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Cambridge Assessment International Education

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CANDIDATE NAME

CENTRE NUMBER

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BIOLOGY **0610/41**

Paper 4 Theory (Extended) **October/November 2025**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

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[Turn over

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1 **(a)** Fig. 1.1 shows drawings of seven species of bacteria.

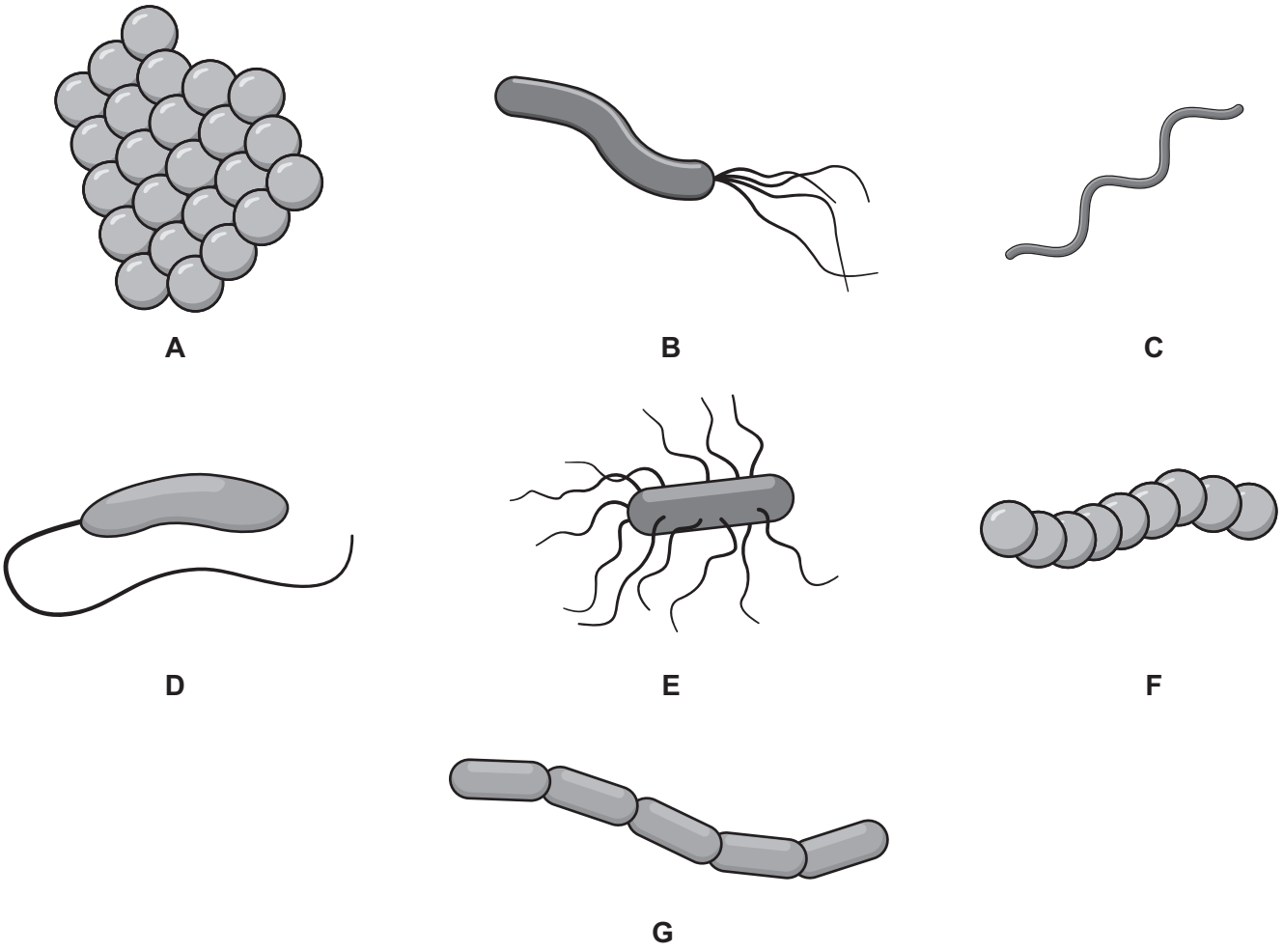


Fig. 1.1

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Use the key to identify each species of bacteria in Fig. 1.1.

Write the letter of each species (**A** to **G**) in the correct box beside the key.

One has been done for you.

key

1	(a)	hair-like structure or structures visible	go to 2	
	(b)	no hair-like structures visible	go to 4	
2	(a)	more than one hair-like structure	go to 3	
	(b)	one hair-like structure only	*Vibrio cholerae*	
3	(a)	hair-like structures attached at one end only	*Helicobacter pylori*	
	(b)	hair-like structures attached all over	*Salmonella typhi*	
4	(a)	bacteria have a spiral shape	*Treponema pallidum*	
	(b)	bacteria do **not** have a spiral shape	go to 5	
5	(a)	bacteria are grouped to form a chain	go to 6	
	(b)	bacteria do **not** form a chain	*Staphylococcus aureus*	
6	(a)	bacteria in the chain are cylindrical in shape	*Streptobacillus moniliformis*	
	(b)	bacteria in the chain are circular in shape	*Streptococcus pyogenes*	**F**

[3]

(b) (i) A cylinder-shaped bacterium has a length of 2 μm and a diameter of 0.5 μm.

Calculate:

- the radius of this bacterium
- the volume of this bacterium.

Include the units in your answers.

Space for working.

radius .....

volume .....

[4]

(ii) State the name of the kingdom that bacteria belong to.

..... [1]

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(c) Fig. 1.2 is a diagram of a virus.

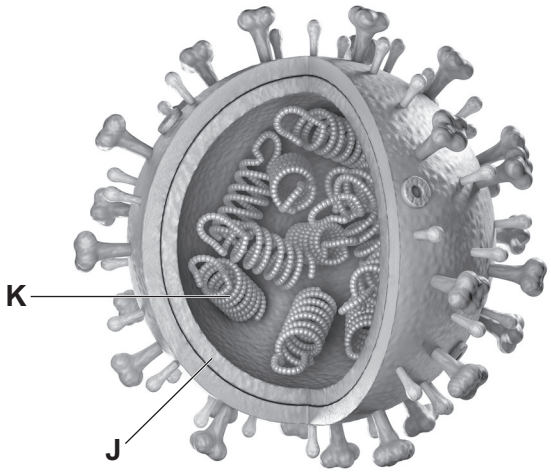


Fig. 1.2

(i) State the name of the parts labelled **J** and **K** in Fig. 1.2.

J .....

K .....

[2]

(ii) State **two** structures present in bacteria that are absent in viruses.

1 .....

2 .....

[2]

[Total:12]

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2 **(a)** Fig. 2.1 is a diagram of part of the human circulatory system.

The arrows show the direction of blood flow.

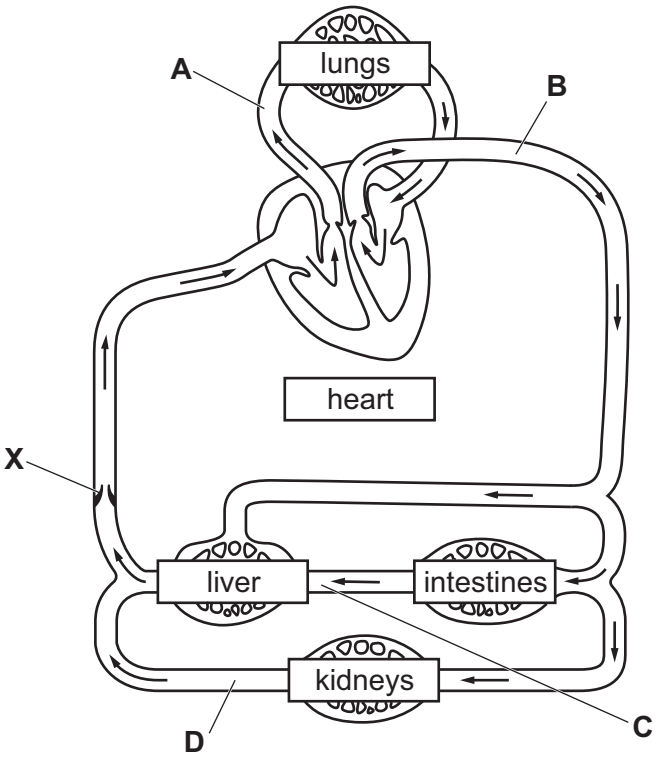


Fig. 2.1

(i) Complete Table 2.1 by naming the blood vessels in Fig. 2.1 and stating whether the blood in each vessel is oxygenated.

Table 2.1

letter in Fig. 2.1	name of the blood vessel	carries oxygenated blood (yes / no)
A		
B		
C		
D		

[4]

(ii) State the name of structure **X** in Fig. 2.1 and outline its function.

name .....

function .....

.....

[2]

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(b) Fig. 2.2 is a diagram of part of a fish circulatory system.

The arrows show the direction of blood flow.

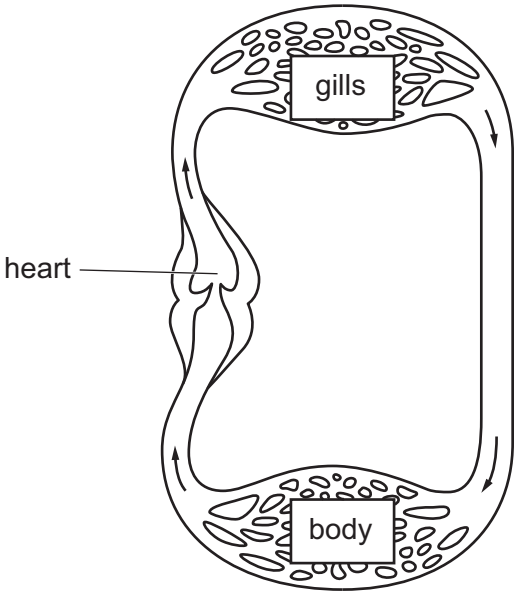


Fig. 2.2

(i) Describe how the structure of the fish heart in Fig. 2.2 differs from a human heart.

.....

.....

.....

.....

..... [2]

(ii) Explain the advantages of the type of circulatory system found in humans, compared with the circulatory system shown in Fig. 2.2.

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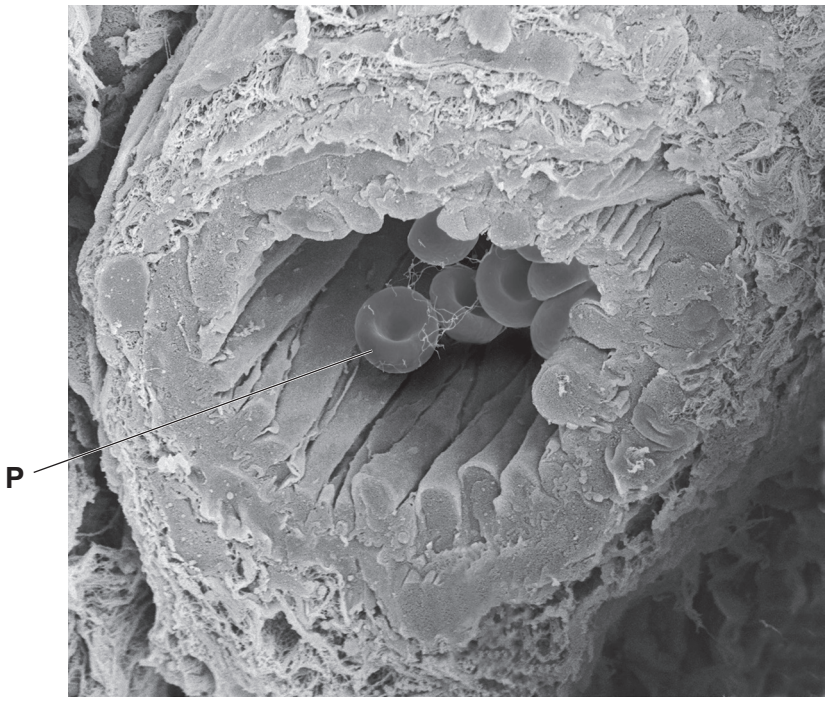
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(c) Fig. 2.3 is a photomicrograph of an arteriole.



magnification ×1430

Fig. 2.3

(i) Identify the structure labelled **P** in Fig. 2.3.

..... [1]

(ii) The magnification of the image is provided. Write the formula that would be used to calculate the actual diameter of the lumen of the arteriole in Fig. 2.3.

..... [1]

(iii) The actual diameter of the lumen of the arteriole shown in Fig. 2.3 is 0.0315 mm.

Convert 0.0315 mm to micrometres (μm).

..... μm [1]

[Total:15]

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3 Fig. 3.1 is a diagram of the nitrogen cycle.

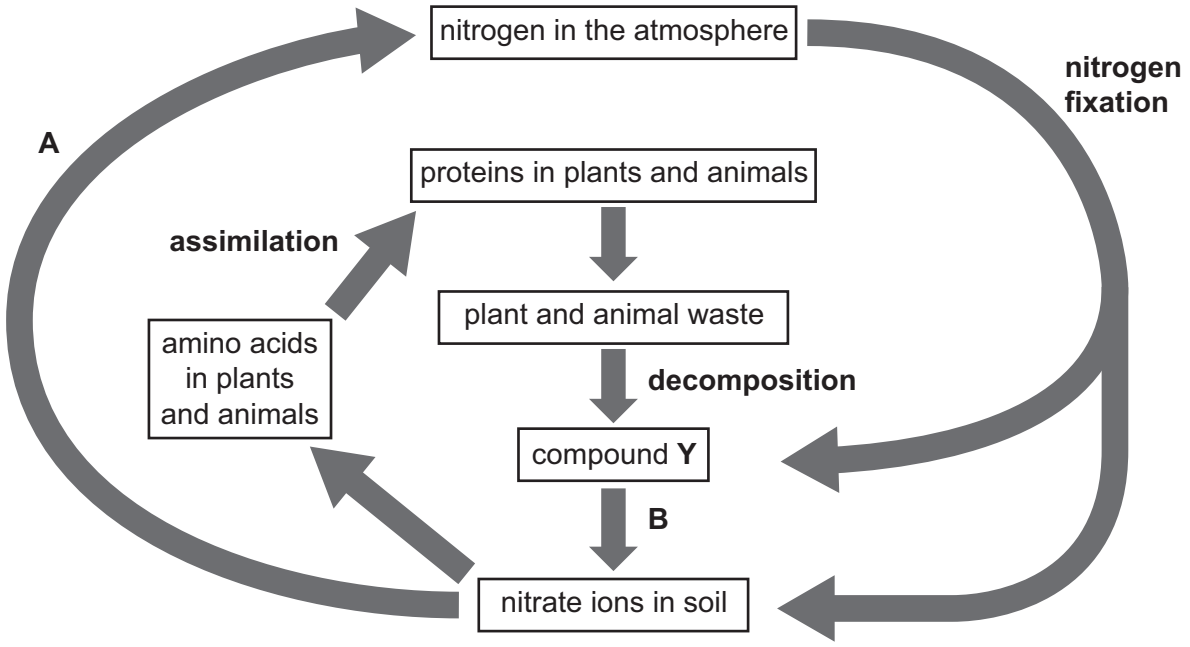


Fig. 3.1

(a) (i) State the names of processes **A** and **B** in Fig. 3.1.

A .....

B .....

[2]

(ii) State **two** ways that nitrogen fixation can occur.

1 .....

2 .....

[2]

(iii) State the name of compound **Y** in Fig. 3.1.

..... [1]

(iv) State the name of an organ in animals, where assimilation **and** deamination of amino acids occurs.

..... [1]

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(v) Describe the process of deamination.

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..... [2]

(b) Complete the sentences about pollution of the air by writing the appropriate words or phrases in the spaces provided.

Methane is a pollutant gas that contributes to the enhanced .....

and climate change. Methane is released into the atmosphere from cattle and from the

farming of ..... crops.

..... is a gas that is absorbed by trees in the process

of ..... . This gas is released into the atmosphere by the

..... of fossil fuels, where it also contributes to climate change.

[5]

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(c) Explain the process of eutrophication in aquatic ecosystems.

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..... [6]

[Total:19]

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4 Fig. 4.1 is a photograph of a bee on a flower. One of the bee's legs is covered with pollen.



Fig. 4.1

(a) (i) State **three** features of flowers that attract pollinating insects such as bees.

1 .....

2 .....

3 .....

[3]

(ii) State **one** way that pollen grains are adapted for pollination by bees.

.....

.....

..... [1]

(b) Describe **two** ways the structure of a monocotyledonous plant differs from the structure of a dicotyledonous plant.

1 .....

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2 .....

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[2]

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(c) Fig. 4.2 is a diagram of a cross-section of an insect-pollinated flower.

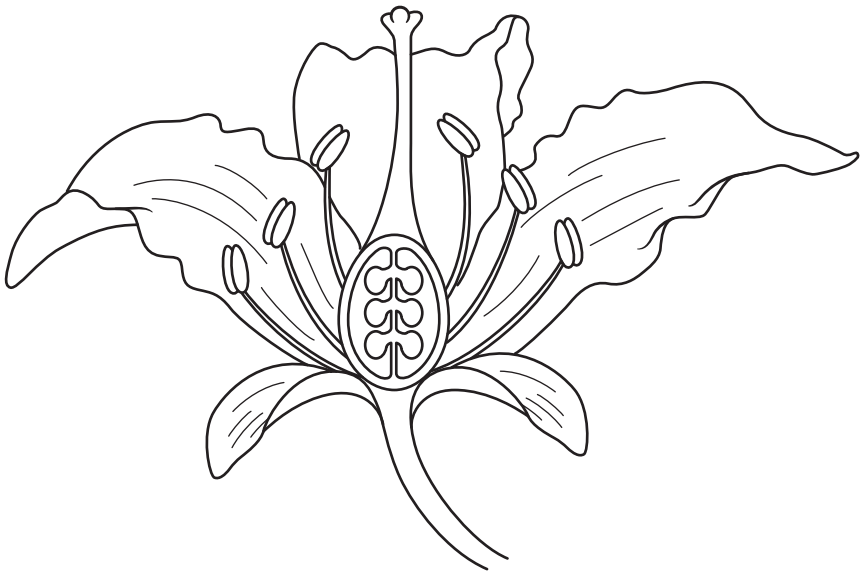


Fig. 4.2

On Fig. 4.2, name and draw label lines to:

- the structure that supports an anther
- a structure that protects the flower bud
- an ovule.

[3]

(d) Describe sexual reproduction in a flower, from the release of pollen to the formation of a zygote.

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..... [5]

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(e) Sexual reproduction also occurs in humans.

(i) State the name of the male gamete in a human.

..... [1]

(ii) State where gametes are formed in the human male reproductive system.

..... [1]

(iii) Human male gametes are haploid.

State the name of the process that produces haploid male gametes.

..... [1]

(iv) Describe the function of the prostate gland in the male reproductive system.

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..... [1]

[Total: 18]

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5 A student investigated the effect of humidity on water vapour loss in plant leaves. As water vapour was lost, the mass of the leaves decreased.

Similar-sized leaves were collected from one species of plant.

The leaves were divided into two groups, **A** and **B**. The leaves in group **A** were placed in a low humidity environment and the leaves in group **B** were placed in a high humidity environment. The leaves in each group were kept in their environment for 12 hours.

The temperature in each environment was maintained at 20 °C.

The mass of the leaves in each group was measured at the start of the investigation and then every hour throughout the 12-hour period.

The student calculated the mass of water vapour lost as a percentage of the starting mass of the leaves for each group.

Fig. 5.1 shows the student's results.

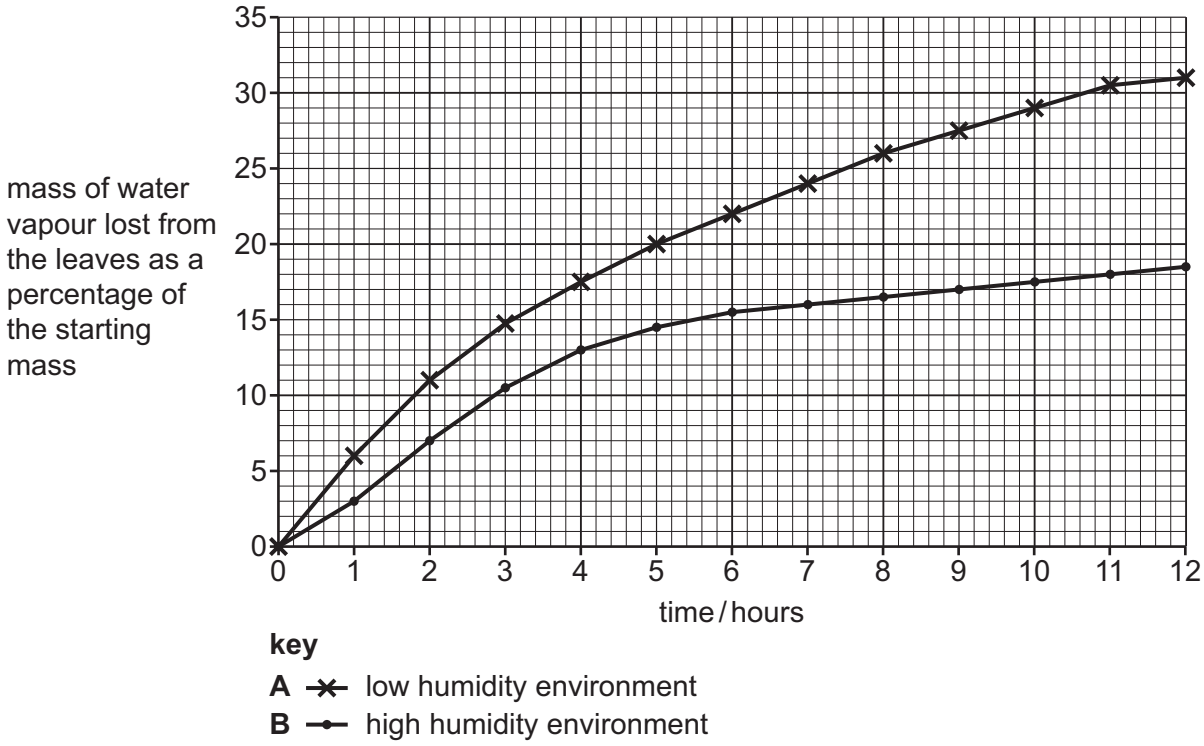


Fig. 5.1

(a) (i) State the name of the process by which water vapour is lost from plant leaves.

..... [1]

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(ii) Compare **and** explain the effects of high and low humidity shown in Fig. 5.1.

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..... [5]

(iii) The students repeated the investigation at a temperature of 35 °C.

The leaves were kept in a low humidity environment.

Draw a line **on the graph** in Fig. 5.1 to predict the results of this investigation. [1]

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(b) Humans also lose water vapour from their bodies by sweating.

(i) Explain how sweating helps a person to maintain a constant internal body temperature.

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..... [3]

(ii) State **one** other way that humans lose water vapour from their bodies.

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..... [1]

[Total:11]

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6 Fig. 6.1 is a diagram of a cell that shows how DNA is involved in protein synthesis.

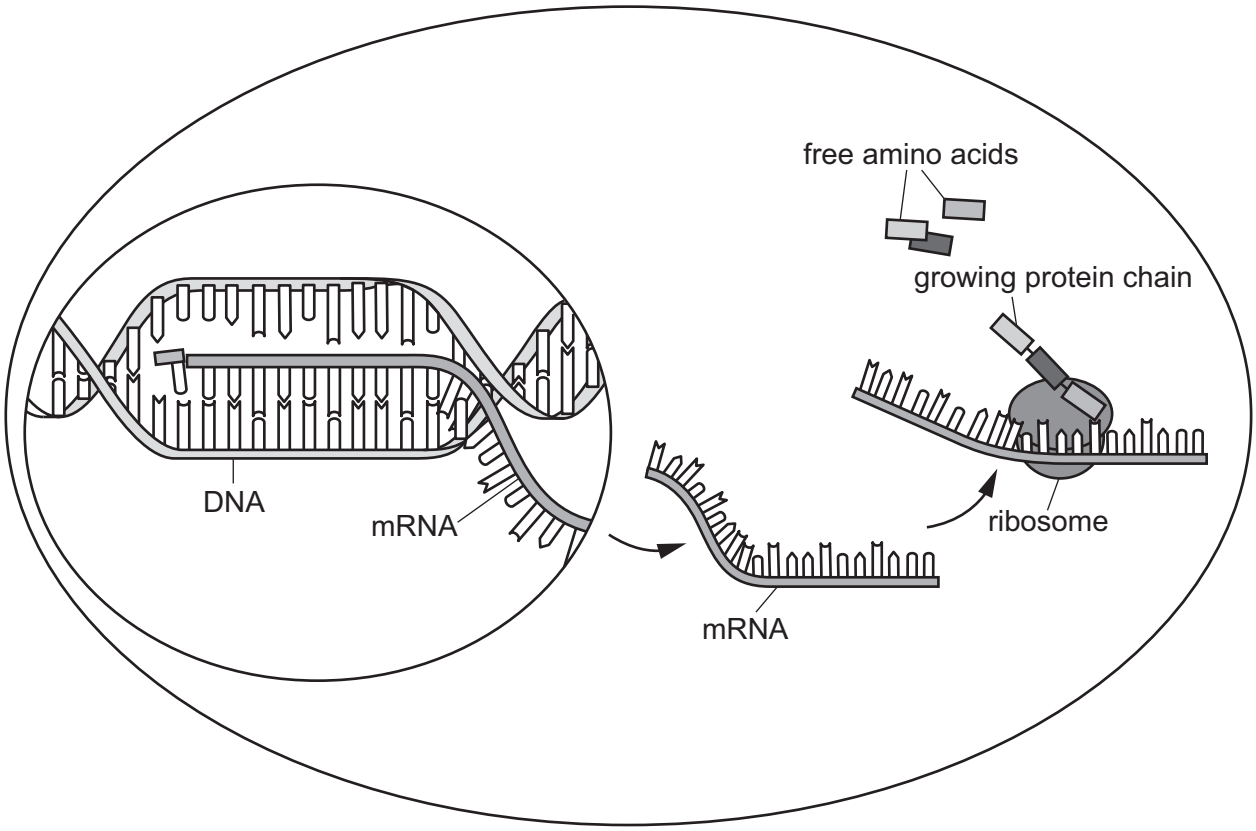


Fig. 6.1

(a) State the name of the part of the cell that contains DNA.

..... [1]

(b) DNA controls cell function by controlling the production of proteins.

State the name of **one** type of protein.

..... [1]

(c) Using Fig. 6.1, explain how mRNA is involved in protein synthesis.

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..... [3]

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