



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

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

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

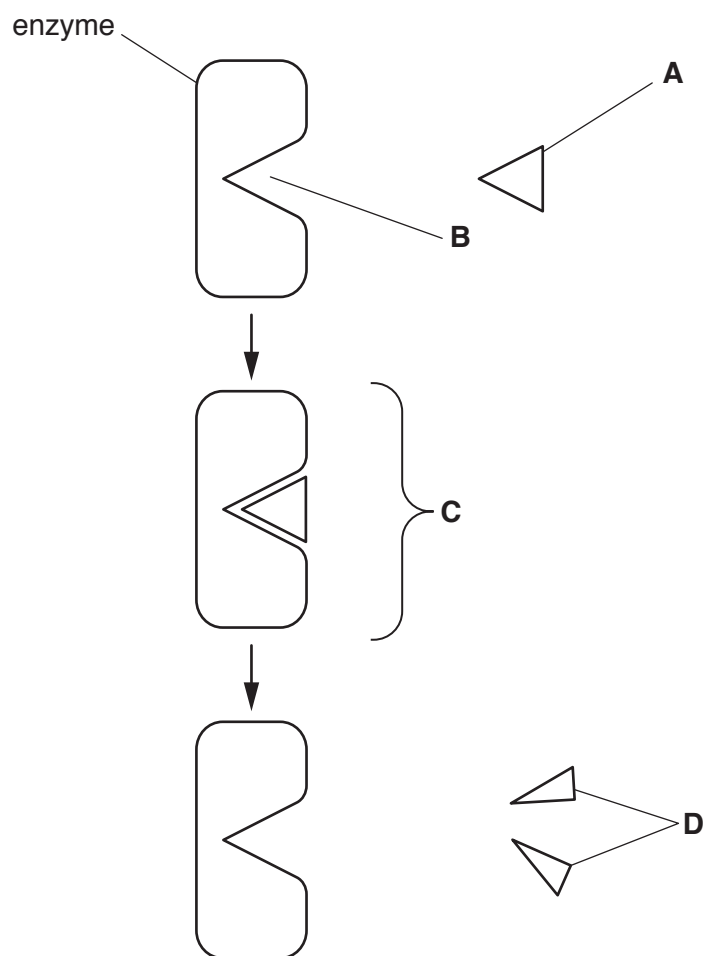


Fig. 1.1

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.

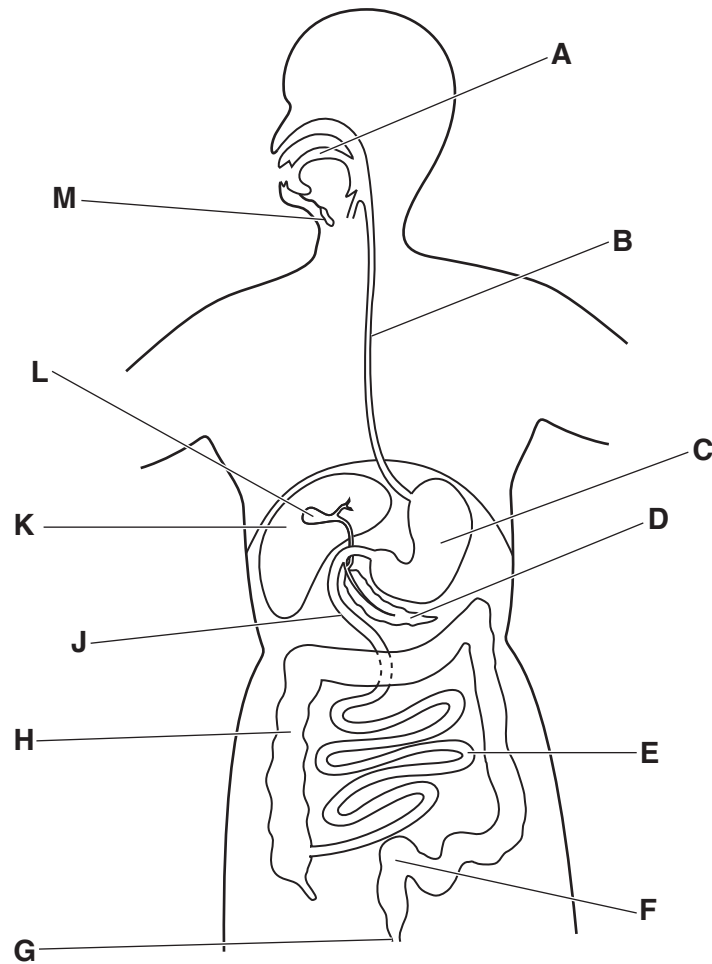


Fig. 1.2

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.

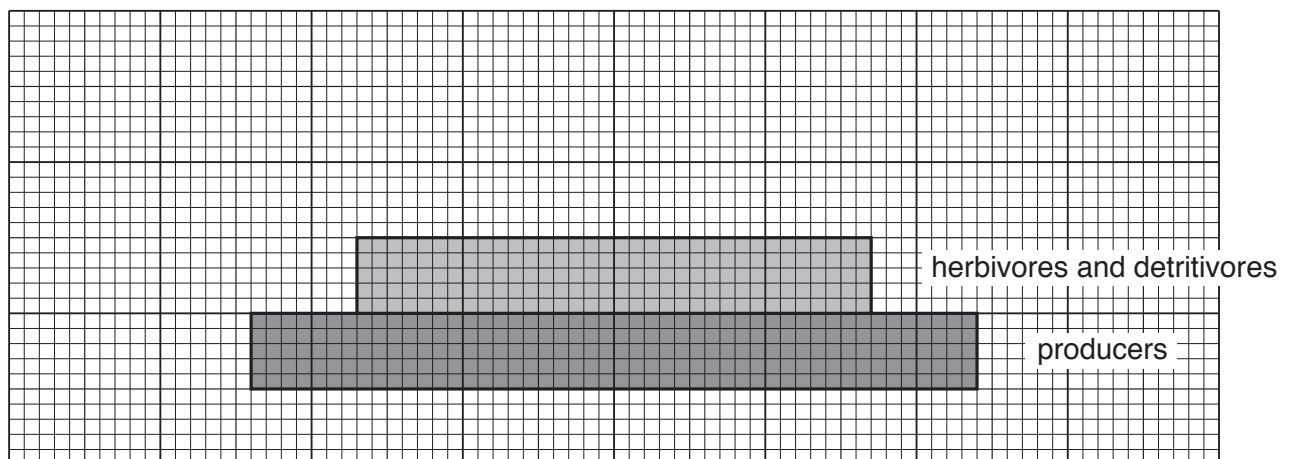


Fig. 2.2

- (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.

.....

.....

.....[1]

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

.....

.....

.....

.....

.....[2]

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

.....

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 13]

- 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.

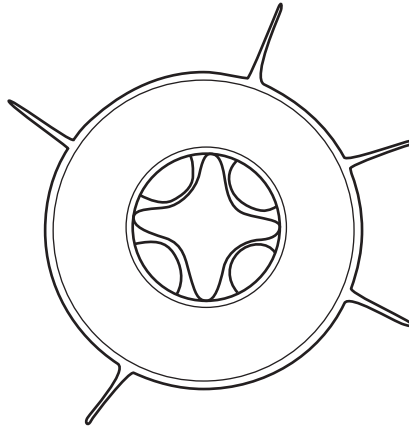


Fig. 3.1

- (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.

.....

.....

.....

.....

.....

.....

..... [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.

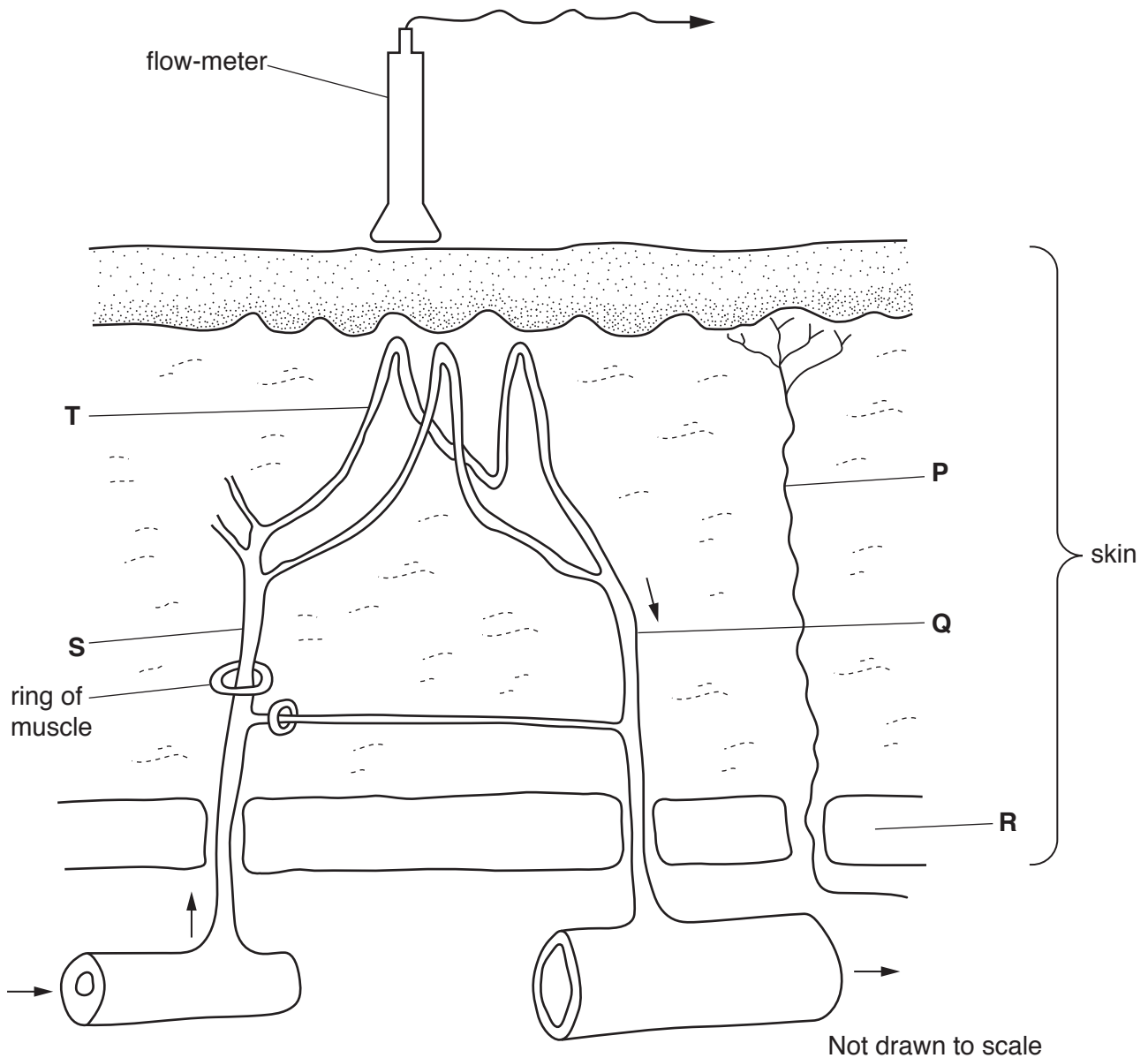


Fig. 4.1

- (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]

- 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.

Figure 1 is a line graph showing the relationship between skin surface temperature and average blood flow as a percentage of maximum blood flow. The x-axis represents the temperature of the skin surface in degrees Celsius (°C), ranging from 15 to 45. The y-axis represents the average blood flow as a percentage of maximum blood flow, ranging from 0 to 100. Two curves are plotted: one for 'with capsaicin' (solid line with 'x' markers) and one for 'without capsaicin' (dashed line with 'o' markers). Both curves show an exponential increase in blood flow with temperature, with the 'with capsaicin' curve being consistently higher.

Temperature (°C)	Average blood flow (%) - with capsaicin	Average blood flow (%) - without capsaicin
19	4	4
21	4	4
23	4	4
25	5	5
27	7	5
29	10	6
31	26	9
33	50	13
35	66	20
37	83	30
39	90	54
41	100	100

(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.

.....[3]

[3]

Space for working.

..... % [1]

Explain the process by which capsaicin could reach these receptors.

.....[3]

[4]

[3]

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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.

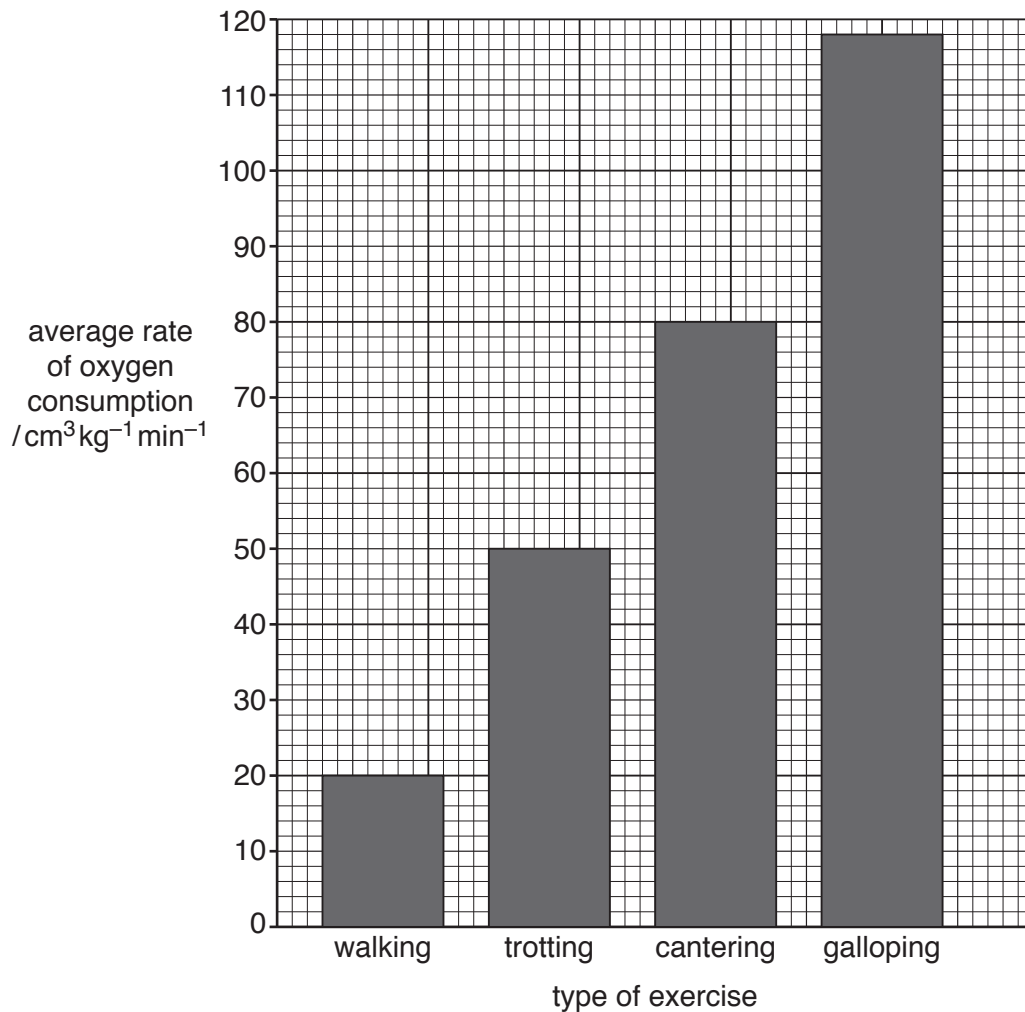


Fig. 5.1

Show your working.

..... %
[2]

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

.....[3]

- [4]

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

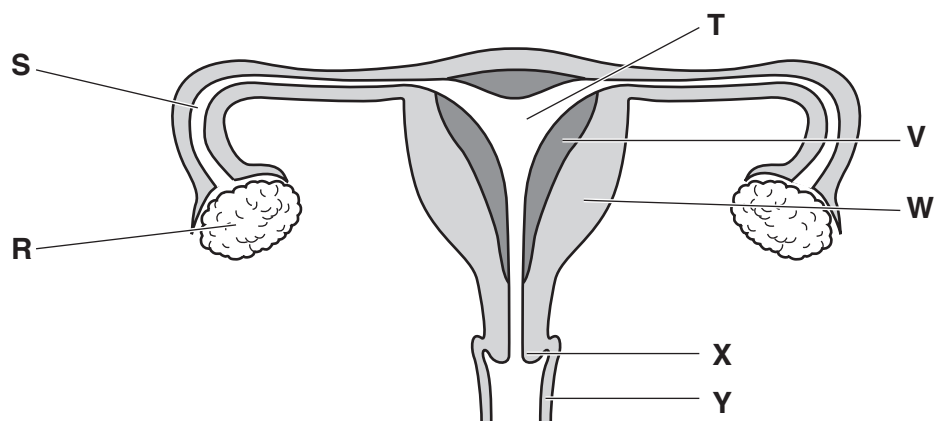


Fig. 6.1

- (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.

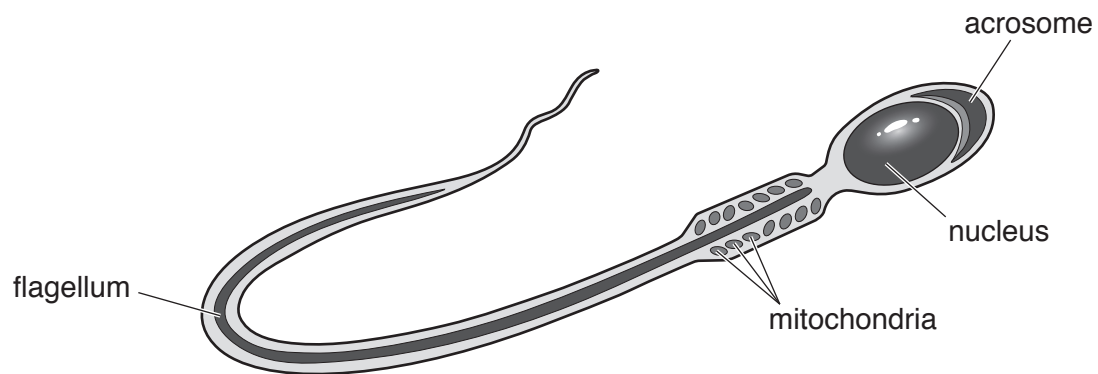


Fig. 6.2

(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.

.....

.....

.....

..... [2]

.....[6]

.....[2]

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