* 0019656624201 *

Cambridge Assessment International Education

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CENTRE NUMBER

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BIOLOGY **0610/42**

Paper 4 Theory (Extended) **May/June 2024**

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

1 Fungal cells and plant cells contain mitochondria.

(a) (i) State the function of mitochondria.

..... [1]

(ii) State **one** feature of plants that is used to distinguish them from fungi.

.....

.....

..... [1]

(b) Yeast is a fungus that can respire to produce ethanol.

State the balanced chemical equation for this type of respiration in yeast.

..... [2]

(c) A scientist investigated the effect of sugar on respiration in yeast cells.

One flask contained 100 cm^3 of a sugar solution and another flask contained 100 cm^3 of water. Both flasks contained the same mass of yeast. The temperature was maintained at 25 °C.

The scientist used the apparatus shown in Fig. 1.1.

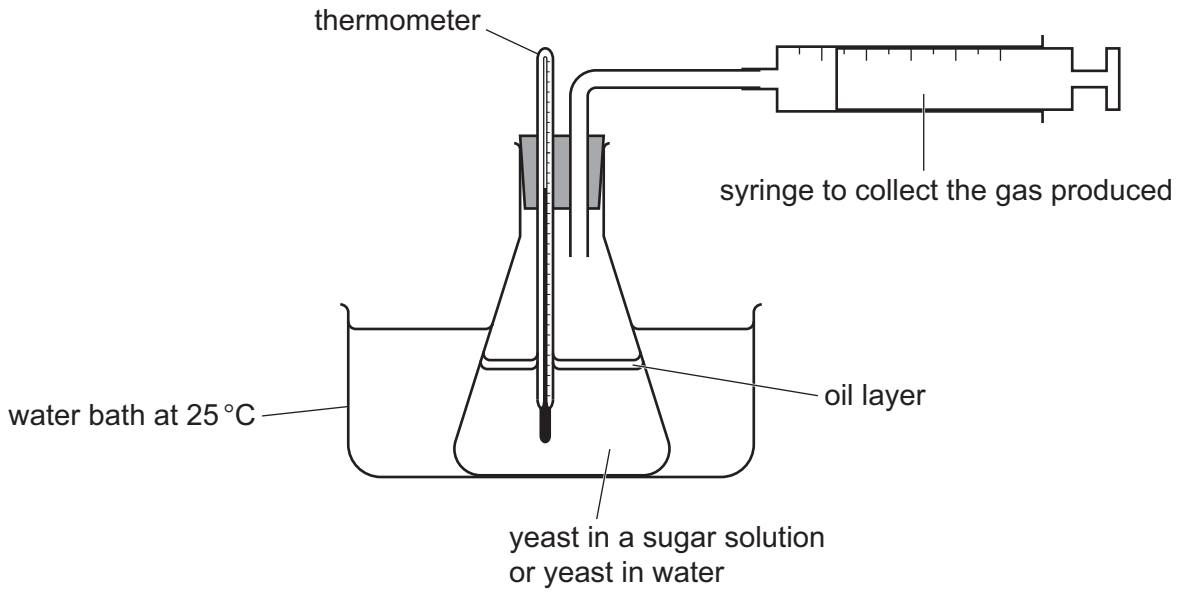


Fig. 1.1

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Fig. 1.2 is a graph of the results of the investigation.

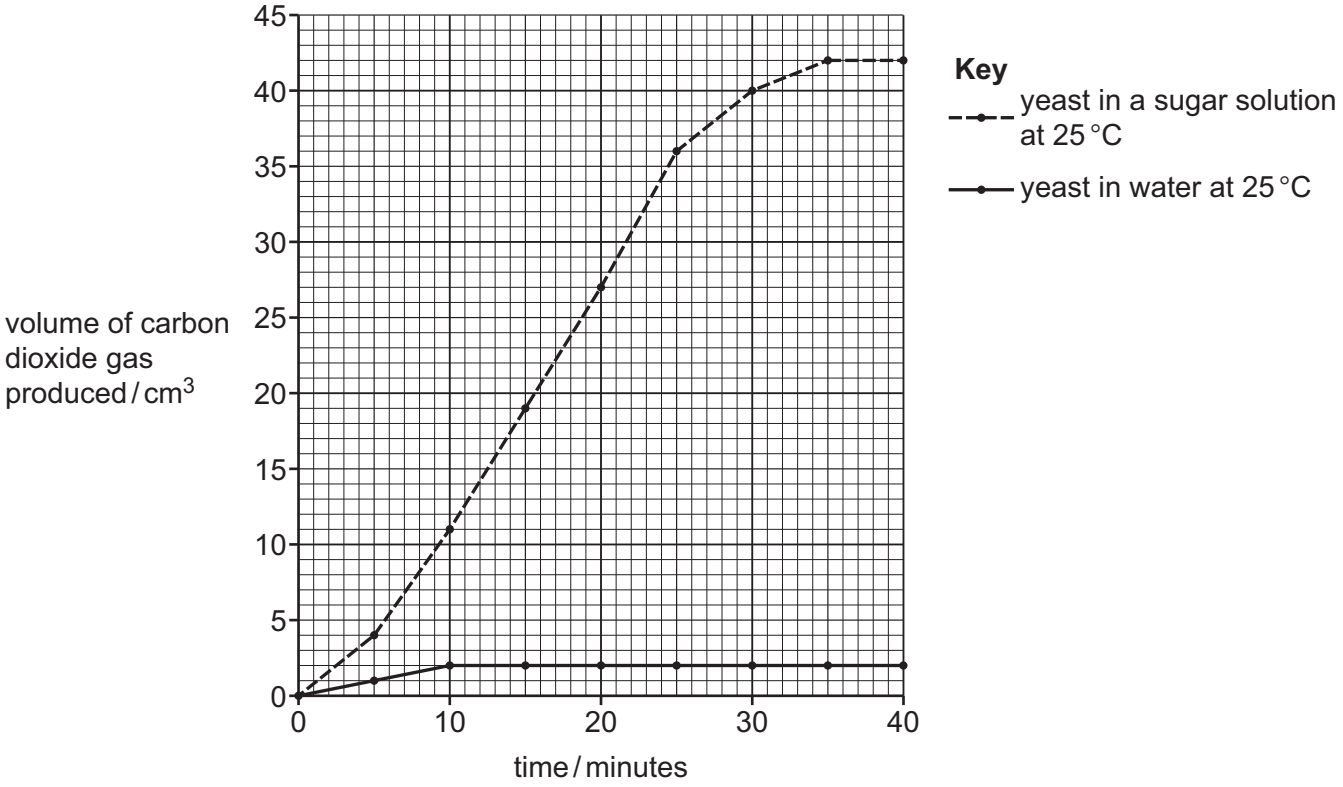


Fig. 1.2

(i) Using the gradient shown in Fig. 1.2, calculate the rate of carbon dioxide gas produced by the yeast in a sugar solution between 10 minutes and 15 minutes.

Include the unit.

Space for working.

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[3]

(ii) Suggest the reason for the oil layer in the apparatus shown in Fig. 1.1.

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(iii) State **one** reason why no more carbon dioxide gas was produced after 35 minutes by the yeast in a sugar solution, shown in Fig. 1.2.

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..... [1]

(iv) The scientist repeated the investigation using yeast and the sugar solution at a temperature of 95 °C.

Explain why no carbon dioxide was produced at a temperature of 95 °C.

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..... [3]

(d) State **one** way in which humans use the carbon dioxide gas produced by yeast cells.

..... [1]

(e) State the name of **one** gas, other than carbon dioxide, that contributes to the enhanced greenhouse effect.

..... [1]

[Total: 14]

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2 **(a)** Define the term sense organ.

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..... [2]

(b) Fig. 2.1 shows the structure of the eye. It also shows the pathway taken by nerve impulses which help bring about changes in the eye in order to bring light to a focus.

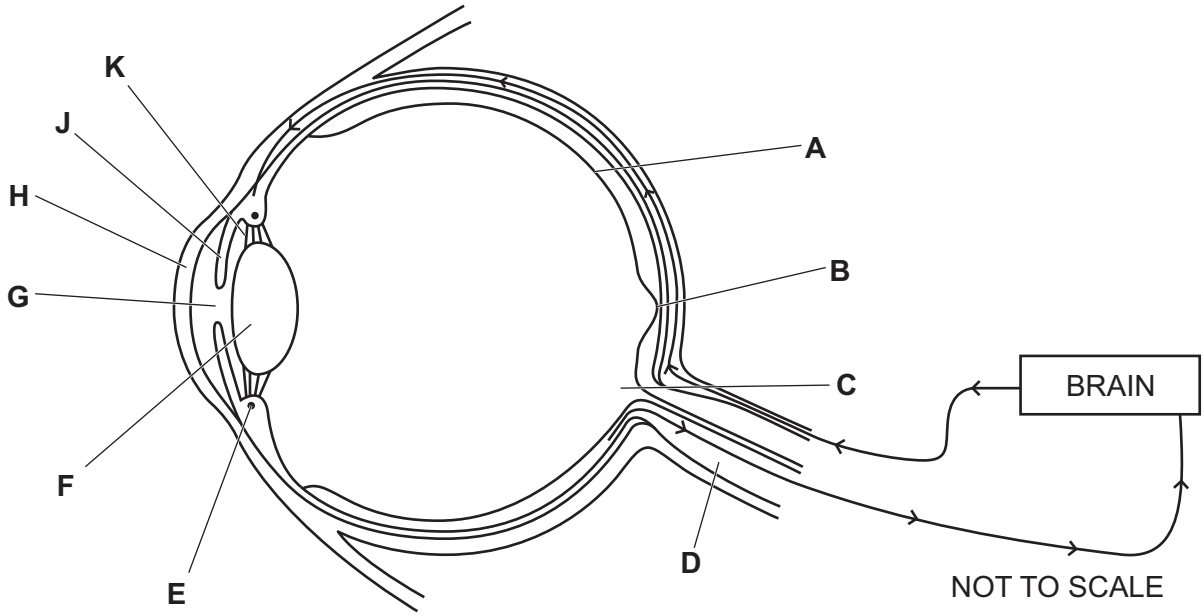


Fig. 2.1

(i) Draw a label line and a letter **X** on Fig. 2.1 to identify a motor neurone.

[1]

(ii) Describe how the events that occur at a synapse generate an impulse in the next neurone.

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(iii) Describe **and** explain the process of accommodation in the eye to view a near object.

Use the letters in Fig. 2.1 in your answer.

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(c) Describe the distribution and function of rods and cones in the eye.

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(d) Red-green colour blindness is a sex-linked characteristic. It is controlled by a gene on the **X** chromosome.

There are two alternative versions of this gene:

- no colour blindness $\mathbf{X^A}$
- colour blindness $\mathbf{X^a}$.

(i) State the term used to describe an alternative version of a gene.

..... [1]

(ii) State the genotype of a male with colour blindness.

..... [1]

[Total: 16]

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3 **(a)** Meiosis and mitosis are important processes in the life cycles of organisms.

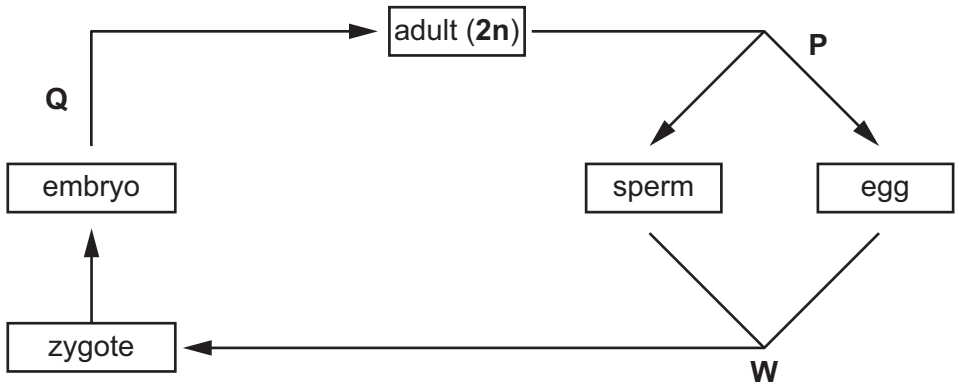
Fig. 3.1 shows the life cycles of two different organisms.

Organism **1** has a simple life cycle.

Organism **2** has a complex life cycle. It has a stage **A** that produces spores and a stage **B** that produces gametes.

In the diagrams, the haploid number of chromosomes is represented by **n.** The diploid number of chromosomes is represented by **2n**.

organism **1**



organism **2**

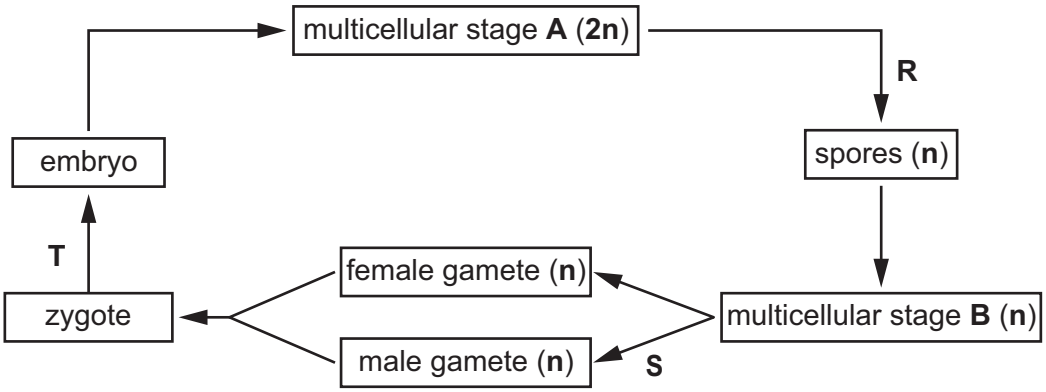


Fig. 3.1

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(i) Table 3.1 shows the letters **P** to **T** in Fig. 3.1 and the type of nuclear division.

Place a tick (✓) in each row to indicate the type of nuclear division that occurs at each of the letters, **P** to **T**.

Table 3.1

letter in Fig. 3.1	meiosis	mitosis
P		
Q		
R		
S		
T		

[3]

(ii) State the name of process **W** shown in Fig. 3.1.

..... [1]

(iii) An embryo contains stem cells.

Complete the sentences about stem cells and body cells.

Stem cells are ..... cells that divide by

..... to produce daughter cells that can become

..... for a specific function.

Most body cells in an organism contain the same genes, but many genes in a particular cell are not ..... because the cell only makes the specific ..... it needs.

[5]

(b) State the events in the life cycle diagram for organism **1** in Fig. 3.1 that would **not** be present in a life cycle diagram for **asexual** reproduction.

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.....

.....

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..... [2]

[Total: 11]

4 **(a)** Some algae are single-celled organisms that can photosynthesise. Their cells contain the pigment chlorophyll.

State the name of **one** mineral ion that is needed to make chlorophyll.

..... [1]

(b) A student investigated the effect of light on photosynthesis in algae, using hydrogencarbonate indicator solution.

Carbon dioxide is an acidic gas.

Table 4.1 shows the colour of the hydrogencarbonate indicator solution at different pH values.

Table 4.1

pH	7.6	8.4	9.2
colour of indicator	yellow	red	purple

(i) Two test-tubes were set up at the same time. Both contained algae and hydrogencarbonate indicator. At the start of the investigation the hydrogencarbonate indicator was red in both test-tubes.

One test-tube was placed in the dark and one test-tube was placed in the light.

After 20 minutes, the contents of the test-tube in the dark were yellow and the contents of the test-tube in the light were purple.

Explain these results.

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(ii) Fig. 4.1 is a graph showing the effect of light intensity on the rate of photosynthesis.

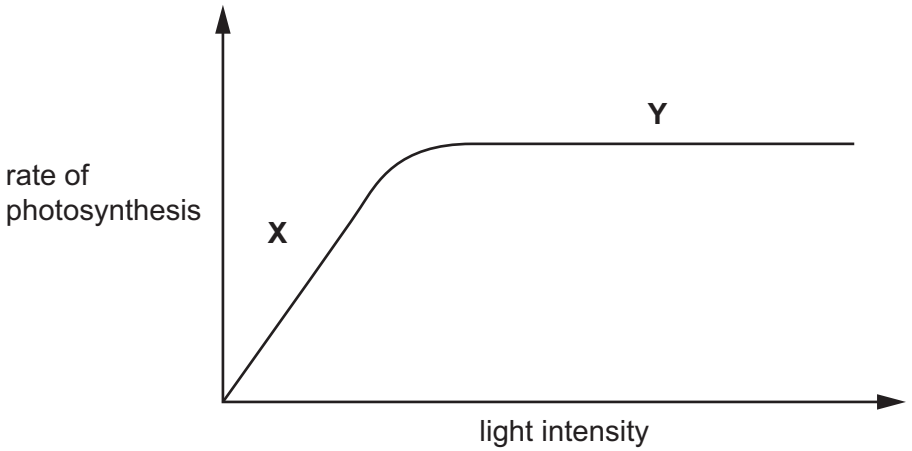


Fig. 4.1

State which factors could be limiting the rate of photosynthesis at **X** and at **Y** in Fig. 4.1.

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..... [3]

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(c) Starch and sucrose are made by plants after photosynthesis.

(i) State the name of the tissue that transports sucrose around the plant **and** the name of **one other** biological molecule that is transported in this structure.

tissue .....

biological molecule .....

[2]

(ii) Describe how starch is broken down in the human digestive system so that it can be absorbed into the blood.

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[Total: 16]

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5 Fig. 5.1 is a photograph of a koala.

Koalas are marsupial mammals that give birth to offspring that are incompletely developed.

The offspring develops further for several months inside the pouch of the mother.



Fig. 5.1

(a) State **one** feature visible in Fig. 5.1 that could be used to identify the koala as a mammal.

..... [1]

(b) Mammals use sexual reproduction to produce offspring.

Discuss the advantages of sexual reproduction in organisms such as the koala.

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(c) Fig. 5.2 is a diagram of part of the human female reproductive system, viewed from the side of the body.

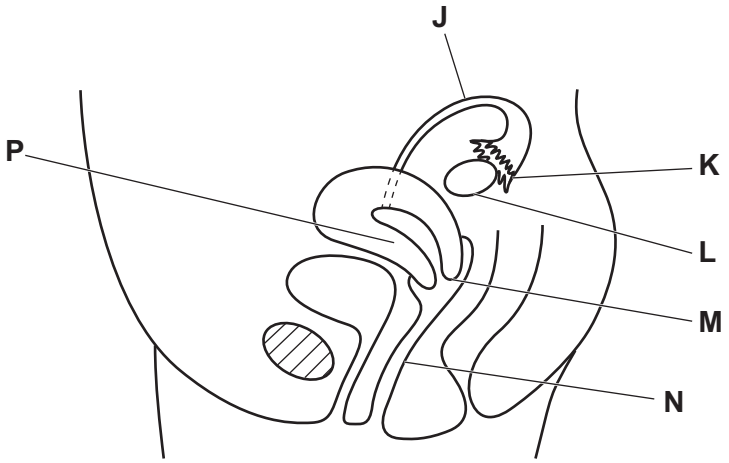


Fig. 5.2

Complete Table 5.1 by writing the letters that identify the structures in Fig. 5.2, the names of the structures and the functions.

Table 5.1

function	letter in Fig. 5.2	name
		cervix
		ovary
site of fertilisation		
site of implantation		

[4]

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(d) Pregnant human females have a placenta.

(i) Describe the function of the placenta in humans.

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..... [4]

(ii) The placenta is connected to the amniotic sac.

State **two** functions of the amniotic fluid that is found in the amniotic sac.

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[2]

[Total: 14]

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6 **(a)** Complete the sentences about human teeth.

The process of taking food into the mouth is called ..... .

Flat sharp-edged teeth at the front of the mouth, called ..... , are used for biting off pieces of food.

The ..... and ..... are the large teeth towards the back of the mouth that are used for ..... the food.

[4]

(b) Fig. 6.1 is a diagram of a villus.

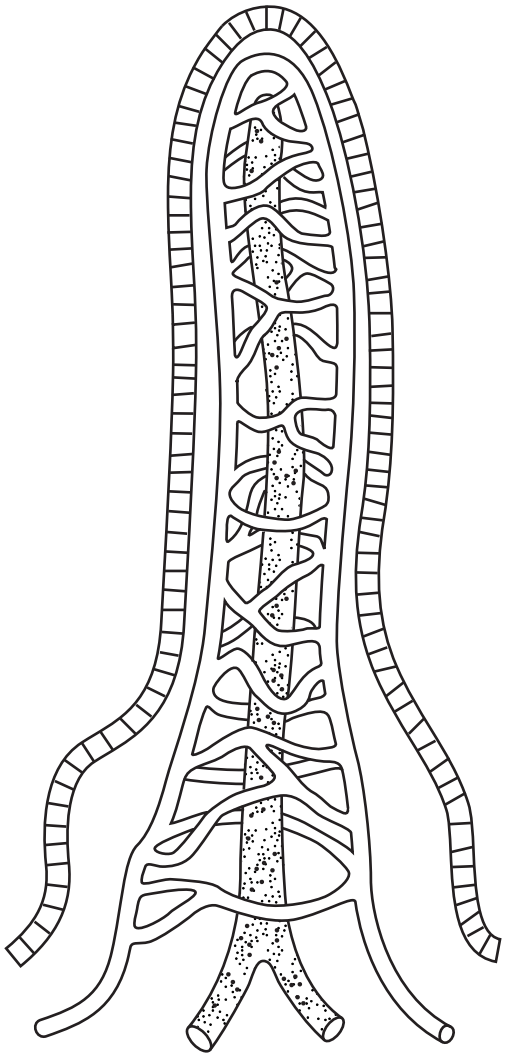


Fig. 6.1

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(i) Draw labels and label lines on Fig. 6.1 to identify a capillary **and** a lacteal. [1]

(ii) State the part of the digestive system where villi are located.

..... [1]

(iii) State the function of the lacteal.

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..... [1]

(c) Describe the pathway taken by the products of protein digestion from the villi to the liver.

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[Total: 9]

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