Topical Past Paper Questions Worksheets

# IGCSE Biology (0610)

**Paper 4 (Extended)**

**Exam Series: Feb/Mar 2017 – May/Jun 2023**

**Format Type B:**
**Each question is followed by its answer scheme**

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# Introduction

Each Topical Past Paper Questions Workbook contains a comprehensive collection of hundreds of questions and corresponding answer schemes, presented in worksheet format. The questions are carefully arranged according to their respective chapters and topics, which align with the latest IGCSE or AS/A Level subject content. Here are the key features of these resources:

1. The workbook covers a wide range of topics, which are organized according to the latest syllabus content for Cambridge IGCSE or AS/A Level exams.
2. Each topic includes numerous questions, allowing students to practice and reinforce their understanding of key concepts and skills.
3. The questions are accompanied by detailed answer schemes, which provide clear explanations and guidance for students to improve their performance.
4. The workbook's format is user-friendly, with worksheets that are easy to read and navigate.
5. This workbook is an ideal resource for students who want to familiarize themselves with the types of questions that may appear in their exams and to develop their problem-solving and analytical skills.

Overall, Topical Past Paper Questions Workbooks are a valuable tool for students preparing for IGCSE or AS/A Level exams, providing them with the opportunity to practice and refine their knowledge and skills in a structured and comprehensive manner. To provide a clearer description of this book's specifications, here are some key details:

- Title: Cambridge IGCSE Biology (0610) Paper 4 Topical Past Paper Questions
- Subtitle: Exam Practice Worksheets With Answer Scheme
- Examination board: Cambridge Assessment International Education (CAIE)
- Subject code: 0610
- Years covered: Feb/Mar 2017 – May/Jun 2023
- Paper: 4
- Number of pages: 974
- Number of questions: 279

# Contents

# Chapter 5

# Plant nutrition

7. 0610_s23_qp_41 Q: 2

**(a)** A student investigated osmosis in potato plant cells.

He immersed cubes of potato tissue in water and different concentrations of sucrose solution for 30 minutes.

The masses of the potato cubes were measured before and after immersion.

The percentage changes in mass were calculated.

Table 2.1 shows the results.

**Table 2.1**

| concentration of sucrose solution / mol dm$^{-3}$ | mass of potato cube before immersion / g | mass of potato cube after immersion / g | percentage change in mass |
|---|---|---|---|
| 0.00 | 1.32 | 1.50 | 13.64 |
| 0.20 | 1.34 | 1.49 | 11.19 |
| 0.40 | 1.30 | 1.34 | 3.08 |
| 0.60 | 1.33 | 1.29 | –3.01 |
| 0.80 | 1.22 | 1.12 | –8.20 |
| 1.00 | 1.28 | 1.11 | |

**(i)** Using the information in Table 2.1, calculate the percentage change in mass at 1.00 mol dm$^{-3}$.

Give your answer to **two** decimal places.

Space for working.

..... %
[3]

**(ii)** Using the information in Table 2.1, explain the difference in the results between the $0.6\,mol\,dm^{-3}$ and the $0.8\,mol\,dm^{-3}$ sucrose solutions.

Use the term water potential in your answer.

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**(iii)** Describe the expected appearance of a cell from a potato cube that has been immersed in distilled water for 30 minutes.

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**(b)** Describe how the process of active transport differs from the process of osmosis.

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..... [3]

**(c)** State the type of plant cells that use active transport to absorb mineral ions from the environment.

..... [1]

**(d)** Explain the effect of a lack of magnesium ions on the colour of plant leaves.

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..... [2]

[Total: 16]

Answer:

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| (a)(i) | –13.28 (%) ;;; | 3 | MP1 for correct selection of data from Table 2.1 = 1.11 – 1.28 ***or*** (–)0.17<br>MP2 correct calculation (–0.17 ***or*** 1.11 – 1.28 / 1.28) × 100 ***or*** –13.28125<br>MP3 answer rounded correctly to two decimal places with a minus sign |
| (a)(ii) | *any five from:*<br>potato (cube) in 0.8 (mol $dm^{-3}$ solution) loses greater (percentage) mass / **ora** ;<br>movement of water out / loss of water, is cause of mass loss ;<br>water moves from an area of high water potential to an area of low water potential / AW ;<br>water potential of 0.8 (mol $dm^{-3}$ solution) is lower than the water potential of the 0.6 (mol $dm^{-3}$ solution) ;<br>greater / steeper, water potential gradient in 0.8 (mol $dm^{-3}$) than in 0.6 (mm $dm^{-3}$) ;<br>(relatively) more water leaves the potato (cube) in 0.8 (mol $dm^{-3}$ solution) ; | 5 | |
| (a)(iii) | *any two from:*<br>(cell is) swollen / large(r) / big(ger) / wide(r) / AW ;<br>(cell is) turgid ;<br>vacuole is, swollen / large(r) / big(ger) / wide(r) / AW ;<br>cell wall bulges / AW ;<br>cell membrane / cytoplasm / cell contents, presses on cell wall / AW ; | 2 | |
| (b) | *any three from:*<br>uses energy (from respiration / mitochondria) ;<br>(transport / movement is) against a concentration gradient / AW ;<br>involves movement of, sugars / ions / substance(s) other than water / AW ;<br>involves protein carriers ; | 3 | |
| (c) | root hair (cells) ; | 1 | |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| (d) | (leaves are) yellow / (leaves show) chlorosis ;<br>magnesium required for making chlorophyll ; | 2 | |

8. 0610_s23_qp_41 Q: 4

**(a)** Fig. 4.1 shows the effect of light intensity on the rate of photosynthesis at different temperatures and concentrations of carbon dioxide.

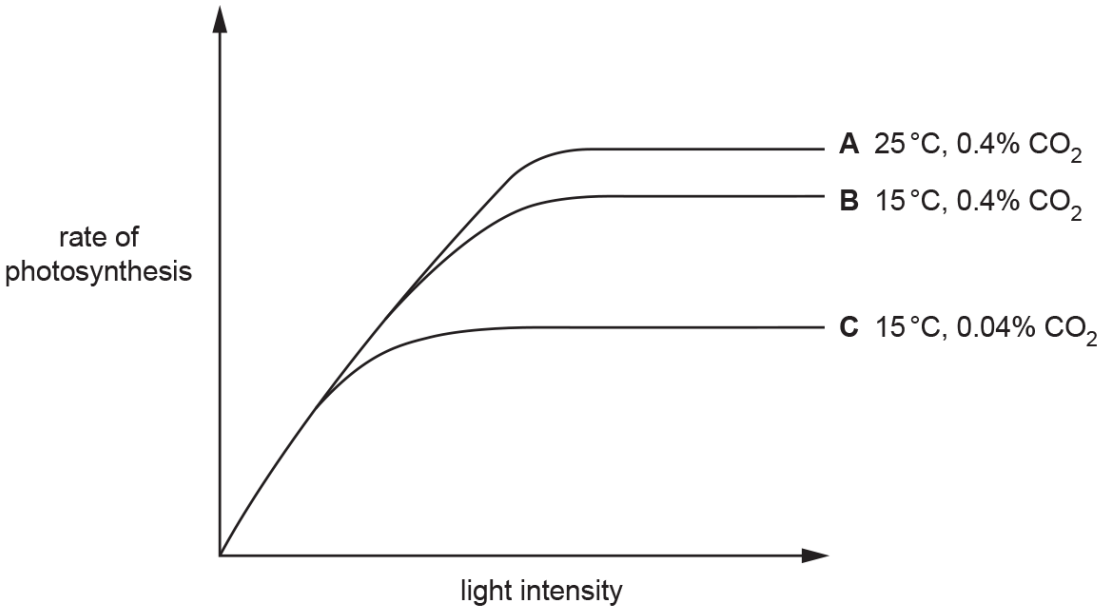


**Fig. 4.1**

Describe **and** explain the reasons for the shape of lines **B** and **C** in Fig. 4.1.

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..... [6]

**(b)** $C_6H_{12}O_6$ is one of the products of photosynthesis.

State the chemical formula of the **other** product.

..... [1]

**(c)** Outline how the carbohydrates made during photosynthesis are used in plants.

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..... [4]

[Total: 11]

Answer:

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| (a) | *any six from:*<br><br>LIGHT<br>(B and C as light intensity increases) the rate (of photosynthesis) increases and remains constant / AW ;<br>rates (of photosynthesis) are the same at low(est) light intensities ;<br>light provides energy (for photosynthesis) ;<br>where the line rises / initially, light intensity is, limiting / the limiting factor ;<br>line(s) / rate, levels off where light intensity is **not** limiting ;<br>in **B** light intensity becomes limiting at higher light intensity than **C** / **ora** ;<br><br>CARBON DIOXIDE<br>*Idea that* line C levels off, at a lower rate (of photosynthesis) / lower light intensity ;<br>carbon dioxide (concentration) is, lower for **C** / 0.04% vs 0.4% ;<br>carbon dioxide is, reactant / substrate / raw material / needed, for photosynthesis ;<br>in **C** carbon dioxide is a limiting factor at a lower light intensity /<br>in **B** carbon dioxide is a limiting factor at a higher light intensity ;<br><br>TEMPERATURE<br>*idea that* temperature is limiting for **B** at high light intensities ; | **6** | **I** if C given as well (as no evidence for C) |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| (b) | $O_2$ ; | 1 | |
| (c) | *any four from:*<br>(glucose) used, in respiration / to provide energy / to release energy / as an energy store ;<br>(glucose) converted to / stored as, starch ;<br>(glucose) converted to sucrose ;<br>sucrose for, translocation / transport (in the phloem) / sent to sink(s) ;<br>(glucose / fructose / sucrose) in nectar ;<br>(nectar) to attract, insects / pollinators ;<br>(glucose / fructose / sucrose) in fruits (to attract animals) ;<br>(glucose) converted to cellulose ;<br>cellulose to build cell walls ;<br>lignin for cell walls ;<br>used to make, amino acids / fatty acids ;<br>AVP ; | 4 | e.g., used to make chlorophyll / (DNA/RNA) bases |

9. 0610_s19_qp_41 Q: 2

The rate of photosynthesis of terrestrial plants can be determined by measuring the uptake of carbon dioxide.

**(a)** Explain why plants take up carbon dioxide during photosynthesis.

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..... [2]

**(b)** The rate of photosynthesis of parts of individual leaves can be measured using a hand-held device as shown in Fig. 2.1.

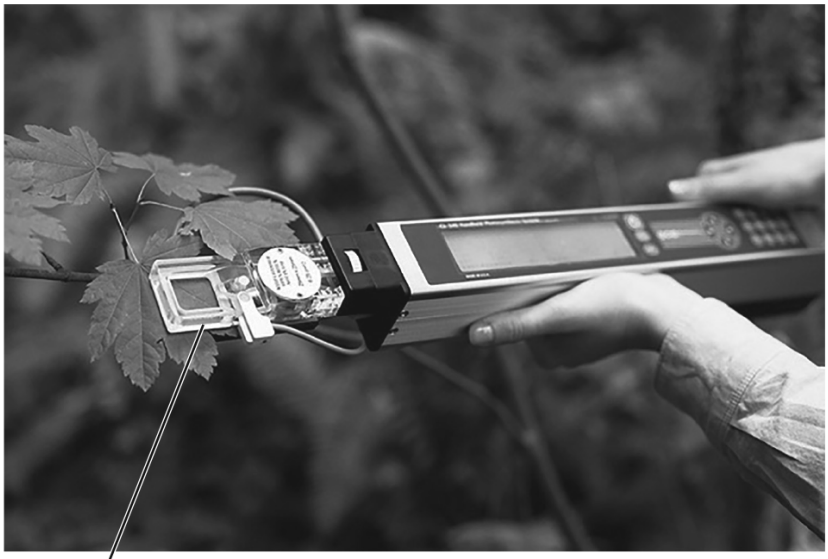


**Fig. 2.1**

This apparatus allows air to flow through the transparent chamber that encloses part of the leaf. The apparatus measures the carbon dioxide concentration of the air entering and leaving the chamber.

Explain how the results from the apparatus can be used to calculate the rate of photosynthesis.

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..... [2]

**(c)** A student used the apparatus shown in Fig. 2.1 to investigate the effect of temperature on the rate of photosynthesis of the leaves of Chinese plantain, *Plantago asiatica*, at two different concentrations of carbon dioxide, **A** and **B**.

Fig. 2.2 shows the results of the investigation.

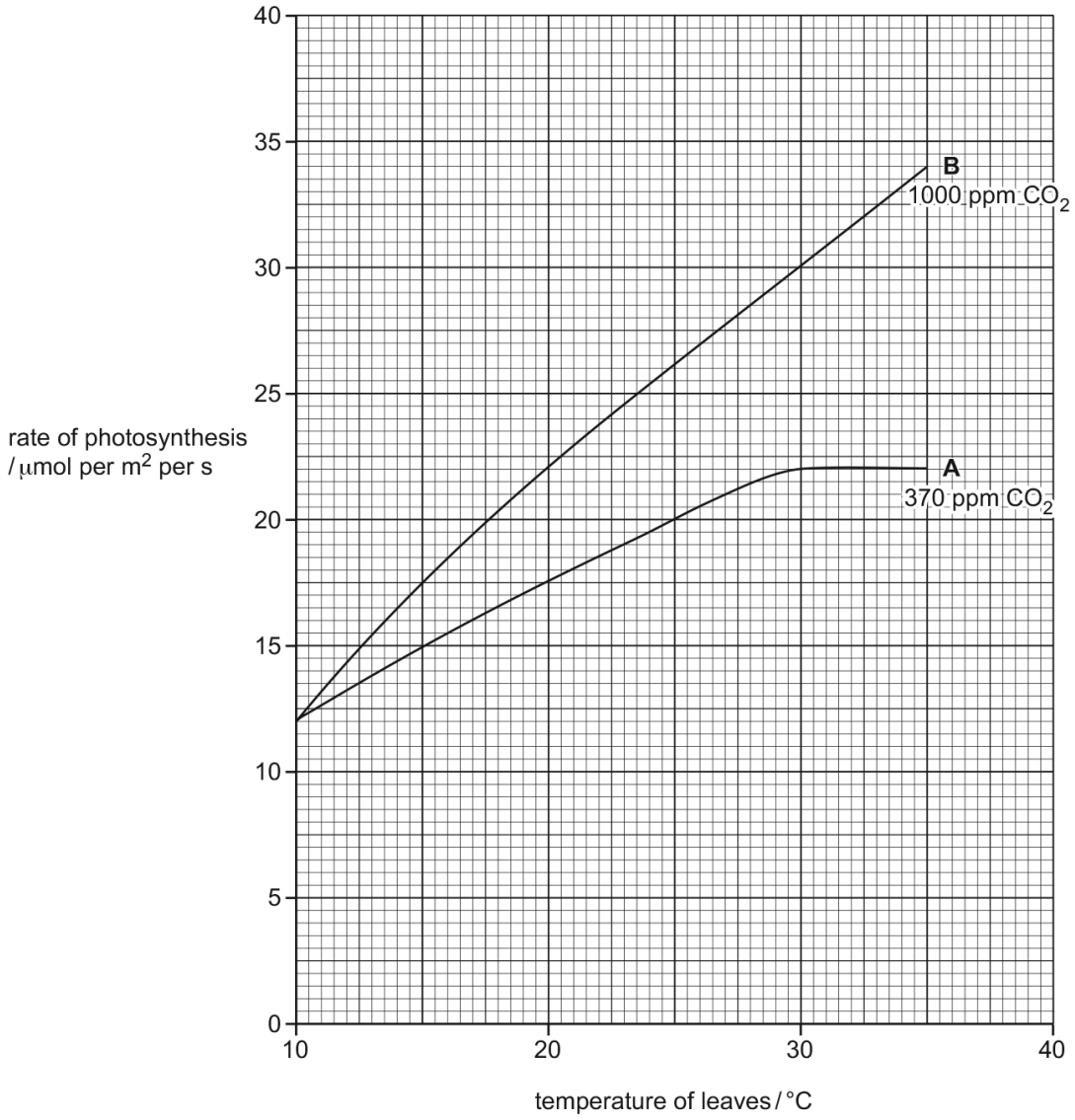


**Fig. 2.2**

**(i)** State **one** environmental factor that should have been kept constant in this investigation.

..... [1]

**(ii)** Describe the effect of temperature on the rate of photosynthesis when carbon dioxide concentration **A** was supplied.

Use the data from Fig. 2.2 in your answer.

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..... [3]

**(iii)** Calculate the percentage increase in the rate of photosynthesis at 30 °C when the carbon dioxide concentration was increased from **A** to **B** as shown in Fig. 2.2.

Show your working and give your answer to the nearest whole number.

..... %
[2]

**(iv)** Explain the effect of increasing temperature on the rate of photosynthesis for carbon dioxide concentration **B**.

Use the term *limiting factor* in your answer.

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..... [3]

**(v)** The student concluded that carbon dioxide concentration is the factor limiting the rate of photosynthesis between 30 °C and 35 °C for the results shown for **A** in Fig. 2.2.

State the evidence for this conclusion.

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..... [1]

**(d)** A similar investigation was carried out on Arizona honeysweet, *Tidestromia oblongifolia*, that grows in Death Valley in California where the highest temperatures may be greater than 45 °C.

The results are shown in Fig. 2.3.

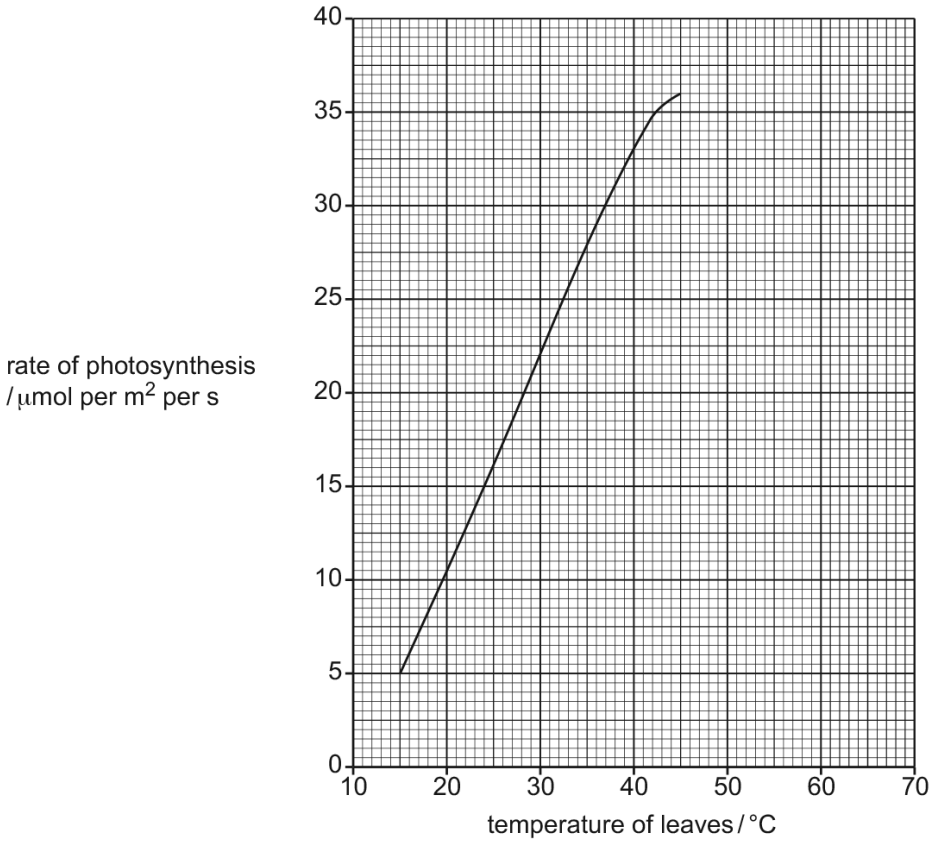


**Fig. 2.3**

Predict **and** explain what would happen to the rate of photosynthesis if the investigation is continued at temperatures higher than 45 °C.

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..... [2]

[Total: 16]

Answer:

| | Answer | Mark | Partial Marks |
|---|---|---|---|
| (a) | carbon dioxide is, raw material / substrate / reactant / AW ;<br>concentration of carbon dioxide is higher outside leaf than inside (so carbon dioxide diffuses into the leaf) ; | 2 | |
| (b) | subtract the concentration of carbon dioxide at the end from the concentration at the start / AW ;<br>divide by the time (taken) / per unit time ;<br>ref. to taking (rate of) respiration into account ; | 2 | |
| (c)(i) | light intensity ;<br>water (supply) ;<br>humidity ; | 1 | |
| (c)(ii) | increases and, reaches a plateau / remains constant / 'levels off' ;<br>increases (between 10 °C) to 30 °C / levels off at 30 °C ;<br>any comparative use of figures for rate with units at least once ; | 3 | |
| (c)(iii) | 36 ;; | 2 | |
| (c)(iv) | temperature is the limiting factor (over whole range) ;<br>increased temperature increases, kinetic energy / KE, (of molecules) ;<br>increases rate of diffusion of carbon dioxide (into leaf) ;<br>temperature, influences / affects, (activity of) enzymes ;<br>*idea of* more (effective) collisions between substrate molecules and enzymes (in plant) / more enzyme-substrate complexes formed ;<br>more carbon dioxide is, fixed / used in photosynthesis / converted into sugar / AW ;<br>carbon dioxide (concentration) is **not** limiting ; | 3 | |
| (c)(v) | ***B** shows that:*<br>rate of photosynthesis is, higher / continues to increase, if carbon dioxide is increased (at all temperatures / AW) ; | 1 | |
| (d) | *prediction:*<br>rate of photosynthesis, remains constant / decreases / slows ;<br><br>*any explanation one from:*<br>enzymes / active sites, are denatured (at high temperatures) ;<br>stomata close, so, little / no, carbon dioxide can enter leaves ;<br>plant is adapted to survive at high temperatures ; | 2 | |

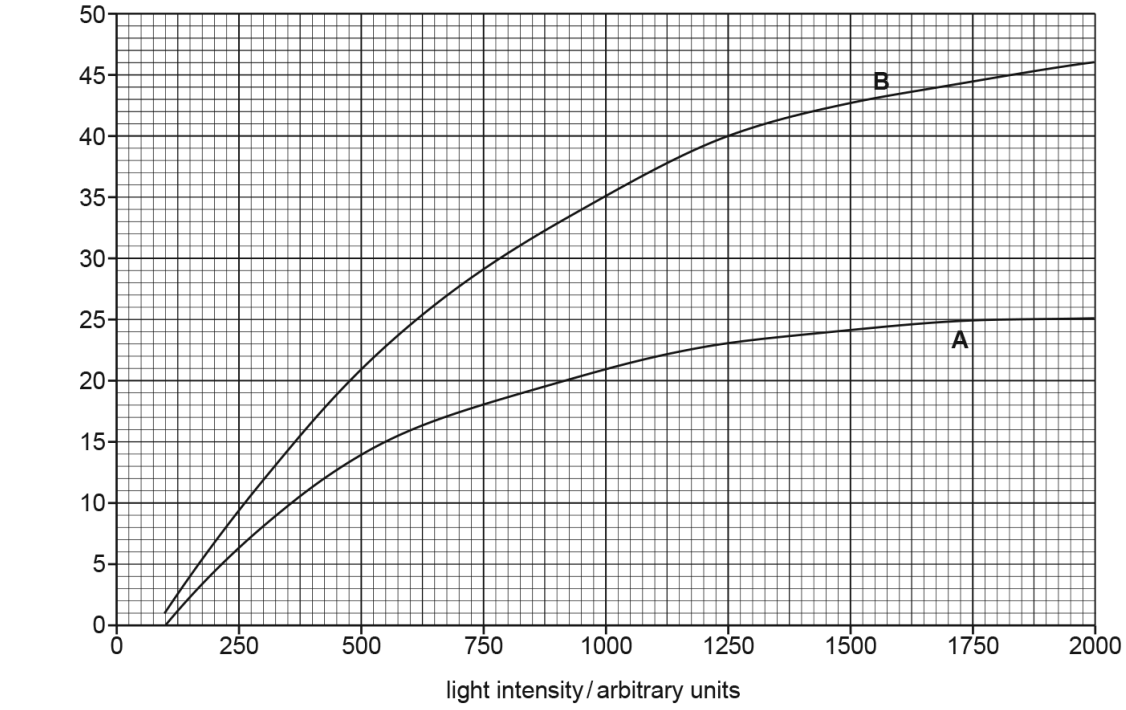
10. 0610_s19_qp_43 Q: 2

**(a)** State the **word** equation for photosynthesis.

..... [2]

**(b)** Scientists investigated the effect of light intensity on the rate of photosynthesis in the leaves of eucalyptus trees at two different concentrations of carbon dioxide, **A** and **B**.

The results are shown in Fig. 2.1.




**Key:**

**A** carbon dioxide concentration 140 ppm

**B** carbon dioxide concentration 1000 ppm

**Fig. 2.1**

**(i)** Suggest **and** explain why the scientists kept the temperature of the leaves at 20 °C while they recorded results.

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..... [2]

**(ii)** Calculate the percentage increase in the rate of photosynthesis at a light intensity of 1250 arbitrary units when the carbon dioxide concentration was increased from 140 ppm to 1000 ppm.

Show your working and give your answer to the nearest whole number.

..... %
[3]

**(iii)** Describe the effect of increasing light intensity on the rate of photosynthesis when the concentration of carbon dioxide was 140 ppm.

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**(iv)** Explain the effect of increasing light intensity on the rate of photosynthesis when the concentration of carbon dioxide was 1000 ppm.

Use the term *limiting factor* in your answer.

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..... [4]

[Total: 14]

Answer:

| | Answer | Mark | Partial Marks |
|---|---|---|---|
| (a) | carbon dioxide + water ⟶ ;<br>glucose □ oxygen ; | 2 | |
| (b)(i) | temperature is a factor that affects the rate of photosynthesis ;<br>*reference to* kinetic energy ;<br>*idea of* effect of temperature, on enzymes / diffusion rate (of carbon dioxide) ;<br>*idea that* temperature is a variable that should be standardised ;<br>AVP ; | 2 | |
| (b)(ii) | 74 ;;; | 3 | |
| (b)(iii) | rate (of photosynthesis) increases and, reaches a plateau / AW ;<br>rate (of photosynthesis) increases until 1750 (a.u)<br>/ 25 □mol per $m^2$ per s ;<br>any comparative use of figures for rate ; | 3 | |
| (b)(iv) | light intensity is the limiting factor, at all light intensities used / AW ;<br>because rate of photosynthesis does not level off (even at high light intensities) ;<br>carbon dioxide / temperature / chlorophyll / another factor, was not a limiting factor ;<br>*correct reference* to (light) energy ;<br>light is absorbed by chlorophyll ;<br>AVP ; | 4 | |

# Chapter 6

# Human nutrition

11. 0610_m23_qp_42 Q: 2

A student investigated the digestion of starch.

Fig. 2.1 shows the apparatus she used.

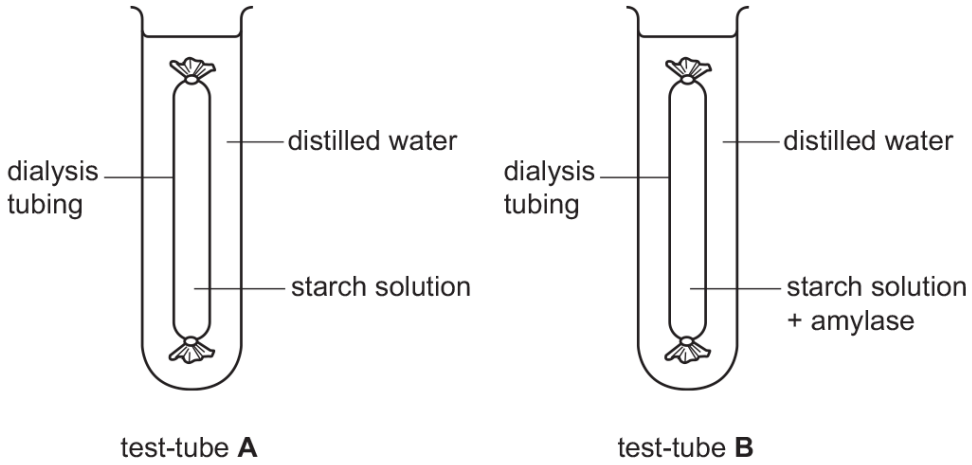


**Fig. 2.1**

Dialysis tubing is used to represent a cell membrane.

The dialysis tubing material allows small molecules to move across it, but not larger molecules.

Test-tubes **A** and **B** were set up as shown in Fig. 2.1 and placed in a water-bath at 37 °C for 30 minutes.

The liquid outside the dialysis tubing in test-tubes **A** and **B** was tested with Benedict's solution at 0 minutes and after 30 minutes.

Table 2.1 shows the results.

**Table 2.1**

| test-tube | colour with Benedict's solution at 0 minutes | colour with Benedict's solution at 30 minutes |
|---|---|---|
| **A** | blue | blue |
| **B** | blue | red |

**(a)** Using the information in Fig. 2.1 and Table 2.1, explain the reasons for the difference in the results for test-tubes **A** and **B** in Table 2.1.

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..... [6]

**(b)** Complete Table 2.2 by writing in the names of the missing enzymes, substrates and products.

**Table 2.2**

| enzyme | substrate | product or products |
|---|---|---|
| pepsin | | |
| | | fatty acids and glycerol |
| trypsin | | |
| | | glucose |

[4]

**(c)** State the name of the structures that increase the surface area for absorption in the small intestine.

..... [1]

[Total: 11]

Answer:

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| (a) | **1** Benedict's solution in A, remains blue / no colour change / negative result, as there is no, maltose / breakdown of starch ;<br>**2** Benedict's solution in B, turns red / changes colour / positive result, in the presence of maltose ;<br>**3** amylase breaks down starch ;<br>**4** into maltose ;<br>**5** (maltose) is a small / soluble, molecule ;<br>**6** maltose is able to pass through the dialysis tubing ;<br>**7** by diffusion ;<br>**8** from an area of high concentration to low concentration / down a concentration gradient ; | **6** | |
| (b) | pepsin / protein / amino acids / peptides<br>lipase / fats / oils / lipids / fatty acid and glycerol<br>trypsin / protein / amino acids / peptides<br>maltase / maltose / glucose<br>;;;; | **4** | one mark for each correct row |
| (c) | villi / microvilli ; | **1** | |

12. 0610_s23_qp_41 Q: 1

**(a)** Fig. 1.1 is a diagram of the digestive system.

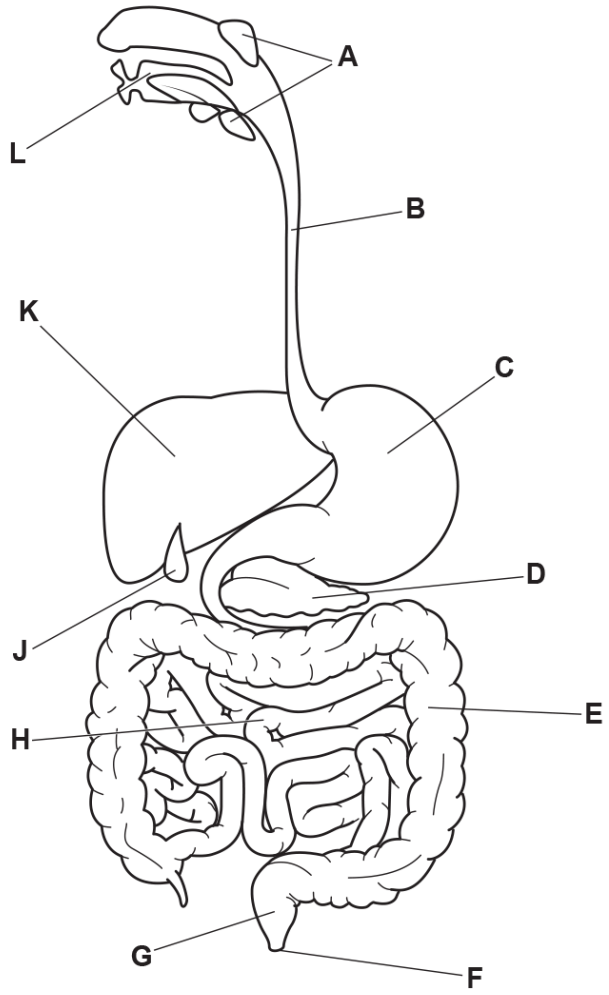


**Fig. 1.1**

Each letter may be used once, more than once or not at all.

State the letter of the part shown in Fig. 1.1:

that produces bile .....

that produces gastric juice .....

that produces urea .....

where maltose is digested .....

where trypsin acts. .....

[5]

**(b)** A student investigated the effect of bile on the digestion of fat in milk.

They set up three different test-tubes:

- test-tube **A** contained milk and bile
- test-tube **B** contained milk and lipase
- test-tube **C** contained milk, lipase and bile.

They used an indicator that is pink in alkaline solutions and colourless in acidic solutions. They added the same volume of indicator to each test-tube.

The student observed and recorded the colour of the contents of each test-tube at 0 minutes, 20 minutes and 40 minutes.

Table 1.1 shows the results of the investigation.

**Table 1.1**

| test-tube | indicator colour observed | | |
|---|---|---|---|
| | 0 minutes | 20 minutes | 40 minutes |
| **A** | pink | pink | pink |
| **B** | pink | pink | colourless |
| **C** | pink | colourless | colourless |

**(i)** Explain the results for test-tubes **B** and **C** in Table 1.1.

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..... [4]

**(ii)** Explain the purpose of test-tube **A** in Table 1.1.

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..... [2]

The action of lipase is affected by temperature.

Fig. 1.2 shows the axes for a graph of the effect of temperature on the activity of lipase.

Complete the graph by:

- drawing a line to show the expected effect of temperature on the activity of lipase
- adding a label line and a label to show the point at which all the lipase has been denatured.

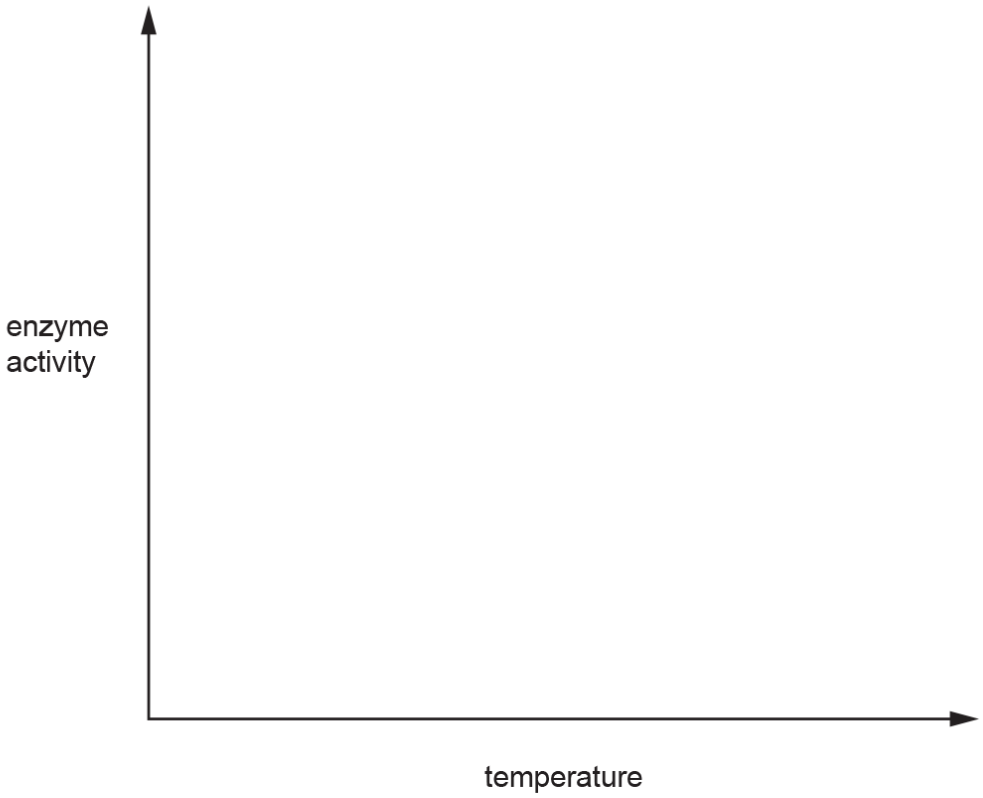


**Fig. 1.2**

[2]

**(d)** Explain why lipase cannot be used to catalyse the breakdown of proteins.

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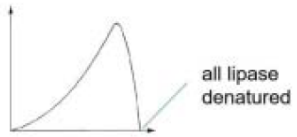
..... [3]

[Total: 16]

Answer:

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| (a) | **K** ;<br>**C** ;<br>**K** ;<br>**H** ;<br>**H** ; | 5 | |
| (b)(i) | *any four from:*<br>pH decreases / (solution) becomes acidic ;<br>(pH changes because) fatty acids are produced ;<br>lipase, digests / breaks down, fat ;<br>fatty acids, produced / AW, faster in test-tube **C** than **B** ;<br>bile, emulsifies fats / converts large particles of fat to small particles ;<br>bile increases the surface area (for lipase action) ; | 4 | |
| (b)(ii) | compare with tubes **B** and **C** to assess effect of lipase and / or bile ;<br>shows that bile, does not (chemically) digest fats / does not make solution acidic ;<br>shows that, lipase / enzyme, is required (for breakdown of fats in milk) ; | 2 | **A** control (experiment) |
| (c) | line drawn showing that decrease after optimum is steeper than increase ;<br>***MP1*** *- line does not have to start at the origin or end at the x-axis*<br><br>label line to point where line meets the *x*-axis **and** label indicating that all the lipase is denatured / AW ;<br>***MP2*** *– line must meet the x-axis* | 2 |  |
| (d) | *any three from:*<br>ref to specificity ;<br>(only) substrate for lipase is fat (molecules) ;<br>shape of active site is, not complementary to protein / complementary to fat ;<br>protein cannot, fit into / bind to, active site / lipase / enzyme ;<br>enzyme-substrate complexes cannot be formed ; | 3 | |

13. 0610_s23_qp_42 Q: 7

Complete the sentences about enzymes by writing a suitable word or phrase in each of the spaces provided.

Enzymes are involved in chemical digestion which produces small ..... molecules that can be absorbed into the blood.

Two examples of protease enzymes are pepsin and trypsin. Pepsin is produced by the ..... and requires acidic conditions. These conditions are created by the release of ..... , which provides the optimum pH for pepsin activity and also kills harmful ..... .

The ..... produces trypsin which breaks down protein in ..... pH conditions. These conditions are created by a substance called ..... , which neutralises the gastric juices and also has an important role in the ..... of fats and oils.

[8]

Answer:

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| | soluble ;<br>stomach ;<br>hydrochloric acid ;<br>(named) microorganisms / pathogens ;<br>pancreas / small intestine ;<br>alkaline ;<br>bile / bile salts ;<br>emulsification ; | 8 | |

14. 0610_s22_qp_43 Q: 4

**(a)** Fig. 4.1 is a diagram of the alimentary canal.

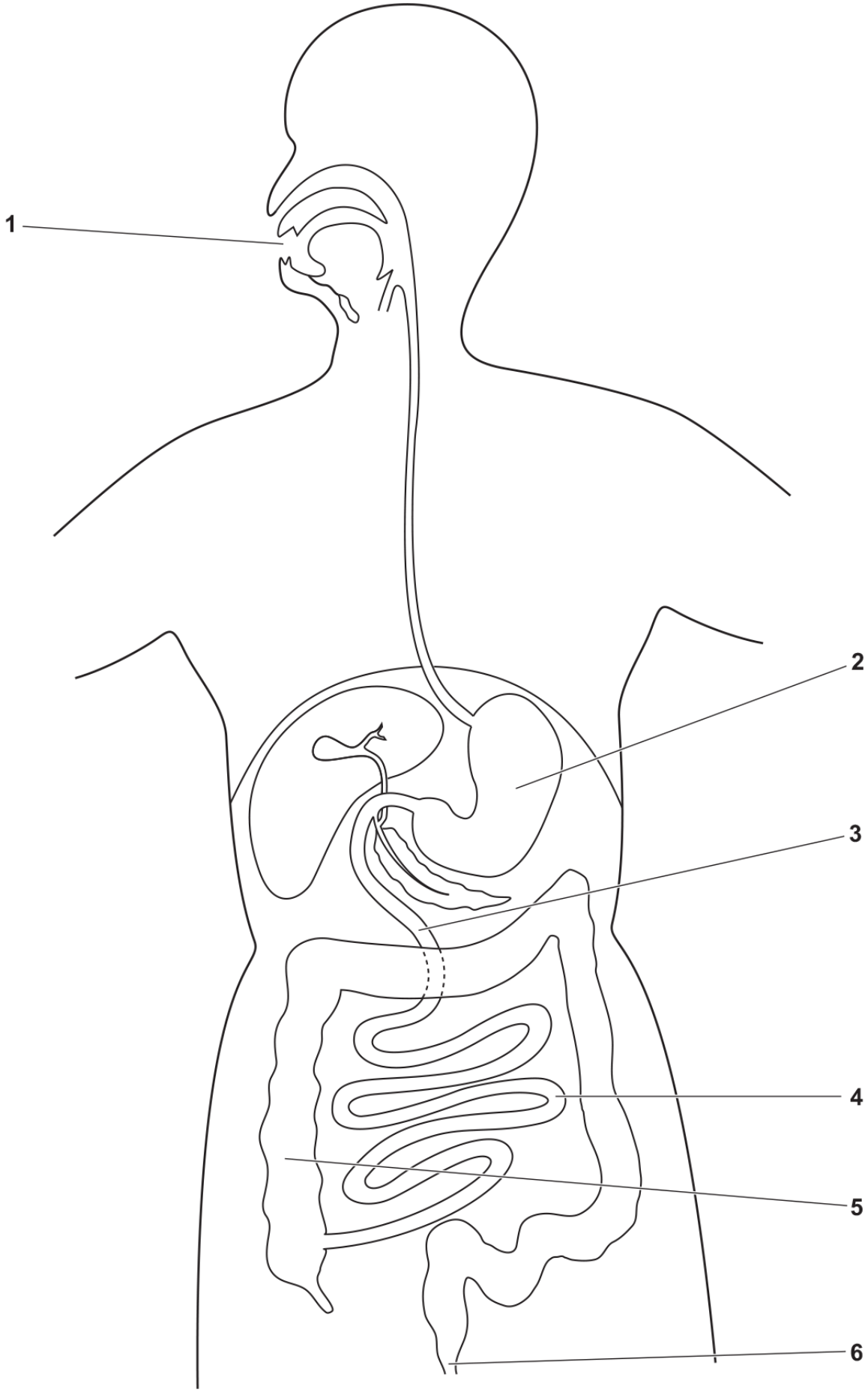



Fig. 4.1

Complete Table 4.1 by stating:

- the names of the organs from Fig. 4.1
- the letters of **all** the processes shown in the key that occur in each organ.

Key:
**A** – absorption
**C** – chemical digestion
**E** – egestion
**I** – ingestion
**M** – mechanical digestion

**Table 4.1**

| number from Fig. 4.1 | name of the organ | letter or letters of all the processes that occur in the organ |
|---|---|---|
| **1** | | |
| **2** | | |
| **3** | | |
| **4** | | |
| **5** | | |
| **6** | | |

[6]

**(b)** Fig. 4.2 is a diagram of a villus. The arrow indicates the direction of blood flow.

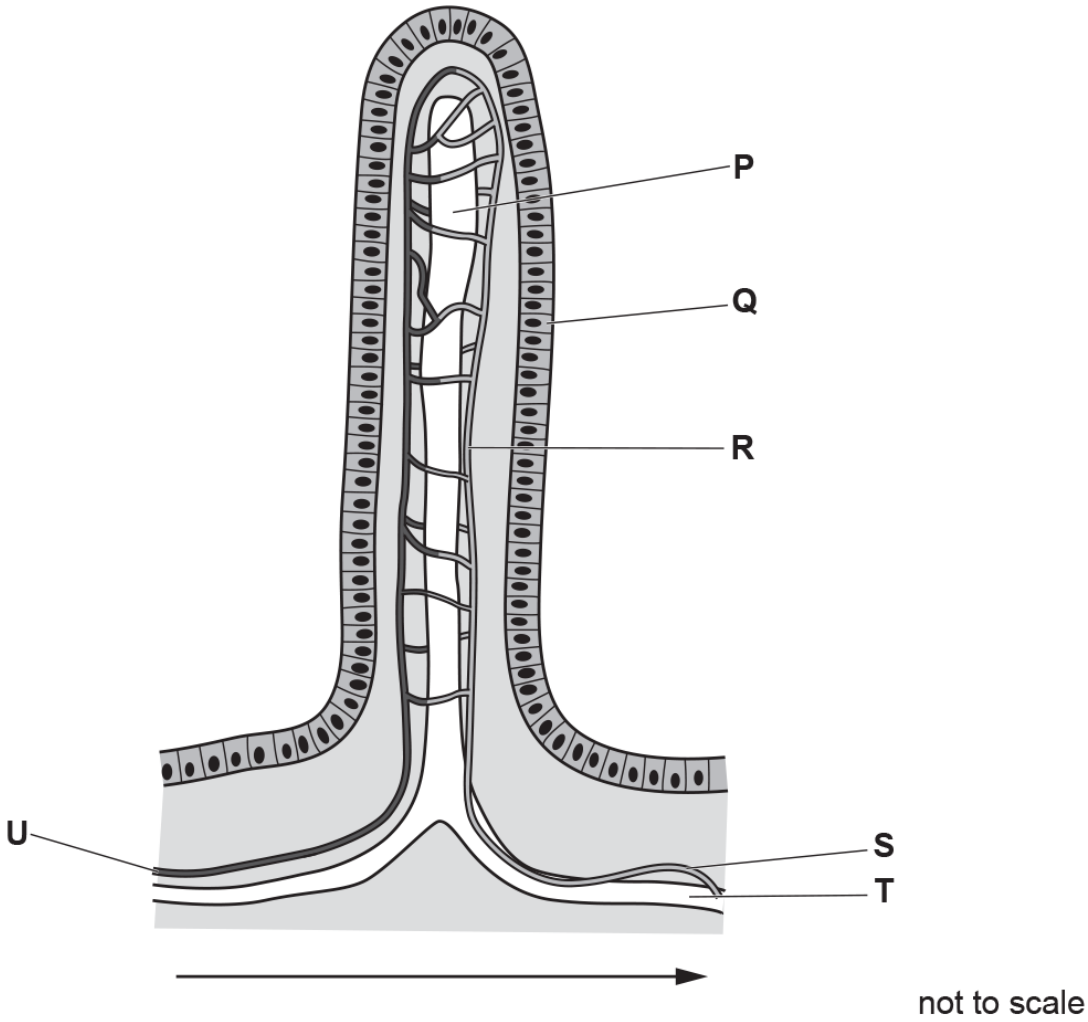



**Fig. 4.2**

Describe the structure of a villus **and** its role in the alimentary canal.

Use the letters in Fig. 4.2 to support your answer.

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..... [6]

[Total: 12]

Answer:

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>(a)</td><td>
<table>
<tr><th>number from Fig. 4.1</th><th>name of the organ</th><th>letter or letters of all the processes that occur in the organ</th></tr>
<tr><td>1</td><td>mouth</td><td>I, C, M</td></tr>
<tr><td>2</td><td>stomach</td><td>C, M (A)</td></tr>
<tr><td>3</td><td>duodenum</td><td>A, C (M)</td></tr>
<tr><td>4</td><td>ileum</td><td>A, C</td></tr>
<tr><td>5</td><td>colon</td><td>A</td></tr>
<tr><td>6</td><td>anus</td><td>E</td></tr>
</table>
;;;;;;</td><td>6</td><td>one mark for each correct row</td></tr>
<tr><td>(b)</td><td>any six from:<br>1 P is a lacteal ;<br>2 (lacteals) absorb, fats / fatty acids / glycerol / (named) fat soluble vitamin ;<br>3 T / lymphatic vessel, returns lymph / fats, to blood / to circulatory system ;<br>4 Q / epithelial cell, has microvilli ;<br>5 (microvilli / villi) increase the surface area for absorption ;<br>6 Q is one cell thick for short diffusion distance / fast diffusion<br>7 Q is site of breakdown of maltose to glucose ;<br>8 glucose uptake by active transport ;<br>9 R / capillary, for absorption of, amino acids / glucose / salts / water / products of digestion / soluble nutrients ;<br>10 R has thin walls / R is one cell thick ;<br>11 blood flowing to maintain concentration gradient / AW ;<br>12 transports absorbed nutrients to, S / venule / vein ;</td><td>6</td><td></td></tr>
</table>

15. 0610_w22_qp_41 Q: 1

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

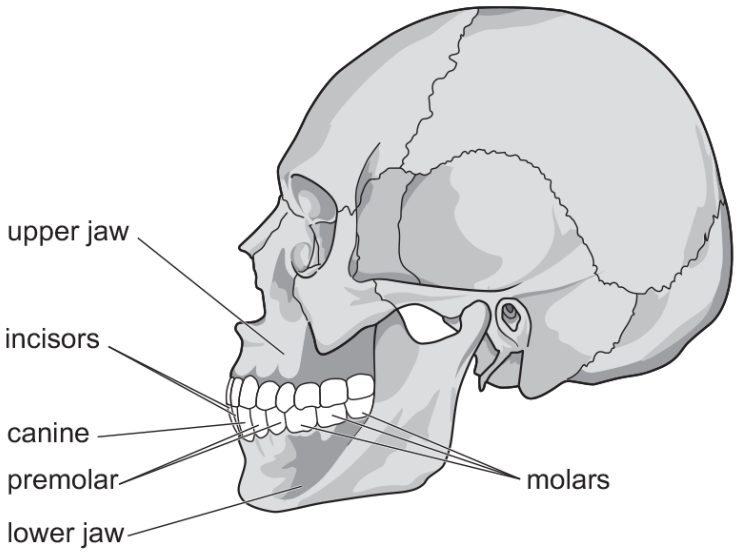


**Fig. 1.1**

**(i)** State the function of human teeth.

.....

.....

..... [1]

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

..... [1]

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

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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.

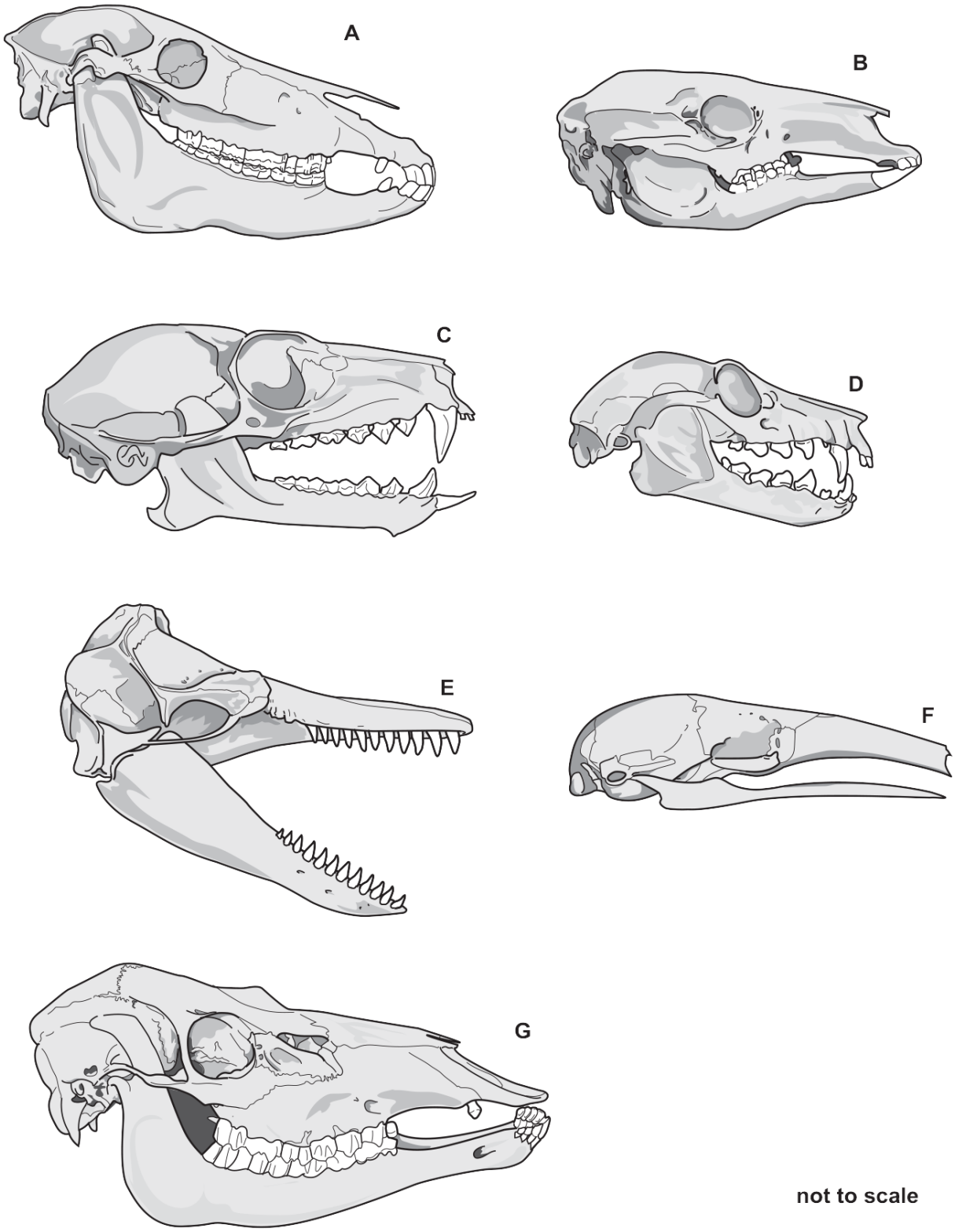


**Fig. 1.2**

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

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.

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.

..... [1]

[Total: 12]

Answer:

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>(a)(i)</td><td>mechanical / physical, digestion ;</td><td>1</td><td></td></tr>
<tr><td>(a)(ii)</td><td>enamel ;</td><td>1</td><td></td></tr>
<tr><td>(a)(iii)</td><td>any three from:<br>sugar / food / plaque, left on teeth ;<br>respiration (of sugar) by bacteria ;<br>produce (lactic) acid ;<br>dissolves, enamel / dentine / AW ;<br>AVP ;</td><td>3</td><td>e.g. dentine is exposed / AW or<br>dentine, is softer / dissolves more rapidly (than enamel) or ref. to, pulp / nerve endings, being exposed or (decay reaches nerve endings) leading to pain</td></tr>
<tr><td>(b)(i)</td><td><table><tr><td>Orcinus orca</td><td>E</td></tr><tr><td>Myrmecophaga tridactyla</td><td>F</td></tr><tr><td>Cervus elephus</td><td>G</td></tr><tr><td>Go to 5</td><td></td></tr><tr><td>Macropus rufus</td><td>B</td></tr><tr><td>Equus ferus</td><td>A</td></tr><tr><td>Lemur catta</td><td>C</td></tr><tr><td>Pteropus niger</td><td>D</td></tr></table>;;;;</td><td>4</td><td>7 correct = 4 marks<br>5 or 6 correct = 3 marks<br>3 or 4 correct = 2 marks<br>1 or 2 correct = 1 mark</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>(b)(ii)</td><td>any two from:<br>double circulation ;<br>four-chambered heart ;<br>lungs / any named part of lungs ;<br>diaphragm ;<br>red blood cells without nuclei ;<br>AVP ;</td><td>2</td><td></td></tr>
<tr><td>(b)(iii)</td><td>vertebrates ;</td><td>1</td><td></td></tr>
</table>

16. 0610_w22_qp_41 Q: 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.

The results are shown in Fig. 2.1.

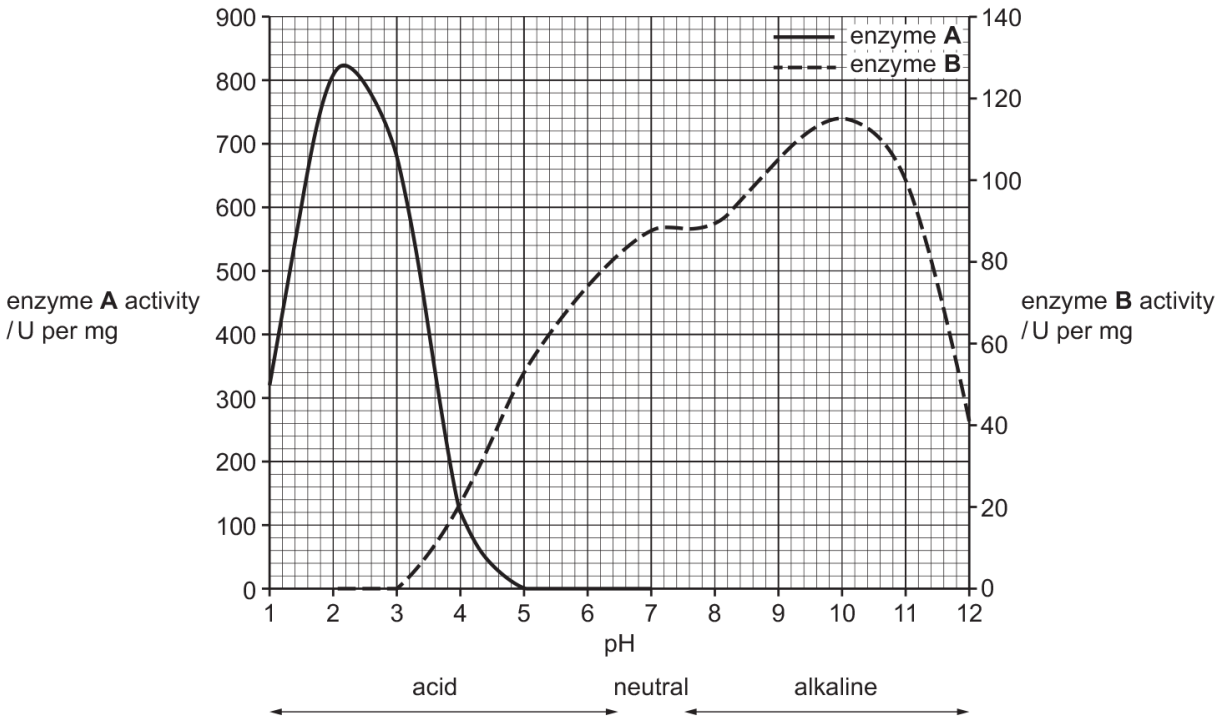


**Fig. 2.1**

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.

State the exact location of maltase in the small intestine.

..... [1]

[Total: 10]

Answer:

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| (a)(i) | *any two from:*<br>become soluble ;<br>for absorption ;<br>small enough, for diffusion / active transport ; | **2** | |
| (a)(ii) | water ; | **1** | |
| (b) | *any six from:*<br>**1** protein → amino acids ;<br><br>**2** ref to specificity ;<br>**3** both enzymes are active between pH 3 and pH5 ; **A** at pH4<br><br>**4** **A** is pepsin ;<br>**5** optimum pH at 2 ;<br>**6** enzyme shows, no activity / is denatured, from pH 5 ;<br>**7** (functions) in stomach ;<br>**8** where HCl is present / in acid conditions ;<br><br>**9** **B** is trypsin ;<br>**10** optimum pH at 10 ;<br>**11** enzyme shows, no activity / is denatured, from pH 3 ;<br>**12** (functions) in small intestine / secreted from pancreas ;<br>**13** bile neutralises (stomach) acid / in alkaline conditions ; | **6** | MP1 **A** breaks down proteins (to, polypeptides / peptides)<br><br>MP13 **A** pancreatic juice neutralises stomach acid |
| (c) | (membrane of) epithelium ; | **1** | |

17. 0610_w22_qp_42 Q: 2

Fig. 2.1 is a diagram of the human alimentary canal and associated organs.

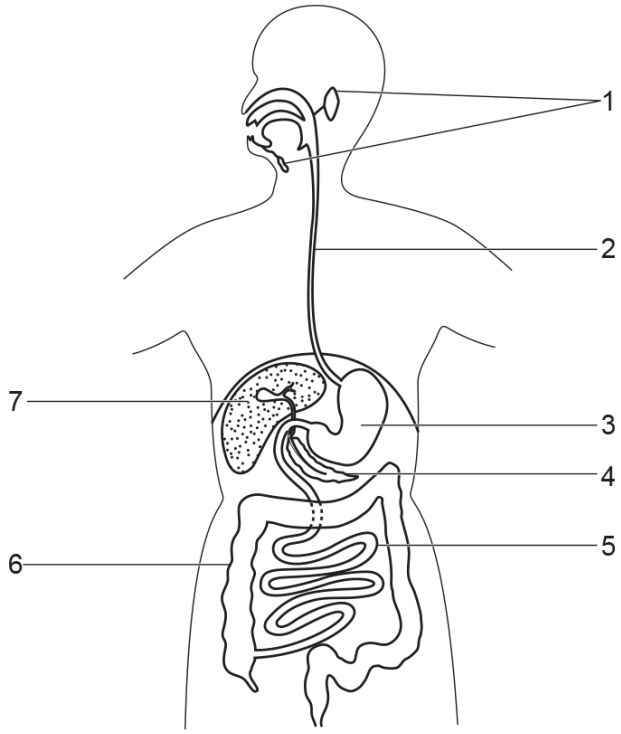


**Fig. 2.1**

**(a)** Table 2.1 shows enzymes, the organs that secrete these enzymes, their substrates and products.

Complete Table 2.1.

**Table 2.1**

| enzyme | organ that secretes the enzyme | number identifying the organ on Fig. 2.1 | substrate | product or products |
|---|---|---|---|---|
| amylase | | 1 | | |
| | | 3 | protein | |
| lipase | | 4 | | |
| maltase | | | | |

[4]

**(b)** Explain the role of hydrochloric acid in the alimentary canal.

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..... [3]

**(c)** State a function of the region of the alimentary canal labelled 6 in Fig. 2.1.

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..... [1]

**(d)** Describe how food eaten by humans is reduced to smaller pieces **and** explain how this makes chemical digestion more efficient.

You may refer to Fig. 2.1 in your answer.

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.....

.....

..... [6]

[Total: 14]

Answer:

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| (a) | *one mark per row*<br><br>enzyme \| organ that secretes the enzyme \| number identifying the organ on Fig. 2.1 \| substrate \| product or products<br>amylase \| salivary gland(s) \| 1 \| starch \| maltose ;<br>pepsin / protease \| stomach / gastric gland \| 3 \| protein \| amino acid(s) ;<br>lipase \| pancreas \| 4 \| fat / lipid / oil \| fatty acids and glycerol ;<br>maltase \| small intestine / duodenum / ileum \| 5 \| maltose \| glucose ; | 4 | **A** pepsinogen<br>**A** (poly)peptides / peptones<br><br>**A** epithelium of small intestine |
| (b) | *any three from:*<br>**1** ref to hydrochloric acid in the stomach ;<br>**2** kills, bacteria / pathogens (in food) ;<br>**3** denatures enzymes in, bacteria / (harmful) microorganisms (in food) ;<br>**4** provides, acid / suitable / low / optimum / best, pH for, pepsin / protease / (digestive) enzymes ;<br>**5** AVP ; e.g. activation of pepsinogen | 3 | |
| (c) | (re)absorbs, water / ions / vitamins ;<br>AVP ; e.g. fermentation of indigestible (food) matter by bacteria | 1 | **A** solidifying undigested waste |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| (d) | *any six from:*<br>**1** mechanical / physical, digestion / breakdown ;<br>**2** (decrease particle size) increase surface area (of food for chemical digestion) ;<br>**3** for (named) enzyme (activity) ;<br><br>**4** any further detail of enzyme activity ;<br><br>**5** chewing / crushing / grinding / AW, in the mouth / by teeth ;<br>**A** mastication<br>**6** incisor / canine, (teeth) for cutting food / AW ;<br>**7** (pre)molar (teeth), crush food / AW ;<br>**8** mixing of saliva with food / formation of bolus of food for swallowing ;<br><br>**9** churning action / formation of chyme / AW, of stomach (3) ;<br>**10** ref to action of muscles in the stomach (wall) ;<br><br>**11** emulsification by bile ;<br>**12** occurs in, small intestine / duodenum / ileum (5) ;<br>**13** *described as* bile (salts) break(s) fat globules into smaller pieces / large fat droplets into small(er) droplets / AW ; | 6 | |

18. 0610_s21_qp_42 Q: 2

The classification of giant pandas, *Ailuropoda melanoleuca*, is debated by many scientists.

Fig. 2.1 shows a giant panda eating bamboo plants.

**Fig. 2.1**

Fig. 2.2 shows a red panda, *Ailurus fulgens*, and a polar bear, *Ursus maritimus*.

red panda eating bamboo plants

polar bear eating fish

**Fig. 2.2**

**(a)** State **one** dietary component that is more likely to be found in bamboo plants than in fish.

..... [1]

**(b)** **(i)** State **two** features, visible in Fig. 2.1 and Fig. 2.2, that identify the three animals as all belonging to the same vertebrate group.

1 .....

2 .....

[2]

**(ii)** DNA can also be used to classify species.

Molecular biologists compared the DNA base sequences of eight species from the same vertebrate group. They used the differences to draw a classification diagram.

Fig. 2.3 shows the classification diagram for these eight species. The shorter the horizontal distance from two species to the branching point that they share, the more similar their DNA sequences are and the more closely the two species are related.

The scale on Fig. 2.3 shows the time at which the molecular biologists estimate that each branching point occurred.

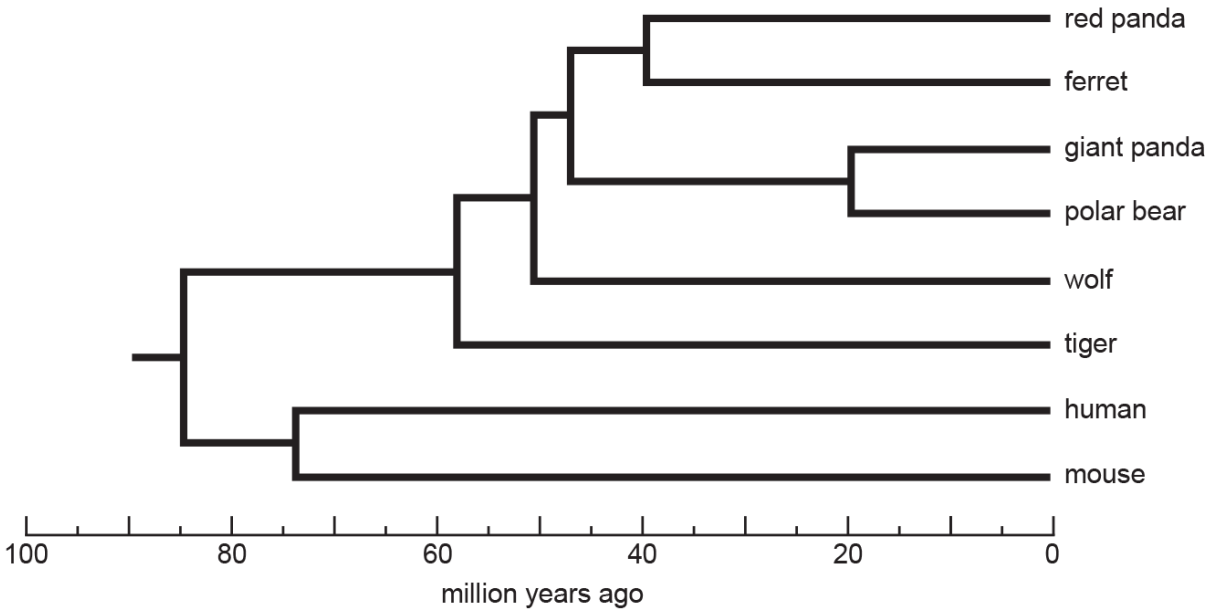


**Fig. 2.3**

Morphology can also be used to classify species. Some scientists think that morphology suggests that the giant panda is more closely related to the red panda than it is to the polar bear.

Discuss the evidence for **and** against the giant panda being more closely related to the red panda than it is to the polar bear. Use the information in Fig. 2.1, Fig. 2.2 and Fig. 2.3 in your answer.

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..... [5]

**(iii)** State one **other** type of evidence that is used to classify species.

..... [1]

[Total: 9]

Answer:

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| (a) | (dietary) fibre / carbohydrate / starch / (named) sugar / vitamin C ; | 1 | |
| (b)(i) | external ears / pinnae ;<br>fur ; | 2 | |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| (b)(ii) | *any five from:*<br><br>*for (giant panda closer to red panda):*<br>same diet / herbivores / AW ;<br>terrestrial / similar, ecosystems / habitats ;<br>fur markings described ;<br>ear position ;<br><br>*against:*<br>shorter (branch) distance between giant panda and polar bear (than to red panda) ;<br>fewer, DNA (base sequence) / gene, differences between giant panda and polar bear (than to red panda) ;<br>(red panda) first appeared, 40±3 million rather than 20±3 million, years ago (giant and polar) ;<br>more time for, mutations / evolution (for red panda) ;<br>common, ancestor / branch / relationship, 20±3 million, (giant and polar), than 47±3 million years ago (red) ;<br>DNA data is likely to be more, accurate / quantitative / not subjective ; | **5** | |
| (b)(iii) | anatomy / ability to produce fertile offspring / AVP ; | **1** | |