Cambridge Assessment International Education

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

BIOLOGY **0610/41**

Paper 4 Theory (Extended) **October/November 2022**

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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1 **(a)** Fig. 1.1 is a side view of a human skull indicating the four types of teeth and the jaws.

View solution

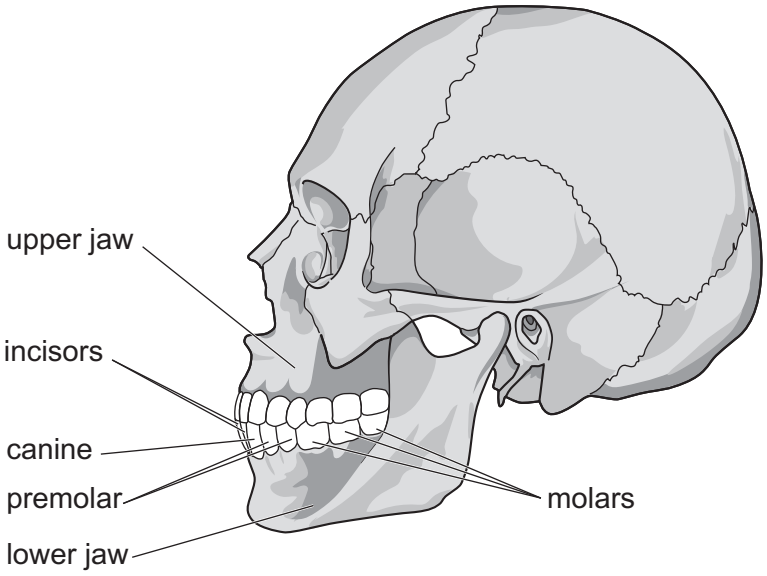

Fig. 1.1

(i) State the function of human teeth.

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..... [1]

(ii) State the name of the visible outer layer of the teeth.

View solution

..... [1]

(iii) Explain the process of tooth decay in humans.

View solution

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..... [3]

(b) Mammals can be classified according to the position and shape of their teeth.

Fig. 1.2 shows the skulls of seven mammals.

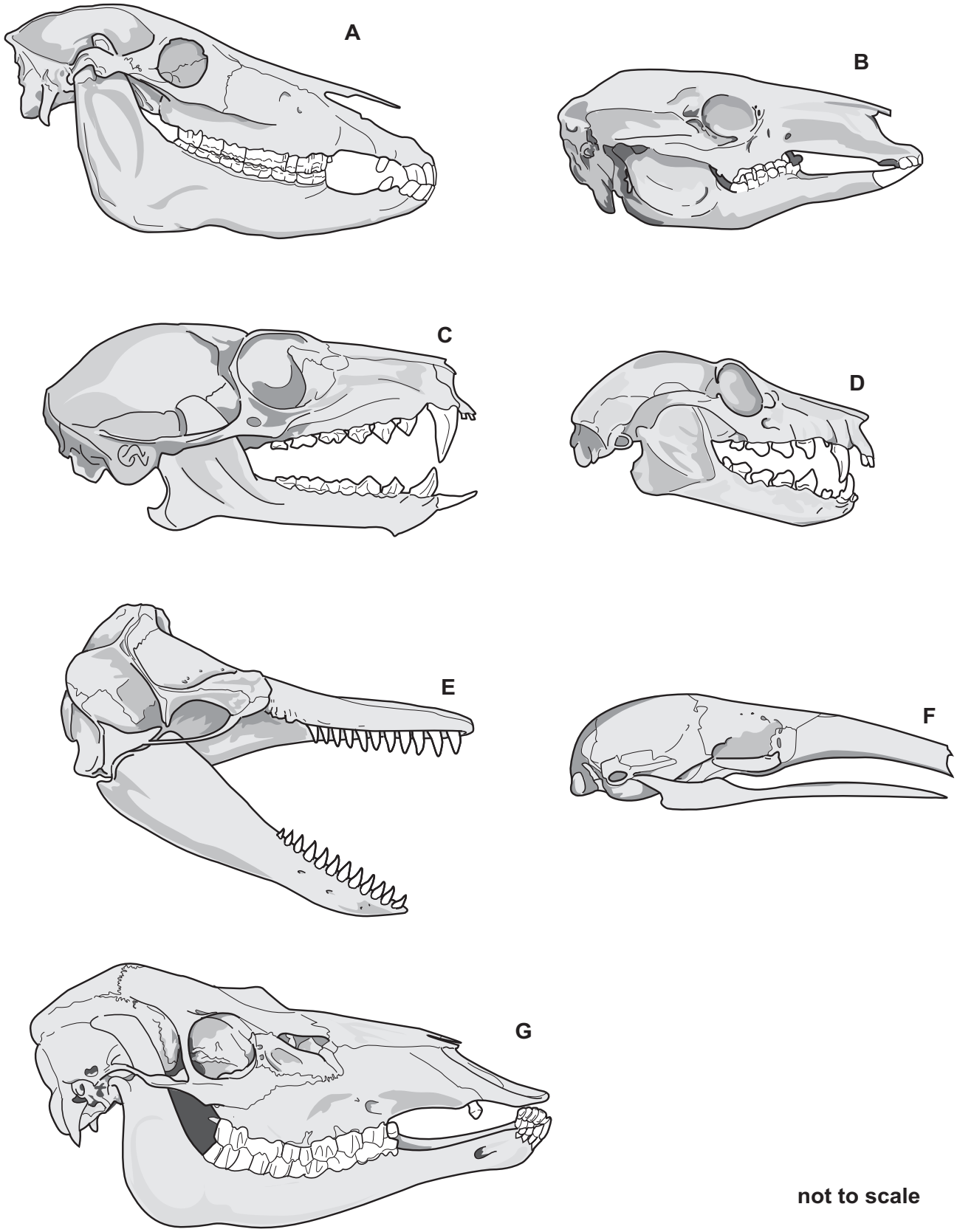

Fig. 1.2

(i) Use the key to identify each species shown in Fig. 1.2.

View solution

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

Key

1 (a)	two or more different types of teeth	go to 2	
(b)	fewer than two different types of teeth	go to 3	
2 (a)	have wide gap between front and back teeth in both jaws	go to 4	
(b)	have no wide gap between front and back teeth in both jaws	go to 6	
3 (a)	all teeth of similar shape	*Orcinus orca*	
(b)	no teeth on either jaw	*Myrmecophaga tridactyla*	
4 (a)	no incisors in upper jaw	*Cervus elephus*	
(b)	incisors in both upper and lower jaw	go to 5	
5 (a)	incisors on lower jaw longer than incisors on upper jaw	*Macropus rufus*	
(b)	incisors on upper and lower jaw are similar in size	*Equus ferus*	
6 (a)	incisors on lower jaw project forwards	*Lemur catta*	
(b)	incisors on lower jaw do not project forwards	*Pteropus niger*	

[4]

(ii) Killer whales, *Orcinus orca*, are mammals.

View solution

State **two internal** features you would expect to find in a killer whale that you would **not** find in a fish.

1 .....

2 .....

[2]

(iii) State the name of the group of animals that includes mammals and fish.

View solution

..... [1]

[Total: 12]

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2 Digestive enzymes catalyse the breakdown of large insoluble molecules.

(a) (i) Explain why it is important that large insoluble molecules are broken down by chemical digestion.

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..... [2]

(ii) State the name of the substance that is the solvent for most molecules that have been digested by enzymes.

..... [1]

(b) The activity of two protease enzymes, **A** and **B**, was measured at different pHs. Both enzymes are found in the human alimentary canal.

View solution

The results are shown in Fig. 2.1.

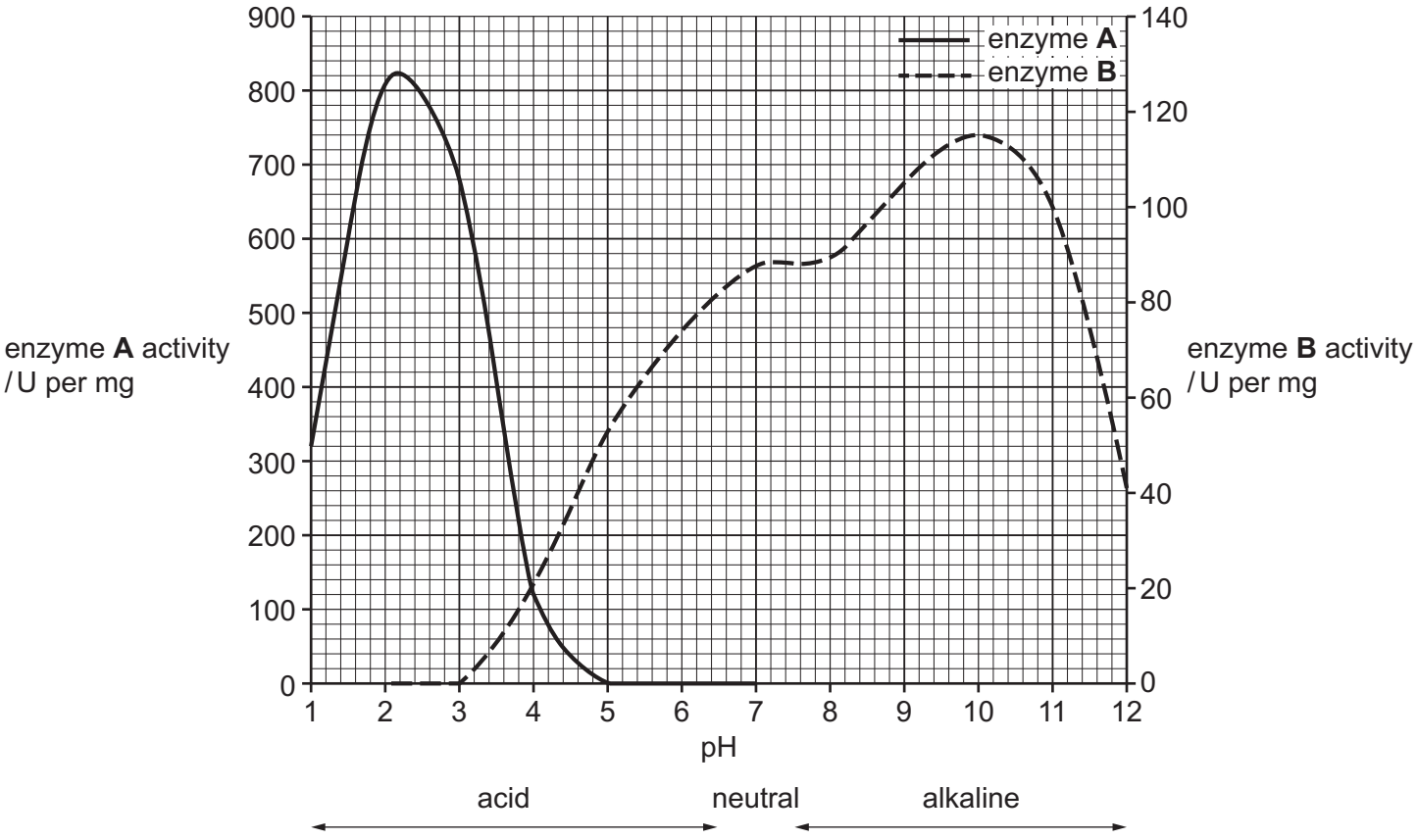

Fig. 2.1

Describe **and** explain the roles of the two protease enzymes, **A** and **B**, in the alimentary canal.

Use the information in Fig. 2.1 to support your answer.

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..... [6]

(c) Maltase is a digestive enzyme that acts in the small intestine.

View solution

State the exact location of maltase in the small intestine.

..... [1]

[Total: 10]

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3 **(a)** Fig. 3.1 shows some apparatus that was used to investigate water loss from a leafy shoot.

View solution

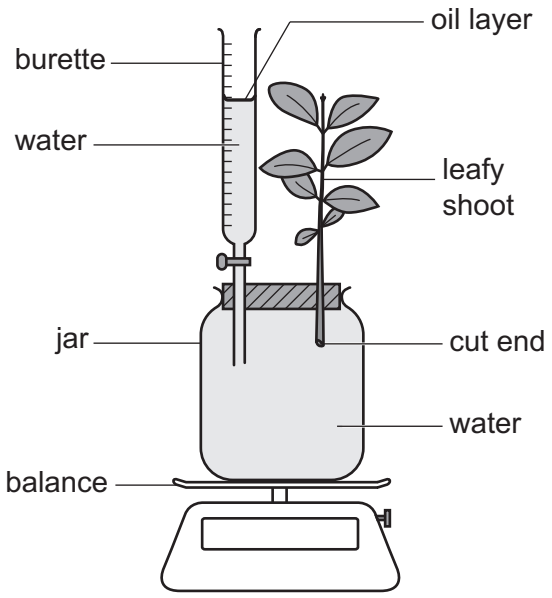

Fig. 3.1

(i) State the name of the process by which leafy shoots lose water.

..... [1]

(ii) Before the leafy shoot is inserted into the jar shown in Fig. 3.1, it must be recut under water.

Suggest why the end of the leafy shoot was cut under water.

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..... [1]

(iii) State the purpose of the oil layer on top of the water in the burette.

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..... [1]

(iv) Using the information in Fig. 3.1, describe **one** method that can be used to determine how much water is lost from the leafy shoot.

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..... [1]

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(b) The apparatus shown in Fig. 3.1 was used to investigate the effect of temperature on the rate of water loss in a species of plant. The results are shown in Fig. 3.2.

View solution

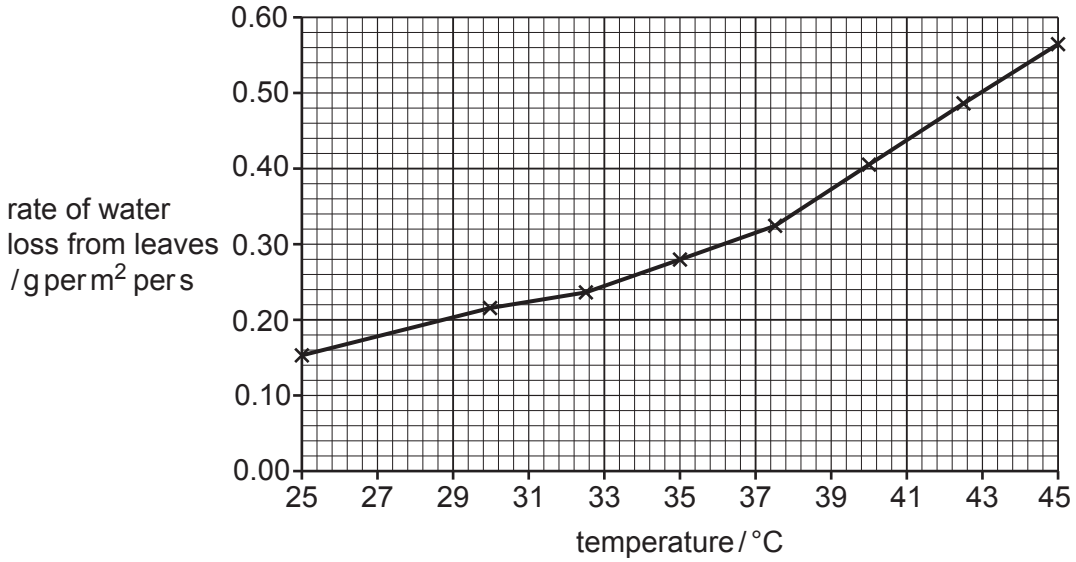

Fig. 3.2

(i) Using the information in Fig. 3.2, calculate how much water would be lost from 1 m^2 of leaves in 12 hours if the plants were kept at 35 °C. Include the unit.

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[3]

(ii) Using the information in Fig. 3.2, describe **and** explain the effect of increasing temperature on the rate of water loss in this species of plant.

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..... [5]

(c) The apparatus shown in Fig. 3.1 can also be used to investigate the effects of changing humidity on water loss in plants.

(i) Suggest why the mass of water in the apparatus does **not** change when the leafy shoot is kept at 100% relative humidity.

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..... [2]

(ii) Even at extremely low relative humidities the leafy shoot did not wilt.

View solution

Explain why the leafy shoot shown in Fig. 3.1 did **not** wilt.

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..... [1]

(iii) The investigation on the effect of temperature was done at a relative humidity of 20%.

The investigation was repeated at a relative humidity of 80% and all other conditions were kept the same.

Predict how the water loss will differ from the trend shown in Fig. 3.2.

Sketch your prediction **on Fig. 3.2**.

[1]

[Total: 16]

4 Chromosomes are made of DNA.

(a) Describe the structure of a DNA molecule.

View solution

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..... [4]

(b) **(i)** Outline how antibiotic resistance develops in a population of bacteria.

View solution

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..... [3]

(ii) Scientists use differences in antibiotic-resistance genes to distinguish between different strains of the bacterium, methicillin-resistant *S. aureus* (MRSA).

Suggest why scientists use differences in base sequences to classify the strains of MRSA rather than using other methods.

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..... [1]

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(iii) Explain why scientists are concerned that some strains of bacteria, such as *S. aureus*, have become resistant to antibiotics.

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..... [2]

(c) (i) Describe how the use of antibiotics can be managed to reduce the development of resistant strains of bacteria.

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..... [2]

(ii) Suggest why MRSA is unlikely to be transmitted from a mother to her unborn fetus.

View solution

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..... [1]

(d) Many species of bacteria do not cause disease. Bacteria are very important in many biological processes.

State the names of **three** natural processes involving bacteria that are important to ecosystems.

1 .....

2 .....

3 .....

[3]

[Total: 16]

View solution

5 Fires release carbon dioxide into the atmosphere.

(a) (i) State **one** other natural process that releases carbon dioxide into the atmosphere.

View solution

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..... [1]

(ii) Carbon dioxide is a greenhouse gas.

View solution

State the name of **one** other greenhouse gas.

..... [1]

(b) Data scientists used satellite images to analyse the occurrence of fires globally, during a 14-year period. They tracked all fires that were larger than 0.21 km^2 and therefore visible from space.

Table 5.1 summarises some of their data, categorising the fires by location. The locations include natural ecosystems and land that is managed by people. The expansion rate is the speed at which each fire becomes larger.

Table 5.1

location of fire	estimated total number of fires	estimated average expansion rate of fires / km^2 per day	estimated average duration of fires / days
natural boreal forest	197 124	0.6	5.4
natural temperate forest	178 909	0.4	4.1
natural savannah (grassland with few trees)	9 809 719	0.7	4.6
managed land being deforested	909 826	0.3	3.8
managed agricultural land	1 631 918	0.3	3.4

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(i) Using the information in Table 5.1, compare the data for the two managed locations with the data for the three natural locations.

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..... [3]

(ii) Describe how the data in Table 5.1 could be used to estimate the total area that was burnt during the 14-year period, for each location.

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..... [2]

(iii) Burning large areas of forest is a cause of habitat destruction.

View solution

Describe the possible consequences of habitat destruction.

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..... [3]

[Total: 10]

6 **(a)** Fig. 6.1 shows part of the human gas exchange system.

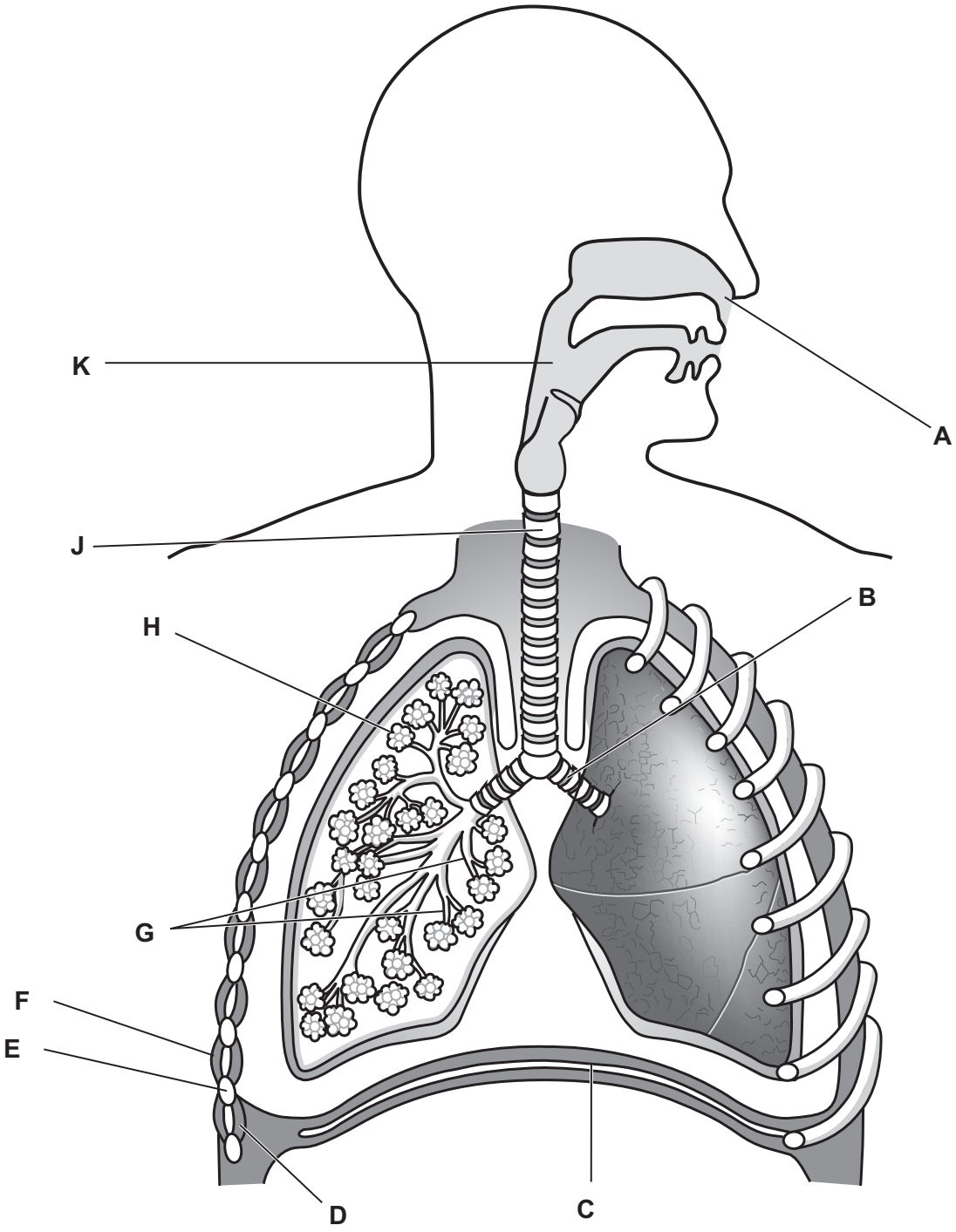

Fig. 6.1

(i) Table 6.1 shows the names of some parts of the human gas exchange system, their functions and the letters in Fig. 6.1 that identify the parts.

View solution

Complete Table 6.1.

Table 6.1

function	name of the structure	letter in Fig. 6.1
	hairs in the nose	**A**
prevents collapse of the airway		
contracts to decrease the pressure in the thorax		**F**
	diaphragm	
protects the lungs from mechanical damage		
contains cilia to move mucus out of the airway		
site of gas exchange	alveoli	

[7]

(ii) Describe and explain how the alveoli are adapted for gas exchange.

View solution

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..... [3]

(b) (i) Explain the differences in composition between inspired and expired air.

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..... [3]

(ii) Physical activity changes the concentration of carbon dioxide in the body.

View solution

State where this change is detected **and** how the body responds to the change.

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..... [2]

(iii) State the name of a solution that can be used to test for the presence of carbon dioxide gas.

..... [1]

[Total: 16]

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