**Q1.** Plants transport water and mineral ions from the roots to the leaves.

(a) Plants move mineral ions:

- from a low concentration in the soil
- to a high concentration in the root cells.

What process do plants use to move these minerals ions into root cells?

Tick **one** box.

Active transport ☐

Diffusion ☐

Evaporation ☐

Osmosis ☐

**(1)**

(b) Describe how water moves from roots to the leaves.

.....

.....

.....

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**(2)**

(c) Plants lose water through the stomata in the leaves.

The epidermis can be peeled from a leaf.

The stomata can be seen using a light microscope.

The table below shows the data a student collected from five areas on one leaf.

| **Leaf area** | **Number of stomata** | |
|---|---|---|
| | **Upper surface** | **Lower surface** |

| | | |
|---|---|---|
| 1 | 3 | 44 |
| 2 | 0 | 41 |
| 3 | 1 | 40 |
| 4 | 5 | 42 |
| 5 | 1 | 39 |
| **Mean** | **2** | **X** |

Describe how the student might have collected the data.

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**(3)**

(d) What is the median number of stomata on the upper surface of the leaf?

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**(1)**

(e) Calculate the value of **X** in the table.

Give your answer to 2 significant figures.

.....

.....

Mean number of stomata on lower surface of leaf = .....

**(2)**

(f) The plant used in this investigation has very few stomata on the upper surface of the leaf.

Explain why this is an **advantage** to the plant.

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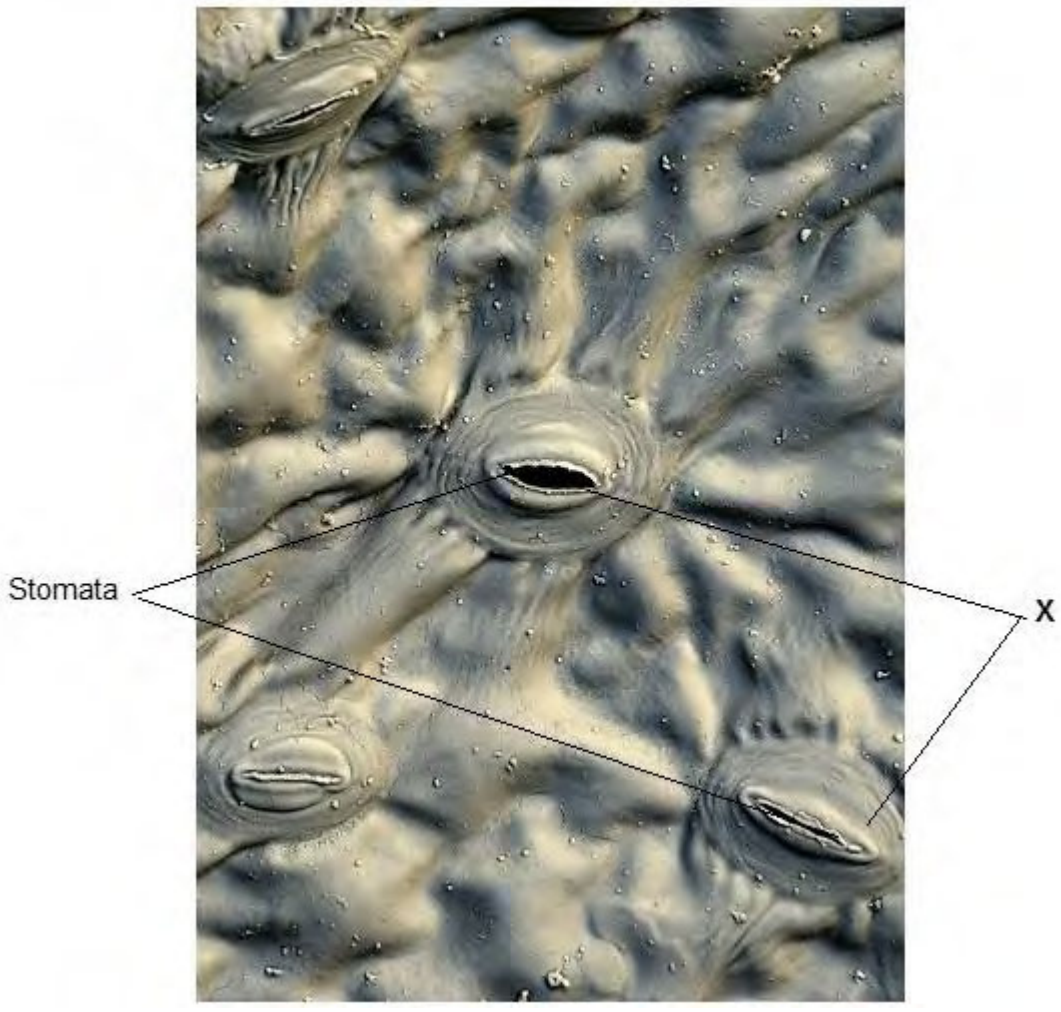
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**(2)**

**(Total 11 marks)**

**Q2.**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.

.....

.....

**(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.

.....

.....

% 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 .....

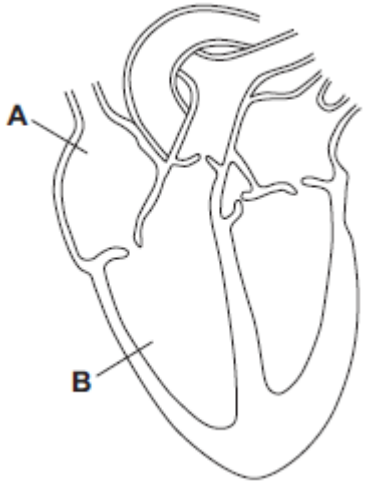
2 .....

3 .....

**(3)**
**(Total 8 marks)**

**Q3.Diagram 1** shows a section through the heart.

**Diagram 1**




(a) Use words from the box to name the structures labelled **A** and **B** on **Diagram 1**.

| | | | |
|---|---|---|---|
| **arota** | **atrium** | **pulmonary artery** | **ventricle** |

**A** .....

**B** .....

**(2)**

(b) The tissue in the wall of the heart contracts.

(i) What type of tissue is this?

Tick (✓) **one** box.

muscular ☐

glandular ☐

epithelial ☐

**(1)**

(ii) What does the heart do when this tissue contracts?

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**(1)**

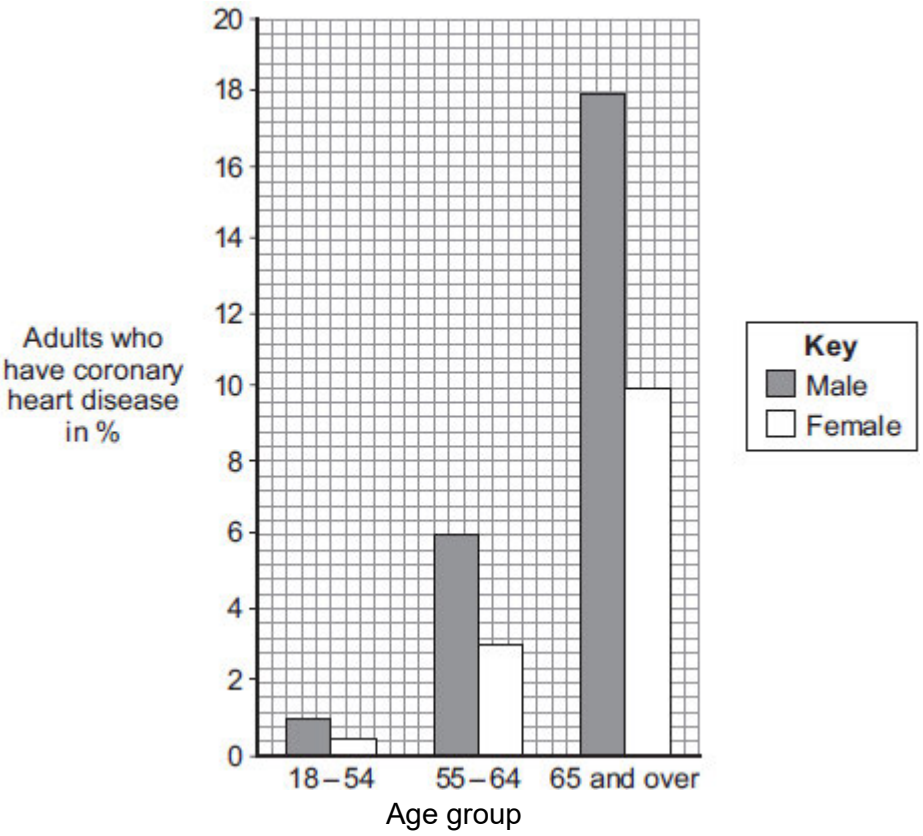
(c) Draw arrows on **Diagram 2** to complete the route taken by deoxygenated blood through the heart.

**Diagram 2**



**(2)**

(d) The graph shows the percentage (%) of adults in the UK who have coronary heart disease.




(i) Look at the graph.

Which group of people is **most** at risk of having coronary heart disease in the UK?

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**(2)**

(ii) Explain what happens to the heart in coronary heart disease.

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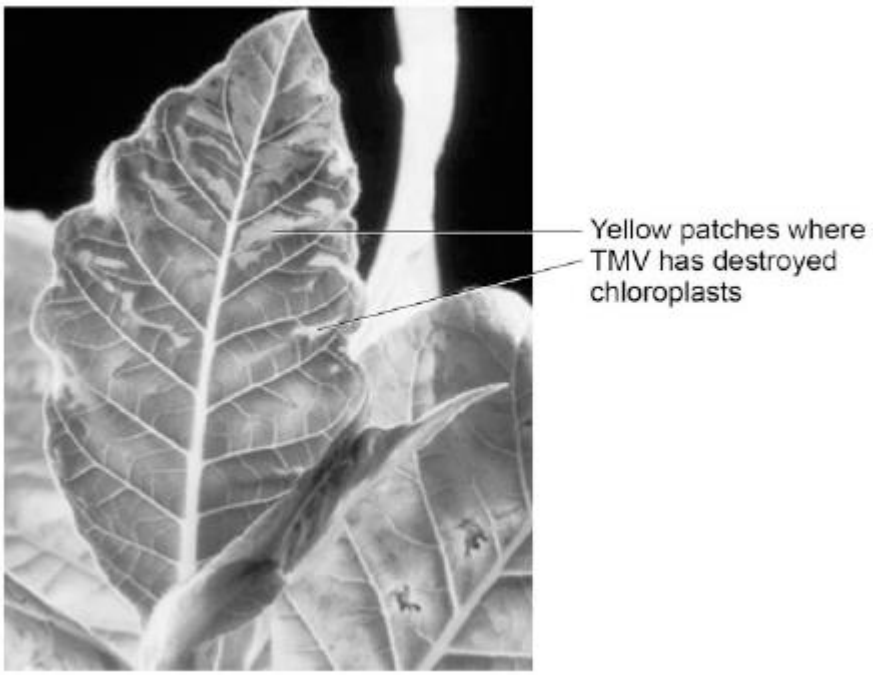
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**(3)**
**(Total 11 marks)**

**Q4.**Tobacco mosaic virus (TMV) is a disease affecting plants.

The diagram below shows a leaf infected with TMV.




© Nigel Cattlin/Visuals Unlimited/Getty Images

(a) All tools should be washed in disinfectant after using them on plants infected with TMV.

Suggest why.

.....

.....

**(1)**

(b) Scientists produced a single plant that contained a TMV-resistant gene.

Suggest how scientists can use this plant to produce **many** plants with the TMV-resistant gene.

.....

.....

**(1)**

(c) Some plants produce fruits which contain glucose.

Describe how you would test for the presence of glucose in fruit.

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.....

**(2)**

(d) TMV can cause plants to produce less chlorophyll.

This causes leaf discoloration.

Explain why plants with TMV have stunted growth.

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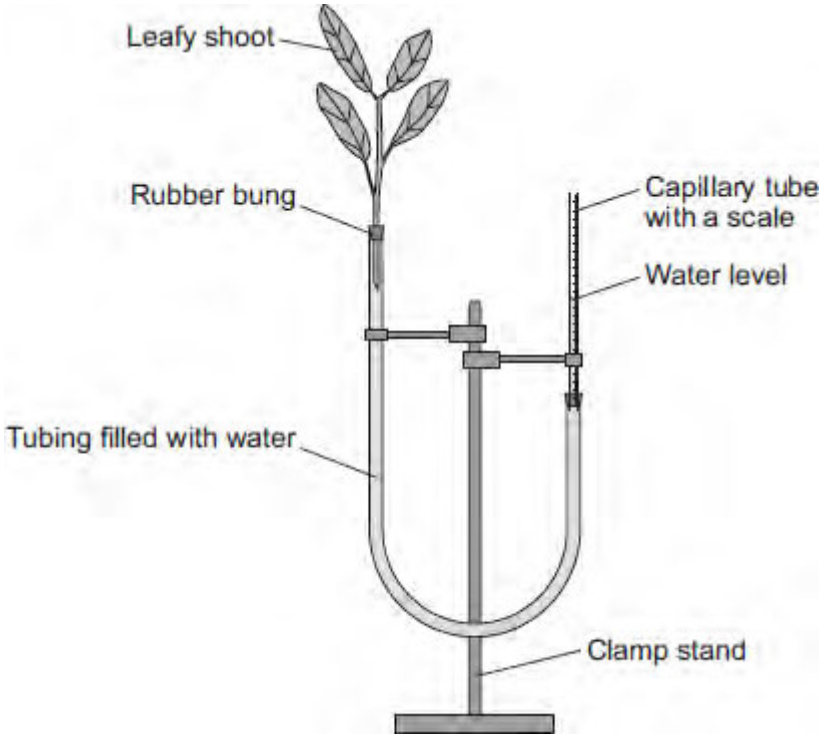
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**(4)**
**(Total 8 marks)**

**Q5.** 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 $mm^2$.

(a) (i) Complete the following calculation to find the volume of water taken up by the shoot in $mm^3$ per minute.

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

Volume of water taken up by the shoot in 10 minutes = .....$mm^3$

Therefore, volume of water taken up by the shoot in 1 minute = .....$mm^3$

**(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.**

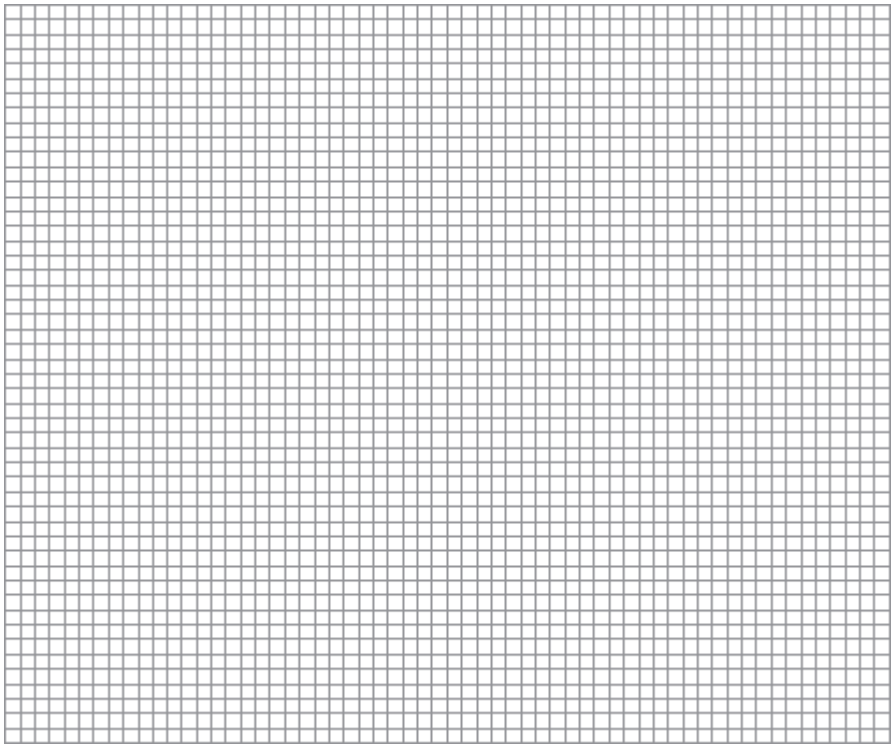
**Table 2**

| Temperature in °C | Rate of water uptake in $mm^3$ 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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**(3)**
**(Total 13 marks)**