**Q1.**          (a)     Draw a ring around **one** word to answer each of the following questions.

(i)      Which type of blood vessel carries blood out of the heart?

**artery**                   **capillary**                      **vein**

**(1)**

(ii)     Which type of blood vessel allows substances to enter and leave the blood?

**artery**                   **capillary**                      **vein**

**(1)**

(b)     Use words from the box to complete the sentences.

|  |
| --- |
| **alveoli**             **cell membrane**         **nucleus**  **plasma**            **red blood cells**            **villi** |

          Oxygen enters the blood through the walls of the .................................................... .

          Most of the oxygen transported by the blood is carried in the

................................................................................................................................... .

          A red blood cell is different from other body cells because it does not have a

.................................................................. .

**(3)**

**(Total 5 marks)**

**Q2.**(a)     (i)      Blood is part of the circulatory system.

Draw **one** line from each part of the blood to its correct function.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Part of the blood** |  | **Function** |
|  |  |  | carry glucose around  the body |
|  | White blood cells |  |  |
|  |  |  | carry oxygen around  the body |
|  | Red blood cells |  |  |
|  |  |  | help the blood to clot |
|  | Platelets |  |  |
|  |  |  | destroy  microorganisms |

**(3)**

(ii)     Name **one** waste product that is transported by the blood plasma.

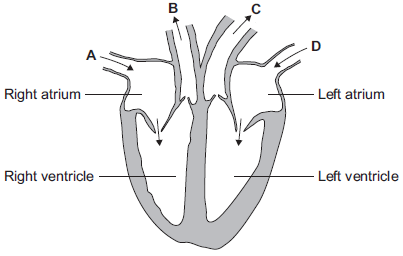
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**(1)**

(b)     The heart is also part of the circulatory system.

**Figure 1** shows a section through the human heart.

**Figure 1**

****

(i)      Which arrow, **A**, **B**, **C** or **D**, shows blood leaving the heart in the pulmonary artery to go to the lungs?  

**(1)**

(ii)     Which arrow, **A**, **B**, **C** or **D**, shows blood from the lungs entering the heart in the pulmonary vein?  

**(1)**

(iii)     Valves in the circulatory system make sure blood only travels in one direction.

Name the type of blood vessel that has valves.

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**(1)**

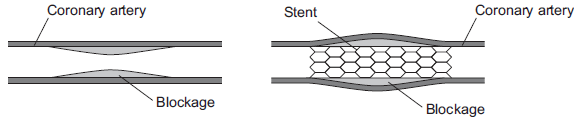
(c)     A person’s coronary artery has become narrower.

The person has a heart attack.

A doctor puts a stent into the person’s coronary artery.

**Figure 2** shows a stent inside a coronary artery.

**Figure 2**

****

(i)      How does the stent help to prevent another heart attack?

Give **one** way.

...............................................................................................................

...............................................................................................................

**(1)**

(ii)     **Figure 3** shows a surgeon putting a stent into a patient.

**Figure 3**

****

                                                                             © Science Photo Library

The surgeon puts the stent into an artery in the leg. He moves the stent through the artery to the coronary artery.

Suggest **two** possible risks of this operation.

1 ............................................................................................................

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2 ............................................................................................................

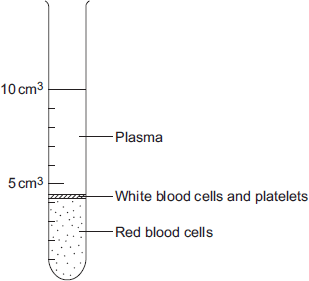
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**(2)**

**(Total 10 marks)**

**Q3.**The parts of the blood can be separated from each other by spinning the blood in a centrifuge.

The image below below shows the separated parts of a 10 cm3 blood sample.



(a)     Calculate the percentage of the blood that is made up of plasma.

........................................................................................................................

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Answer = .............................. %

**(2)**

(b)     Name **three** chemical substances transported by the plasma.

1........................................................................................................................

2........................................................................................................................

3........................................................................................................................

**(3)**

(c)     **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

White blood cells are part of the immune system. White blood cells help the body to defend itself against pathogens.

Describe how pathogens cause infections **and** describe how the immune system defends the body against these pathogens.

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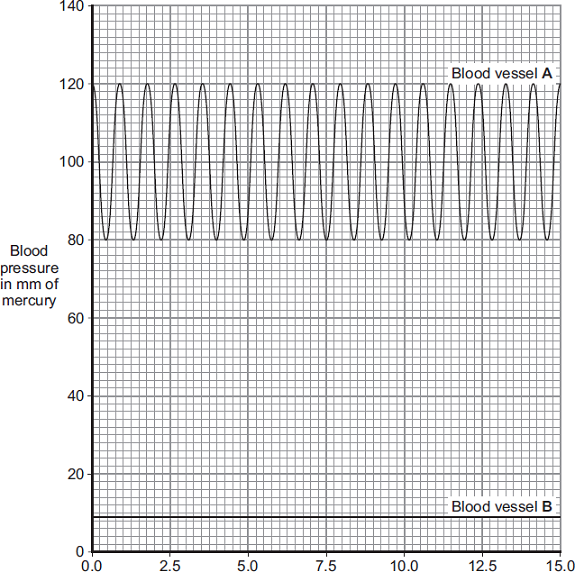
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**(6)**

**(Total 11 marks)**

**Q4.**The heart pumps the blood around the body. This causes blood to leave the heart at   
high pressure.

The graph shows blood pressure measurements for a person at rest.  
The blood pressure was measured in an artery and in a vein.



Time in seconds

(a)     Which blood vessel, **A** or **B**, is the artery?

Blood vessel ....................

Give **two** reasons for your answer.

Reason 1 .......................................................................................................

........................................................................................................................

Reason 2 .......................................................................................................

........................................................................................................................

**(2)**

(b)     Use information from the graph to answer these questions.

(i)      How many times did the heart beat in 15 seconds? .............................

**(1)**

(ii)     Use your answer from part (b)(i) to calculate the person’s heart rate per minute.

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...............................................................................................................

Heart rate = .................... beats per minute

**(1)**

(c)     During exercise, the heart rate increases.

The increased heart rate supplies useful substances to the muscles at a faster rate.

Name **two** useful substances that must be supplied to the muscles at a faster rate   
during exercise.

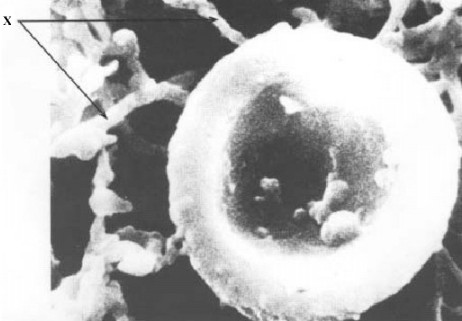
1 ........................................................................................................................

2 ........................................................................................................................

**(2)**

**(Total 6 marks)**

**Q5.**          The photograph shows a red blood cell in part of a blood clot. The fibres labelled **X** are produced in the early stages of the clotting process.



(a)     Suggest how the fibres labelled **X** help in blood clot formation.

.....................................................................................................................................

**(1)**

(b)     The average diameter of a real red blood cell is 0.008 millimetres.  
On the photograph, the diameter of the red blood cell is 100 millimetres.

          Use the formula to calculate the magnification of the photograph.

Diameter on photograph = Real diameter × Magnification

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Magnification = ..............................................................

**(2)**

(c)     Some blood capillaries have an internal diameter of approximately 0.01 millimetres.

(i)      Use information given in part (b) to explain why only one red blood cell at a time can pass through a capillary.

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**(1)**

(ii)     Explain the advantages of red blood cells passing through a capillary one at a time.

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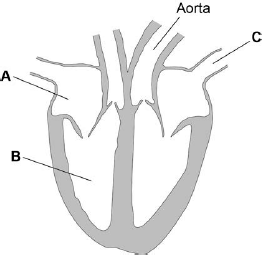
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**(3)**

**(Total 7 marks)**

**Q6.Figure 1** shows a diagram of the human heart.

**Figure 1**

****

(a)     Name parts **A** and **B**.

**A** ....................................................................................................................

**B** ....................................................................................................................

**(2)**

(b)     What is the function of blood vessel **C**?

Tick **one** box.

|  |  |  |
| --- | --- | --- |
|  | To take blood from the heart around the body |  |
|  | To take blood from the body to the heart |  |
|  | To take blood from the heart to the lungs |  |
|  | To take blood from the lungs to the heart |  |

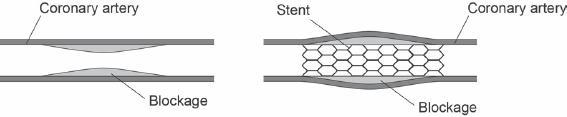
**(1)**

(c)     Coronary heart disease (CHD) develops when layers of fatty material build up in the coronary artery.

One treatment for CHD is to insert a stent into the coronary artery.

**Figure 2** shows a stent in a coronary artery.

**Figure 2**

****

Explain why the stent helps to prevent a heart attack.

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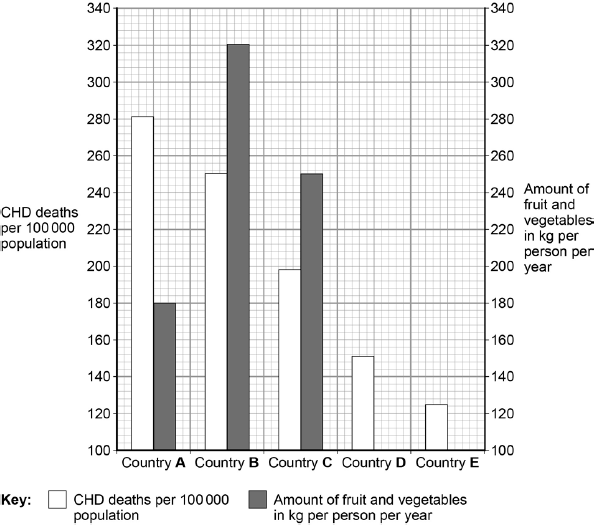
(d)     Look at the table below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Country** | **Number of deaths from CHD per 100 000 population per year** | **Amount of fruit and vegetables eaten in kg per person per year** |
|  | A | 285 | 180 |
|  | B | 250 | 320 |
|  | C | 198 | 250 |
|  | D | 151 | 220 |
|  | E | 125 | 244 |

Plot the missing bars for countries **D** and **E** on **Figure 3**.

Use data from the table above.

**Figure 3**

****

**(2)**

(e)     People in country **B** are more likely to die from CHD than people in country **E**.

How many more times as likely are people to die from CHD in country **B** than in country **E**?

........................................................................................................................ ( 1 )

(f)     A student concluded

‘The factor that causes CHD is not eating enough fruit and vegetables.’

Evaluate the student’s conclusion.

Use data from **Figure 3**, and your own knowledge, in your answer.

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**(6)**

**(Total 16 marks)**

**Q7.**The circulatory system transports substances such as glucose and oxygen around the body.

(a)     Name **two** other substances that the circulatory system transports around the body.

1........................................................................................................................

2........................................................................................................................ ( 2)

(b)     (i)      Blood is a tissue. Blood contains red blood cells and white blood cells.

Name **two** other components of blood.

1...............................................................................................................

2...............................................................................................................

**(2)**

(ii)     The heart is part of the circulatory system.

What type of tissue is the wall of the heart made of?

............................................................................................................... ( 1 )

(c)     **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Every year, many patients need to have heart valve replacements.

The table gives information about two types of heart valve.

|  |  |  |
| --- | --- | --- |
|  | **Living human heart valve** | **Cow tissue heart valve** |
|  | •   It has been used for transplants for     more than 12 years. | •   It has been used since 2011. |
|  | •   It can take many years to find a suitable     human donor. | •   It is made from the artery tissue of a     cow. |
|  | •   It is transplanted during an operation     after a donor has been found. | •   It is attached to a stent and inserted     inside the existing faulty valve. |
|  | •   During the operation, the patient's chest     is opened and the old valve is removed     before the new valve is transplanted. | •   A doctor inserts the stent into a blood     vessel in the leg and pushes it through     the blood vessel to the heart. |

A patient needs a heart valve replacement. A doctor recommends the use of a cow tissue heart valve.

Give the advantages and disadvantages of using a cow tissue heart valve compared with using a living human heart valve.

Use information from the table and your own knowledge in your answer.

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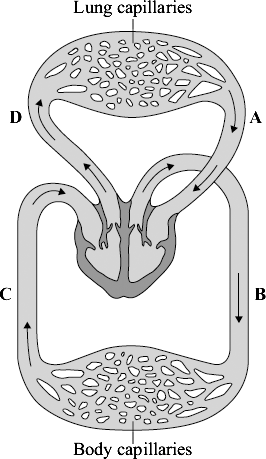
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**(6)**

**(Total 11 marks)**

**Q8.**         The diagram shows the human circulation system.



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

**(1)**

|  |  |  |
| --- | --- | --- |
| (ii) | Give the letter of **one** blood vessel that carries oxygenated blood. |  |

**(1)**

(b)     During exercise, the heart rate increases.

Explain, as fully as you can, why this increase is necessary.

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**(4)**

**(Total 6 marks)**

**Q9.**Coronary heart disease (CHD) can be caused by many factors.

The table below shows data related to CHD for five countries.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Country** | **Number of deaths from CHD per 100 000 population per year** | **Percentage of the population who smoke tobacco** | **Percentage of the population who drink alcohol heavily** | **Amount of fruit and vegetables eaten in kg per person per year** |
|  | **A** | 285 | 36 | 19 | 180 |
|  | **B** | 251 | 63 | 34 | 404 |
|  | **C** | 186 | 47 | 36 | 251 |
|  | **D** | 149 | 23 | 34 | 218 |
|  | **E** | 128 | 27 | 12 | 222 |

(a)     Name **one** risk factor for CHD that is **not** shown in the table above.

........................................................................................................................

**(1)**

(b)     A student concludes that the main cause of CHD is not eating enough fruit and vegetables.

Give **three** reasons why the student’s conclusion is **not** correct.

Use information from the table above.

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**(3)**

(c)     Explain how the build-up of fatty material can damage the heart.

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**(4)**

(d)     Describe how statins can help to reduce deaths from CHD.

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**(2)**

**(Total 10 marks)**

**Q10.**Substances are transported through plants.

(a)     Use the correct answer from the box to complete each sentence.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **capillary** | **guard cells** | **phloem** |
|  | **stomata** | **transpiration** | **xylem** |

(i)      Water is transported from the roots to the stem of a plant

in the ....................................................... .

**(1)**

(ii)     Dissolved sugars are transported through the plant

in the ....................................................... .

**(1)**

(iii)    Movement of water through the plant is called the

....................................................... stream.

**(1)**

(iv)    Water vapour moves out of the plant through pores

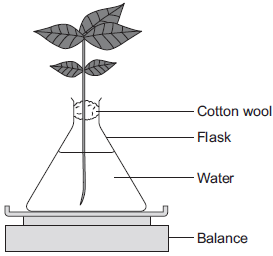
called ....................................................... .

**(1)**

(b)     Students investigated the effect of different conditions on water loss from leaves.

The apparatus is shown in **Figure 1**.

**Figure 1**

****

The students set up four flasks, **A**, **B**, **C** and **D**.

The students:

•        used the same size plant shoot in each flask

•        recorded the mass of the flask and plant shoot at the start of each experiment

•        left each flask and plant shoot in different conditions

•        recorded the mass of each flask and plant shoot after 2 hours.

**Table 1** shows the conditions that flasks **A**, **B**, **C** and **D** were left in for 2 hours.

**Table 1**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Flask** | **Temperature in °C** | **Fan or no fan** |
|  | **A** | 20 | No Fan |
|  | **B** | 20 | Fan |
|  | **C** | 35 | No Fan |
|  | **D** | 35 | Fan |

(i)      Suggest why the students used cotton wool in each flask.

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**(1)**

(ii)     The use of the same size of plant shoot made the investigation a fair test.

Explain why.

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**(2)**

(iii)    **Table 2** shows the students’ results.

**Table 2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **Conditions** | | **Mass at  the start in grams** | **Mass  after 2 hours in grams** | **Mass of  water lost in 2 hours in grams** |
|  | **Flask** | **Temperature in °C** | **Fan or  no fan** |
|  | **A** | 20 | No Fan | 150.0 | 148.1 | 1.9 |
|  | **B** | 20 | Fan | 152.0 | 148.5 | 3.5 |
|  | **C** | 35 | No Fan | 149.0 | 145.9 | 3.1 |
|  | **D** | 35 | Fan | 150.0 | 145.5 |  |

What mass of water was lost by the plant shoot in flask **D**?

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...............................................................................................................

.................... grams

**(1)**

(iv)    Suggest what conclusion can be made about the effect of temperature on water loss from the plant shoot.

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**(1)**

(v)     Suggest what conclusion can be made about the effect of the fan on water loss from the plant shoot.

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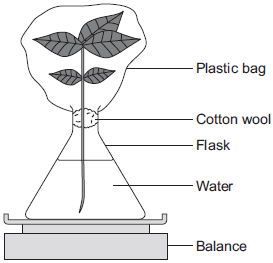
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**(1)**

(c)     The students carried out another experiment at 20 °C, with no fan.

The students used the apparatus in **Figure 2**.

**Figure 2**

****

In this experiment, the students:

•        recorded the mass of the flask and plant shoot before tying the plastic bag around the plant shoot

•        removed the bag after 2 hours and recorded the mass again.

(i)      What mass of water would be lost from the plant shoot in 2 hours?

Draw a ring around the correct answer.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **0.3 g** | **1.9 g** | **3.9 g** |

**(1)**

(ii)     Give a reason for your answer to part **(c)(i)**.

...............................................................................................................

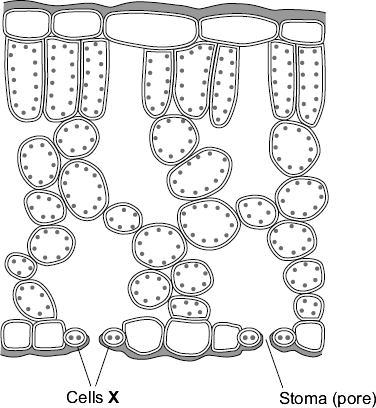
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**(1)**

**(Total 12 marks)**

**Q11.**          The diagram shows a section through a plant leaf.



(a)     The cells labelled **X** surround a stoma (pore).

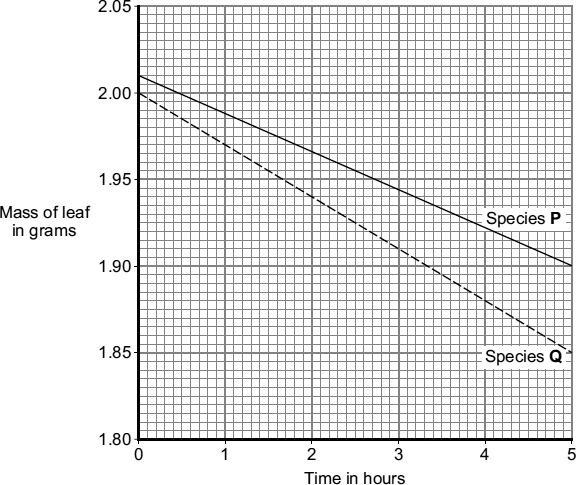
Draw a ring around the correct answer to complete the sentence.

|  |  |
| --- | --- |
|  | alveoli. |
| Cells **X** are called | guard cells. |
|  | villi. |

**(1)**

(b)     Water vapour is lost from leaves. Water loss causes a leaf to lose mass.

The graph shows how the masses of leaves from two plant species, **P** and **Q**, changed over several hours. Both leaves were kept in the same conditions.



(i)      What was the mass of the leaf of species **Q** at 0 hours?  
....................................... grams

**(1)**

(ii)     What was the difference between the mass of the leaf of species **P** and the mass of the leaf of species **Q** after 5 hours?

                                                                                    ....................................... grams

**(1)**

(iii)    The leaf of species **Q** lost water at a faster rate than the leaf of species **P**.

Suggest **one** reason why

...............................................................................................................

...............................................................................................................

**(1)**

(iv)     Which weather conditions would cause the greatest rate of loss of mass for both species **P** and species **Q**?

Tick () **one** box in the table.

|  |  |  |
| --- | --- | --- |
| **Weather conditions** | | **Tick ()** |
| **Still air or wind** | **Temperature in °C** |
| Wind | 30 |  |
| Still air | 30 |  |
| Wind | 20 |  |

**(1)**

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

In very hot, dry conditions, the stomata close.

|  |  |
| --- | --- |
|  | anaerobic respiration. |
| This is to prevent | breathing. |
|  | wilting. |

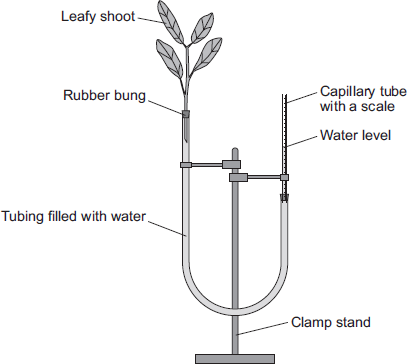
**(1)**

**(Total 6 marks)**

**Q12.**A potometer is a piece of apparatus that can be used to measure water uptake by a leafy shoot.

**Figure 1** shows a potometer.

**Figure 1**

****

Some students used a potometer like the one shown in **Figure 1.**

•        They measured the water taken up by a shoot in normal conditions in a classroom.

•        As the water was taken up by the shoot, the level of water in the capillary tube went down.

•        The students recorded the level of the water in the capillary tube at 2-minute intervals for 10 minutes.

**Table 1** shows the students’ results.

**Table 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Time in minutes | 0 | 2 | 4 | 6 | 8 | 10 |
|  | Level of water (on scale) in capillary tube in mm | 2.5 | 3.6 | 4.4 | 5.4 | 6.5 | 7.5 |

The area of the cross section of the capillary tube was 0.8 mm2.

(a)     (i)      Complete the following calculation to find the volume of water taken up by the shoot in mm3 per minute.

Distance water moved along the scale in 10 minutes = ...........mm

Volume of water taken up by the shoot in 10 minutes = ..........mm3

Therefore, volume of water taken up by the shoot in 1 minute = ...........mm3

**(3)**

(ii)     The students repeated the investigation but this time placed the potometer next to a fan blowing air over the leafy shoot.

Suggest how the results would be different. Give a reason for your answer.

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**(2)**

(b)     The students repeated the investigation at different temperatures.

The results are shown in **Table 2.**

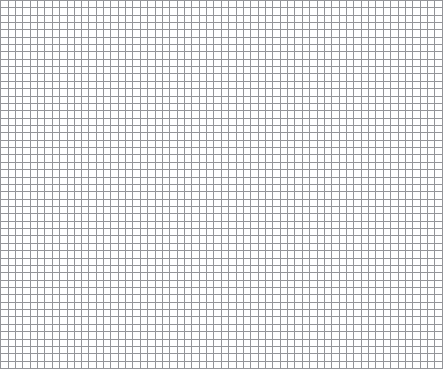
**Table 2**

|  |  |  |
| --- | --- | --- |
|  | **Temperature in °C** | **Rate of water uptake in mm3 per minute** |
|  | 10 | 0 |
|  | 15 | 0.4 |
|  | 20 | 1.0 |
|  | 25 | 2.1 |
|  | 30 | 3.2 |
|  | 35 | 4.0 |
|  | 40 | 4.4 |

Plot the data from **Table 2** on the graph paper in **Figure 2**.

Choose suitable scales, label both axes and draw a line of best fit.

**Figure 2**

****

**(5)**

(c)     What would happen to the leaves if the potometer was left for a longer time at 40 °C?

Explain your answer.

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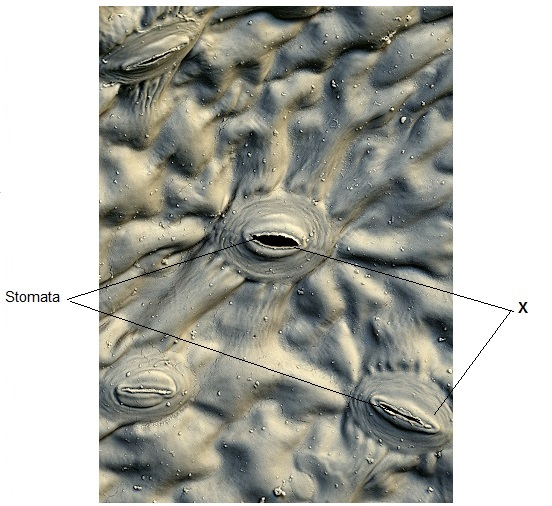
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**(3)**

**(Total 13 marks)**

**Q13.**The image below shows some cells on the lower surface of a leaf.



                                                        © Stefan Diller/Science Photo Library

(a)     What are the cells labelled **X** called?

Draw a ring around the correct answer.

**guard cells                palisade cells                mesophyll cells**

**(1)**

(b)     Water loss by evaporation from leaves is called **transpiration**.

A student set up an experiment to investigate water loss from leaves.

The student:

•        took two leaves, **A** and **B**, from a plant

•        put Vaseline (grease) on both sides of **Leaf B**; did nothing to **Leaf A**

•        wrote down the mass of each leaf

•        attached the leaves onto a string as shown in the diagram below.



|  |  |  |
| --- | --- | --- |
|  | **Leaf A** (no treatment) | **Leaf B** (both surfaces covered in Vaseline) |

•        left the leaves for 48 hours

•        wrote down the mass of each leaf again

•        calculated the percentage (%) change in mass for each leaf.

(i)      Give **one** variable that the student controlled in this investigation.

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**(1)**

(ii)     The mass of **Leaf A** was 1.60 g at the start of the investigation. After 48 hours it was 1.28 g.

Calculate the % decrease in mass over 48 hours.

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% decrease = .....................................

**(2)**

(c)     Vaseline blocks the stomata.

The % change in mass of **Leaf B** was less than **Leaf A** after 48 hours.  
Explain why.

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**(1)**

(d)     Give **three** environmental conditions that would increase transpiration.

1 ......................................................................................................................

2 ......................................................................................................................

3 ......................................................................................................................

**(3)**

**(Total 8 marks)**

**Q14.**The leaves of most plants have stomata.

(a)     (i)      Name the cells which control the size of the stomata.

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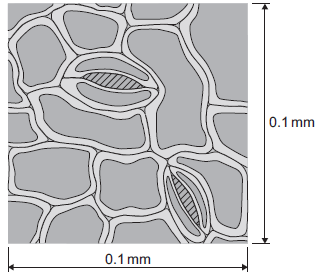
**(1)**

(ii)     Give **one** function of stoma

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**(1)**

(b)     The image below shows part of the surface of a leaf.



The length and width of this piece of leaf surface are both 0.1 mm.

(i)      Calculate the number of stomata per mm2 of this leaf surface.

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.................................................. per mm2

**(2)**

(ii)     A different plant species has 400 stomata per mm2 of leaf surface.

Having a large number of stomata per mm2 of leaf surface can be a disadvantage to a plant.

Give **one** disadvantage.

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**(1)**

(c)     A student investigated the loss of water from plant leaves.

The student did the following:

•        Step 1: took ten leaves from a plant

•        Step 2: weighed all ten leaves

•        Step 3: hung the leaves up in a classroom for 4 days

•        Step 4: weighed all ten leaves again

•        Step 5: calculated the mass of water lost by the leaves

•        Step 6: repeated steps **1** to **5** with grease spread on the upper surfaces of the leaves

•        Step 7: repeated steps **1** to **5** with grease spread on both the upper and lower surfaces of the leaves.

All the leaves were taken from the same type of plant.

The table below shows the student’s results.

|  |  |  |
| --- | --- | --- |
|  | **Treatment of leaves** | **Mass of water the leaves lost in g** |
|  | No grease was used on the leaves | 0.98 |
|  | Grease on upper surfaces of the leaves | 0.86 |
|  | Grease on upper and lower surfaces of the leaves | 0.01 |

(i)      What mass of water was lost in 4 days through the upper surfaces of the leaves?

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Mass = .................... g

**(1)**

(ii)     Very little water was lost when the lower surfaces of the leaves were covered in grease.

Explain why.

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**(3)**

**(Total 9 marks)**

**Q15.**Plants exchange substances with the environment.

(a)     Plant roots absorb water mainly by osmosis.   
Plant roots absorb ions mainly by active transport.

Explain why roots need to use the two different methods to absorb water and ions.

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**(4)**

(b)     What is meant by the *transpiration stream*?

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**(3)**

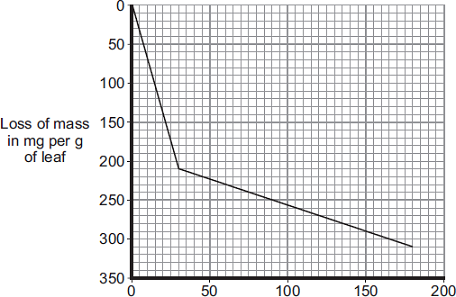
(c)     Students investigated the loss of water vapour from leaves.

They

•        cut some leaves off a plant

•         measured the mass of these leaves every 30 minutes for 180 minutes.

The graph shows the students’ results.



(i)      The rate of mass loss in the first 30 minutes was 7 milligrams per gram of leaf per minute.

Calculate the rate of mass loss between 30 minutes and 180 minutes.

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Rate of mass loss = .............................. milligrams per gram of leaf per minute

**(2)**

(ii)     The rate of mass loss between 0 and 30 minutes was very different from the rate of   
mass loss between 30 and 180 minutes.

Suggest an explanation for the difference between the two rates.

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**(2)**

**(Total 11 marks**