Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

* 6 3 1 5 2 9 4 3 6 8 *

BIOLOGY **5090/22**

Paper 2 Theory **October/November 2025**

1 hour 45 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 **16** pages. Any blank pages are indicated.

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1 **(a)** Hormones are produced by glands in the body. They alter the activity of specific target organs.

Draw lines to link:

- each gland to a hormone it produces
- each hormone to a specific target organ.

Two lines have been drawn for you. Draw **six** more lines.

gland	**hormone**	**target organ**
adrenal	glucagon	ovary
ovary	progesterone	uterus
pancreas	follicle-stimulating hormone (FSH)	heart
pituitary	adrenaline	liver

[5]

(b) Name a chemical that is produced in a plant shoot to coordinate the shoot's response to gravity.

..... [1]

[Total: 6]

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2 A constant supply of water is essential for both animals and plants.

(a) Fig. 2.1 is a diagram showing the average daily water intake and average daily water loss for an adult human.

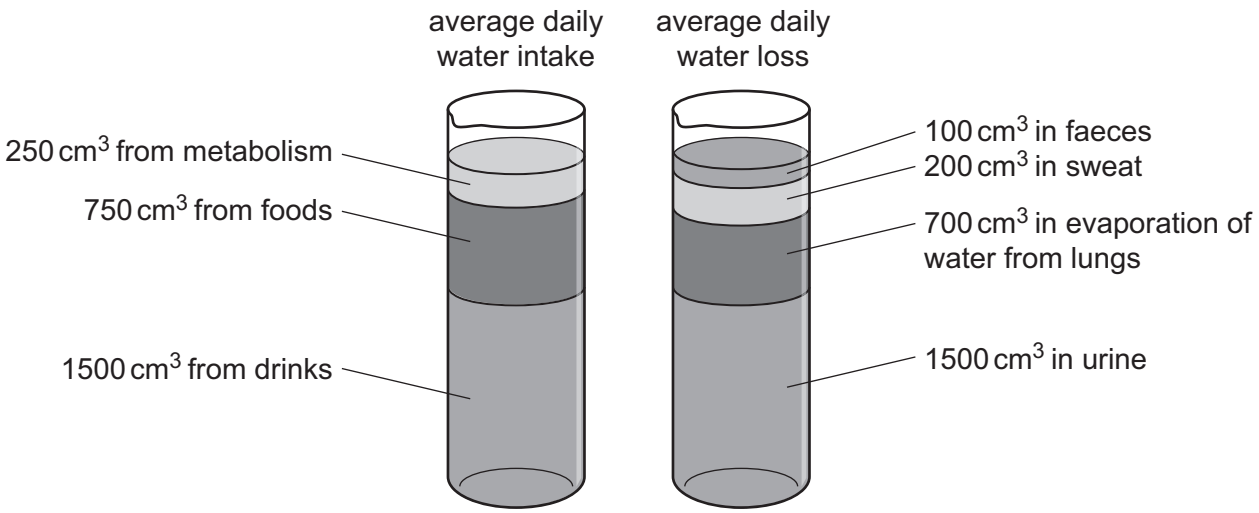

Fig. 2.1

(i) Calculate the percentage of average daily water intake that is lost in sweat from an adult human.

Space for working.

..... % [2]

(ii) The percentage of water lost in sweat is **not** always the same.

Explain why.

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(b) A scientist measured the mass of water taken up and lost by a plant over 21 hours. The plant was kept at a constant temperature of 20 °C on a windowsill in a laboratory. Readings were taken every 90 minutes.

At 0 hours it was sunrise and at 15 hours it was sunset.

The results are shown in Fig. 2.2.

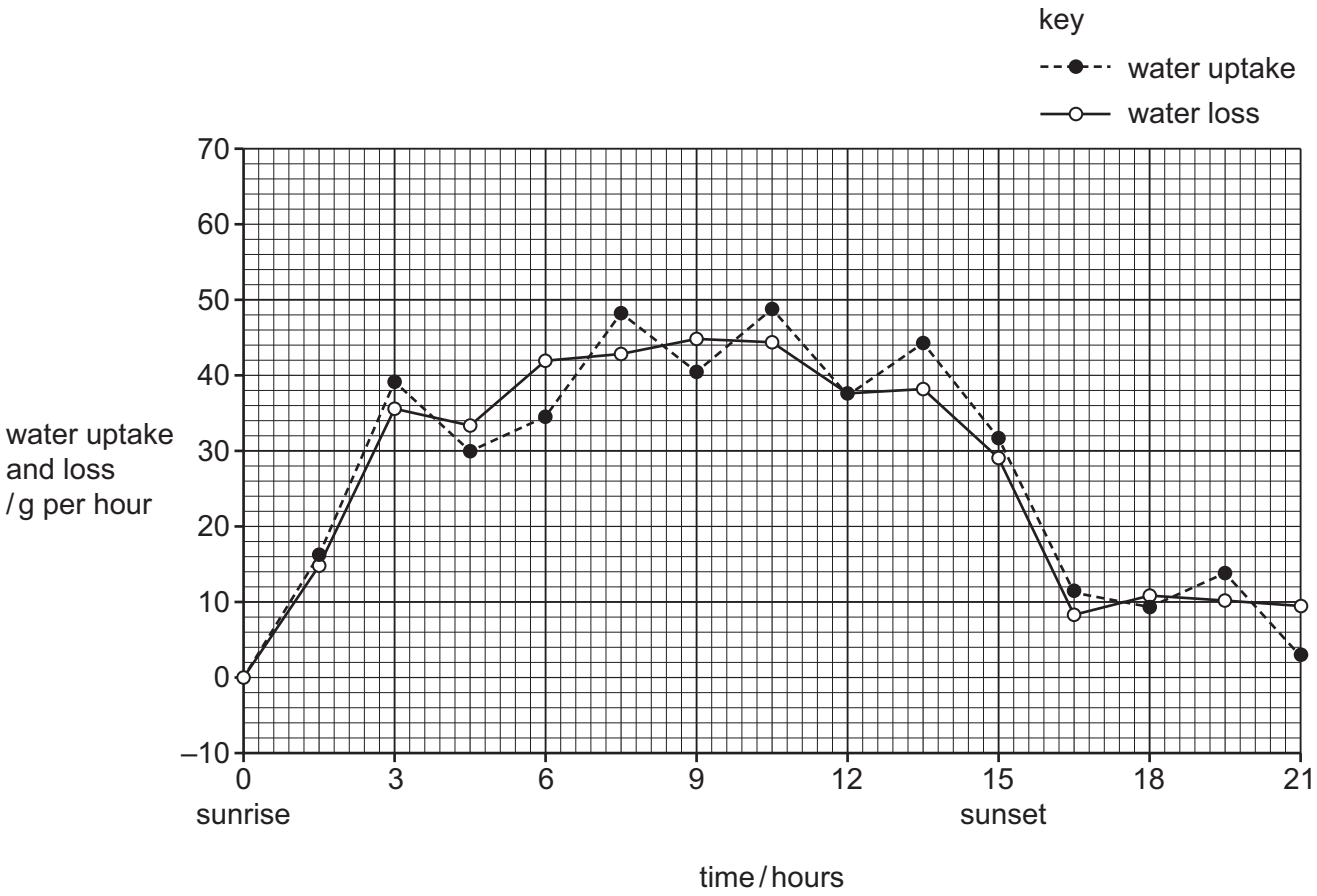

Fig. 2.2

(i) Plants lose water by evaporation from their leaves.

State the name of this process.

..... [1]

(ii) Explain the shape of the curve for **water loss** from the plant over the 21 hours of the experiment.

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..... [2]

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(iii) Explain why the shape of the curve for water loss is very similar to the shape of the curve for water uptake.

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..... [3]

(iv) The scientist repeated the experiment. All conditions were kept the same except the temperature of the laboratory, which was 10 °C lower.

On Fig. 2.2, draw a new curve to show the expected results for **water loss** at the lower temperature. [1]

[Total: 12]

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3 *Azolla* is a genus of small ferns that float in slow-flowing or stationary fresh water.
Azolla has cavities in its leaves that contain nitrogen-fixing bacteria called *Anabaena azollae*.

In some parts of the world, farmers grow *Azolla* in their rice fields. Rice fields are flooded with water so that rice plants grow half submerged.

Fig. 3.1 shows rice and *Azolla* growing together in a flooded field.
Fig. 3.2 shows a section through an *Azolla* leaf.

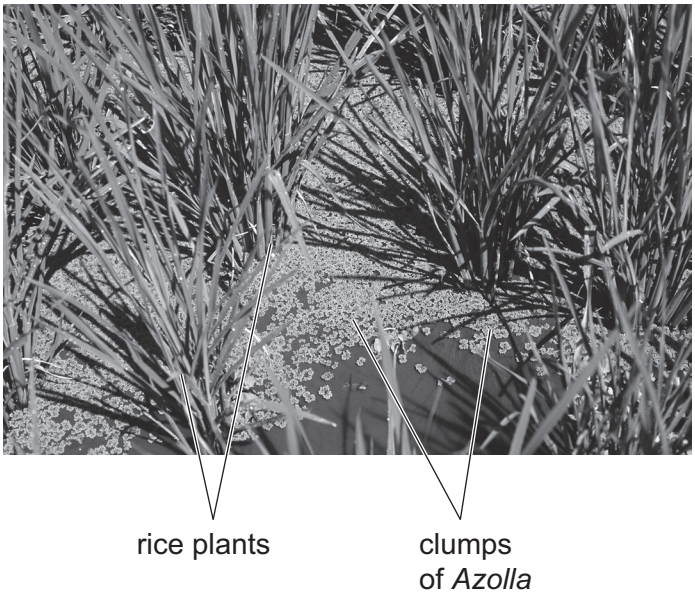

Fig. 3.1

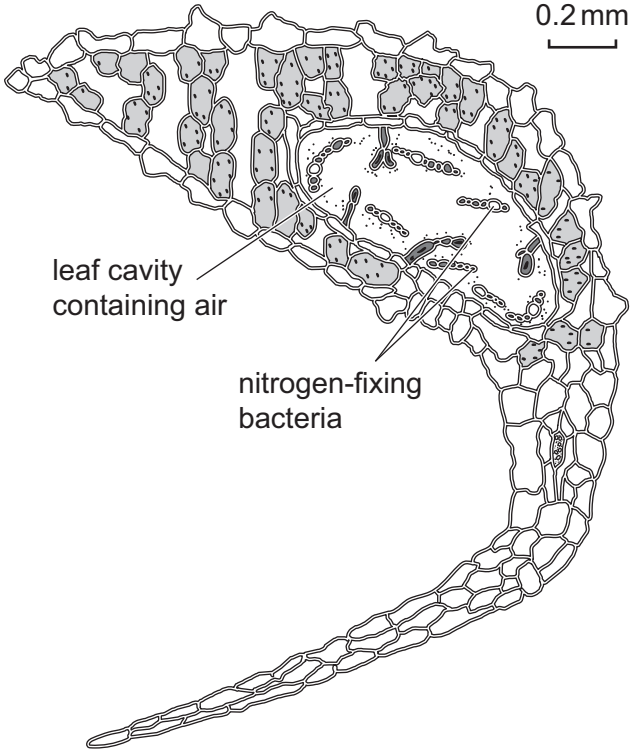

Fig. 3.2

(a) *Azolla* is a fern and rice is a flowering plant.

Ferns and flowering plants are two groups in the plant kingdom.

(i) Using information from Fig. 3.1 and Fig. 3.2, state **two** structural features used to classify *Azolla* in the plant kingdom.

1 .....

2 .....
[2]

(ii) Complete the sentences below.

Rice plants reproduce sexually and after pollination they produce ..... that are then dispersed.

Azolla reproduces sexually by producing ..... . [1]

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(b) Farmers grow *Azolla* in rice fields to increase the rice yield.

Suggest why the rice yield increases.

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..... [3]

(c) *Azolla* can grow very quickly. It can remove as much as 1.5 kg / m^2 / year of carbon from the atmosphere.

(i) Describe how *Azolla* removes carbon from the atmosphere.

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..... [4]

(ii) Explain why removing carbon from the atmosphere may help the global environment.

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..... [3]

(d) Different species of *Azolla* are found naturally in many countries. *Azolla* has also been introduced by humans to some countries where it is **not** native. When *Azolla* is introduced to a country, it can have an impact on natural fresh water ecosystems.

Suggest how *Azolla* can have an impact on these fresh water ecosystems.

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..... [3]

[Total: 16]

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4 Lipases are enzymes produced by animals, plants and microorganisms. Lipases from different species can have different chemical structures.

(a) All enzymes are biological catalysts.

Explain what is meant by the term catalyst.

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..... [2]

(b) Lipase is a digestive enzyme in humans.

(i) Name an organ that secretes lipase into the duodenum.

..... [1]

(ii) Name the substrate and products of lipase.

substrate .....

products .....

[2]

(c) Some scientists collected species of bacteria from three different sources, **A**, **B** and **C**.

The scientists investigated how temperature affected the activity of the lipase produced by the bacteria collected from the three different sources. They wanted to find a source of lipase that could be used in biological washing powders.

Fig. 4.1 shows the results.

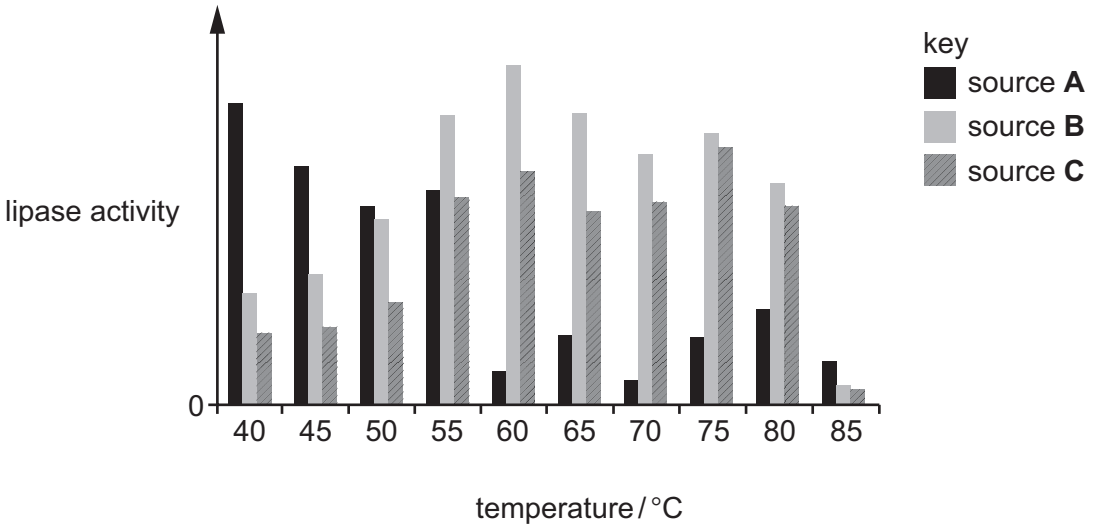

Fig. 4.1

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(i) Using Fig. 4.1, discuss the results from this investigation.

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..... [3]

(ii) The lipase molecules produced by different species of bacteria have different chemical structures.

Explain:

- what determines the different chemical structures of lipase molecules
- why having different chemical structures can affect their activity at different temperatures.

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..... [3]

[Total: 11]

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5 A sample of human blood is put in a small tube. The tube is placed in a centrifuge, which spins it around very fast, to separate the components of the blood. The denser components of the blood collect at the bottom of the tube.

Fig. 5.1 shows the composition of this blood sample.

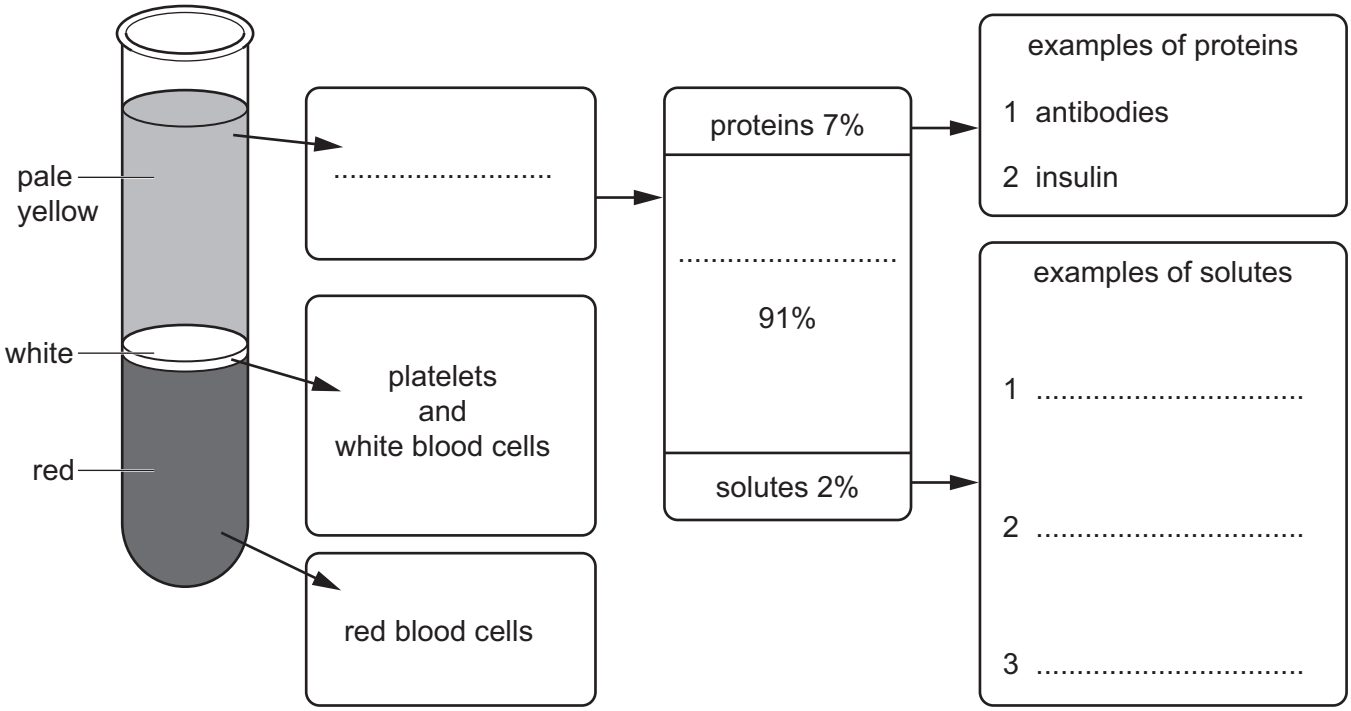

Fig. 5.1

(a) **(i)** Complete Fig. 5.1 by filling in the names of **five** components shown by the blank spaces. [5]

(ii) Suggest why red blood cells are **more** dense than white blood cells.

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..... [2]

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(b) The ABO blood groups in humans are determined by three alleles, I^A, I^B and I^O.
There are four blood groups (phenotypes) but six different genotypes for the ABO blood groups.

Complete Table 5.1 to match the blood groups to their possible genotypes.

Table 5.1

blood group (phenotype)	possible genotype(s)
A	
B	
AB	
O	

[4]

(c) A pregnant woman has blood group O.

The fetus in the woman's uterus developed from one of her fertilised eggs and has blood group B.

(i) State the **genotype** of the fetus.

..... [1]

(ii) The woman and the fetus have different blood groups so they have different antigens on their red blood cell membranes.

The woman has antibodies to the antigens on the red blood cell membranes of the fetus.

Explain why the woman's antibodies are **not** usually able to come into contact with the antigens of the fetus.

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[Total: 15]

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6 Cholera is a disease caused by the pathogen *Vibrio cholerae*.

Outbreaks of cholera often occur after natural disasters such as earthquakes.

(a) **(i)** *Vibrio cholerae* is a microorganism.

Name the type of microorganism.

..... [1]

(ii) Suggest and explain reasons why outbreaks of cholera are more likely after natural disasters.

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(b) An infection with *Vibrio cholerae* can cause severe diarrhoea. This can be treated by giving the patient a solution to drink.

Fig. 6.1 shows the ingredients of a standard solution.

water	1000 cm^3
sodium chloride	3.5 g
potassium chloride	1.5 g
trisodium citrate dihydrate	2.9 g
glucose	20.0 g

Fig. 6.1

(i) Explain how an infection with *Vibrio cholerae* causes diarrhoea.

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..... [4]

(ii) Using Fig. 6.1, suggest why giving the patient this solution to drink is an effective treatment for diarrhoea.

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[Total: 10]

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7 The mammalian nervous system is essential for coordination and control.

It is an organ system that contains the eyes.

(a) Explain the differences between organs, tissues and cells, using the eye as an example.

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..... [4]

(b) Synapses are found in the mammalian nervous system.

Explain how the structure of a synapse ensures that electrical impulses travel in **one** direction only.

You may use the outline of a synapse in Fig. 7.1 to illustrate your answer.

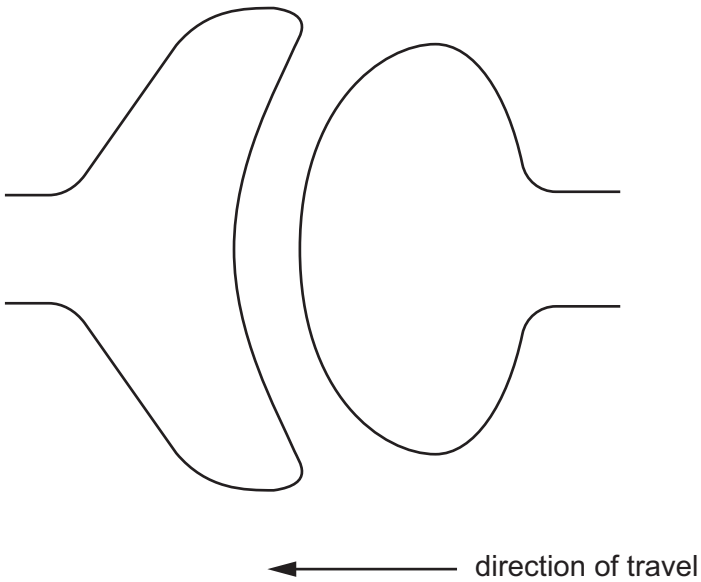

Fig. 7.1

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[Total: 10]

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