Topical Past Papers

IGCSE Biology (0610) Paper 4

[Extended | Short-answer and structured questions]

Exam Series: February/March 2017 - May/June 2025

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 Papers
- Subtitle: Exam Practice Worksheets With Answer Scheme
- Examination board: Cambridge Assessment International Education (CAIE)
- Subject code: 0610
- Years covered: February/March 2017 - May/June 2025
- Paper: 4
- Number of pages: 1267
- Number of questions: 364

Contents

Chapter 1

Characteristics and classification of living organisms

1. 0610_w19_qp_41 Q: 1

All living organisms are placed into groups according to their features.
Myriapods are one of the main groups of arthropods.

(a) State **two** features of myriapods that can be used to distinguish them from other arthropods.

1 .....

2 .....
[2]

Fig. 1.1 shows that there are four main groups of arthropods.

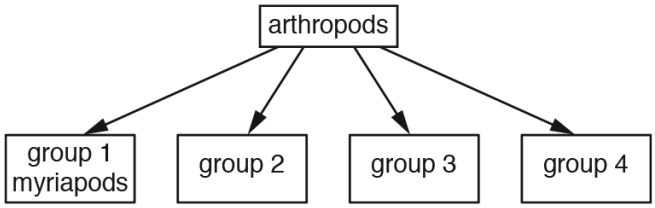

Fig. 1.1

(b) State the names of **two** of the other groups of arthropods in Fig. 1.1.

1 .....

2 .....
[2]

(c) Myriapods can be classified into four classes, **1**, **2**, **3** and **4**.

Fig. 1.2 is a dichotomous key that can be used to distinguish the four classes of myriapods.

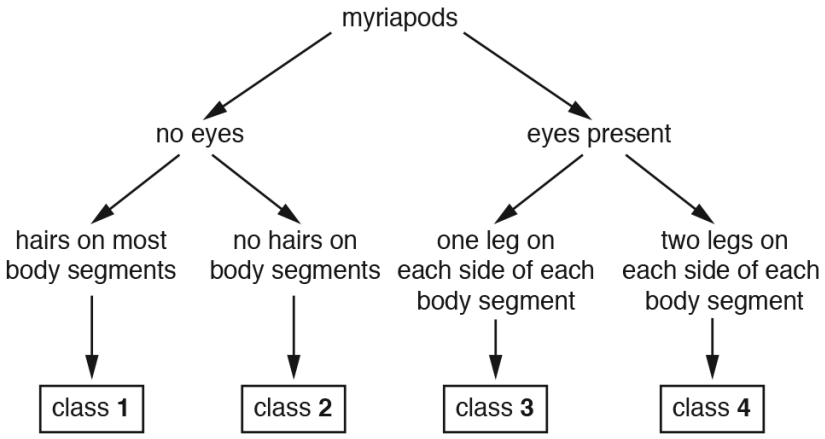

Fig. 1.2

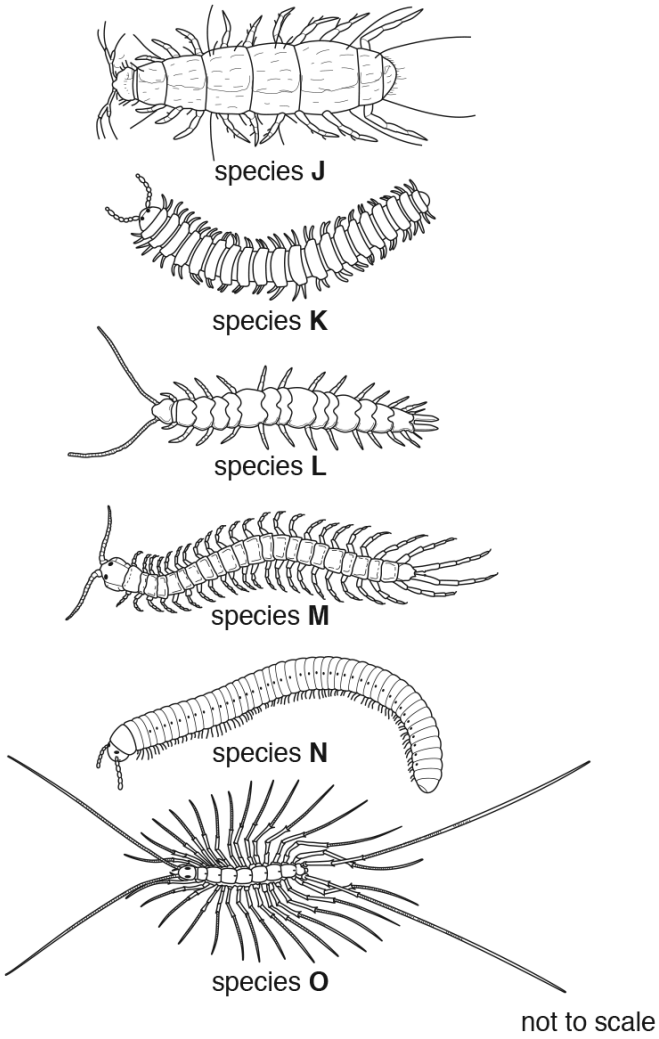

Fig. 1.3

Complete Table 1.1 by using the key in Fig. 1.2 to classify the six myriapods in Fig. 1.3 into the four classes.

Table 1.1

class	letter(s) of species from Fig. 1.3 in each class
1	
2	
3	
4	

[3]

(d) Fig. 1.4 is a photograph of the myriapod, *Apheloria virginiensis*.

Fig. 1.4

(i) State the genus name and kingdom name for the myriapod shown in Fig. 1.4.

genus .....

kingdom .....
[2]

(ii) *A. virginiensis* releases the poison cyanide when it is attacked by predators. Cyanide stops enzymes in the mitochondria from functioning.

Suggest why cells die if the mitochondria do not function.

.....

.....

..... [1]

[Total: 10]

Answer:

<table>
<tr><th></th><th>Answer</th><th>Mark</th><th>Partial Marks</th></tr>
<tr><td>(a)</td><td>many (body) segments ;
head and, body (segments) / AW ;
many legs / many pairs of legs;
elongated bodies ;</td><td>2</td><td></td></tr>
<tr><td>(b)</td><td>crustaceans ;
arachnids ;
insects ;</td><td>2</td><td></td></tr>
<tr><td>(c)</td><td><table><tr><th>class</th><th>letter(s) of species from Fig. 1.3 in each class</th></tr><tr><td>1</td><td>J</td></tr><tr><td>2</td><td>L</td></tr><tr><td>3</td><td>M,</td></tr><tr><td>4</td><td>K,N,O</td></tr></table>;;;</td><td>3</td><td>4 rows correct = 3
2 or 3 rows correct = 2
1 row correct = 1</td></tr>
<tr><td>(d)(i)</td><td>(genus) Apheloria ;
(kingdom) animal ;</td><td>2</td><td></td></tr>
<tr><td>(d)(ii)</td><td>no (aerobic) respiration ; ora
cannot release energy ; ora</td><td>1</td><td></td></tr>
</table>

2. 0610_w19_qp_43 Q: 1

(a) The ant-mimic jumping spider, *Myrmarachne formicaria*, is shown in Fig. 1.1.

The common name of this species describes its behaviour. It is an arachnid that tricks its prey because it looks like the insects that it eats.

Fig. 1.1

(i) Suggest which trophic level in a food chain *M. formicaria* could belong to.

..... [1]

(ii) State the genus of the spider shown in Fig. 1.1.

..... [1]

(iii) Some keys use paired choices of features to identify species such as the ant-mimic jumping spider.

State the name of this type of key.

..... [1]

(b) Spiders are classified as arachnids. Arachnids are one of the main groups of arthropods.

Fig. 1.2 shows diagrams of six arthropods, four of which are arachnids.

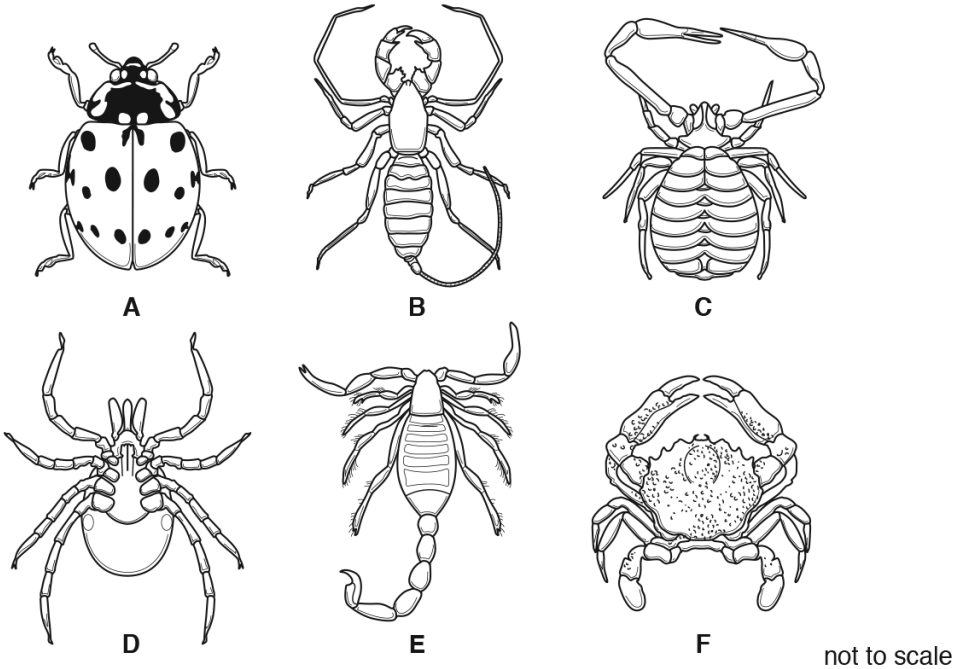

Fig. 1.2

(i) State **two** common features of all the arthropods, visible in Fig. 1.2.

1 .....

2 .....
[2]

(ii) State **two** common features of all arachnids that can be used to distinguish them from other arthropods.

1 .....

2 .....
[2]

(iii) State the letters of the **four** arachnids shown in Fig. 1.2.

..... [2]

(c) The features shown in Fig. 1.2 are morphological features. Many traditional methods of classification used morphology.

State the name of one **other** type of feature that can also be used in classification.

..... [1]

[Total: 10]

Answer:

	Answer	Mark	Partial Marks
(a)(i)	(level) 3 / tertiary / secondary consumer ;	1	
(a)(ii)	*Myrmarachne* ;	1	
(a)(iii)	dichotomous (key) ;	1	
(b)(i)	exoskeleton ; jointed / segmented, legs / AW ; (at least) 1 (or more up to 6) / (at least 1) (or more up to 3) pair, of legs / AW ; segmented (body) ; bilateral body symmetry ;	2	
(b)(ii)	two body parts ; eight legs / four pairs of legs ; AVP ;	2	
(b)(iii)	**B C D E** (in any order) ;;	2	
(c)	anatomy ; DNA (sequences) / genes ; sequences of amino acids (in proteins) ; AVP ; e.g. behaviour	1	

Chapter 2

Organisation of the organism

3. 0610_s23_qp_42 Q: 5

Fig. 5.1 is a photomicrograph of a structure found in animal and plant cells.

Fig. 5.1

(a) State the name and function of the cell structure labelled **A** in Fig. 5.1.

name .....

function .....

.....
[2]

(b) State the **two** pieces of information needed to calculate the actual length of cell structure **A** in Fig. 5.1.

1 .....

2 .....
[1]

(c) The actual length of cell structure **A** is 0.000 75 mm.

Convert this value to micrometres (μm).

.....μm [1]

[Total: 4]

Answer:

Question	Answer	Marks	Guidance
(a)	mitochondrion ; (aerobic) respiration ;	2	**A** release energy **A** cytoplasm for MP1 with correct function for MP2 i.e. allows / location of, (biochemical / metabolic) reactions / cell processes **ecf** MP2 from incorrect structure in MP1
(b)	length of the (cell structure), in image / picture / photomicrograph / diagram and magnification ;	1	

Question	Answer	Marks	Guidance
(c)	0.75 (μm) ;	1	**A** 7.5×10^{-1}

Chapter 3

Movement into and out of cells

4. 0610_w20_qp_41 Q: 1

Water is an essential molecule for life.

(a) Complete the statements.

Water moves into and out of cells by ..... .

Water is known as a ..... because it can dissolve solutes.

[2]

(b) A leaf cell was put into a solution. The water potential of the solution was lower than the water potential of the contents of the cell.

Fig. 1.1 is a sketch of the cell after three hours in the solution.

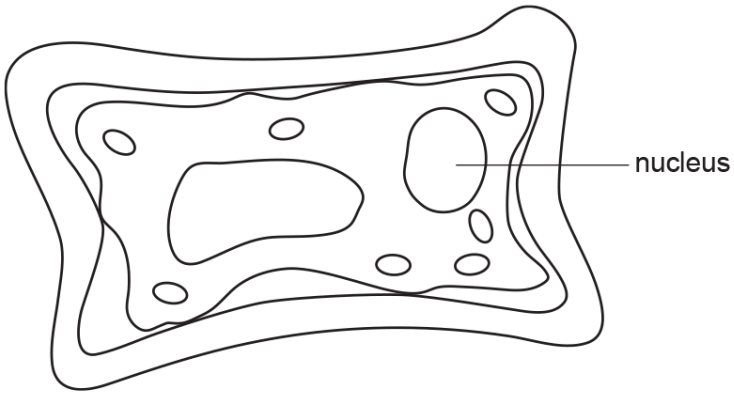

Fig. 1.1

The leaf cell was transferred into pure water.

Sketch the expected appearance of the cell after it had been in the pure water for three hours.

Draw **one** arrow on your sketch to show the direction of water movement.

[3]

(c) A plant was **not** watered for one week.

Fig. 1.2 shows a series of photographs of the plant during the week.

day 0 day 3 day 7

Fig. 1.2

Explain how the lack of water has affected the support of the leaves of the plant shown in Fig. 1.2.

Use the term *turgor pressure* in your answer.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 8]

Answer:

Question	Answer	Marks	Guidance
(a)	osmosis ; solvent ;	2	
(b)	*drawing with:* arrow showing water movement into cell ; *max. two from:* no space between cell membrane and cell wall ; cell wall, slightly bent outwards / straight ; vacuole larger in proportion than in Fig 1.1 ;	3	
(c)	wilting ; lack of turgor pressure (at the end of the week) ; **ora** no longer a push against cell wall / AW ; **ora** (mesophyll) cells not providing support / cell collapses / AW ; (lack of water means cells become) flaccid / plasmolyse ;	3	

5. 0610_s23_qp_43 Q: 1

(a) The movement of molecules within an organism can occur by diffusion and active transport.

Complete Table 1.1 by placing ticks (✓) to show the correct features of each process.

Table 1.1

feature	active transport	diffusion
movement of particles always occurs across a cell membrane		
movement of molecules during gas exchange		
rate of movement of particles is higher when the concentration gradient is larger		
requires energy from respiration		

[4]

(b) Explain why active transport is important in root hair cells.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 7]

Answer:

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>(a)</td><td>
<table>
<tr><th>feature</th><th>active transport</th><th>diffusion</th></tr>
<tr><td>movement of particles always occurs across a cell membrane</td><td>✓ ;</td><td></td></tr>
<tr><td>molecules moving during gas exchange</td><td></td><td>✓ ;</td></tr>
<tr><td>rate of movement of particles is higher when the concentration gradient is larger</td><td></td><td>✓ ;</td></tr>
<tr><td>requires energy from respiration</td><td>✓ ;</td><td></td></tr>
</table>
</td><td>4</td><td>one mark per correct row
R each additional tick</td></tr>
<tr><td>(b)</td><td>any three from:
for ion, uptake / absorption ;
ion concentration lower in the soil than in the root (cell) / AW ;
movement against the concentration gradient / AW ;
creates a water potential gradient / AW ;
named example of ion e.g. nitrate / magnesium ;</td><td>3</td><td></td></tr>
</table>

Chapter 4

Biological molecules

6. 0610_s25_qp_41 Q: 5

(a) Organisms can be classified by their features and by studying the sequence of bases in their DNA.

Fig. 5.1 is a diagram showing the evolutionary relationships between some different groups of organisms.

Each branch shows the point at which organisms developed new features that classify them as a new group.

The point where the branch starts also indicates a common ancestor shared by the new groups.

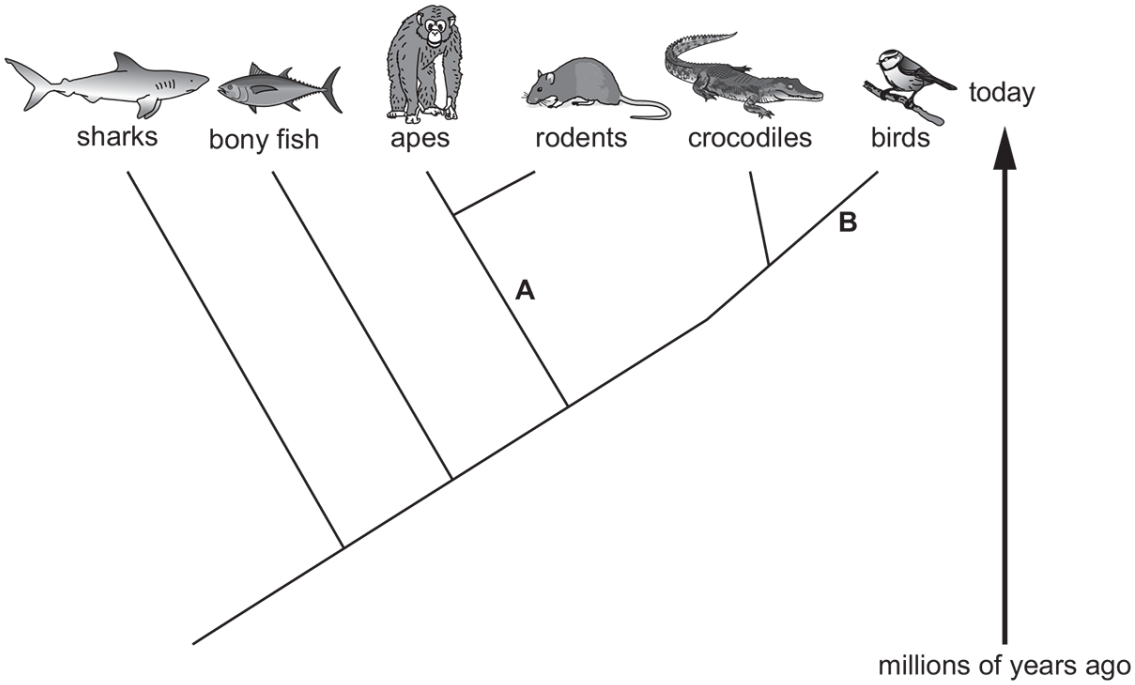

Fig. 5.1

(i) Suggest which visible features have developed at **A** and **B** in Fig. 5.1.

A .....

B .....
[2]

(ii) Identify the names of the **two** groups that share the most recent common ancestor in Fig. 5.1.

..... and ..... [1]

(iii) Suggest the groups with the most similar and least similar DNA base sequences to crocodiles in Fig. 5.1.

most similar .....

least similar .....
[2]

(b) Describe the structure of a DNA molecule.

.....

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..... [4]

(c) Outline how the base sequences in DNA control cell function.

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..... [3]

[Total: 12]

Answer:

Question	Answer	Marks	Guidance
(a)(i)	**A** - hair / external ears ; **B** – wings / feathers ;	**2**	
(a)(ii)	apes and rodents ;	**1**	
(a)(iii)	*most similar* – birds ; *least similar* – sharks ;	**2**	
(b)	*any four from:* 1 *ref. to* two strands / chains ; 2 double helix ; 3 *ref. to* four bases / A, T, C, G ; 4 A pairs with T **and** C pairs with G ; 5 *ref. to* bonds between bases ;	**4**	**A** annotated diagram

Question	Answer	Marks	Guidance
(c)	*any three from:* (base sequences of DNA / mRNA) determine sequence of amino acids ; amino acids form proteins / protein synthesis / production of proteins ; named example of protein ; *ref. to* sequence of amino acids determining protein shape ;	3	e.g. enzymes / neurotransmitters

Chapter 5

Enzymes

7. 0610_w18_qp_41 Q: 6

Young mammals that are orphaned can be bottle-fed.

Fig. 6.1 shows a newborn tiger cub sucking on a bottle.

Fig. 6.1

(a) (i) Sucking is an example of an involuntary action observed in newborn mammals.

State the name given to involuntary actions.

.....[1]

(ii) Describe the advantages of breast-feeding compared with bottle-feeding.

.....

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.....[4]

(b) The digestive systems of young mammals are not fully developed.

Enzymes such as amylase, maltase and protease are often added to baby food to aid chemical digestion.

(i) Complete Table 6.1 by stating the substrate and product(s) for each enzyme reaction.

Table 6.1

enzyme	substrate	product(s)
amylase		
maltase		
protease		

[3]

(ii) Suggest why the temperature of baby food must be controlled when the enzymes are added.

.....

.....

.....[2]

(iii) State **one** other condition that must also be controlled to optimise enzyme activity.

.....[1]

[Total: 11]

Answer:

<table>
<tr><th></th><th>Answer</th><th>Mark</th><th>Partial Marks</th></tr>
<tr><td>(a)(i)</td><td>reflex (action) ;</td><td>1</td><td></td></tr>
<tr><td>(a)(ii)</td><td>contains antibodies / passive immunity / idea of fighting infections ;
bonding with mother /AW ;
is at a suitable body temperature ;
sterile / less risk of infection / contamination ;
convenience / always available / no preparation ;
cheap / free ;
easy to digest / less risk of colic / less risk of diabetes in child ;
no additives / less risk of allergies ;
idea of volume is controlled / no over-feeding ;
nutrient requirements met / change with age / change with development ;
AVP ;;</td><td>4</td><td></td></tr>
<tr><td>(b)(i)</td><td><table><tr><td>enzyme</td><td>substrate</td><td>product(s)</td></tr><tr><td>amylase</td><td>starch</td><td>glucose / maltose ;</td></tr><tr><td>maltase</td><td>maltose</td><td>glucose ;</td></tr><tr><td>protease</td><td>protein</td><td>amino acids ;</td></tr></table></td><td>3</td><td></td></tr>
<tr><td>(b)(ii)</td><td>high temperatures denature enzymes / AW ;
low temperatures result in low energy / fewer collisions / slower reactions / AW ;
enzymes work best / most efficient at optimum temperature ;</td><td>2</td><td></td></tr>
<tr><td>(b)(iii)</td><td>pH ;
enzyme concentration ;
substrate concentration ;</td><td>1</td><td></td></tr>
</table>

Chapter 6

Plant nutrition

8. 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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..... [5]

(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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..... [2]

(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.

.....

.....

.....

.....

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

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

9. 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.

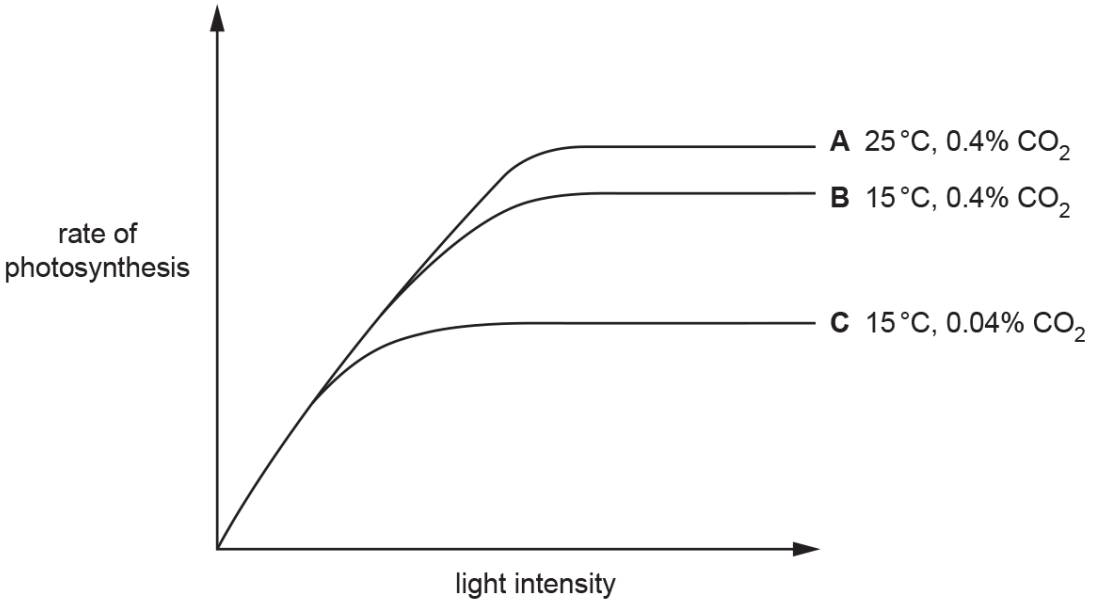

Fig. 4.1

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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.....

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.....

.....

.....

.....

..... [4]

[Total: 11]

Answer:

Question	Answer	Marks	Guidance
(a)	*any six from:* LIGHT (B and C as light intensity increases) the rate (of photosynthesis) increases and remains constant / AW ; rates (of photosynthesis) are the same at low(est) light intensities ; light provides energy (for photosynthesis) ; where the line rises / initially, light intensity is, limiting / the limiting factor ; line(s) / rate, levels off where light intensity is **not** limiting ; in **B** light intensity becomes limiting at higher light intensity than **C** / **ora** ; CARBON DIOXIDE *Idea that* line C levels off, at a lower rate (of photosynthesis) / lower light intensity ; carbon dioxide (concentration) is, lower for **C** / 0.04% vs 0.4% ; carbon dioxide is, reactant / substrate / raw material / needed, for photosynthesis ; in **C** carbon dioxide is a limiting factor at a lower light intensity / in **B** carbon dioxide is a limiting factor at a higher light intensity ; TEMPERATURE *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:* (glucose) used, in respiration / to provide energy / to release energy / as an energy store ; (glucose) converted to / stored as, starch ; (glucose) converted to sucrose ; sucrose for, translocation / transport (in the phloem) / sent to sink(s) ; (glucose / fructose / sucrose) in nectar ; (nectar) to attract, insects / pollinators ; (glucose / fructose / sucrose) in fruits (to attract animals) ; (glucose) converted to cellulose ; cellulose to build cell walls ; lignin for cell walls ; used to make, amino acids / fatty acids ; AVP ;	4	e.g., used to make chlorophyll / (DNA/RNA) bases

10. 0610_w23_qp_42 Q: 4

A scientist investigated the effect of temperature on the rate of photosynthesis in one species of plant.

Photosynthesis involves enzyme-controlled reactions.

Discs were cut from a leaf and kept at different temperatures.

The total surface area of the discs was kept the same for each temperature.

The volume of oxygen that was produced by the leaf discs was measured and used to estimate the rate of photosynthesis.

The results are shown in Fig. 4.1.

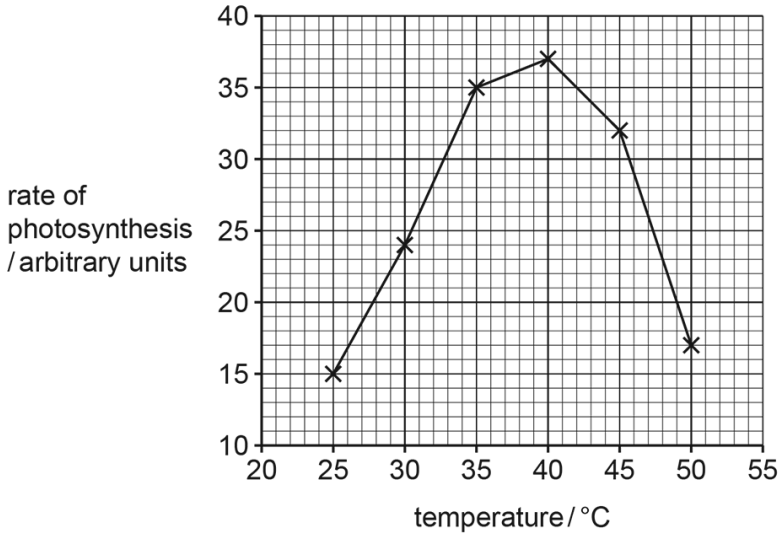

Fig. 4.1

(a) Identify the optimum temperature for photosynthesis in Fig. 4.1.

..... °C [1]

(b) Explain the results shown in Fig. 4.1.

.....

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..... [6]

(c) Carbon dioxide was supplied in excess at each temperature during the investigation.

Explain why.

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..... [2]

(d) Suggest why not all of the oxygen produced by the leaf is released.

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..... [1]

(e) Describe the role of chlorophyll in photosynthesis.

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.....

.....

..... [2]

[Total: 12]

Answer:

Question	Answer	Marks	Guidance
(a)	40 (°C) ;	1	
(b)	*any six from:* *before 40 °C* 1 increasing temperature increases the kinetic energy (of reactants / molecules) ; 2 increasing the, frequency / rate, of (effective) collisions ; 3 more enzyme-substrate complexes are formed ; 4 releasing more, oxygen / glucose / products ; 5 temperature is the limiting factor ; *at 40 °C* 6 (optimum temperature) maximum number of, enzyme-substrate complexes / collisions; *after 40 °C* 7 increasing temperature changes the shape of active site(s) (of enzyme(s)) ; 8 ref. to denaturation ; 9 substrate, no longer complementary (to active sites) / can no longer fit into active sites ; 10 fewer / no, enzyme-substrate complexes are formed ; 11 fewer / no, products are released ; 12 AVP ;	6	e.g. stomata close (as high rate of transpiration) so no CO_2 enters
(c)	*any two from:* carbon dioxide is a limiting factor / so that carbon dioxide is **not** a limiting factor / AW ; so that temperature is the only, variable / limiting factor ; to ensure that the effects are caused (only) by temperature ;	2	
(d)	*any one from:* (some is) used, for (aerobic) respiration / to react with glucose ; some remains in air spaces ;	1	

Question	Answer	Marks	Guidance
(e)	*any two from:* absorbs / traps / captures, light ; transfers / converts, light energy into chemical energy ; for the synthesis of, glucose / carbohydrates ;	2	

11. 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.

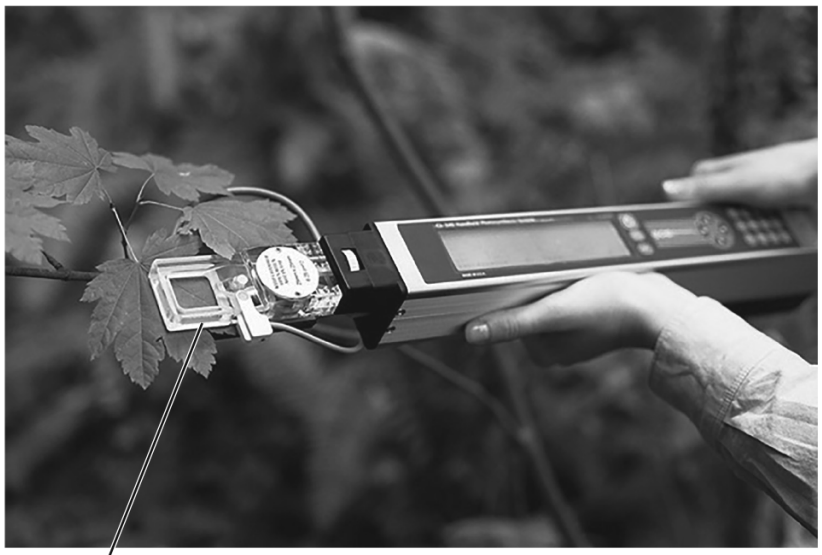

Fig. 2.1

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.

.....

.....

.....

..... [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.

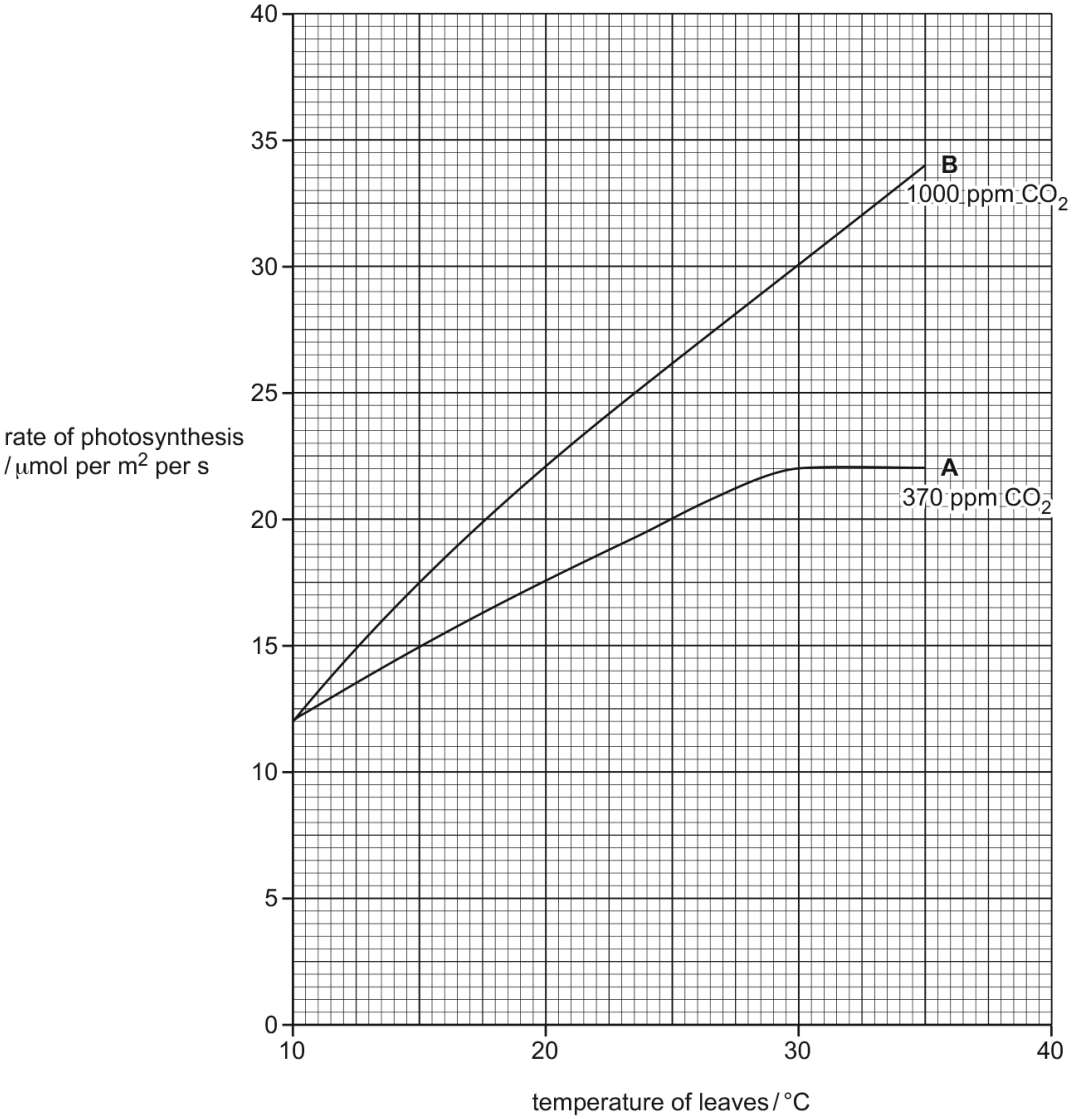

Fig. 2.2

(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.

.....

.....

..... [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.

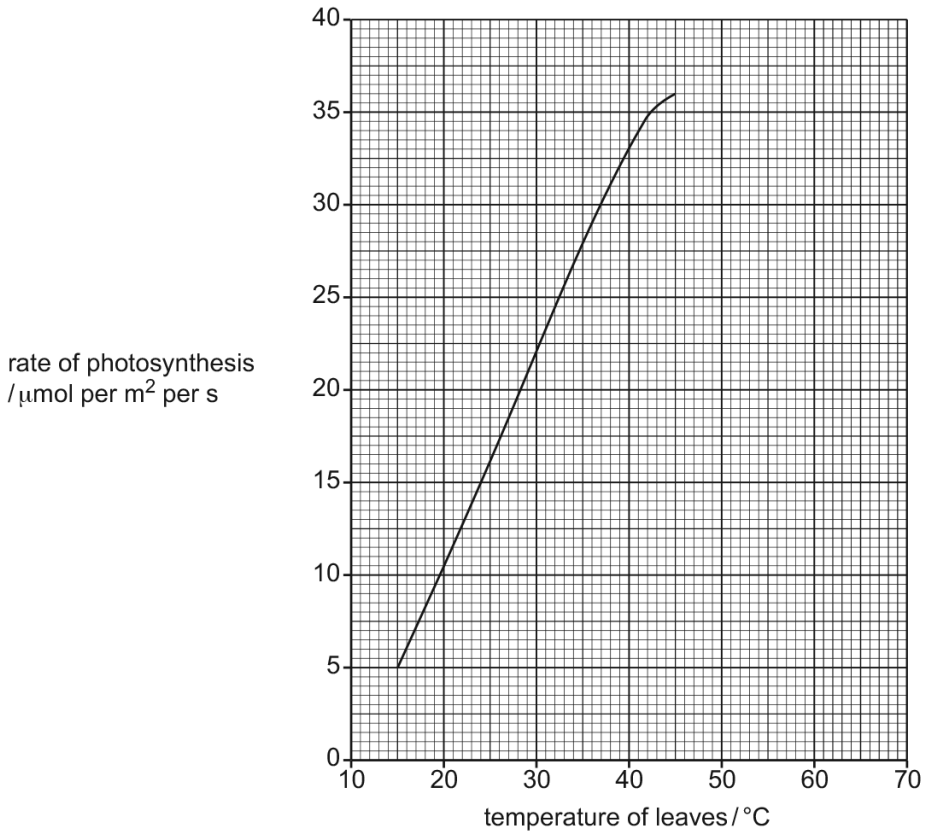


Fig. 2.3

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

.....

.....

.....

.....

..... [2]

[Total: 16]

Answer:

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

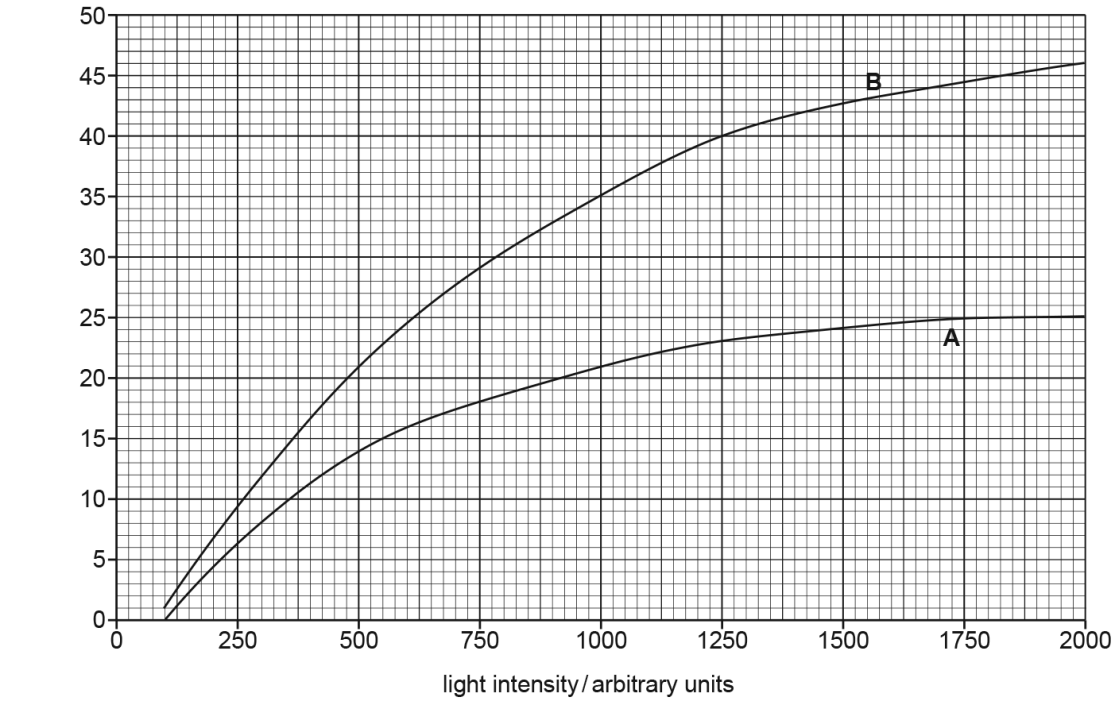
12. 0610_s19_qp_43 Q: 2

(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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..... [3]

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

13. 0610_s25_qp_43 Q: 4

Fig. 4.1 is a photograph of a water lily, *Nymphaea alba*, in a lake.

Fig. 4.1

Fig. 4.2 is a photomicrograph of a cross-section of part of a water lily leaf.

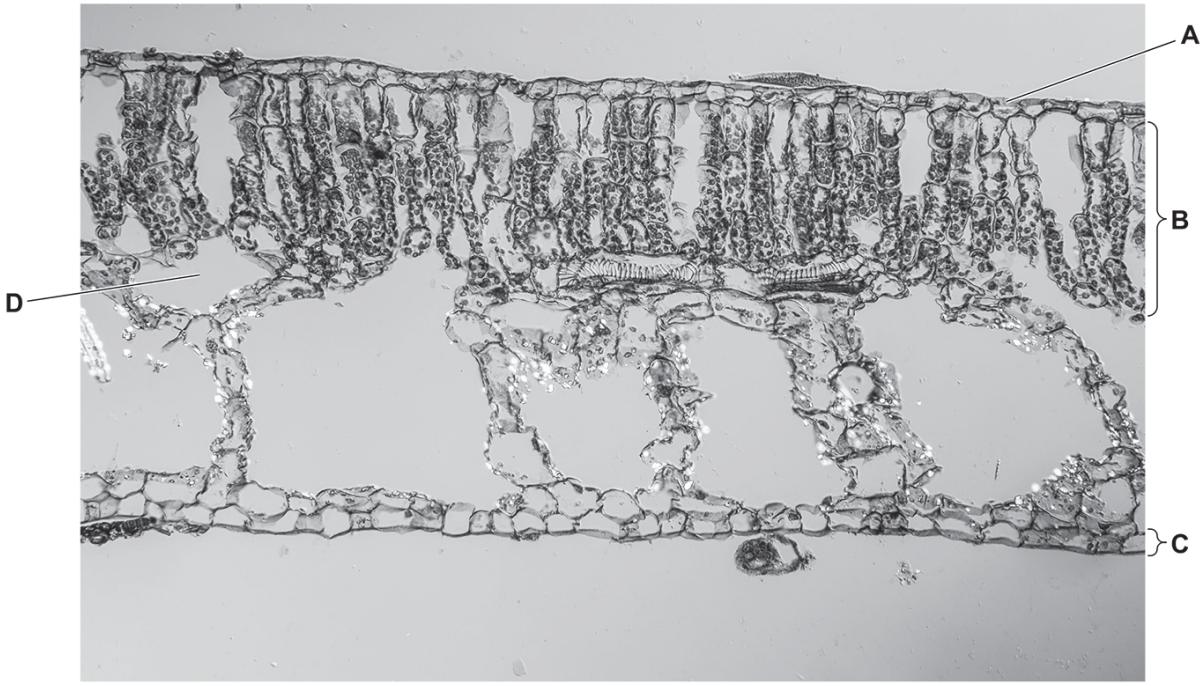

Fig. 4.2

(a) (i) Identify tissue **B** and tissue **C** labelled in Fig. 4.2.

B .....

C .....

[2]

(ii) Describe **two** functions in water lilies of the area labelled **D** in Fig. 4.2.

1 .....

.....

2 .....

.....

[2]

(iii) A green pigment is found in tissue **B** in Fig. 4.2.

Describe the function of this pigment.

.....

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.....

..... [2]

(iv) Water lilies have a very thin cuticle compared to a plant growing on land.

Explain how this is an adaptation for water lilies.

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..... [2]

(b) Table 4.1 shows the stomatal density and habitat of two different hydrophytes.

Table 4.1

type of plant	habitat	stomatal density on upper leaf surface /stomata per mm^2	stomatal density on lower leaf surface /stomata per mm^2
pondweed	under the water	0	0
water lily	leaves on the surface of the water	573	0

(i) Convert the stomatal density of the upper leaf surface of the water lily to stomata per cm^2.

..... stomata per cm^2 [1]

(ii) Using the data in Table 4.1, explain the stomatal density found in the two different hydrophytes.

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..... [4]

(c) Fig. 4.3 is a photograph of rice, *Oryza sativa*, a monocotyledonous crop plant grown in flooded fields in waterlogged soils.

Fig. 4.3

(i) Identify a characteristic visible in Fig. 4.3 that can be used to classify rice as a monocotyledonous plant.

..... [1]

(ii) Waterlogged soil contains very low concentrations of oxygen.

Suggest how this limits the amount of proteins a plant can make.

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.....

..... [3]

[Total: 17]

Answer:

Question	Answer	Marks	Guidance
(a)(i)	**B** – palisade mesophyll ; **C** – (lower) epidermis ;	**2**	

Question	Answer	Marks	Guidance
(a)(ii)	*any two from:* diffusion of (named) gases for photosynthesis / respiration ; diffusion of <u>water vapour</u> for transpiration ; idea of buoyancy / to make the leaf float (to get more light) ;	**2**	
(a)(iii)	*any two from:* traps light energy ; transfers energy from light into energy in chemicals ; (energy) for the synthesis of (named) carbohydrates ;	**2**	
(a)(iv)	*any two from:* 1 water lilies do not need to prevent water loss ; 2 carbon dioxide uptake is less restricted / AW ; 3 use less resources to produce a cuticle ; 4 allows more light to penetrate ; 5 to the palisade (mesophyll) layer ; 6 AVP ;	**2**	e.g. leaf does not need to be rigid / AW
(b)(i)	57 300 (stomata per cm^2) ;	**1**	
(b)(ii)	*any four from:* 1 pondweed is submerged in water so no need for stomata to let air into a leaf ; 2 oxygen and carbon dioxide can diffuse into, leaf / cells, from water ; 3 water lily has stomata only on upper surface ; 4 because lower surface is, on the surface of the water / under the water ; 5 constant water supply to water lily / no risk of wilting ;	**4**	
(c)(i)	*any one from:* 1 thin / strap-shaped, leaves ; 2 parallel veins ;	**1**	

Question	Answer	Marks	Guidance
(c)(ii)	*any three from:* 1 reduced aerobic respiration can occur ; 2 less energy released for active transport ; 3 less nitrate ions absorbed ; 4 less amino acids (to make protein) ; 5 less energy released for protein synthesis ; 6 more denitrifying (bacteria) ; 7 less nitrogen fixing (bacteria) ; 8 fewer nitrate ions in the soil ;	3	

Chapter 7

Human nutrition

14. 0610_s24_qp_41 Q: 4

(a) A student investigated the effect of lactase on three different liquids:

- milk
- lactose-free milk
- sucrose solution.

The student used an indicator to test for the presence of glucose. A sample of each liquid was tested before and after treatment with lactase.

The indicator turned brown in the presence of glucose. The indicator remained blue in the absence of glucose.

Table 4.1 shows the results of the tests.

Table 4.1

liquid	colour before treatment with lactase	colour after treatment with lactase
milk	blue	brown
lactose-free milk	brown	brown
sucrose solution	blue	blue

(i) Explain the results for the three liquids shown in Table 4.1.

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..... [3]

(ii) The student kept the solutions at a temperature that was close to the optimum during the investigation.

Using your knowledge of the effect of temperature on enzyme activity, explain why this was important.

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..... [4]

(b) As part of a balanced diet, some governments recommend that children drink milk that has vitamin D added to it.

(i) Suggest the dietary reasons for this advice.

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..... [2]

(ii) Describe what is meant by a balanced diet.

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..... [2]

[Total: 11]

Answer:

Question	Answer	Marks	Guidance
(a)(i)	*any three from:* *row 1* – lactase breaks down lactose into glucose (and galactose in milk) ; *row 2* – lactose-free milk has already been treated with lactase (so glucose is already present) ; *row 3* – sucrose, is not broken down / does not contain lactose / AW ; lactase is specific for breakdown of lactose / AW OR lactose only fits into active site of, lactase / enzyme ;	3	*accept simple sugar(s) for glucose throughout* MP2 **A** lactose already broken down to glucose MP3 **A** lactase cannot breakdown sucrose MP4 **A** 'lactose is only complementary to lactase'

Question	Answer	Marks	Guidance
(a)(ii)	*any four from:* 1 at optimum temperature maximum enzyme activity *or* rate of reaction OR outside the optimum / when cold / when hot, reduced, enzyme activity / rate of reaction ; 2 at optimum temperature maximum, successful collisions / enzyme-substrate complexes (ESCs) OR outside the optimum / when cold / when hot, fewer, successful collisions / enzyme-substrate complexes (ESCs) ; 3 as temperature increases kinetic energy increases / ora ; 4 ref to denaturation at, high temperatures / temperatures above optimum ; 5 (so) shape of active site changes ; 6 (so) lactase is no longer complementary to the lactose ; 7 AVP ; e.g. ref. to temperature as a standardised variable	4	**A** enzyme and substrate for lactase and lactose MP2 **A** binding of lactose to lactase for ESC MP3 **A** at high temperatures kinetic energy is high / at low temperatures kinetic energy is low
(b)(i)	*any two from:* milk contains, calcium ; calcium / vitamin D, required for, healthy / strong / AW, teeth / bones ; (calcium / vitamin D) prevent, rickets / any symptom of rickets ; AVP ;	2	e.g. vitamin D stimulates absorption of calcium calcium needed for, blood clotting / muscle contraction / nerve function
(b)(ii)	*ref. to* all nutrients / all food groups / AW ; *idea of* nutrients in the, correct / appropriate / healthy, proportions / amounts OR to provide suitable amount of energy for, level of activity / (stated) lifestyle(s) ;	2	

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