Topical Past Papers

IGCSE Combined Science (0653) Paper 4

[Short-answer and structured questions]

Exam Series: February/March 2018 – May/June 2025

Format Type A:
Answers to all questions are provided as an appendix

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Introduction

Each Topical Past Paper Questions Compilation 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 Combined Science (0653) Paper 4 Topical Past Papers
- Subtitle: Exam Practice Worksheets With Answer Scheme
- Examination board: Cambridge Assessment International Education (CAIE)
- Subject code: 0653
- Years covered: February/March 2018 – May/June 2025
- Paper: 4 [Extended]
- Number of pages: 1131
- Number of questions: 468

Contents

Chapter 1

Biology

1.1 Plant nutrition

1. 0653_m25_qp_42 Q: 3

(a) Fig. 3.1 shows a cross-section of a leaf.

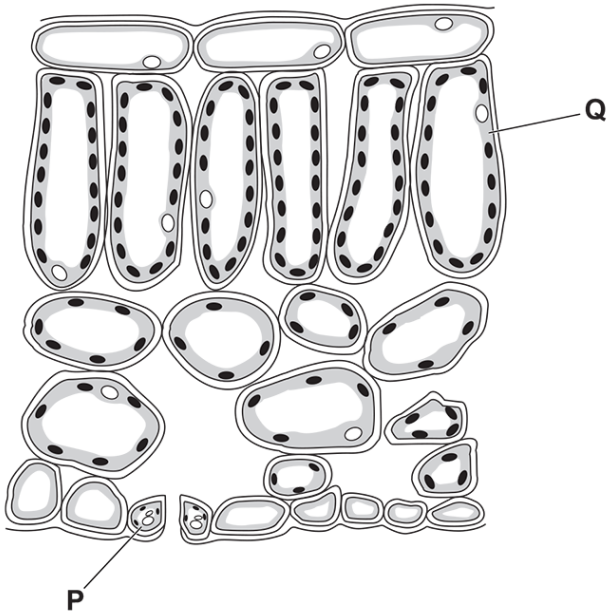

Fig. 3.1

(i) Name the type of cell labelled **P** in Fig. 3.1.

..... [1]

(ii) The cell labelled **Q** is specialised for a specific function.

State the function of the cell labelled **Q**.

..... [1]

(b) Root hair cells take in water and mineral ions from the soil.

Root hair cells are adapted for the uptake of mineral ions by having high numbers of mitochondria in their cytoplasm.

Explain why large numbers of mitochondria are important for the uptake of mineral ions.

.....

.....

.....

.....

..... [3]

(c) Fig. 3.2 is a diagram of a plant cell that has been immersed in a sugar solution.

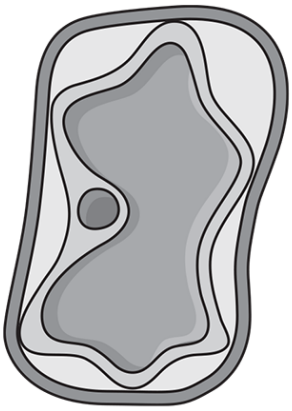

Fig. 3.2

Complete these sentences about the cell in Fig. 3.2.

Water has left the cell because the sugar solution has a lower

water ..... than that of the cell.

The loss of water reduces the ..... pressure inside the cell.

The cell membrane moves away from the cell wall and the cell becomes

..... .

[3]

[Total: 8]

2. 0653_s25_qp_43 Q: 2

(a) Fig. 2.1 is a diagram of a cross-section through a leaf.

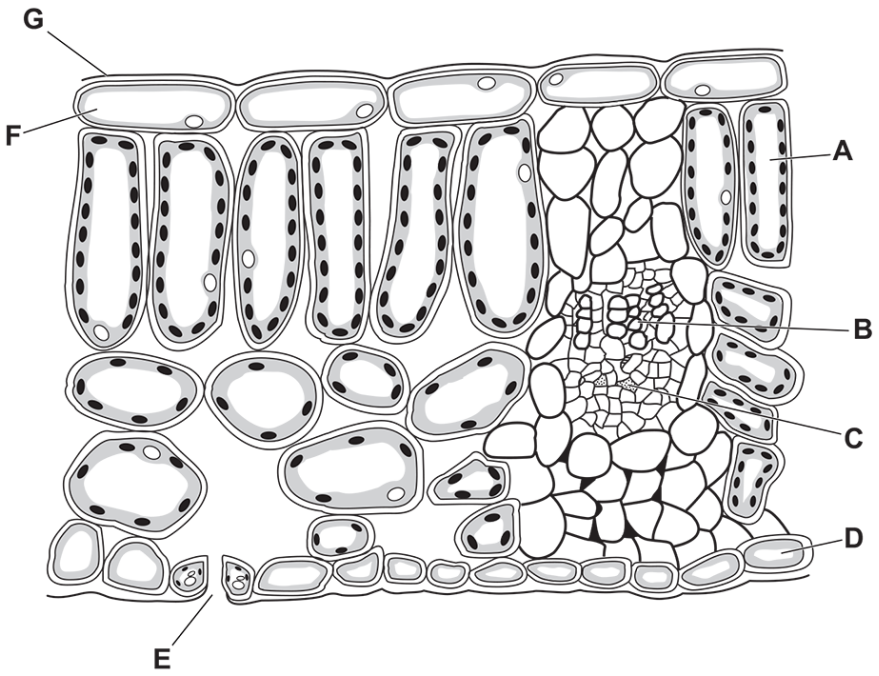

Fig. 2.1

State the letter on Fig. 2.1 that identifies:

cuticle .....

a cell specialised for photosynthesis .....

a cell that transports mineral ions to the leaf. .....

[3]

(b) A green pigment is needed for photosynthesis.

State the name of this pigment and its role in photosynthesis.

name .....

role .....

.....

.....

.....

[3]

(c) The graph in Fig. 2.2 shows the effect of temperature on the rate of photosynthesis in a plant.

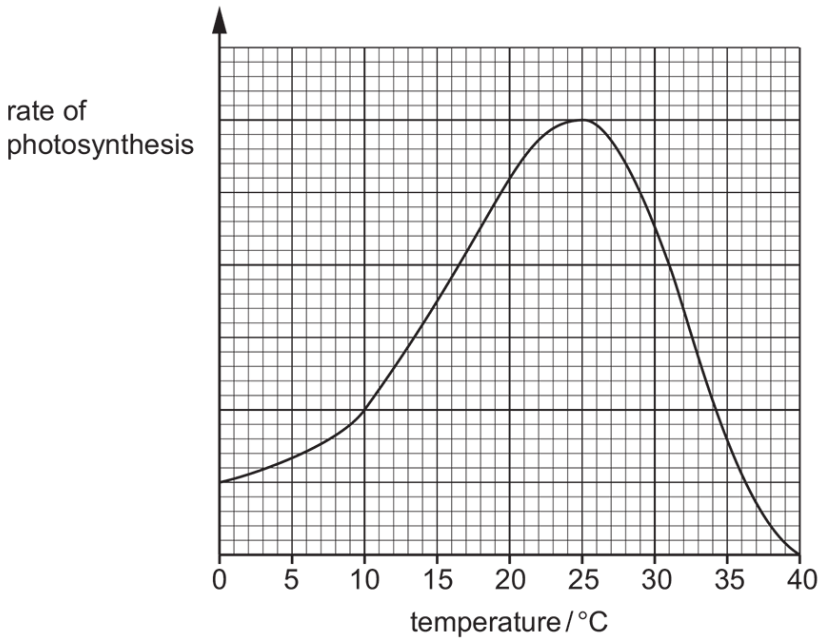

Fig. 2.2

(i) Identify the optimum temperature for photosynthesis shown in Fig. 2.2.

..... °C [1]

(ii) Enzymes are involved in photosynthesis.

Explain the result at 40 °C shown in Fig. 2.2.

.....

.....

.....

.....

..... [3]

[Total: 10]

3. 0653_s24_qp_42 Q: 4

(a) A student labels a diagram of a plant cell.

Fig. 4.1 shows the student's diagram.

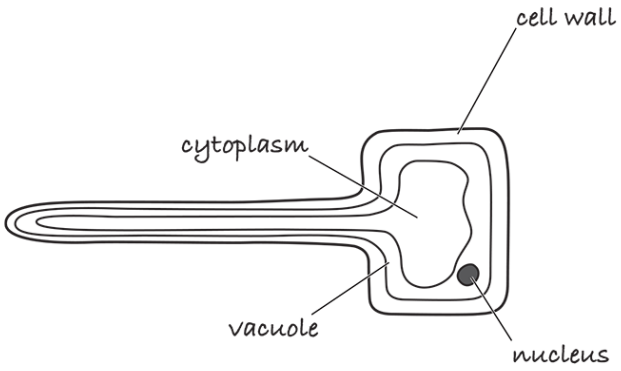

Fig. 4.1

(i) The student has **not** labelled the diagram correctly.

(Circle) **all** the labels on Fig. 4.1 that are **not** correct. [1]

(ii) Explain how the cell in Fig. 4.1 is adapted to its function.

.....

.....

..... [2]

(b) Fig. 4.2 shows the effect of carbon dioxide concentration and light intensity on the rate of photosynthesis.

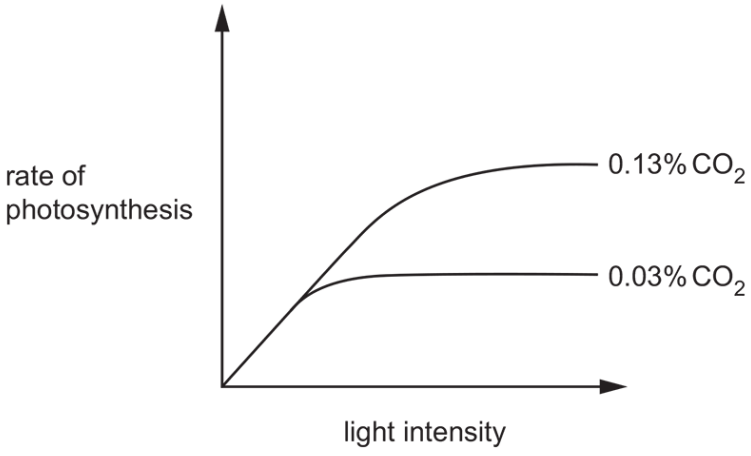

Fig. 4.2

(i) Describe the effect of increasing **light intensity** on the rate of photosynthesis as shown in Fig. 4.2.

.....

.....

..... [1]

(ii) Trees in a forest are cut down and burnt where they fall.

Use Fig. 4.2 to suggest why the rate of photosynthesis in the surrounding plants increases.

.....

.....

.....

..... [2]

(c) Explain why the leaves of plants deficient in magnesium change from green to yellow.

.....

.....

.....

..... [2]

[Total: 8]

4. 0653_s23_qp_42 Q: 4

(a) Fig. 4.1 shows a student's diagram of a cross-section through a leaf.

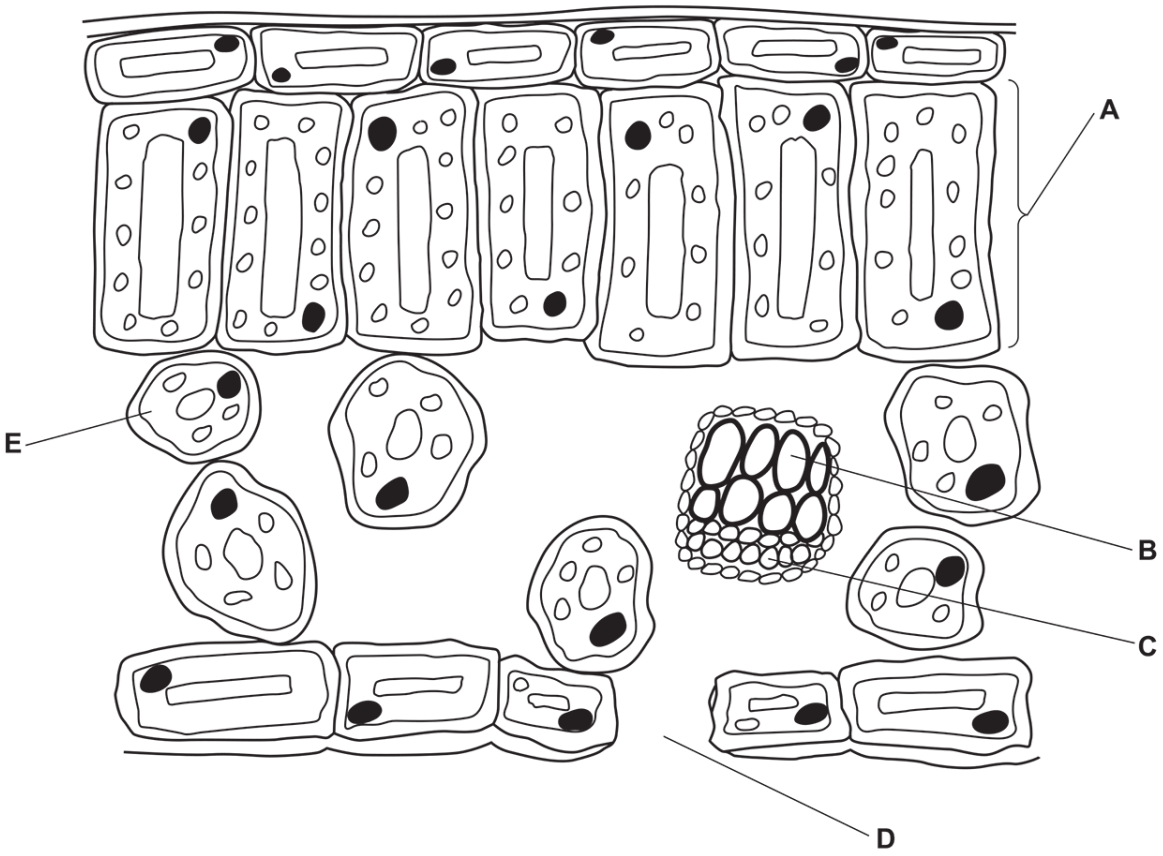

Fig. 4.1

The student uses Table 4.1 to show the functions of some of the leaf parts labelled in Fig. 4.1.

Complete Table 4.1.

Table 4.1

letter	name of part	function
A		photosynthesis
D		
	phloem cell	

[3]

(b) Plants use light energy in photosynthesis.

(i) Complete the balanced equation for photosynthesis.

..... H_2O + ... CO_2 ⟶ ..... + ... [2]

(ii) Fig. 4.2 shows the effect of temperature on the rate of photosynthesis in a species of plant.

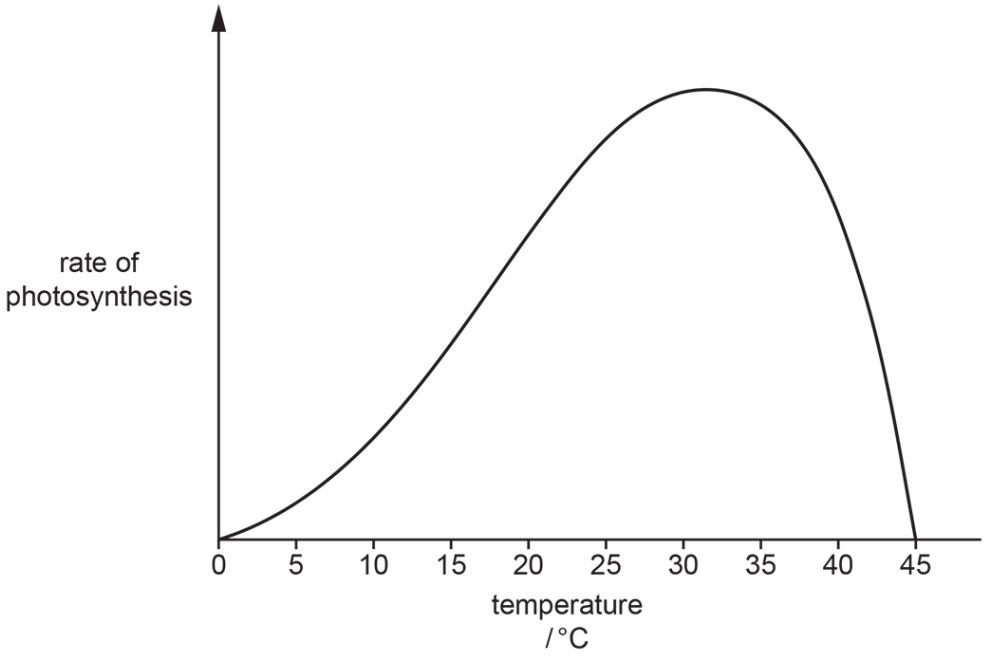

Fig. 4.2

Photosynthesis is an enzyme-controlled reaction.

Explain the effect of a temperature of 45 °C on the rate of photosynthesis in Fig. 4.2.

.....

.....

.....

.....

..... [3]

(c) Fig. 4.3 shows some of the cells and molecules at the tip of a plant shoot. The plant shoot is placed in a position where the direction of light is constantly from the side as shown in Fig. 4.3.

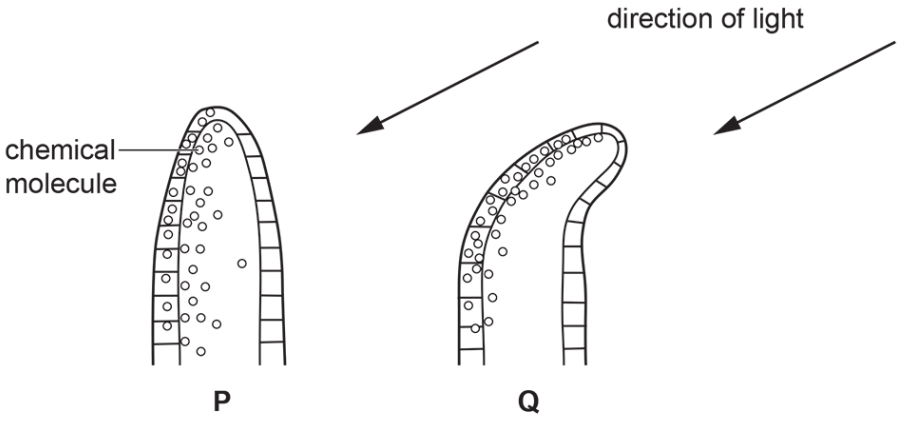

Fig. 4.3

P shows the plant shoot at the start.

Q shows the plant shoot after 2 days.

Complete these sentences about the response of the plant shoot to light.

The plant shoot is responding to light, this is called ..... .

The response is caused by a chemical made in the shoot tip called ..... .

The chemical stimulates growth by causing greater cell ..... on the shaded side of the shoot.

[3]

[Total: 11]

5. 0653_w21_qp_42 Q: 7

(a) A student investigates the effect of light intensity on the rate of photosynthesis of an aquatic plant submerged in a beaker of water.

During photosynthesis, the aquatic plant produces bubbles of gas.

The student shines a lamp on the aquatic plant from different distances and measures the volume of gas produced in 3 minutes.

Table 7.1 shows the results.

Table 7.1

distance of lamp from aquatic plant / cm	volume of gas produced in 3 minutes / cm^3	rate of gas produced / cm^3 per second
50	0.2	
40	0.8	0.004
30	1.6	0.009
20	2.2	0.012
10	2.2	0.012

(i) Calculate the rate of gas produced when the lamp is 50 cm from the aquatic plant.

..... cm^3 per second [2]

(ii) Describe the effect of light intensity on the rate of photosynthesis shown by the results in Table 7.1.

.....

.....

.....

..... [2]

(b) The student does a different experiment to investigate the effect of **temperature** on the rate of photosynthesis.

Fig. 7.1 shows a graph of the results.

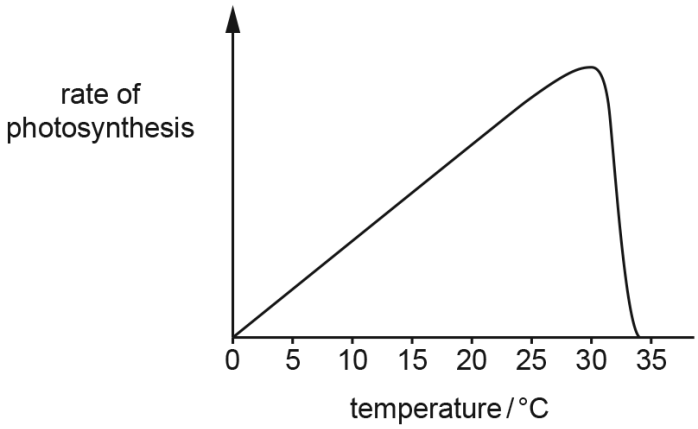

Fig. 7.1

The process of photosynthesis is controlled by enzymes.

Explain the shape of the graph seen in Fig. 7.1.

Use ideas about enzymes in your answer.

.....

.....

.....

.....

.....

..... [3]

(c) Glucose is a product of photosynthesis.

Complete these sentences about the uses of glucose in a plant.

Choose words from the list.

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

glycogen	**mesophyll**	**phloem**
protein	**starch**	**xylem**

Glucose is converted to sucrose and transported to the roots in ..... vessels.

In the roots, the sucrose is converted to ..... for storage.

[2]

(d) Plant shoots grow towards a light source.

(i) State the name of this tropic response of plants to light.

..... [1]

(ii) State the name of the chemical involved in this response.

..... [1]

[Total: 11]

6. 0653_w21_qp_43 Q: 7

(a) A student uses the apparatus in Fig. 7.1 to investigate the effect of temperature on the rate of photosynthesis of an aquatic plant.

During photosynthesis, the aquatic plant produces bubbles of gas.

The rate of bubbles produced shows the rate of photosynthesis.

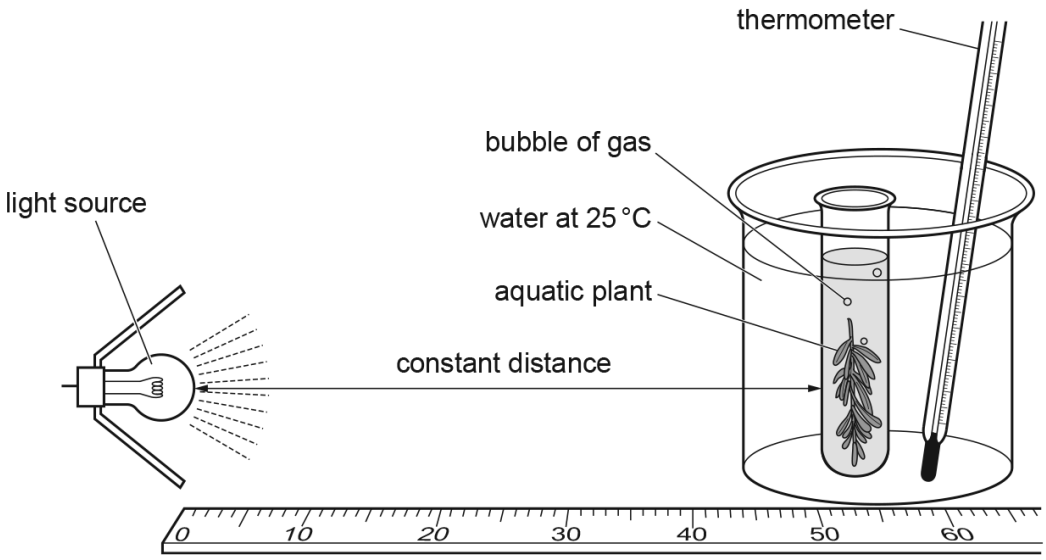

Fig. 7.1

The student counts the number of bubbles produced by the aquatic plant in 3 minutes.

The student does this two more times and calculates the average number of bubbles.

The student then repeats the investigation at different temperatures of water.

Table 7.1 shows the results.

Table 7.1

temperature of water / °C	number of bubbles produced in 3 minutes			
	experiment 1	experiment 2	experiment 3	average
25	56	64	59	60
30	75	78	83	79
35	98	93	97	96
40	78	81	76	78
45	20	21	19	20

(i) Describe the effect of temperature on the rate of photosynthesis shown by the results in Table 7.1.

.....

.....

..... [2]

(ii) The process of photosynthesis is controlled by enzymes.

Explain the result at 45 °C in Table 7.1.

Use ideas about enzymes in your answer.

.....

.....

..... [2]

(b) Fig. 7.2 shows a cross-section of a leaf of a plant.

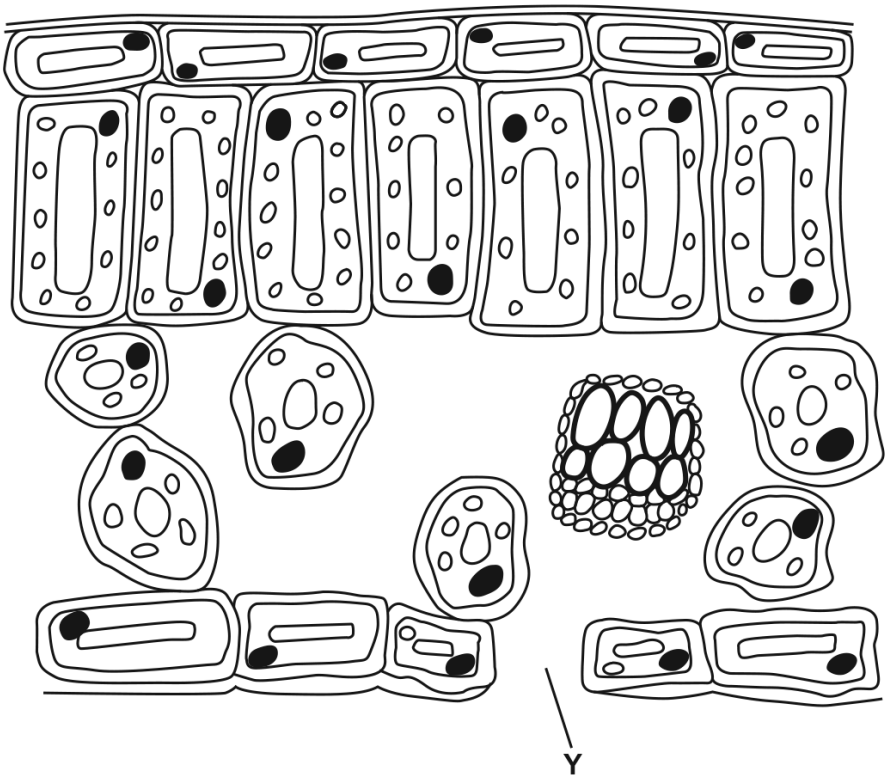

Fig. 7.2

(i) On Fig. 7.2, draw a label line and the letter **X** to identify cells adapted to synthesise **most** of the carbohydrates made by the leaf. [1]

(ii) State the function of the part labelled **Y** in Fig. 7.2.

..... [1]

(iii) Explain why a deficiency in magnesium ions results in a reduction in the synthesis of carbohydrates.

.....

.....

.....

.....

..... [3]

[Total: 9]

7. 0653_s19_qp_41 Q: 1

Fig. 1.1 shows a bag containing sucrose solution placed in a beaker of water for 20 minutes.

The bag acts like the partially permeable membranes in cells. It allows small molecules to pass through. It does not allow larger molecules such as sucrose to pass through.

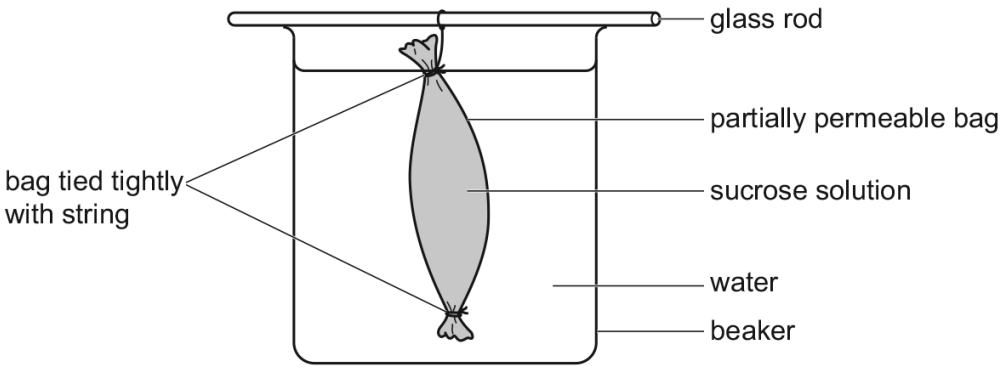

Fig. 1.1

The mass of the bag and its contents shown in Fig. 1.1 increases from 25.6 g to 27.3 g.

(a) (i) Calculate the percentage increase in the mass of the bag and its contents.

percentage increase = ...% [2]

(ii) Water molecules move into the bag.

Explain in detail why this happens.

.....

.....

.....

..... [2]

(b) Suggest **one** molecule from the list which is unable to pass through the partially permeable bag.

carbon dioxide **glucose** **oxygen** **nitrogen** **protein**

..... [1]

(c) Water is one of the raw materials needed for photosynthesis.

(i) Complete the balanced symbol equation for photosynthesis.

..... H_2O + ... $\xrightarrow[\text{chlorophyll}]{\text{light}}$ $C_6H_{12}O_6$ + ... [2]

(ii) State **two** ways in which the plant uses the glucose produced by photosynthesis.

1. .....

2. .....

[2]

[Total: 9]

8. 0653_m18_qp_42 Q: 4

Fig. 4.1 shows a cross-section of a leaf. Cells **P** and **Q** are examples of mesophyll cells in the leaf.

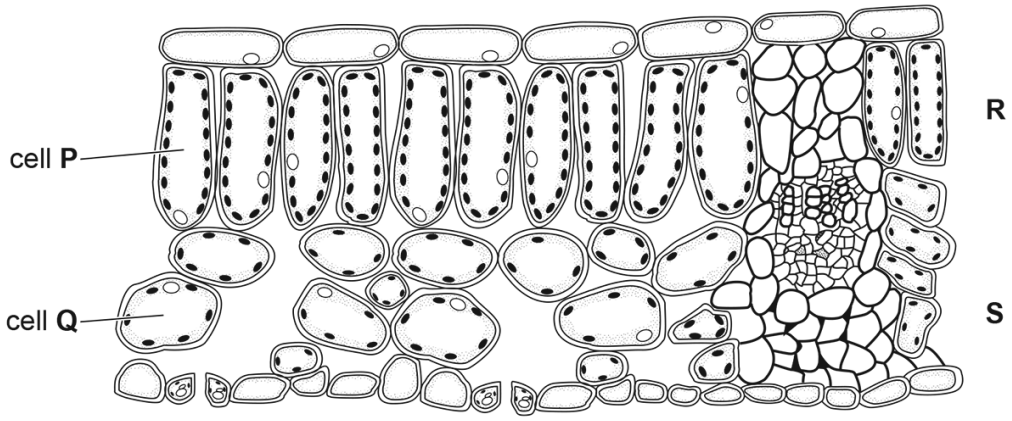

Fig. 4.1

(a) On Fig. 4.1 draw label lines from

1. **R** to the part of any cell which contains the genetic material,
2. **S** to a part of tissue that transports water.

[2]

(b) Cell **P** is able to carry out photosynthesis at a greater rate than cell **Q**.

Use evidence from Fig. 4.1 to support this statement referring to

(i) the position of cell **P** in the leaf compared with cell **Q**,

.....

.....[1]

(ii) the number of chloroplasts in cells **P** and **Q**.

.....

.....

.....[2]

(c) Describe in detail the function of chlorophyll in chloroplasts.

.....

.....

.....[2]

1.2 Human nutrition

9. 0653_s25_qp_42 Q: 1

(a) Fig. 1.1 is a diagram of the digestive system and associated organs.

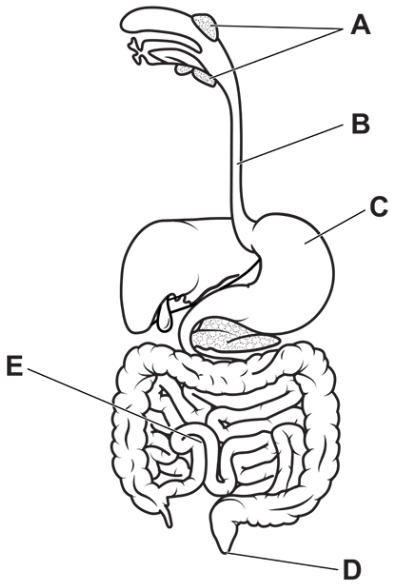

Fig. 1.1

Table 1.1 shows some information about the parts labelled in Fig. 1.1.

Complete Table 1.1.

Table 1.1

name of part	letter	function of part
stomach	.....	digestion
small intestine	**E**	digestion and ..... of digested food
.....	**A**	.....

[3]

(b) The stomach contains protease and hydrochloric acid.

State the function of protease and hydrochloric acid in the stomach.

protease .....

.....

hydrochloric acid .....

.....

.....

[3]

(c) Fig. 1.2 is a graph of the effect of pH on the activity of an enzyme found in the mouth.

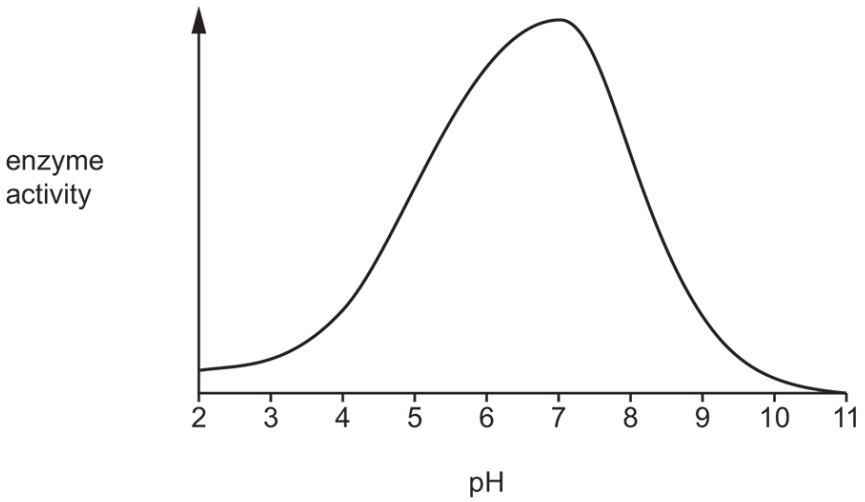

Fig. 1.2

Explain why this enzyme stops working at pH 11.

.....

.....

.....

.....

..... [3]

[Total: 9]

10. 0653_m24_qp_42 Q: 1

(a) Fig. 1.1 shows part of the human alimentary canal and associated organs.

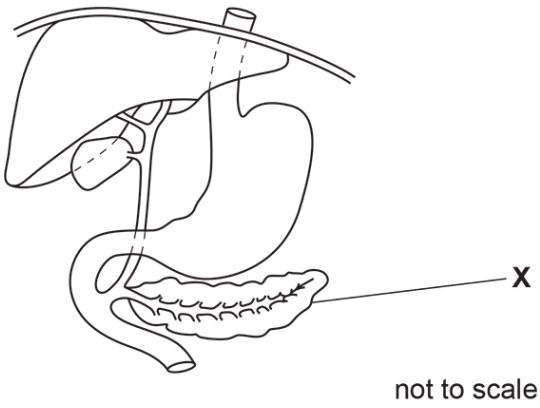

Fig. 1.1

(i) On Fig. 1.1, draw a line and the letter **L** to label the liver. [1]

(ii) State the name of the part labelled **X** shown on Fig. 1.1.

..... [1]

(b) Mechanical digestion takes place in the alimentary canal.

Complete the definition of mechanical digestion.

Mechanical digestion is the breakdown of food into smaller ..... without chemical change to the food ..... .

[2]

(c) Enzymes in the alimentary canal speed up chemical digestion.

State the function of the enzyme amylase.

.....

..... [2]

(d) Fig. 1.2 is a graph showing the effect of pH on enzyme **A** and enzyme **B**.

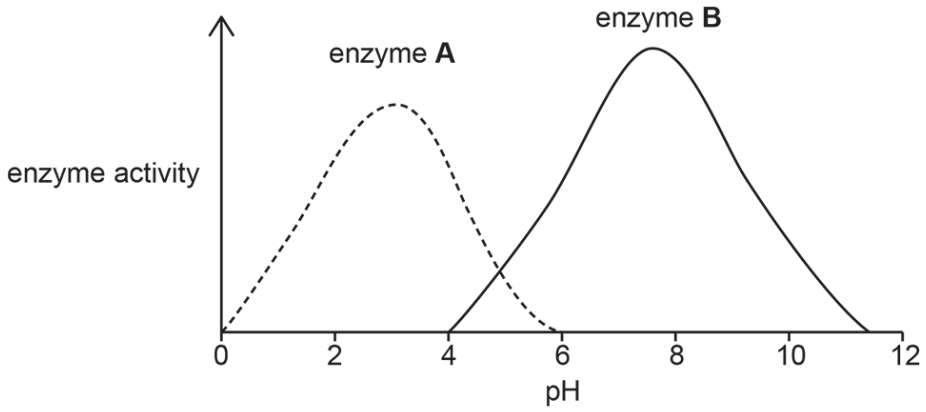

Fig. 1.2

State which of the enzymes in Fig. 1.2 is found in gastric juice.

Explain your answer using evidence from Fig. 1.2.

enzyme .....

explanation .....

.....

[2]

[Total: 8]

Appendix A

Answers

1. 0653_m25_ms_42 Q: 3

Question	Answer	Marks
(a)(i)	guard (cell) ;	1
(a)(ii)	photosynthesis ;	1

Question	Answer	Marks
(b)	*any **three** from:* uptake of mineral ions is by active transport ; energy required for, active transport / uptake of mineral ions ; respiration releases energy ; (mitochondria are) site of (aerobic) respiration ;	3
(c)	potential ; turgor ; plasmolysed ;	3

2. 0653_s25_ms_43 Q: 2

Question	Answer	Marks
(a)	**G** ; **A** ; **B** ;	3
(b)	chlorophyll ; transfers light energy to chemical energy ; to synthesise / produce, carbohydrates / glucose ;	3
(c)(i)	25 (°C) ;	1
(c)(ii)	enzymes denature (at high temperature) ; active site changes shape ; active site no longer complementary to substrate / substrate no longer fits active site ;	3

3. 0653_s24_ms_42 Q: 4

Question	Answer	Marks
(a)(i)	vacuole **and** cytoplasm circled ;	1
(a)(ii)	large surface area / **elongated** shape ; increases, **rate** of absorption / uptake of water / uptake of mineral (ions) ;	2

Question	Answer	Marks
(b)(i)	(as light intensity increases) rate of photosynthesis increases, **and** then levels off / is constant ;	1
(b)(ii)	more light / less competition for light ; more CO_2 / less competition for CO_2 / CO_2 is released by combustion ;	2
(c)	magnesium is required to **make** chlorophyll ; chlorophyll is a green pigment ;	2

4. 0653_s23_ms_42 Q: 4

Question	Answer	Marks
(a)	<table><tr><th>letter</th><th>name of part</th><th>function</th></tr><tr><td>**(A)**</td><td>palisade (mesophyll cell / layer)</td><td>(photosynthesis)</td></tr><tr><td>**(D)**</td><td>stoma / stomata</td><td>to allow gas exchange</td></tr><tr><td>**C**</td><td>(phloem)</td><td>**transport** (sucrose / amino acids)</td></tr></table> ;;; *one mark for each correct row*	3
(b)(i)	6 (H_2O) + 6 (CO_2) ; $C_6H_{12}O_6 + 6O_2$;	2
(b)(ii)	*any three from:* photosynthesis stops / slows down ; enzymes denature ; active site changes shape ; substrate no longer fits active site ;	3
(c)	phototropism ; auxin ; elongation ;	3

5. 0653_w21_ms_42 Q: 7

Question	Answer	Marks
(a)(i)	0.2 ÷ 180 ; 0.001 (cm / s) ;	2
(a)(ii)	as light intensity increases, the rate of photosynthesis increases ; idea that rate levels off (below 20 cm) ;	2
(b)	*any three from:* 0 to 30 °C rate increases as enzymes gain more kinetic energy ; 0 to 30 °C rate increases as there are more (effective) collisions ; above 30 °C enzymes denature / shape of active site changes ; above 30 °C substrate no longer fits into active site ;	3
(c)	phloem ; starch ;	2
(d)(i)	phototropism ;	1
(d)(ii)	auxin ;	1

6. 0653_w21_ms_43 Q: 7

Question	Answer	Marks
(a)(i)	as temperature increases so does the rate ; rate decreases above 35 °C ;	2
(a)(ii)	enzymes denature / shape of active site changes ; substrate no longer fits into active site ;	2
(b)(i)	any palisade cell labelled ;	1
(b)(ii)	gas exchange ;	1
(b)(iii)	*any three from:* magnesium ions needed to make chlorophyll ; (deficiency means) less chlorophyll will be made ; (less chlorophyll means) less light energy transferred to chemical energy ; idea that the chemical energy is in the form of carbohydrates (so less are made) ;	3

7. 0653_s19_ms_41 Q: 1

Question	Answer	Marks
(a)(i)	27.3–25.6 = 1.7 ; (1.7) / 25.6 × 100 = 6.64(%) ;	2
(a)(ii)	high water potential outside and low water potential inside bag / higher water potential outside bag / water moves from high to low water potential ; *and one of* water moves in by osmosis ; use of the term diffusion ; water moves so as to try to equalise water potential ;	2
(b)	protein ;	1
(c)(i)	**6**H_2O + **6**CO_2 → $C_6H_{12}O_6$ + **6**O_2 1 mark for formulae ; 1 mark for balancing dependent on formulae ;	2
(c)(ii)	*any two of* (used) in respiration / release energy ; stored as starch ; avp ;	max 2

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8. 0653_m18_ms_42 Q: 4

Question	Answer	Marks
(a)	line drawn from **R** to any nucleus ; line drawn from **S** to any xylem tube cross section ;	2
(b)(i)	**P** is nearer to the surface / top so it captures more light ;	1
(b)(ii)	**P** has more chloroplasts than **Q** ; chloroplast is the site of photosynthesis ; reference to increased light absorption / increased amounts of chlorophyll ;	max 2
(c)	traps **light energy** ; converts it to chemical energy / for formation of carbohydrates ;	2

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9. 0653_s25_ms_42 Q: 1

Question	Answer	Marks
(a)	<table><tr><th>name of part</th><th>letter</th><th>function of part</th></tr><tr><td>stomach</td><td>C</td><td>digestion</td></tr><tr><td>small intestine</td><td>E</td><td>(digestion and) absorption (of digested food)</td></tr><tr><td>salivary gland</td><td>A</td><td>produce, saliva / amylase</td></tr></table> ;;; *one mark for each correct row*	**3**
(b)	protease: digests / breaks down, proteins (into amino acids) ; hydrochloric acid: kills, (harmful) microorganisms / pathogens / bacteria ; provides optimum / acidic / low pH, for enzyme / protease ;	**3**
(c)	enzyme will denature ; active site changes **shape** ; active site no longer complementary to substrate / substrate no longer fits active site ;	**3**

10. 0653_m24_ms_42 Q: 1

Question	Answer	Marks
(a)(i)	liver labelled ;	**1**
(a)(ii)	pancreas ;	**1**
(b)	pieces ; molecules ;	**2**
(c)	digest / breakdown, starch ; into (simpler) sugars ;	**2**
(d)	*enzyme:* **A** AND works (best) at low pH / acidic conditions ; gastric juice, contains hydrochloric acid / is acidic ;	**2**