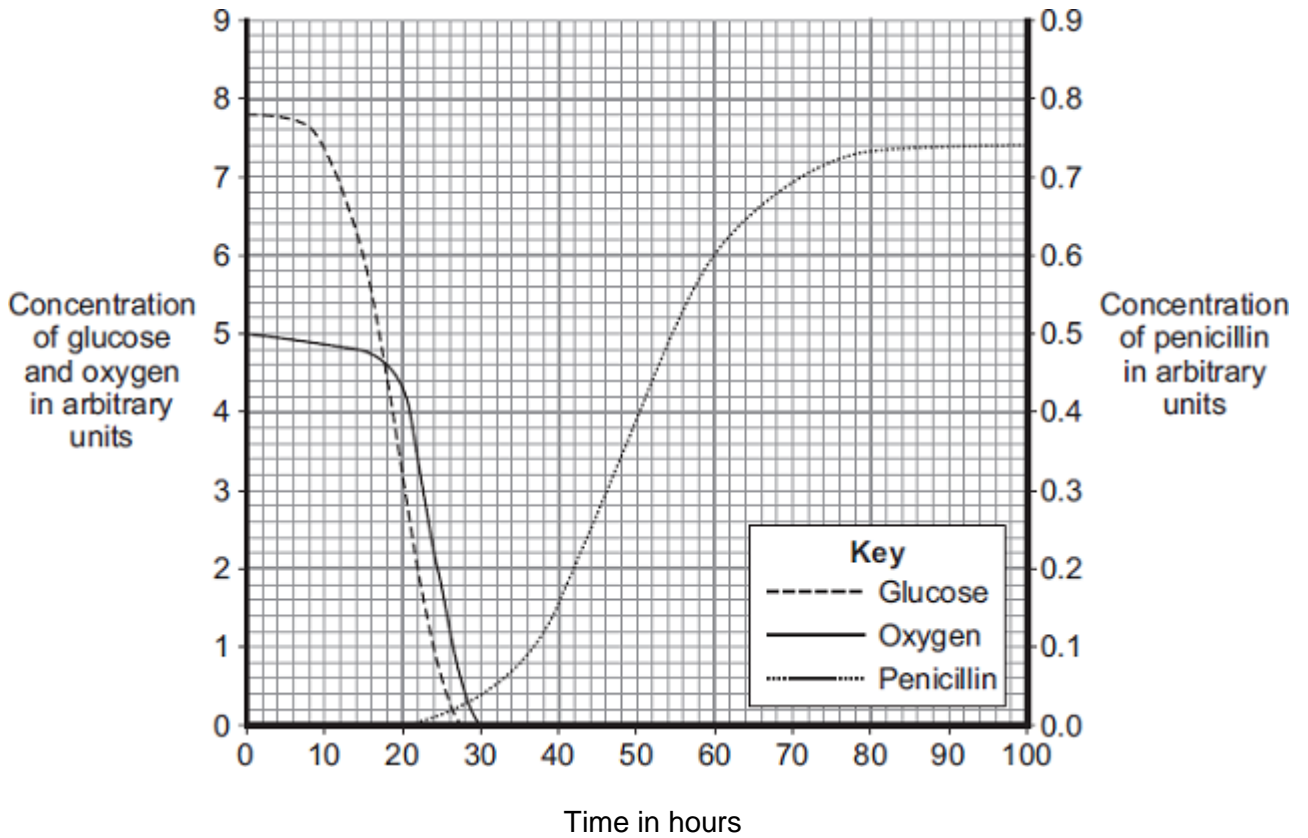
(1)

(Total 4 marks)

Q32.

The mould *Penicillium* can be grown in a fermenter. *Penicillium* produces the antibiotic penicillin.

The graph shows changes that occurred in a fermenter during the production of penicillin.



(a) During which time period was penicillin produced most quickly?

Draw a ring around **one** answer.

0 – 20 hours

40 – 60 hours

80 – 100 hours

(1)

(b) (i) Describe how the concentration of glucose in the fermenter changes between 0 and 30 hours.

(2)

(ii) How does the change in the concentration of oxygen in the fermenter compare with the change in concentration of glucose between 0 and 30 hours?

Tick (✓) **two** boxes.

The oxygen concentration changes after the glucose concentration.

The oxygen concentration changes before the glucose concentration.

The oxygen concentration changes less than the glucose concentration.

The oxygen concentration changes more than the glucose concentration.

(2)

(iii) What is the name of the process that uses glucose?

Draw a ring around **one** answer.

distillation

filtration

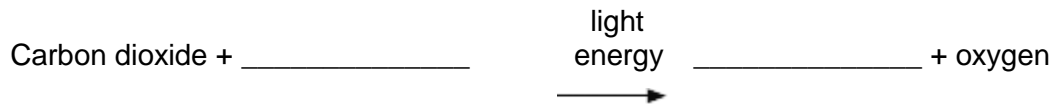
respiration

(1)

(Total 6 marks)

Q33.

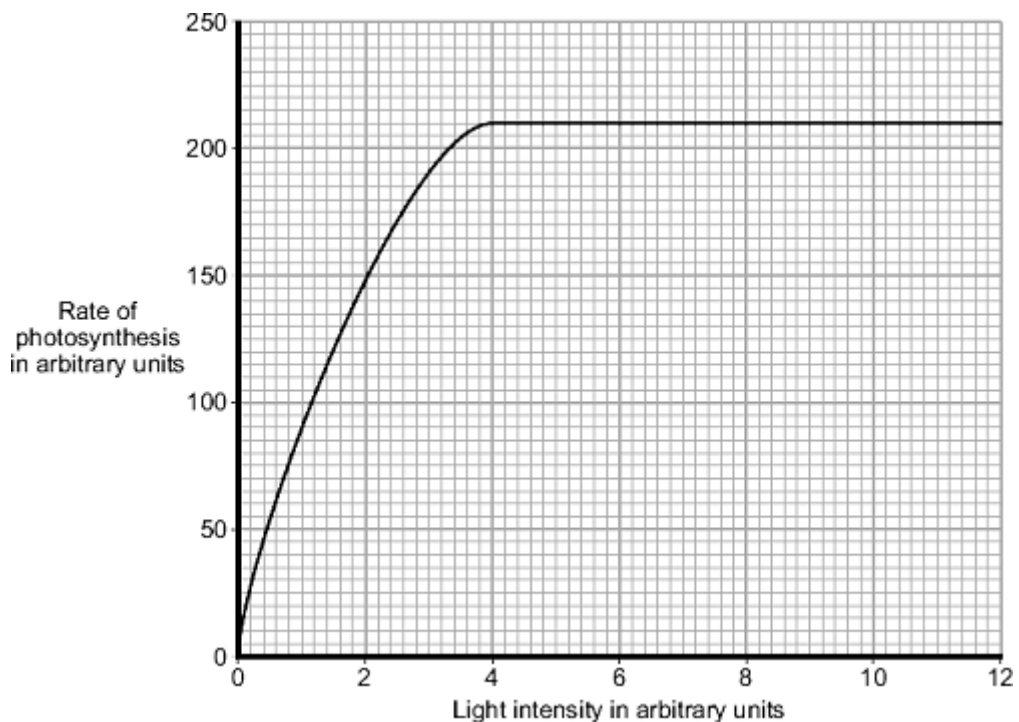
(a) Complete the equation for photosynthesis.



(2)

(b) A farmer grew tomato plants in a greenhouse.

The graph shows the effect of light intensity on the rate of photosynthesis in the tomato plants growing in the greenhouse.



(i) At which light intensity was light a limiting factor for photosynthesis?

Tick (✓) **one** box.

1 arbitrary unit

4 arbitrary units

10 arbitrary units

(1)

(ii) What was the highest rate of photosynthesis?

_____ arbitrary units

(1)

(iii) The farmer wants to increase the rate of photosynthesis in his tomato plants.

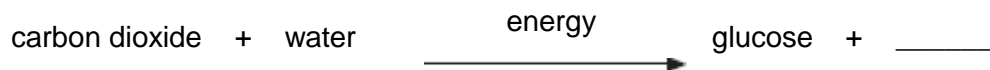
Apart from light intensity, name **one** factor that the farmer could change to increase the rate of photosynthesis in his tomato plants.

(1)

(Total 5 marks)

Q34.

(a) Complete the word equation for photosynthesis.



(1)

(b) Draw a ring around the correct answer to complete each sentence.

(i) The energy needed for photosynthesis comes from

light.
osmosis.
respiration.

(1)

(ii) Energy is absorbed by a green pigment called

chloride.
chloroplast.
chlorophyll.

(1)

(iii) If the temperature is decreased the rate of photosynthesis will

decrease.
increase.
stay the same.

(1)

(c) Give **three** ways in which plants use the glucose made in photosynthesis.

1. _____

2. _____

3. _____

(3)

(Total 7 marks)

Q35.

(a) Complete the word equation for photosynthesis.

Use words from the box.

chlorophyll	minerals	oxygen	water
--------------------	-----------------	---------------	--------------

carbon dioxide + _____ → glucose + _____

(2)

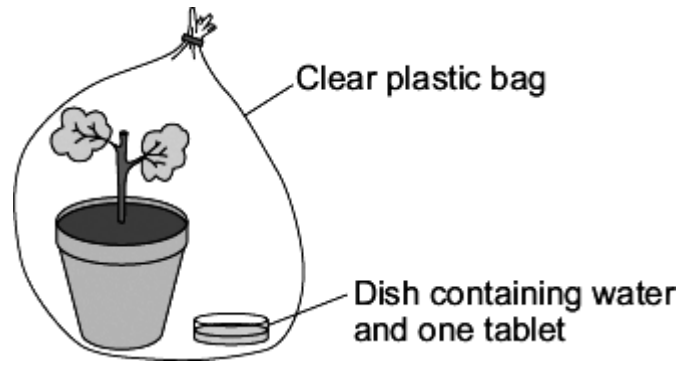
(b) Plants may grow faster if they have more carbon dioxide.

Indigestion tablets dissolve in water to form a solution.
This solution slowly gives off carbon dioxide.

A student set up an investigation to see what concentration of carbon dioxide is best for increasing the growth of geranium plants.

The student:

- put a geranium plant in a clear plastic bag
- put a dish containing water and one tablet in the bag
- sealed the top of the bag.



The student:

- set up 5 more experiments each with water and a different number of tablets
- left all the plants in a well-lit place for four weeks.

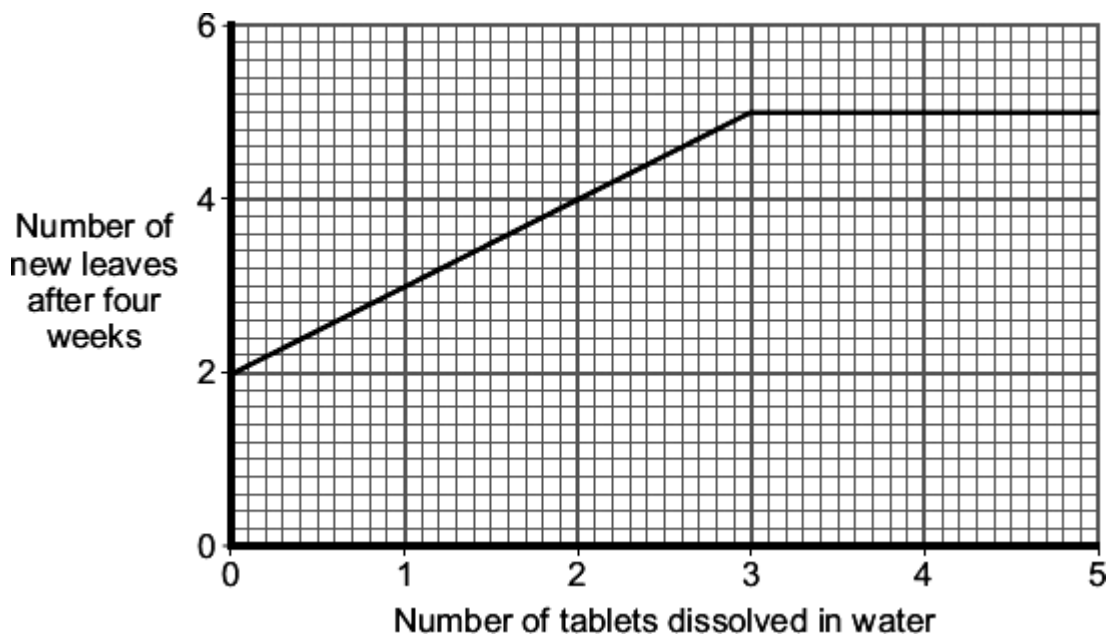
The student used a clear plastic bag, not a black plastic bag.

Explain why.

(2)

- (c) After four weeks, the student counted the number of new leaves on each plant.

The graph shows his results.

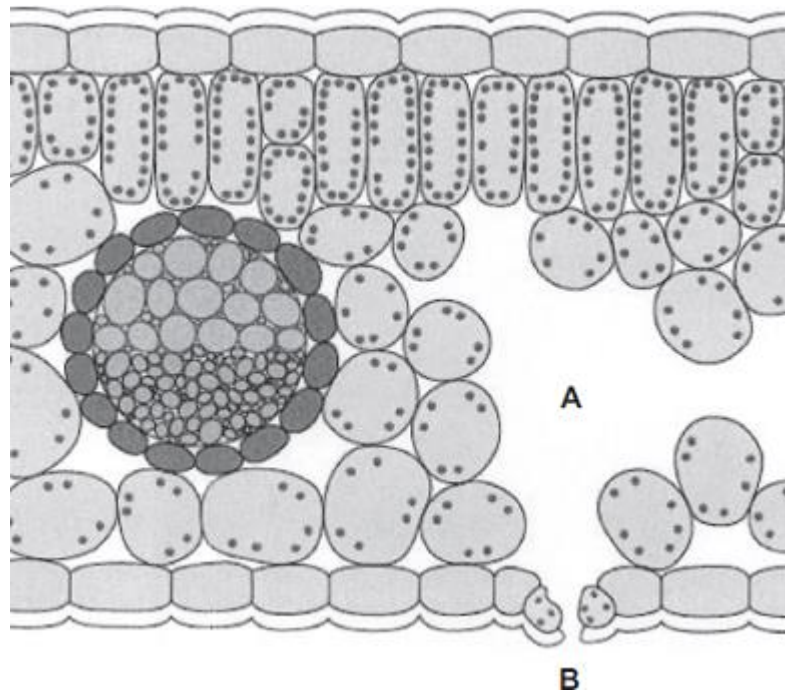


Describe the effect of increasing the number of tablets dissolved in water on the number of new leaves that grew in four weeks.

(3)
(Total 7 marks)

Q36.

The diagram shows a section through a plant leaf.



- (a) Use words from the box to name **two** tissues in the leaf that transport substances around the plant.

epidermis	mesophyll	phloem	xylem
-----------	-----------	--------	-------

_____ and _____

(1)

- (b) Gases *diffuse* between the leaf and the surrounding air.

- (i) What is *diffusion*?

(2)

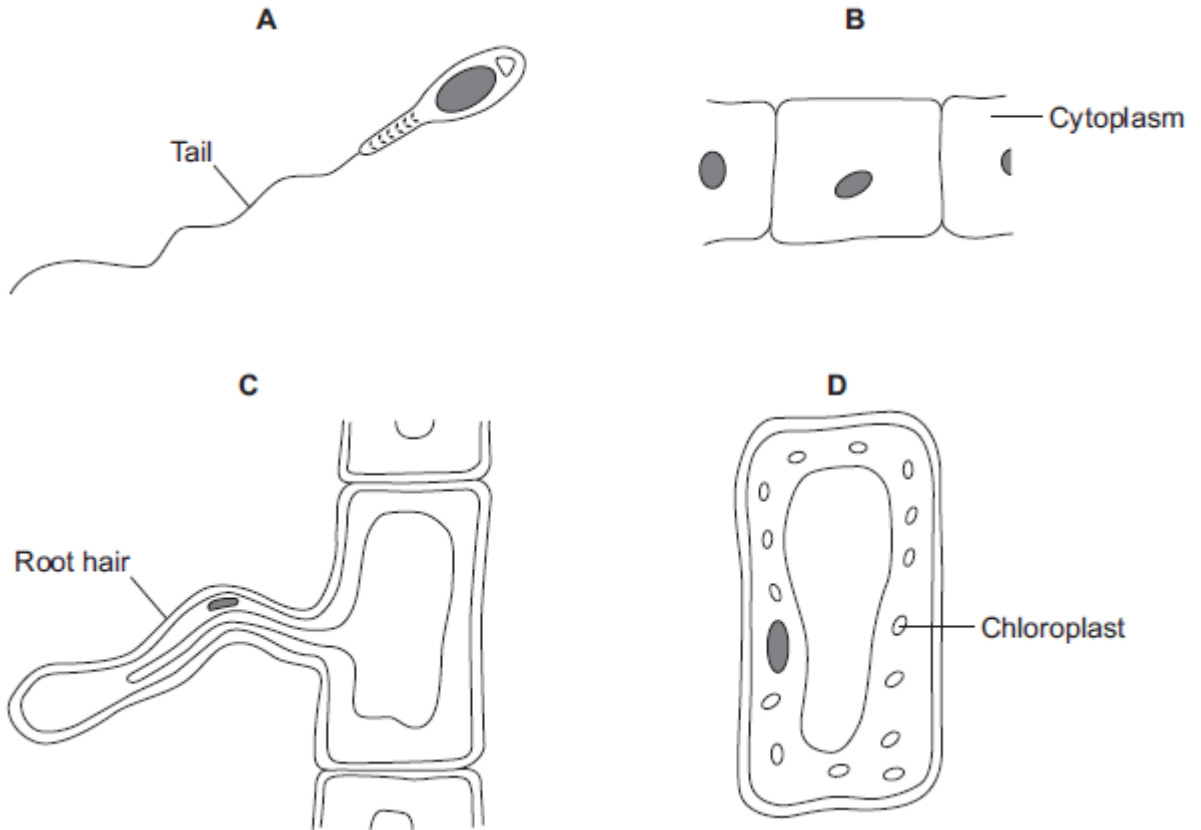
- (ii) Name **one** gas that will diffuse from point **A** to point **B** on the diagram on a sunny day.

(1)

(Total 4 marks)

Q37.

The diagrams show four types of cell, **A**, **B**, **C** and **D**.
Two of the cells are plant cells and two are animal cells.



- (a) (i) Which **two** of the cells are plant cells?

Tick (✓) **one** box.

A and B	<input type="checkbox"/>
A and D	<input type="checkbox"/>
C and D	<input type="checkbox"/>

(1)

- (ii) Give **one** reason for your answer.

(1)

(b) (i) Which cell, **A**, **B**, **C** or **D**, is adapted for swimming?

(1)

(ii) Which cell, **A**, **B**, **C** or **D**, can produce glucose by photosynthesis?

(1)

(c) Cells **A**, **B**, **C** and **D** all use oxygen.

For what process do cells use oxygen?

Draw a ring around **one** answer.

osmosis

photosynthesis

respiration

(1)

(Total 5 marks)

Q38.

Scientists investigated how exercise affects blood flow to different organs in the body.

The scientists made measurements of blood flow to different organs of:

- a person resting in a room at 20°C
- the same person, in the same room, doing vigorous exercise at constant speed on an exercise cycle.

The table shows the scientists' results.

Organ	Blood flow in cm ³ per minute whilst ...	
	resting	doing vigorous exercise
Brain	750	750
Heart	250	1000
Muscles	1200	22 000
Skin	500	600
Other	3100	650

(a) In this investigation, it was better to do the exercise indoors on an exercise cycle than to go cycling outdoors on the road.

Suggest **two** reasons why.

Do **not** include safety reasons.

1. _____

2. _____

(2)

(b) Blood flow to **one** organ did **not** change between resting and vigorous exercise.

Which organ? _____

(1)

(c) (i) How much more blood flowed to the muscles during vigorous exercise than when resting?

Answer = _____ cm³ per minute

(2)

(ii) Name **two** substances needed in larger amounts by the muscles during vigorous exercise than when resting.

1. _____

2. _____

(2)

(iii) Tick (✓) **one** box to complete the sentence.

The substances you named in part (c)(ii) helped the muscles to

make more lactic acid.

respire aerobically.

make more glycogen.

(1)

(iv) The higher rate of blood flow to the muscles during exercise removed larger amounts of waste products made by the muscles.

Which **two** substances need to be removed from the muscles in larger amounts during vigorous exercise?

Tick (✓) **two** boxes.

- | | |
|----------------|--------------------------|
| Amino acids | <input type="checkbox"/> |
| Carbon dioxide | <input type="checkbox"/> |
| Glycogen | <input type="checkbox"/> |
| Lactic acid | <input type="checkbox"/> |

(2)

- (d) The total blood flow was much higher during exercise than when resting.

One way to increase the total blood flow is for the heart to pump out a larger volume of blood each beat.

Give **one** other way to increase the blood flow.

(1)

(Total 11 marks)

Q39.

- (a) A student carried out the following investigation using a plant with variegated leaves. A variegated leaf has green and white stripes.

The student:

- left the plant in the dark for 3 days to remove the starch
- fixed two pieces of card to a leaf on the plant
- left the plant in the light for 2 days
- removed the leaf from the plant
- tested the leaf for starch.

Figure 1 shows how the two pieces of card were attached to the leaf.

Figure 1

Leaf without card

Leaf with card

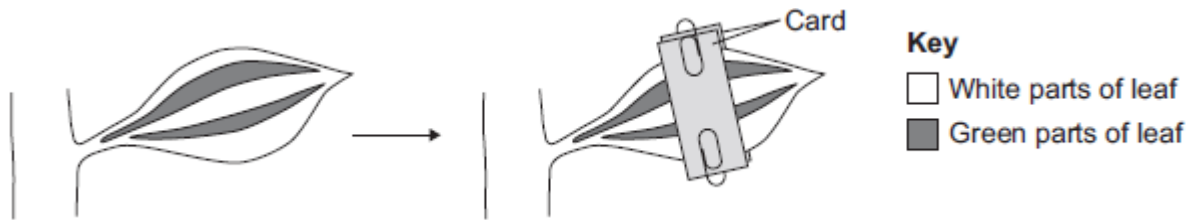
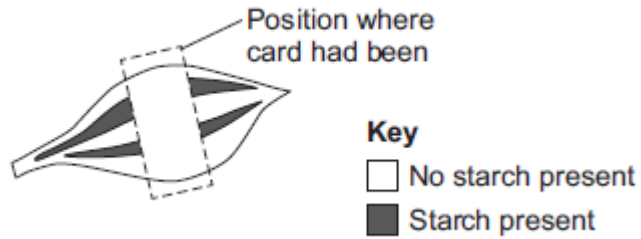


Figure 2 shows the same leaf after 2 days in the light. The leaf has been tested for starch.

Figure 2



Give **two** conclusions from this investigation.

Tick (✓) **two** boxes.

Carbon dioxide is needed for photosynthesis.

Chlorophyll is needed for photosynthesis.

Light is needed for photosynthesis.

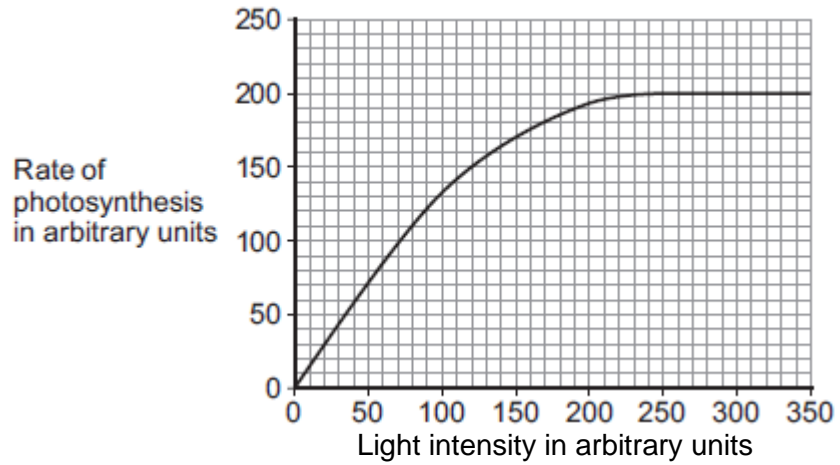
Water is needed for photosynthesis.

(2)

(b) Scientists investigated the effect of light intensity on the rate of photosynthesis.

Figure 3 shows the scientists' results.

Figure 3



Describe the effect of increasing light intensity on the rate of photosynthesis. You should include numbers from **Figure 3** in your description.

(3)

(c) At a light intensity of 250 arbitrary units, light is **not** a limiting factor of photosynthesis.

(i) What is the evidence for this in **Figure 3**?

(1)

(ii) Give **two** factors that could be limiting the rate of photosynthesis at a light intensity of 250 arbitrary units.

1. _____
2. _____

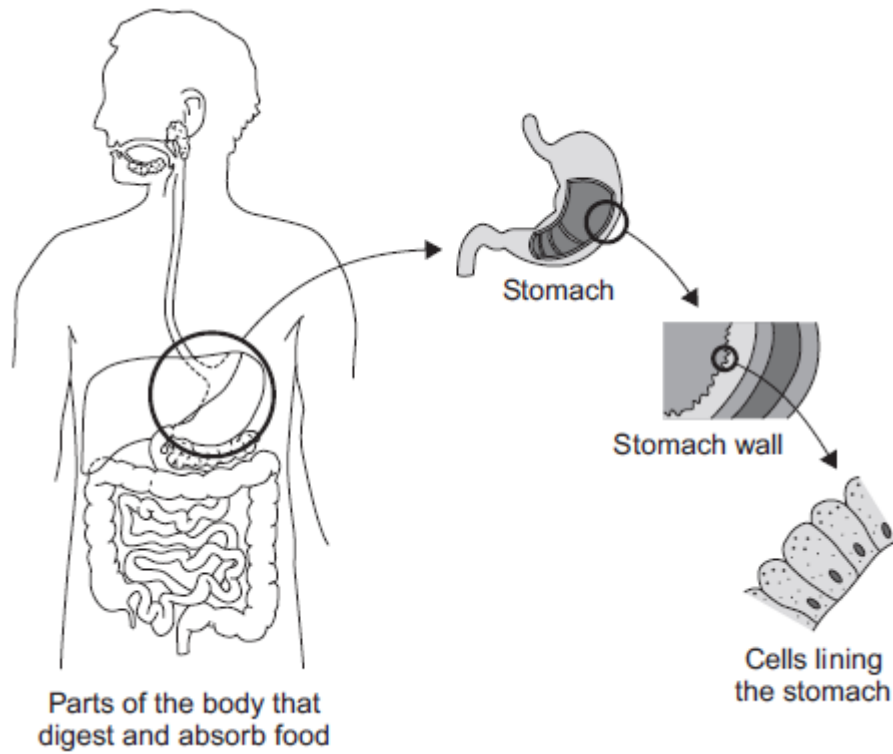
(2)

(Total 8 marks)

Q40.

The diagram below shows the parts of the body that digest and absorb food.

It also shows some details about the structure of the stomach.



- (a) Complete the table to show whether each structure is an organ, an organ system or a tissue.

For each structure, tick (✓) **one** box.

Structure	Organ	Organ system	Tissue
Stomach			
Cells lining the stomach			
Mouth, oesophagus, stomach, liver, pancreas, small and large intestine			

(2)

- (b) (i) The blood going to the stomach has a high concentration of oxygen. The cells lining the stomach have a low concentration of oxygen.

Complete the following sentence.

Oxygen moves from the blood to the cells lining the stomach by the process of _____.

(1)

- (ii) What other substance must move from the blood to the cells lining the stomach so that respiration can take place?

Draw a ring around the correct answer.

glucose

protein

starch

(1)

(iii) In which part of a cell does aerobic respiration take place?

Draw a ring around the correct answer.

cell membrane mitochondria nucleus

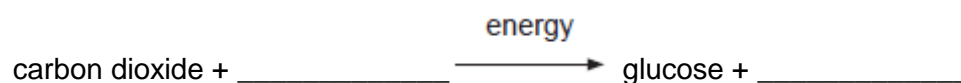
(1)

(Total 5 marks)

Q41.

Photosynthesis uses carbon dioxide to make glucose.

(a) (i) Complete the equation for photosynthesis.



(2)

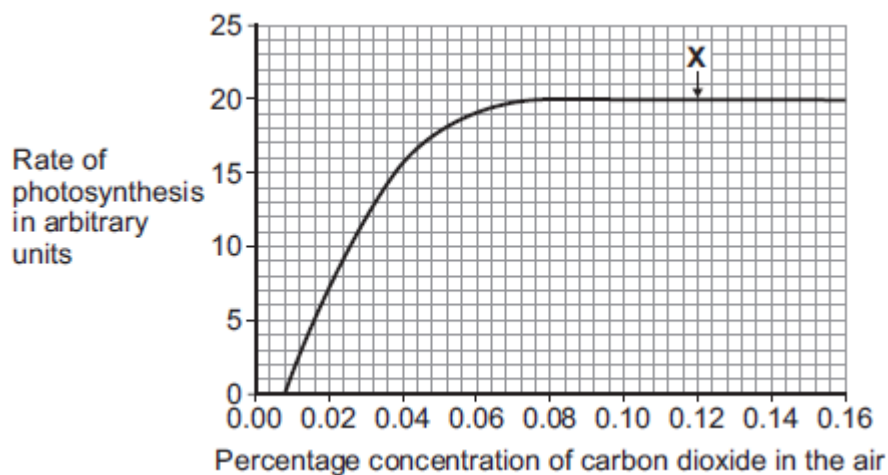
(ii) What type of energy does a plant use in photosynthesis?

(1)

(iii) Which part of a plant cell absorbs the energy needed for photosynthesis?

(1)

(b) The graph shows the effect of the concentration of carbon dioxide on the rate of photosynthesis in tomato plants at 20 °C.



(i) What is the maximum rate of photosynthesis of the tomato plants shown in the graph?

_____ arbitrary units

(1)

(ii) At point X, carbon dioxide is **not** a limiting factor of photosynthesis.

Suggest **one** factor that is limiting the rate of photosynthesis at point X.

(1)

(c) A farmer plans to grow tomatoes in a large greenhouse.

The concentration of carbon dioxide in the atmosphere is 0.04%.
The farmer adds carbon dioxide to the greenhouse so that its concentration is 0.08%.

(i) Why does the farmer use 0.08% carbon dioxide?

Tick (✓) **one** box.

To increase the rate of growth of the tomato plants

To increase the rate of respiration of the tomato plants

To increase water uptake by the tomato plants

(1)

(ii) Why does the farmer **not** use a concentration of carbon dioxide higher than 0.08%?

Tick (✓) **two** boxes.

Because it would cost more money than using 0.08%

Because it would decrease the temperature of the greenhouse

Because it would not increase the rate of photosynthesis of the tomato plants any further

Because it would increase water loss from the tomato plants

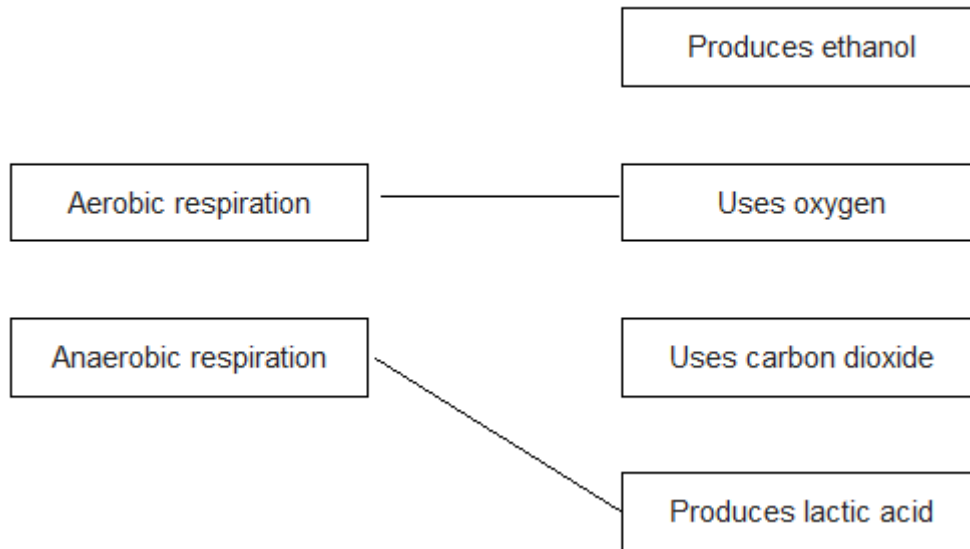
(2)

(Total 9 marks)

Mark schemes

Q1.

(a)



an extra line from a LH box negates that mark

2

(b) any **one** from:

- not enough oxygen present (for aerobic respiration)
- more energy required for exercise (than can be transferred by aerobic respiration)

1

allow named example for exercise

(c) produces carbon dioxide

1

produces ethanol

1

plus any **two** from:

- (carbon dioxide) makes bread rise
- (carbon dioxide) makes beer / cider / (some) wines fizzy
allow for alcoholic drinks / named drink
- (ethanol) is the alcohol in beer / cider / wine / spirits

2

[7]

Q2.

(a) (i) glycogen

1

(ii) respiration

1

(b) (i) 483 kJ

1

- (ii) oxygen 1
- (iii) dilate 1
- (c) supplies more / a lot of oxygen **or** removes more carbon dioxide
or release more energy / faster respiration 1

[6]

Q3.

- (a) carbon
water
oxygen

light

chlorophyll

starch

1 mark each 6
- (b) leaf (**or** named part of leaf)
or
chloroplasts

accept anywhere green
do not credit chlorophyll unless qualified 1
- (c) water through the roots
or
root hairs
or
by osmosis

do not credit where the candidate is unclear about which is which 1
- CO₂ through the leaf
or
stomata
or
by diffusion 1
- (d) any **one** point:

increased CO₂ concentration
increased water supply
increased temperature (up to a point)
increased light (intensity)

*accept altered light quality by less green **or** increasing other colours*
accept increased duration of exposure to light
*do not credit sun **or** sunshine*
accept CO₂ from respiration

1

[10]

Q4.

(a) (i) trachea
accept windpipe 1

(ii) (left) lung **or** lungs
do not credit right lung 1

(b) carbon dioxide **or** water vapour
do not credit just 'water' 1

oxygen
answers in terms of used air or fresh air or of temperature differences are not acceptable 1

[4]

Q5.

(a) (temperature) thermometer or temperature probe / sensor 1

(oxygen concentration) oxygen probe / sensor / meter 1

(b) (i) 13 (arbitrary units)
allow values in the range 12.5 – 13.5 1

(ii) the greater the concentration of oxygen the faster the rate of decay 1

(c) line drawn below line on graph following similar pattern
line starts at 0% oxygen concentration and from 0 – 3 arbitrary units 1

(d) microorganisms / bacteria / fungi
accept any correct organism
allow decomposers / detritivores or named example e.g. worms 1

plants
allow crops or named plants 1

respiration 1

[8]

Q6.

(a) idea that

- light doesn't reach deeper parts
 - plants need / absorb light
 - to make food
- gain 1 mark each to maximum of 2*

but

so they can photosynthesise
gains 2 marks

2

(b) herring will be on the bottom
herring follow / will be feeding
on the copepods

independent marking points

for 1 mark each

2

[4]

Q7.

A – respiration

ignore breathing

1

B – feeding / eating

allow consumption / ingestion / feeds
ignore nutrition / food
*do **not** accept digestion*

1

C – photosynthesis

1

D– combustion / burning

1

[4]

Q8.

(a) (i) photosynthesis

allow phonetic spellings

1

(ii) respiration

allow phonetic spellings
ignore breathing / decay

1

(b) any **two** from:

- burn / use less fossil fuels
or
reduce industrial processes
or

use cars less
allow cycle / use buses / walk / trains / public transport
allow stop for reduce in all cases

- reduce deforestation
accept named example
or
plant more trees
allow plants
- use alternative sources of energy
accept solar / wind / nuclear / hydroelectric / wave / tidal / geothermal
ignore renewable / biomass
- trap CO₂ in sedimentary rocks / underground / under sea
or
carbon capture / CCS
- rear less cattle / animals
allow eat less meat
allow reduce growth of human population
ignore reduce the human population

2

[4]

Q9.

(a) more water vapour
accept more water

1

more carbon dioxide

1

less oxygen

1

(b) (i) glucose
accept carbohydrate(s)
accept sugar(s)

1

(ii) heat
or *thermal*
or *internal kinetic*

1

(iii) lungs
accept alveoli / alveolus
do not credit air sacs
do not credit capillaries
both neutral if included with lungs

1

(c) oxygen

accept O₂

1

lactic

1

[8]

Q10.

- (a) carbon dioxide in range 2.5-5%
gains 1 mark

but

carbon dioxide closer to 4% than to 3% or 5%
gains 2 marks

OR

oxygen in range 15-17.5%
gains 1 mark

but

If 3 sectors drawn and two correctly labelled,
award marks and ignore remaining sector
Oxygen and carbon dioxide sectors labelled
for 1 mark

3

- (b) carbon dioxide
oxygen
for 1 mark each

Do not allow water vapour.
(Allow correct symbols/formulae)

2

[5]

Q11.

- (a) oxygen passes from the air/lungs into the body
gains 1 mark

but

oxygen passes from the air/lungs into the blood
gains 2 marks

carbon dioxide passes from the body into the air/lungs
gains 1 mark

but

carbon dioxide passes from the blood into the air/lungs
gains 2 marks

4

- (b) increased/5% more
gains 1 mark

but
6 times more (in air breathed out)
gains 2 marks

2

[6]

Q12.

- (a) trachea / windpipe
bronchus
alveoli
diaphragm

for 1 mark each

4

- (b) alveoli / air sacs (*reject capillaries*)
for one mark

1

- (c) respiration

for one mark

1

[6]

Q13.

- (a) (i) oxygen

do not credit air

1

- (ii) lung(s)

do not credit blood or nose or windpipe alone but accept as a neutral answer if included with lungs

1

- (b) oxygen

1

lactic acid

both words required

1

[4]

Q14.

- (a) A

1

- (b) (i) diffusion

1

- (ii) respiration

1

- (iii) mitochondria

1

(iv) photosynthesis

1

[5]

Q15.

- (a) (i) carbon dioxide / CO₂ (*reject CO*)
(ii) oxygen / O₂ / O (*reject water vapour*)
for 1 mark each

2

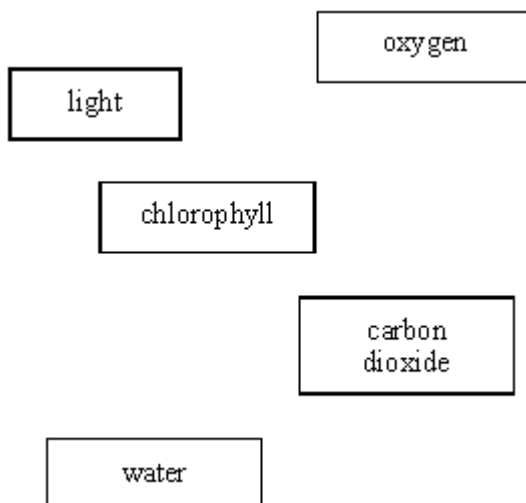
- (b) (provides) energy
for 1 mark

1

[3]

Q16.

(a)



5

- (b) (i) sugar **or** carbohydrate
(ii) it can be stored **or** it is insoluble
accept it has no osmotic effect

1

1

- (iii) any **one** from:
respires it **or** releases **or** transfers
energy
turns it **or** stores it as fructose **or**
sucrose **or** lipid **or** protein **or**
cellulose

1

- (c) (i) photosynthesis

1

- (ii) any **one** from:
flat surface
stomata
thin

chloroplasts
veins
large surface area
air spaces
do not accept chlorophyll

1

[10]

Q17.

X – oxygen

accept O₂

Y – carbon dioxide

accept CO₂

[2]

Q18.

(a) carbon dioxide/CO₂

1

(b) through the roots/root hairs

do not accept leaves

1

(c) oxygen

1

sugar/glucose/other named sugar/starch/carbohydrate

1

(d) award one mark for each mark point

n.b. accept chloroplast for chlorophyll

*n.b. credit the candidate who answers **in** terms of the white areas of the leaf*

chlorophyll is green

e.g. green areas have chlorophyll

1

chlorophyll/green is needed for photosynthesis

e.g. it is only in green areas that photosynthesis can take place

after this point do not penalise a candidate if they do not refer to photosynthesis

1

light is needed

*e.g. it does not happen in the dark
do not accept sunshine/sun*

1

photosynthesis produces/makes starch

e.g. starch is made

so

e.g. 'you need light to make starch' scores 3rd and 4th marking points

'you need chlorophyll and light for photosynthesis' scores on the 2nd and 3rd marking points

'photosynthesis makes starch and you need green leaves and light for it to work' scores

on the 2nd, 3rd and 4th marking points

1

[8]

Q19.

(a) photosynthesis

1

(b) oxygen

1

(c) chlorophyll

1

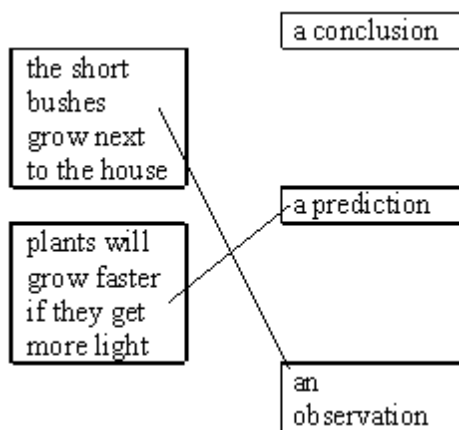
(d) starch

1

[4]

Q20.

(a) (i)



both correct = 2 marks

one correct = 1 mark

extra line from a statement cancels the mark

2

(ii) 1st space: carbon dioxide
allow CO₂ (ignore superscript)
do **not** allow CO alone

1

2nd space: glucose / sugar / starch / carbohydrate

1

(b) (i) any **one** from:

- move lamp or change distance between lamp and plant
ignore measure the distance

- change wattage / power of (light) bulb
do not accept just "change bulb"
- change voltage / power supply to the (light) bulb
- change the number of lamps
- put translucent material between lamp and plant
accept examples, eg tracing paper / filters
do not accept coloured filters

1

(ii) rises

1

levels off

ignore numbers

1

(iii) idea that it levels off

or

does not increase at all light intensities

or

it only increases to a certain amount

answers should relate to photosynthesis and not to bubbling

1

[8]

Q21.

(a) respire

1

oxygen / glucose

glucose / oxygen

} each once only

2

blood

1

carbon dioxide / heat

heat / carbon dioxide

} each once only

2

[6]

Q22.

in correct sequence:

breathing

1

diffusion	1
respiration	1

[3]

Q23.

- | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| (a) 66 (beats per minute) | 1 |
| (b) heart rate increased | 1 |
| (c) 4 | 1 |
| (d) any two from: | |
| <ul style="list-style-type: none"> resting heart rate was lower heart rate did not increase as much heart rate did not increase as fast heart rate returned to normal sooner | 2 |

- (e) **Level 2 (3–4 marks):**
A detailed and coherent explanation is given, which logically links changes in the body during exercise to reasons for these changes.

Level 1 (1–2 marks):
Discrete relevant points made. Links may not be made.

0 marks:
No relevant content

Indicative content

Changes:

- breathing rate increases
- deeper breathing
- (body) temperature increases
- sweating occurs
- muscle fatigue
- vasodilation

Explanations linked to correct change:

- to provide more oxygen
- to remove carbon dioxide faster
- (as) more energy required
- (so) increased respiration
- (so) more energy transferred
- for movement or contraction of muscles
- some energy warms the body
- (sweating) cools the body down
- (by) evaporation of sweat

4

[9]

Q24.

- (a) (i) C and D 1
- (ii) cell wall 1
- (b) (i) A 1
- (ii) D 1
- (c) respiration 1
- [5]**

Q25.

- (a) (i) A **or** C
allow lower case 1
- (ii) B **or** D
allow lower case 1
- (b) (i) 60 1
- (ii) 4 1
- (c) red blood cells 1
- [5]**

Q26.

- (a) any **one** from:
- (type of / amount of) soil / minerals / nutrients / pH
 - amount of water / time of watering
 - space between plants / plants and wall
 - time for growth
list principle
ignore carbon dioxide / same number of plants / food
*do **not** allow temperature / light / exposure to wind* 1
- (b) (i) North wall 1
- (ii) nugget
list principle 1
- (c) has not tested all varieties / nugget / champion against all walls

do **not** allow repeat experiment

1

[4]

Q27.

(a) (i) 150

1

(ii) any **two** from:

accept correct use of numbers

accept pulse rate

- lower resting rate
- lower rate during exercise
- recovers faster after exercise

allow a general statement about lower rate if neither of the first two points given

2

(b) glucose

1

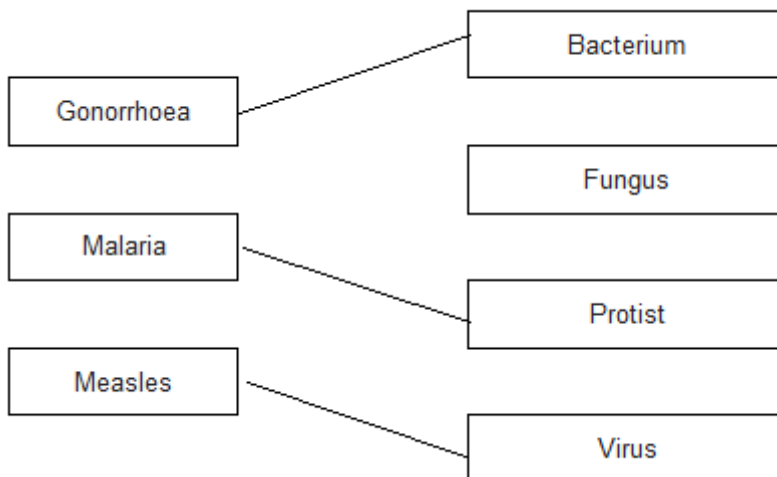
oxygen

1

[5]

Q28.

(a)



3

(b) (trachea) has mucus

1

to trap pathogens

1

(trachea) has cilia

1

to move mucus out of trachea

1

- (c) **dependent variable:**
 number of times mosquitoes landed on socks 1
- control variable:**
 any **one** from:
- number of mosquitoes in each container
 - length of time socks worn
 - dampness of socks
 - same type of socks
 - size of container
 - time
 - temperature
 - species of mosquito
 - age of mosquito
- 1

- (d) use worn socks
or
 use chemical from worn socks 1
- to attract / trap infected mosquitoes 1
- or accept:*
wear clean socks / change socks regularly (1)
to reduce the chance of attracting mosquitoes (1)

- (e) less chlorophyll present 1
- (so) less light absorbed 1
- (so) reduced photosynthesis
or
 (so) less sugar / food made 1

[14]

Q29.

- (a) (i) 70
*award 2 marks for correct answer irrespective of working
 allow 1 mark for 30 + 10 + 24 + 6 (with wrong answer or no
 answer), do **not** award this sum if other figure(s) are
 included in the addition* 2
- (ii) 6
*award 2 marks for correct answer irrespective of working
 award 2 marks for correct answer to (a)(i) – 64 (ecf)
 award 1 mark either for 70 – 64 or answer to (a)(i) – 64 with
 no answer or incorrect answer* 2
- (b) photosynthesis. 1

Q30.

- (a) add mineral ions to the soil
extra box ticked cancels the mark

- (b) increasing the temperature
each extra box ticked cancels 1 mark

- turning lights on at night

1

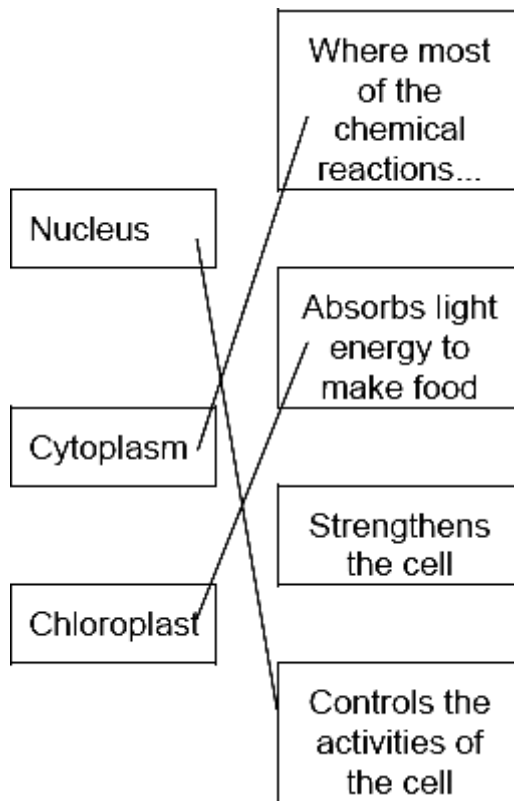
1

1

[3]

Q31.

(a)



*1 mark for each correct line
mark each line from left hand box
two lines from left hand box cancels mark for that box*

3

- (b) energy

1

[4]

Q32.

- (a) 40 – 60 hours

- (b) (i) decrease

1

1

1st slowly then faster / appropriate detail from the graph – e.g. from 7.8 to 0 / faster after 4 – 10h

1

- (ii) oxygen after glucose
extra box ticked cancels 1 mark

1

oxygen less than glucose

1

- (iii) respiration

1

[6]

Q33.

- (a) (LHS) water / H₂O
allow H₂O
*do **not** accept H⁺O*

1

(RHS) glucose / sugar / C₆H₁₂O₆
allow starch / carbohydrate
allow C₆H₁₂O₆
*do **not** accept C⁶H¹²O⁶*

1

- (b) (i) 1 arbitrary unit
extra box ticked – cancel

1

- (ii) 210

1

- (iii) carbon dioxide / CO₂ / CO₂
or
temperature / heat / warmth
*do **not** accept CO²*
ignore mineral ions
ignore water

1

[5]

Q34.

- (a) oxygen
allow O₂ / O₂
*do **not** accept O² or O*

1

- (b) (i) light

1

- (ii) chlorophyll

1

- (iii) decrease

1

(c) any **three** from:

- for respiration / energy
*do **not** accept use energy for photosynthesis*
- to make cellulose / starch
accept named carbohydrate other than glucose
- to make lipid / fat / oil
accept fatty acid / glycerol
- to make protein
accept named protein / amino acid / named amino acid
- to build big molecules from small molecules / metabolism
if no other marks awarded for making molecules allow 1 mark for growth / repair / new cells

3

[7]

Q35.

(a) water

1

oxygen

in this order only
accept correct chemical symbols
allow H₂O / OH₂

1

(b) allow light (in / through) / need light

*do **not** accept attracts light*
ignore heat / moisture / carbon dioxide
ignore so the plants can be seen
accept the converse, ie the black plastic bag would not let light in (1)

1

for photosynthesis / make sugar / glucose

so there would be no photosynthesis (1)
*do **not** allow make food unqualified*

1

(c) Increase (in leaves / new leaves)

ignore growth unqualified

1

(then) level off **or** number of (new) leaves (then) stays the same

1

numerical statement eg max at 3 tablets / 5 (new) leaves

should refer to one of the first two marking points
for every extra tablet get 1 extra leaf = 2 marks
for every extra tablet get 1 extra leaf then it levels off = 3 marks

1

[7]

Q36.

- (a) xylem **and** phloem
either order
allow words ringed in box
allow mis-spelling if unambiguous 1
- (b) (i) movement / spreading out of particles / molecules / ions / atoms
ignore names of substances / 'gases' 1
- from high to low concentration
accept down concentration gradient
ignore 'along' / 'across' gradient
ignore 'with' gradient 1
- (ii) oxygen / water (vapour)
allow O₂ / O₂
ignore O² / O
allow H₂O / H₂O
ignore H²O 1

[4]

Q37.

- (a) (i) **C and D**
no mark if more than one box is ticked 1
- (ii) any **one** from:
do not allow if other cell parts are given in a list
- (have) cell wall(s)
 - (have) vacuole(s)
- (b) (i) **A**
apply list principle 1
- (ii) **D**
apply list principle 1
- (c) respiration
apply list principle 1

[5]

Q38.

- (a) any **two** from:
or allow converse for outdoors

- constant speed
 - *variable speed*
- constant effort
 - *variable terrain*
- constant temperature
 - *traffic conditions*
 - *variable temperature*
 - *wind (resistance)*
 - *rain / snow*

allow weather

allow pollution only if qualified by effect on body function but ignore pollution unqualified
if no other marks obtained allow variable conditions outdoors

2

(b) Brain

1

(c) (i) 20 800

correct answer with or without working gains 2 marks
if answer incorrect, allow 1 mark for use of 1200 and 22 000 only

2

(ii) oxygen

apply list principle

1

*do **not** accept other named substances eg CO₂ water*

glucose / sugar

allow glycogen

ignore food / carbohydrate

1

(iii) respire aerobically

1

(iv) carbon dioxide

1

lactic acid

1

(d) increased heart rate

ignore adrenaline / drugs

accept heart beats more but not heart pumps more

1

[11]

Q39.

(a) chlorophyll is needed for photosynthesis

1

light is needed for photosynthesis

1

(b) increases

1

levels off / reaches a maximum / remains constant / stays the same / plateaus
do not allow stops / stationary / peaks
allow stops increasing

1

goes up to / reaches a maximum / levels off at (a rate of) 200 (arbitrary units)
or
levels off at 225 – 240 (light units)
ignore references to other numerical values

1

(c) (i) higher light intensity does not increase rate of photosynthesis

accept the graph stays level (above this value)

allow stops increasing

allow the rate of photosynthesis stays the same (above this value)

1

(ii) any **two** from:

- carbon dioxide (concentration)
 - temperature / heat
 - (amount of) chlorophyll / chloroplasts
- allow water*
allow ions / nutrients
ignore ref to surface area of the leaf

2

[8]

Q40.

(a)

Structure	Organ	Organ system	Tissue
Stomach	✓		
Cells lining the stomach			✓
Mouth, oesophagus, stomach, liver, pancreas, small and large intestine		✓	

all 3 correct = 2 marks
2 correct = 1 mark
1 or 0 correct = 0 marks

2

(b) (i) diffusion

allow phonetic spelling

- (ii) glucose 1
- (iii) mitochondria 1

[5]

Q41.

- (a) (i) LHS = water
accept H₂O
do not accept H²O / H2O 1
- RHS = oxygen
accept O₂
do not accept O / O² / O2 1
- (ii) light / sunlight
ignore solar / sun / sunshine
do not allow thermal / heat 1
- (iii) chloroplasts
allow chlorophyll 1
- (b) (i) 20 1
- (ii) any **one** from:
• light (intensity)
• temperature. 1
- (c) (i) To increase the rate of growth of the tomato plants 1
- (ii) Because it would cost more money than using 0.08% 1
- Because it would not increase the rate of photosynthesis of the tomato plants any further 1

[9]