**Cambridge International Examinations**
Cambridge International General Certificate of Secondary Education

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| CANDIDATE NAME | |

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**BIOLOGY** **0610/41**

Paper 4 Theory (Extended) **May/June 2018**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **17** printed pages and **3** blank pages.

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CAMBRIDGE International Examinations

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**1** **(a)** The reactions of chemical digestion are catalysed by enzymes.

Fig. 1.1 shows the stages of an enzyme-catalysed reaction.

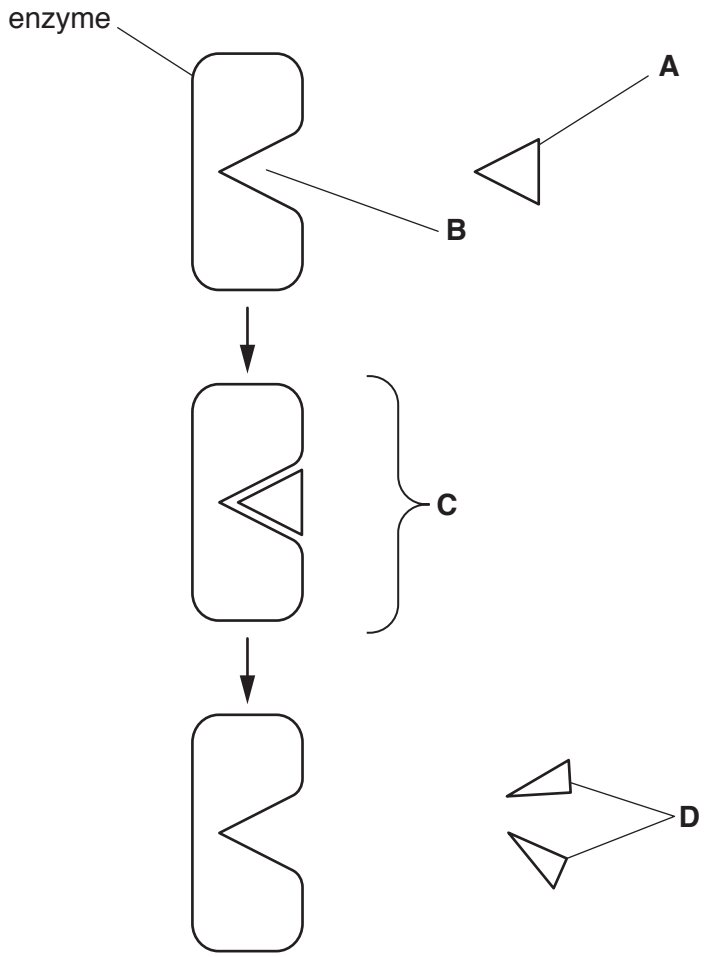


**Fig. 1.1**

State the names of **A** to **D** in Fig. 1.1.

**A** .....

**B** .....

**C** .....

**D** .....

[4]

**(b)** Explain the importance of chemical digestion.

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.....[2]

**(c)** Fig. 1.2 shows the human alimentary canal and associated organs.

The functions of some of these parts of the body are given in Table 1.1.

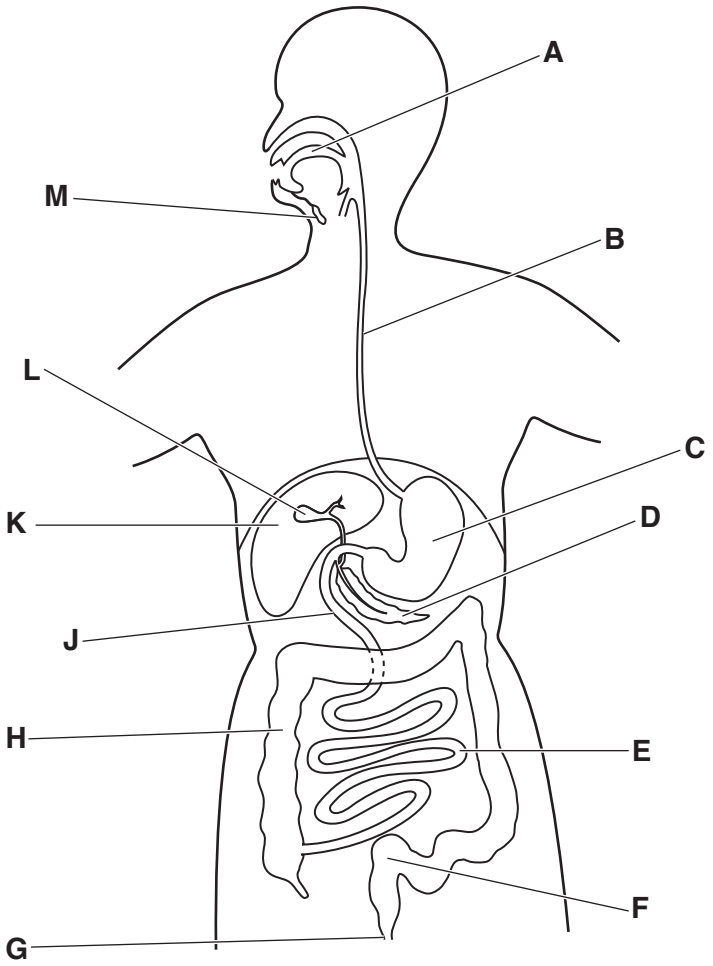


**Fig. 1.2**

Complete Table 1.1. One row has been done for you.

**Table 1.1**

| function | letter from Fig. 1.2 | name of structure |
|---|---|---|
| site of starch digestion | | |
| reabsorption of water | | |
| secretion of pepsin | | |
| site of maltose digestion | | |
| secretion of bile | | |
| storage of faeces | **F** | rectum |
| secretion of lipase and trypsin | | |

[6]

[Total: 12]

**2** **(a)** Adaptive features are defined as the inherited features of an organism that increase its fitness.

State what is meant by *fitness* in this context.

.....

.....

.....[1]

**(b)** Rodents are the most common mammals in many hot deserts.

Fig. 2.1 shows the lesser Egyptian jerboa, *Jaculus jaculus*, which lives in North Africa and the Middle East in areas that have high daytime temperatures and very little rainfall.

**Fig. 2.1**

Like many desert-living mammals, jerboas are active at night.

Suggest **two** features of *J. jaculus* that adapt it to each of the following challenges of living in desert ecosystems:

**(i)** very high daytime temperatures

1 .....

2 .....
[2]

**(ii)** very little or no light at night

1 .....

2 .....
[2]

**(c)** A scientist studied communities in different parts of a desert and estimated the biomass of the organisms in each area.

He divided the organisms into four groups according to their roles in the food web as shown in Table 2.1.

Detritivores are animals that eat dead organisms or parts of organisms.

**Table 2.1**

| groups of organisms in the food web | biomass / g per $m^2$ |
|---|---|
| producers | 480 |
| herbivores | 220 |
| detritivores | 120 |
| carnivores | 40 |

Some of these results are shown as a pyramid of biomass in Fig. 2.2.

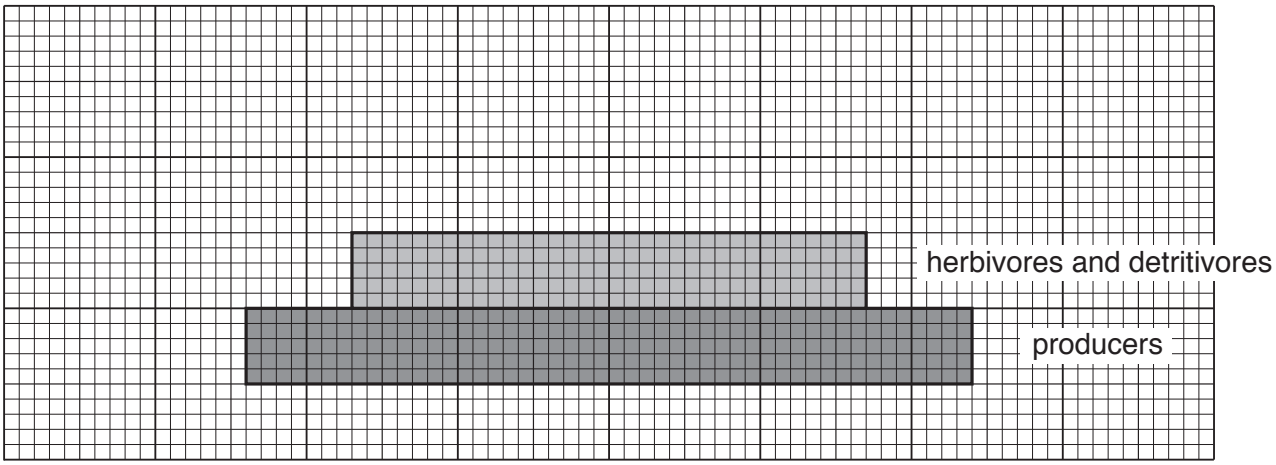


**Fig. 2.2**

**(i)** Use the information in Table 2.1 to complete the pyramid of biomass in Fig. 2.2. [2]

**(ii)** The scientist observed the detritivores and decided to include them with herbivores in this pyramid of biomass.

Suggest what the scientist discovered about the detritivores that made him make this decision.

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.....[1]

**(iii)** Explain why there are rarely more than four or five trophic levels in ecosystems.

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.....[2]

**(iv)** Explain the advantages of presenting information about food webs as a pyramid of biomass and **not** as a pyramid of numbers.

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.....[3]

[Total: 13]

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**3** A student cut a section of a root and made an outline drawing of the distribution of tissues as shown in Fig. 3.1.

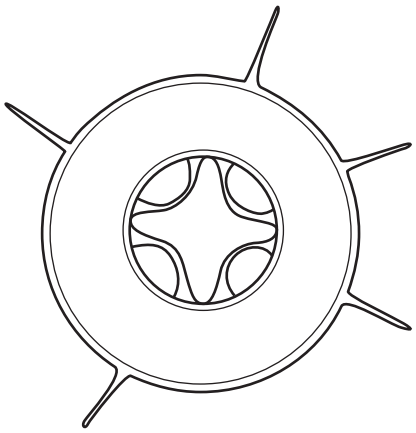

**Fig. 3.1**

**(a)** **(i)** Identify the position of the xylem tissue by drawing a label line and the letter **X** on Fig. 3.1. [1]

**(ii)** State why xylem is a tissue.

.....

.....

.....

.....[2]

**(b)** Water absorbed by the roots moves through the stem and enters the leaves. Most of this water is lost in transpiration.

Explain how the internal structure of leaves results in the loss of large quantities of water in transpiration.

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.....[3]

[Total: 6]

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**4** The flow of blood through the skin can be investigated by using a flow-meter.

Fig. 4.1 shows a flow-meter above a section through the skin.

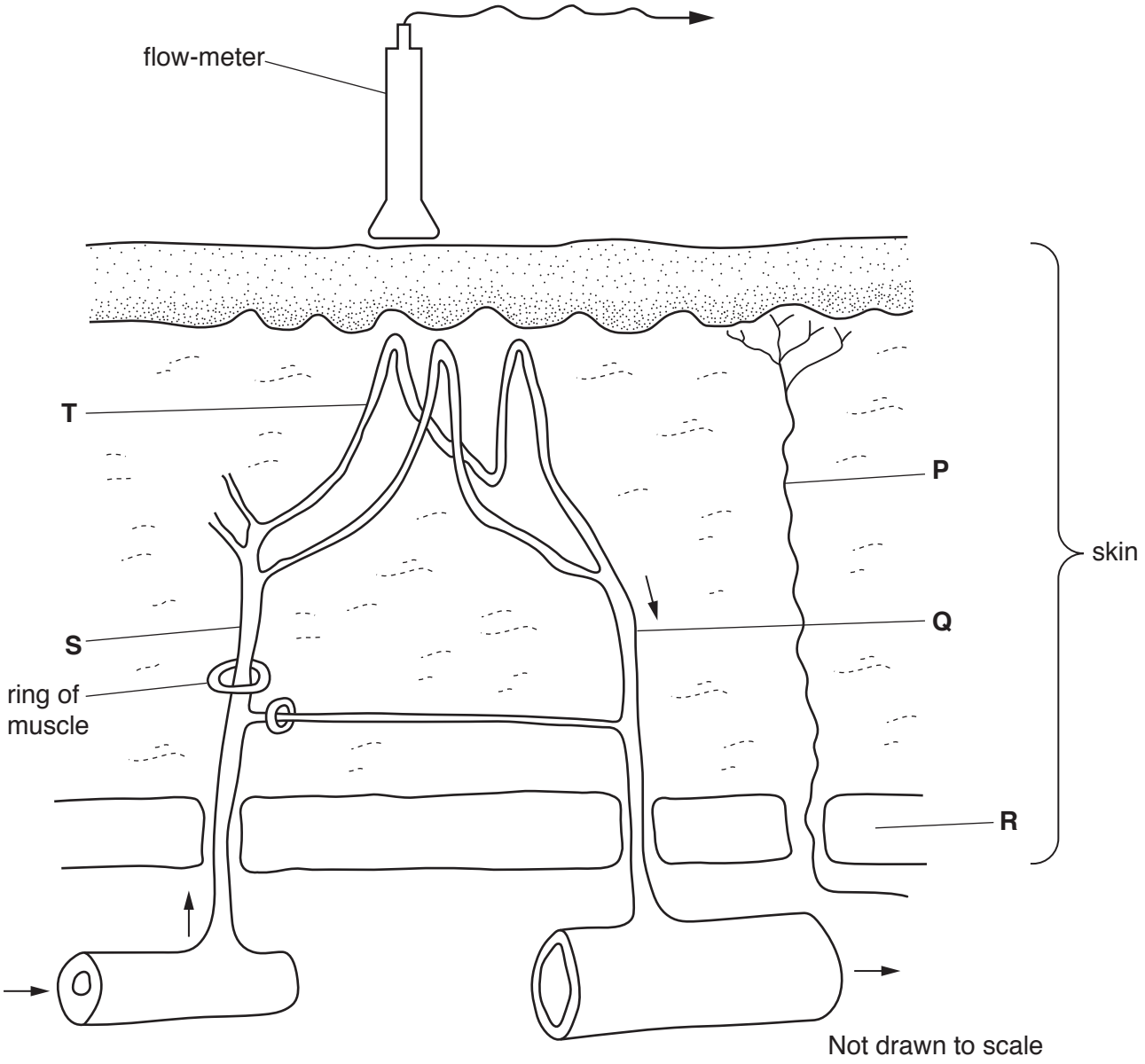


**Fig. 4.1**

**(a)** **(i)** State the name of cell **P**.

.....[1]

**(ii)** State the types of blood vessel labelled **Q**, **S** and **T**.

**Q** .....

**S** .....

**T** .....

[3]

**(iii)** State the name of the tissue at **R** that provides insulation.

.....[1]

**(b)** The blood flow through the skin of some volunteers was measured with a flow-meter when their skin was exposed to different temperatures.

Capsaicin is a compound that gives people the sensation of feeling hot when it is put on the skin. Researchers applied capsaicin to the skin of the volunteers and again measured the blood flow through their skin at different temperatures.

Fig. 4.2 shows the results.

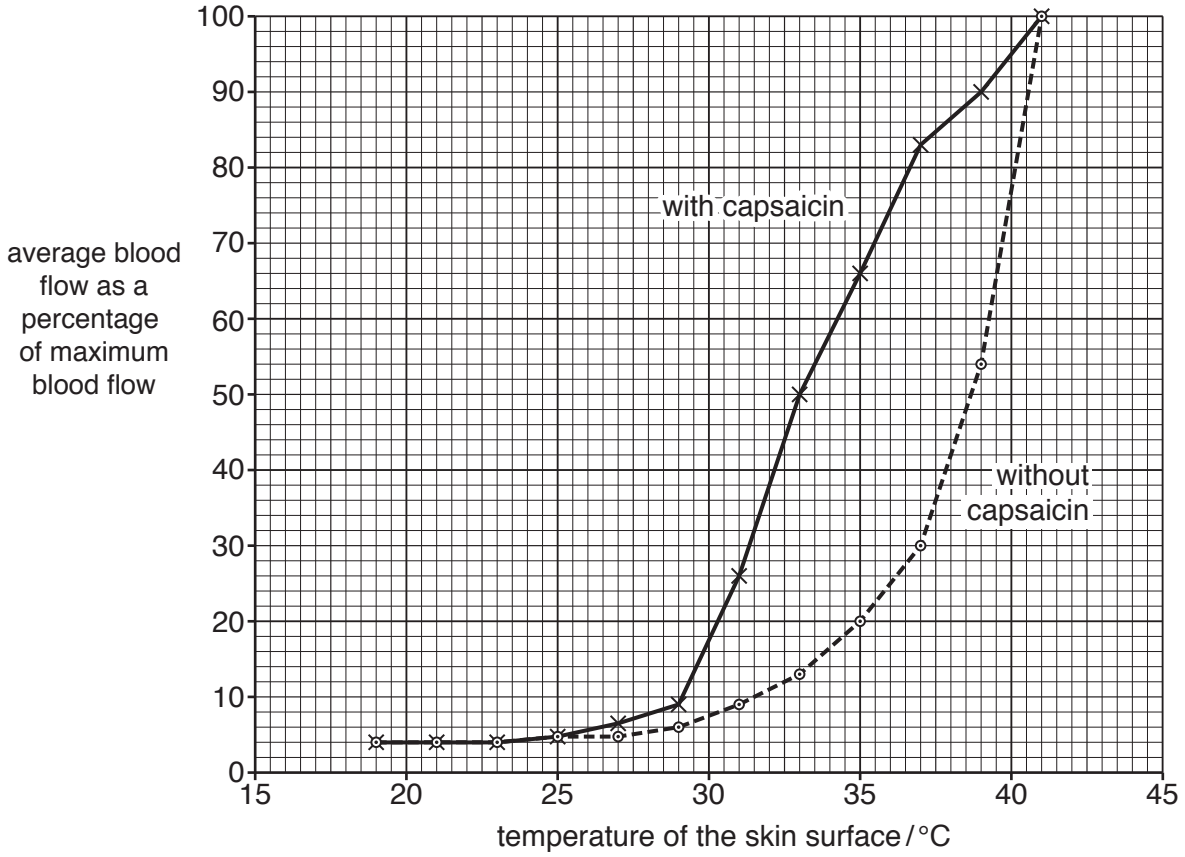


**Fig. 4.2**

**(i)** Use the information in Fig. 4.2 to describe the effect of increasing the temperature of the skin surface on blood flow to the skin **without** capsaicin.

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.....[3]

**(ii)** Explain the mechanism that increases blood flow through the skin.

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.....[3]

**(iii)** State the difference between the average blood flow for the treatments (with and without capsaicin) at 35 °C.

Space for working.

..... % [1]

**(iv)** The researchers thought that capsaicin stimulated receptors in the skin.

Explain the process by which capsaicin could reach these receptors.

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.....[3]

**(c)** Explain the importance of regulating body temperature in humans.

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.....[4]

**(d)** Body temperature is controlled by both hormones and nerves.

Explain how co-ordination by hormones differs from co-ordination by nerves.

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.....[3]

[Total: 22]

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**5** **(a)** State the balanced chemical equation for aerobic respiration.

.....[2]

**(b)** Researchers in the Czech Republic investigated oxygen consumption in horses. They measured the oxygen consumption of the horses while they were exercising at four different paces: walking, trotting, cantering and galloping.

The results are shown in Fig. 5.1.

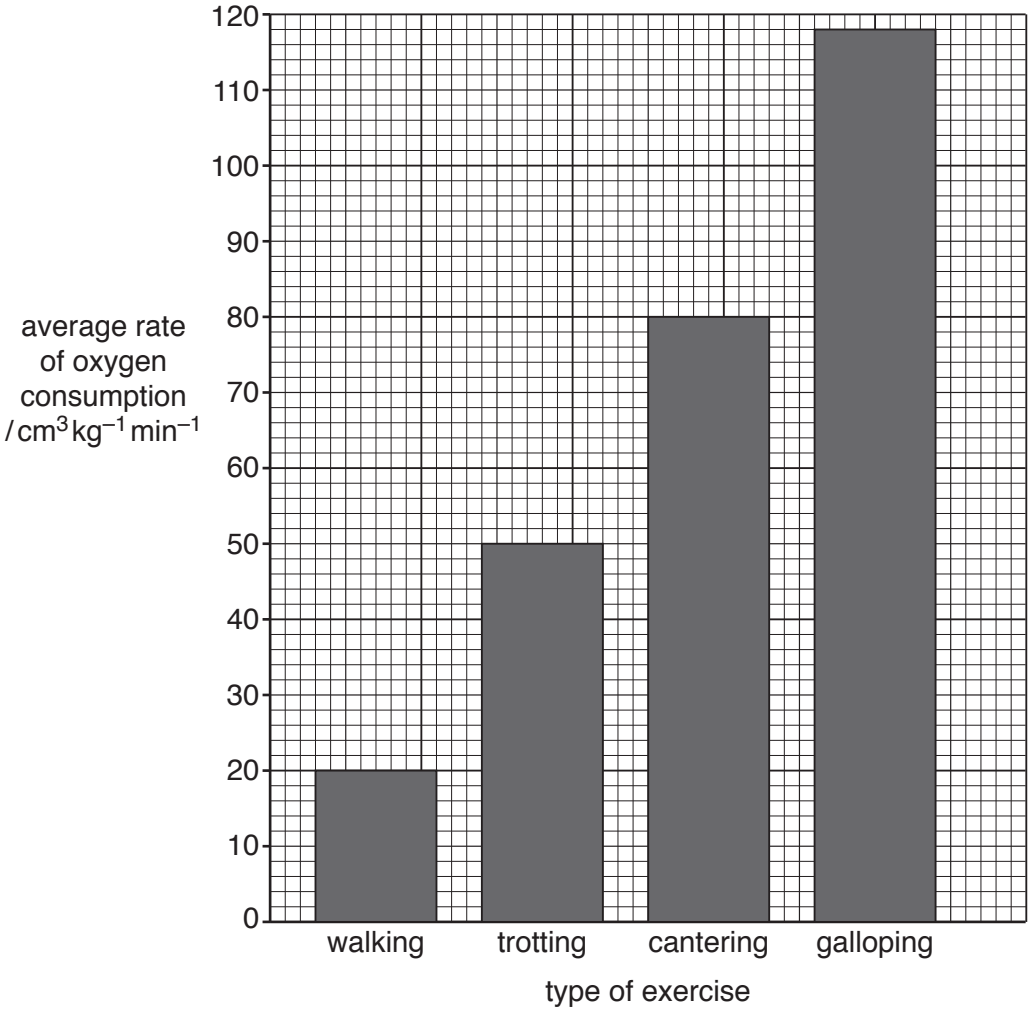


**Fig. 5.1**

Calculate the percentage increase in the average rate of oxygen consumption as the horses change from walking to trotting.

Show your working.

..... %
[2]

**(c)** The researchers also calculated the oxygen debt for each type of exercise.

They found that the horses developed a larger oxygen debt when they exercised by galloping and cantering rather than when they walked.

Explain why the horses developed an oxygen debt when they exercised.

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**(d)** Describe how the horses would recover from an oxygen debt when they stop exercising.

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[Total:11]

**6** **(a)** Fig. 6.1 is a diagram of the human female reproductive system.

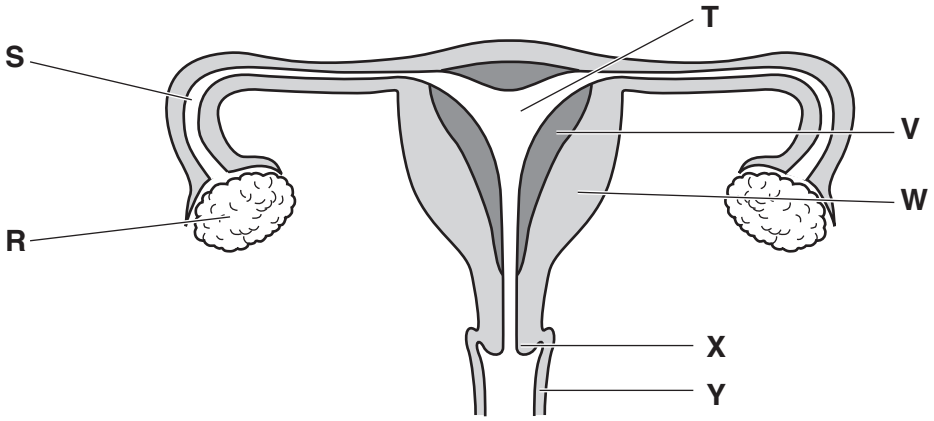


**Fig. 6.1**

**(i)** Complete Table 6.1 by stating the letter from Fig. 6.1 that identifies the structure where each process occurs.

**Table 6.1**

| process | letter from Fig. 6.1 |
|---|---|
| meiosis | |
| fertilisation | |
| implantation | |

[3]

**(ii)** State the name of the part of the female reproductive system labelled **S** in Fig. 6.1.

..... [1]

**(b)** Fig. 6.2 is a diagram of a human sperm cell.

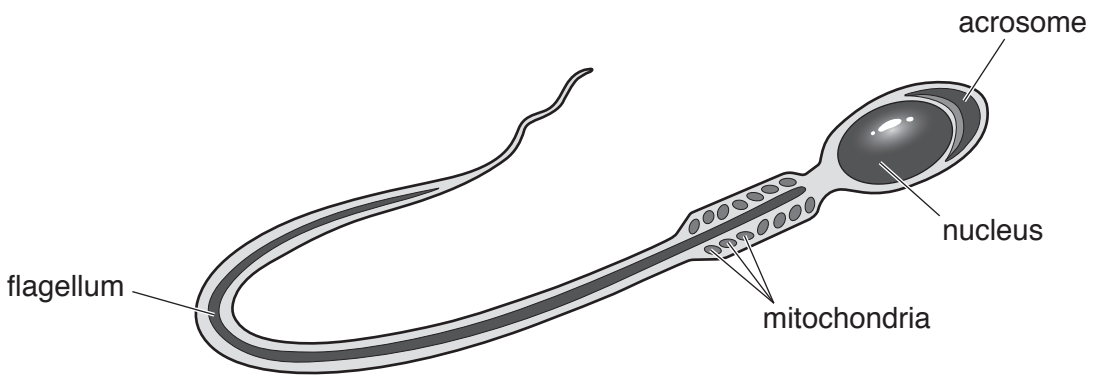


**Fig. 6.2**

**(i)** Write the formula that would be used to calculate the magnification of the diagram.

[1]

**(ii)** The actual length of the sperm cell in Fig. 6.2 is 0.055 mm.

Convert this value to micrometres (μm).

Space for working.

..... μm [1]

**(c)** Explain why the nuclei of sperm cells differ from those of other cells in the male.

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.....[2]

**(d)** Explain the roles of the flagellum, the mitochondria and the acrosome in sperm cells.

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.....[6]

**(e)** Explain why the sex of a child is determined by its father.

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.....[2]

[Total: 16]

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