GCE Biology

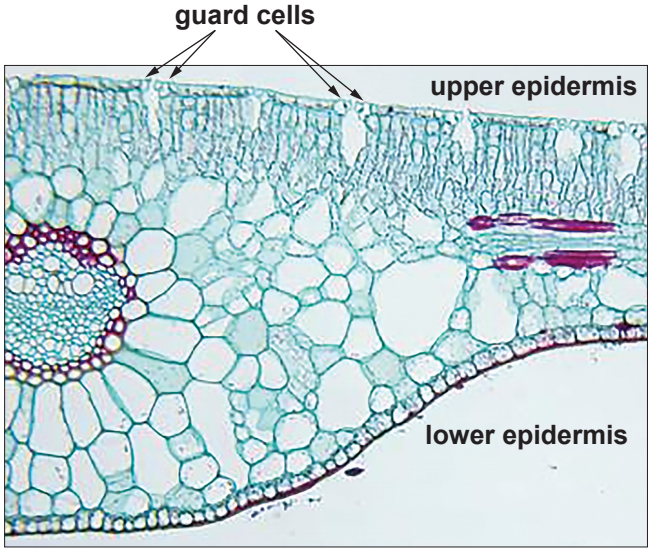
S21-A400U30-1

Assessment Resource 22

Requirements of Life Resource D

1. For plants to photosynthesise effectively they need to obtain certain resources. Leaves are the main sites of gas exchange and photosynthesis in plants. They are adapted to these main functions in several ways. Figure 1.1 is a photomicrograph showing a transverse section through a leaf.

Figure 1.1



(a) (i) **Label figure 1.1** using the letters **A** and **B** to show the position of the following:

A the main tissue responsible for photosynthesis [1]

B the tissue that transports water to the leaf tissues [1]

(ii) Conclude whether the leaf shown in figure 1.1 is from a hydrophyte or a xerophyte. Identify **two** adaptations that support your conclusion. [3]

Type of plant: .....

Adaptation 1: .....

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Adaptation 2: .....

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(iii) Explain why leaves and chloroplasts change their orientation during the day. [1]

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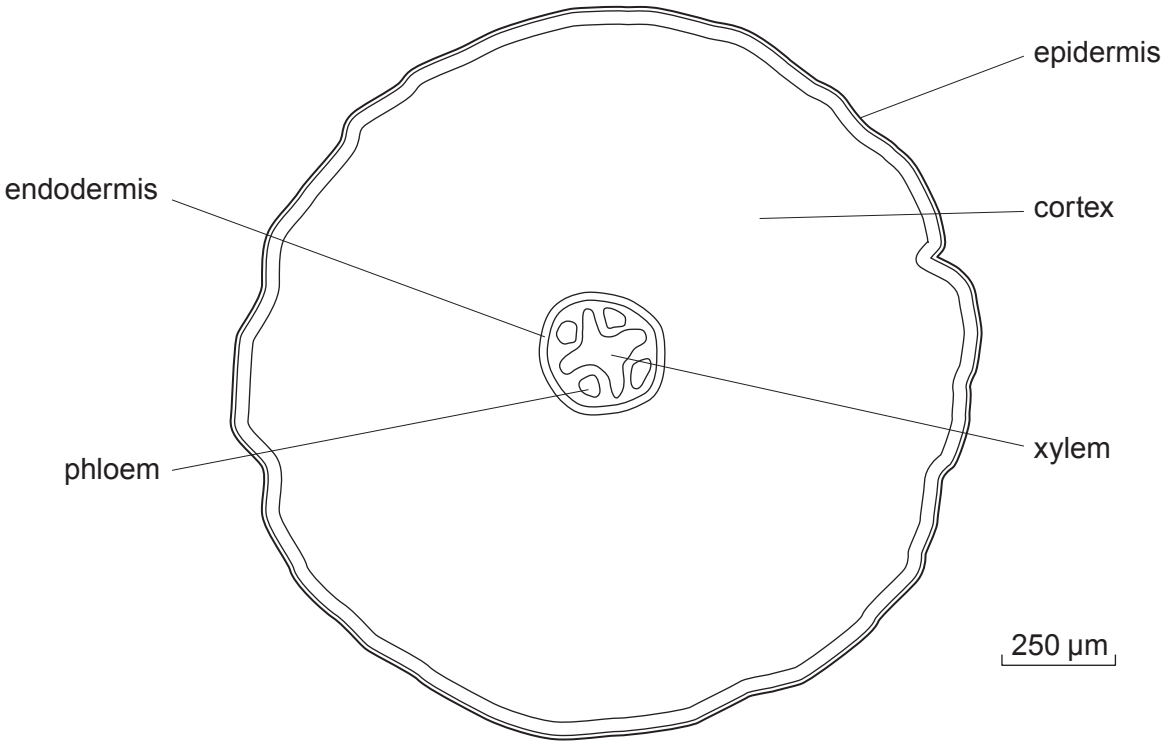
(b) Roots are the main site of water and mineral uptake. Figure 1.2 shows a low power plan of the structure of a root of a buttercup, *Ranunculus*, a dicotyledonous plant.

Figure 1.2



(i) **Using only the scale bar**, calculate the magnification of the image in figure 1.2. [2]

Magnification = × .....

(ii) Water and minerals can follow several paths from the soil to the xylem. These are the apoplast, symplast and vacuolar pathways. Both the symplast and vacuolar routes involve water crossing cell membranes. Explain why the vacuolar route is slower than the symplast pathway. [2]

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(c) In the stem of a buttercup, vascular tissues are organised into bundles.

(i) Describe how the arrangement of the vascular tissues in a stem of a buttercup is different from their arrangement in the root. [1]

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(ii) Xylem vessels and phloem sieve tubes are strengthened by different chemicals found in their cell walls. Name these chemicals. [1]

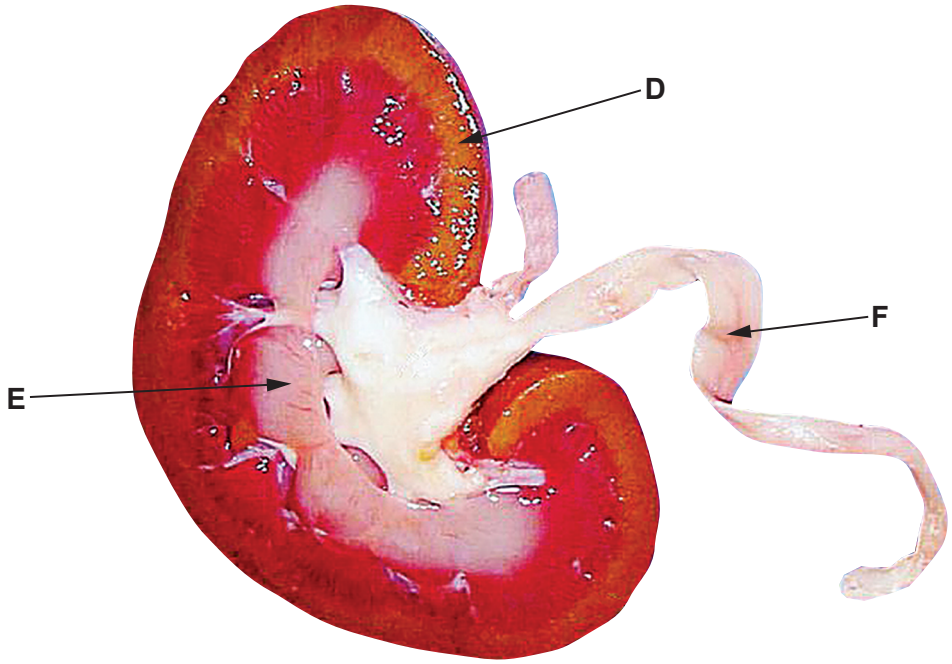
xylem .....

phloem .....

2. Osmoregulation and urine formation in mammals is carried out by the nephrons. During this process, many small soluble molecules and ions are initially forced out of the blood by **ultrafiltration** in the glomerulus followed by **selective reabsorption** in the proximal convoluted tubule. The remaining filtrate is concentrated in the loop of Henle and collecting duct to produce urine.

Figure 2.1 shows a section through a mammalian kidney.

Figure 2.1



(a) (i) Name the parts of the kidney labelled **D**, **E** and **F** on figure 2.1. [1]

D .....

E .....

F .....

(ii) Using letters **D**, **E** or **F** from figure 2.1, identify the part of the kidney in which each of the following processes takes place: [1]

ultrafiltration .....

selective reabsorption .....

(b) Figure 2.2 shows a section through a proximal convoluted tubule of a mammal.

Figure 2.2

(i) Identify the structures labelled **X** on figure 2.2 and explain how they are involved in selective reabsorption by the proximal convoluted tubules. [2]

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(ii) Explain how the capillaries increase the rate of selective reabsorption. [1]

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(c) Alport's Syndrome is an inherited condition which causes the thickening of the basement membrane of the glomerulus. This can lead to the retention of fluid in the blood, reduced urine volume and very high blood pressure.

There are two forms of the disease caused by different alleles:

Type 1 X-linked, dominant

Type 2 autosomal, recessive

A couple, both unaffected by Alport's Syndrome, had a child with Alport's Syndrome. Conclude which type of Alport's Syndrome the child inherited. Explain your answer. [3]

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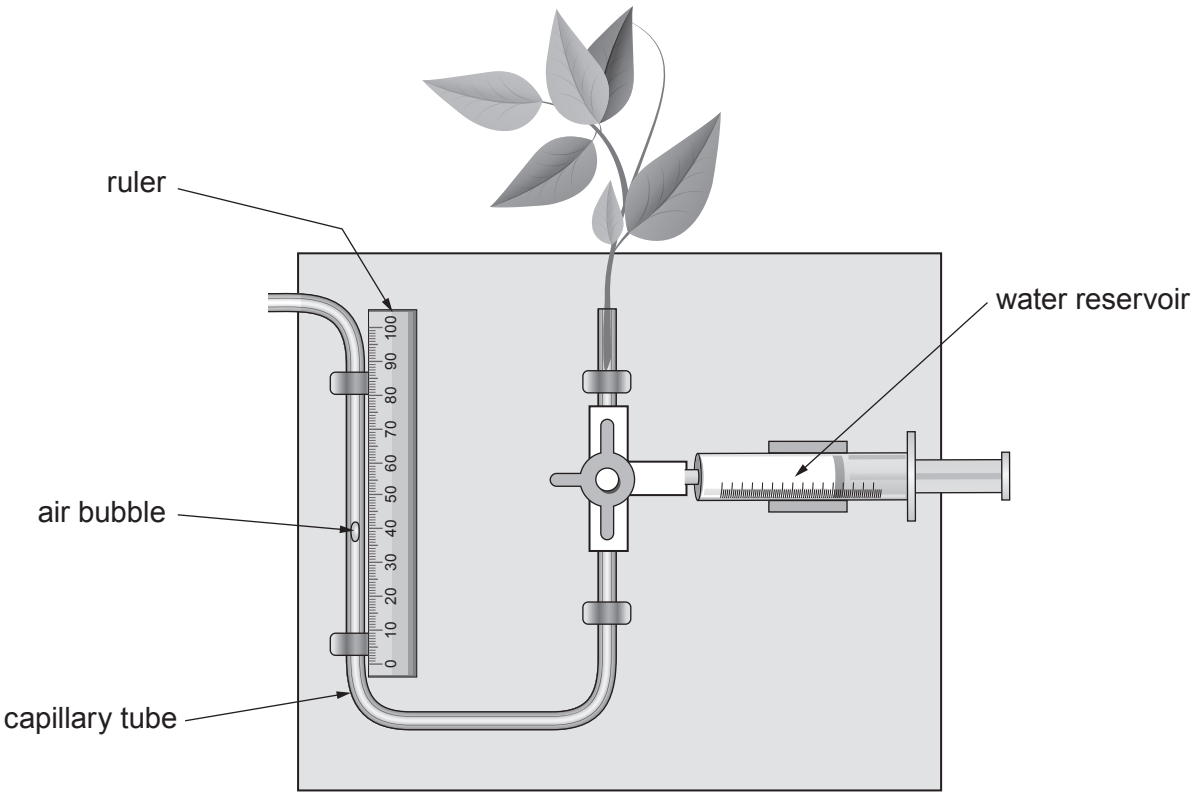
3. The rate of water uptake by a plant shoot can be measured in the laboratory using a potometer. Students set up a potometer as shown in figure 3.1.

Figure 3.1



The students investigated the effect of light intensity on the rate of water uptake by shining a light onto the shoot. They changed the light intensity by placing a lamp at different distances from the shoot.

(a) (i) The diameter of the capillary tube was measured as 1 mm. State **three** *other* measurements they would need to take in order to calculate the rate of water uptake in $mm^3\ cm^{-2}\ minute^{-1}$ at each light intensity. [2]

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(ii) Describe the purpose of the water reservoir in this apparatus. [1]

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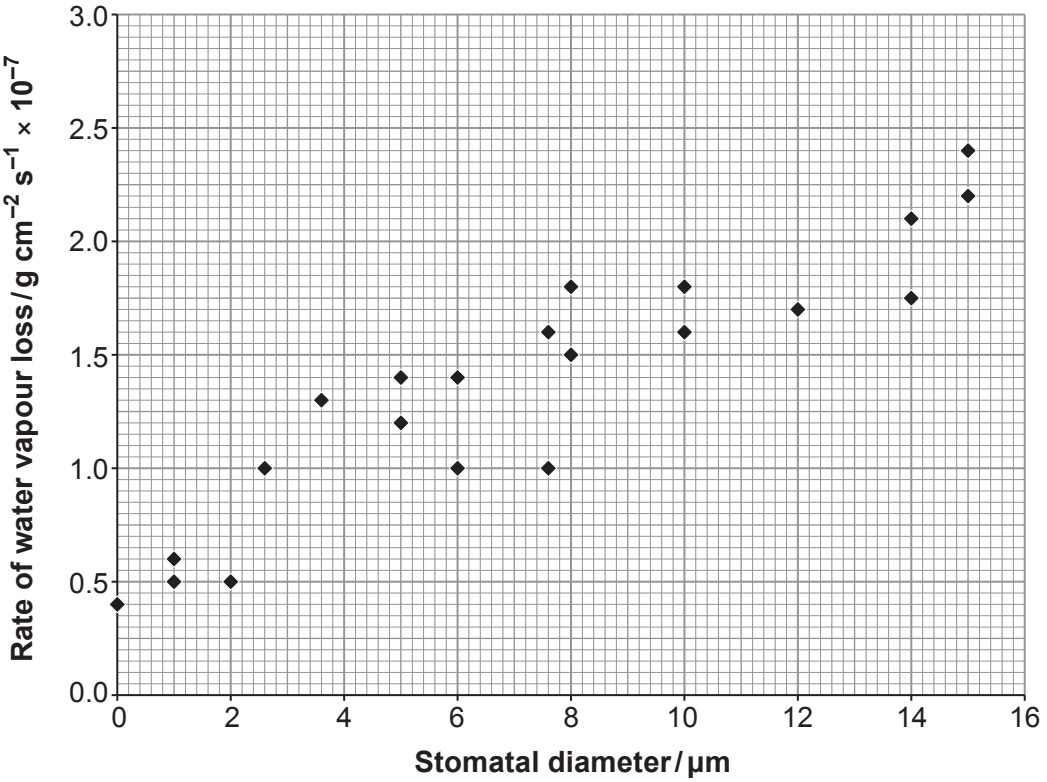
(b) A potometer measures water uptake but a **porometer** can measure actual water loss from the stomata of a leaf by measuring changes in humidity on the surface of a leaf.

An experiment was conducted to investigate how the diameter of stomata affected the rate of water loss from a leaf. Figure 3.2 shows the results of the experiment.

Figure 3.2



Analysis of the data showed that the line of best fit for these data followed the equation

$y = mx + c$

where m = gradient of the line

c = the intercept on the y axis

(i) Calculate the value of y when x = 10, m = 0.11 and c = 0.6. [1]

y = ... g cm^{-2} s^{-1} × 10^{-7}

(ii) Using the values provided and your calculated value of y **draw the line of best fit** for these data. [2]

(iii) Explain why there was still water loss when the stomatal diameter was zero. [1]

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(c) Stomata have been observed to close at high wind speeds.

(i) Predict what would happen to the rate of water loss from a plant when exposed to a high air speed. [1]

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(ii) Explain the advantage to the plant of closing stomata at high wind speeds. [1]

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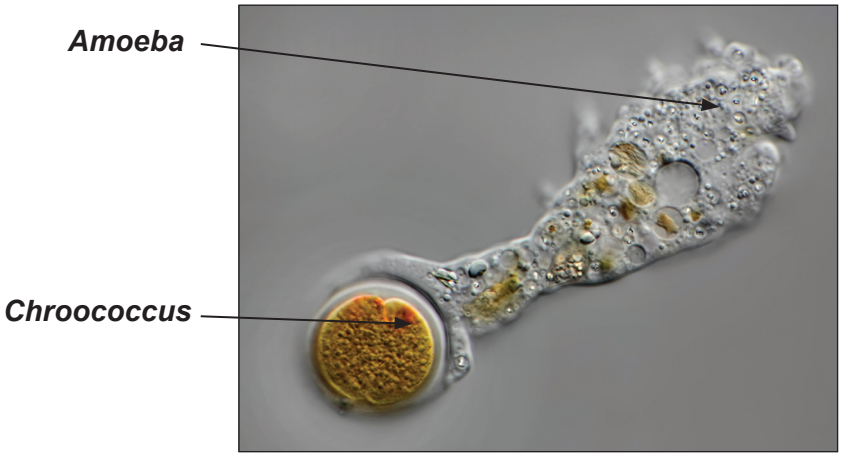
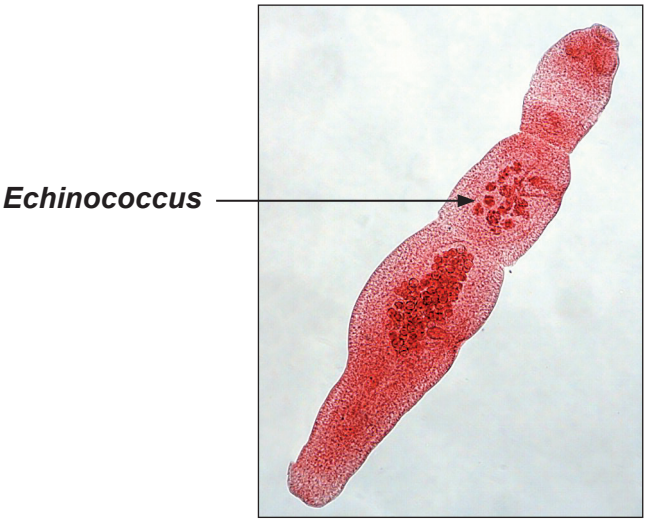
4. All living organisms need to obtain energy and raw materials for growth and survival but do this in different ways. The images below show **four** organisms that have different modes of nutrition.

Botrytis cinerea is a fungus that grows on a wide range of fruit causing decay.

Amoeba sp. ingesting a cell of *Chroococcus sp*, an unicellular alga.



Echinococcus granulosus is a small tapeworm (2 – 4 mm long) found in large numbers in intestines of infected dogs.



Using your knowledge of nutrition in different organisms and the information provided, identify the different modes of nutrition in each of the **four labelled** organisms shown in the images.
Describe what is meant by each mode of nutrition you identify.
Explain the adaptations of each of these organisms to their mode of nutrition. [9 QER]