EDEXCEL GCSE BIOLOGY

BIOLOGY



EXAM QUESTION PACK

UNIT B2 HIGHER TIER 5BI2H PAPERS

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Surname	Other names

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Centre Number | | | | | |

Candidate Number | | | | |

Biology/Additional Science

Unit B2: The Components of Life

Higher Tier

Wednesday 17 January 2018 – Morning
Time: 1 hour

Paper Reference
5BI2H/01

You must have:
Calculator, ruler

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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

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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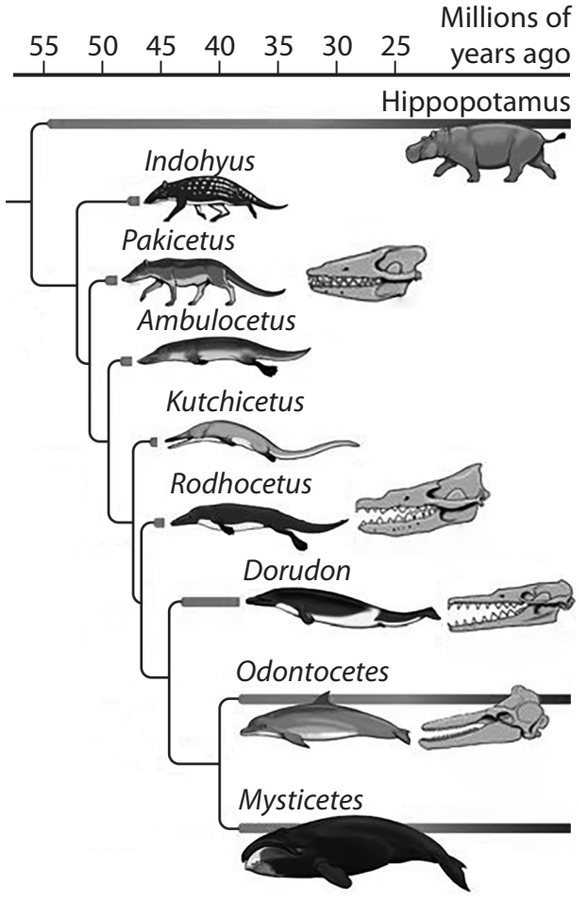
Answer ALL questions.

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 ☒.

Fossils

1 (a) The diagram shows an evolutionary tree for the whale genus *Mysticetes*.

The bar next to each genus indicates how much time that genus inhabited the Earth.



(i) Name each genus shown in the diagram that is not extinct.

(1)

1 .....

2 .....

3 .....

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(ii) Use the diagram to estimate the number of years that *Dorudon* inhabited the Earth.

(1)

number of years = ...

(iii) Suggest how **one** feature of the skulls in the diagram shows that *Dorudon* was more suited to living in the sea than *Rodhocetus*.

(2)

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(b) Some of the earliest known organisms are bacteria.

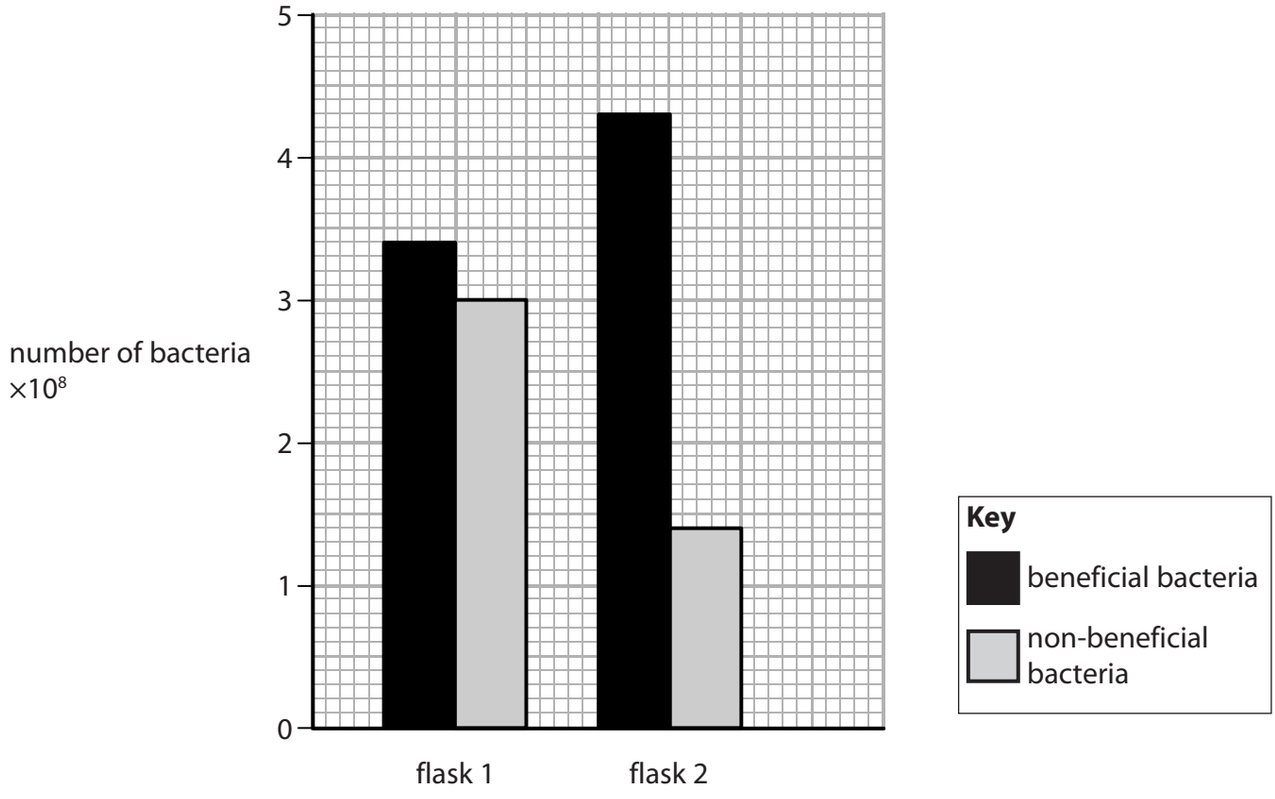
Some bacteria that live in human intestines are beneficial to human health, whilst others are non-beneficial to human health.

A mixture of these types of bacteria was grown in two flasks.

Flask 1 contained the two types of bacteria and a food source.

Flask 2 contained the two types of bacteria, the food source and prebiotics.

The graph shows the results.



(i) Explain the effect of prebiotics on the population of beneficial bacteria.

(2)

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(ii) Explain why the population of non-beneficial bacteria was lower than the population of beneficial bacteria in flask 2.

(2)

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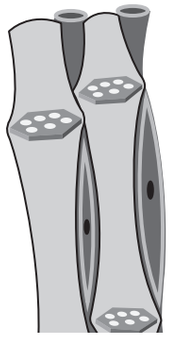
(Total for Question 1 = 8 marks)

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Plants

2 The diagram shows plant cells that transport sugars.



(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

These plant cells are

(1)

☒ **A** xylem

☒ **B** phloem

☒ **C** root hair cells

☒ **D** leaf palisade cells

(b) Explain how sugars are made in a leaf.

(2)

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(c) The photograph shows some grassland on the north side of a building.



The distribution of plant species, X and Y, growing at different distances from the building was investigated.

(i) Which pieces of equipment would be used to measure the distribution of plants in this investigation?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** a pooter and a quadrat

☒ **B** a pooter and a sweep net

☒ **C** a tape measure and sweep net

☒ **D** a tape measure and a quadrat

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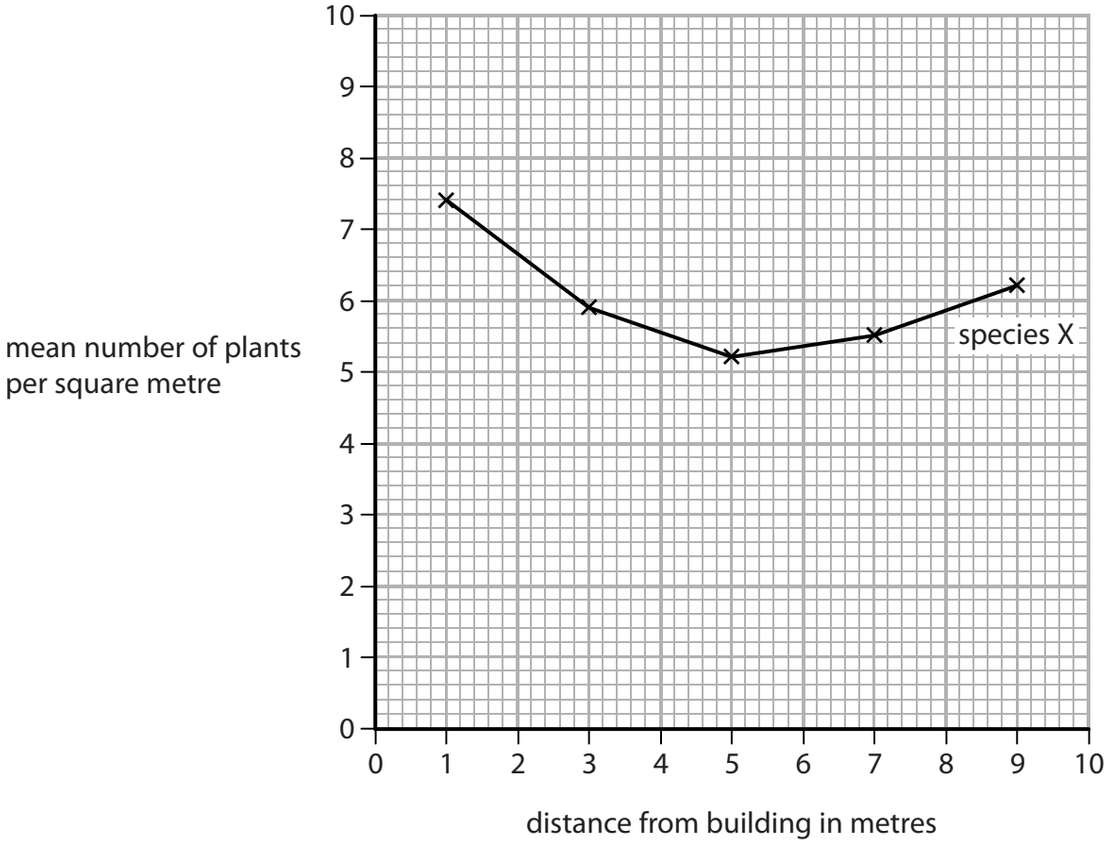
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(ii) The results of the investigation are shown in the table.

distance from building in metres	mean number of plants per square metre	
	species X	species Y
1	7.4	1.3
3	5.9	4.3
5	5.2	8.1
7	5.5	8.0
9	6.2	7.5

Complete the graph to show the distribution of species Y.

(2)



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(iii) Suggest reasons for the difference in the distribution of species X and species Y at 1 metre and 5 metres from the north side of the building.

(2)

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(Total for Question 2 = 8 marks)

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Growth

3 (a) The table shows the masses of two children, R and S, from birth to 18 months.

	mass in kilograms	
age in months	**child R**	**child S**
birth	3.3	2.7
6	7.1	6.5
12	8.2	7.9
18	9.1	8.8

(i) Compare the growth of child R and child S from birth to 6 months.

(2)

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(ii) The percentage increase in mass for child R from 6 to 18 months is 28.2%.

Calculate the percentage increase in mass for child S from 6 to 18 months.

(2)

% increase in mass = ... %

(iii) Suggest a reason for the difference in the percentage increase in mass of child R and child S from 6 to 18 months.

(1)

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(b) (i) Humans produce enzymes to digest proteins.

Which organs release enzymes for protein digestion?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** mouth, stomach and small intestine
- ☒ **B** pancreas, liver and large intestine
- ☒ **C** stomach, pancreas and small intestine
- ☒ **D** mouth, liver and large intestine

(ii) Explain why proteins in food need to be digested.

(2)

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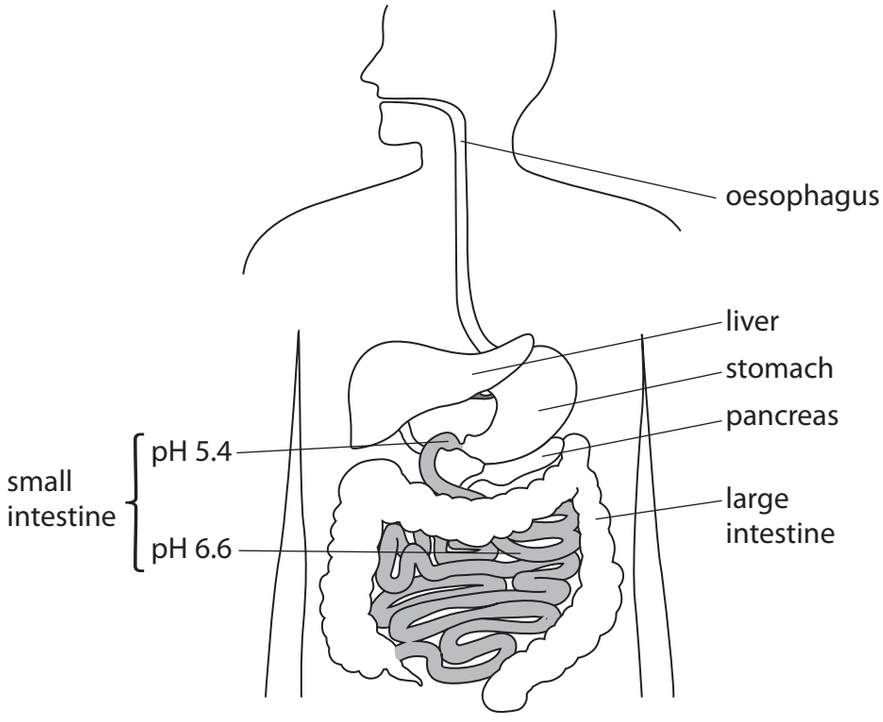
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(c) The diagram shows the pH in two parts of the small intestine 3 hours after a meal.



Explain why there are differences in the pH in the small intestine.

(2)

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(Total for Question 3 = 10 marks)

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Exercise and the circulatory system

4 (a) Most of the energy used during exercise comes from aerobic respiration.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The products of aerobic respiration are

(1)

☒ **A** glucose and water

☒ **B** glucose and oxygen

☒ **C** carbon dioxide and lactic acid

☒ **D** carbon dioxide and water

(b) The volume of blood that the heart pumps during each beat is known as the stroke volume.

The table shows the stroke volume, heart rate and cardiac output of an athlete at rest, during gentle exercise and during strenuous exercise.

	stroke volume in dm^3	heart rate in beats per minute	cardiac output in dm^3 per minute
at rest	0.10	68	6.8
during gentle exercise	0.13	?	15.6
during strenuous exercise	0.16	182	29.1

(i) Calculate the heart rate of the athlete during gentle exercise.

(2)

heart rate = ... beats per minute

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(ii) Explain why athletes need to increase their cardiac output during exercise.

(3)

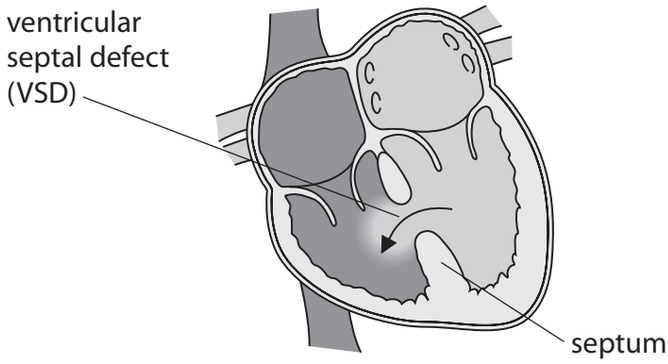
(c) Describe how oxygen is transported around the body.

(2)

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(d) Some people are born with a condition known as ventricular septal defect (VSD).

The diagram shows a heart with VSD.



Explain the effect of VSD on blood travelling through the heart.

(2)

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(Total for Question 4 = 10 marks)

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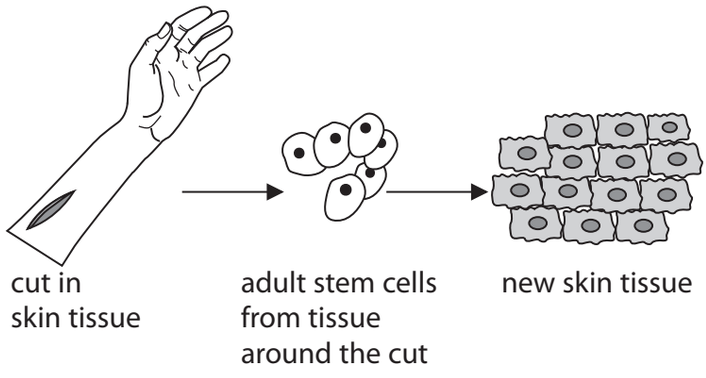
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Cells

5 (a) The diagram shows new skin tissue produced from stem cells in the skin.



(i) Which part of the blood starts the process of clotting?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** plasma

☒ **B** red blood cells

☒ **C** platelets

☒ **D** white blood cells

(ii) State **two** differences between adult stem cells and skin cells.

(2)

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(b) State **one** advantage and **one** disadvantage of using embryonic stem cells in medical research.

(2)

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*(c) The red panda shown in the photograph is an endangered species.



(Source: india.com)

Describe how this red panda could be cloned to stop this species from becoming extinct.

(6)

(Total for Question 5 = 11 marks)

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DNA and gametes

6 (a) DNA is transcribed and translated during protein synthesis.

Describe how DNA is transcribed.

(3)

(b) (i) Which of the statements about gene mutations are true?

1. Gene mutations only affect one strand of a DNA molecule.

2. Gene mutations are always harmful.

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** only statement 1

☒ **B** only statement 2

☒ **C** both statement 1 and 2

☒ **D** neither statement 1 nor 2

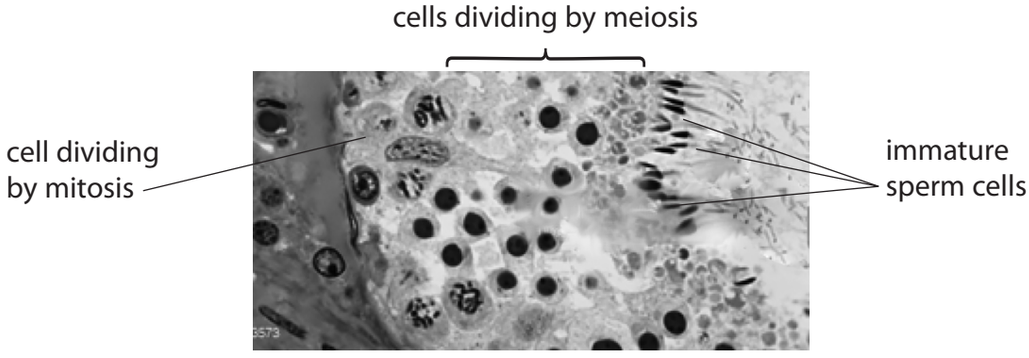
(ii) Explain how a gene mutation can change the function of a protein.

(3)

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*(c) The image shows a section through a tubule producing sperm cells.



(Source: getty images)

Compare mitosis and meiosis in humans.

(6)

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

January 2018

Pearson Edexcel GCSE
In Biology (5BI2H)
Paper 01

edexcel

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- 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 may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Acceptable answers	Marks
1 (a) (i)	Hippopotamus, Odontocetes, Mysticetes (1) All three required in any order for one mark	Accept phonetic spellings	(1)

Question number	Answer	Acceptable answers	Marks
1 (a) (ii)	5.5 million (1)	Accept any figure between 4.5 to 7 million years.	(1)

Question number	Answer	Acceptable answers	Marks
1 (a) (iii)	A suggestion to include two of the following: • thinner skull (in *Dorudon*)(1) • so more streamlined (1) OR • thinner / more streamlined (in *Dorudon*)(1) • so catch more fish / can swim faster / use less energy to {swim / catch fish} / outcompete *Rhodhocetus* (1) OR • more pointed/thinner teeth (in *Dorudon*) (1) • so grip fish / prey better (1)	Accept reverse arguments for *Rhodohocetus* accept less water resistance ignore references to 'body' features	(2)

Question number	Answer	Acceptable answers	Marks
1 (b) (i)	An explanation linking the two following points: • increase in the number of the (beneficial) bacteria (in flask two) (1) • because the beneficial bacteria can use the oligosaccharides / the prebiotics contain /are oligosaccharides / they can digest the prebiotics (1)	Ignore refs to any numbers quoted or to non-beneficial bacteria.	(2)

Question number	Answer	Acceptable answers	Marks
1 (b) (ii)	An explanation including • (the non-beneficial bacteria were) **out-competed** by beneficial bacteria (1) • the beneficial bacteria used up more of the available food source / space (1)		(2)

Question 1 total= 8 marks

Question number	Answer	Acceptable answers	Marks
2 (a)	B phloem		(1)

Question number	Answer	Acceptable answers	Marks
2 (b)	An explanation linking two of the following: • photosynthesis occurs (1) • when chlorophyll / chloroplasts absorb light (1) • causing a reaction between carbon dioxide and water (1)	accept using light accept equation accept glucose is converted to sucrose / starch is digested into glucose. (1)	(2)

Question number	Answer	Acceptable answers	Marks
2 (c) (i)	D a tape measure and a quadrat		(1)

Question number	Answer	Acceptable answers	Marks
2 (c) (ii)	• all points plotted correctly within ½ square (1) • line drawn with dot to dot and labelled species Y (1)		(2)

Question number	Answer	Acceptable answers	Marks
2 (c) (iii)	A suggestion including the following: • (more species X than species Y near the wall because) X can grow in lower light intensity (1) • at distances at 3m and more, there are fewer of species X because Y out competes X (1)	accept in lower temperatures for lower light intensity accept at 3 m there are more Y than X as Y uses up all the named factor / nutrient e.g. water.	(2)

Question 2 total = 8 marks

Question number	Answer	Acceptable answers	Marks
3 (a) (i)	Any two from the following: • the increase in mass is the same / 3.8kg (1) • however, child S is a lower mass at 6 months because of a lower birth mass (1) • percentage increase for child S is greater (1)	accept their growth rate is the same accept weight for mass	(2)

Question number	Answer	Acceptable answers	Marks
3 (a) (ii)	2.3 ÷ 6.5 (1) = 0.354846 X 100 = 35.3846 / 35.4% OR 8.8 ÷ 6.5 = 1.35846 (1) x 100 = 135.3846 -100 = 35.3846 / 35.4%	Award full marks for correct bald answer accept 35% or 35.38%	(2)

Question number	Answer	Acceptable answers	Marks
3 (a) (iii)	difference in gender/diet/illness /genes / (1)	accept R has faster metabolism / is more active accept born at different masses (1)	(1)

Question number	Answer	Acceptable answers	Marks
3 (b) (i)	C ☒ stomach, pancreas and small intestine		(1)

Question number	Answer	Acceptable answers	Marks
3 (b) (ii)	An explanation linking two of the following: • to make them into amino acids (1) • which are smaller (1) • which are soluble (1) • so that they can be absorbed (1)		(2)

Question number	MT	Answer	Acceptable answers	Marks
3 (c) W	exp	An explanation including two from the following: • food enters from the stomach which has a low pH/is acidic (1) • pH increases as bile is released from the gall bladder/bile is alkaline (1)	accept pancreas secretes sodium bicarbonate / alkali (1) accept so that enzymes (in the Small intestine) are at the correct pH	2

Question 3 total = 10 marks

Question number	Answer	Acceptable answers	Marks
4 (a)	D carbon dioxide and water		(1)

Question number	Answer	Acceptable answers	Marks
4 (b)(i)	15.6 ÷ 0.13 (1) 120	 award both marks for correct bald answer	 (2)

Question number	Answer	Acceptable answers	Marks
4 (b)(ii)	An explanation linking three of the following • faster blood flow / more blood flows per beat / more blood flows per minute (to muscles) (1) • more {oxygen / glucose} {absorbed / supplied} (to muscles) (1) • for aerobic respiration (1) • so more energy released / more energy is being used (1)	 accept more blood flows (to muscles) accept to avoid anaerobic respiration /build-up of lactic acid	(3)

Question number	Answer	Acceptable answers	Marks
4 (c)	An description including the following • carried in red blood cells (1) • attached to haemoglobin / as oxyhaemoglobin (1)	Ignore in the blood accept pumped by heart in the blood / through arteries in the blood	(2)

Question number	Answer	Acceptable answers	Marks
4 (d)	An explanation linking two of the following: • blood from the left ventricle moves into the right ventricle (1) • oxygenated / deoxygenated blood mixes (1) • blood in the left side is lower pressure / blood leaving the right side is higher pressure (1)	accept blood can go through the hole in the heart	(2)

Question 4 total = 10 marks

Question number	Answer	Acceptable answers	Marks
5 (a) (i)	**C** ☒ platelets		(1)

Question number	Answer	Acceptable answers	Marks
5 (a) (ii)	Two differences from the following: • adult stem cells are unspecialised / can differentiate/unipotent (1) • adult stem cells have no limit to the number of times they can divide (1)		(2)

Question number	Answer	Acceptable answers	Marks
5 (b)	Any one advantage and any one disadvantage Advantages • can differentiate into any body cell type/totipotent • can be used to generate any body tissue • wider range of treatments possible than with adult stem cells • similar to cancer cells so could be used to find cures/treatments for cancer • (if you have an embryo) it is easier to extract the stem cells Disadvantages • destroys embryos / a potential life • difficult to obtain embryonic stem cells due to legislation • lack of understanding and could turn cancerous • can be rejected		(2)

Question Number		Indicative Content	Mark
QWC	***5c**	A description which includes some of the following points • remove a body cell of a red panda • remove the diploid nucleus • remove an egg cell from a female red panda • enucleate the egg cell • insert the diploid nucleus into the enucleated egg cell • stimulate this cell to divide • using electric shock/chemicals • cell divides by mitosis • embryo is implanted into uterus • of surrogate female panda • repeat to increase population of red pandas	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited description that includes at least **one** stages of cloning • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple description that includes at least **two** stages of cloning in a logical sequence • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed description that would result in a cloned red panda including **two** of:- stimulating division / with chemicals or an electric shock and implanting into uterus /of a surrogate mother. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question 5 total = 11 marks

Question number	Answer	Acceptable answers	Marks
6 (a)	A description including 3 of the following • DNA splits (along short length) / hydrogen bonds broken (between DNA strands) (1) • complementary bases pair up free bases / nucleotides match up to DNA(1) • U replaces T (in copied strand) (1) • to make mRNA (1)	Accept DNA unzips Ignore DNA acts as a template T to A and C to G accept reference to enzymes either splitting DNA or joining bases (1) accept occurs in the nucleus / then leaves the nucleus (1)	(3)

Question number	Answer	Acceptable answers	Marks
6 (b) (i)	**D** ☒ neither statement 1 nor 2		(1)

Question number	Answer	Acceptable answers	Marks
6 (b) (ii)	A explanation including two of the following: • base / triplet / codon changed (1) • mRNA / codon matches up with different tRNA / anticodon (1) • different amino acid (added to polypeptide / protein) (1) • protein is a different shape (so has different properties) (1)	accept enzyme / active site for protein	(3)

Question Number		Indicative Content	Mark
QWC	***6c**	A comparison between some of the following: Mitosis • two cells produced • diploid cells • chromosomes in pairs/2n/23 pairs • one cell division • cells produced are genetically identical • cells produced are body/somatic cells / for growth and repair • occurs in all parts of the body / named part of body. Meiosis • 4 cells produced • haploid cells • single set of chromosomes/n/23 • two cell divisions • cells produced are genetically different • cells produced are gametes / for sexual reproduction • occurs in testes/ovaries credit any similarity eg both mitosis and meiosis involve DNA being copied / chromosomes are pulled to the poles. Similarities may be expressed if the details of the process of mitosis and meiosis are described.	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited description of either stating **one** similarity or **one** difference. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3- 4**	• A simple description comparing at least **two** similarities or **two** differences or **one** of each. • communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed description comparing at least **three** similarities and differences. • the answer communicates ideas clearly two and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question 6 total = 13 marks

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Surname	Other names

Pearson Edexcel GCSE

Centre Number | Candidate Number

Biology/Additional Science

Unit B2: The Components of Life

Higher Tier

Friday 9 June 2017 – Morning **Time: 1 hour**	Paper Reference **5BI2H/01**

You must have:
Calculator, ruler

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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

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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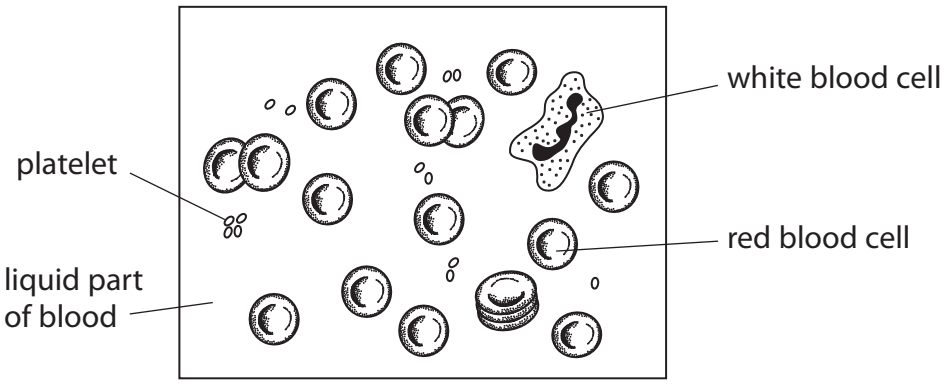
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Answer ALL questions

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 ☒.

Blood

1 The diagram shows a sample of human blood.



(a) The table shows the minimum and maximum numbers of each type of cell in 1mm^3 of human blood.

human blood cells	number of cells / mm^3 of human blood	
	minimum	maximum
white blood cells	5.0×10^3	1.1×10^4
red blood cells	4.4×10^6	4.9×10^6
platelets	1.4×10^5	4.0×10^5

State the most common type of cell in human blood.

(1)

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(b) (i) Explain why the number of blood cells will change if a person has a bacterial infection.

(2)

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

People with low numbers of platelets are more likely to have

☒ **A** problems clotting blood if they are cut

☒ **B** problems removing carbon dioxide from muscles

☒ **C** blood clots causing heart attacks

☒ **D** a higher oxygen debt during exercise

(iii) Describe the function of the liquid part of the blood.

(2)

(c) Adult stem cells make red blood cells.

(i) State one similarity between adult stem cells and embryonic stem cells.

(1)

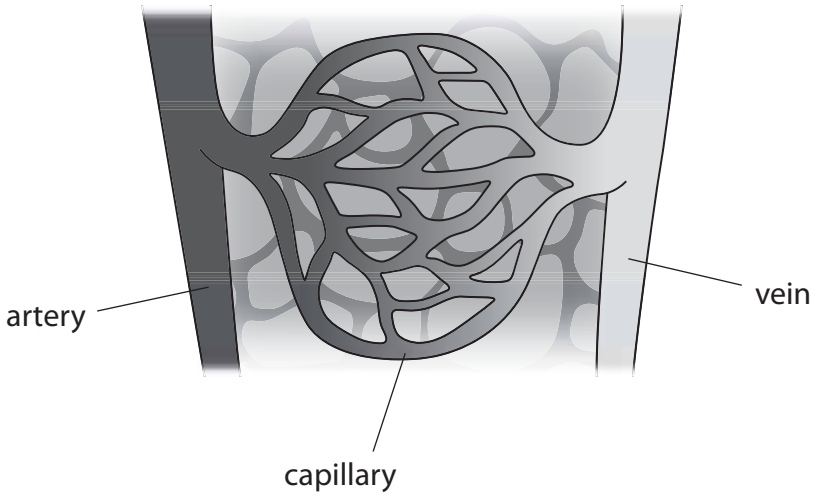
(ii) State one difference between adult stem cells and embryonic stem cells.

(1)

(Total for Question 1 = 8 marks)

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2 The diagram shows capillaries carrying blood through muscle.



(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The blood vessel that transports oxygenated blood from the heart is the

☒ **A** aorta

☒ **B** pulmonary artery

☒ **C** pulmonary vein

☒ **D** vena cava

(b) (i) Oxygen diffuses down a concentration gradient.

Explain how the concentration gradient is maintained between the blood and muscles.

(2)

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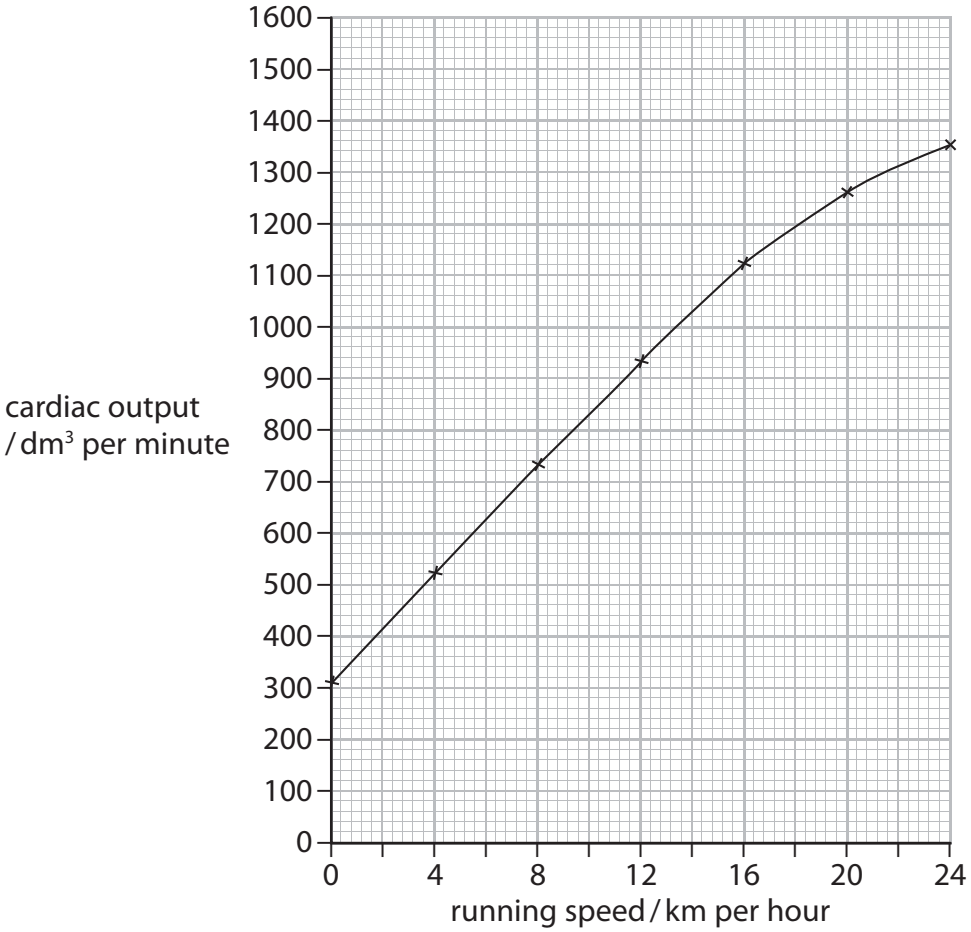
(ii) Complete the word equation for aerobic respiration.

(1)

..... + oxygen ⟶ carbon dioxide + ...

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(c) The graph shows cardiac output for a person running at different speeds.



(i) Describe the relationship between cardiac output and running speed.

(2)

(ii) Explain why this runner gets muscle cramp when he runs at speeds over 24 km per hour.

(2)

(Total for Question 2 = 8 marks)

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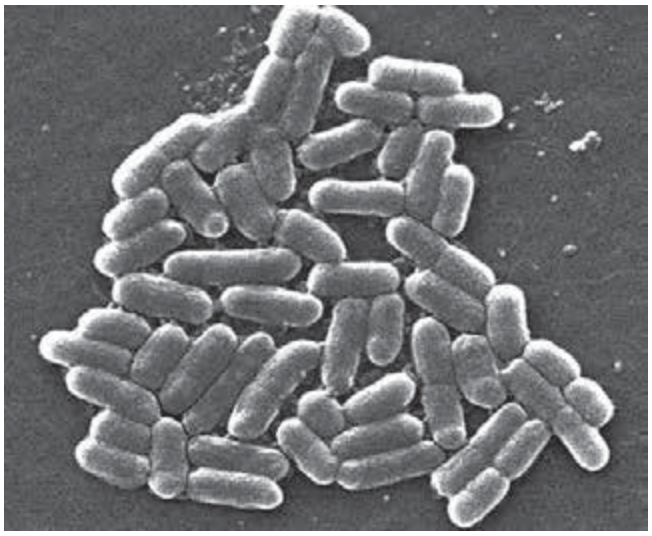
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Bacteria

3 The photograph shows a magnified image of bacterial cells from a human intestine.



(a) Which of the statements about cells are true?

1. Bacterial cells and plant cells have a cell wall.
2. Bacterial cells and animal cells have a nucleus.

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** statement 1 only

☒ **B** statement 2 only

☒ **C** both statement 1 and 2

☒ **D** neither statement 1 nor 2

(b) Foods containing prebiotic chemicals increase the number of beneficial bacteria living in human intestines.

A scientist measured the mass of two prebiotic chemicals in 100 g of four different foods.

The results are shown in the table.

food	mass / g per 100 g of food	
	prebiotic chemical A	prebiotic chemical B
onions	17.3	16.9
dandelion leaves	15.8	11.8
garlic	12.5	5.0
artichokes	18.0	11.5

(i) Compare the mass of prebiotic chemical A with that of prebiotic chemical B in these foods.

(2)

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(ii) Which food shown in the table would cause the greatest increase in the number of beneficial bacteria in the intestines?

(1)

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(iii) Prebiotic chemicals allow beneficial bacteria to double every hour.

How much time will it take for 10 g of beneficial bacteria to increase to 80 g if a person has enough prebiotic chemicals in their diet?

(2)

..... hours

(iv) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Prebiotic chemicals are

☒ **A** hormones

☒ **B** beta carotenes

☒ **C** oligosaccharides

☒ **D** stanol esters

(c) Probiotic yoghurt contains living bacteria.
Probiotic yoghurt is claimed to have positive effects on health.

Describe how scientists would investigate this claim.

(3)

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(Total for Question 3 = 10 marks)

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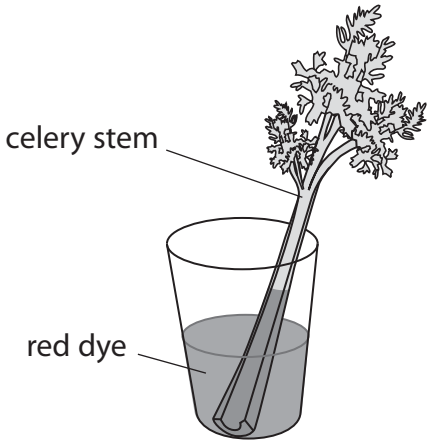
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Transpiration

4 (a) The diagram shows a celery stem in some red dye.

The red dye moves up the celery stem.



A student used five sets of this apparatus to study the rate of transpiration.

Suggest how these five sets of apparatus could be used to measure the effect of light intensity on the rate of transpiration.

(3)

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(b) The table shows the effect of air temperature on the rate of transpiration in a plant.

air temperature / °C	rate of transpiration / arbitrary units
5	2
10	4
15	8
20	11
25	11
30	5

(i) Explain why the rate of transpiration decreases between 25 °C and 30 °C .

(2)

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The percentage increase in the rate of transpiration between 10 °C and 15 °C in this plant is

☒ **A** 25%

☒ **B** 50%

☒ **C** 100%

☒ **D** 200%

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(c) Explain one way in which root hair cells absorb mineral ions from the soil.

(2)

(d) Explain how water moves from root hair cells, across the root and into the stem.

(2)

(Total for Question 4 = 10 marks)

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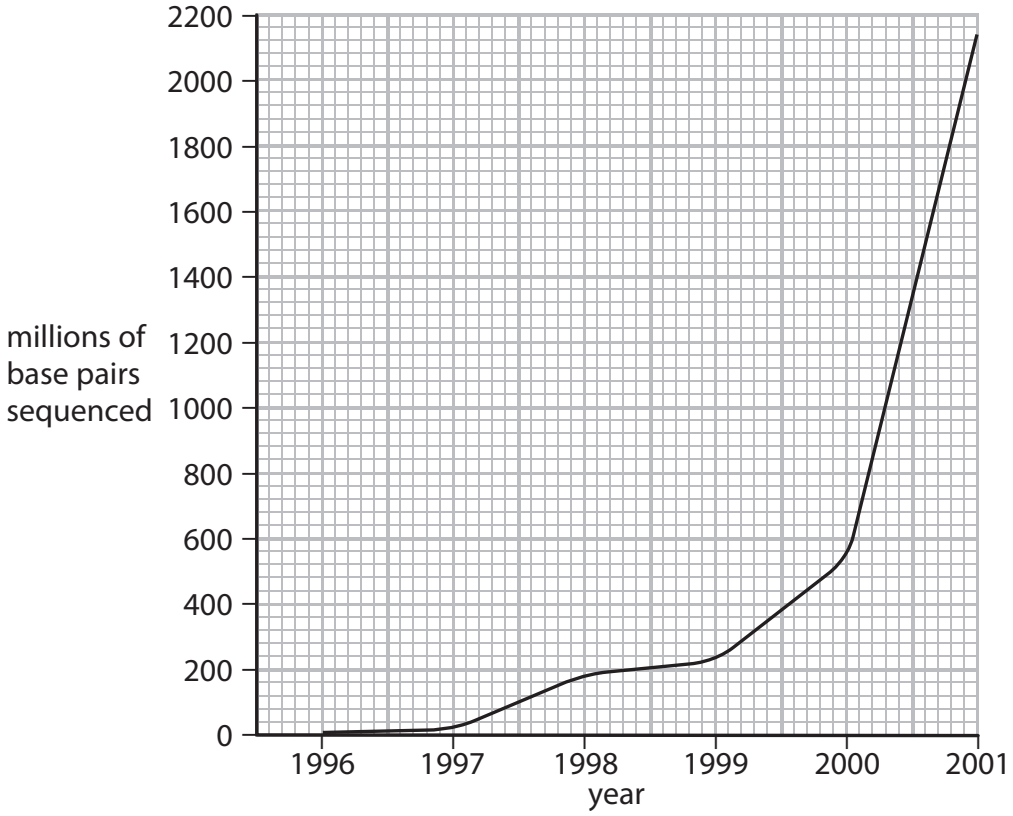
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The Human Genome Project

5 Scientists completed the Human Genome Project in 2003.

(a) The graph shows the number of DNA base pairs sequenced from 1996 to the beginning of 2001.



(i) Complete the table to show the number of base pairs sequenced by the beginning of 2001.

(1)

year	number of base pairs sequenced by the start of each year (millions)
1996	5
1997	9
1998	176
1999	240
2000	550
2001	

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(ii) Suggest why the number of base pairs sequenced each year increased.

(1)

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(iii) State **two** ways that the Human Genome Project has been used to improve medical science.

(2)

1 .....

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2 .....

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*(b) Describe how a gene is transcribed for use in the cytoplasm.

(6)

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(c) The diagram shows an enzyme and three amino acids.



This enzyme catalyses the reaction that joins amino acids to form proteins.

Explain how a gene mutation could reduce the rate of activity of this enzyme.

(2)

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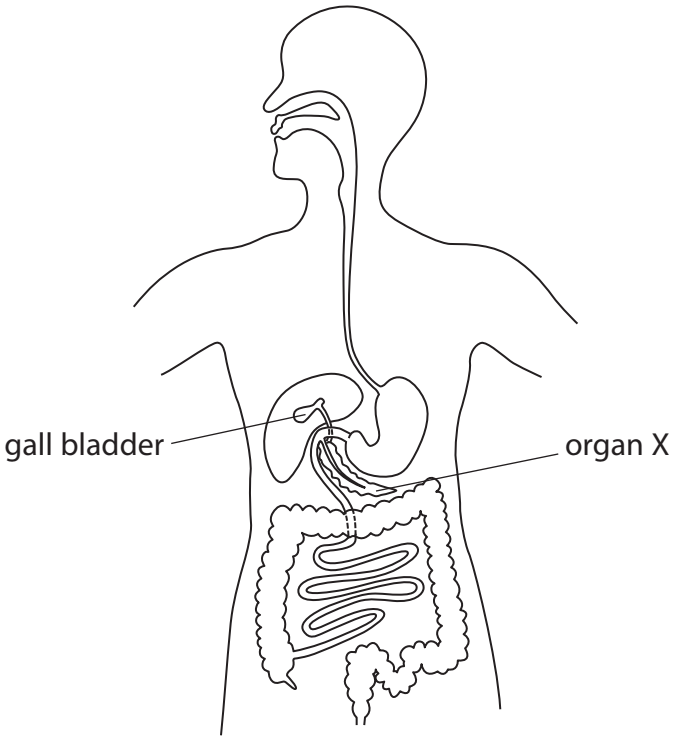
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(Total for Question 5 = 12 marks)

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The digestive system

6 The diagram shows the digestive system.



(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Organ X secretes enzymes into the

☒ **A** stomach

☒ **B** small intestine

☒ **C** large intestine

☒ **D** liver

(ii) Describe the action of amylase in digestion.

(2)

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(b) Every year in Britain, over 60 000 people have their gall bladder removed.

Suggest how living without a gall bladder may affect these people.

(3)

Question 6 continues on the next page

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*(c) Explain how the structure of the small intestine allows the products of digestion to be absorbed effectively.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCSE

In Biology (5BI2H) Paper 01

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Summer 2017
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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- 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 may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Acceptable answers	Marks
1 (a)	red blood cells accept any reasonable spelling	accept red accept red blood accept erythrocytes	(1)

Question number	Answer	Acceptable answers	Marks
1 (b) (i)	Any two from the following: • number of white blood cells **increase** (1) • white blood cells / phagocytes / lymphocytes defend against disease (1) • (by) producing antibodies / engulfing bacteria / pathogens (1)	accept: white blood cells are part of the immune system ignore: refs to other blood cells	(2)

Question number	Answer	Marks
1 (b) (ii)	**A** problems clotting blood if they are cut **The only correct answer is A** ***B*** *is not correct because platelets play no role in the transport of carbon dioxide* ***C*** *is not correct because this is opposite to the fact that more platelets increase blood clotting* ***D*** *is not correct because platelets play no role in the transport of oxygen or anaerobic respiration/EPOC*	(1)

Question number	Answer	Acceptable answers	Marks
1 (b) (iii)	A description including two of the following: • transport (1) • named substance / **blood** cell (1) • (which is transported) to or from named cell / tissue /organ (1)	accept: carries accept: heat MP2 is dependent on MP1	(2)

Question number	Answer	Acceptable answers	Marks
1 (c) (i)	A description of one similarity: both can keep dividing / have no Hayflick limit / produce cells that differentiate / develop into specialised cells	accept are unspecialised / make other **types** of cell ignore: references to cell structures	(1)

Question number	Answer	Acceptable answers	Marks
1 (c) (ii)	A description of one difference: Difference Embryonic stem cells are totipotent / pluripotent / produce cells that can develop into any type of body cell AND adult stem cells are multipotent / unipotent / can develop into one / few types of cells.	accept: embryonic stem cells can differentiate into all types of cell, adult stem cells can't	(1)

Total for question 1 = 8 marks

Question number	Answer	Marks
2 (a)	**A** aorta **The only correct answer is A** ***B*** *is not correct because the pulmonary artery carries deoxygenated blood to the lungs* ***C*** *is not correct because the pulmonary vein carries oxygenated blood to the heart* ***D*** *is not correct because the vena cava carry deoxygenated blood to the heart*	(1)

Question number	Answer	Acceptable answers	Marks
2 (b) (i)	A explanation including following: • cells use oxygen (keeping concentration of oxygen in cells low) (1) • concentration of oxygen in blood kept high by blood flow / blood flow replaces blood with (fully) oxygenated blood (1)	accept: cells respire aerobically ignore: definitions of diffusion	(2)

Question number	Answer	Acceptable answers	Marks
2 (b) (ii)	GLUCOSE + (oxygen) ⟶ (carbon dioxide) + WATER	accept any spelling ignore $C_6H_{12}O_6$ / H_2O ignore references to energy or ATP as a product. answers must be in correct order	(1)

Question number	Answer	Acceptable answers	Marks
2 (c) (i)	A description including two of the following • as running speed increases, cardiac output increases (1) • linear increase up to 12 / 16 km per hr / increases more slowly after 12 / 16 km per hr (1) • credit any manipulated data that compares two aspects of the graph (1)	accept any figure between 12 and 16 accept cardiac output data for speeds	(2)

Question number	Answer	Acceptable answers	Marks
2 (c) (ii)	A suggestion linking **two** of the following: • cardiac output / blood cannot supply enough oxygen / not enough oxygen is received by cells / muscles tissues / body • cells respire anaerobically / increase anaerobic respiration (1) • lactic acid produced / increases (1)	accept: cells cannot get enough energy reject: stops respiring aerobic ignore: references to EPOC	(2)

Total for question 2 = 8 marks

Question number	Answer	Marks
3 (a)	**A** statement 1 only **The only correct answer is A** Bacterial cells and plants cells do have cell walls and so statement 1 is correct. Bacterial cells do not have a nucleus and so statement 2 is incorrect. Therefore, as statements B, C and D are mutually exclusive to A, they are all incorrect. ***B** is not correct because statement 2 is incorrect* ***C** is incorrect as statement 2 is incorrect* ***D** is incorrect as statement 1 is correct*	(1)

Question number	Answer	Acceptable answers	Marks
3 (b) (i)	A comparison including: • more A than B (in all food / named food) (1) • detail of difference of any food eg. onions have only a little more A than B / **similar** amounts of A and B / manipulation of data e.g. garlic is the only food to have over twice as much A than B / dandelions have 4g (per 100g of carbohydrates) more A than B (1)	ignore: speculation about which food is better for you Ignore adding A to B Ignore just numbers eg 7.5 written by table.	(2)

Question number	Answer	Marks
3 (b) (ii)	onions (1) accept any reasonable spelling	(1)

Question number	Answer	Acceptable answers	Marks
3 (b) (iii)	10 (x2) to 20 (X2) to 40 (X2) (=80) (1) 3 (hours)	accept an answer / diagram showing that after 1 hour there are 20 cells, after 2 there are 40 and after 3 there are 80 Award full marks for correct bald answer	(2)

Question number	Answer	Marks
3 (b) (iv)	**C** oligosaccharides **The only correct answer is C** ***A*** *is not correct because hormones are not oligosaccharides, they are chemical messengers carried in the blood. They are either peptide based or steroid based not saccharides* ***B*** *is not correct because Beta carotenes are linked to vitamin A which is an isoprenoid with beta rings at both ends of the chain, not an oligosaccharide* ***D*** *is not correct because stanol esters are not oligosaccharides. They are a saturated ester usually formed from a carboxylic acid an alcohol, not from saccharides*	(1)

Question number	Answer	Acceptable answers	Marks
3 (c)	A description including any **three** from the following: • select two groups of people (1) • one detail to make the investigation valid / reliable e.g. composition of group /number in each group (10+)/ repeat investigation / blind testing / same time period (1) • give **probiotic** (yoghurt) to one of the groups (and ref to what second group get) (1) • measurement of health of the groups, e.g. record how many infections each group has (during / after the test)(1)	accept: one in each group accept: test the same people with probiotic yoghurt for a month and then with normal yoghurt for a month for 2 marks accept: measure number of probiotic / beneficial bacteria (in L intestine) accept how many times they get sick	(3)

Total for question 3 = 10 marks

Question number	Answer	Acceptable answers	Marks
4 (a)	A suggestion linking: • change the light intensity for each piece of celery / detail of how to change light intensity eg. change distance of lamp (1) with **two** of the following: • keep at least one other named factors constant eg. amount of foliage / temperature (1) • measure how far up the stem the dye has risen (1) • in set time (1)	accept: measure time taken to reach a set distance / point on celery (2 marks) accept: measure how much dye is left in the beakers	(3)

Question number	Answer	Acceptable answers	Marks
4 (b) (i)	A explanation including **two** of the following: • water exits leaves through stomata (1) • guard cells close / stomata close (1) • so less water can leave the leaf / less diffusion of water occurs / plant is becoming dehydrated (1) • plants wilt (1)	accept: plant is losing too much water / to prevent water loss	(2)

Question number	Answer	Acceptable answers	Marks
4 (b) (ii)	**C** 100% **The only correct answer is C** This is a mathematical question with only one correct answer. The questions asks for the % increase from 4 to 8 which have to be extracted from the table. The increase is therefore 4 so (4÷4) x 100 = 100% therefore the other answers are incorrect ***A** is not correct because 25% is not 100%* ***B** is not correct because 50% is not 100%* ***D** is not correct because 200% is not 100%*		(1)

Question number	Answer	Acceptable answers	Marks
4 (c)	An explanation including **two** of the following: • active uptake / active transport (1) • using energy / ATP (1) • to move (mineral ions) against concentration gradient (1) **OR** • when (mineral ions) concentration is higher in the soil) (1) • by diffusion / from an area of high concentration to an area of low concentration) (1)	accept: if excess fertiliser has been added to the soil second mark point can only be given linked to first	(2)

Question number	Answer	Acceptable answers	Marks
4 (d)	An explanation to include **two** of the following: • by osmosis (1) • from low **solute** concentration to high **solute** concentration / from higher **water** concentration to lower **water** concentration (through a partially permeable membrane)(1) • across root as 'next' cell has higher solute concentration / equivalent (1) • in to the xylem (1)	accept: from higher concentration to lower concentration	(2)

Total for question 4 = 10 marks

Question number	Answer	Acceptable answers	Marks
5 (a) (i)	any number between 2130 to 2140		(1)

Question number	Answer	Acceptable answers	Marks
5 (a) (ii)	improvements to techniques / better equipment / more equipment / more people working on the project / more collaboration	Ignore: references to cost alone	(1)

Question number	Answer	Acceptable answers	Marks
5 (a) (iii)	Any **two** of the following: • to research / have a better understanding of genetic disorders / locating where faulty alleles are (on chromosomes) (1) • to find cures / medicines for **genetic** disease / Gene therapy (1) • to develop personalised genomic / specialised medicines (1) • predict risk of (genetic) disorder / genetic counselling (1)	accept: faulty gene for faulty allele accept: detect genetic disorders accept: cancer for genetic disease throughout	(2)

Question Number		Indicative Content	Mark
QWC	***5b**	A description which includes some of the following points • transcription occurs in the nucleus • a gene is a sequence of bases on DNA • one gene codes for one polypeptide / protein • DNA strands split • H bonds between bases broken • by enzyme • the gene / section of DNA / section of chromosome is copied • mRNA bases / nucleotides are complementary to (DNA) bases • mRNA bases are ACG and U • U replaces T in mRNA • enzyme / RNA polymerase makes mRNA / joins bases together • mRNA is a small molecule / single strand (so can fit through nuclear pore) • mRNA leaves nucleus • through nuclear pore	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited description that includes at least **one** piece of indicative content • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple description of transcription that includes references to DNA being copied and mRNA • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5**	• A detailed description linking the stages of transcription including references to DNA being copied and mRNA and a reference to uracil / U. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question number	Answer	Marks
5 (c)	An explanation linking: • (the mutation results in) a change in the shape of the enzyme / active site (1) with any **one** of: • mutation is a change in the DNA (base sequence) (1) • enzyme – substrate complex can't form / {amino acids / substrate} will not fit into / bind to the {active site / enzyme} (as well) (1)	(2)

Total for question 5 = 12 marks

Question number	Answer	Marks
6 (a) (i)	**B** small intestine **The only correct answer is B** **Organ X is the pancreas that secretes enzymes into small intestine.** ***A** is not correct because the pancreas does not secrete enzymes into the stomach* ***C** is not correct because the pancreas does not secrete enzymes into the large intestine* ***D** is not correct because the pancreas does not secrete enzymes into the liver*	(1)

Question number	Answer	Acceptable answers	Marks
6 (a) (ii)	Description including two of the following • amylase is an enzyme / carbohydrase (1) • amylase breaks down starch / carbohydrate (1) • into (simple) sugar / maltose / glucose (1)	accept: amylose for starch ignore: digests	(2)

Question number	Answer	Acceptable answers	Marks
6 (b)	A suggestion to include **three** of the following: • gall bladder stores bile / less bile (added to small intestine) (1) • bile emulsifies fats / neutralises acids / increases pH / (without gall bladder) less emulsification of lipids / fats (1) • (so) {lipases / enzymes} **less effective** (1) • a consequence described eg fewer fatty acids / less glycerol absorbed / less energy released in body / (have to) eat a low fat diet (1)	accept: no bile released. Ignore: bile not produced accept surface area not increased lipids not made into smaller drops ignore: no lipase action accept: causes diarrhoea / heartburn / indigestion / weight loss	(3)

Question Number		Indicative Content	Mark
QWC	***6c**	An explanation to include some of the following points: **structures** • villi • microvilli • capillaries / blood supply • lacteal • thin intestinal lining • muscles in intestinal walls • small intestine is long **description** • (molecules) absorbed by diffusion / active uptake • (villi) finger like projections increase surface area • (long small intestine) increase surface area • (microvilli) are more folds on the villi / increased surface area • (intestinal lining) one cell thick / permeable • good blood supply / capillary network /increases surface area • muscles contract / peristalsis **how structures increase absorption** • thin surface / layer of cells reduces distance for diffusion / digested foods are absorbed quicker • (increased surface area) means **more** food can be absorbed • (lacteal) absorbs fatty acids / glycerol • blood flow maintains concentration gradients / maintain rate of diffusion / takes nutrients away • (muscles) keeps moves food closer to villi / maintains concentration gradient	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited explanation that includes **one** piece of indicative content • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple explanation stating at least **three** structures **OR** describing the features of **one** structure • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed explanation describing at least **two** structures linking **one** of them to how they allow the effective absorption of molecules • the answer communicates ideas clearly two and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for question 6 = 12 marks

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Surname	Other names

Pearson Edexcel GCSE

Centre Number | Candidate Number

Biology/Additional Science

Unit B2: The Components of Life

Higher Tier

Friday 10 June 2016 – Morning **Time: 1 hour**	Paper Reference **5BI2H/01**

You must have:
Calculator, ruler

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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

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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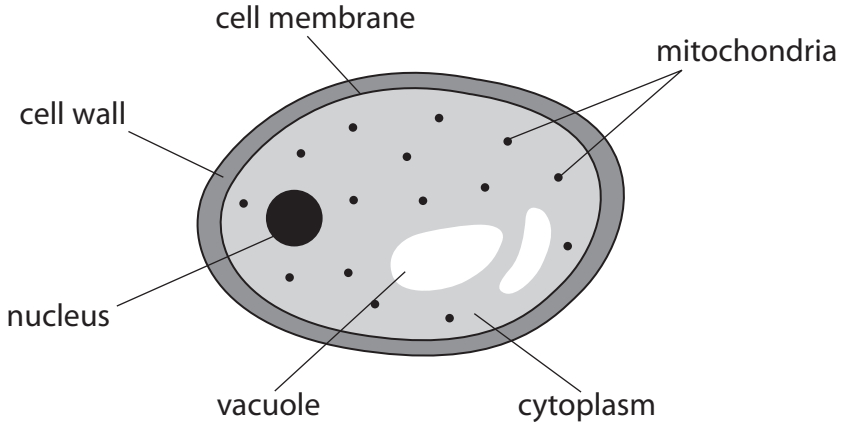
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Answer ALL questions

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 ☒.

Respiration

1 The diagram shows a yeast cell.



(a) Describe how the structure of a bacterial cell differs from this yeast cell.

(2)

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(b) Yeast use both aerobic and anaerobic respiration to release energy.

(i) Which organelle in the yeast cell is the site of aerobic respiration?

(1)

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(ii) The word equation for anaerobic respiration in yeast is

glucose ⟶ alcohol + carbon dioxide

Describe how aerobic respiration is different from anaerobic respiration in yeast.

(2)

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(c) Six test tubes, U, V, W, X, Y and Z, were set up to investigate how the type of sugar and range of pH affect the rate of anaerobic respiration in yeast.

Each test tube was at a different pH and contained 2 g of yeast, 2 g of sugar (either sucrose or lactose) and 30 cm^3 of water.

The temperature of each test tube was kept at 30 °C.

The volume of carbon dioxide produced from each test tube after one hour is shown in the table.

test tube	pH	type of sugar	volume of carbon dioxide produced after one hour / cm^3
U	9	sucrose	369
V	7	sucrose	455
W	5	sucrose	225
X	9	lactose	28
Y	7	lactose	35
Z	5	lactose	

(i) Estimate the volume of carbon dioxide produced in test tube Z after one hour.

(1)

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(ii) Explain the differences in the volume of carbon dioxide produced in test tubes U, V and W.

(2)

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(Total for Question 1 = 8 marks)

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The digestive system

2 The photograph shows a model of the small intestine.

Bread, saliva and water were mixed together.

This bread mixture was placed inside a tube made from one leg of a pair of tights.



(a) The person squeezed the tube behind the mixture to move the mixture along the tube.

Name the physical process in the digestive system that is being modelled in this demonstration.

(1)

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(b) Liquid came through the sides of the tube during the demonstration.

This liquid was collected and the concentration of sugar was measured at the start and after every 30 seconds.

The results are shown in the table.

time / s	concentration of sugar in liquid / mg per cm^3
0	9
30	15
60	22
90	28
120	32
150	32
180	32

(i) Describe how the concentration of sugar in the liquid changes between 0 and 180 seconds.

(2)

(ii) Explain how the sugar was produced in the bread mixture.

(2)

(iii) Suggest **one** way that the tube is not a good model of the small intestine.

(1)

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(c) Which of these statements are true?

1. The small intestine receives food from the stomach.
2. The pancreas produces bile.

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** statement 1 only

☒ **B** statement 2 only

☒ **C** both statement 1 and 2

☒ **D** neither statement 1 nor 2

(d) Complete the sentence by putting a cross (☒) in the box next to your answer.

Bile is added to the contents of the small intestine to emulsify

(1)

☒ **A** fats and lower the pH

☒ **B** proteins and lower the pH

☒ **C** fats and increase the pH

☒ **D** proteins and increase the pH

(Total for Question 2 = 8 marks)

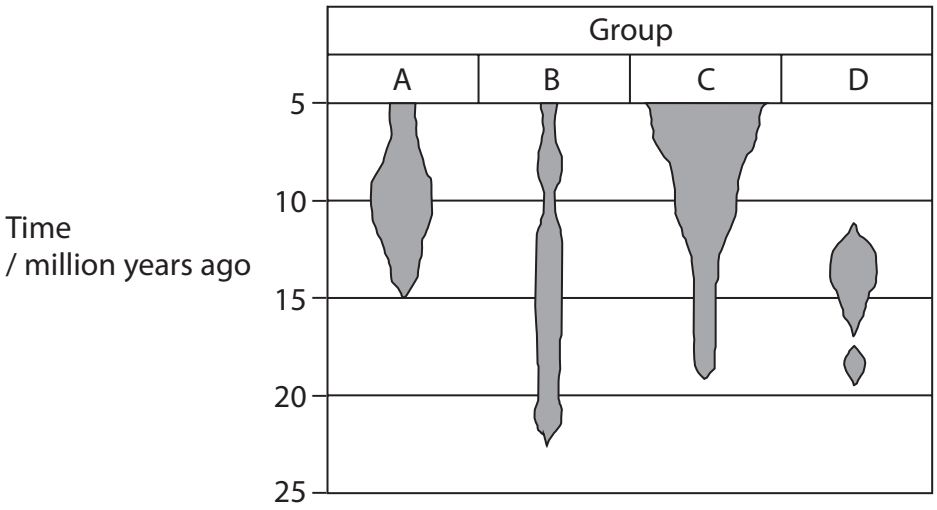
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Fossils

3 Scientists investigated fossils of four different groups of mammals.

The diagram shows how the estimated population of each group of mammals changed from 25 million to 5 million years ago.

The width of each shaded area shows the estimated population size, based on the number of fossils found.



(a) (i) Which statement is supported by the information in the diagram?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** Group A contains mammals that came into existence 10 million years ago
- ☒ **B** Group B contained the largest group of mammals 15 million years ago
- ☒ **C** Group C is the most recent group of mammals to come into existence
- ☒ **D** Group D were extinct 10 million years ago

(ii) The scientists compared the pentadactyl limbs of these groups of mammals.

Describe the structure of a pentadactyl limb.

(2)

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(iii) Suggest reasons for the change in the estimated population size of group A from 10 million to 7 million years ago.

(3)

(b) Scientists investigated a protein found in a mammal.

The protein contains 630 amino acids.

What is the minimum number of bases in the gene that codes for this protein?

(2)

.....bases

(c) Explain how a mutation in DNA may result in a different protein.

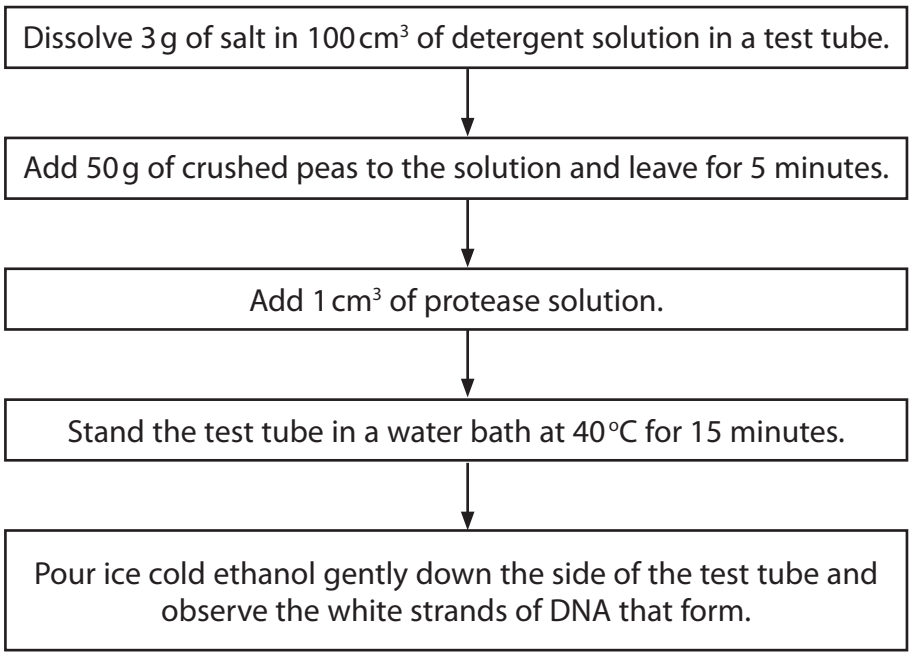
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(Total for Question 3 = 10 marks)

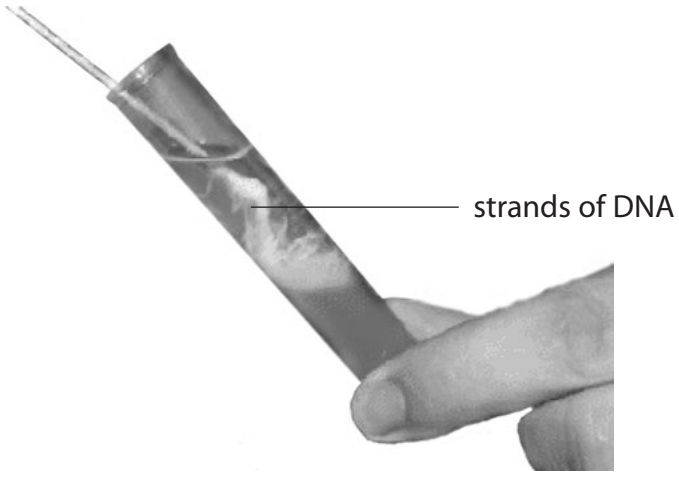
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DNA and meiosis

4 The flow chart shows a sequence for extracting DNA from peas.



The photograph shows the DNA extracted from the peas.



© The University of Arizona

(a) (i) Explain why the peas need to be crushed and added to detergent solution in order to extract the DNA from the cells of the peas.

(2)

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Protease was added to the solution to

(1)

☒ **A** join amino acids to synthesise proteins

☒ **B** digest proteins in the nucleus

☒ **C** break down the lipids in the membranes

☒ **D** digest the DNA

(b) Describe how Watson and Crick contributed to the understanding of the structure of DNA.

(2)

(c) DNA is involved in the processes of meiosis and mitosis.

Describe how the cells formed by meiosis are different from the cells formed by mitosis.

(3)

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(d) A fertilised ovum (egg cell) divides by mitosis to form an embryo.

Describe how some cells in an embryo become specialised cells.

(2)

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(Total for Question 4 = 10 marks)

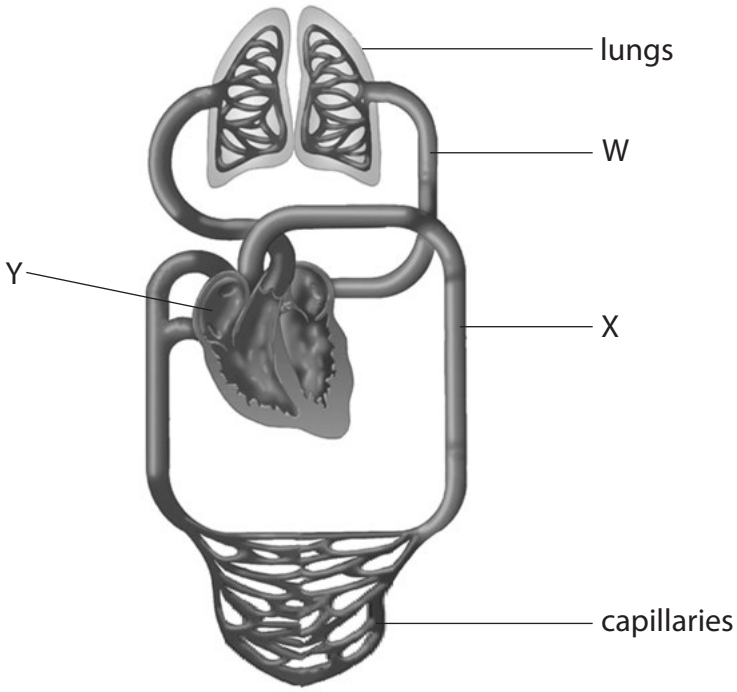
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The circulatory system

5 The diagram shows the human circulatory system.



(a) (i) Name blood vessel W.

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** aorta
- ☒ **B** pulmonary artery
- ☒ **C** pulmonary vein
- ☒ **D** vena cava

(ii) Deoxygenated blood enters the heart in the chamber labelled Y.

Explain how blood is moved from chamber Y to the lungs.

(3)

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(iii) The blood vessel labelled X carries blood to capillaries.

Explain how substances are exchanged between capillaries and body cells.

(2)

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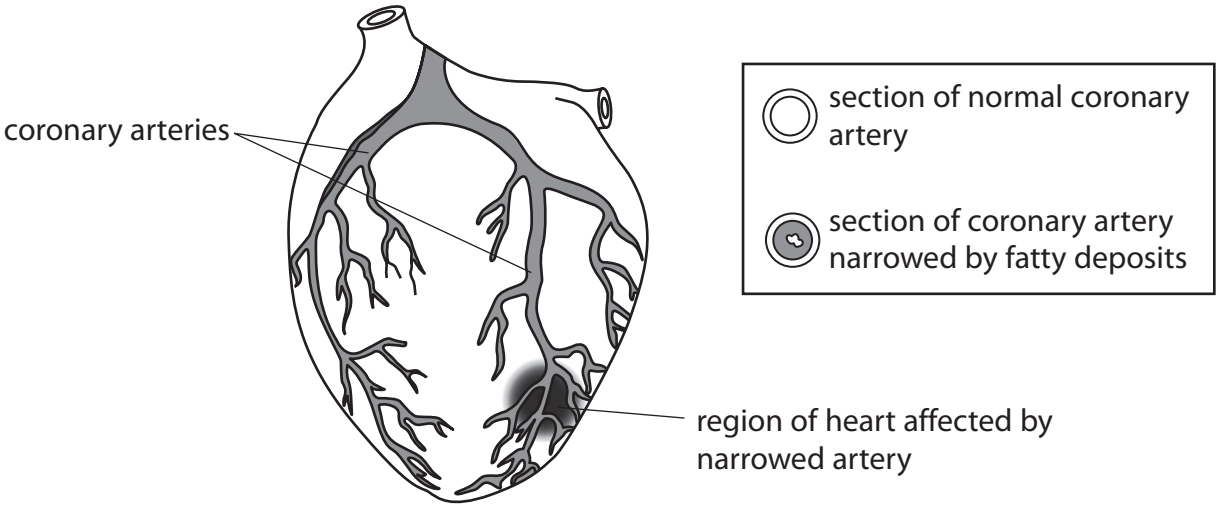
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*(b) The diagram shows the coronary arteries surrounding a human heart.

The coronary arteries deliver blood to the muscle cells in the heart.

The coronary arteries can become narrowed or blocked by fatty deposits.



Suggest how the narrowing of the coronary artery may affect how the heart functions and how this may affect other body cells.

(6)

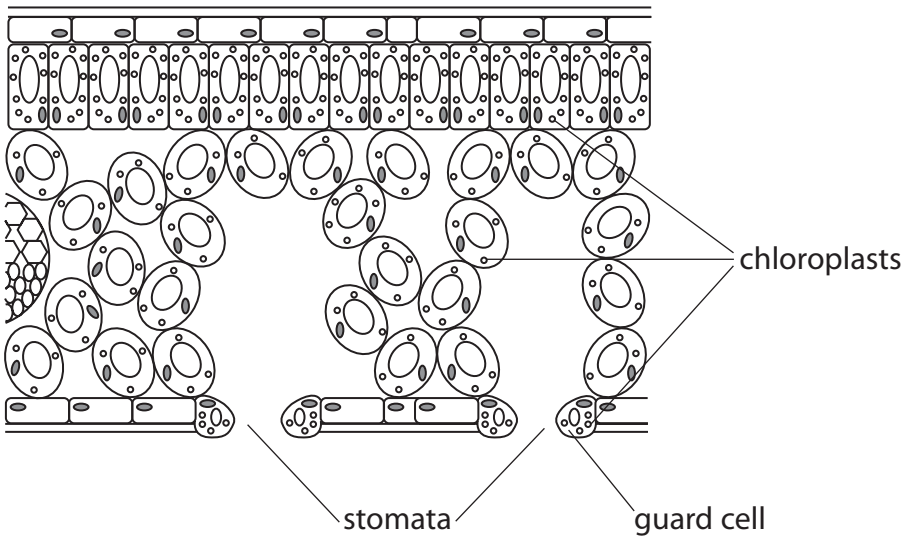
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(Total for Question 5 = 12 marks)

Photosynthesis

6 The diagram shows a section through a leaf.



(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

During the day, guard cells open stomata to allow diffusion of

(1)

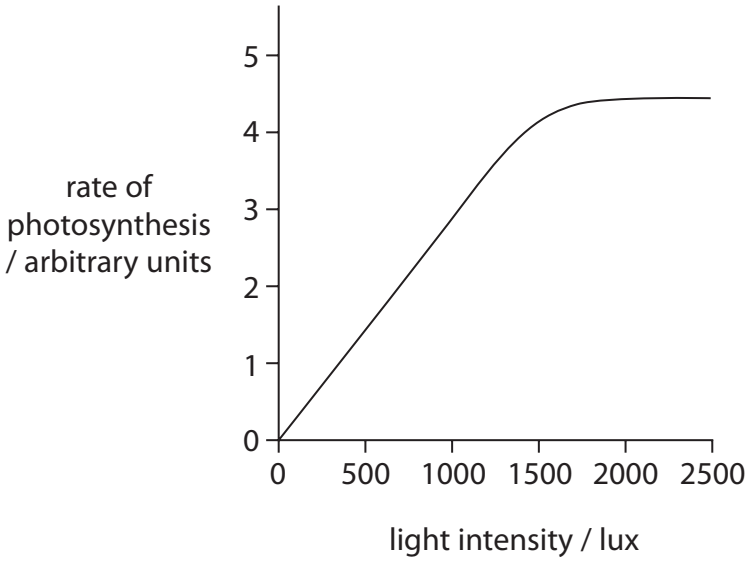
- ☒ **A** carbon dioxide into the leaf for photosynthesis
- ☒ **B** light into the leaf for photosynthesis
- ☒ **C** oxygen into the leaf for photosynthesis
- ☒ **D** nitrogen into the leaf to make nitrates

(ii) Suggest the benefits to a plant of having different numbers of chloroplasts in different types of cell in the leaf.

(3)

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(b) The graph shows how light intensity affects the rate of photosynthesis.



Explain why the rate of photosynthesis does not increase after 1750 lux.

(2)

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*(c) Explain how water enters a plant and is moved to the leaf.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCSE
in Biology (5BI2H) Paper 01
Unit 2: The Components of Life

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- 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.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)	A description including any **two** from the following: Bacterial cells • contain plasmid(s) (1) • have a flagellum(1) • have a (slime) capsule (1) • do not contain a nucleus (1) • do not have mitochondria (1)	Allow reverse argument for each marking point Accept: bacteria have chromosomal DNA Accept: bacterial cells do not contain a vacuole (1) Accept specific answers describing other bacterial structures that are not found in yeast.	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	mitochondria	Accept any reasonable spelling	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	A description including any **two** from the following: Aerobic respiration • **uses** oxygen (1) • **produces** water (1) • releases more energy (1) • does not produce / release alcohol (1)	Accept cells will respire aerobically if oxygen is present Accept: anaerobic respiration occurs in the cytoplasm (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	• Allow any number between 10 and 24 (cm^3)		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	An explanation linking two of the following: • differences are due to changes in pH (1) • <u>optimum</u> pH is {7 / neutral} (1) • at pH 5/acid or pH 9 / alkaline the {enzyme / active site} has changed shape (1)	Accept: a pH between 6.2 and 7.2 Accept: denatured for changed shape.	**(2)**

Total for question 1 = 8 marks

Question Number	Answer	Acceptable answers	Mark
2 (a)	peristalsis	Accept any reasonable spelling	**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (b) (i)	A description to include any **two** from the following: • increases from 0 to 120s (1) • levelled off by / from 120s (1) • credit correct manipulation of data for numbers from 0 to 120s (1)	Accept: increases from 0 to any time between 100 and 120s Accept **starts** to level off **after** 90s	**(2)**

Question Number	Answer	Acceptable answers	Mark
2 (b) (ii)	An explanation linking: • amylase / enzymes / maltase /carbohydrase (1) • have digested starch / carbohydrates (in the bread) (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
2 (b) (iii)	The tube / tights have: larger holes / allow solid particles through / no muscles in the sides / no blood vessels in the sides / no **villi** / have a smaller surface area (1)	Accept: ORA for the intestines Accept: the small intestine has other enzymes present Ignore: references to size / length / strength / and flexibility	**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (c)	A ☒ statement 1 only		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(d)	C ☒ fats and increase the pH		**(1)**

Total for question 2 = 8 marks

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	D ☒ Group D were extinct 10 million years ago		**(1)**

Question Number	Answer	Acceptable answers	Mark
3 (a)(ii)	A description including two of the following: • 1 upper bone / humerus / femur (1) • (connected to / then) 2 lower bones / radius and ulna / tibia and fibula (1) • (then) wrist / ankle bones (1) • **five** digits / fingers / phalanges (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a) (iii)	A suggestion including **three** of the following: • population of A has decreased (1) • a change in the environment / natural disaster (1) • species A not as well adapted (to the new conditions) (1) • predation increased (1) • habitat destroyed / disease / less food / less water / fewer nesting sites (1) • idea of outcompeted (by other species / group B or C) (1)	Accept: conditions were not suitable for fossils to form	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)	630 X 3 (1) 1890	Allow full marks for correct bald answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	An explanation to include two of the following: • one (or more) bases may have changed (on DNA) (1) • {changed / different} mRNA / reference to different codon / triplet / anticodon / tRNA (1) • a change in the amino acid (in the protein) (1) • (resulting in) a change of **shape** of protein (1)	Accept: proteins are made / mRNA is read on the ribosome (1)	**(2)**

Total for question 3 = 10 marks

Question Number	Answer	Acceptable answers	Mark
4 (a) (i)	An explanation to include any **two** from the following: • DNA is in the nucleus / mitochondria (1) • crushing to break down the cells / cell wall / membrane (1) • (detergent) dissolves / breaks down (cell / nuclear) **membrane** (1)	 Accept: chromosomes for DNA Accept: to increase surface area Accept: allow enzymes to get to more cells / nucleus Accept: detergent breaks down the nucleus	**(2)**

Question Number	Answer	Acceptable answers	Mark
4 (a) (ii)	B ☒ digest proteins in the nucleus		**(1)**

Question Number	Answer	Acceptable answers	Mark
4 (b)	A description to include any **two** from the following: • used information from other scientists / used Franklin's X ray pictures (1) • made a model of DNA (1) • showed how the bases fitted together (1) • showed how the (DNA) back bone was arranged / that DNA is a double helix (1)	 Accept used X rays of DNA Accept showed the 3D structure of DNA Accept A-T / G-C	**(2)**

Question Number	Answer	Acceptable answers	Mark
4 (c)	A description to include any **three** from the following: meiosis • produces four cells (instead of two) / has two cell divisions (instead of 1) (1) • **genetically** different (1) • haploid (instead of diploid) (1) • gametes (instead of somatic / body / cells)(1)	 Accept have half the number of chromosomes (compared to parent cell) Accept: named gametes	 **(3)**

Question Number	Answer	Acceptable answers	Mark
4 (d)	A description to include any **two** from the following: • stem / meristematic cells (1) • **differentiate** (1) • by changing shape / size/ metabolic ability(1) • becomes a named cell eg root hair cell / muscle cell / neurone (1)		 **(2)**

Total for question 4 = 10 marks

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	C pulmonary vein		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	A explanation including any **three** from the following: • Y is the **right** atrium (1) • (blood flows into the) right ventricle / ventricle (1) • Heart / muscle / atrium / ventricle **contracts** (1) • (blood flows) through pulmonary artery (to the lungs) (1) • Correct references to any valve through which the blood flows (1)		**(3)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	An explanation including any **two** from the following: • glucose/oxygen/carbon dioxide/other valid named substance (1) • diffuses (1) • from a high concentration to a low concentration / down a concentration gradient (1)	Accept equivalent marks for osmosis if water is stated as the substance moving between capillaries and body cells (in either direction).	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(b)**	A suggestion to include some of the following points **Effect on heart:** • less blood flow (through the coronary artery) • to cardiac / heart muscle /muscle cells • heart muscle / cells dies / does not work as effectively • may cause a heart attack / angina • less forceful contraction **Effect on rest of body:** • less blood flows/ blood flow slower to **body cells /organs** • lactic acid builds up / more likely to get cramp • fatigue / tiring easily • less oxygen in the blood **Effect on heart cells and / or body cells** • less oxygen • less glucose • less **aerobic** respiration • less energy released • **body cells** start / increase anaerobic respiration • less waste products removed	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited suggestion that covers **ONE** effect of narrowed arteries within the heart e.g. the heart muscle receives less oxygen **OR** the body cells eg less blood is pumped to the body • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple suggestion that explains the effect of narrowed arteries on the function of the heart **OR** body including at least one area from the final section of indicative content. the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed suggestion that links the effect of narrowed arteries on the function of the heart **AND** body including at least **TWO** areas from the final section of indicative content. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	A ☒ carbon dioxide into the leaf for photosynthesis		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	An explanation to include any **three** from the following: • chloroplasts / chlorophyll absorb light / are site of photosynthesis (1) • **more** light at the top of the leaf (1) • (so) {more chloroplasts /more glucose made / more photosynthesis} in palisade cells (1) • some / few / less chloroplasts in spongy / mesophyll (cells) as some light gets through / not absorbed by palisade cells (1) • chloroplasts in guard cells to open / shut them (1)	Accept less light at the bottom Accept no chloroplasts in upper epidermis as (UV) bright light destroys the chlorophyll.	**(3)**

Question Number	Answer	Acceptable answers	Mark
6(b)	An explanation linking: • Something (other than light) has become the **limiting factor** (1) • Named example, eg carbon dioxide (concentration) / temperature / amount of chlorophyll or chloroplasts. (1)	Accept light is no longer a limiting factor Accept water	**(2)**

Question Number		Indicative Content	Mark
QWC	**6(c)***	An explanation including some of the following points **Stage 1 - Water enters root** • osmosis • through root hair cells • root hairs increase surface area • from a high water concentration to a low water concentration • as more solutes in cytoplasm of root cells (than in soil) • through a partially permeable membrane **Stage 2 - Water moves across root to xylem** • cell to cell • by osmosis • as next cell in sequence has lower water concentration **Stage 3 - Water moves up stem (to leaves)** • up the xylem • xylem is a tube • transpiration stream • capillary action • water moving from xylem into leaf cells draws more water up xylem • transpiration / evaporation of water maintains gradient • water moves from xylem to leaf cells by osmosis	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation of at least one stage • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a detailed explanation of the way that water moves through **ONE** stage and **ONE** of: osmosis, xylem, transpiration. **OR** a simple explanation of at least two stages and **ONE** of: osmosis, xylem, transpiration stream. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation of at least **TWO** stages from soil to leaves and **TWO** of: osmosis, xylem, transpiration stream. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for question 6 = 12 marks

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Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Biology/Additional Science

Unit B2: The Components of Life

Higher Tier

Friday 5 June 2015 – Afternoon
Time: 1 hour

Paper Reference
5BI2H/01

You must have:
Calculator, ruler

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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

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

Turn over ▶

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P 4 4 6 7 5 A 0 1 2 0

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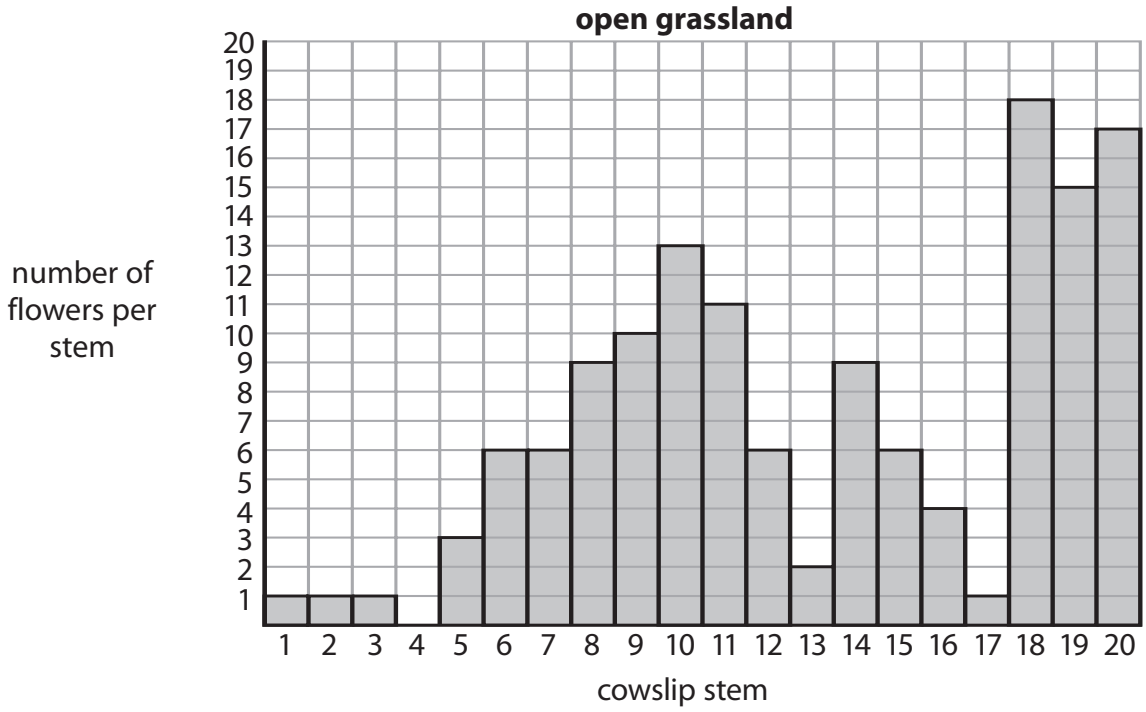
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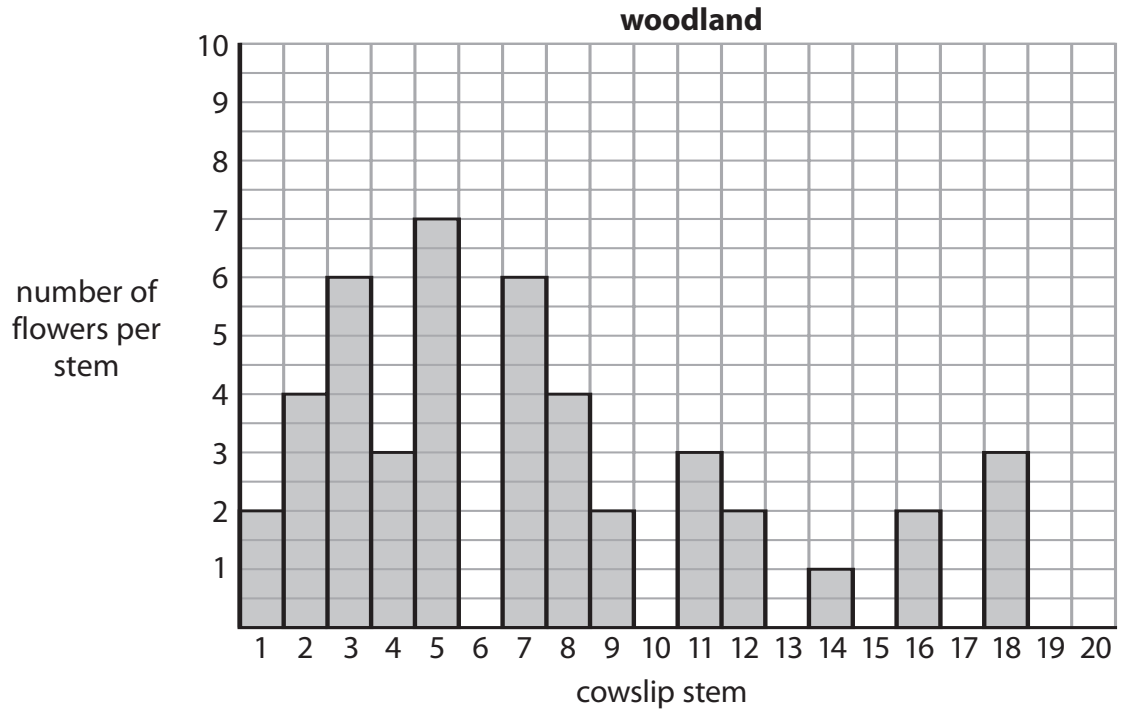
Answer ALL questions

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 ☒.

Investigating plants

1 Cowslips are flowering plants.
Each cowslip stem can produce different numbers of flowers.
The graphs show the number of flowers on 20 stems of cowslip growing in open grassland and 20 stems of cowslip growing in woodland.





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(a) (i) In the open grassland, 60% of cowslips have stems with five or more flowers.

Use the information from the graph to calculate the percentage of cowslips in the woodland that have stems with five or more flowers.

(2)

..... %

(ii) Suggest reasons why there are more stems with five or more flowers in the open grassland.

(2)

.....

.....

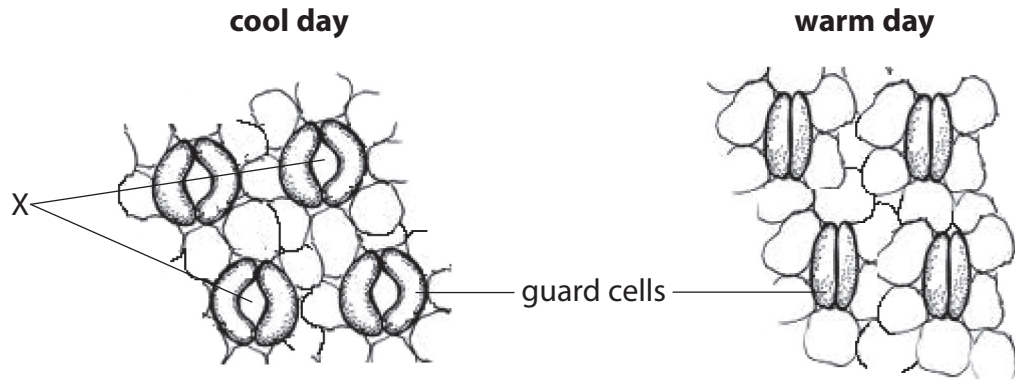
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(b) The diagrams show the underside of a leaf of a cowslip plant on a cool day and on a warm day.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The parts of the leaf labelled **X** are

(1)

☒ **A** stomata

☒ **B** phloem vessels

☒ **C** xylem vessels

☒ **D** chloroplasts

(ii) Complete the following sentence.

(1)

Carbon dioxide moves into the leaves through the parts labelled **X** by the process of ..... .

(iii) Explain how changes to the guard cells on the warm day help the plant to survive.

(2)

.....

.....

.....

.....

.....

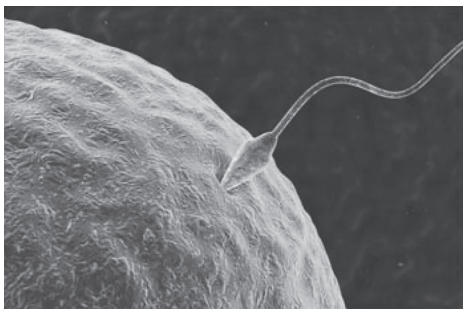
(Total for Question 1 = 8 marks)

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DNA and sperm cells

2 The photograph shows a sperm cell and an egg cell just before fertilisation.



© Education Portal

(a) Which row describes the sperm cell and the egg cell before fertilisation?

Place a cross (☒) in the box next to your answer.

(1)

	sperm cell	egg cell
☒ **A**	diploid	diploid
☒ **B**	diploid	haploid
☒ **C**	haploid	diploid
☒ **D**	haploid	haploid

(b) The sperm cell contains DNA.

Describe the structure of DNA.

(3)

(c) Information in a DNA strand can be transcribed to make a strand of mRNA.

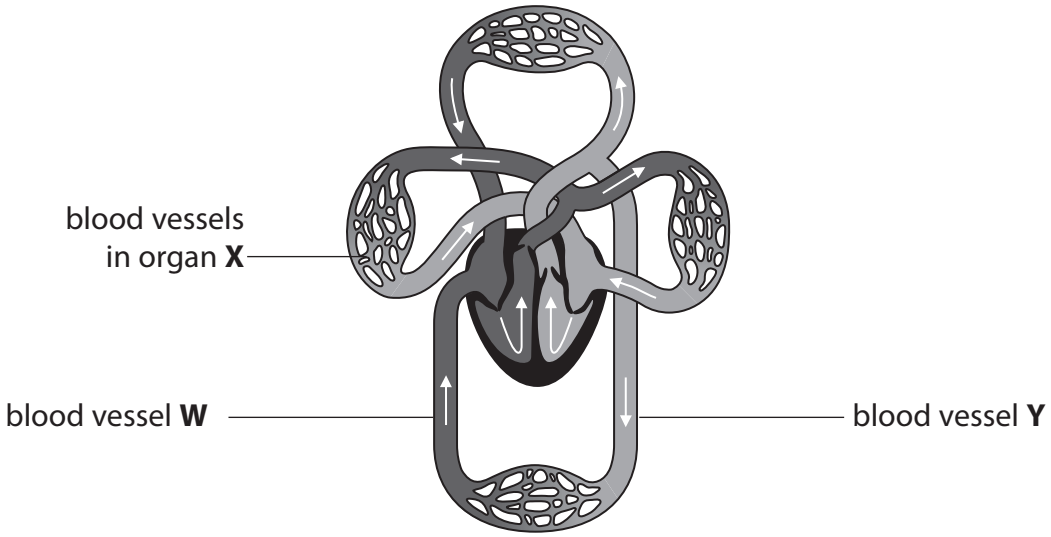
Describe how this mRNA strand is then used to make proteins.

(4)

(Total for Question 2 = 8 marks)

The circulatory system

3 The diagram shows the human circulatory system.



(a) (i) Name organ **X**.

(1)

.....

(ii) Explain how the heart causes blood to move to organ **X**.

(2)

.....

.....

.....

.....

.....

(iii) Which row shows the names of blood vessels **W** and **Y**?

Place a cross (☒) in the box next to your answer.

(1)

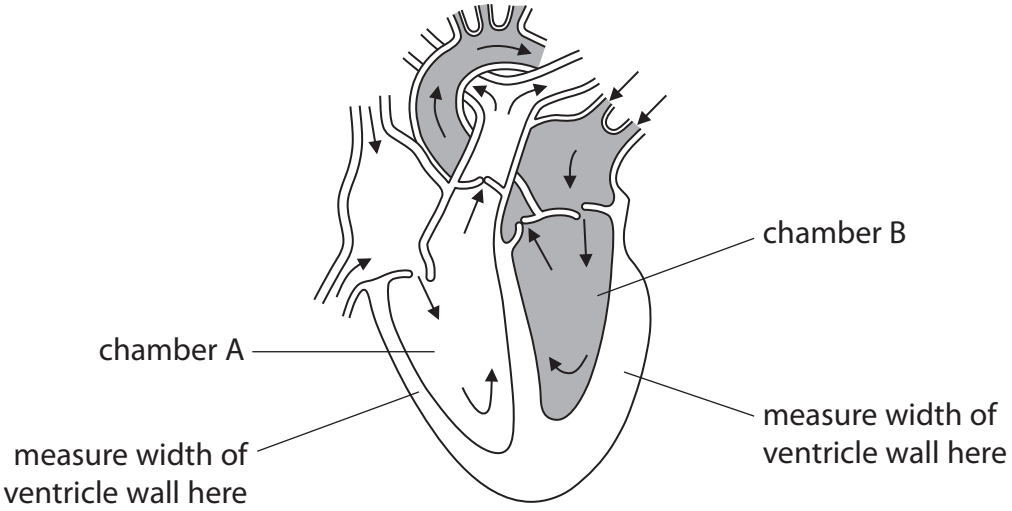
	blood vessel W	**blood vessel Y**
☒ **A**	pulmonary vein	aorta
☒ **B**	vena cava	pulmonary artery
☒ **C**	pulmonary artery	vena cava
☒ **D**	vena cava	aorta

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(iv) Describe how the blood in vessel **W** is different from the blood in vessel **Y**.

(2)

(b) The diagram shows the chambers of the heart.



(i) Calculate how many times thicker the wall of chamber B is compared with the wall of chamber A.

(1)

..... times thicker

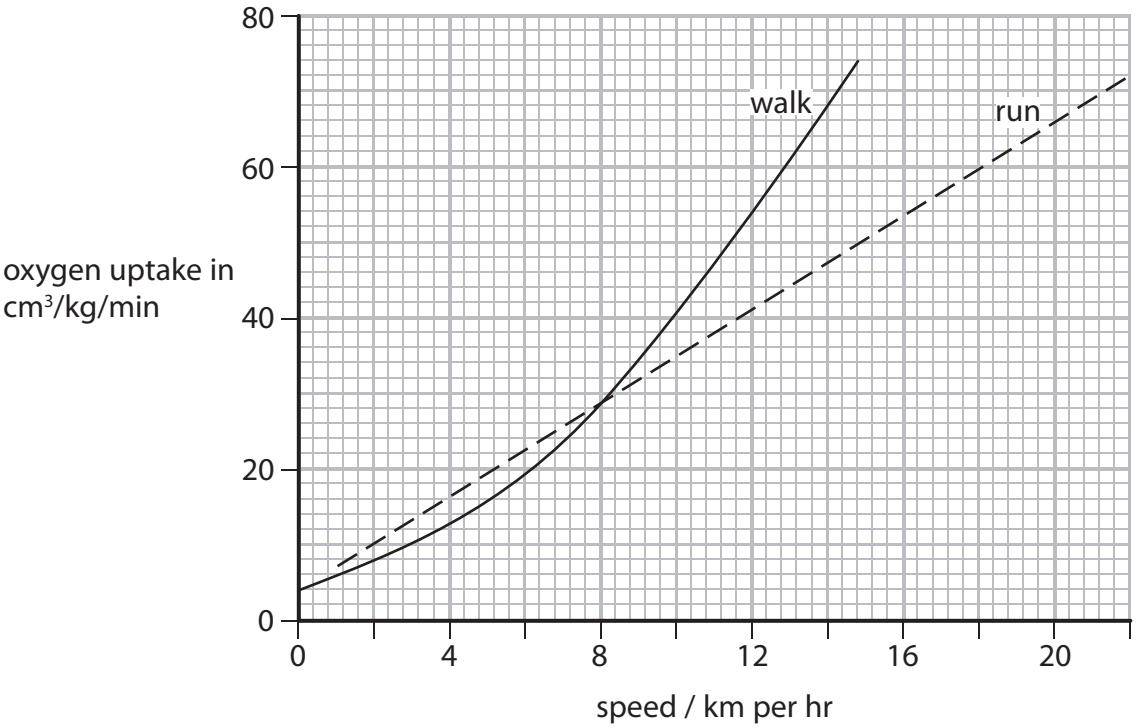
(ii) Explain why the wall of chamber B is thicker than the wall of chamber A.

(2)

(Total for Question 3 = 9 marks)

Walking and running

4 The graph shows the oxygen uptake for an athlete when walking and running.



(a) Compare the oxygen uptake when the athlete is walking and running at speeds from 6 to 10 km per hour.

(3)

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(b) (i) Complete the word equation for aerobic respiration.

(1)

oxygen + glucose ⟶ ..... + ...

(ii) Explain why oxygen uptake increases as an athlete runs at faster speeds.

(2)

.....

.....

.....

.....

.....

.....

(iii) When athletes train hard they can respire anaerobically.

Which of the following statements about anaerobic respiration are true?

1. Lactic acid and carbon dioxide are produced.
2. Lactic acid can build up causing cramp.

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** statement 1 only

☒ **B** statement 2 only

☒ **C** both statement 1 and 2

☒ **D** neither statement 1 nor 2.

(c) The heart rate and stroke volume of an athlete training at a high intensity were measured and their cardiac output was calculated.

The table shows the measurements before, after 2 weeks and after 4 weeks of training.

	heart rate / beats per minute	stroke volume / dm^3	cardiac output / dm^3 per minute
Before training	142	0.08	11.4
After 2 weeks training	164	0.10	16.4
After 4 weeks training		0.12	24.0

(i) Calculate the heart rate after 4 weeks of training.

(2)

..... beats per minute

(ii) Explain how the higher cardiac output after 4 weeks of training increased the rate of aerobic respiration.

(2)

.....

.....

.....

.....

.....

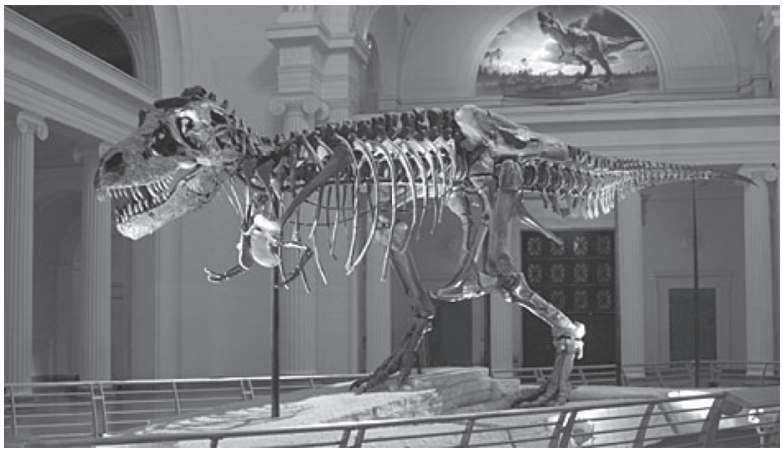
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(Total for Question 4 = 11 marks)

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Fossilised bones

5 In 2005, a scientist claimed to have found red blood cells in the fossilised bones of a *Tyrannosaurus rex* that lived 68 million years ago.



© history.com

(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

A group of the same type of cells, such as red blood cells, is known as

(1)

☒ **A** an organ

☒ **B** an organ system

☒ **C** an organism

☒ **D** a tissue

(ii) The scientist said that each red blood cell found contained a nucleus.

In humans, each mature red blood cell does not have a nucleus.

Suggest why not having a nucleus in a red blood cell is an advantage.

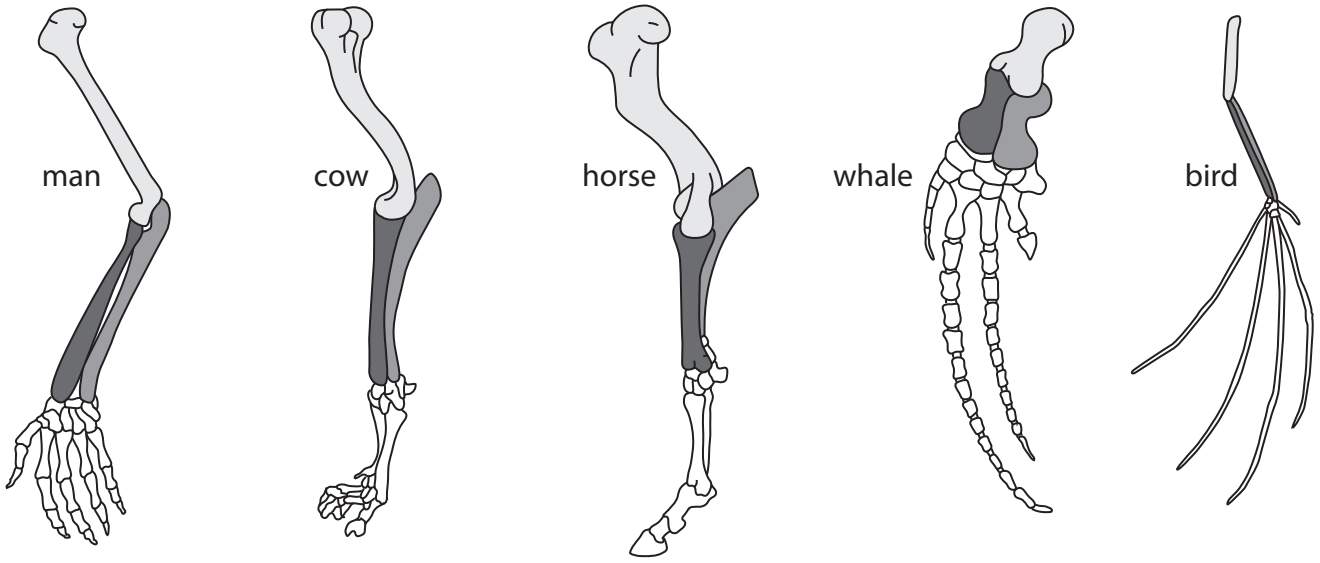
(2)

(b) Explain why fossils of dinosaurs are often incomplete.

(3)

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*(c) The diagram shows some limbs of modern-day animals.



Explain how the study of the limbs of different species of vertebrates provides evidence for evolution.

(6)

(Total for Question 5 = 12 marks)

Tegon, the glowing beagle

6 In 2011, South Korean scientists genetically engineered a cell from a beagle.

They then cloned this cell to create a beagle.

They called this beagle Tegon.

Tegon glows in the dark when UV light is shone on him.



© Dentistry Today

Cloning involves cells that divide by mitosis.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

When a cell divides by mitosis it produces

(1)

☒ **A** two cells that are genetically different

☒ **B** two cells that are genetically identical

☒ **C** four cells that are genetically different

☒ **D** four cells that are genetically identical

(b) To genetically engineer the original cell so that it would glow, the scientists had to obtain a suitable gene.

(i) Describe the stages that a scientist would complete to obtain this gene.

(2)

*(ii) Describe the stages used in the laboratory to clone and produce Tegon from the genetically engineered cell.

(6)

(c) Suggest the advantages of cloning mammals, such as dogs, for use in medical research into human diseases.

(3)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCSE in Biology (5BI2H) Paper 01 Unit B2: The Components of Life

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- 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.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
-

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	3 (÷ 20) (X100) (1) 15 (%)	**Accept 3** ÷ 13 Full marks for correct bald answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	Any two of the following: can photosynthesise more (1) higher light intensity / more light (1) more water / rain (1) warmer (1) more mineral ions / nutrients(1)	accept: reverse argument for woodland Accept: more competition from trees (for water / mineral ions) (1) bigger leaves (1) less flowers eaten (1) different genes (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	**A** stomata		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	diffusion / diffusing /	Accept description of diffusion eg carbon dioxide molecules move from an area of high concentration to an area of low concentration accept diffuse	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	• guard cells change shape / (guard cells) close stomata /guard cells close (1) • to reduce water loss /rate of transpiration reduced (1)	accept stop water loss / keep water in Ignore get more water	**(2)**

Total for Question 1 = 8 marks

Question Number	Answer	Acceptable answers	Mark
2(a)	**D** haploid and haploid		**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (b)	A description linking three of the following (DNA is a) double helix (1) the sides of DNA are made from (alternating) sugars and phosphate (molecules) / sugar phosphate backbone (1) {paired / complementary} bases / A (joins to) T and C (joins to) G (1) (bases joined by/strands held together by) hydrogen bonds (1)	 Accept H bonds Ignore h or H_2 bonds	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(c)	A description including four of the following: (the process is) translation (1) (mRNA) leaves the nucleus / enters the cytoplasm (1) (mRNA joins to) ribosomes(1) tRNA carries amino acids (1) tRNA joins to mRNA / bases on tRNA matches bases on mRNA (1) (bases read as) {sets of three / triplets / idea of codons} (1) (ribosome / mRNA holds tRNA so) amino acids are joined together / to make polypeptides (1)		**(4)**

Total for Question 2 = 8 marks

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	(right) lung / lungs		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	An explanation including two of the following: blood flows into (right) atrium (1) (into right) ventricle (1) (ventricle / heart / muscle) contracts (1) (blood) pressure increased (by heart) (1) blood moves into <u>pulmonary</u> artery (1)	 **reject** references to left for either atrium or ventricle. accept blood under high pressure accept reference to valves stopping back flow	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iii)	**D** vena cava aorta		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iv)	A description including two of the following: blood in vessel W / vena cava has: lower pressure (1) deoxygenated / low(er) concentration of oxygen (1) greater concentration of carbon dioxide (1) darker (red) (1)	 accept reverse arguments for blood vessel Y / aorta ignore low pressure accept low pressure in W and high pressure in Y accept low(er) oxygen levels accept carries carbon dioxide ignore W takes blood towards heart / Y takes blood away from heart	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	3 / x3 / three (times thicker) Accept any number between 2.5 and 3 (times thicker).		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	An explanation including two of the following: wall of {left ventricle / chamber B} is {more muscular / stronger / applies more force / more powerful} (1) blood from left ventricle / chamber B is under higher pressure (than blood from right ventricle) (1) (as) blood needs to be {pushed / pumped / forced} through {more capillaries / whole body} (1)	Accept reverse argument for right ventricle / chamber A. ignore left hand side pumps more blood than right hand side / pumps blood faster.	**(2)**

Total for Question 3 = 9 marks

Question Number	Answer	Acceptable answers	Mark
4(a)	A comparison including two of the following: both increase (1) oxygen uptake increases more when running / less when walking (from 6 to 10 km per hr) (1) from 6 to 8 km per hour running has a higher oxygen uptake (1) at 8 km per hour both running and walking have the same oxygen uptake (1) from 8 to 10 km walking has a higher oxygen uptake (1)	 accept from 6 to 10 km per hour running increase by 13 ± 1 and walking increase by 22± 1 accept quoted figures ± 1 eg at 6 running uses 2 (cm^3/kg/min) more than walking accept any speed between 6 and 7.9 (km per hr) ignore lines cross at 8 accept quoted figures ± 1 eg at 9 running uses 6 (cm^3/kg/min) less than walking accept any speed between 8.1 and 10	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	(oxygen + glucose →) water + carbon dioxide	both water and carbon dioxide are required in either order. Accept H_2O + CO_2 Ignore: energy reject wrong symbols eg H2O or H^2O	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	an explanation linking two of the following: muscles **contract** more / faster (1) more (aerobic) respiration (1) (so) more energy (is needed from aerobic respiration) (1)	'More' only has to be stated once for MP 2 and 3 more respiration for energy is carried out = 2 marks. Reject produce / make energy	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	**B** statement 2 only		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	24 ÷ 0.12 (1) = 200 (beats per minute)	two marks for correct bald answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	more blood per minute / faster blood flow (1) more oxygen / glucose (transported to muscle cells) (1)	'more' only has to be stated once blood flows faster carrying oxygen /glucose = 2 marks.	**(2)**

Total for Question 4 = 11 marks

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	**D** a tissue		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	A suggestion including two from: more haemoglobin can be carried (1) {increase in surface area (to volume ratio) / biconcave shape} (1) can carry more / absorb more oxygen (1) idea that RBCs are only carriers / does not need to carry out processes like protein synthesis (1)	more only needs to be stated once eg more haemoglobin to carry oxygen = 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)	An explanation linking the following: soft body tissue decays / decompose (1) some parts / bones may have been eaten / moved away from rest of skeleton / (by animals before fossilisation) (1) (some parts) not found / eroded / corroded / damaged / crushed / changed by pressure / heat (when in ground / excavated)(1)		**(3)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A explanation to include some of the following points Basic structure All have: • similar bone structure • humerus / femur / has one upper limb bone • radius and ulna / tibia and fibula / two lower limb bones • carpels / wrist bones • pentadactyl limb • have 5 digits Specific examples • some (eg horse) have digits reduced / missing • different shapes reflect different uses • suitable example, eg bat has extended first digit to support wing • different features caused by mutations • different environments have selected different features / mutations • idea of different features being beneficial / survival of the fittest • idea of adaptive radiation / selection of features / genes • suggests similar ancestors for all mammals /birds / reptiles / and (many) amphibians • can show how one species is related to another	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation of at least one idea from the basic structure section or the specific examples • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation from the basic structure linked to at least one specific example OR a detailed explanation of the basic structure • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation that includes linking some of the areas of basic structure to specific examples related to evolution • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
6a	**B** Two cells that are genetically identical		**(1)**

Question Number	Answer	Acceptable answers	Mark
6bi	A description to include 2 of the following points: select a species that glows (when UV light is shone on it) (1) identify the gene location (1) cut the gene out (1) using a (restriction) enzyme (1)		**(2)**

Question Number		Indicative Content	Mark
QWC	***6(b)(ii)**	a description to include some of the following: • diploid nucleus is removed from the genetically engineered cell • making a lone nucleus • a donor egg is enucleated/its nucleus is removed • the diploid nucleus from the GE cell is inserted into the enucleated egg cell • division of the nucleus is stimulated • by electric shock/chemicals • cell divides by mitosis • cells put into surrogate mother • cells divide further and differentiates to form an embryo • Tegon born and is a glow in the dark beagle The above points could be made diagrammatically, but a written description is also required.	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description including at least one stage of cloning in an appropriate context • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description of at least two stages of cloning linked sequentially in an appropriate context • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation of most of the stages of cloning • answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(c)	Any three of the following points: the clones will all be genetically identical (1) so test results will be similar / not affect by genes (1) the clones could be GE to have specific human diseases /(dogs have) similar diseases / disorders to humans (1) dogs and humans are mammals / have similar anatomy / physiology / DNA (1)	 accept a disease will affect dogs in a similar way to humans accept dogs could be cloned who have (specific human) diseases / disorders accept dogs are similar to humans	**(3)**

Total for question 6 = 12 marks

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Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Biology/Additional Science

Unit B2: The Components of Life

Higher Tier

Friday 6 June 2014 – Afternoon
Time: 1 hour

Paper Reference
5BI2H/01

You must have:
Calculator, ruler

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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

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

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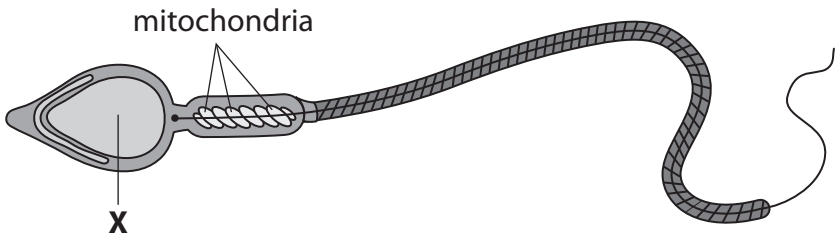
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Answer ALL questions

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 ☒.

Cells

1 The diagram shows a human sperm cell.



(a) (i) Structure **X** on the diagram contains DNA.

Name structure **X**.

(1)

.....

(ii) Which statement is true for DNA?

Place a cross (☒) in the box next to your answer.

(1)

☒ **A** DNA is made up of amino acids and bases.

☒ **B** DNA is made up of amino acids which give instructions to make proteins.

☒ **C** In DNA, the bases A and T are complementary.

☒ **D** Every gene in a DNA molecule contains only three bases.

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(b) Sperm cells are involved in fertilisation.

Define fertilisation.

(2)

(c) (i) Describe the function of mitochondria.

(2)

(ii) Gene mutations in DNA can produce abnormal mitochondria.

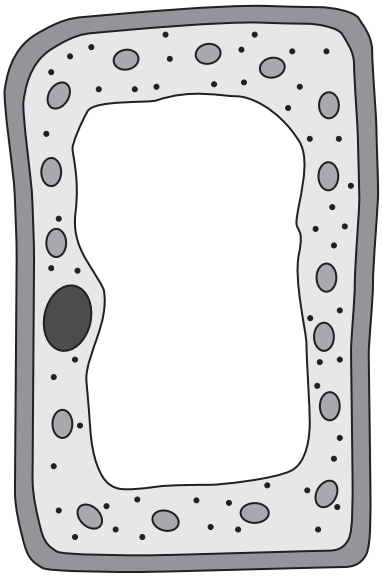
Explain how a gene mutation can produce a different protein.

(2)

(Total for Question 1 = 8 marks)

Photosynthesis

2 The diagram shows a plant cell.



(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

This plant cell is a

(1)

- ☒ **A** xylem vessel
- ☒ **B** phloem vessel
- ☒ **C** root hair cell
- ☒ **D** leaf palisade cell

(b) Explain how water moves from cell to cell in a leaf.

(2)

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(c) Some small plants can grow on the bark of trees.

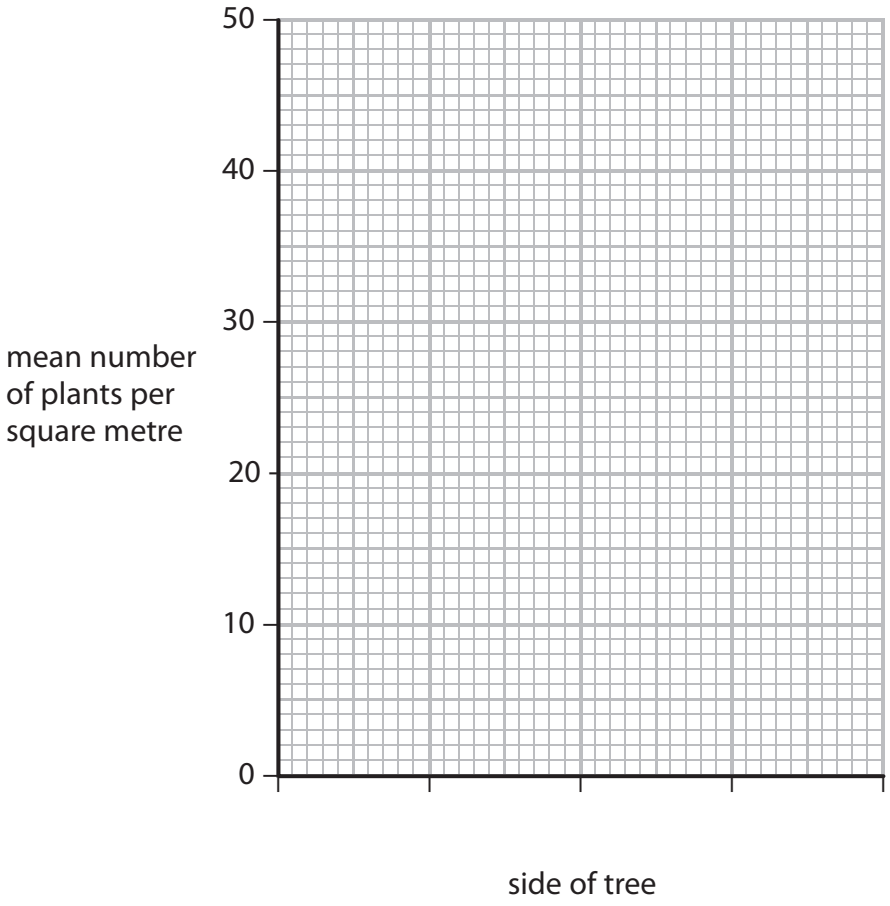
The distribution of two plant species, species A and species B, growing on the north and south side of a tree was investigated.

The results are shown in the table.

	mean number of plants per square metre	
side of tree	**species A**	**species B**
North	48	12
South	0	36

(i) Draw a bar chart to illustrate the data in this table.

(2)



(ii) Which piece of equipment would be used to measure the distribution of plants on the bark of the tree?

Place a cross (☒) in the box next to your answer.

(1)

☒ **A** a pooter

☒ **B** a sweep net

☒ **C** a pitfall trap

☒ **D** a quadrat

(iii) Suggest reasons for the distribution of species B on the north and south sides of the tree.

(2)

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.....

(Total for Question 2 = 8 marks)

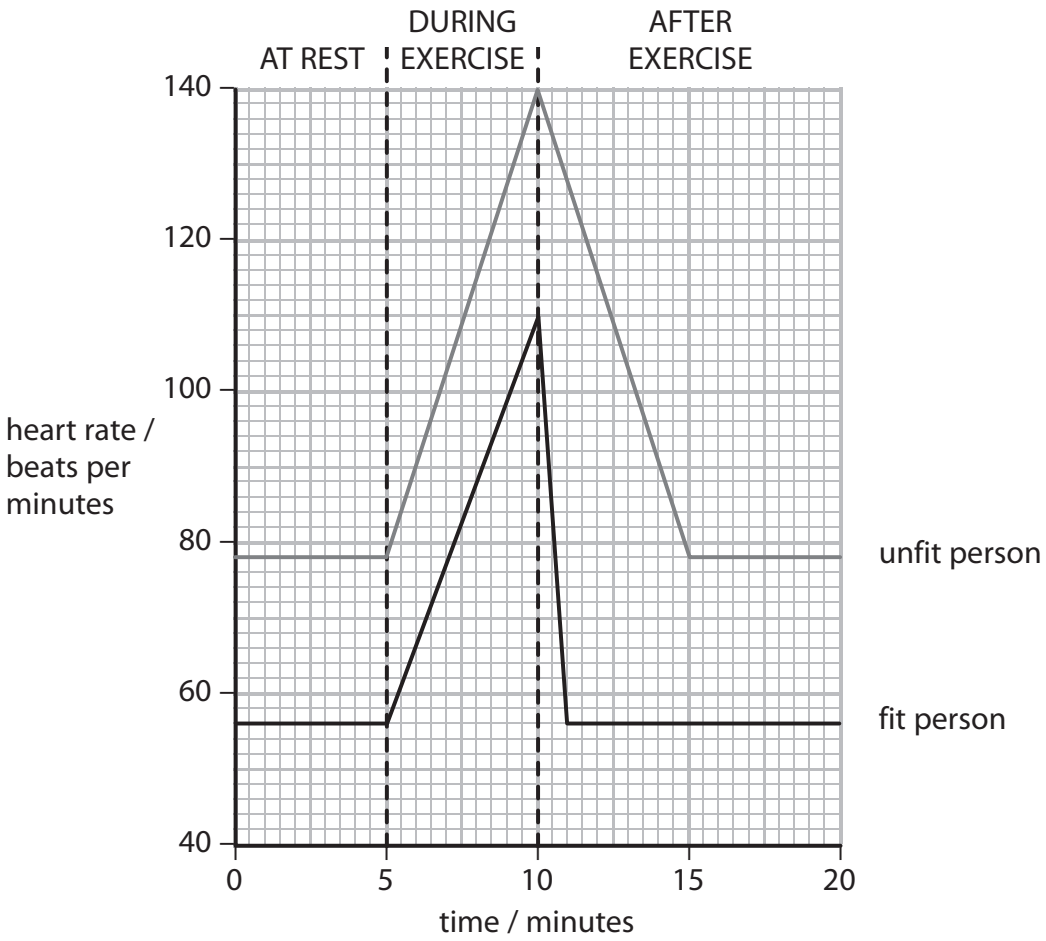
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Question 3 is on the next page

Exercise

3 The graph shows the heart rate of a fit person and of an unfit person at rest, during exercise and after exercise.



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(a) (i) Compare the heart rate of the fit person with the heart rate of the unfit person from 5 to 15 minutes.

(3)

(ii) Cardiac output = stroke volume × heart rate.

The stroke volume of the fit person at 10 minutes is 0.20 dm^3 per beat.

Calculate the cardiac output of the fit person at 10 minutes.

Use the graph to help you.

(2)

..... dm^3 per minute

(iii) The recovery period is the time it takes for the heart rate to return to its rate at rest after exercise.

Explain why the recovery period for the fit person was different from the recovery period for the unfit person.

(3)

(b) Which of the following shows the direction that blood flows towards, through and from the heart?

Place a cross (☒) in the box next to your answer.

(1)

☒ **A** vena cava → ventricle → atrium → pulmonary vein

☒ **B** pulmonary artery → atrium → ventricle → aorta

☒ **C** aorta → ventricle → atrium → pulmonary vein

☒ **D** pulmonary vein → atrium → ventricle → aorta

(c) More carbon dioxide is produced by cells during exercise.

Name the part of the blood that transports most of the carbon dioxide to the lungs.

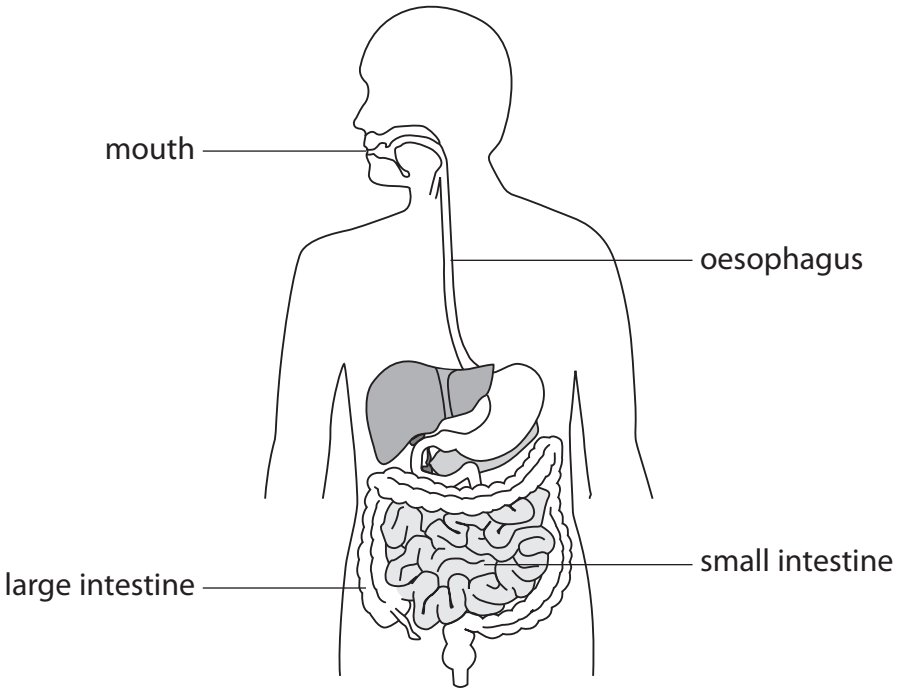
(1)

.....

(Total for Question 3 = 10 marks)

A healthy digestive system

4 The diagram shows the digestive system of a human.



(a) Describe the role of the mouth in digestion.

(2)

(b) Villi are structures in the small intestine.

(i) Which **one** of the statements about villi is true?

Place a cross (☒) in the box next to your answer.

(1)

☒ **A** Glucose is the only substance absorbed by villi

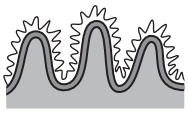
☒ **B** Three types of enzyme are absorbed by villi

☒ **C** The capillary network in the villi have a large surface area

☒ **D** The walls of the villi are thicker to absorb more food

(ii) Coeliac disease can cause a loss of microvilli.

The table shows how the structure of villi affects the surface area of the small intestine.

structure	diagram	surface area compared to small intestine as a tube
small intestine as a tube with no villi or microvilli		1
small intestine with villi but no microvilli		30
small intestine with villi and microvilli		600

A person with coeliac disease has no microvilli in their small intestine.

Explain why this person would find it hard to exercise.

Use information from the table to help you.

(3)

(c) Fibre in food is not digested.

Fibre makes up most of the solid material in the contents of the small intestine.

The recommended daily allowance (RDA) for fibre is between 18g and 30g.

Suggest why the muscles in the intestines of someone who eats much less fibre per day than the RDA may have trouble moving food through the small intestine.

(2)

(d) Describe how probiotics containing *Bifidobacteria* are thought to improve the health of the digestive system.

(2)

(Total for Question 4 = 10 marks)

5 Some students investigated water movement in plant cells.

They measured the mass of five pieces of potato.

Each piece of potato was put into a different concentration of salt solution.

After one hour the pieces of potato were dried and the mass of each was recorded.

The results are shown in the table.

concentration of salt solution / %	mass / g			percentage change / %
	start	after 1 hour	change	
0	10.2	13.1	+2.9	+28.4
10	9.8	11.4	+1.6	+16.3
20	10.3	9.8	–0.5	
30	10.1	8.9	–1.2	–11.9
40	9.7	7.7	–2.0	–20.6

(a) (i) Calculate the percentage change in the mass of the potato in the 20% salt solution.

(2)

..... %

(ii) Suggest why calculating a percentage change is more useful than calculating the change in mass in this investigation.

(1)

.....

.....

(b) Mitosis occurs in plant cells during growth.

Describe the division of a cell by mitosis.

(3)

*(c) Explain how active transport and diffusion provide a plant with named substances it needs for growth.

(6)

(Total for Question 5 = 12 marks)

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Question 6 is on the next page

Enzymes

6 DNA and RNA are involved in the synthesis of proteins such as enzymes.

(a) Protein synthesis involves transcription and translation.

Which row shows the molecules involved in both transcription and translation?

Place a cross (☒) in the box next to your answer.

(1)

	transcription	translation
☒ **A**	tRNA	tRNA
☒ **B**	mRNA	DNA
☒ **C**	tRNA	DNA
☒ **D**	mRNA	mRNA

(b) Describe what happens to the molecule produced by transcription before it is translated.

(2)

.....

.....

.....

.....

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(c) Explain how the lock and key hypothesis models how enzymes work.

You may use labelled diagrams in your answer.

(3)

*(d) Describe how named factors affect the rate of enzyme-catalysed reactions.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2014

Pearson Edexcel GCSE in Biology (5BI2H) Paper 01

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Question Number	Answer	Acceptable answers	Mark
1(a)(i)	nucleus (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	**C** In DNA, the bases A - T are complementary		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	A definition including two of the following: • a sperm fuses with egg / penetrates the egg (1) • nuclei/genetic information fuses /combines (1) • reference to haploid gametes /gametes have 23 chromosomes (1) • reference to cell made being diploid / has 23 pairs of chromosomes / zygote formed (1)	Ignore sperm meets egg	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	A description that includes the following: • (aerobic) respiration / using glucose / using oxygen (1) • energy released (for movement / swimming / metabolism)(1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	An explanation including **two** of the following: • a change in a base/base sequence/order of bases / a change in mRNA (1) • named change e.g. addition/deletion (1) • reference to change in an amino acid / order of amino acids (1)	Accept codon, triplet, genetic code for base. substitution/deletion/other named gene mutation.	**(2)**

(Total for question 1 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
2(a)	**D** leaf palisade cell		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	An explanation linking two of the following: • by osmosis • from an area of high **water** concentration to an area of low **water** concentration • through (partially permeable) membrane	Ignore references to diffusion reject active transport accept water moves down a concentration gradient	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	• all four bars plotted correctly (+/- 1/2 small square) (1) • X axis correctly labelled for plotted bars , eg North A, North B, South A, South B (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	**D** a quadrat		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(iii)	A suggestion including two of the following: • Species B **is able to** grow on both (North and South) sides (1) • (there are more) on the south side because of a specific difference in a named abiotic factor eg lighter /darker on South side , temperature, pH, water level, (1) • there are fewer on the north side because they are out competed by species A / idea of eaten more on North side (1)	Ignore species B is found / grows on both sides Ignore carbon dioxide concentration Accept less pollution / less sulphur dioxide on South side	**(2)**

(Total for question 2 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	A comparison to include three of the following: For the unfit person: • the unfit person's heart rate is higher / faster(1) • idea that both react in the same way eg both peak at ten minutes, both increase when they start exercising (1) • heart rate increases more quickly (to maximum) (1) • heart rate decreases more slowly (back to resting rate) (1) • credit correct manipulated values obtained for heart rates (1)	ORA for fit person	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	• Correct substitution i.e. 0.20 x 110 (1) • 22	Allow 2 marks for correct final bald answer ecf. Allow one mark if final value is correct for the substitution of a different heart rate from the graph, ie between 56 and 140 bpm.	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iii)	An explanation that includes: • the fit person recovers faster/ has a shorter recovery period (1) and two of the following: Fit Person has • greater {vital capacity / blood flow / stroke volume / cardiac output} (1) • correct reference to less / no anaerobic respiration less /no lactic acid build up (1) • lactic acid removed faster EPOC less / lower oxygen debt less oxygen to replace(1)	ORA unfit person Accept Heart pumps more blood / more red blood cells / haemoglobin Accept fit person only respires aerobically / unfit person does anaerobic respiration. Accept unfit person has an oxygen debt /fit person has no oxygen debt	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)	**D** pulmonary vein → atrium → ventricle → aorta		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)	plasma (1)		**(1)**

(Total for question 3 = 10 marks)

Question Number	Answer	Acceptable answers	Mark
4(a)	A description including two of the following: • teeth chop / cut / grind food into smaller pieces (1) • amylase / enzymes added (1) • digests starch into (simple) sugars /maltose / glucose (1) • (saliva / mucus added) to soften / moisten / lubricate (food) (1) • bolus formed / tongue rolls food into ball / (1)	Accept increase in surface area Reject into smaller molecules Accept to make food easier to swallow.	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	**C** the capillary network in the villi have a large surface area		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	An explanation linking three of the following: • surface area decreased • by 20 times • so less glucose / fatty acid / glycerol / absorbed • which are used for energy	Accept (surface area reduced) by 570. Accept sugar / amino acids	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)	A suggestion linking two of the following: • (food is moved by) peristalsis • (waves of) muscular contraction • if no bulk to push against – food will not move. • intestine **muscles** weaker / idea of not enough fibre means that less exercising of intestinal muscle	Accept idea that it is the fibre that is pushed along / (muscle push against fibre) which pushes food along Accept may become constipated.	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)	An description linking two of the following: • probiotics are (claimed to be) beneficial bacteria / natural gut flora • (Reproduce so) outcompete / replace harmful bacteria • Any health benefit eg: reduce diarrhoea / IBS/ inflammation of intestinal wall / increase in vitamin uptake /	Accept useful / helpful for beneficial Ignore friendly Accept improves the immune system / reduce allergies	**(2)**

(Total for question 4 = 10 marks)

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	Correct substitution i.e. (-0.5 ÷ 10.3) x 100 (1) - 4.85 / - 4.9	Accept data correctly put into other acceptable methods. Accept answer with more decimal places eg: - 4.8543 / - 4.854368932 Full marks for correct bald answer award max of one mark if negative is not written eg 4.85 / 4.9	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	better / easier / more valid comparison can be made between values /can make more valid conclusion / because the original / starting masses of potato were not the same / Idea of easier to visualise the size of the change	Ignore makes the results / test reliable / accurate	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	A description including the following: • Produce two (daughter) cells • which are **genetically** identical • and diploid	Accept DNA for chromosomes throughout Also credit details of the process of mitosis chromosomes replicates (1) spindle fibres form / chromosomes attached to spindle (1) Chromosomes arranged on equator / middle of cell / chromosomes pulled apart /pulled to poles /separation of sets of chromosomes (1) Idea of nucleus reforming / New cell wall formed (to divide cell) / cytokinesis / description of cytokinesis (1)	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A explanation to include some of the following points • active transport requires energy • (active transport moves mineral ions) from the soil • into root (hair cells) • reference to pumps (in the cell membranes) • from a low concentration to a high concentration/against their concentration gradient • reference to mineral ions / mineral salts accept named minerals eg nitrates • diffusion is a passive process • gases diffuse from high to low concentration/down their concentration gradient • gas exchange in the leaf occurs by diffusion • carbon dioxide diffuses in • to air spaces in leaves / into cells • for photosynthesis / produces glucose • oxygen diffuses in • for respiration	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation that gives information about active transport **OR** diffusion in the correct context e.g. minerals ions are transported into root (hair cells) • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation that gives details of active transport or diffusion transporting materials e.g. carbon dioxide diffuses into leaves down their concentration gradient OR a limited explanation of both active transport and diffusion • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation that describes **both** processes e.g. active transport requires energy to transport mineral ions into the root hair cell AND carbon dioxide diffuses into the leaf for photosynthesis • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for question 5 = 12 marks)

Question Number	Answer	Acceptable answers	Mark
6(a)	**D** mRNA mRNA		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	A description linking two of the following: • leaves the nucleus / moves to the cytoplasm • through the nuclear membrane • attaches to ribosome	Accept through a nuclear pore	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)	A explanation linking three of the following: • (enzyme and substrate have) complementary shapes • substrate fits into enzyme / enzyme substrate complex formed • reference to <u>active site</u> • enzymes break (chemical) bonds / form chemical bonds / (causes) reaction to occur / make products • Idea of products leaving enzyme (so that enzyme can be used again)	this may be awarded if clearly shown in an unlabelled diagram reject if active site is part of substrate	**(3)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	A description to include some of the following points Temperature • (temperature) too low – not enough energy to make reactions occur (fast enough) • reference to optimum temperature • optimum for most (humans) - 37^{o}C • over 37^{o}C changes enzyme shape / changes active site shape of enzyme • therefore rate of reaction decreases / stops • enzymes denatured (if temperature too high) pH • optimum pH – around 7.3 / 6 to 8 for most enzymes • specific optimum quoted eg pepsin – pH 2 to 3 • pH either side of optimum – changes the shape of the enzyme / shape of the active site • therefore rate of reaction decreases / stops • enzymes denatured (if pH too high / too low) substrate / enzyme concentration • higher concentrations faster reactions • due to more collisions • until maximum rate reached / all enzymes being used	**(6)**
Level	**0**	No rewardable content	
1	**1 – 2**	• a limited description of how temperature OR pH OR substrate concentration affects the rate of enzyme action • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 – 4**	• a simple description of two or more factors OR a detailed description of one factor • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 – 6**	• a detailed description of at least two factors • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for question 6 = 12 marks)

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Centre Number | Candidate Number

Edexcel GCSE

Biology/Additional Science

Unit B2: The Components of Life

Higher Tier

Monday 10 June 2013 – Afternoon
Time: 1 hour

Paper Reference
5BI2H/01

You must have:
Calculator, ruler

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.
- Answer the questions in the spaces provided
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- Keep an eye on the time.
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- Check your answers if you have time at the end.

Turn over ▶

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Answer ALL questions

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 ☒.

Proteins

1 Proteins are made up of amino acids.

(a) The table shows the DNA bases that code for some of the amino acids found in proteins.

DNA bases	AAA	AAC	CAA	TAC	TTC
Amino acid	phe	leu	val	met	lys

Part of the DNA coding for a protein is:

T A C C A A T T C

(i) State the order of amino acids coded for by this sequence of DNA.

(1)

.....

(ii) These amino acids will be joined together during protein synthesis.

During which stage of protein synthesis will this take place?

(1)

.....

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Amino acids are joined together

(1)

☒ **A** at the membrane

☒ **B** in the mitochondria

☒ **C** in the nucleus

☒ **D** at the ribosome

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(b) DNA can code for the amino acids in the active site of an enzyme.

Explain the role of the active site of an enzyme.

(2)

(c) Mutations can occur in DNA.

Describe what effect a mutation could have on the action of an enzyme.

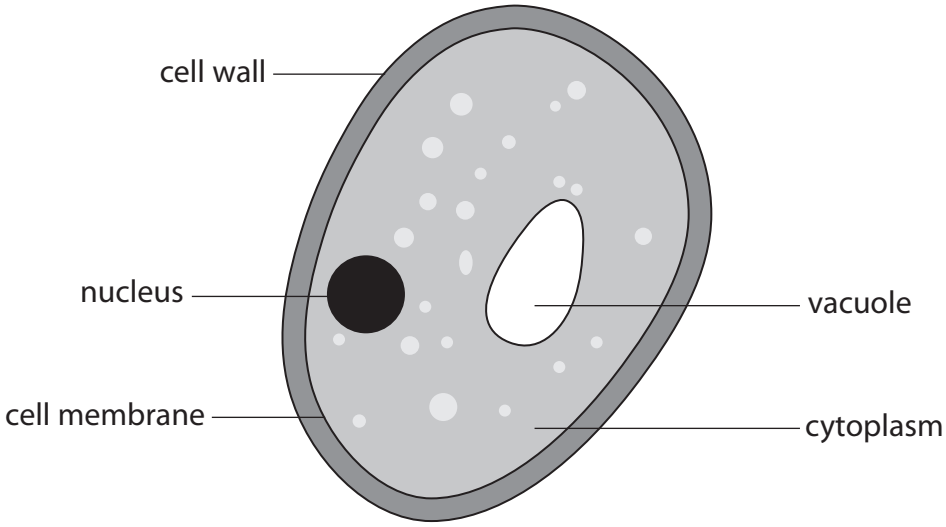
(3)

(Total for Question 1 = 8 marks)

Cells

2 Yeasts are microorganisms that are used in the brewing and baking industries.

The diagram shows a yeast cell.



(a) (i) State **two** ways in which the structure of this yeast cell differs from the structure of a bacterial cell.

(2)

1 .....

.....

2 .....

.....

(ii) Plant cells can produce glucose.

Suggest why yeast cells cannot produce glucose.

(1)

.....

.....

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(b) The table shows the number of different components found in the blood of a healthy person and the blood of two other people.

	number of components per dm^3 of blood		
component of blood	**healthy person**	**person A**	**person B**
red blood cells	5×10^{12}	6×10^{12}	3×10^{12}
white blood cells	7×10^{9}	5×10^{10}	8×10^{10}
platelets	3×10^{11}	3×10^{11}	3×10^{11}

(i) Calculate the difference in the number of white blood cells per dm^3 of blood between the healthy person and person A.

(2)

answer = ...

(ii) Describe the functions of white blood cells.

(2)

.....

.....

.....

.....

(iii) Person B has a low number of red blood cells compared to the healthy person.

Suggest an effect this may have on person B.

(1)

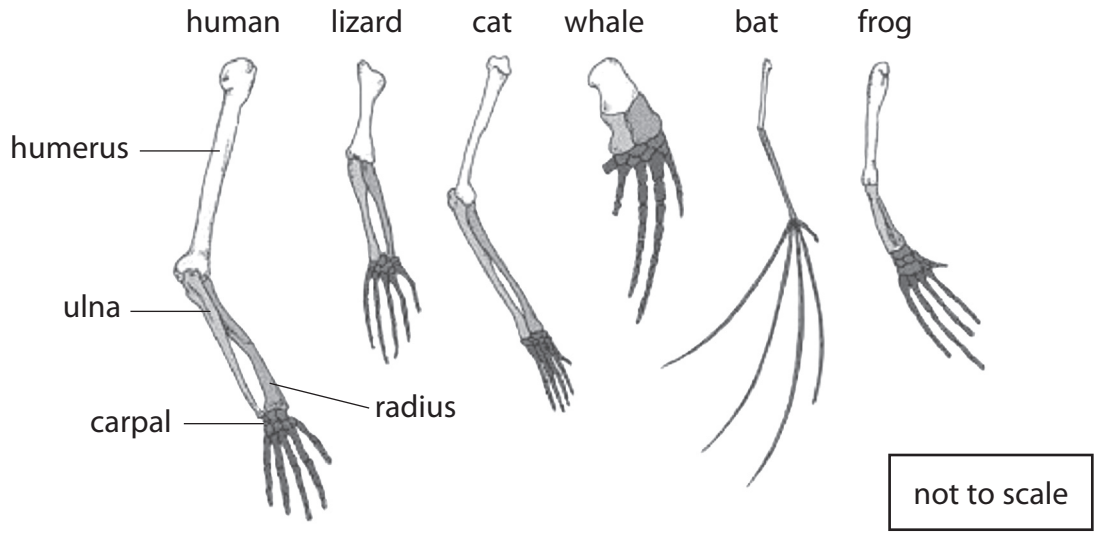
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(Total for Question 2 = 8 marks)

Evidence for evolution

3 The diagrams show the limbs of six organisms.



(a) Many scientists believe that these six organisms evolved from one common ancestor.

Describe the evidence shown in the diagrams that supports this belief.

(3)

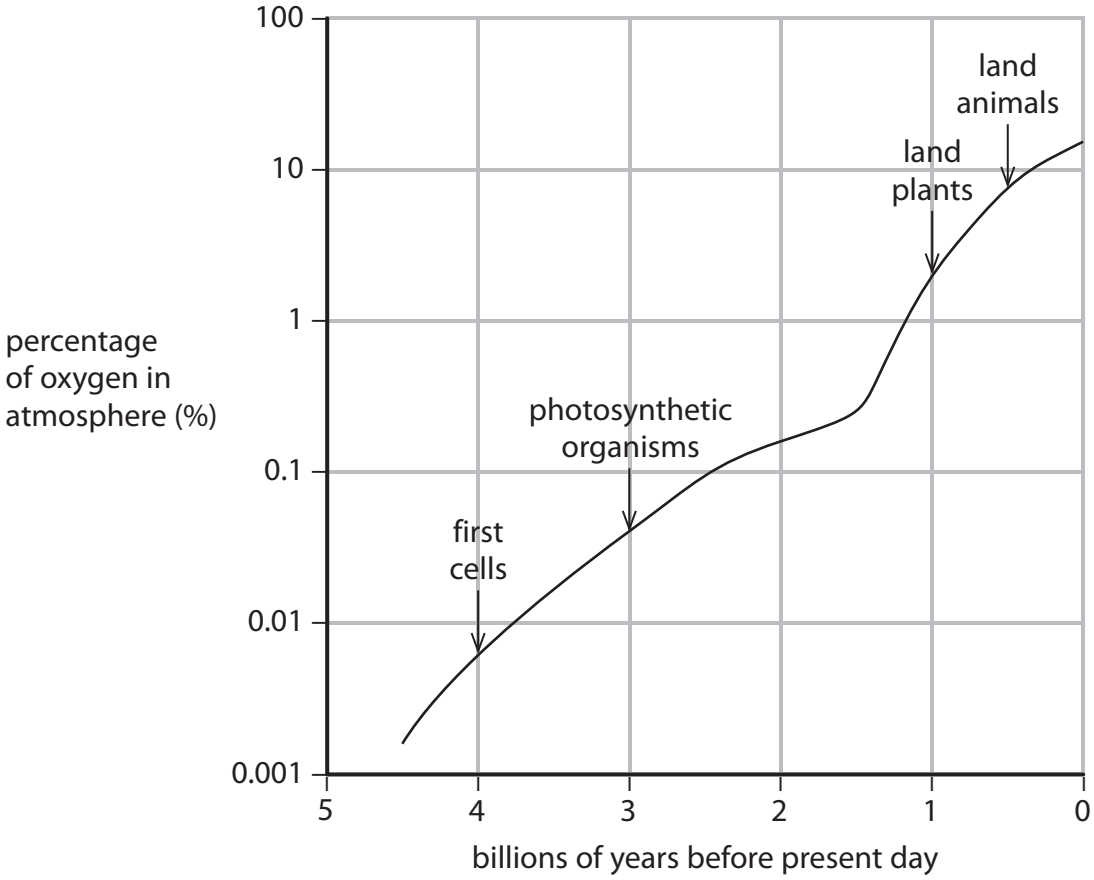
(b) Fossils can provide evidence for evolution.

Explain why the fossil record is incomplete.

(2)

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(c) The graph suggests that the level of oxygen in the atmosphere was important for the evolution of many living organisms.



(i) How much oxygen was needed in the atmosphere for the evolution of land animals?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** 0.009%

☒ **B** 0.09%

☒ **C** 0.9%

☒ **D** 9.0%

(ii) Suggest how photosynthesis could have changed the gas content of the atmosphere.

(2)

.....

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(iii) Suggest why such a high percentage of oxygen in the atmosphere was needed for large land animals to evolve.

(2)

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(Total for Question 3 = 10 marks)

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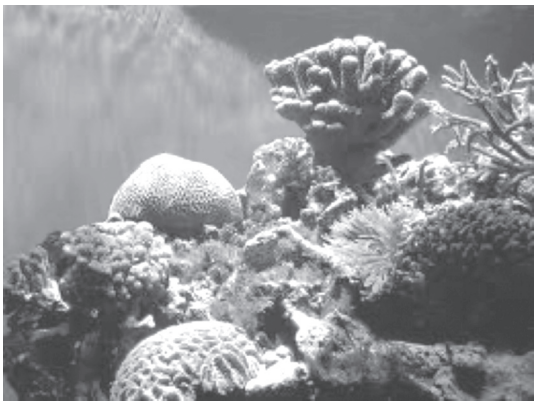
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Question 4 is on the next page

Sexual reproduction in coral

4 Corals are animals that live on the sea bed.

The photograph shows some species of coral.



(a) Corals can reproduce sexually, releasing sperm cells into the water.

The mass of DNA in one sperm cell from a species of coral is 0.5 picogram.

(i) Suggest the mass of DNA that would be present in an unfertilised egg cell of the same species.

(1)

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The term used to describe the number of chromosomes in an egg or sperm cell is

(1)

☒ **A** diploid

☒ **B** gamete

☒ **C** haploid

☒ **D** zygote

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The base pairs in DNA are

(1)

☒ **A** thymine with adenine, cytosine with guanine

☒ **B** thymine with guanine, adenine with cytosine

☒ **C** uracil with adenine, guanine with cytosine

☒ **D** uracil with thymine, guanine with cytosine

(iv) Name the bond that joins the base pairs together.

(1)

.....

(b) After fertilisation, mitosis takes place to form an embryo.

The embryo develops into new coral.

(i) Describe mitosis.

(3)

.....

.....

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.....

(ii) Describe how the embryo develops into new coral.

(3)

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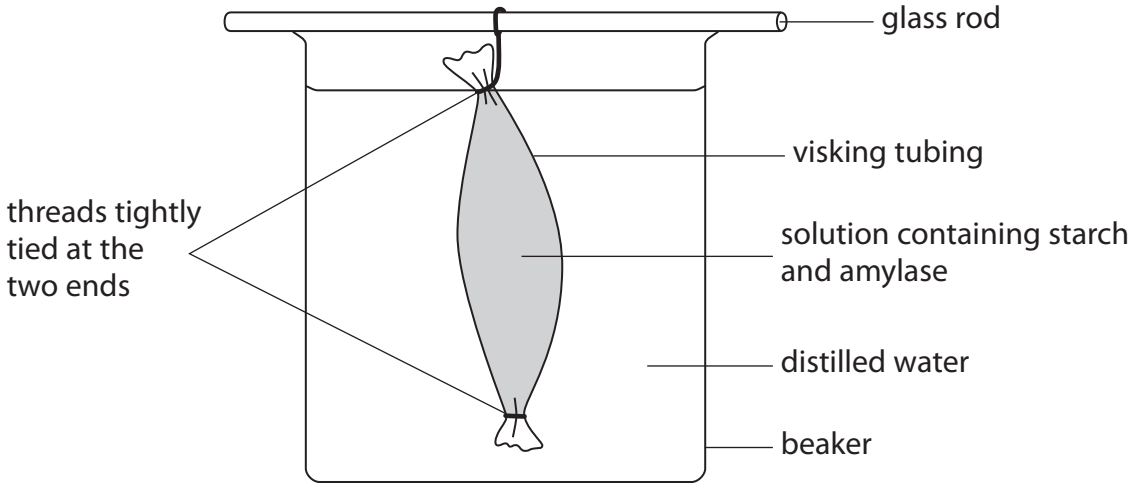
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(Total for Question 4 = 10 marks)

Using visking tubing

5 Visking tubing is made of a plastic material through which small molecules can pass.

The diagram shows how the equipment for an investigation using visking tubing was set up.



(a) In this investigation, the concentration of glucose in the distilled water was measured at the start and then every five minutes.

The results are shown in the table.

time of measuring the glucose concentration in the distilled water / mins	concentration of glucose in the distilled water / g cm^{-3}
0	0.00
5	0.07
10	0.39
15	0.52
20	0.79
25	0.79

(i) Describe the results of this investigation.

(2)

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(ii) Explain the results of this investigation.

(3)

*(iii) The diagram shows how visking tubing can be used to model the small intestine.

This model does not fully represent the structure and functions of the small intestine.

Evaluate the strengths and weaknesses of this model.

(6)

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

The function of the gall bladder is to

(1)

☒ **A** make bile

☒ **B** make lipase

☒ **C** store bile

☒ **D** store lipase

(Total for Question 5 = 12 marks)

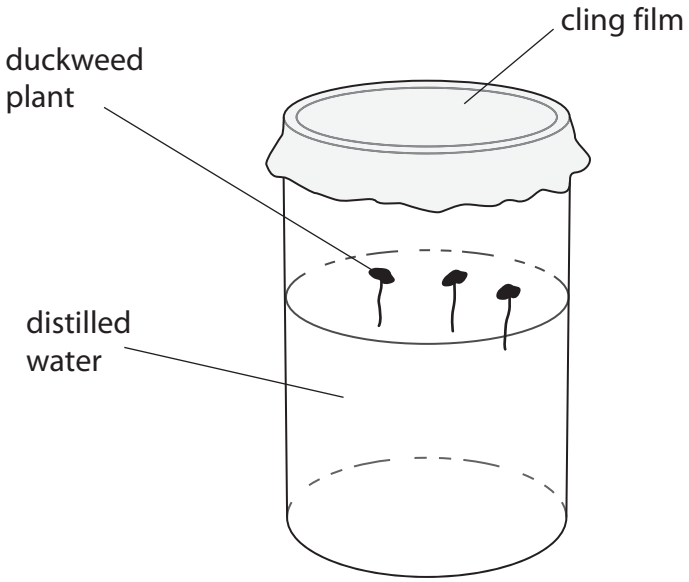
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Question 6 is on the next page

Water transport

6 The diagram shows three duckweed plants in a beaker of distilled water.



(a) (i) Explain how the water moves into these plants.

(3)

(ii) Salt was added to the water in the beaker to form a salt solution.

Explain how the salt solution would affect the movement of water into and out of the plant.

(2)

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(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

When the concentration of mineral ions in the soil is greater than in the root hair cell, mineral ions are transported into the root hair cells by

(1)

☒ **A** diffusion

☒ **B** osmosis

☒ **C** respiration

☒ **D** transpiration

*(b) Explain how water, glucose and mineral salts are transported through a plant.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2013

GCSE Biology (5BI2H)
Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- 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.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	met, val, lys met – val – lys MET VAL LYS	Accept mix of upper and lower case Accept: metvallys / metvalys Not necessary to separate the words out.	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	translation	Accept spellings such as transation, transalation reject: transcription	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	**D** ribosome		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	An explanation including **two** of the following points: • ref to specific shape (1) • to bind to substrate / form enzyme substrate complex (1) • for reaction to take place / catalysed(1) • joining together {substrates / molecules} / break down {substrates / molecules} (1) • ref to lock and key mechanism / hypothesis (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	A description including **three** of the following points: • a mutation is a change in a gene (sequence) / base pairs (1) • (change in DNA) causes a change in amino acid(s) /order of amino acids (1) • change in shape of {active site / protein / enzyme} (1) • prevent / reduce binding to substrate (1) • enzyme can no longer function / reduced function (1) • enzyme could be more effective (1)	accept change enzyme function / stops the function of the enzyme ignore: refs to denaturation	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	Any **two** of the following points: (yeast cell) • has a nucleus (1) • does not have a flagellum (1) • does not have a plasmid (1) (bacterial cell) • has chromosomal DNA / circular DNA (1) • has a capsule (1) • has a slime coat (1) • does not have mitochondria (1)	Accept: has a vacuole accept: named bacterial feature e.g pilli, small ribosome, if not labelled in yeast cell	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	does not have chloroplasts/chlorophyll	cannot photosynthesise	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	7×10^9 (-) 5×10^{10} **(1)** = (-)4.3×10^{10} or (-)43×10^9	two marks for correct bald answer accept 43 000 000 000 allow one mark for correct subtraction from wrongly selected numbers only accept the numbers in the table with a correct minus calculation	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	A description including any **two** of the following points: • involved in defence against disease / part of immune system (1) • phagocytosis (1) • antibody / antitoxin production (1)	accept: (fight pathogen / harmful microorganism / named microorganism) accept: engulf / ingest / surround /digest cells reject: make antigens ignore: refs to role of red blood cells or platelets	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	tired / lack of energy / lethargy / short of breath	anaemia /fainting / less oxygen / increased anaerobic respiration reject: references to asthma	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)	A description including **three** of the following points: • all have digits/fingers (1) • all have { similar bones /radius / ulna / carpals} (1) • all have a humerus bone (1) • pentadactyl limb (1)	accept: phalanges for fingers accept: same bone structure	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)	An explanation including **two** of the following points: • soft tissue of organisms does not form fossils (1) • some fossils are yet to be found (1) • fossils may be damaged (1) • conditions not correct for fossil formation (1) • fossils may only be fragments / not whole organisms (1)	accept: references to plant or animal tissue accept: reasons why they may not be found accept: reasons for damage e.g. earthquakes accept: named conditions e.g. pH	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c) (i)	D 9.0%		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c) (ii)	• lowered the level of carbon dioxide / carbon dioxide {removed / taken in} (1) • increased the level of oxygen / oxygen {produced / made}(1)	accept: percentage for level If CO_2 written must be correct, do not accept CO^2	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c) (iii)	Any **two** from: • large organisms {more complex/carry out greater number of functions / more cells} • for (more aerobic) respiration • for (more) energy		**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	0.5 / 0.5 picogram	Accept: 0.5 picograms accept: the same (mass) as the sperm cell	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	**C** haploid		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	**A** thymine with adenine, cytosine with guanine		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iv)	weak hydrogen bonds / hydrogen bonds / hydrogen (1)	H (bond)	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	A description including **three** of the following points: • cell divides / cell division / cell splits(1) • two cells produced (1) • (both) diploid (1) • (both) cells are genetically identical (1)	credit correct reference to stages of mitosis: DNA replication / chromosomes duplicate (1) Chromosomes line up along the equator / middle of the cell (1) chromosomes pulled to either end of cell (1) cytokinesis / cytoplasm splits (1)	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	A description including **three** of the following points: • ref (to many) cell divisions / eq (1) • growth (1) • ref to differentiation / specialisation (1) • ref to stem cells (1)	 accept: gets bigger / larger accept: become specific cells	 **(3)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	A description including the following points: • increase in concentration of glucose / glucose diffused into water/eq (1) • levels off after 20 mins / at 0.79 g/cm^3(1)	small increase, followed by greater increase / eq	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	An explanation including **three** of the following points: • starch broken down into glucose (1) • by enzymes / amylase / carbohydrase (1) • glucose passes through visking tubing / eq (1) • by diffusion (1) • down the (glucose) concentration gradient (1) • (net) diffusion stops when {all starch is broken down / concentration of glucose is equal inside and outside the tubing}	reject: references to osmosis or active transport accept: from area of high concentration to area of low concentration	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(a) (iii)**	An evaluation including some of the following points: Strengths • thin membrane • permeable membrane • presence of amylase • presence of (large) starch molecules • digestion into glucose • glucose diffuses out • concentration gradient • water represents the blood weaknesses • membrane not one cell thick • not a large surface area • shorter length / not same size • no villi /micro villi • only carbohydrate digestion • no other enzymes present • no peristalsis • no blood movement • other factors e.g. pH	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited evaluation of the model including **at least one** strength OR weakness of the model • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple evaluation of the model showing evidence of **at least one** strength AND at least one weakness of the model OR a detailed evaluation of several strengths or several weaknesses of the model • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed evaluation, commenting on **several** of the strengths AND weaknesses of the model and its limitations • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
5(b)	**C** store bile		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	A description including **three** of the following points: • into root hairs (1) • through a partially permeable membrane (1) • by osmosis (1) • down a concentration gradient (1)	 accept: through leaves (as correct for water plants) reject: active transport ignore: refs to diffusion accept: from a high concentration (of water) to a low concentration (of water)	**(3)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	An explanation including **two** of the following points: • less /slower movement of water into the plant (1) OR • more / faster movement of water out of the plant (1) • (because) less (free) water outside the plant than inside (1)	 accept: lowers concentration of water outside the plant (than inside) ORA	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(a)(iii)	**A** diffusion		**(1)**

Question Number		Indicative Content	Mark
QWC	***6(b)(ii)**	An explanation including some of the following points: water • through the xylem • capillary action • osmosis into cells in the leaf • evaporation from leaves • transpiration stream • diffusion into the atmosphere • through stomata glucose • converted to sucrose • dissolved in water • through the phloem • bidirectional mineral salts • dissolved in water • through the xylem • from root to tip	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation of the transport of one molecule e.g. water moves from roots to leaves • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation of the transport of two molecules including correct reference to at least one of the vessels phloem or xylem. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation of the transport of all three molecules with correct reference to movement through phloem and xylem • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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Edexcel GCSE

Biology/Additional Science

Unit B2: The Components of Life

Higher Tier

Friday 1 March 2013 – Morning
Time: 1 hour

Paper Reference
5BI2H/01

You must have:
Calculator, ruler

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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

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

Turn over ▶

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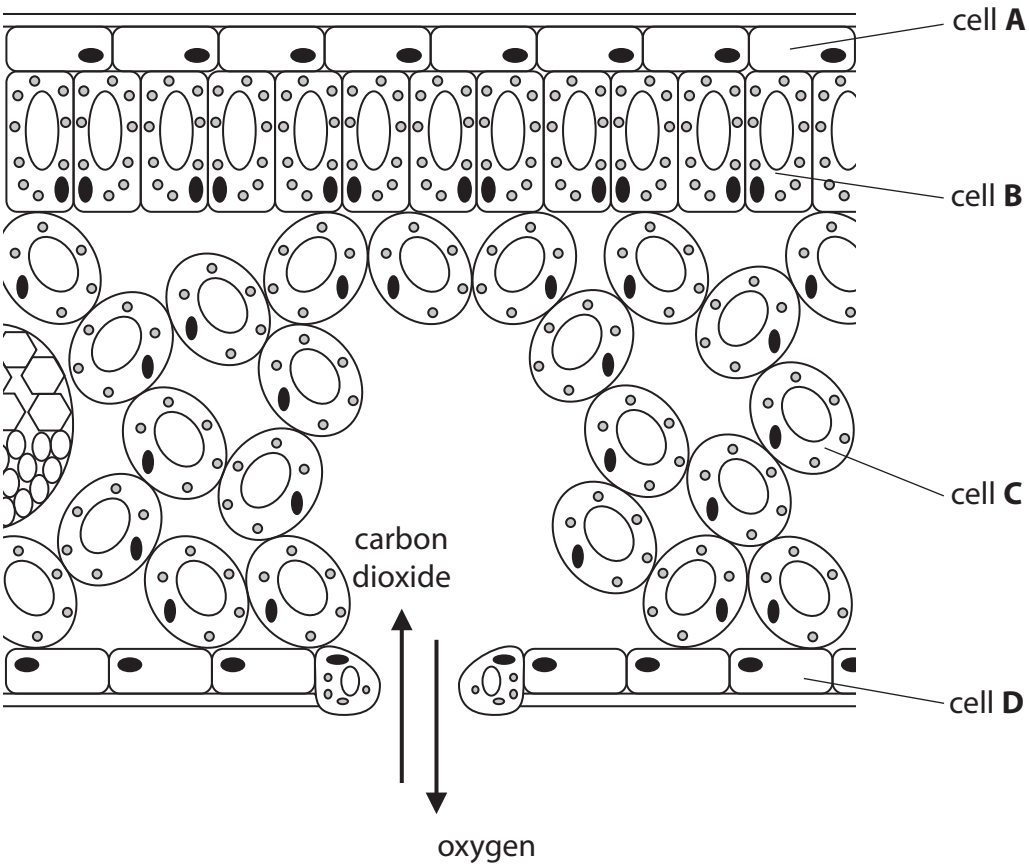
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Answer ALL questions

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 ☒.

Plant processes

1 (a) The diagram shows a section through a leaf.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The cell that will make the **most** glucose is

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

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(ii) Describe how carbon dioxide enters the leaf.

(2)

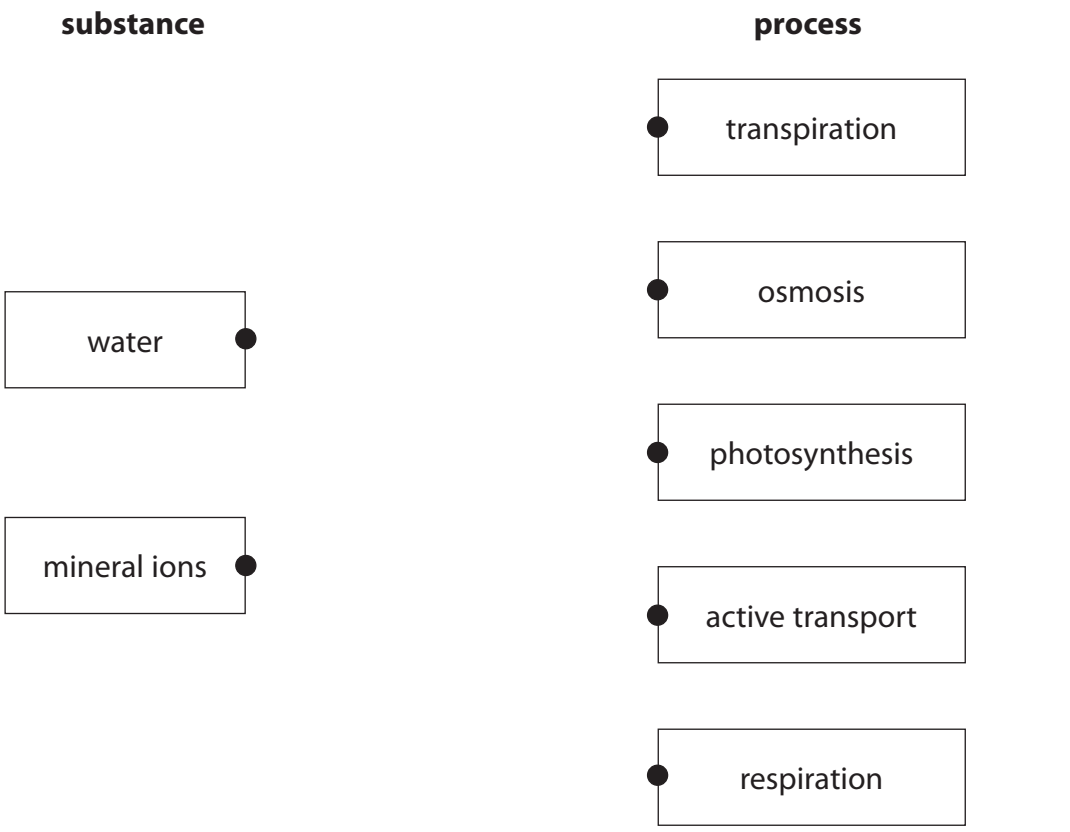
(iii) Describe the process that takes place in the leaf to produce oxygen.

(3)

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

Draw **one** straight line from each substance to the process by which it enters the root hair cell.

(2)



(Total for Question 1 = 8 marks)

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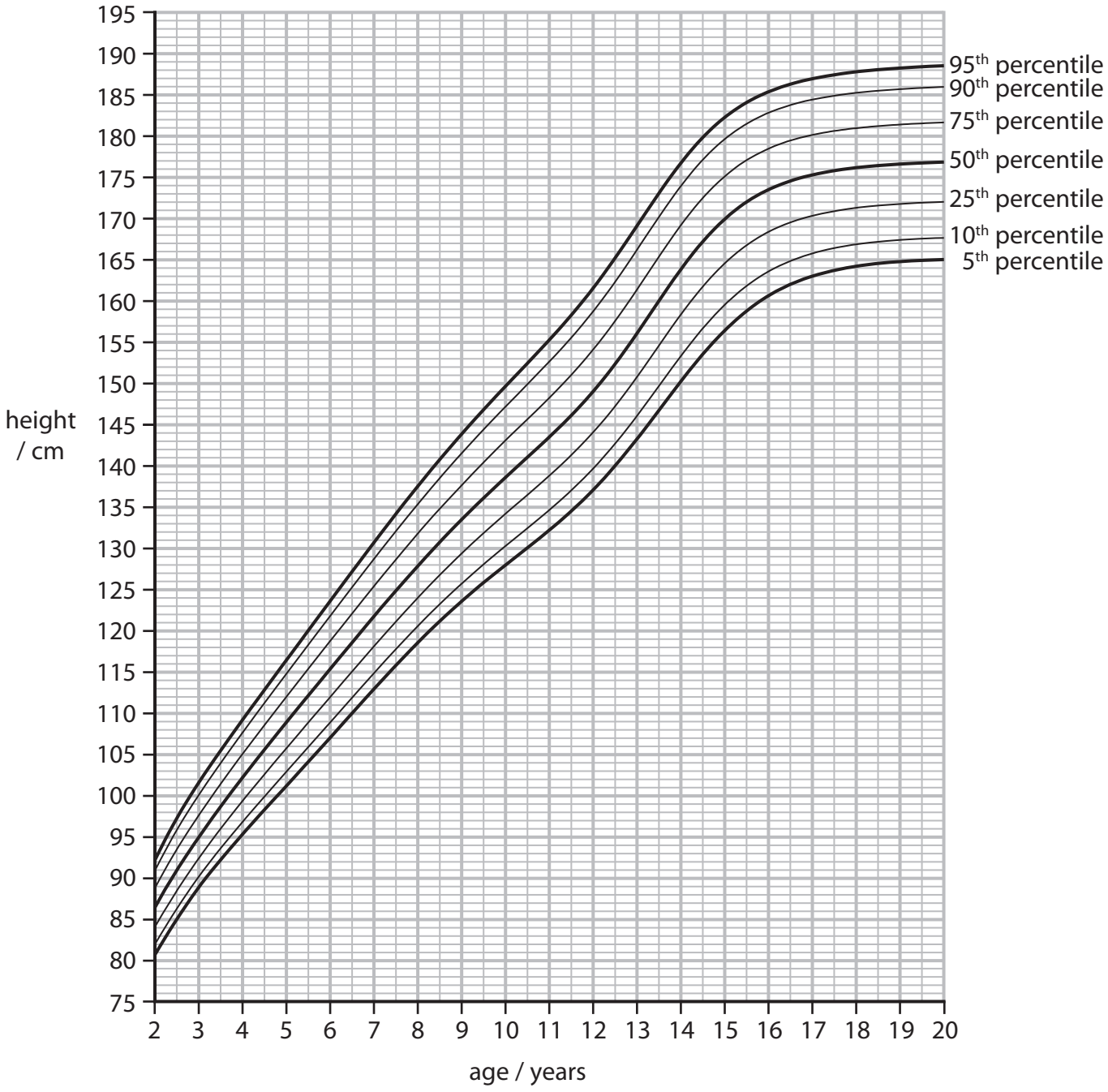
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Question 2 is on the next page

Growth

2 Height can be used to monitor growth.

(a) The graph shows a percentile chart for height for males aged between 2 and 20 years.



(i) Describe how the height of males changes from the age of 2 to 20 years.

(2)

.....

.....

.....

.....

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(ii) Calculate the difference in height of an 11 year old male in the 95th percentile and an 11 year old male in the 5th percentile.

(2)

answer = ... cm

(iii) Explain what is meant by the 95th percentile on this graph.

(2)

.....

.....

.....

.....

(b) Protein is needed for growth.

(i) Name the first stage of protein synthesis.

(1)

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The second stage of protein synthesis produces a

(1)

☒ **A** polypeptide made of amino acids

☒ **B** polypeptide made of bases

☒ **C** strand of mRNA made of amino acids

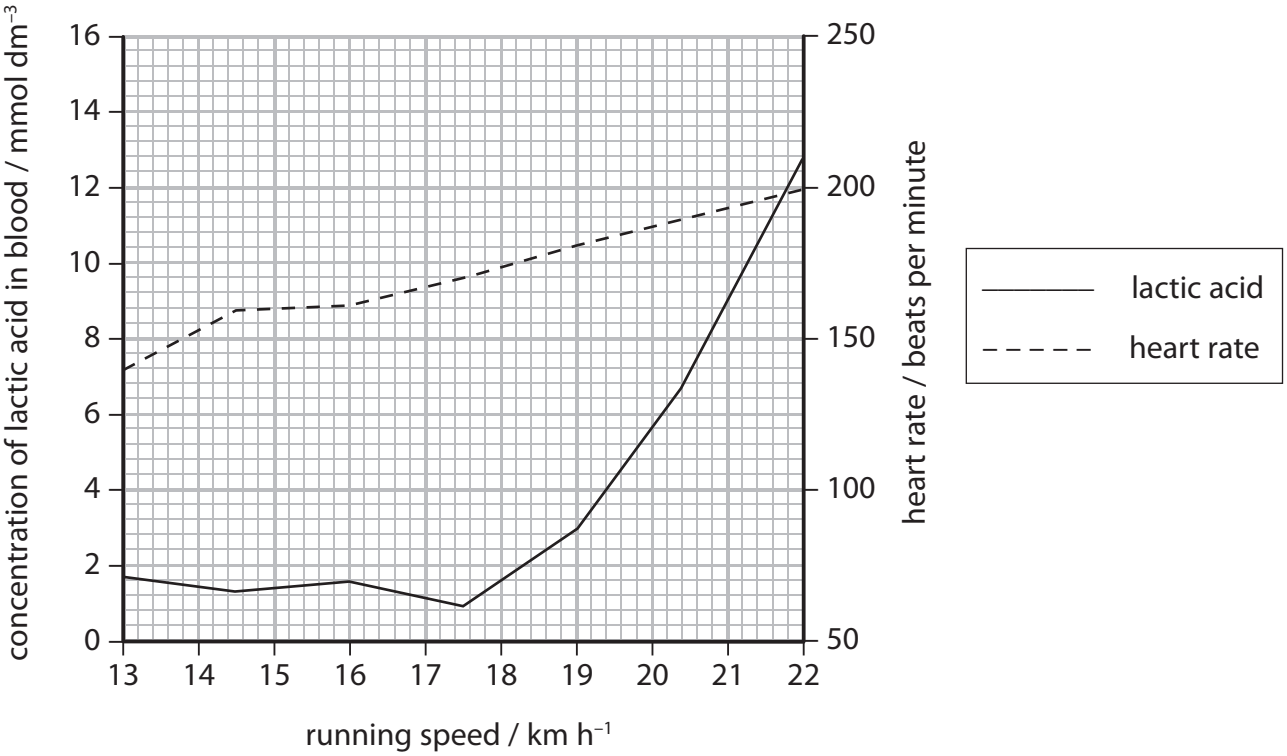
☒ **D** strand of mRNA made of bases

(Total for Question 2 = 8 marks)

Distance running

3 In an investigation, a person ran at different speeds.

(a) The graph shows the concentration of lactic acid in the blood and the heart rate of this person while running.



(i) When the running speed is 22 km h^{-1}, the stroke volume of the runner is 0.18 dm^3.

Calculate the cardiac output of the runner using the equation.

cardiac output = stroke volume × heart rate

(2)

answer = ... dm^3 per minute

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

When the heart rate is at its maximum the concentration of lactic acid in the blood is

(1)

☒ **A** 11.2 mmol dm^{-3}

☒ **B** 12.8 mmol dm^{-3}

☒ **C** 200.0 mmol dm^{-3}

☒ **D** 210.0 mmol dm^{-3}

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The graph shows that

☒ **A** as the heart rate increases the concentration of lactic acid increases

☒ **B** as the concentration of lactic acid increases the heart rate decreases

☒ **C** the concentration of lactic acid increases as running speed increases

☒ **D** the concentration of lactic acid is not dependent on heart rate

(iv) Explain why the concentration of lactic acid changes at running speeds greater than 18 km h^{-1}.

(3)

(b) After running the person rested.

Explain why the concentration of lactic acid in the blood changes whilst resting.

(3)

.....

.....

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.....

(Total for Question 3 = 10 marks)

Herbicide-resistant weeds

4 Genetic engineering can be used to produce plants that are resistant to herbicide.

One herbicide works by preventing the activity of an enzyme.

Some bacteria have a form of this enzyme that is not affected by the herbicide.

(a) Suggest how genetic engineering can be used to produce plants resistant to this herbicide.

(3)

.....

.....

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.....

(b) This herbicide is sprayed onto the leaves of plants.

Suggest which vessel could transport the herbicide from the leaf to other parts of the plant.

(1)

.....

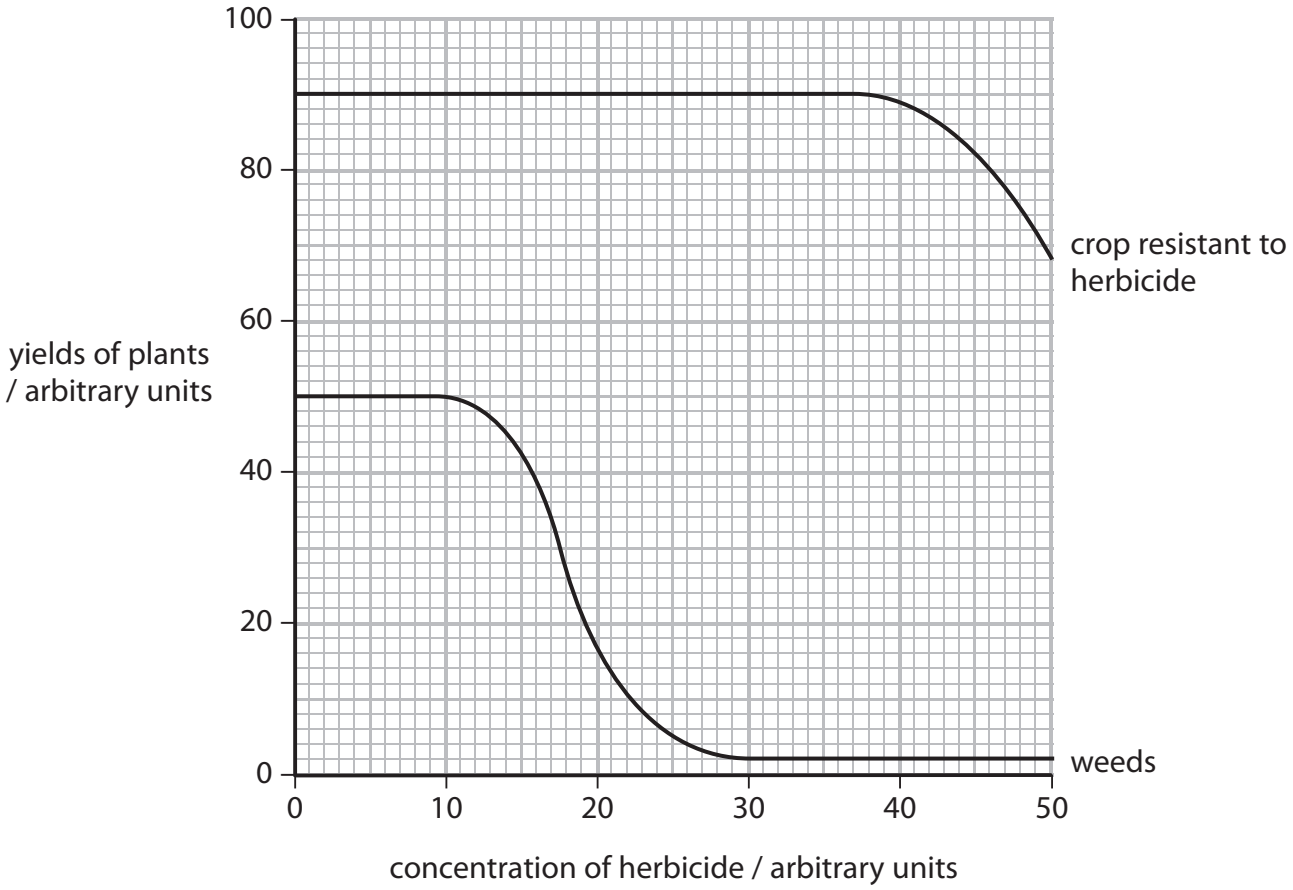
(c) Fields of crops have weeds growing in them.

In an investigation, crops resistant to a herbicide were grown in different fields.

The crops were sprayed with different concentrations of the herbicide.

The mass of the crops and weeds were recorded.

The graph shows the results of this investigation.



(i) Describe the effects of the herbicide on the yield of weeds.

(2)

.....

.....

.....

.....

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The most appropriate concentration of herbicide to use is

(1)

☒ **A** 10 arbitrary units

☒ **B** 30 arbitrary units

☒ **C** 40 arbitrary units

☒ **D** 50 arbitrary units

(d) The table shows the number of species of weeds resistant to this herbicide from 1996 to 2004.

	Year				
	1996	**1998**	**2000**	**2002**	**2004**
Number of species of weeds resistant to this herbicide	1	2	3	5	8

(i) Describe the trend shown in the data.

(1)

.....

.....

(ii) Suggest reasons for this trend.

(2)

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(Total for Question 4 = 10 marks)

Digestion

5 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

Food is moved through the digestive system by

(1)

- ☒ **A** diffusion
- ☒ **B** digestion
- ☒ **C** peristalsis
- ☒ **D** active transport

(b) State **two** roles of bile in digestion.

(2)

1 .....

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2 .....

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*(c) Describe the roles of the enzymes involved in digestion.

(6)

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(d) Explain how the structure of the villi allows efficient absorption in the small intestine.

(3)

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(Total for Question 5 = 12 marks)

DNA

6 (a) Describe how a section of DNA determines the structure of a protein.

(4)

*(b) Describe the structure of DNA, including the roles of the scientists involved in its discovery.

(6)

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Human DNA was sequenced during the Human Genome Project.

(c) Explain how the Human Genome Project has contributed to advances in medicine.

(2)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

March 2013

GCSE Biology
5BI2H/01

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Question Number	Answer	Acceptable answers	Mark
1(a)(i)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	Any two from the following: • diffusion (1) • from an area of high concentration to an area of low concentration/down a concentration gradient (1) • through stoma / stomata (1)	Accept pores / between guard cells Ignore through guard cells	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	Any three from the following: • (by) photosynthesis (1) • ref to chloroplast / chlorophyll (1) • requires carbon dioxide and water (1) • light (energy) needed (for photosynthesis)(1) • (to produce) glucose (1)	Ignore incorrect balancing of equations throughout Reject (and) respiration Accept if written on arrow in word / formula equation Accept correct formulae word / formula equation Accept if written on arrow in word / formula equation Reject energy is created / produced Accept sugar from word / formula equation	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(b)	water——————— osmosis (1)	3 lines, 1 correct = 0 mark 3 lines, 2 correct = 1 mark 4 lines, 1 correct = 0 mark 4 lines, 2 correct = 0 mark	

	mineral ions ⟍ active transport (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	• height / growth increases until 15/18 (years old) (1) • height / growth starts to level off / plateau / slows down after 15/18 (1)	Accept increases and then levels off / height increases (until 20) for 1 mark ecf on figures quoted Accept growth stops after 18	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	• 155 / 155.5 – 132 / 132.5 (cm) (1) • answer between 22 and 23.5 (cm) (1)	Two marks for correct bald answer ecf 2 marks cannot be awarded if mp 1 not correct	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	An explanation linking two points • 95% will be smaller / that height or smaller OR 5% will be taller / at that height or taller (1) • at that age (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	transcription (1)	Accept phonetic spelling	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	A		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	• (heart rate =)198 to 200 (1) • (0.18 x 198 to 200 =) 35.6 to 36 (1)	2 marks for correct bald answer ecf	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	B - 12.8 mmol dm^{-3}		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iii)	D - the concentration of lactic acid is not dependent on heart rate		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iv)	Any three from the following: • lactic acid increases / **more** lactic acid produced (as exercise increases) (1) • using more energy /muscles working / contracting harder / faster (1) • <u>aerobic</u> respiration at its maximum (rate) (1) • as oxygen not supplied fast enough / muscles not getting enough oxygen (1) • <u>anaerobic</u> respiration occurs (producing lactic acid) (1)	Accept stops Ignore breathing Accept body Accept not enough oxygen /oxygenated blood	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)	Any three from the following: • (concentration of lactic acid) decreases (1) • lactic acid broken down(1) • using oxygen / oxidised(1) • into carbon dioxide and water (1) • ref to oxygen debt / EPOC (1)	Accept amount Accept if written in a word or formula equation for MP3 and MP4	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(a)	A suggestion including any three linked points • ref to use of enzymes (1) • isolate / remove /cut out gene / DNA (for resistance)(1) • (coding for) enzyme (1) • from bacteria (1) • insertion of gene / DNA into crops / plants (1)	Any named enzyme must be in correct context. Ignore plasmids Reject replace	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)	• in the phloem (1)	Accept phonetic spelling e.g. phloem /flowem	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	A description including two of the following points • 0 to 10/11 no effect / change / difference (1) • 10/11 to 28 / 29/30 decrease in mass / yield (1) • Over 28 / 29/30 no change (1)	Accept decreases for 1 mark (if no other marks awarded) ecf throughout	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	B - 30 arbitrary units		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(d)(i)	• number of **species** increase / go up (1)	Ignore number of weeds	**(1)**

Question Number	Answers	Acceptable answers	Mark
4(d)(ii)	Suggestions including two of the following linked points • increased use of herbicide-resistant crops (1) • increased use (concentration / time) of herbicide (1) • ref to transfer of genes into weeds from other plants / cross pollination (1) • mutation(1)	Ignore ref to evolution / natural selection Ignore immune (to herbicide) Accept a description eg continued use of herbicide Accept cross breeding / reproduction / contamination	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)	**C** peristalsis		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	• neutralisation (of stomach acid) / raise pH (1) • emulsification / break down of fats (1)	Accept makes stomach / intestine contents more alkaline Accept breaks down large droplets /globules / increases surface area of fats Reject molecules broken down	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A description including some of the following points in a logical sequence Names of enzymes: • carbohydrases • named carbohydrase eg amylase • proteases • named protease eg pepsin • lipases • named lipase General points about enzyme action: • breakdown of large / insoluble / named molecules into small / soluble / named molecules • for absorption • catalysts • speeds up reactions • active sites that bind to substrate • idea of specificity Specific points: • carbohydrates/ starch are broken down • into sugars / glucose • proteins /named protein are broken down • into amino acids • fats / oils / lipids / named lipid are broken down • into fatty acids /glycerol	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of enzyme action that includes at least three points • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description of enzyme action that includes at least six points • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description of at least nine points • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
5(d)	An explanation linking three of the following points • (E) more /fast / maximises diffusion / absorption (1) • (S) microvilli (1) • (E) large surface area (1) • (S) single layer of cells / one cell thick / thin walls (1) • (E) small diffusion distance (1) • (S) capillary network / good blood supply / capillaries inside villus (1) • (E) maintains diffusion gradient (1)	To award all three marks at least one structure (S) and explanation (E) must be linked together. Award once, linked to any structure Ignore efficient (in stem) / easier Reject ref to cell wall	**(3)**

Question Number	Answer	Acceptable answers	Mark
6(a)	A description including the following linked points • ref to a gene (coding for protein)(1) • sequence of bases determines sequence of amino acids (1) • idea of one code / triplet / codon / 3 bases (for one amino acid) (1) • several amino acids make up a protein / (poly)peptide (1) • transcription / detail of transcription (1) • translation / detail of translation (1)	Accept on either DNA or RNA base pairs Accept a chain of amino acids eg mRNA made eg mRNA attached to ribosome	**(4)**

Question Number		Indicative Content	Mark
QWC	***6(b)**	A description including some of the following points in a logical sequence Points relating to DNA structural features: • two strands • double helix • (contains) bases • A, T, C, G • adenine / A paired with thymine / T • guanine / G paired with cytosine / C • hydrogen / H bonds joining bases Contributions from Scientists: • X-ray (crystallography) being used • to show helical structure • to show diameter of molecule • how base pairs are arranged was shown • how strands are arranged was shown • modelling • reference to using other people's ideas	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description that includes either: at least **three** DNA features **OR one** contribution • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description that includes at least **three** features of DNA and at least **one** contribution **OR two** features of DNA and **two** contributions. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description of the structure of DNA that includes at least **three** features and **two** contributions. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(c)	An explanation to include two of the following points linked together • genes / base sequence (on human chromosome) identified (1) • identification of faulty / mutated genes (1) • people can be tested for a genetic disorder (1) • ref to development of gene therapy (1) • idea that appropriate /early /personalised / genomic medication / counselling can be given (1)	Accept base pair sequence gene map Accept idea that genes can be linked to disease Accept diagnosis of cancer Accept a description of gene therapy	**(2)**

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Biology/Additional Science

Unit B2: The Components of Life

Higher Tier

Monday 5 November 2012 – Morning **Time: 1 hour**	Paper Reference **5BI2H/01**

You must have: Calculator, ruler	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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

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

Turn over ▶

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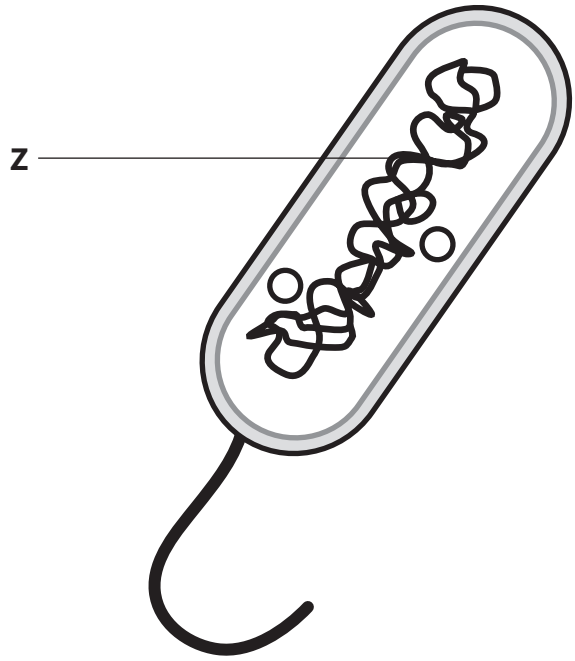
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Answer ALL questions

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 ☒.

Genetically modified (GM) organisms

1 The diagram shows a bacterial cell.



(a) What is the part of the bacterial cell labelled **Z**?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** chromosomal DNA

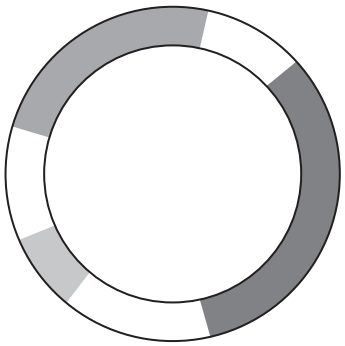
☒ **B** flagellum

☒ **C** nucleus

☒ **D** ribosome

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(b) The diagram shows a plasmid from a bacterial cell.



(i) Name **two** structures other than DNA, that bacterial cells have but animal cells do not.

(2)

(ii) Describe how the plasmid can be used to genetically modify a bacterial cell to contain a human gene.

(3)

(iii) Suggest how a named product from genetically modified (GM) bacteria can benefit humans.

(2)

(Total for Question 1 = 8 marks)

DNA

2 A DNA molecule consists of two strands coiled to form a double helix.

(a) Describe how the two strands of a DNA molecule are linked together.

(2)

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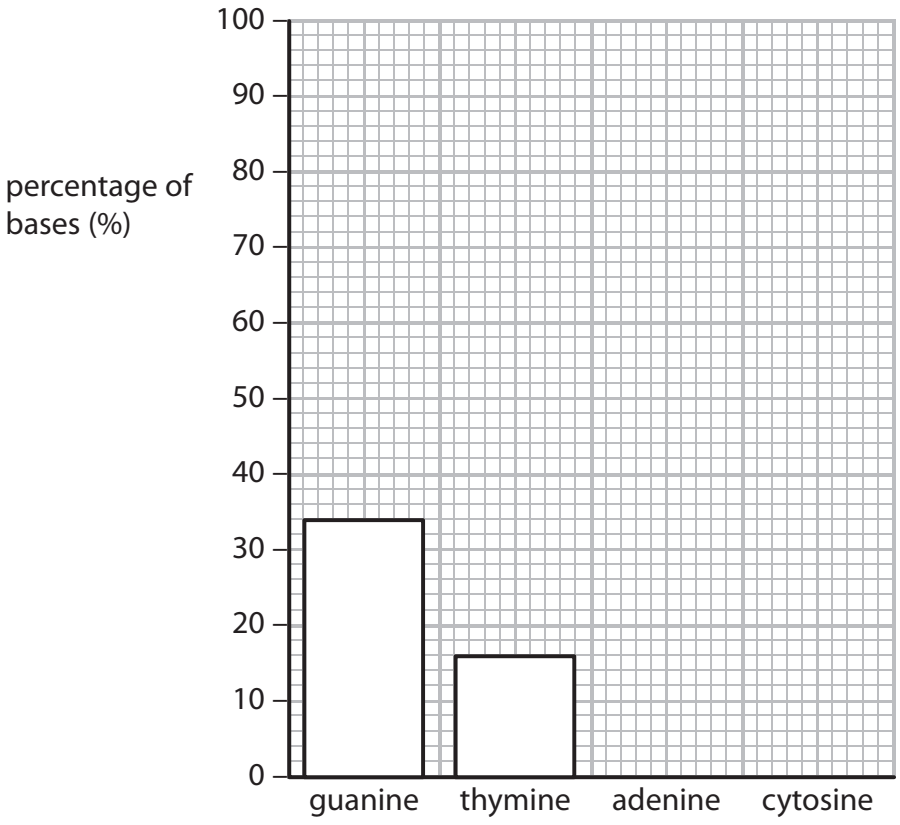
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(b) The bar chart shows the percentage of guanine and thymine in a sample of DNA.

Complete the bar chart to show the percentage of adenine and cytosine in the sample.

(2)



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(c) The diagram shows part of one DNA strand.

(i) Complete the empty boxes to show the mRNA strand coded for by this DNA strand.

(2)

DNA strand	G	G	C	T	A	G	T	T	G
mRNA strand									

(ii) State the maximum number of amino acids that are coded for by this DNA strand.

(1)

.....

(d) Name the structure where translation occurs.

(1)

.....

(Total for Question 2 = 8 marks)

Water loss in plants

3 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

Plants lose water, into the air, by a process called

(1)

☒ **A** active transport

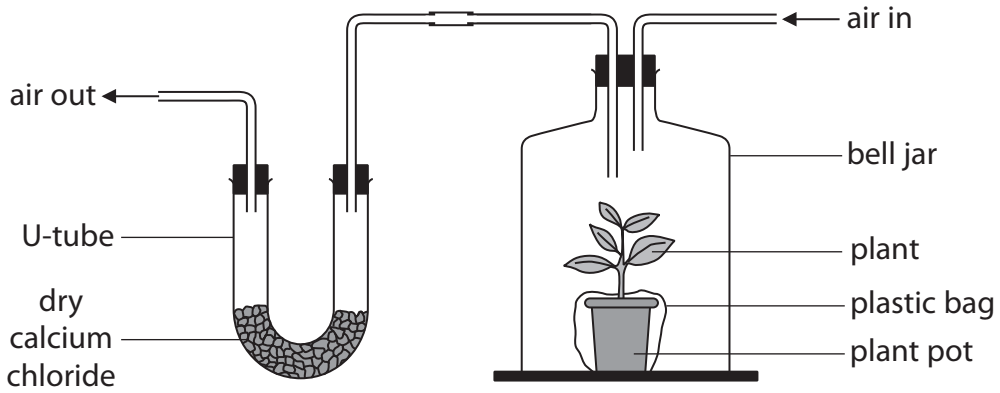
☒ **B** fertilisation

☒ **C** photosynthesis

☒ **D** transpiration

(b) An investigation was carried out to measure water loss from a plant, at four different temperatures.

The diagram shows the apparatus used.



The calcium chloride absorbs the water lost by the plant.

The table shows the results of this investigation.

temperature / °C	mass of calcium chloride / g	
	before investigation	after investigation
15	90	100
25	90	115
35	90	122
45	90	117

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(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The maximum mass of water lost from the plant in this investigation was

(1)

☒ **A** 27 g

☒ **B** 32 g

☒ **C** 117 g

☒ **D** 122 g

(ii) Describe the effect of temperature on water loss from this plant during the investigation.

(2)

(iii) Suggest why the plastic bag was placed around the plant pot during this investigation.

(2)

(c) Explain how glucose production could be affected if this plant lost a lot of water.

(2)

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(d) Describe the process that moves water from the soil into the plant.

(2)

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(Total for Question 3 = 10 marks)

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Digestive enzymes

4 The table shows some of the enzymes involved in the digestion of starch, protein and fat, in three parts of the digestive system.

part of digestive system	substance digested	enzyme	products of digestion
mouth	starch	P	simple sugars
stomach	protein	R	molecule W
small intestine	fat	S	molecules Y and Z
	starch	Q	simple sugars

(a) Complete the sentences by putting a cross (☒) in the box next to your answer.

(i) Enzyme Q is produced by the

(1)

☒ **A** large intestine

☒ **B** liver

☒ **C** oesophagus

☒ **D** pancreas

(ii) Molecules Y and Z are

(1)

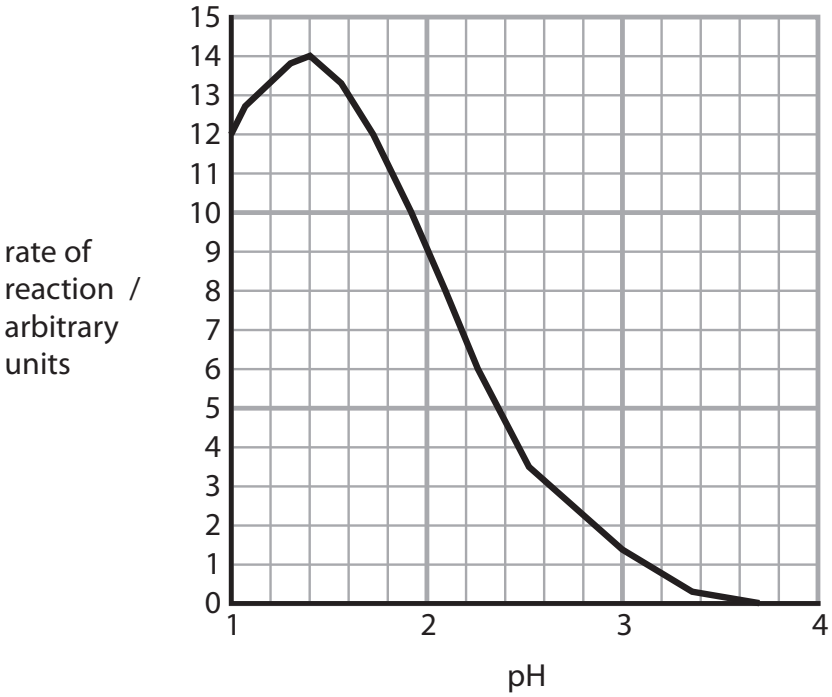
☒ **A** fatty acids and glucose

☒ **B** fatty acids and glycerol

☒ **C** lactic acid and glucose

☒ **D** lactic acid and glycerol

(b) The graph shows how pH affects the rate of the reaction catalysed by enzyme R.



(i) Name enzyme R.

(1)

.....

(ii) The rate of reaction can be determined by measuring how quickly molecule W is formed.

Name molecule W.

(1)

.....

(iii) Calculate the difference in the rate of the reaction between pH 1 and pH 2.

(2)

answer = ... arbitrary units

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(iv) Suggest why this enzyme works better at pH 1 than at pH 2.

(2)

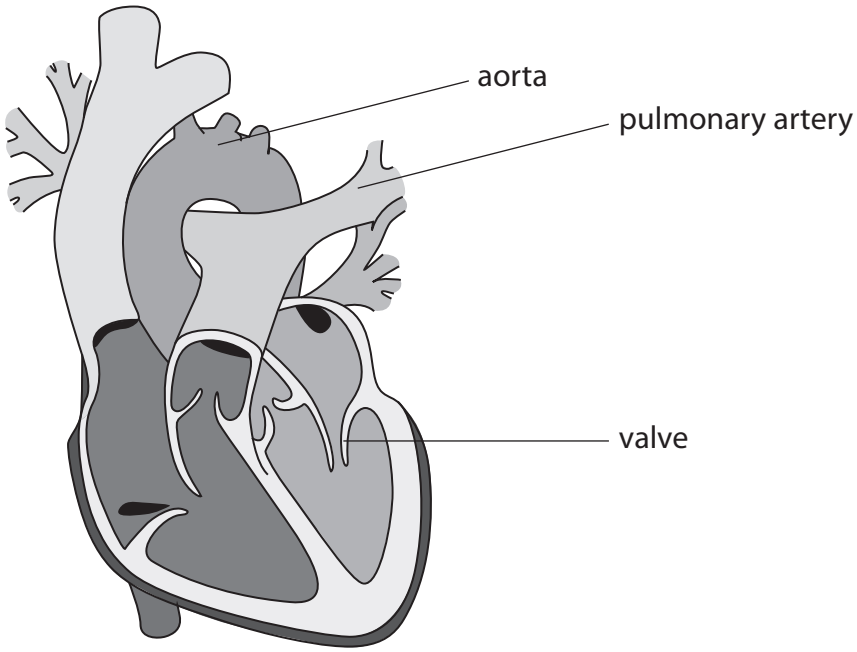
(c) Explain the roles of bile in digestion.

(2)

(Total for Question 4 = 10 marks)

The heart

5 The diagram shows a human heart.



(a) (i) Draw an arrow onto the diagram to show where oxygenated blood enters the heart.

(1)

(ii) Suggest how the blood flowing through the pulmonary artery would be different from the blood flowing through the aorta.

(2)

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(iii) Describe the role of the valve labelled on the diagram.

(2)

.....

.....

.....

.....

(b) Heart disease can significantly reduce cardiac output.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

Cardiac output is the volume of blood leaving the

(1)

☒ **A** atrium every heart beat

☒ **B** atrium every minute

☒ **C** ventricle every heart beat

☒ **D** ventricle every minute

*(ii) A reduced cardiac output would affect the performance of an athlete.

Explain the effects that a reduced cardiac output would have on the muscle cells of an athlete.

(6)

(Total for Question 5 = 12 marks)

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Question 6 is on the next page

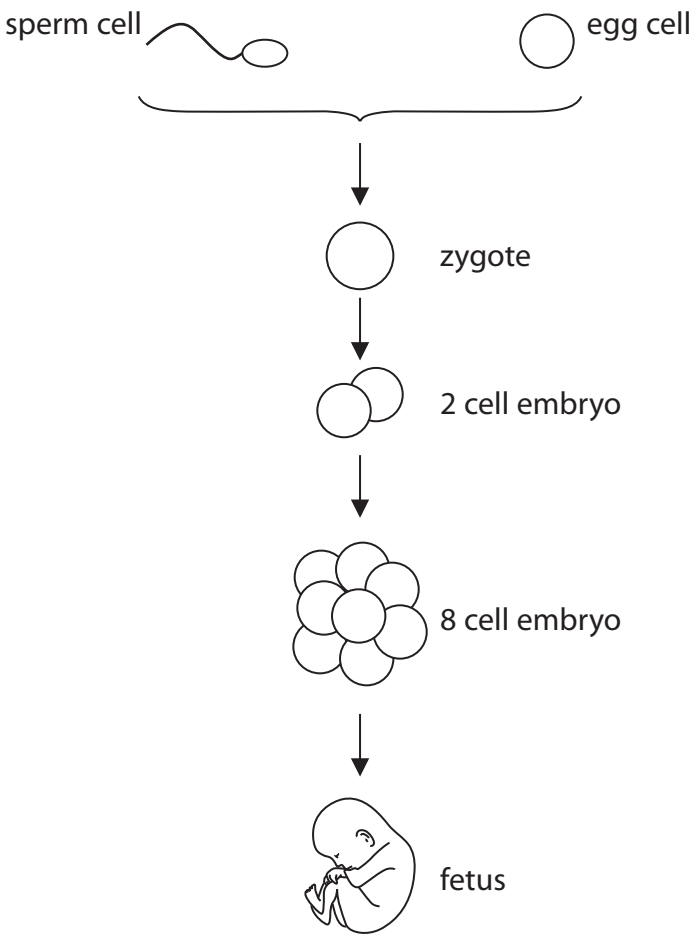
Reproduction

6 (a) Sperm cells and egg cells are needed for human sexual reproduction.

Describe in detail the type of cell division that produces sperm cells.

(4)

*(b) The diagram shows some of the stages that occur in the formation of a human fetus.



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Using the diagram and your own knowledge, describe the processes that take place in the formation of the fetus from a sperm cell and an egg cell.

(6)

(c) State **two** differences between sexual reproduction and asexual reproduction.

(2)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

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Question Number	Answer	Acceptable answers	Mark
1(a)	A – chromosomal DNA		**(1)**

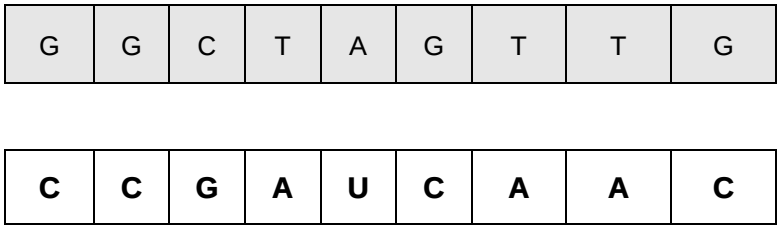
Question Number	Answer	Acceptable answers	Mark
1(b)(i)	Any **two** from the following • cell wall (1) • capsule / slime coat (1) • small ribosome (1) • pilli (1) • mesosome (1)	not membrane ignore flagellum / vacuole / DNA	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	A description including any **three** from the following • removal of (human) gene (1) • plasmid is cut / removed from bacteria (1) • using enzymes (1) • gene / DNA (from human cell) added to plasmid (1) • plasmid inserted into bacterium (1)	ignore ref to DNA being removed from plasmid	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	Any **two** from the following • to produce medicines/vaccines / hormones /insulin / clotting factors (1) • an appropriate advantage (1)	 ignore details of modification e.g. cure diseases, for diabetes, less likely to be rejected, avoids use of animals, produces large quantities, can be used by vegans Allow an appropriate advantage of golden rice	 **(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)	A description that includes two of the following • hydrogen bonds (1) • between (complementary) base pairs (1)	H bonds accept singular A and T, G and C but not the wrong pairings	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	• one bar the height of the guanine bar (34%) and one bar the height of the thymine bar (16%) (1) • bars for cytosine and adenine shown the correct way round (1)	+/- 1 square (including sketches)	**(2)**

Question Number	Answer	Mark
2(c)(i)	 [all correct = 2 marks and 1 mistake = 1 mark]	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	three / 3	**Reject** any other numbers given	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(d)	ribosome(s) / polysome(s)	**Ignore** cytoplasm **Reject** any other structure given	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)	D - transpiration		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	B – 32 g		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	A description including two of the following • it rises between the temperatures of 15(^{o}C) and 35(^{o}C) (1) • water loss decreases after 35(^{o}C) (1) • credit correct reference to figures from the table, if related to temperature (1)	ignore any explanation given, including ref to transpiration award one mark for : water loss went up and then went down eg. greatest water loss at 35(^{o}C) there is less water loss at 45(^{o}C) than at 35(^{o}C)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(iii)	A suggestion including any two from the following: • prevent evaporation/loss of water from the soil (1) • to ensure that mass of the calcium chloride only changed (due to water loss from plant) (1) • to ensure that method is valid / it is a fair test (1) • to stop the uptake of water by the soil (1)	ignore ref to water loss from pot or roots ignore accurate and reliable	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	An explanation including any two from the following: • glucose production will decrease (1) • photosynthesis will decrease (with increase in waterloss)(1) • as water is used in photosynthesis (1)	 glucose production stops photosynthesis will stop / is less efficient accept from a correct equation	**(2)**
Question Number	Answer	Acceptable answers	Mark
3(d)	A description including **two** from the following: • osmosis (1) • from high concentration to low concentration / down a concentration gradient (1) • through a partially permeable membrane (1)	 not active transport, but ignore diffusion correct references to water potential and solute potential not from where there are more water molecules semi permeable and selectively permeable	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	D - pancreas		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	B – fatty acids and glycerol		**(1)**

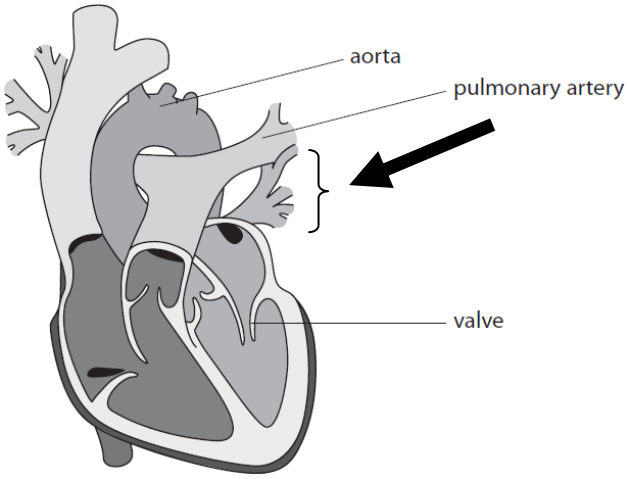
Question Number	Answer	Acceptable answers	Mark
4(b)(i)	protease / pepsin	**Reject** any other enzyme given	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	amino acid / amino acids		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	• correct values read from graph (= 12 and 9) (1) • 3 arbitrary units (1)	award 2 marks for correct answer with no working ecf ignore + and - signs	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iv)	Any **two** of the following points • at pH 2 the active site is distorted / enzyme changes shape / enzyme is denatured (1) • so less successful collisions / less enzyme substrate complexes /enzyme cannot bind to substrate (1) • optimum pH is 1.4 (1) • pH 1 is closer to the enzyme's optimum pH (1)	ignore any names of enzymes	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)	An explanation including the following points • neutralisation of stomach acid • emulsification of fats	makes intestine more alkaline breaks down fats but not into fatty acids and glycerol	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)		ignore any labels on the arrow allow an arrow coming out of the opening of pulmonary vein into heart	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	Any **two** from the following: • (blood in pulmonary artery) deoxygenated (1) • (blood in pulmonary artery) lower pressure (1)	accept reverse argument for aorta carrying less oxygen / no oxygen less force / slower	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	Any **two** from the following: • prevent backflow (1) • (from ventricle) into atrium (1)	description of backflow ignore references to left atrium and deoxygenated blood	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	D – ventricle every minute		**(1)**

Question Number		Indicative Content	Mark
QWC	***5(b)(ii)**	A description including • there will less blood flow (to the muscles) • because less blood leaving the heart • less oxygen (reaching muscle) • less glucose (reaching muscle) • reduced rate of aerobic respiration • less energy released • less carbon dioxide removed • greater rate of anaerobic respiration • glucose broken down without oxygen • reduced muscle contraction • build up of lactic acid (in muscle cells) • causing cramp / fatigue	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of 2 effects of reduced cardiac output on muscle • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description of 4 or more effects of reduced cardiac output on muscle, but some steps maybe missing or out of sequence • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description of 6 or more effects of a reduced cardiac output on muscle, with the sequence largely in order and complete • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)	A description including four of the following points • ref to meiosis (1) • 4 cells produced (from one parent cell) (1) • haploid (cells) / cells have half the number of chromosomes (1) • cells are genetically different (1)	do not accept if there is a 't' cells have one set of chromosomes / 23 chromosomes	**(4)**

Question Number		Indicative Content	Mark
QWC	***6(b)**	A description including • fertilisation of egg by sperm • ref to fusion of nuclei • forming diploid cell • ref to zygote • (zygote) divides by mitosis • to form identical cells • several mitotic divisions • growth of foetus • examples of how fetus grows eg in height, mass • stem cells in embryo • specialisation / differentiation of (stem) cells into different cell types • examples of different cell types eg neurones, skin cells • development of fetus	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description including 2 or more comments about one process • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description including 2 or more comments on 2 processes • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description including 2 or more comments on all 3 processes • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(c)	Any **two** from the following: • sexual reproduction involves two parents but asexual reproduction only involves one (organism / parent / cell) (1) • sexual reproduction needs gametes / sex cells but asexual reproduction does not (1) • sexual reproduction produces genetically different organisms but asexual reproduction produces genetically identical offspring / clones (1)	ignore any reference to meiosis or mitosis sexual reproduction results in variation but asexual reproduction does not	**(2)**

T

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Edexcel GCSE

Biology/Additional Science

Unit B2: The Components of Life

Higher Tier

Tuesday 15 May 2012 – Morning
Time: 1 hour

Paper Reference
5BI2H/01

You must have:
Calculator, ruler

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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

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

Turn over ▶

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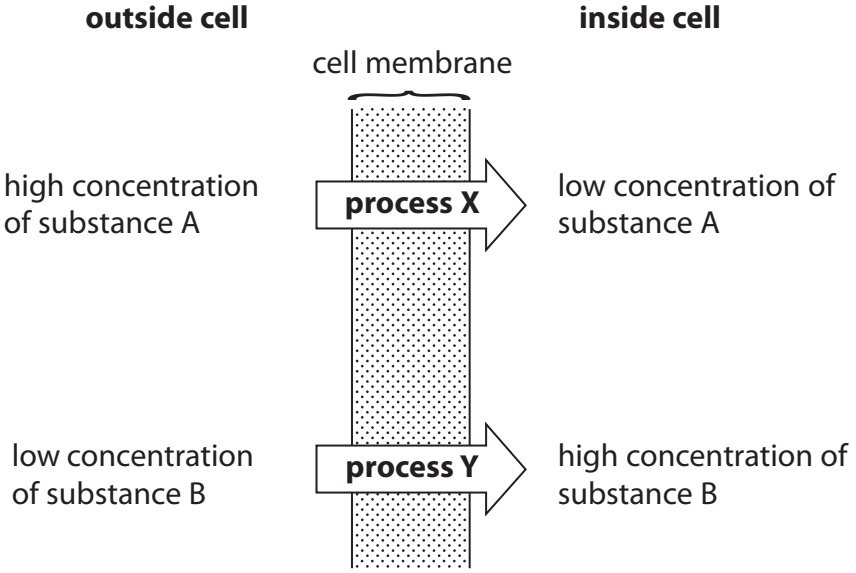
Answer ALL questions

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 ☒.

Cell transport mechanisms

1 (a) Substances in the soil are taken up by plant root hair cells.

The diagram shows the direction of movement of two substances A and B across the cell membrane of a root hair cell.



(i) Name **process X**.

(1)

.....

(ii) Name **process Y**.

(1)

.....

(iii) Mineral ions are taken up by the root hair cells of plants.

Name the type of vessel that transports these mineral ions through the plant.

(1)

.....

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(b) A student investigated osmosis in a courgette.

The photograph shows a courgette.

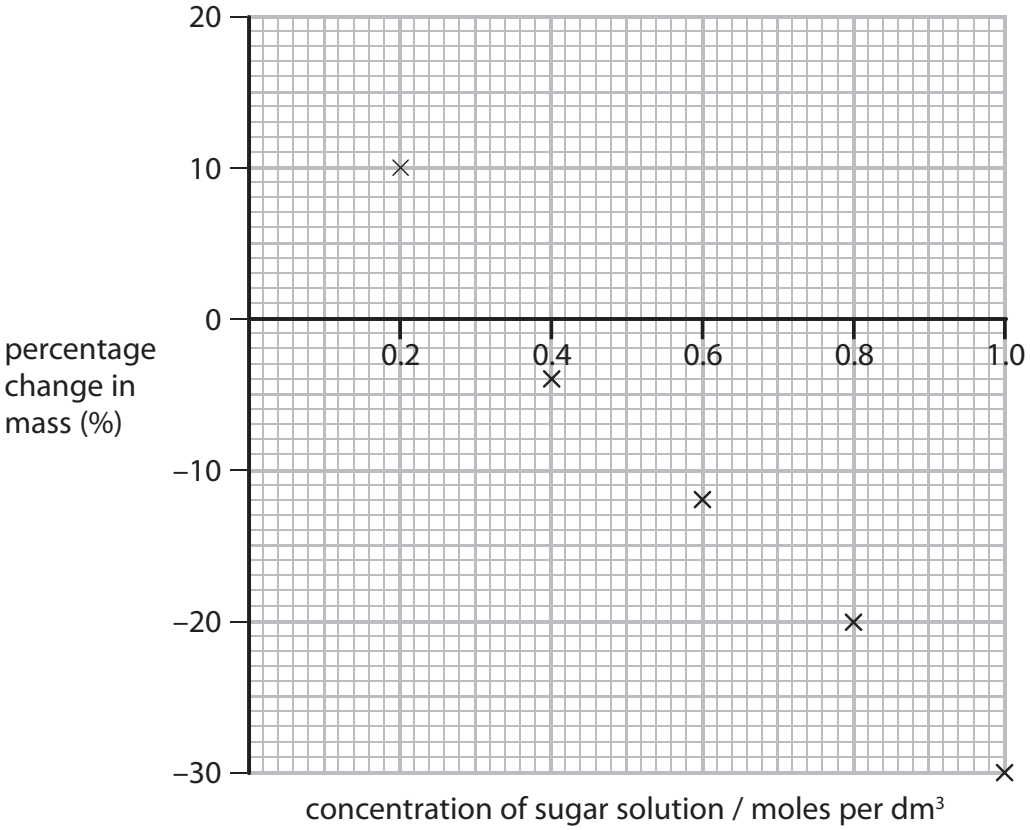


The student weighed pieces of courgette and placed them in five different concentrations of sugar solution.

After one hour she dried and reweighed the pieces of courgette.

She calculated the percentage change in mass.

The graph shows the results of this investigation.



(i) Draw a line of best fit on the graph.

(1)

(ii) Use your line of best fit to estimate the concentration of sugar solution that would result in no change in mass.

(1)

estimate = ... moles per dm^3

(iii) Explain why there was an increase in the mass of the courgette in the sugar solution at 0.2 moles per dm^3.

(3)

.....

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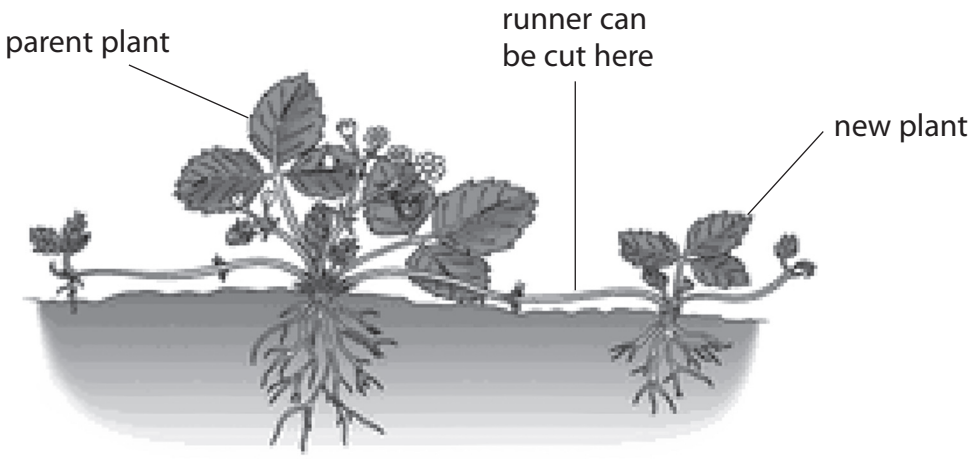
(Total for Question 1 = 8 marks)

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Producing new strawberry plants

2 Strawberry plants grow runners and new strawberry plants develop along the runners. The new plants are genetically identical to the parent plant.

The diagram shows the parent plant with new plants attached to runners.



(a) (i) Name the type of cell division that results in the production of these new plants.

(1)

.....

(ii) Farmers cut the runners and sell the new plants.

Suggest advantages of producing new strawberry plants in this way.

(2)

.....

.....

.....

.....

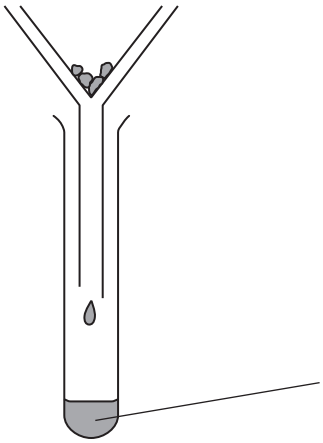
(b) Some students extracted DNA from strawberries.
The diagram shows the method used.

stage 1



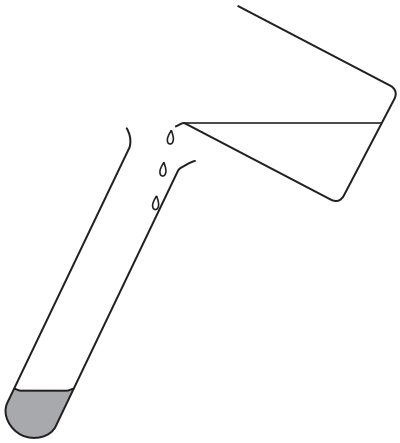
grind strawberry in soapy water

stage 2



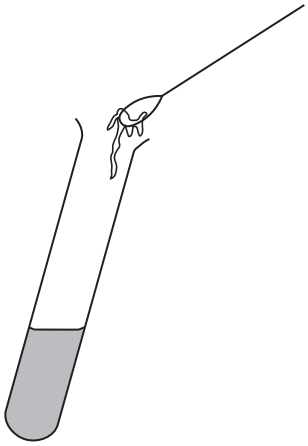
filter mixture into a boiling tube

stage 3



slowly pour ice cold ethanol into the strawberry filtrate

stage 4



remove DNA with a wire loop

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Suggest the purpose of stages 1 and 3 in the DNA extraction.

(2)

stage 1 .....

.....

.....

stage 3 .....

.....

.....

(c) A short section of DNA from a strawberry is shown in the diagram.



(i) How many codons are shown in this section of DNA?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** 2

☒ **B** 3

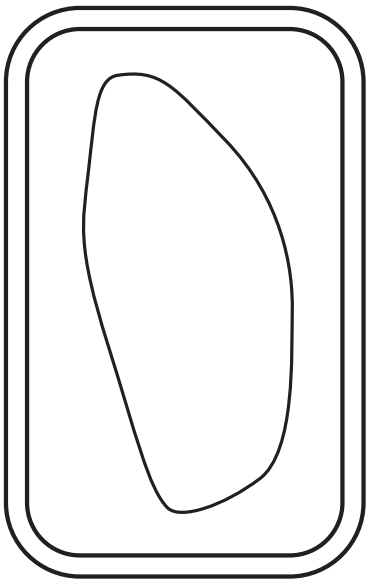
☒ **C** 4

☒ **D** 12

(ii) This DNA is found in a structure within a cell of a strawberry plant.

On the diagram of a plant cell, draw and name the structure containing DNA.

(2)



(Total for Question 2 = 8 marks)

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Probiotic bacteria

3 The digestive system is made up of a number of different organs.

(a) Define the term **organ**.

(1)

.....

.....

(b) (i) How many of the statements are correct?

- The low pH of the stomach kills bacteria.
- The low pH of the stomach provides optimum conditions for pepsin activity.
- The pH of the stomach is low so that acid digests protein.

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** none

☒ **B** 1

☒ **C** 2

☒ **D** 3

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Protein is broken down to form

(1)

☒ **A** amino acids

☒ **B** fatty acids

☒ **C** glucose

☒ **D** glycerol

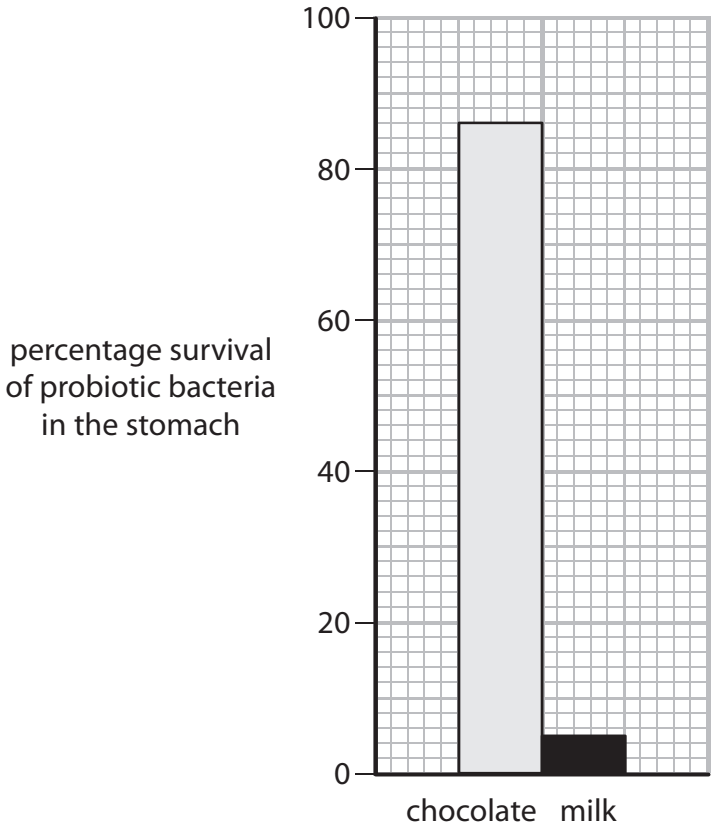
(c) Explain how the structure of villi allows efficient absorption of the soluble products of protein digestion.

(4)

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(d) Probiotic bacteria are thought to be beneficial to health.
Probiotic bacteria can be consumed in chocolate and milk.

The graph shows the percentage survival of probiotic bacteria in the stomach.



(i) The total number of live bacteria in the chocolate was five million.

Calculate the number of live bacteria from the chocolate that survived in the stomach.

(2)

answer = ...

(ii) Suggest a reason for the survival differences of probiotic bacteria in chocolate compared with probiotic bacteria in milk.

(1)

.....

.....

(Total for Question 3 = 10 marks)

Fitness Training

4 The volume of blood that the heart pumps with every beat is known as the stroke volume.
Stroke volume can be used to indicate fitness level.

The table gives information about the stroke volume, heart rate and cardiac output of an athlete at rest and during exercise.

athlete	stroke volume / dm^3	heart rate / beats per minute	cardiac output / $dm^3\ min^{-1}$
at rest	0.1	53	5.3
during exercise		182	30.4

(a) Calculate the stroke volume of the athlete during exercise.

(2)

answer = ... dm^3

(b) Explain why it is important that the cardiac output of the athlete increases during exercise.

(3)

.....

.....

.....

.....

.....

.....

(c) Describe how the circulatory system transports substances around the body.

(2)

.....

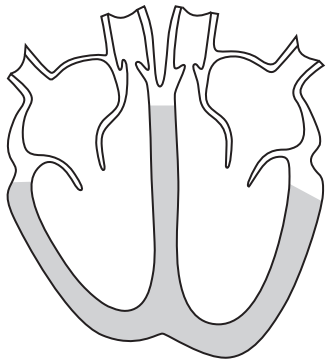
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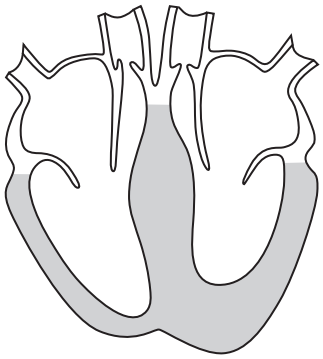
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(d) The diagrams below show a healthy heart and a heart with a condition known as hypertrophic cardiomyopathy (HCM).



healthy heart



hypertrophic cardiomyopathy

A symptom of HCM is that contraction of the heart muscle is more difficult.

Suggest the effects HCM may have on an athlete during competitive sport.

(2)

.....

.....

.....

.....

(e) Some athletes, such as sprinters, use energy from anaerobic respiration.

Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Anaerobic respiration produces

- ☒ **A** carbon dioxide
- ☒ **B** glucose
- ☒ **C** lactic acid
- ☒ **D** oxygen

(Total for Question 4 = 10 marks)

Cloning

5 In May 2011, the Food Standards Agency stated that meat and milk produced from cloned animals should be allowed to go on sale to the public.

(a) (i) Describe the risks associated with cloning mammals.

(3)

*(ii) A cloned animal contains genetic information that is identical to its parent.

Describe the stages in the production of a cloned mammal.

(6)

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(b) (i) Fertilisation takes place during sexual reproduction to produce genetically different offspring.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Fertilisation occurs when

(1)

☒ **A** diploid gametes combine to produce a diploid zygote

☒ **B** diploid gametes combine to produce a haploid zygote

☒ **C** haploid gametes combine to produce a diploid zygote

☒ **D** haploid gametes combine to produce a haploid zygote

(ii) Genetically different organisms contain different DNA codes that produce different proteins.

Describe the process that takes place in the nucleus during the first stage of protein synthesis.

(2)

.....

.....

.....

.....

(Total for Question 5 = 12 marks)

Cells

6 There are many different types of cell in the human body.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

An embryonic stem cell can

(1)

- ☒ **A** differentiate into any type of cell
- ☒ **B** differentiate into only one type of cell
- ☒ **C** only be obtained from embryos
- ☒ **D** only produce haploid cells

(b) Describe how the structure of a red blood cell is related to its function.

(3)

(c) Describe the function of platelets.

(2)

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*(d) Mitosis and meiosis are types of cell division.

Compare these two types of cell division.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2012

GCSE Biology
5BI2H/01

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GCSE Biology 5BI2H/01 Mark Scheme – Summer 2012

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	diffusion / osmosis		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	active transport	active transportation	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	xylem	xylem vessel / tube(s)	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	reasonable straight line drawn through all points, must be drawn with a ruler, must have at least one point on either side of the line	lines drawn to include zero value are not correct reject two lines drawn reject point to point lines ignore extrapolation to y axis	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	reading from their graph at the point that line crosses x axis / 0.3M +/- half square tolerance	ecf from 1(b)(i)	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	An explanation linking the following points in a logical order: • ref to (increase in mass due to) {osmosis / movement of water / absorption of water} (1) • water into the cell (1) • ref to higher concentration of water outside of the courgette (1) • water across (cell) membrane / cell wall (1)	**Ignore** movement of sugar correct ref to sugar concentration ORA	**(3)**

Question Number	Answer	Acceptable answers	Mark
2 (a)(i)	mitosis	any reasonable phonetic spelling provided there is a 't' ignore asexual reproduction	**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (a)(ii)	Any two from the following: • same characteristics in offspring as parent plant /best characteristics inherited / clones produced / identical (1) • easier to generate new plants/propagate (1) • quicker to produce new plants (1) • cheap /idea that the plants will not run out / no need to buy new plants / seeds (1)	Accept same as parent plant	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	<u>Stage 1</u> • to break open cells/release cell contents / release DNA /dissolve proteins (1) <u>Stage 3</u> • to precipitate DNA from the solution/to separate DNA (from other components)/ (1)	Accept break down cell membrane / cell wall Accept to make DNA visible ignore refs to freezing the DNA	**(2)**

Question Number	Answer	Acceptable answers	Mark
2 (c)(i)	**C** 4		**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (c)(ii)	• location drawn anywhere in cytoplasm (1) • correct name - nucleus (1)	chloroplast / mitochondria NB these are stand alone mark points	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	a group of (different) tissues	(different) types of tissue (working together)	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	**C** 2		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	**A** amino acids		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)	An explanation linking **four** of the following points • microvilli (1) • large surface (area) (1) • single layer of cells / thin walls / small diffusion distance (1) • capillary network / good blood supply / capillaries within villus (1) • maintains diffusion gradient (1) • increased / fast / maximises diffusion / absorption (1)	Accept - easier / efficient	**(4)**

Question Number	Answer	Acceptable answers	Mark
3(d)(i)	• 86 (%) / 0.86 (1) • correct answer = 4.3 million / 4 300 000 (1)	ecf Accept bald correct answer for 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)(ii)	Any **one** from • chocolate is thicker / solid / chocolate digested slower (1) • idea of different type of (probiotic) bacteria (1) • more bacteria in the chocolate (initially) (1) • more sugar/ nutrients in the chocolate (1)	ORA	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)	• evaluation (1) 30.4 ÷ 182 • Correct answer (1) 0.167 / 0.17 / 0.2 (dm^3)	give full marks for bald correct answer, no working ecf allow correct answer with full number of decimal points 0.1670329	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)	An explanation linking three of the following points: • muscles working harder / contract faster (1) • need more energy (1) • (aerobic) respiration (1) • more / enough / faster delivery oxygen (1) • more / enough / faster glucose (to muscles / body) (1) • more / faster removal of carbon dioxide (1)	Ignore references to anaerobic respiration	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)	A description including two of the following points: • arteries / aorta transport blood away from heart (1) • veins / vena cava transport blood to the heart (1) • capillaries exchange / pass materials / named substance with tissues / cells (1) • substances carried in plasma / oxygen carried in red blood cells (1) • credit correct description of passage of blood through heart (1)	Ignore references to heart beating faster	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)	Any two from the following: • less blood / not enough leaving heart / going round body (1) • less oxygen (to the body) (1) • fatigue/breathlessness/ faint / cannot run as fast (1) • cramps / lactic acid build up / anaerobic respiration (1)	Ignore references to heart beating faster / heart attacks and death Accept less oxygenated blood Accept tired / less energy	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(e)	**C** lactic acid		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	A description including **three** the following points: • (cloned animals) tend to be larger at birth / body organs /named organ enlarged (1) • embryo rejected/fails to develop normally/many cloned mammals failed to develop (1) • (cloned animals) early death /speeds up aging (1) • narrowing of the gene pool / less (genetic) variation (1) • genetic disorders / defects (1) • susceptible to same diseases / pathogen (1)	Ignore answers related to the meat/food product /ethics	**(3)**

Question Number		Indicative Content	Mark
QWC	***5 (a) (ii)**	A description including • use of body cell • nucleus removed from body / parent cell • use of egg cell • nucleus removed from egg cell/enucleated egg • nucleus (from body cell) transferred to enucleated egg • electric shock; • to stimulate cell division • mitosis • formation of embryo; • embryo implanted • into surrogate	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• Limited description of 2 of the stages involved in cloning and the sequence of events is confused • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description of 3 or more of the stages involved in cloning but some of the steps may be missing or out of sequence • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description of 5 or more of the stages involved in cloning but the sequence is largely in order and complete • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	**C** haploid gametes combine to produce a diploid zygote		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	A description including **two** of the following • transcription (1) • DNA unzips (1) • (formation of) mRNA (1) • complementary to / copy of DNA / DNA acts as a template (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
6(a)	**A** differentiate into any type of cell		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	Any **two** structures from the list with at least **one** matched adaptation: Structures (maximum of 2) • biconcave shape (1) • no nucleus (1) • thin membrane (1) • flexible / small (1) • contains haemoglobin (1) (matched) adaptation (maximum of 2) • large surface area / increase oxygen uptake (1) • to increase amount of haemoglobin / oxygen-carrying capacity (1) • so short distance for diffusion (1) • to get through capillaries (1) • to bind oxygen (1)		**(3)**

Question Number	Answer	Acceptable answers	Mark
6(c)	A description including **two** of the following points • clotting / to seal a wound / scab formed (1) • stop bleeding (1) • prevent infection / entry of microbes (1) • fibrin (1)		**(2)**

Question Number		Indicative Content	Mark
QWC	***6d**	A comparison between mitosis and meiosis including **Mitosis** • (genetically) identical cells produced • two daughter cells • one division • diploid daughter cells • identical set of chromosomes • occurs in the formation of body cells • for growth and repair (of body tissues) **Meiosis** • (genetically) non-identical cells • four daughter cells • 2 divisions • haploid daughter cells • half the number of chromosomes • occurs in the formation of gametes • for sexual reproduction • results in genetic variation	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description including two points on either meiosis or mitosis there maybe confusion between the two but this does not negate the level • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description including one comparison of meiosis and mitosis or a detailed description of either mitosis or meiosis • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed comparison of both meiosis and mitosis – at least two correct comparisons made • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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