



AS Biology B

Sample Assessment Materials

Pearson Edexcel Level 3 Advanced Subsidiary GCE in Biology B (8BI0)

First teaching from September 2015

First certification from 2016

Issue 1

**Pearson
Edexcel Level 3
Advanced Subsidiary GCE
in Biology B (8BI0)**

Sample Assessment Materials

First certification 2016

Edexcel, BTEC and LCCI qualifications

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Introduction

The Pearson Edexcel Level 3 Advanced Subsidiary GCE in Biology B is designed for use in schools and colleges. It is part of a suite of GCE qualifications offered by Pearson.

These sample assessment materials have been developed to support this qualification and will be used as the benchmark to develop the assessment students will take.

General marking guidance

- All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than be penalised for omissions.
- Examiners should mark according to the mark scheme – not according to their perception of where the grade boundaries may lie.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification/indicative content will not be exhaustive.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, a senior examiner must be consulted before a mark is given.
- Crossed-out work should be marked **unless** the candidate has replaced it with an alternative response.

Write your name here

Surname	Other names
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Pearson Edexcel

Level 3 GCE

Centre Number

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Candidate Number

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Biology B

Advanced Subsidiary

Paper 1: Core Cellular Biology and Microbiology

Sample Assessment Material for first teaching September 2015
Time: 1 hour 30 minutes

Paper Reference
8BI0/01

You may need a ruler, a pencil and a calculator.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided
– there may be more space than you need.
- You may use a scientific calculator.
- In question(s) marked with an asterisk (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
– use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions.

Write your answers in the spaces provided.

Some questions must be answered with a cross ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Prokaryotes and eukaryotes are major divisions of cellular organisms.

(a) Which of the following would **only** be found in prokaryote cells?

(1)

- ☐ **A** nucleoid
- ☐ **B** nucleolus
- ☐ **C** nucleosome
- ☐ **D** nucleus

(b) A person had food poisoning caused by a bacterium.

Explain how antibiotic treatment could help to identify if the type of bacterium that caused the food poisoning was Gram positive or Gram negative.

(3)

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(Total for Question 1 = 4 marks)

2 Glucose isomerase is an intracellular enzyme that is extracted from cells and used by manufacturers of food products that help people lose weight. The enzyme converts glucose into fructose which is a much sweeter carbohydrate.

(a) Explain how proteins like glucose isomerase are made in cells.

(5)

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(b) A point mutation occurred in the DNA responsible for making glucose isomerase in a cell.

Explain why this mutation may produce an enzyme that would not be of any use to manufacturers of food products that help people lose weight.

(2)

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(Total for Question 2 = 7 marks)

3 Triose isomerase is an enzyme containing two polypeptide chains.

(a) (i) Which of the following describes the synthesis of one of these polypeptide chains?

(1)

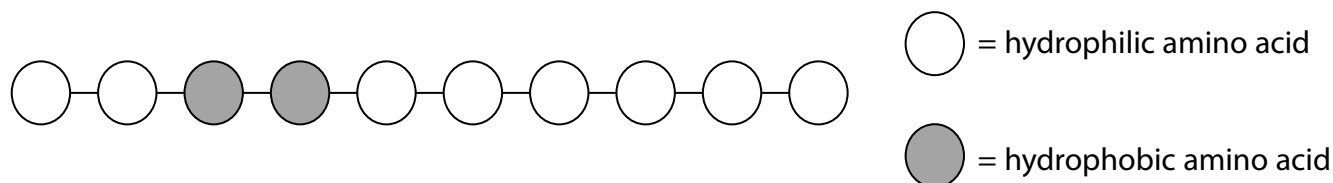
- ☐ **A** a series of condensation reactions forming peptide bonds
- ☐ **B** a series of condensation reactions forming glycosidic bonds
- ☐ **C** a series of hydrolysis reactions forming peptide bonds
- ☐ **D** a series of hydrolysis reactions forming glycosidic bonds

(ii) Which of the following is the best description of this enzyme?

(1)

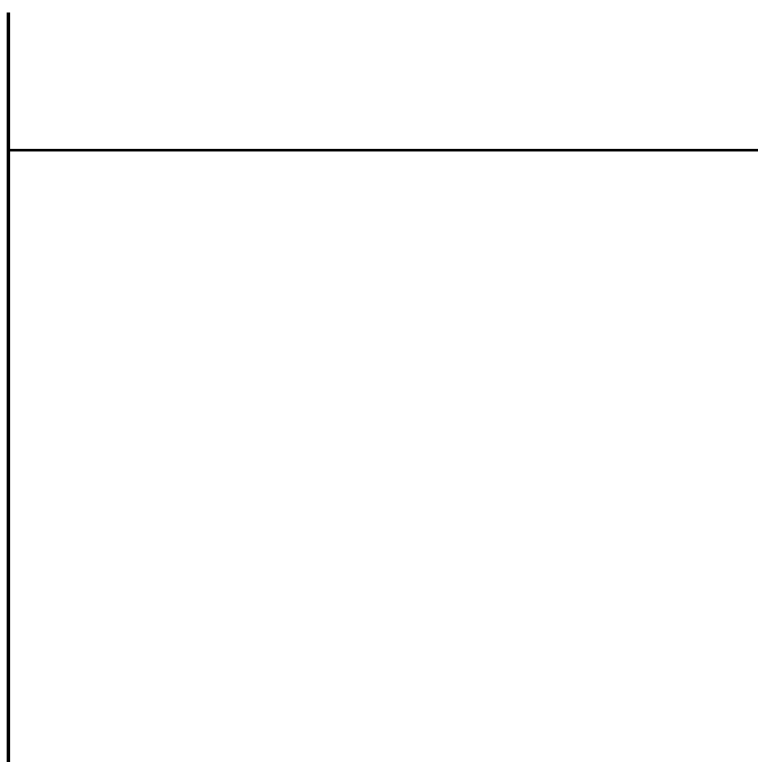
- ☐ **A** a fibrous protein with a secondary structure
- ☐ **B** a globular protein with a quaternary structure
- ☐ **C** an insoluble protein with a quaternary structure
- ☐ **D** a soluble protein with a primary structure

(b) Amino acids can be hydrophilic or hydrophobic. The diagram shows a polypeptide chain composed of 10 amino acids.



This polypeptide was placed in a beaker of distilled water.
Draw a diagram to show the structure of this polypeptide in the beaker.

(3)



(c) Describe how a quaternary protein is formed after protein synthesis has occurred.

(2)

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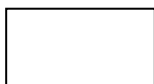
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(Total for Question 3 = 7 marks)

4 DNA is a molecule found in the nucleus of eukaryotic cells.

(a) DNA is made up of the components:

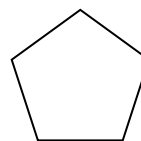
base



phosphate



pentose



Draw a molecule of DNA that contains four nucleotides, using the shapes shown.

(2)

(b) Part of a DNA molecule contained 250 bases of which 22% of these bases were guanine.

(i) Determine the number of each of the bases present.

(4)

Answer.....

(ii) Explain why some of the bases in a gene do not code for amino acids.

(2)

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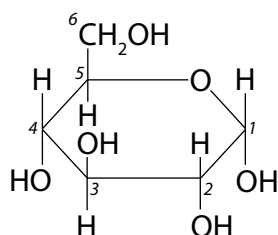
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(Total for Question 4 = 8 marks)

- 5 Glucose exists in two different forms called α -glucose and β -glucose.

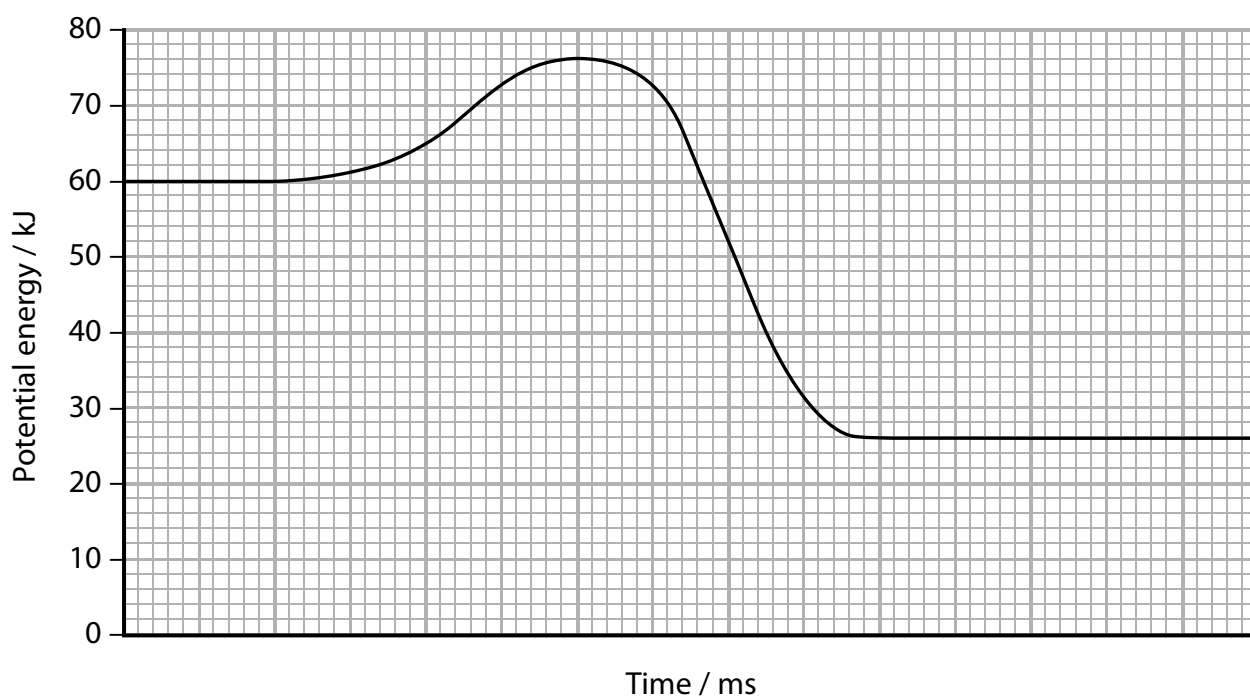
The diagram shows the structure of an α -glucose molecule.



- (a) Draw the products that are formed from a condensation reaction between two α -glucose molecules.

(2)

(b) The diagram shows the energy changes during an enzyme-controlled reaction.



Calculate the activation energy for this reaction.

(2)

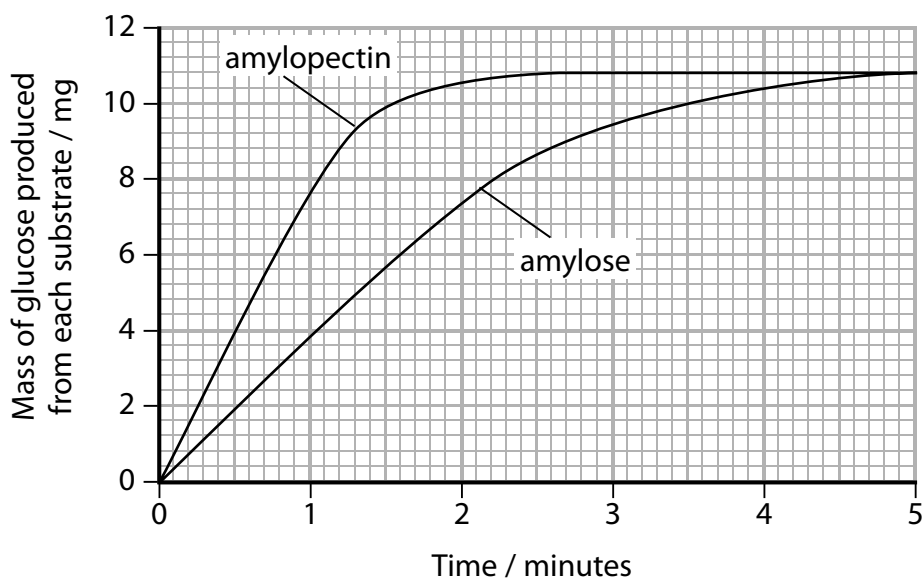
Answer..... kJ

(c) Starch is made up of amylose and amylopectin.

Amylase is an enzyme that can break down both amylose and amylopectin.

A student carried out an investigation to compare the mass of glucose produced from the breakdown of each substrate. The same mass of amylose and amylopectin was used and all other variables were kept constant.

The results of the investigation are shown in the graph.



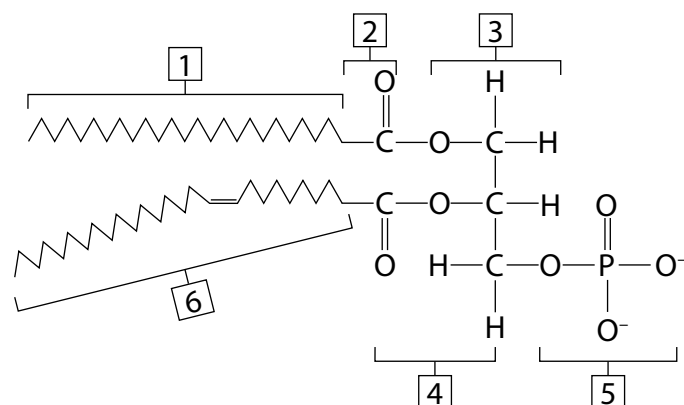
Analyse the data to explain the rate of breakdown of amylopectin and amylose by amylase.

(4)

(Total for Question 5 = 8 marks)

- 6 Artificial liposomes are spheres with an outer layer of phospholipids. They can be filled with a cytotoxic solution of drugs that kill cancer cells.

(a) The diagram shows a phospholipid.



(i) Which label includes an ester bond?

(1)

- ☐ **A** 2
- ☐ **B** 3
- ☐ **C** 4
- ☐ **D** 6

(ii) Which label shows the glycerol component?

(1)

- ☐ **A** 1
- ☐ **B** 3
- ☐ **C** 4
- ☐ **D** 5

- (b) A cancer tumour can damage capillaries and increase their normal pore size. They can also cause the temperature of nearby tissue to rise above normal body temperature.

Explain the advantage of treating cancer with artificial temperature-sensitive liposomes that contain cytotoxic drugs.

(5)

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- (c) Cancer cells undergo uncontrolled mitosis.

- (i) Which of the following shows the correct number of cancerous cells there would be after a single cell carries out six mitotic cell divisions?

(1)

- ☐ **A** 2^6
- ☐ **B** 6^2
- ☐ **C** 2^3
- ☐ **D** 3^2

(ii) Cytotoxic drugs prevent the proper formation of spindle fibres.

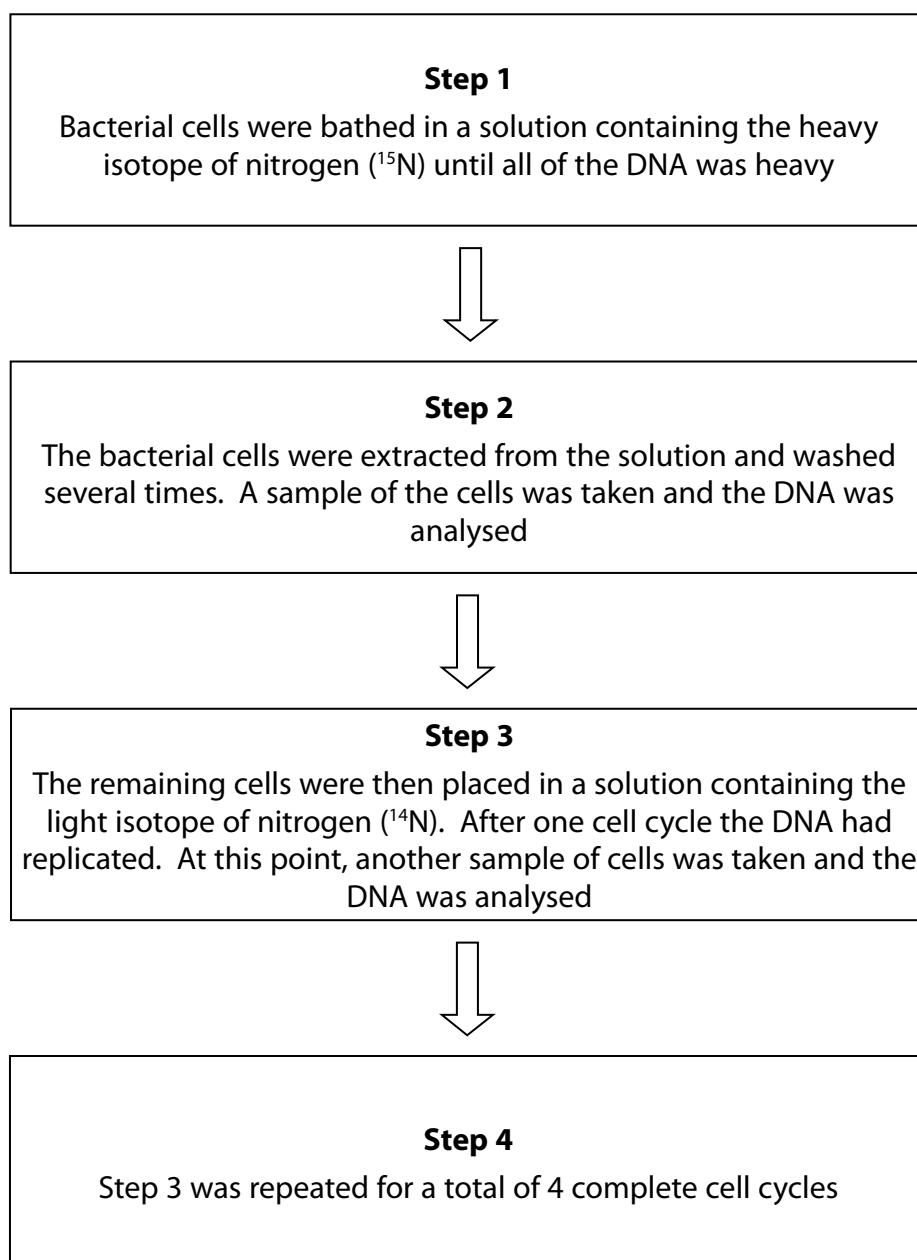
Explain how these drugs will stop cancer cells dividing.

(3)

(Total for Question 6 = 11 marks)

7 DNA replication occurs during the cell cycle.

The diagram shows some of the steps involved in an investigation to study DNA replication in bacterial cells.

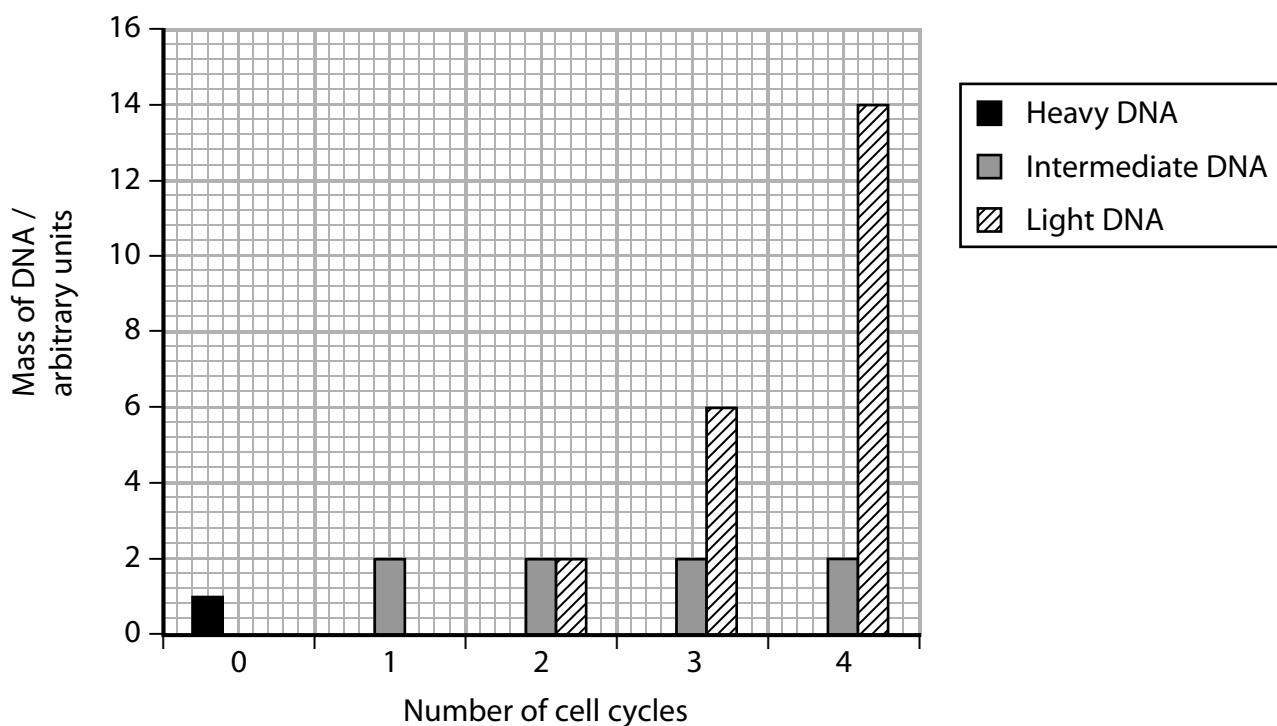


(a) In which cell cycle stage does DNA replication occur?

(1)

- ☐ **A** anaphase
- ☐ **B** interphase
- ☐ **C** prophase
- ☐ **D** metaphase

(b) The results of this investigation are shown in the graph.



(i) Predict the total mass of DNA after six cell cycles.

(2)

Answer.....

(ii) Analyse the data to explain how it supports the theory for DNA replication.

(4)

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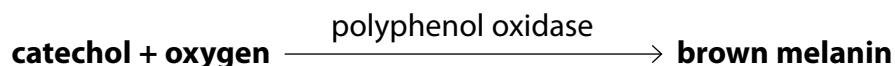
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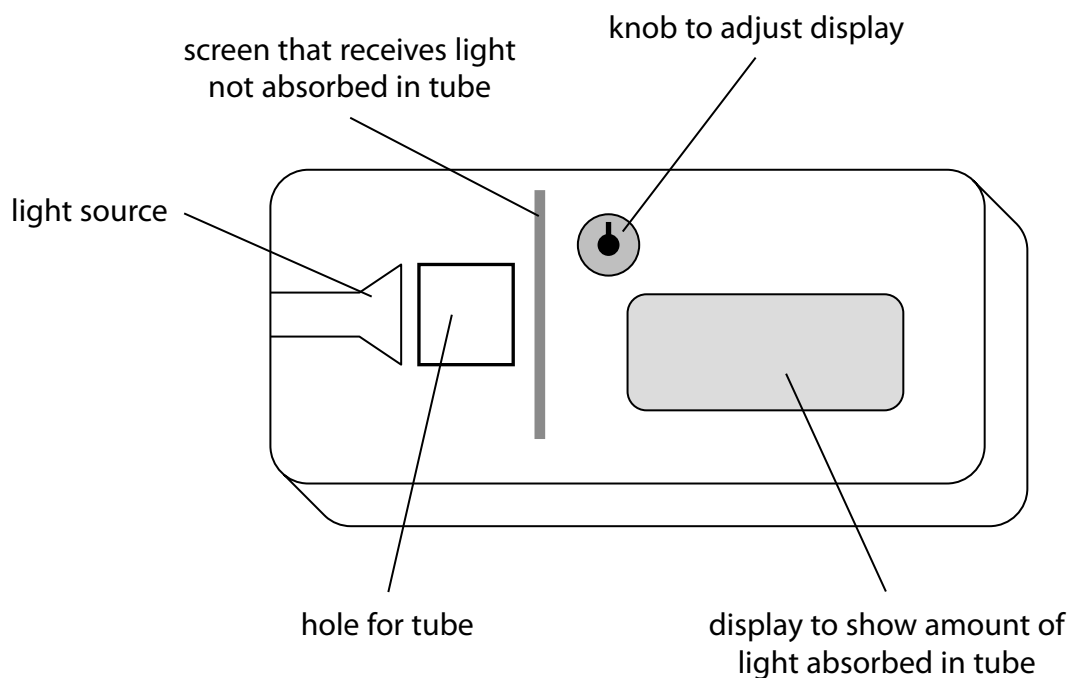
(Total for Question 7 = 7 marks)

- 8 When banana flesh is cut or mashed up, a chemical compound called catechol is released which reacts with oxygen to form brown melanin. This reaction is catalysed by the enzyme polyphenol oxidase.



A student investigated the rate of this reaction by using a colorimeter to measure the rate of appearance of the brown colour.

The diagram below shows a colorimeter.



- (a) The student recorded absorbance in the colorimeter every 10 seconds for 60 seconds. He repeated the process and calculated the mean for each 10-second period. The results are shown in the table.

Time in colorimeter / s	Mean absorbance / absorbance units
0	0.2
10	0.8
20	1.3
30	1.6
40	1.8
50	1.9
60	1.9

(i) Calculate the mean rate for the first 20 seconds of this reaction.

(3)

Answer.....

(ii) Explain why the mean rate changes after the first 20 seconds of this reaction.

(3)

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(iii) Describe how the initial rate of reaction could be obtained from a graph of this data. You may use a diagram to illustrate your answer.

(3)

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(b) Many fruits turn brown when they are cut open and this is a major cause of food wastage.

- (i) Explain why it is only when fruits are cut open that they are likely to turn brown.

(2)

- (ii) Explain why the addition of lemon juice, which contains citric acid, will often stop fruits turning brown.

(3)

(Total for Question 8 = 14 marks)

9 Mitosis in plant tissue is a form of cell division that is affected by a number of factors.

- (a) A student carried out an investigation into the effect of environmental stress on mitosis in one species of bean plant.

Sixty bean plants were divided into four groups of 15, labelled A, B, C and D. All the groups were grown in a complete mineral solution.

After 15 days, the bean plants from groups B, C and D were removed from this mineral solution for different lengths of time to stress them.

Cells from the root were then observed and the percentage of cells undergoing mitosis was found for each group.

The results are shown in the table.

Group	Time out of mineral solution / min	Percentage of root cells in mitosis (%)
A	0	18
B	50	6
C	100	6
D	150	4

- (i) Analyse the data to explain why removing the plants from the mineral solution affects mitosis in the root cells.

(4)

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- (ii) The student concluded that the decrease in the percentage of cells in mitosis was due to a lack of mineral ions during the stress period.

Give two reasons why this conclusion may not be valid.

(2)

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- (iii) For each group, the percentage of cells in the prophase stage of mitosis was recorded.

The mean percentage of cells in prophase was calculated for groups B, C and D.

These results are given in the table.

Group	Percentage of cells in the prophase stage of mitosis
A	65
Mean of groups B, C and D	28

Explain the effect of environmental stress on the root cells of these bean plants.

(2)

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Explain how this investigation could be modified to test this hypothesis in a safe, valid and reliable way.

[illegible]

TOTAL FOR PAPER = 80 MARKS

26

Biology B AS Paper 1

Question Number	Acceptable Answer	Additional guidance	Mark
1(a)	A		(1)

Question Number	Acceptable Answer	Additional guidance	Mark
1(b)	<p>An explanation that that makes reference to the following:</p> <ul style="list-style-type: none"> • if antibiotic worked then bacterium is Gram positive / if antibiotic does not work then bacterium is Gram negative (1) • because Gram positive bacteria have cell wall with more peptidoglycan / Gram negative bacteria have a thin cell wall with less peptidoglycan}(1) • therefore there is a target site for the antibiotic / no target site for the antibiotic (1) 		(3)

(Total for Question 1 = 4 marks)

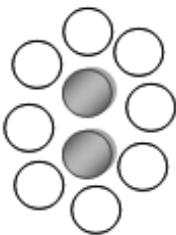
Question Number	Acceptable Answer	Additional guidance	Mark
2(a)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • DNA unzips because hydrogen bonds are broken using helicase (1) • mRNA made by {complementary base pairing / transcription / using RNA polymerase} (1) • mRNA leaves nucleus and attaches to {ribosomes / rRNA} (1) • tRNA anticodon attaches to mRNA codon (1) • amino acids form peptide bonds in translation (1) 		(5)

Question Number	Acceptable Answer	Additional guidance	Mark
2(b)	<p>An explanation that makes reference to two of the following:</p> <ul style="list-style-type: none"> • mutation would affect the {specificity / active site} of the enzyme (1) • change in the {sequence of amino acids / primary structure} (1) • glucose would not {fit / bind} to active site so no {enzyme substrate complex / no fructose / no product} would be made (1) 		(2)

(Total for Question 2 = 7 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
3(a)(i)	A		(1)

Question Number	Acceptable Answer	Additional guidance	Mark
3(a)(ii)	B		(1)

Question Number	Acceptable Answer	Additional guidance	Mark
3(b)	<ul style="list-style-type: none"> folded so the two hydrophobic amino acids are in the centre surrounded by hydrophilic ones (1) single layer of hydrophilic amino acids on the outside (1) polypeptide completely surrounded by water (1) example of diagram 	Accept first bullet two hydrophobics above water, second all hydrophilics in water, third two hydrophilics on one side and 6 on the other	(3)

Question Number	Acceptable Answer	Additional guidance	Mark
3(c)	<p>A description that makes a reference to the following:</p> <ul style="list-style-type: none"> • polypeptides fold up into a helix or β-pleated sheet arrangement (1) • two or more polypeptides join together by {H bonds/disulfide bridge} (1) 		(2)

(Total for Question 3 = 7 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
4(a)	<ul style="list-style-type: none"> • a nucleotide correctly drawn containing base phosphate and pentose (1) • strands antiparallel joined by bases (1) <p>Example:</p>		(2)

Question Number	Acceptable Answer	Additional guidance	Mark
4(b)(i)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> • $(22 \div 100) \times 250 = 55$ guanine (1) • Since guanine pairs with cytosine, 55 bases are cytosine (1) • Therefore 110 bases are guanine plus cytosine, the rest must be adenine plus thymine = 140 (1) • Since adenine pairs with thymine the number of adenine/thymine = $140 \div 2 = 70$ (1) 	All bases named gains 1 mark: guanine, cytosine, adenine, thymine	(4)

Question Number	Acceptable Answer	Additional guidance	Mark
4(b)(ii)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • some are start/stop codons (1) • some parts of the gene are introns (1) 	Accept answers that correctly refer to ribosome binding sites, promoter, operon	(2)

(Total for Question 4 = 8 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
5(a)	<ul style="list-style-type: none"> • correct drawing to show glycosidic bond in maltose (1) • evidence that a water molecule has been removed (1) 		(2)

Question Number	Acceptable Answer	Additional guidance	Mark
5(b)	max potential energy = 76 kJ (1) activation energy = $76 - 60 = 16$ kJ (1)	Correct answer gains full marks with no working	(2)

Question Number	Acceptable Answer	Additional guidance	Mark
5(c)	An explanation that makes reference to the following: <ul style="list-style-type: none"> • rate for amylopectin is faster than amylose (1) • active site is more complementary to amylopectin (1) • all amylopectin hydrolysed by 2.5 minutes (1) • amylopectin has side branches / has more terminal glycosidic bonds / amylose has only two terminal glycosidic bonds (1) 	Allow converse argument for amylose Accept more sophisticated answers that refer to competition for the active site	(4)

(Total for Question 5 = 8 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
6(a)(i)	C		(1)

Question Number	Acceptable Answer	Additional guidance	Mark
6(a)(ii)	B		(1)

Question Number	Acceptable Answer	Additional guidance	Mark
6(b)	<p>An explanation that makes reference to five of the following:</p> <ul style="list-style-type: none"> • liposomes can be made bigger than normal pores to prevent drug contact with healthy cells (1) • remain stable in circulation at 37°C but destabilized at higher temperatures in tumour microenvironment so drug only released at cancer (1) • phospholipids protect drug from being broken down by chemicals in plasma and only release drug at target site (1) • reduce need for other treatments such as radiotherapy / reduce possible side effects of other treatments (1) • able to fuse with tumour cell membrane to release drug by endocytosis (1) • high dose of cytotoxic drug can be delivered / not diluted in plasma (1) 		(5)

Question Number	Acceptable Answer	Additional guidance	Mark
6(c)(i)	A	2 ⁶	(1)

Question Number	Acceptable Answer	Additional guidance	Mark
6(c)(ii)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • fibres unable to contract (1) • contraction of fibres is needed to cause {daughter chromosomes / chromatids} to separate / centromere to split (in anaphase) (1) • therefore {daughter chromosomes / chromatids} cannot be pulled {towards opposite pole of the cell / away from the equator} (in anaphase) so new cells cannot be made(1) 		(3)

(Total for Question 6 = 11 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
7(a)	B		(1)

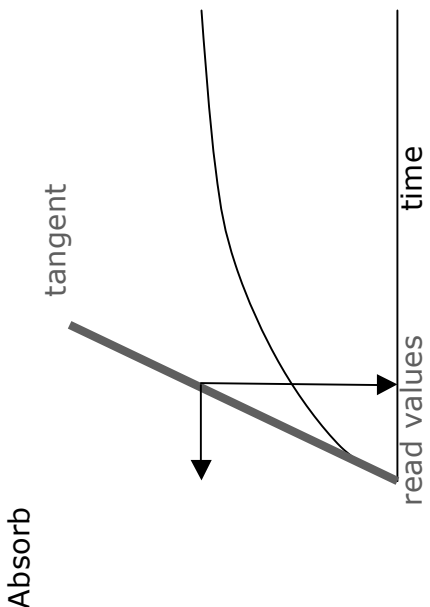
Question Number	Acceptable Answer	Additional guidance	Mark
7(b)(i)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> • Pattern is that DNA total mass is doubled for each cycle (1) • Therefore the mass of DNA for 5 cycles = 32, mass of DNA for 6 cycles = 64 (1) 	<p>Cycle 1 mass = 2, cycle 2 = 4, cycle 3 = 8, cycle 4 = 16 (1)</p> <p>Correct answer gains full marks with no working shown</p>	(2)

Question Number	Acceptable Answer	Additional guidance	Mark
7(b)(ii)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • DNA is replicated semi-conservatively (1) • because the graph shows that the heavy DNA has disappeared in the first cycle (1) • after 1 replication DNA is an intermediate as one strand comes from {original / heavy DNA} and one from a newly constructed {light DNA strand} (1) • as you get more DNA being formed, the increase is all due to newly formed strands, which are all light DNA (1) 		(4)

(Total for Question 7 = 7 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
8(a)(i)	$1.3 - 0.2 = 1.1$ (1) $1.1 \div 20 = 0.055$ (1) units a.u. s ⁻¹ (1)		(3)

Question Number	Acceptable Answer	Additional guidance	Mark
8(a)(ii)	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none"> enzyme controlled reactions are very rapid (1) therefore the {substrate / catechol} concentration is rapidly {reducing / used up} in the first 10s (1) less substrate means fewer collisions and therefore the rate slows (1) all the substrate has been converted to product by 50 seconds (1) 		(3)

Question Number	Acceptable Answer	Additional guidance	Mark
8(a)(iii)	<p>A description that makes reference to three of the following:</p> <ul style="list-style-type: none"> • draw a tangent to the curve of the graph (1) • tangent drawn following only the first 5-10 seconds of the curve (1) • read off single values of change in absorbance and time (1) • calculate gradient of tangent to find the rate (1) 	Points can be given by reference to annotations on a diagram	(3)

Question Number	Acceptable Answer	Additional guidance	Mark
8(b)(i)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • substrate and enzyme contained within cells {so do not mix / have restricted oxygen supply} (1) • therefore reaction only takes place when cells are broken so enzyme substrate and oxygen mix (1) 		(2)

Question Number	Acceptable Answer	Additional guidance	Mark
8(b)(ii)	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none"> • enzymes are proteins that are sensitive to pH (1) • because changes in pH disrupt ionic bonding in protein (1) • these changes in bonding change the shape of the active site (1) • change in shape of the active site means the catechol will not bind with PPO and therefore no browning (1) 		(3)

(Total for Question 8 = 14 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
9(a)(i)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> groups B, C and D show a decrease in the percentage of root cells in mitosis compared to group A (1) this is because the supply of minerals is limiting (1) however in groups B, C and D some cells are still showing mitosis (1) because {they have stored minerals / they have already synthesised materials needed} (1) 		(4)

Question Number	Acceptable Answer	Additional guidance	Mark
9(a)(ii)	<p>An answer that makes reference to two of the following:</p> <ul style="list-style-type: none"> lack of water (1) handling e.g. damage to root hairs (1) exposure to light (1) 	Accept other appropriate changes e.g. effects on temperature	(2)

Question Number	Acceptable Answer	Additional guidance	Mark
9(a)(iii)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> lowers percentage (of cells) in prophase (when stressed) (1) (because) when stressed cells will remain in interphase (and not progress to prophase) (1) 	Accept more sophisticated answers that give an explanation as to why prophase has not occurred e.g. no DNA synthesis	(2)

Question Number	Indicative content
*9(b)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <ul style="list-style-type: none"> Reference to {3 / more} different light intensities used as this is the independent variable Validity ensured by detailing how light intensity varied, e.g. moving light source further way Repeats at each light intensity to improve reliability of data Example of similarity of plants, e.g. clones, same age to ensure validity of method Control of other named variable to ensure validity, e.g. CO₂ levels, duration of light exposure, pH of mineral ion solution Safety aspect explained e.g. {cut finger when cutting root tip + cut way from finger/ cut on a hard surface} / {HCl or stain harmful to eyes + wear safety goggles} / {heat is harmful + use tongs} / (cut finger on glass during squash + wrap in soft material)

Level	Mark	Descriptor
	0	No awardable content
Level 1	1-2	<p>An explanation of how the investigation should be modified may be attempted but with limited analysis, interpretation and/or evaluation of the scientific information. Generalised comments made.</p> <p>The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.</p>
Level 2	3-4	<p>An explanation of how the investigation should be modified will be given with occasional evidence of analysis, interpretation and/or evaluation of the scientific information.</p> <p>The explanation shows some linkages and lines of scientific reasoning with some structure.</p>
Level 3	5-6	<p>An explanation of how the investigation should be modified is given which is supported throughout by evidence from the analysis, interpretation and/or evaluation of the scientific information.</p> <p>The explanation shows a well-developed and sustained line of scientific reasoning which is clear, coherent and logically structured.</p>

(Total for Question 9 = 14 marks)

Write your name here	
Surname	Other names
Pearson Edexcel Level 3 GCE	Centre Number <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></div>
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<h1 style="margin: 0;">Biology B</h1> <h2 style="margin: 0;">Advanced Subsidiary</h2> <h3 style="margin: 0;">Paper 2: Core Physiology and Ecology</h3>	
Sample Assessment Material for first teaching September 2015 Time: 1 hour 30 minutes	Paper Reference 8BI0/02
You may need a ruler, a pencil and a calculator.	Total Marks <div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div>

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You may use a scientific calculator.
- In question(s) marked with an asterisk (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions.

Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

- 1** Platelets are tiny fragments of cells that, together with plasma proteins, are involved in the blood clotting process.

(a) (i) During the blood clotting process

(1)

- ☐ **A** prothrombin is changed to thromboplastin
- ☐ **B** prothrombin is changed to thrombin
- ☐ **C** thrombin is changed to thromboplastin
- ☐ **D** thromboplastin is changed to thrombin

(ii) When blood clots a mesh is produced because

(1)

- ☐ **A** insoluble fibrin is converted to soluble fibrinogen
- ☐ **B** insoluble fibrinogen is converted to soluble fibrin
- ☐ **C** soluble fibrin is converted to insoluble fibrinogen
- ☐ **D** soluble fibrinogen is converted to insoluble fibrin

(b) Several of the plasma proteins involved in making blood clot quickly are enzymes.

Explain how the properties of enzymes help to make blood clot quickly.

(2)

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(Total for Question 1 = 4 marks)

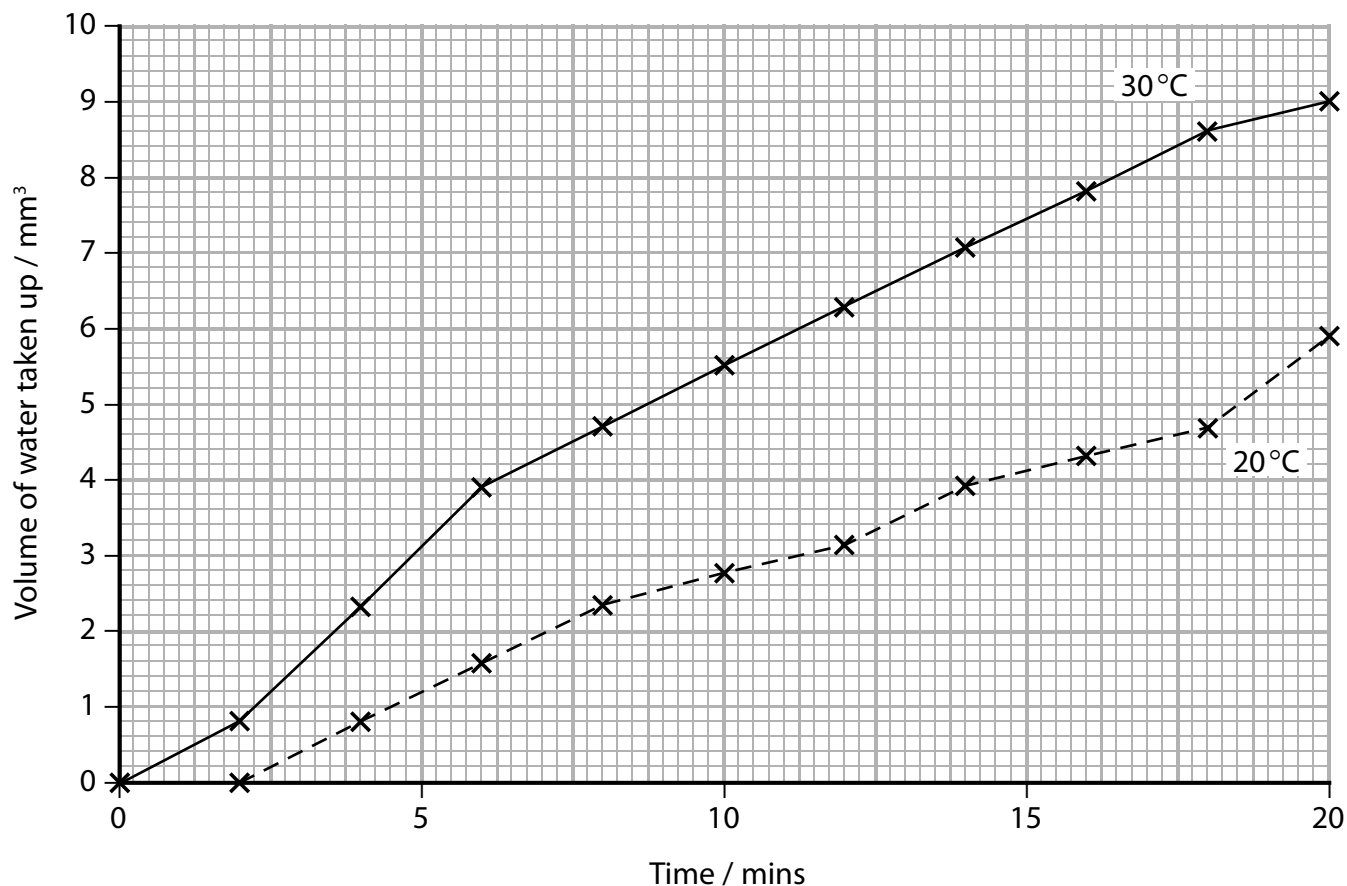
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Turn over for question 2

- 2 A student used a potometer to investigate the effect of temperature on the uptake of water by a plant shoot. The potometer was set up in a room at 30 °C and the volume of water taken up by the shoot was recorded for a period of 20 minutes.

The potometer was then moved to a room at 20 °C. After a period of acclimatisation, the volume of water taken up by the shoot was recorded for a further 20 minutes.

The results of the investigation are shown in the graph.



- (a) Calculate the mean transpiration rate for this shoot at 30 °C between 6 and 18 minutes.

(3)

Answer.....

(b) Explain how an increase in temperature increases the transpiration rate of shoots.

(3)

(Total for Question 2 = 6 marks)

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- 3 (a) The image below shows a part of the underside of a leaf as seen by a student using a microscope.



(Source: <http://www.nscsd.org>)

- (i) The stomata in the image is open because the

(1)

- ☒ A guard cells are turgid and the thin part of the cellulose wall stretches more than the thick part
- ☒ B guard cells are flaccid and the thin part of the cellulose wall stretches less than the thick part
- ☒ C guard cells are turgid and the thick part of the cellulose wall stretches more than the thin part
- ☒ D guard cells are flaccid and the thick part of the cellulose wall stretches less than the thin part

- (ii) Which row of the table correctly shows the method of water absorption by guard cells and the change in size of the stomatal pore?

(1)

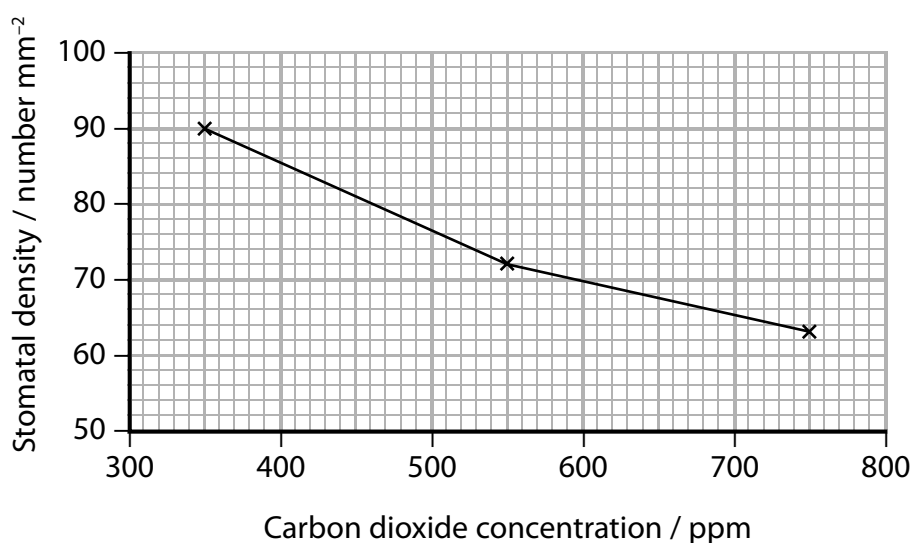
	Method of water absorption	Stomatal pore size
<input checked="" type="checkbox"/> A	active transport	decreases
<input checked="" type="checkbox"/> B	diffusion	increases
<input checked="" type="checkbox"/> C	facilitated diffusion	decreases
<input checked="" type="checkbox"/> D	osmosis	increases

- (b) A student investigated how the exposure of a young plant called *Arabidopsis thaliana* to different concentrations of carbon dioxide affected the density of stomata in its adult leaves.

He put one plant in a greenhouse where the carbon dioxide concentration was regulated at 350 ppm. He waited for two weeks then measured the number of stomata on a leaf from the plant.

He repeated this procedure using a greenhouse with a carbon dioxide concentration of 550 ppm and a greenhouse with a carbon dioxide concentration of 750 ppm.

His results are shown in the graph.



The student concluded that there was a negative correlation between stomatal density and the concentration of carbon dioxide.

Discuss the improvements that the student needs to make before being confident that this conclusion is supported.

(5)

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(c) Explain how an increase in atmospheric carbon dioxide might affect the evolution of stomatal density in plants.

(3)

(Total for Question 3 = 10 marks)

- 4 An insect pest infects a tree causing the leaves to fall off. These trees need to be treated with an insecticide that kills the pest.

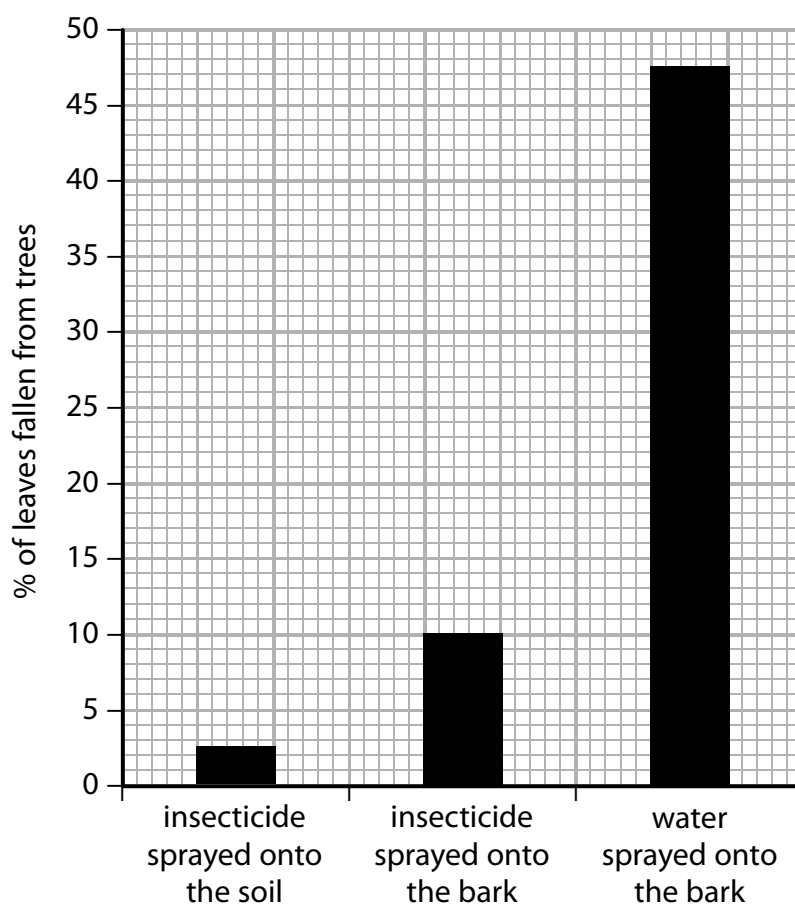
Scientists wanted to compare the procedures that could be used to treat trees with an insecticide.

They used the following procedures in their investigation:

- spraying the insecticide onto the soil
- spraying the insecticide onto the bark of the trees
- spraying the bark of the trees with water

After each procedure was used they measured the percentage of leaves still remaining on the trees after a period of time.

The graph shows the results.



- (a) Give one other procedure that should be used to allow a valid comparison of the results to be made.

(1)

(b) Insecticide is transported in trees from root hair cells to the leaves and from lenticels in the bark to the leaves.

- (i) Describe how insecticide would be transported from the soil into root hair cells and then to the leaves.

(4)

- (ii) Give a reason why insecticide transport is more effective when sprayed onto soil rather than onto bark.

(1)

- (c) Give a reason why spraying the insecticide onto the bark of trees is better for woodland biodiversity than spraying it onto the soil.

(1)

(Total for Question 4 = 7 marks)

5 (a) (i) Describe how tissue fluid is formed.

(2)

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(ii) Which of the following substances are exchanged between the capillaries and tissue fluid?

(1)

- ☐ **A** lymph, glucose and oxygen
- ☐ **B** oxygen, water and haemoglobin
- ☐ **C** glucose, lymph and water
- ☐ **D** water, glucose and oxygen

(b) Blood samples were taken from a vein of a woman using a needle in order to measure the plasma protein concentration during pregnancy.

(i) Give a reason why the structure of a vein makes it suitable for obtaining blood samples.

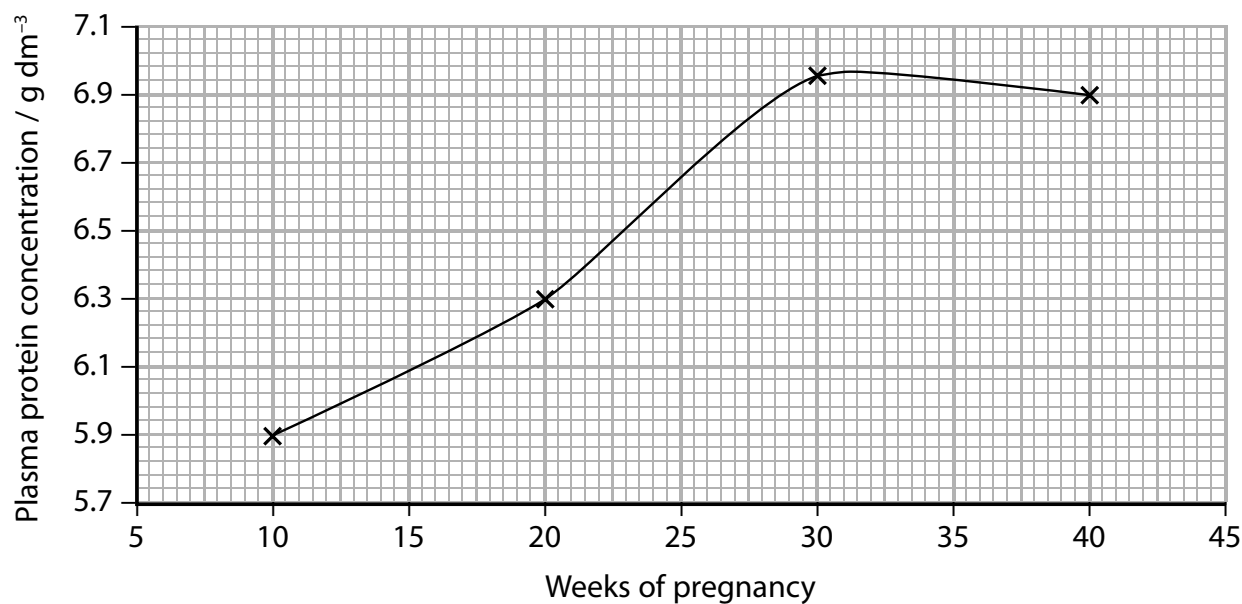
(1)

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The graph shows changes in the plasma protein concentration in the blood of a pregnant woman.



(ii) Analyse the data to explain the effect the changes in plasma protein concentration could have on the blood volume of a pregnant woman.

(4)

(Total for Question 5 = 8 marks)

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6 Blood plays a role in the mass transport of substances around the body.

(a) Explain why organisms need a mass transport system.

(2)

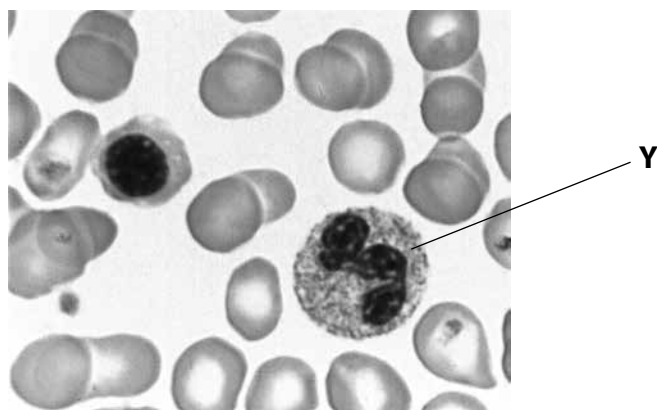
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(b) The photograph shows a stained blood sample.



(Source: <http://www.pathologystudent.com>)

(i) The blood cell labelled **Y** is

(1)

- ☐ **A** an erythrocyte
- ☐ **B** a lymphocyte
- ☐ **C** a neutrophil
- ☐ **D** a monocyte

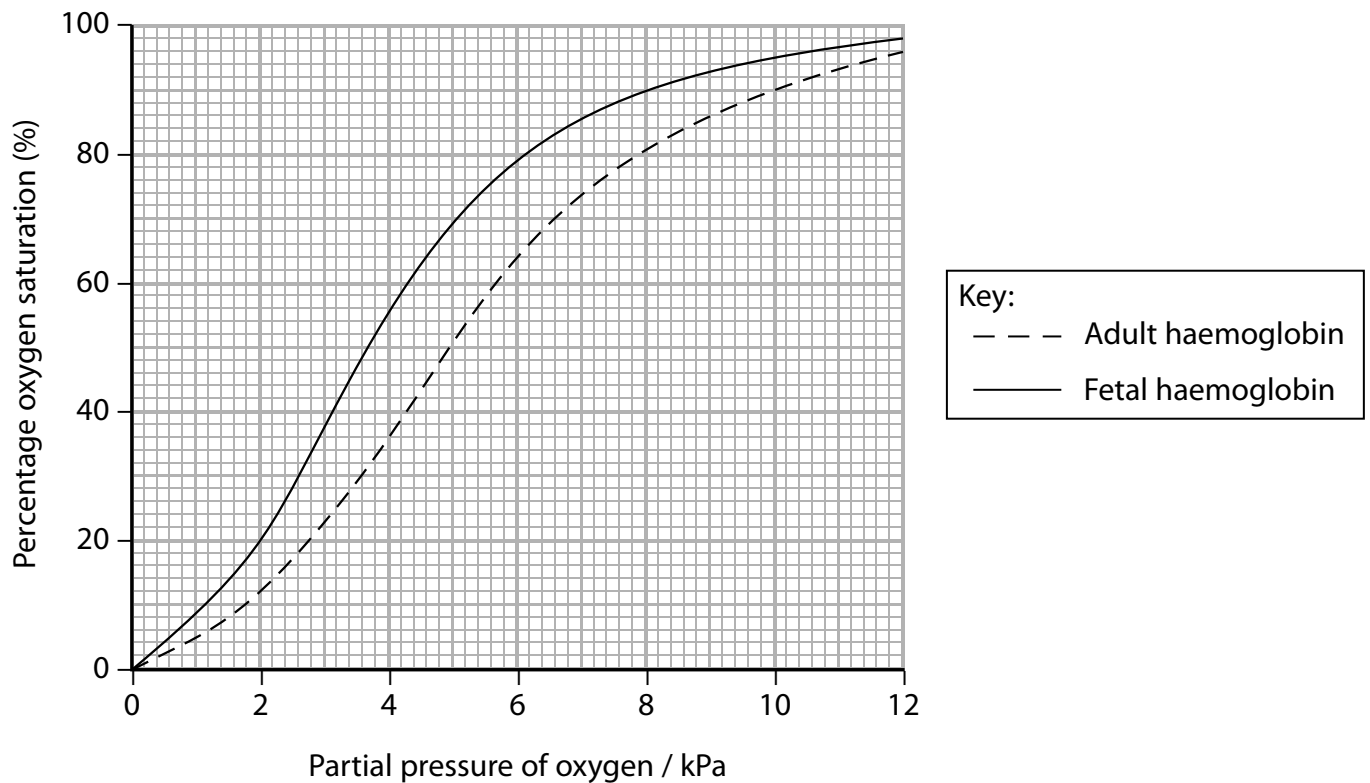
(ii) An increase in the concentration of carbon dioxide in the blood will cause

(1)

- ☐ **A** more oxygen to bind to haemoglobin
- ☐ **B** no change in the amount of oxygen bound to haemoglobin
- ☐ **C** the release of oxygen from haemoglobin
- ☐ **D** less oxygen to bind to haemoglobin

- (c) In mammals, the mother and fetus have separate circulatory systems. Materials are exchanged between the two circulatory systems in the placenta.

The graph shows the oxygen dissociation curves for adult and fetal haemoglobin.



- (i) Calculate the percentage increase in oxygen saturation between adult haemoglobin and fetal haemoglobin at an oxygen concentration of 4 kPa.

(2)

Answer.....

- (ii) Explain why fetal haemoglobin ensures the transfer of oxygen from the maternal to the fetal circulation.

(2)

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The oxygen dissociation curve for myoglobin is different from that for adult haemoglobin.

- (iii) Draw a line on the graph to show the dissociation curve for myoglobin.

(1)

- (iv) The table shows the results of an investigation to measure the myoglobin content in the muscle tissue of two different mammals.

Myoglobin concentration in muscle tissue / mg g ⁻¹	
Dolphin	Whale
25	68

Explain why the difference in myoglobin concentration affects the time mammals can spend underwater.

(3)

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(Total for Question 6 = 12 marks)

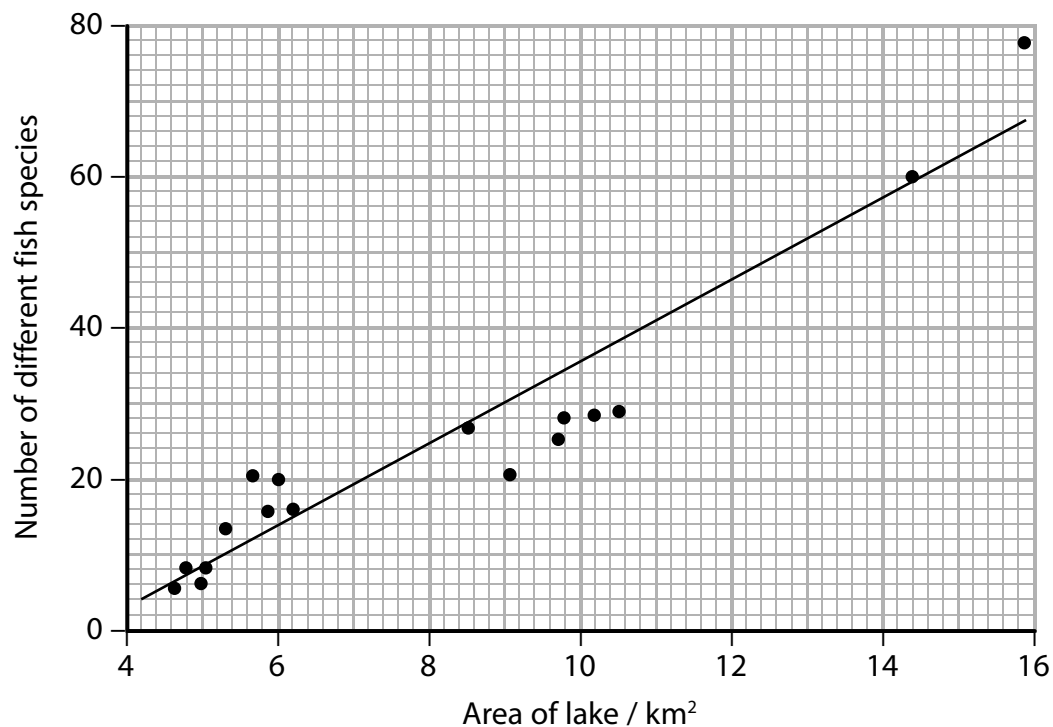
7 Species diversity varies in different habitats.

- (a) Explain why there is a difference in the species diversity found in a tropical rainforest compared to the species diversity found in a desert.

(3)

- (b) An investigation was carried out to find out if there was a correlation between the fish species diversity in a lake and the size of the area sampled.

The graph below shows the results.



Explain how natural selection could account for the change in fish species diversity as the size of the area sampled increased.

(3)

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- (c) An investigation was carried out to determine the numbers of different species of lizards in two areas. The results are shown in the table.

Species of lizard	Number of individuals observed	
	Area A	Area B
Collared lizard	1	5
Greater earless lizard	6	2
Lesser earless lizard	18	29
Fence lizard	29	3
Texas spotted whiptail lizard	32	2
Little striped whiptail lizard	45	1

- (i) Calculate an index of diversity (D) for area A, using the formula

(3)

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

N = total number of organisms of all species

n = total number of organisms of a particular species

Answer.....

(ii) Area B has an index of diversity of 2.1.

With reference to these indices and the data given, compare and contrast the biodiversity of these two areas.

(4)

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(Total for Question 7 = 13 marks)

- 8 A student carried out an investigation to test the hypothesis that the cells of sweet potatoes have a lower water potential than the cells of white potatoes.

One gram of potato tissue was placed in a test tube and 10 cm³ of a 0.1 mol dm⁻³ sucrose solution was added.

After 30 minutes, one drop of blue colouring was added to the test tube and the contents of the tube mixed.

A pipette was used to remove some of the solution from the test tube and one drop was placed in the middle of a second test tube containing the original 0.1 mol dm⁻³ sucrose solution.

The movement of the blue coloured drop was observed.

The procedure was repeated for a further six different concentrations of sucrose solution.

The results are shown in the table.

	Concentration of sucrose solution / mol dm ⁻³						
	0.1	0.2	0.3	0.4	0.5	0.6	0.7
Sweet potato drop moves	down	down	down	down	up	up	up
White potato drop moves	down	down	down	down	up	up	up

It is important to stop evaporation from the solution in the test tubes in this investigation because it will affect the water potential.

- (a) State how evaporation would affect the water potential of the solution in the test tubes.

(1)

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(b) Explain the movement of the drop placed in the 0.2 mol dm^{-3} sucrose solution.

(3)

(c) The student concluded that the sweet potato and white potato have the same water potential.

Explain why this is not a valid conclusion.

(3)

(Total for Question 8 = 7 marks)

9 Materials are transported into and out of a cell through the surface membrane.

(a) (i) Proteins are transported out of a cell by

(1)

- ☐ **A** active transport and diffusion
- ☐ **B** active transport and exocytosis
- ☐ **C** active transport and endocytosis
- ☐ **D** diffusion and exocytosis

*(ii) Cigarette smoke contains molecules called free radicals that damage the structure of cell membranes.

Explain the effect that cigarette smoke could have on the movement of molecules into and out of a cell.

(6)

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- (b) The content of blood needs to be monitored when being stored for later use. In an investigation, samples of blood were stored at 4 °C for 5 days.

The concentration of potassium ions in the plasma and in the erythrocytes was measured at the beginning and end of storage.

The results are shown in the table.

Blood	Component of blood	Concentration of potassium ions / mmol dm⁻³
At the beginning of storage	Erythrocytes	94
	Plasma	3
At end of storage at 4 °C for 5 days	Erythrocytes	65
	Plasma	7

Calculate the percentage change in the concentration of potassium ions in erythrocytes during this storage at 4 °C for 5 days.

(2)

Answer.....

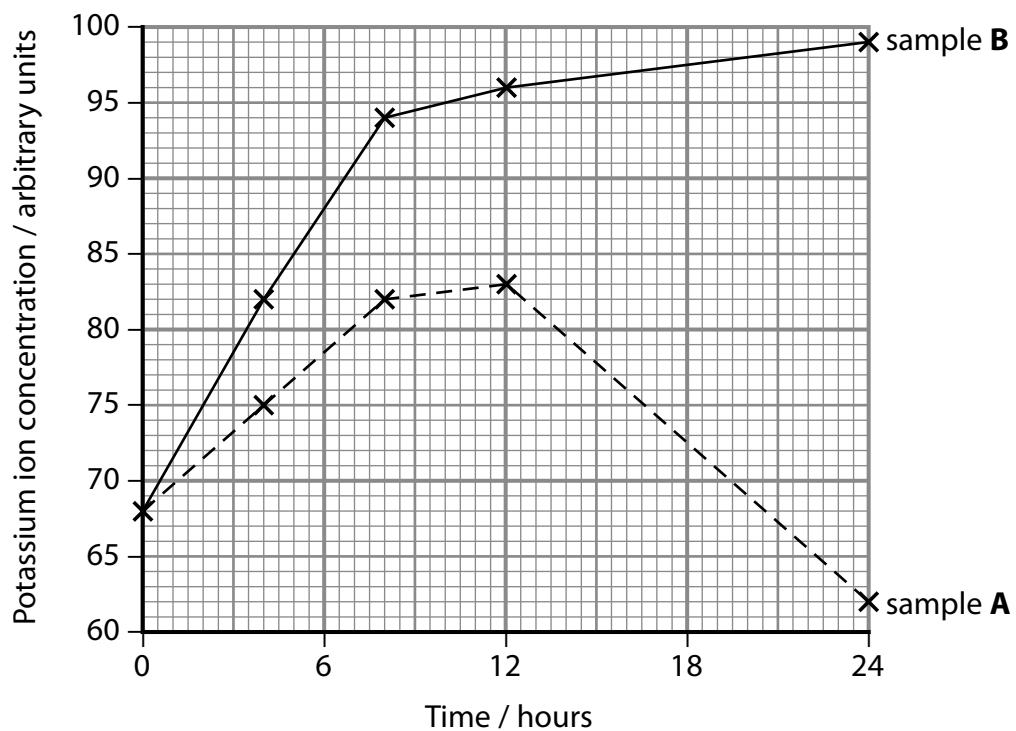
In another investigation, two blood samples, **A** and **B**, were stored at 4 °C for 5 days.

Sample **A** was then stored at 37 °C for 24 hours.

Glucose was added to sample **B**, which was stored at 37 °C for 24 hours.

The potassium ion concentration in the erythrocytes was recorded.

The results are shown in the graph.



(c) Analyse the data to explain the results of this investigation.

(4)

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(Total for Question 9 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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Biology B AS Paper 2

Question Number	Answer	Additional guidance	Mark
1(a)(i)	B		(1)

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	D		(1)

Question Number	Answer	Additional guidance	Mark
1(b)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> enzymes lower the activation energy of reactions in the clotting pathway therefore speeding it up (1) enzymes are not destroyed by the reaction they catalyse therefore speeding it up (1) 		(2)

(Total for Question 1 = 4 marks)

Question Number	Answer	Additional guidance	Mark
2(a)(i)	correctly extracts values from graph 3.9 and 8.6 mm ³ (1) (8.6 – 3.9) ÷ 12 = 0.39 (1) mm ³ min ⁻¹ (1)	Correct answer gains full marks, with no working shown.	(3)

Question Number	Answer	Additional guidance	Mark
2(b)	An explanation that makes reference to the following: <ul style="list-style-type: none"> • at a higher temperature water molecules have more kinetic energy (1) • therefore more water molecules evaporate (1) • therefore there is greater diffusion rate through stomata (1) 		(3)

(Total for Question 2 = 6 marks)

Question Number	Answer	Additional guidance	Mark
3(a)(i)	A		(1)

Question Number	Answer	Additional guidance	Mark
3(a)(ii)	D		(1)

Question Number	Answer	Additional guidance	Mark
3(b)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> needs to {take more measurements in the range of 350 to 750 ppm / extend the range below 350 and above 750} to ensure the pattern is linear / to find out if other concentrations of carbon dioxide have a greater or lesser effect (1) needs to use {more than one plant / measure more than one leaf} to improve reliability (1) needs to ensure that {light intensity / water supply / temperature} are controlled to ensure validity (1) needs to use leaves from the same height / measure number of stomata at the same place on the leaf because stomatal density may vary (1) needs to use leaves from genetically identical / cloned plants because genes may affect stomatal density (1) 		(5)

Question Number	Answer	Additional guidance	Mark
3(c)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> plants will have different densities of stomata as a result of natural variation (1) if concentration of carbon dioxide increases, plants will need fewer stomata (1) plants with lower stomatal densities will have a selective advantage (1) 	<p>Accept converse argument for marking points 2 and 3</p> <p>(3)</p>	

(Total for Question 3 = 10 marks)

Question Number	Answer	Additional guidance	Mark
4(a)	<ul style="list-style-type: none"> spray soil with water as a control (1) 		(1)

Question Number	Answer	Additional guidance	Mark
4(b)(i)	<p>An description that makes reference to the following:</p> <ul style="list-style-type: none"> absorbed by diffusion because insecticide concentration is higher in soil than in root hair (1) may be transported through the {apoplast / cells walls} (1) may be transported through the symplast when reaching the endodermis because of the Casparian strip (1) transported in xylem by transpirational pull (1) 		(4)

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	<ul style="list-style-type: none"> more absorbed by root hair cells than by lenticels because surface area for absorption is greater (1) 		(1)

Question Number	Answer	Additional guidance	Mark
4(c)	<ul style="list-style-type: none"> does not kill soil organisms / less disruptive to woodland food chains (1) 		(1)

(Total for Question 4 = 7 marks)

Question Number	Answer	Additional guidance	Mark
5(a)(i)	<p>A description that makes reference to the following:</p> <ul style="list-style-type: none"> • hydrostatic pressure generated by the heart (1) • water and low molecular mass solutes forced out of capillaries (1) 		(2)

Question Number	Answer	Additional guidance	Mark
5(a)(ii)	D		(1)

Question Number	Answer	Additional guidance	Mark
5(b)(i)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> • wider lumen and thin wall that has less {muscle / elastic} tissue (1) 		(1)

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • the concentration of plasma proteins in blood capillaries rises from 5 to 30 weeks (1) • therefore there is a higher solute potential in the blood than in tissue fluid (1) • therefore blood volume (progressively) increases because solute potential is greater than hydrostatic pressure (1) • after 30 weeks the concentration of plasma proteins levels off, so the blood volume remains constant and raised (1) 		(4)

(Total marks for question 5 = 8 marks)

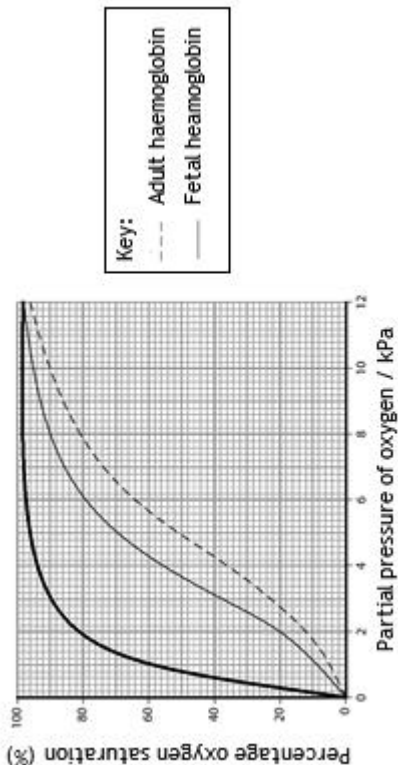
Question Number	Answer	Additional guidance	Mark
6(a)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • to move molecules quickly between gas exchange surfaces and cells (1) • in organisms that have small surface area to volume ratio where diffusion would be inadequate (1) 		(2)

Question Number	Answer	Additional guidance	Mark
6(b)(i)	C		(1)

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	C		(1)

Question Number	Answer	Additional guidance	Mark
6(c)(i)	<p>correctly extracts values from graph 55 and 35 (1)</p> <p>$[(55-35) \div 35] \times 100 = 57\%$ (1)</p>	Correct answer gains full marks, with no working shown.	(2)

Question Number	Answer	Additional guidance	Mark
6(c)(ii)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • fetal haemoglobin has a higher affinity for oxygen (1) • therefore at lower oxygen partial pressures oxygen will transfer from adult to fetal haemoglobin more readily (1) 		(2)

Question Number	Answer	Additional guidance	Mark
6(c)(iii)	 <p>Key: --- Adult haemoglobin — Fetal haemoglobin</p> <ul style="list-style-type: none"> • non-sigmoid line drawn to left of fetal haemoglobin (1) 		(1)

Question Number	Answer	Additional guidance	Mark
6(c)(iv)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • myoglobin stores oxygen (1) • greater concentration in whale means more oxygen can be stored so can remain underwater for longer (1) • because cells having to respire anaerobically (1) 		(3)

(Total for Question 6 = 12 marks)

Question Number	Answer	Additional guidance	Mark
7(a)	<p>An explanation that makes a reference to the following:</p> <ul style="list-style-type: none"> • greater species diversity in rain forest than in the desert (1) • because abiotic factors { more food / water / eq } are more favourable in rainforests than in a desert (1) • this leads to greater survival of number and diversity of species in rainforests compared to desert(1) 		(3)

Question Number	Answer	Additional guidance	Mark
7(b)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • mutations occur in fish populations that enable individuals to survive in different niches (1) • isolation prevents sharing of {mutations / genetic material} leading to sympatric speciation (1) • likely to be more potential niches in bigger lakes (1) 		(3)

Question Number	Answer	Additional guidance	Mark
7(c)(i)	$N(N-1) = 17030$ (1) $\Sigma n(n-1) = 4120$ (1) $D = 4.13$ (1)	Correct answer gains full marks, with no working shown.	(3)

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	<p>A comparison and contrast that must include one similarity and one difference from four of the following:</p> <ul style="list-style-type: none"> • both areas have the same number of lizard species (1) • both areas have a similar total number of lizards (1) • the number of lizards is more evenly spread across the different species in area A (1) • area A has a larger index of diversity than area B (1) • area A is the more biodiverse (for lizards) (1) 		(4)

(Total for Question 7 = 13 marks)

Question Number	Answer	Additional guidance	Mark
8(a)	<ul style="list-style-type: none"> lowers water potential (1) 		(1)

Question Number	Answer	Additional guidance	Mark
8(b)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> water had moved from the solution into the potato by osmosis (1) increasing the sucrose concentration of the solution (1) making the solution more dense (1) 		(3)

Question Number	Answer	Additional guidance	Mark
8(c)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> no readings between 0.4 and 0.5 mol dm⁻³ (1) other physical variable not controlled and its effect on osmosis (e.g. temperature, surface area) (1) other tissue variable not controlled and its effect on water potential (e.g. age, source, pre-treatment of potato) (1) 		(3)

(Total for Question 8 = 7 marks)

Question Number	Answer	Additional guidance	Mark
9(a)(i)	B		(1)

Question Number	Indicative content
*9(a)(ii)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <ul style="list-style-type: none"> • reference to membrane being a phospholipid bilayer with channel and carrier proteins • damage to phospholipids affects transport of {oxygen / carbon dioxide / non-polar molecules} • damage to phospholipids affects the processes of endocytosis and exocytosis • damage to channel and carrier proteins alters their shape and affects facilitated diffusion • damage to channel proteins affects transport of {charged ions / large molecules / polar molecules} • damage to carrier proteins affects active transport • damage to cell membrane allows lysosomes to escape and release digestive enzymes onto other cells

Level	Mark	Descriptor
	0	No awardable content
Level 1	1-2	<p>Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made.</p> <p>The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context</p>
Level 2	3-4	<p>Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts to provide the explanation being presented.</p> <p>Lines of argument occasionally supported through the application of relevant evidence (scientific ideas, processes, techniques and procedures).</p> <p>The explanation shows some linkages and lines of reasoning with some structure.</p>

Level	Mark	Descriptor
Level 3	5-6	<p>Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to provide the explanation being presented.</p> <p>Line(s) of argument supported throughout by sustained application of relevant evidence (scientific ideas, processes, techniques and procedures).</p> <p>The explanation shows a well-developed and sustained line of reasoning which is clear, coherent and logically structured.</p>

Question Number	Answer	Additional guidance	Mark
9(b)	<p>change = $94.0 - 65.0 \div 29$ (1)</p> <p>% change = $[(94.0 - 65) \div 94.0] \times 100 = 31\%$ (1)</p>	Correct answer gains full marks, with no working shown.	(2)

Question Number	Answer	Additional guidance	Mark
9(c)	<p>An explanation that makes reference to four of the following:</p> <ul style="list-style-type: none"> • in sample A, after 12 hours diffusion out faster than uptake (1) • in sample B, the glucose is used to produce ATP, therefore rate of uptake is faster (1) • the rate in sample B slows after 8 hours due to lowering of concentration of potassium ions outside the cell (1) • increase in uptake in both samples must be due to active transport (1) • in sample A there must be some ATP available to supply the energy (1) 		(4)

(Total for Question 9 = 13 marks)

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