AQA GCSE BIOLOGY (4401)

BIOLOGY



EXAM QUESTION PACK

UNIT B3 HIGHER TIER BL3HP PAPERS

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AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
Biology

H

Higher Tier Unit Biology B3

Friday 10 June 2016 Morning Time allowed: 1 hour

Materials
For this paper you must have:
- a ruler.

You may use a calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 3 should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

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Do not write outside the box

Answer **all** questions in the spaces provided.

1 Cells, tissues and organs are adapted to take in different substances and get rid of different substances.

Table 1 shows the concentration of four ions outside cells and inside cells.

Table 1

Ion	Concentration outside cells in mmol per dm^3	Concentration inside cells in mmol per dm^3
Sodium	140	9
Potassium	7	138
Calcium	2	27
Chloride	118	3

1 (a) Use information from **Table 1** to complete the following sentences.

[2 marks]

Sodium ions will move into cells by the process

of _____ .

Potassium ions will move into cells by the process

of _____ .

1 (b) Some students investigated the effect of the different concentrations of sugar in four drinks, **A**, **B**, **C** and **D**, on the movement of water across a partially permeable membrane.

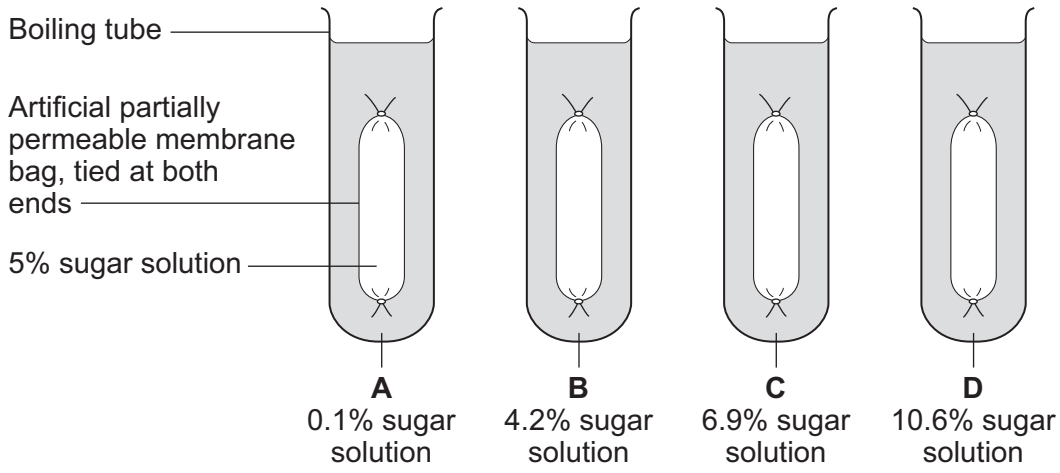
The students:

- made four bags from artificial partially permeable membrane
- put equal volumes of 5% sugar solution in each bag
- weighed each bag containing the sugar solution
- placed one bag in each of the drinks, **A**, **B**, **C** and **D**
- after 20 minutes removed the bags containing the sugar solution and weighed them again.

Do not write outside the box

Figure 1 shows how they set up the investigation.

Figure 1



1 (b) (i) The bag in drink **A** got heavier after 20 minutes.

Explain why.

[3 marks]

1 (b) (ii) In which drink, **A**, **B**, **C** or **D**, would you expect the bag to show the smallest change in mass?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

1 (b) (iii) Explain why you think the bag you chose in part **(b)(ii)** would show the smallest change.

[2 marks]

8

Turn over ▶

Do not write outside the box

2 (a) Carbon dioxide enters a plant through stomata on the leaves.

Name the cells that control the size of the stomata.

[1 mark]

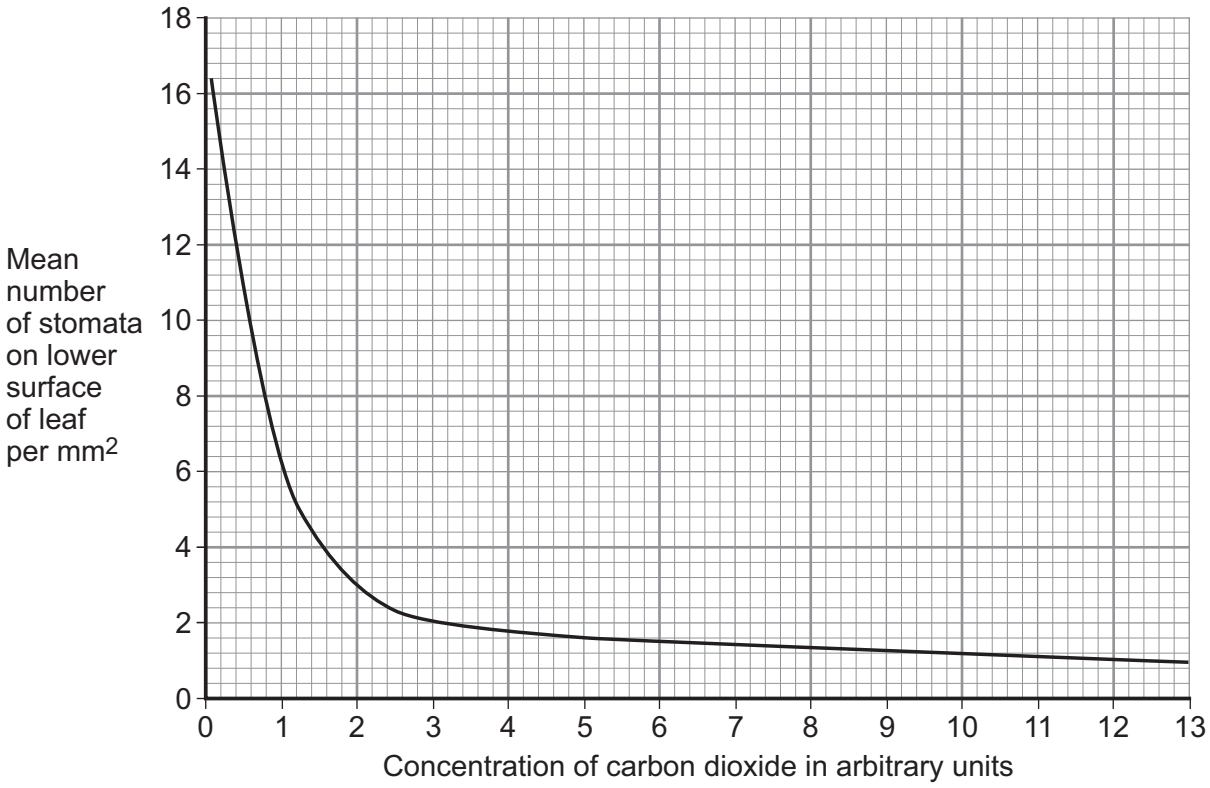
_____

2 (b) Scientists grew tomato plants in air containing different concentrations of carbon dioxide.

The scientists recorded the number of stomata found on the lower surface of the leaves of plants grown at each carbon dioxide concentration.

Figure 2 shows the results.

Figure 2



Do not write outside the box

2 (b) (i) Describe the relationship between the mean number of stomata per mm^2 and carbon dioxide concentration.

[2 marks]

2 (b) (ii) Suggest a reason for the relationship you described in part **(b)(i)**.

[1 mark]

2 (c) (i) Suggest **one** disadvantage to a plant of having a large number of stomata per mm^2 on each leaf.

[1 mark]

2 (c) (ii) Suggest **one** environmental condition where a large number of stomata per mm^2 on each leaf would be a disadvantage.

[1 mark]

6

Turn over for the next question

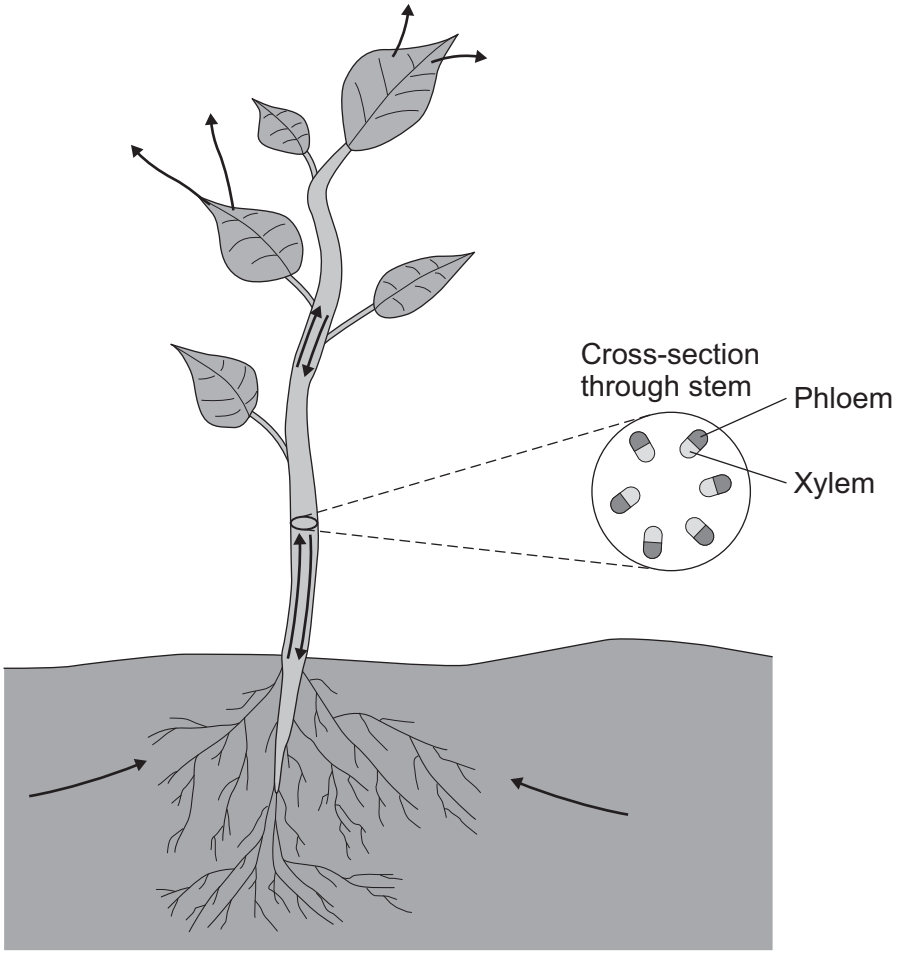
Do not write outside the box

3 **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Plants transport many substances between their leaves and roots.

Figure 3 shows the direction of movement of substances through a plant.

Figure 3



Do not write outside the box

Describe how **ions**, **water** and **sugar** are obtained and transported through plants.

In your answer you should refer to materials moving upwards in a plant and to materials moving downwards in a plant.

[6 marks]

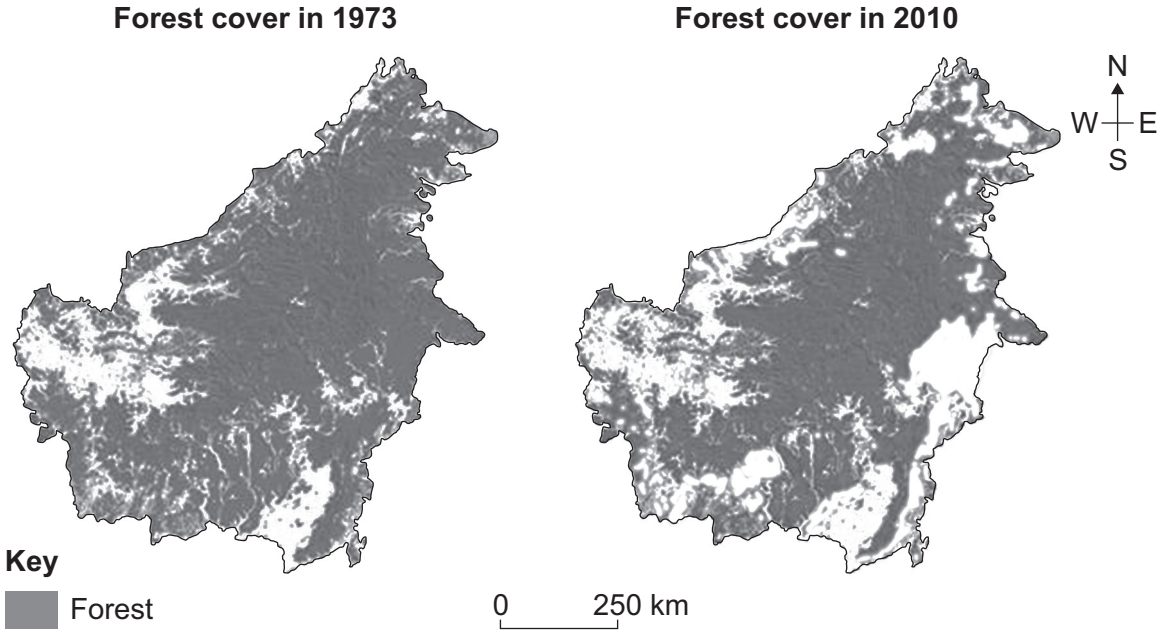
Extra space

6

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4 **Figure 4** shows the amount of forest cover on an island in Asia, in 1973 and in 2010.

Figure 4



4 (a) (i) Deforestation has decreased the amount of forest cover on the island.

Describe the change in the pattern of forest cover on the island.

[2 marks]

4 (a) (ii) Give **two** possible reasons why the amount of forest has decreased between 1973 and 2010.

[2 marks]

1

2

Do not write outside the box

4 (b) Scientists are concerned about the effects of a decrease in forest cover on ecosystems.

Give **two** possible negative effects of the decrease in forest cover on ecosystems.

[2 marks]

1 _____

_____

2 _____

_____

6

Turn over for the next question

Do not write outside the box

5 When we breathe in and breathe out the ribs and the diaphragm move.

5 (a) Complete **Table 2** to describe the changes that occur when we breathe in.

[2 marks]

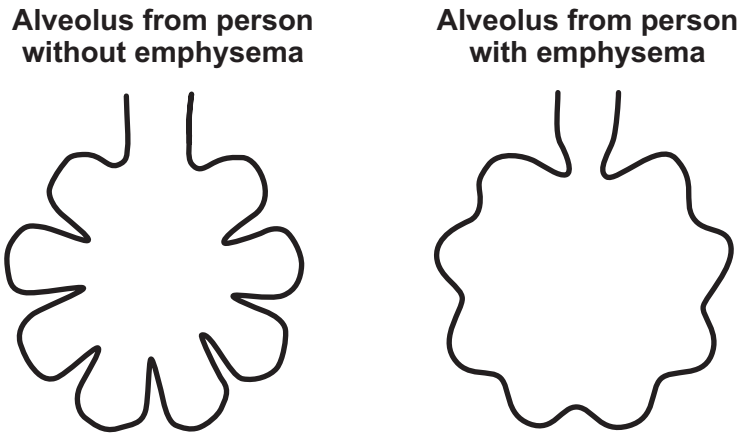
Table 2

	Movement of the ribs	Movement of the diaphragm	Change in volume of the thorax
Breathing in	up and out		

5 (b) Emphysema is a disease affecting the lungs. People with emphysema are often short of breath and find exercise difficult.

Figure 5 shows an alveolus from a person without emphysema and an alveolus from a person with emphysema.

Figure 5



5 (b) (i) Describe **one** difference between the alveolus from a person without emphysema and the alveolus from a person with emphysema.

[1 mark]

Do not write outside the box

5 (b) (ii) Explain how the difference you described in part **(b)(i)** causes the person with emphysema to find exercise difficult.

[3 marks]

6

Turn over for the next question

Do not write outside the box

6 The circulatory system contains arteries and veins.

6 (a) (i) Describe how the structure of an artery is different from the structure of a vein.

[2 marks]

6 (a) (ii) A comparison is made between blood taken from an artery in the leg and blood taken from a vein in the leg.

Give **two** differences in the composition of the blood.

[2 marks]

1 _____

2 _____

Do not write outside the box

6 (b) During operations patients can lose a lot of blood. Patients often need blood transfusions to keep them alive.

Figure 6 shows information about a new artificial blood product.

Figure 6

Sea worms give hope for people in need of blood transfusions

Scientists have carried out a five-year trial using a new artificial blood product. The scientists have used a protein from sea worms to create the new artificial blood and the results from the trial are very positive. Thousands of sea worms can be grown and collected.

During the trial, mice were given blood transfusions of the artificial blood. The bodies of the mice tolerated the artificial blood and the artificial blood did not cause any side effects.

Suggest **two** possible advantages of using the new artificial blood, instead of using human blood for a transfusion in humans.

[2 marks]

1 _____

_____

2 _____

_____

6

Turn over for the next question

Do not write outside the box

7 Humans keep their internal conditions almost constant.

Body temperature is kept within a narrow range.

When the core body temperature is too low, this is detected by the thermoregulatory centre in the brain.

Describe how the body responds when a decrease in core body temperature is detected.

[6 marks]

6

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

8 People with type 1 diabetes inject insulin to control their blood glucose level.

A pancreas transplant is another treatment for type 1 diabetes.

One risk of a pancreas transplant is organ rejection.

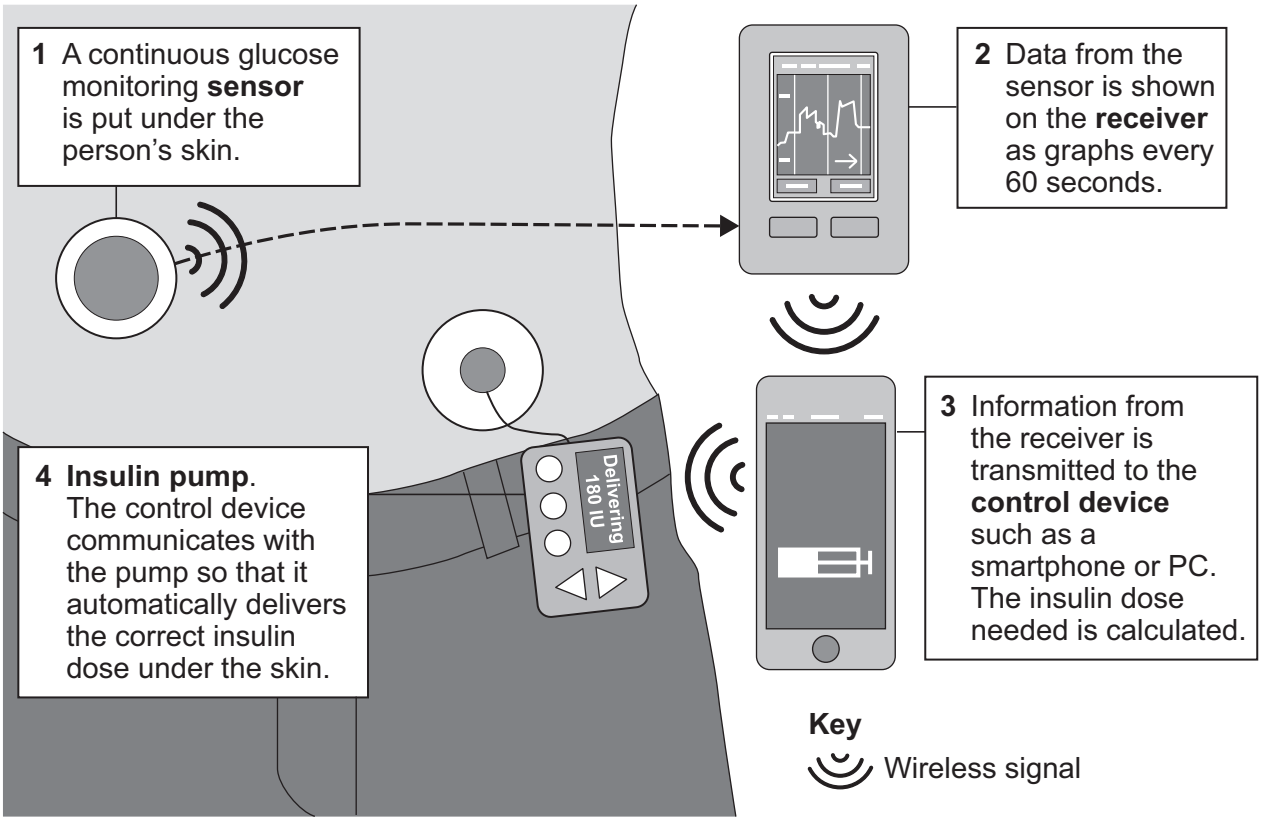
8 (a) Explain why a transplanted organ may be rejected.

[3 marks]

8 (b) Scientists have developed an artificial pancreas to treat type 1 diabetes.

Figure 7 shows how an artificial pancreas works.

Figure 7



Do not write outside the box

8 (b) (i) A woman with type 1 diabetes has an artificial pancreas. The woman eats a meal high in sugar. The meal causes her blood glucose level to rise.

Use information from **Figure 7** to describe what happens to bring the blood glucose level of the woman back to normal.

[4 marks]

8 (b) (ii) The traditional way of monitoring and treating type 1 diabetes is to take a small sample of blood and put it on a test strip to find out how much insulin to inject.

Suggest **one** possible advantage, other than not having to do blood tests, of the method used in **Figure 7**.

[1 mark]

8

Turn over for the next question

Do not write outside the box

9 **Figure 8** shows some information about 'stem cell burgers'.

Figure 8

The first laboratory burger has now been cooked

In July 2013 the first burger grown from cow stem cells was cooked.

Muscle stem cells from cows were grown into strands of beef in a laboratory. About 20 000 strands of beef were then made into a burger. The burger can be cooked and eaten by humans. This type of meat is called cultured meat.

The cultured meat is exactly the same as normal cow muscle tissue and the cells are not genetically modified.

9 (a) (i) Some scientists think using cultured meat instead of traditionally-produced meat will help reduce global warming.

Suggest **two** reasons why using cultured meat may slow down the rate of global warming.

[2 marks]

1 _____

_____

2 _____

_____

9 (a) (ii) Suggest **two** other possible advantages of producing cultured meat instead of farmed meat.

Do **not** refer to cost in your answer.

[2 marks]

1 _____

_____

2 _____

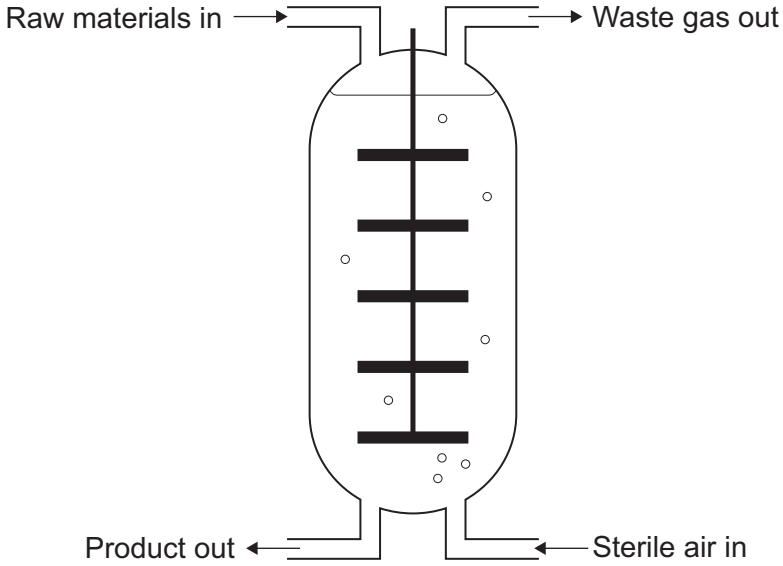
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9 (b) Mycoprotein is one type of food that is mass-produced.

Figure 9 shows a fermenter used to produce mycoprotein.

Figure 9



Describe how mycoprotein is produced.

[4 marks]

8

END OF QUESTIONS

There are no questions printed on this page

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GCSE

Biology

BL3HP

Mark scheme

4401

June 2016

Version 1.0: Final Mark Scheme

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**.
Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

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Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation 'ecf' in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient are used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

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4. Quality of Written Communication and levels marking

In Question 3 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	diffusion active transport	this order only	1 1	AO2 3.1.1a/g
1(b)(i)	concentration (of sugar) in the bag was higher (than in the drink) **or** higher concentration of water outside the bag **or** in the drink / boiling tube (so) water moved in (to the tubing) by osmosis	allow concentration (of sugar) in the drink was lower (than in the bag) allow higher water potential outside the bag **or** lower water potential inside the bag allow water moves down **its** concentration gradient do **not** allow sugar moving allow diffusion (of water) do **not** allow sugar moving by osmosis **or** water moving by active transport	1 1 1	AO2 3.1.1.a/b/c
1(b)(ii)	**B**		1	AO3 3.1.1a/b/c
1(b)(iii)	close(st) to the concentration in the bag **or** to 5% (so rate of) diffusion / osmosis is slow	allow small(est) diffusion gradient **or** close(st) to an equilibrium allow (so) less water moves in (to the bag) ignore ref. to sugar	1 1	AO2/3 3.1.1a/b/c
Total			**8**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	guard (cells)	allow phonetic spelling	1	AO1 3.1.3e
2(b)(i)	as carbon dioxide (concentration) increases, the (mean) number of stomata decreases (there is a) rapid drop initially	allow there is a <u>negative correlation</u> allow use of any number between 1.5 and 3.0 to indicate "initially"	1 1	AO2 3.1.3
2(b)(ii)	(there is) more carbon dioxide so plant doesn't need as many stomata (to obtain the amount needed) **or** (there is) less carbon dioxide so the plant needs more stomata (to obtain enough)		1	AO3 3.1.3c
2(c)(i)	may lose too much water	allow plant may wilt ignore references to oxygen / carbon dioxide plants lose a lot of water is insufficient ignore flaccid	1	AO3 3.1.3d
2(c)(ii)	any **one** from: • hot • dry • windy	ignore environments unqualified eg desert	1	AO3 3.1.3d
Total			**6**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
3			6	AO1 3.1.1a/b/g 3.1.1a/d 3.2.3a

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant points are made	At least **one** process (P) for obtaining a material is given **or** at least **one** vessel (V) and the material it carries is given **or** there is a description of the direction of movement (M) for at least **one** material	At least **one** process for obtaining a specified material is given **and** is correctly linked to the vessel that the material is transported in **or** correctly linked to a description of the direction of movement of the material	Processes used for obtaining specified materials are given. **and** correctly linked to the vessels that the materials are transported in **or** correctly linked to a description of the direction of movement of the materials. **For full credit,** in addition to the above descriptors at least **one** of the processes must be linked to the vessel that the material is transported in **and** the direction of the movement of the material.

examples of points made in the response Ions:	extra information
(P) taken up by diffusion or active transport • from an area of high to low concentration (diffusion) **or** an area of low to high concentration (active transport) (V) travels in the xylem (M) to the leaves **or** from the roots / soil	
Water: (P) taken up by osmosis • from an area of low to high concentration (V) travels in the xylem (M) to the leaves **or** from the roots / soil (P) transpiration stream • movement replaces water as it evaporates from leaves (V) in the xylem	allow high concentration of water to low concentration of water allow from high water potential to low water potential ignore along a concentration gradient
Sugar: (P) made during photosynthesis (V) travels in the phloem (M) to other parts of the plant **or** to storage organs **or** travels up and down	

Total		6

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	forest at the edges (of the island) has been removed an appropriate area on the island is identified eg south east **or** bottom right	allow centrally the forest remains	1 1	AO3 3.4.2
4(a)(ii)	any **two** from: • (to provide land) for farming / agriculture • (to provide land) for quarrying • (to provide land / wood) for building • to provide fuel • to produce paper	allow to provide timber allow forest fires	2	AO2 3.4.1c 3.4.2c
4(b)	any **two** from: • decreased biodiversity • loss of habitats • increased carbon dioxide (concentration) • global warming	allow effects of global warming eg flooding / rise in sea level allow soil erosion	2	AO3 3.4.1c 3.4.2a/b/c
Total			**6**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	(diaphragm) down **or** (becomes) flattened	do **not** allow up / in / expands ignore out ignore reference to contraction	1	AO1 3.1.2c
	(volume) increases		1	
5(b)(i)	(healthy alveolus has a) larger surface area	allow larger SA:Volume ratio accept converse for alveoli from person with emphesema allow walls between alveoli disintegrate **or** fluid accumulation in alveoli	1	AO2 3.1.1h/k
5(b)(ii)	less oxygen into the blood / muscles	less only needed once	1	AO2 3.1.1h/k 3.1.2b
	(so) less respiration	ignore ref. to anaerobic respiration	1	
	(and therefore) less energy is released (for exercise)	do **not** allow energy is produced / made do **not** allow energy **for** respiration	1	
Total			**6**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	doesn't have valves has a thicker wall **or** thicker layer of muscle	allow veins have valves allow has a smaller lumen ignore references to elastic (in walls)	1 1	AO1 3.2.1e
6(a)(ii)	any **two** from: • (artery has) more oxygen • (artery has) more glucose • (artery has) less carbon dioxide • (artery has) less lactic acid	ignore reference to pressure accept converse for veins if veins is clearly stated allow (artery has) more amino acids / fatty acids ignore urea	2	AO1 3.2.1g
6(b)	any **two** from: • no rejection • abundant supply • low risk of infection • longer shelf life	ignore side effects allow no tissue matching required allow named example ie HIV, CJD allow less space needed for storage	2	AO2/3 3.2
Total			**6**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
7		ignore hair erection		AO1
	blood vessels supplying skin		1	3.3.2e
	constrict	allow vasoconstriction do **not** allow capillaries /veins constricting do **not** allow moving blood vessel	1	
	less blood flow (to / through capillaries / to skin)	allow blood flows further away from skin surface	1	
	so less energy is lost (to the surroundings)	allow less heat is lost	1	
	'shivering' by <u>muscle</u> (contraction)	allow <u>muscles</u> contract (and relax) rapidly	1	
	releasing energy **or** respiring (more)	allow 'heat produced' do **not** allow energy produced / made do **not** allow energy **for** respiration allow sweating stops / reduces	1	
Total			**6**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	immune system	allow white blood cells / lymphocytes ignore phagocytes	1	AO1 3.3.1g/h
	produces antibodies		1	
	(which) attack the antigens on the transplanted organ / pancreas	allow transplanted organs have foreign antigens at start of explanation **and** linked to attacking the organ	1	
8(b)(i)		max 2 if no ref. to artificial pancreas		AO1/2 3.3.3/a
	change / rise detected by the sensor		1	
	information used to calculate how much insulin she is going to need (bring her blood glucose back to normal)		1	
	(pump delivers) insulin into the blood		1	
	(causing) glucose to move into cells	allow (liver) converts glucose to glycogen	1	
8(b)(ii)	any **one** from: • it is more accurate **or** less chance of human error • (glucose) level will remain more stable **or** no big rises and falls in blood sugar levels • you don't forget to test and / or inject insulin • if ill or in coma insulin is still injected	ignore continuous and automatic unqualified	1	AO3 3.3.3
Total			**8**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(a)(i)	fewer cows any **one** from: • less methane • less CO_2 in the atmosphere because of less deforestation **or** less plants consumed.	 do **not** allow CH^4 allow less CO_2 released into the atmosphere because less fuel used e.g. to heat cowsheds **or** to transport meat do **not** allow CO^2	1 1	AO2/3 3.4.2c 3.4.3a
9(a)(ii)	any **two** from: • could be mass produced to feed an increasing population • disease free meat • no / low fat • no harm to animals or less intensive farming • antibiotic free meat • more land available for farming crops	 allow (may be) suitable for vegetarians allow no energy loss along a food chain	2	AO3 3.4.4a/b
9(b)	 fungus / *Fusarium* with <u>glucose</u> (syrup) in aerobic conditions **or** in presence of oxygen mycoprotein is harvested / purified	ignore stirring / mixing and temperature ignore air allow ammonia added (as source of nitrogen)	 1 1 1 1	AO1 3.4.4d
Total			**8**	

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

AQA

General Certificate of Secondary Education
Higher Tier
June 2015

Biology
Unit Biology B3

BL3HP

H

Tuesday 12 May 2015 1.30 pm to 2.30 pm

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 1 hour

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 2(c) should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

Do not write outside the box

Answer **all** questions in the spaces provided.

1 The world population is increasing and the need for food is increasing.

Mycoprotein is a high-protein food made in fermenters using the organism *Fusarium*.

The process takes only a few weeks to produce a large amount of food.

1 (a) (i) What type of organism is *Fusarium*?

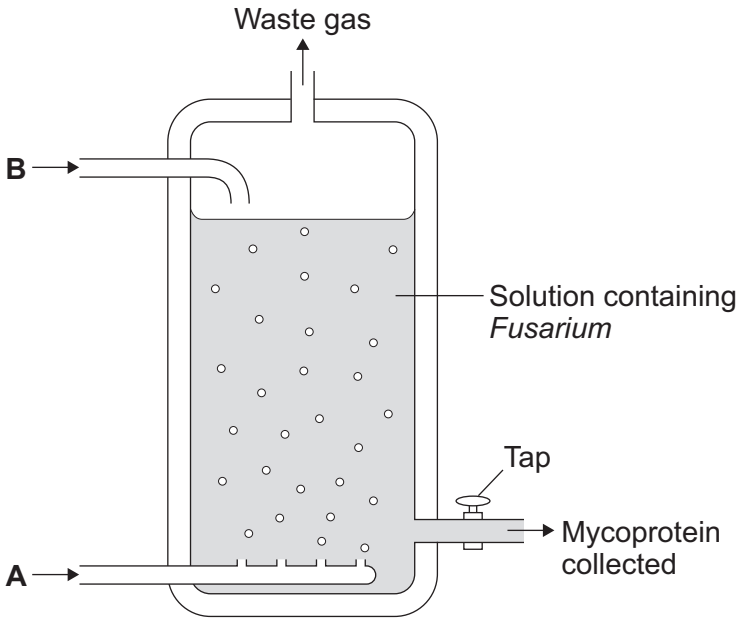
Draw a ring around the correct answer.

[1 mark]

bacterium **fungus** **virus**

Figure 1 shows a fermenter used in mycoprotein production.

Figure 1



1 (a) (ii) *Fusarium* makes mycoprotein. *Fusarium* respires aerobically.

Suggest which gas is added to the fermenter at point **A**.

[1 mark]

.....

Do not write outside the box

1 (a) (iii) Another substance is added to the fermenter at point **B**. This substance is used in aerobic respiration.

Name this substance.

[1 mark]

.....

1 (b) People need to eat protein to grow and to be healthy.

Some people think that it would be an advantage to get more food from mycoprotein and less from farming animals.

Suggest **two** possible advantages of getting more food from mycoprotein.

[2 marks]

1 .....

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2 .....

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5

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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2 The circulatory system transports substances such as glucose and oxygen around the body.

2 (a) Name **two** other substances that the circulatory system transports around the body.

[2 marks]

1 .....

2 .....

2 (b) (i) Blood is a tissue. Blood contains red blood cells and white blood cells.

Name **two** other components of blood.

[2 marks]

1 .....

2 .....

2 (b) (ii) The heart is part of the circulatory system.

What type of tissue is the wall of the heart made of?

[1 mark]

.....

Question 2 continues on the next page

Do not write outside the box

2 (c) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Every year, many patients need to have heart valve replacements.

Figure 2 gives information about two types of heart valve.

Figure 2

Living human heart valve	Cow tissue heart valve
• It has been used for transplants for more than 12 years. • It can take many years to find a suitable human donor. • It is transplanted during an operation after a donor has been found. • During the operation, the patient's chest is opened and the old valve is removed before the new valve is transplanted.	• It has been used since 2011. • It is made from the artery tissue of a cow. • It is attached to a stent and inserted inside the existing faulty valve. • A doctor inserts the stent into a blood vessel in the leg and pushes it through the blood vessel to the heart.

A patient needs a heart valve replacement. A doctor recommends the use of a cow tissue heart valve.

Give the advantages and disadvantages of using a cow tissue heart valve compared with using a living human heart valve.

Use information from **Figure 2** and your own knowledge in your answer.

[6 marks]

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Extra space .....

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11

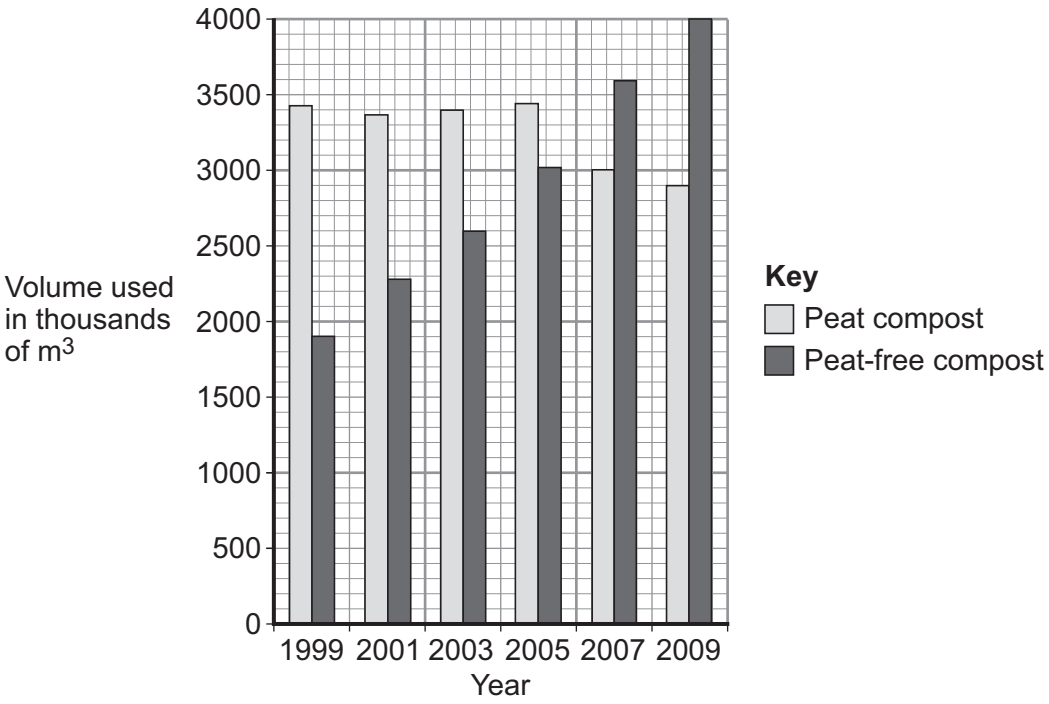
Turn over for the next question

Do not write outside the box

3 Human activities have many effects on our ecosystem.

Figure 3 shows the volume of peat compost and peat-free compost used in gardening from 1999 to 2009.

Figure 3



3 (a) Describe the trends shown in **Figure 3**.

[2 marks]

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Do not write outside the box

3 (b) What effect does the destruction of peat bogs have on the gases in the atmosphere?

[1 mark]

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3 (c) Deforestation is also damaging ecosystems.

Describe **one** effect of deforestation on ecosystems.

[1 mark]

.....

.....

4

Turn over for the next question

Do not write outside the box

4 In many areas of the world the mass of household waste produced each year is increasing.

4 (a) Give **two** reasons why the mass of household waste is increasing each year.

[2 marks]

1 .....

.....

2 .....

.....

4 (b) **Table 1** shows how the mass of household waste in the UK has changed from 2004 to 2012.

Table 1

Year	Total mass of household waste in thousands of tonnes (including total household recycling)	Total mass of household recycling in thousands of tonnes	Percentage of household waste recycled
2004	25 658	5785	22.5
2006	25 775	7976	30.9
2008	24 334	9398	38.6
2010	23 454	9733	
2012	22 643	9782	43.2

4 (b) (i) Calculate the percentage of household waste recycled in 2010.

[2 marks]

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..... %

Do not write outside the box

4 (b) (ii) The UK government has been encouraging a 'zero waste economy'.

In a 'zero waste economy', we reduce, reuse and recycle as much waste as possible.

A newspaper concluded that: **'The government's 'zero waste economy' has been successful.'**

Use information from **Table 1** to describe the reasons for and against the newspaper's conclusion.

[4 marks]

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4 (c) (i) Some waste releases carbon dioxide and methane into the atmosphere.
An increase in carbon dioxide and methane contributes to global warming.

Global warming can cause sea levels to rise.

Describe **two** other possible effects of global warming on our environment.

[2 marks]

1 .....

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2 .....

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4 (c) (ii) Storing the carbon dioxide helps to prevent more global warming.
Carbon dioxide can be stored (sequestered) in trees when they photosynthesise.

Give **one** different way in which carbon dioxide is sequestered in our environment.

[1 mark]

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Do not write outside the box

5 Many runners drink sports drinks to improve their performance in races.

A group of students investigated the effects of three brands of sports drink, **A**, **B** and **C**, on the performance of three runners on a running machine. One of the runners is shown in **Figure 4**.

Figure 4



Table 2 gives information for each drink.

Table 2

	Brand of sports drink		
Nutrient per dm^3	**A**	**B**	**C**
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

Do not write outside the box

5 (a) (i) In the investigation, performance was measured as the time taken to reach the point of exhaustion.

Exhaustion is when the runners could not run anymore.

All three runners:
- ran on a running machine until the point of exhaustion
- each drank 500 cm^3 of a different brand of sports drink
- rested for 4 hours to recover
- ran on the running machine again and recorded how much time they ran until the point of exhaustion.

The speed at which the runners ran was the same and all other variables were controlled.

The students predicted that the runner drinking brand **B** would run for the shortest time on the second run before reaching the point of exhaustion.

Use information from **Table 2** to suggest an explanation for the students' prediction.

[2 marks]

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5 (a) (ii) If the balance between ions and water in a runner's body is not correct, the runner's body cells will be affected.

Describe **one** possible effect on the cells if the balance between ions and water is **not** correct.

[1 mark]

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5 (b) When running, a runner's body temperature increases.

Describe how the brain monitors body temperature.

[3 marks]

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Turn over ▶

Do not write outside the box

5 (c) (i) **Table 2** is repeated here to help you answer this question.

Table 2

	Brand of sports drink		
Nutrient per dm^3	**A**	**B**	**C**
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

People with diabetes need to be careful about drinking too much sports drink.

Use information from **Table 2** to explain why drinking too much sports drink could make people with diabetes ill.

[3 marks]

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5 (c) (ii) Other than paying attention to diet, how do people with diabetes control their diabetes?

[1 mark]

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10

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Turn over for the next question

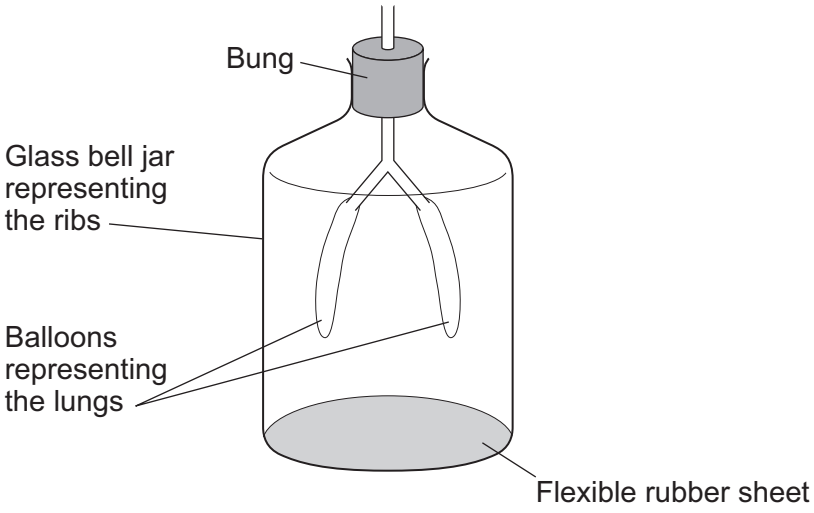
DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

6 **Figure 5** shows a model representing the human breathing system.

The different parts of the model represent different parts of the human breathing system.

Figure 5



6 (a) (i) Which part of the human breathing system does the flexible rubber sheet represent?

[1 mark]

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6 (a) (ii) Explain why the balloons inflate when the flexible rubber sheet is pulled down.

[3 marks]

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Do not write outside the box

6 (b) (i) During breathing, oxygen moves into the blood.

Explain how oxygen moves into the blood.

[2 marks]

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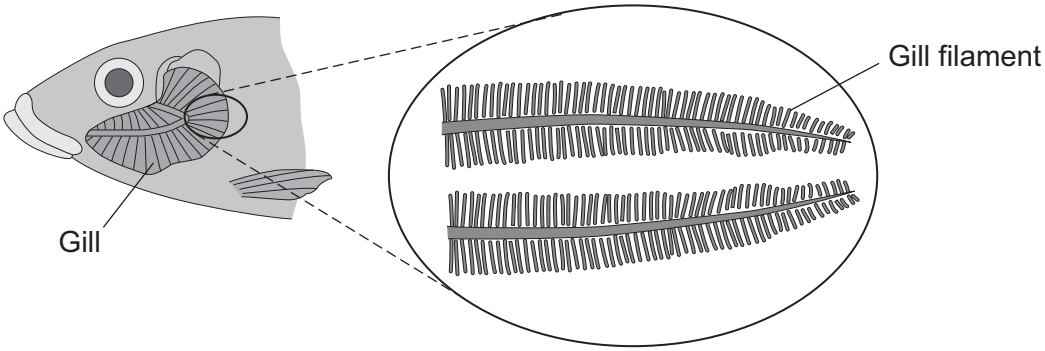
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6 (b) (ii) **Figure 6** shows a fish head and gill.

Figure 6



Fish absorb oxygen from the water. Oxygen is absorbed through the gills of the fish.

Explain **one** way in which the gills are adapted for rapid absorption of oxygen.

[2 marks]

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8

Turn over for the next question

Do not write outside the box

7 It is important to remove waste products from our bodies.

Healthy kidneys help to keep our internal environment constant.

7 (a) Describe how a healthy kidney produces urine.

[5 marks]

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7 (b) A child has kidney failure and is treated with dialysis.

Before the dialysis starts, the doctor measures the concentration of urea and glucose in the child's blood.

Table 3 shows the results.

Table 3

	Concentration in the blood before dialysis starts in mmol per dm^3
Urea	28
Glucose	6

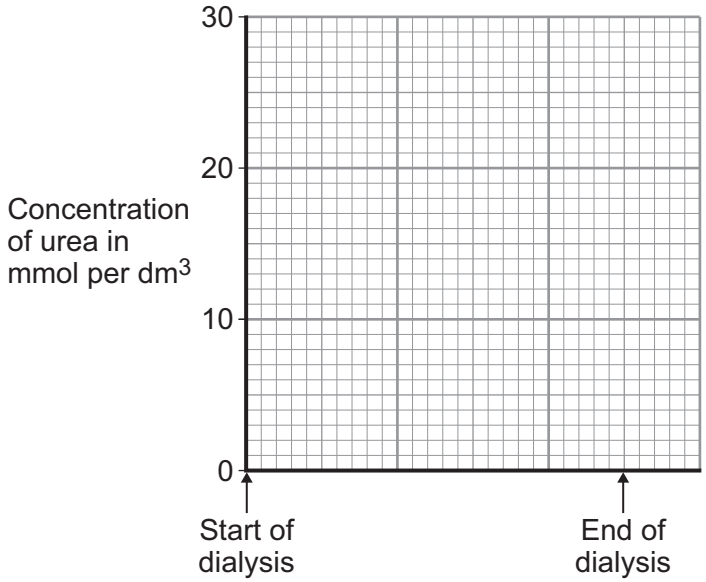
The child has a normal blood glucose concentration.

Do not write outside the box

7 (b) (i) Sketch a graph on **Figure 7** to suggest what will happen to the concentration of urea in the blood during dialysis.

[1 mark]

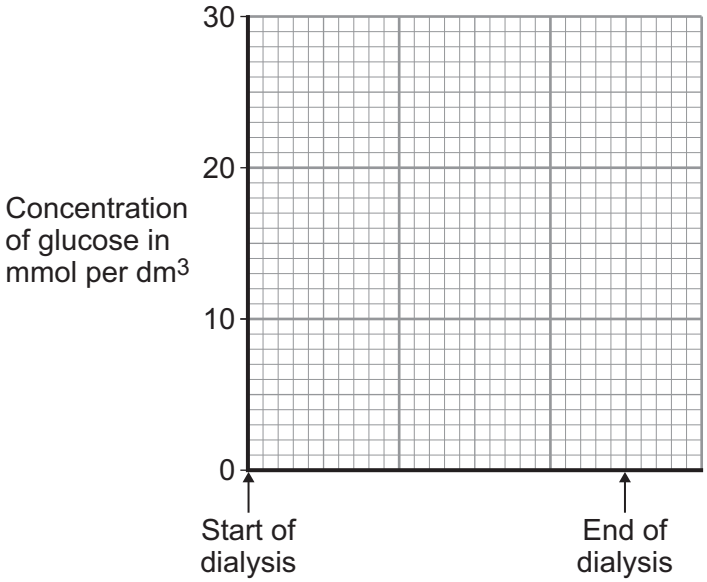
Figure 7



7 (b) (ii) Sketch a graph on **Figure 8** to suggest what will happen to the concentration of glucose in the blood during dialysis.

[1 mark]

Figure 8



Question 7 continues on the next page

Turn over ▶

Do not write outside the box

7 (c) (i) Another way of treating kidney failure is with a kidney transplant.

A transplanted kidney can be rejected.

Explain why the new kidney may be rejected.

[3 marks]

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7 (c) (ii) Describe **one** way in which doctors try to prevent kidney rejection.

[1 mark]

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11

END OF QUESTIONS

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Question 5, Figure 4: © Thinkstock

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GCSE

Biology

BL3HP

Mark scheme

4401

June 2015

Version: 1.0 Final

STEMUP.CO.UK

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from aqa.org.uk

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

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Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient are used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Quality of Written Communication and levels marking

In Question 2(c) students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)(i)	fungus		1	AO1 344d
1(a)(ii)	oxygen / O_2	accept air accept O_2 do **not** allow O^2/ O / O2	1	AO2 344d
1(a)(iii)	glucose (syrup)	allow carbohydrate / sugar ignore food / starch allow oxygen if oxygen / air not given in (a)(ii)	1	AO1 344d
1(b)	any **two** from: • quicker • suitable for vegetarians • cheaper • more efficient **or** less land / methane	ignore high in protein ignore sustainability unqualified ignore less pollution unqualified allow less animals harmed / killed allow food chain is shorter **or** has less trophic levels allow less energy lost (from the food chain) do **not** allow no energy lost allow low(er) in calories (than some meat) allow low(er) in fat / healthier (than some meat) allow source of fibre / prevent constipation	2	AO3 344a/d
Total			**5**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	any **two** from: • carbon dioxide / CO_2 • urea • protein • water / H_2O • hormones / insulin	ignore food / waste / alcohol / drugs / enzymes ignore glucose and oxygen allow **two** correct hormones for 2 marks allow **two** correct food components for 2 marks allow antibodies allow antitoxins	2	AO1 321a,322b /c,331a
2(b)(i)	plasma platelets		1 1	AO1 322a
2(b)(ii)	(cardiac) muscle	allow muscular	1	AO1 321b

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<table>
<tr><th>Question</th><th>Answers</th><th>Extra Information</th><th>Mark</th><th>AO / Spec. Ref</th></tr>
<tr><td>2(c)</td><td></td><td></td><td>6</td><td>AO3
32, 321f</td></tr>
<tr><td colspan="4">Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a ‘best-fit’ approach to the marking.</td></tr>
<tr><td>0 marks</td><td>Level 1 (1–2 marks)</td><td>Level 2 (3–4 marks)</td><td>Level 3 (5–6 marks)</td></tr>
<tr><td>No relevant content</td><td>There is a description of at least one advantage of the cow tissue valve
or
a description of at least one disadvantage of the cow tissue valve.</td><td>There is a description of at least one advantage of the cow tissue valve
and
at least one disadvantage of the cow tissue valve.</td><td>There is a description of the advantages and disadvantages of the cow tissue valve
or
a description of several advantages of the cow tissue valve and at least one disadvantage.</td></tr>
<tr><td colspan="2">examples of the points made in the response
Advantages of cow tissue valve:
• abundant supply of cows
• so shorter waiting time
• no need for tissue typing
• quicker operation
• less invasive or shorter recovery time
• cheaper operation costs
• less operation / anaesthetic risks

Disadvantages of cow tissue valve:
• made from cow so possible objections on religious grounds
• new procedure so could be unknown risks
• risks of using a stent eg. blood clots, stent breaking or valve tearing
• not proven as a long term treatment
• may be rejected</td><td colspan="2">extra information
ignore information copied directly from the table without value added

ignore can take many years to find a suitable human donor

ignore ethical arguments

allow possible transfer of disease from cow</td></tr>
</table>

Total		**11**

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	any **two** from: • (volume of) peat compost has been steady and then declined **or** volume of peat compost has declined since 2005 • (volume of) peat-free compost has increased (since 1999) • (volume of) peat is higher than peat-free until 2005, then peat-free compost is higher (than peat) • total volume of peat and peat-free compost has increased	allow 2007 instead of 2005 allow 2007	2	AO2 342d
3(b)	increases carbon dioxide (in the atmosphere)	ignore methane	1	AO1 342
3(c)	any **one** from: • reduces biodiversity • destruction of habitats • disruption of food chains		1	AO1 342b
Total			**4**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	(rapid) growth in population (size) increase in the standard of living	 accept description of increased standard of living, eg more packaging, more food thrown away or overbuying resources	1 1	AO1 341a
4(b)(i)	41.5	allow 1 mark for 9733 ÷ 23454 **or** allow 1 mark for 0.415 **or** allow 1 mark for 41.49 **or** 41 **or** 41.4	2	AO2 341
4(b)(ii)	any **four** from: arguments for: • there has been a reduction in total waste • there has been an increase in (total mass of) recycling • there has been an increase in the percentage of waste recycled • it (may) not be possible to achieve zero waste arguments against: • there is still a lot of waste (not recycled) • there has only been a small reduction in total waste • there was one year (2006) where total waste went up • the rate of increase of percentage recycled is slowing down • no information on materials reused • no information on waste from factories / industry	max 3 marks for a one sided argument allow as reason against if clear allow still more than half or 56.8% of waste (not recycled)	4	AO3 341

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(c)(i)	any **two** from: • reduce biodiversity **or** extinction • change in migration patterns • change in species distribution • change in climate	ignore rise in sea levels ignore temperature change accept correct examples of climate change eg storms, flooding, drought references to weather changing is insufficient allow ice caps melting or habitat destruction	2	AO1 343a
4(c)(ii)	any **one** from: • absorbed by oceans / ponds / lakes • peat bogs	allow used for skeletons / shells of sea creatures allow in fossil fuels / limestone	1	AO1 343b
Total			**11**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	has the least amount of glucose (to) transfer energy (for the run)	allow least amount of fat **or** no fat allow (to) release energy (for the run) do **not** allow produces energy do **not** allow 'energy for respiration'	1 1	AO2 311d/e
5(a)(ii)	any **one** from: • cells will work inefficiently • absorb too much water / swell / overhydrate • lose too much water / shrink / dehydrate	ignore turgid / flaccid cells burst is insufficient allow cramp in muscle	1	AO2 311c/f
5(b)	any **three** from: • thermoregulatory centre • (has temperature) receptors • (which) monitor blood temperature (as it flows through the brain) • (temperature) receptors in the skin • (receptors) send impulses to the brain	ignore vasoconstriction / vasodilation / sweating allow hypothalamus impulses sent to the thermoregulatory centre = 2 marks	3	AO1 332b/c

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(c)(i)	(sports drinks) contain a lot of glucose		1	AO1 / AO2 333c
	(a person with diabetes) does not produce insulin **or** does not produce enough insulin	allow (person with diabetes) has cells which do not respond to insulin do **not** allow insulin produced by liver	1	
	so <u>blood</u> glucose / sugar levels will rise too high **or** to a dangerous level		1	
5(c)(ii)	inject insulin **or** have an insulin pump (fitted)	do **not** allow swallow insulin accept exercise accept inhale insulin accept take metformin **or** other correctly named drug allow pancreatic transplant	1	AO1 333d
Total			**10**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	diaphragm	accept phonetic spelling	1	AO2 312a
6(a)(ii)		maximum **two** marks if no reference to correct part of model		AO2 312c
	(because) the volume (inside the jar) increases		1	
	(causing) the pressure to decrease		1	
	(and) air enters the balloon	allow oxygen	1	
6(b)(i)	(so it moves by) diffusion	do **not** allow osmosis or active transport	1	AO1
	from a high concentration (of oxygen) to a low concentration	allow down its / oxygen concentration gradient from the air **or** to the blood	1	311a, 312b
	or			
	(because) there is a high(er) concentration (of oxygen) in the air **or** there is a low(er) concentration of oxygen in the blood	ignore reference to amount of oxygen		

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(b)(ii)	many gill <u>filaments</u> (give a) large surface / area **or** thin (so) short diffusion pathway **or** good blood supply (to) maintain the concentration gradient **or** water continually flows over them / continually ventilated (to) maintain the concentration gradient	must be in the correct pairs to gain 2 marks do **not** allow surface area to volume ratio	1 1	AO2 311h/i/k
Total			**8**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	(the kidney) filters the blood	ignore refs to hormones and drugs	1	AO1 331a/c
	(and then) reabsorbs <u>all</u> of the glucose		1	
	reabsorbs some of the ions	allow salts ignore minerals	1	
	reabsorbs some of the water		1	
	releases urea (in urine)		1	
7(b)(i)	should fall from 28 (to the end of dialysis)	ignore any line drawn after end of dialysis allow + / - 0.5 square graph line must fall to / below below 15	1	AO2 331d/e
7(b)(ii)	should stay level at about 6 throughout	ignore slight variations allow + / - 1 square ignore any line drawn after end of dialysis	1	AO2 331d/f
7(c)(i)	immune system	allow white blood cells / lymphocytes	1	AO1 331g/h
	(produces) antibodies		1	
	(which) attack the antigens (on the transplanted kidney)	non-matching antigens insufficient	1	
7(c)(ii)	any **one** from: • tissue typing (to find match) • treating with drugs that suppress the immune system	accept treat with immunosuppressants	1	AO1 331i
Total			**11**	

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

AQA

General Certificate of Secondary Education
Higher Tier
June 2014

Biology
Unit Biology B3

BL3HP

H

Tuesday 13 May 2014 9.00 am to 10.00 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 1 hour

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 2 should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

Do not write outside the box

Answer **all** questions in the spaces provided.

1 The number of fish in the oceans is decreasing.

Table 1 shows information about the mass of fish caught by UK fishermen between 2002 and 2010.

Table 1

Year	Mass of fish caught by UK fishermen from ALL SOURCES in thousands of tonnes	Mass of fish caught by UK fishermen from SUSTAINABLE SOURCES in thousands of tonnes	Percentage of fish caught from sustainable sources
2002	690.0	427.8	62.0
2004	655.0	396.6	60.5
2006	619.0	386.0	62.4
2008	589.0	436.1	74.0
2010	611.5	465.0	

1 (a) (i) Calculate the percentage of fish caught from sustainable sources in 2010.

[2 marks]

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1 (a) (ii) Describe the pattern in **Table 1** for the mass of fish caught from all sources.

Suggest reasons for this pattern.

[4 marks]

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1 (a) (iii) Suggest why the percentage of fish caught from sustainable sources is increasing.

[1 mark]

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1 (b) Give **two** methods of maintaining fish stocks at a sustainable level.

[2 marks]

1 .....

2 .....

Question 1 continues on the next page

Do not write outside the box

1 (c) **Figure 1** shows a fish farm.

Figure 1



In a fish farm, large numbers of fish are grown in cages in the sea.

Why do fish in the cages grow faster than fish of the same species that are free in the sea?
You should refer to energy in your answer.

[4 marks]

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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2 **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Deforestation affects the environment.

Deforestation is causing a change in the amounts of different gases in the atmosphere. This change causes global warming and climate change.

Figure 2 shows an area of deforestation.

Figure 2



Give the reasons why deforestation is taking place.

Describe how deforestation is causing the change in the amounts of different gases in the atmosphere.

[6 marks]

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Turn over for the next question

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3 Plant roots absorb water from the soil by osmosis.

3 (a) What is osmosis?

[3 marks]

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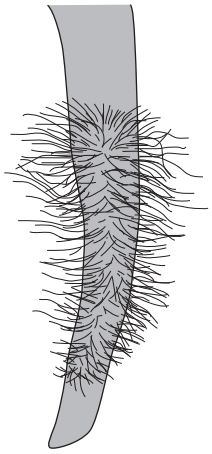
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3 (b) **Figure 3** shows part of a plant root.

Figure 3



The plant root is adapted for absorbing water from the soil.

Use information from **Figure 3** to explain how this plant root is adapted for absorbing water.

[3 marks]

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Do not write outside the box

4 Blood is part of the circulatory system.

4 (a) (i) Give **one** function of white blood cells.

[1 mark]

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4 (a) (ii) Which of the following is a feature of platelets?

Tick (✓) **one** box.

[1 mark]

They have a nucleus. ☐

They contain haemoglobin. ☐

They are small fragments of cells. ☐

4 (b) Urea is transported by the blood plasma from where it is made to where the urea is excreted.

Complete the following sentence.

[2 marks]

Blood plasma carries urea from where it is made in the .....

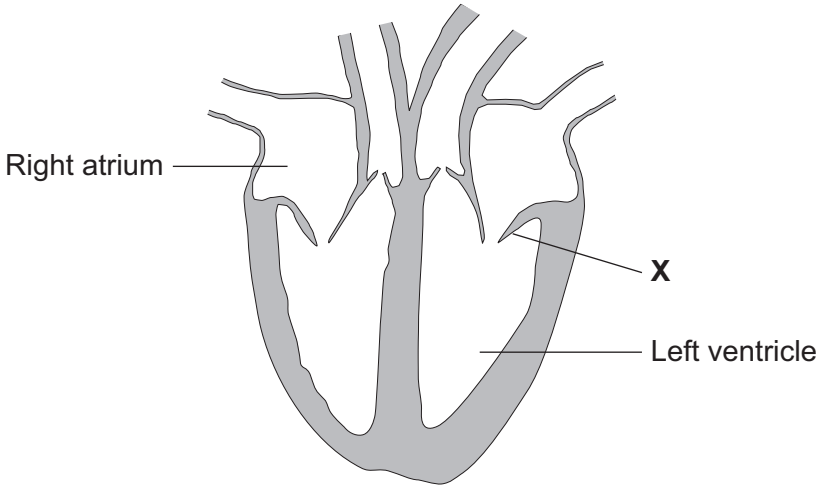
to the ..... where the urea is removed from the blood.

Question 4 continues on the next page

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4 (c) **Figure 4** shows a section through the human heart.

Figure 4



Structure **X** is a valve. If valve **X** stops working, it may need to be replaced.

A scientist is designing a new heart valve. The scientist knows that the valve must be the correct size to fit in the heart.

Suggest **two** other factors the scientist needs to consider so that the newly designed valve works effectively in the heart.

[2 marks]

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Do not write outside the box

5 The leaves of most plants have stomata.

5 (a) (i) Name the cells which control the size of the stomata.

[1 mark]

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5 (a) (ii) Give **one** function of stomata.

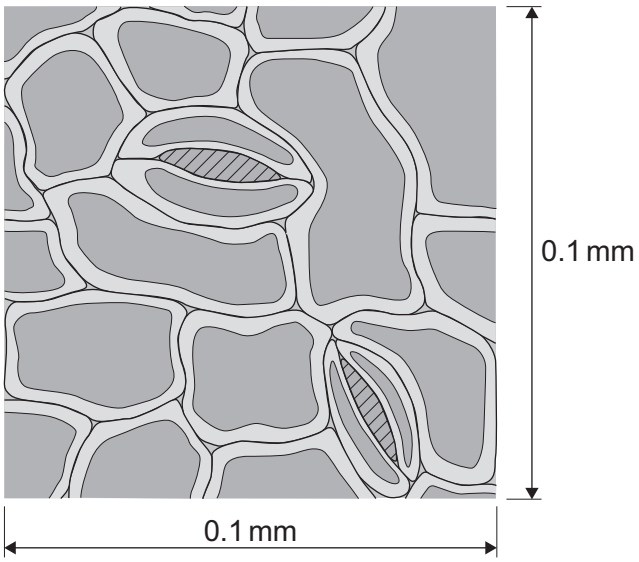
[1 mark]

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5 (b) **Figure 5** shows part of the surface of a leaf.

Figure 5



The length and width of this piece of leaf surface are both 0.1 mm.

5 (b) (i) Calculate the number of stomata per mm^2 of this leaf surface.

[2 marks]

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..... per mm^2

Turn over ▶

Do not write outside the box

5 (b) (ii) A different plant species has 400 stomata per mm^2 of leaf surface.

Having a large number of stomata per mm^2 of leaf surface can be a disadvantage to a plant.

Give **one** disadvantage.

[1 mark]

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5 (c) A student investigated the loss of water from plant leaves.

The student did the following:

- Step 1: took ten leaves from a plant
- Step 2: weighed all ten leaves
- Step 3: hung the leaves up in a classroom for 4 days
- Step 4: weighed all ten leaves again
- Step 5: calculated the mass of water lost by the leaves
- Step 6: repeated steps **1** to **5** with grease spread on the upper surfaces of the leaves
- Step 7: repeated steps **1** to **5** with grease spread on both the upper and lower surfaces of the leaves.

All the leaves were taken from the same type of plant.

Table 2 shows the student's results.

Table 2

Treatment of leaves	**Mass of water the leaves lost in g**
No grease was used on the leaves	0.98
Grease on upper surfaces of the leaves	0.86
Grease on upper and lower surfaces of the leaves	0.01

Do not write outside the box

5 (c) (i) What mass of water was lost in 4 days through the upper surfaces of the leaves?

[1 mark]

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Mass = ... g

5 (c) (ii) Very little water was lost when the lower surfaces of the leaves were covered in grease.

Explain why.

[3 marks]

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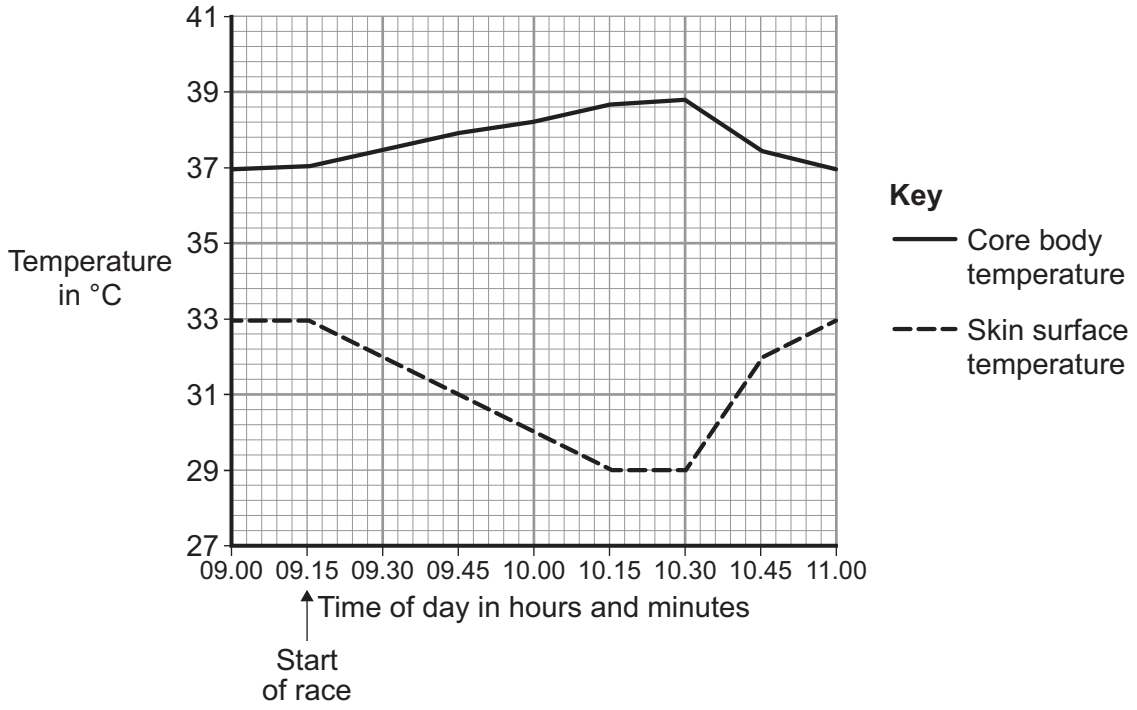
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Turn over for the next question

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6 **Figure 6** shows the core body temperature and the skin surface temperature of a cyclist before, during and after a race.

Figure 6



6 (a) (i) When the cyclist finished the race, his core body temperature started to decrease.

How long did the race last?

[1 mark]

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6 (a) (ii) Describe and explain the different patterns shown in the core body temperature and skin surface temperature between 09.15 and 10.15.

[6 marks]

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6 (a) (iii) After 10.30, the core body temperature decreased.

Explain how changes in the blood vessels supplying the skin caused the skin surface temperature to increase.

[2 marks]

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6 (b) During the race, the cyclist's blood glucose concentration began to decrease.

Describe how the body responds when the blood glucose concentration begins to decrease.

[3 marks]

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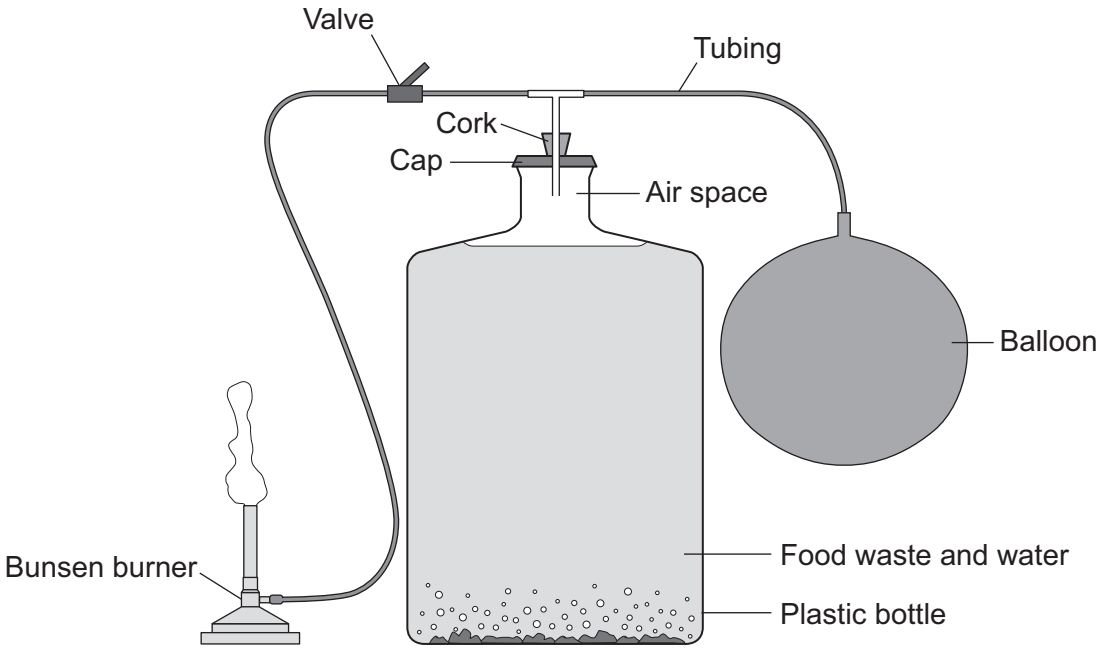
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7 **Figure 7** shows a model biogas generator.

Figure 7



Students used the model biogas generator to investigate which type of food waste produces the greatest yield of biogas.

Gas collects in the balloon. The gas is then released through the valve and is burned at the Bunsen burner.

The students:

- put 500 g of potato peelings in the plastic bottle with some water and sealed the apparatus
- released the gas from the balloon after day two and timed how long the gas burned for
- released the gas that had collected in the balloon from day two to day four and timed how long the gas burned for
- repeated the investigation using 500 g of cooked rice, then 500 g of cabbage leaves and then 500 g of cooked pasta.

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7 (a) **Table 3** shows the students' results.

Table 3

Type of food waste	Length of time the gas burned in seconds	
	After day two	From day two to day four
Potato peelings	0	175
Cooked rice	0	100
Cabbage leaves	0	150
Cooked pasta	0	160

7 (a) (i) Suggest why the gas collected in the balloon and released after day two did not burn.

[3 marks]

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7 (a) (ii) Suggest why potato peelings produced the most biogas.

[1 mark]

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Question 7 continues on the next page

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7 (b) Scientists investigated the production of biogas from different types of animal manure.

Table 4 shows the scientists' results.

Table 4

Type of manure	Volume of biogas produced in m^3 per kg of manure	Methane in the biogas as % of total volume
Cow	0.34	65
Pig	0.58	68
Hen	0.62	60
Horse	0.30	66
Sheep	0.61	67

7 (b) (i) Calculate the volume of methane produced from 1 kg of cow manure.

[2 marks]

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Volume of methane = ... m^3

7 (b) (ii) One scientist concluded that it would be better to use sheep manure in a biogas generator than to use cow manure.

What is the evidence for this conclusion?

Use information from **Table 4** in your answer.

[2 marks]

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END OF QUESTIONS

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AQA Qualifications

GCSE

BIOLOGY

BL3HP

Mark scheme

4401

June 2014

Version: 1.0 Final

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from aqa.org.uk

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

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Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient are used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Quality of Written Communication and levels marking

In Question 2 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

Question	Answers	Extra information	Mark	AO / spec ref.
1(a)(i)	76.0 / 76	correct answer with or without working gains 2 marks allow 76.04 for 2 marks allow 76.04 with extra decimal places eg 76.042 for 1 mark $\frac{465}{611.5}$ for 1 mark	2	AO2 3.4.4c
1(a)(ii)	mass of fish declines (until 2008) (due to an) increase in fishing / overfishing and then rises (until 2010) (which could be due to) quotas / net restrictions working	ignore use of numbers allow number of fish decline (until 2008) allow any reasonable suggestion, such as countries swapping quotas or restrictions on fishing during breeding seasons ignore less fishing if no other marks awarded allow 1 mark for a decrease in mass **and** an increase in mass if answer relates to sustainable fishing	1 1 1 1	AO2 / AO3 3.4.4c
1(a)(iii)	(this is due to) public awareness / demand	allow legislation / rules	1	AO3 3.4.4c
1(b)	fishing quotas / bans (small) net / mesh size	 if size of net is stated then it must be smaller if size of mesh is stated then it must be larger	1 1	AO1 3.4.4c

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1(c)	(fish) cannot move freely / as much		1	AO1 / AO2 3.4.4b
	(therefore) less <u>energy</u> loss from the fish	do **not** allow 'no energy is lost' ignore references to less heat loss though controlling body temperature ignore references to respiration	1	
	(there is) more food available / better quality food / fed more often	accept 'high-protein food for making cells'	1	
	(so) there is more energy for growth **or** (more food) is converted to biomass		1	
Total			13	

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Question	Answers	Extra information	Mark	AO / spec ref.
2			6	AO1 3.3.1

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	There is at least one reason for deforestation **or** an attempt at a description of at least one way deforestation is affecting the atmosphere.	There is at least one reason for deforestation **and** a description of the way deforestation is affecting one gas in the atmosphere **or** the process that causes an effect.	There are reasons for deforestation **and** a clear description of the way deforestation is affecting one gas in the atmosphere **and** the process that causes this.

examples of the points made in the response	extra information
Reasons for deforestation • timber for construction / furniture / boat building / paper production • growing plants for biofuels for motor fuel / aviation / lawnmowers • use of wood as a fuel • land for building or agriculture to provide food, such as rice fields and cattle ranching	
Effects of deforestation • increase in carbon dioxide in atmosphere ○ due to burning ○ due to activities of microbes ○ less carbon dioxide taken in / locked up (by trees) ○ less photosynthesis • increase in methane in atmosphere due to rice production / cattle	ignore references to oxygen accept explanations of the effect of water (vapour)

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Question	Answers	Extra information	Mark	AO / spec ref.
3(a)	any **three** from: • (water through a) partially permeable • membrane • from dilute to (more) concentrated solution • (it's a) passive (process)	 accept 'semi permeable' / selectively permeable allow 'from a high concentration of water to a lower concentration (of water)' allow 'from high water potential to low water potential' allow 'down a concentration gradient of water' do **not** accept 'along a concentration gradient of water' allow requires no energy	3	AO1 3.1.1b
3(b)	(there are) many <u>hairs</u> **or** thin <u>hairs</u> **or** <u>hairs</u> are one cell thick (which gives) large / increased surface area **or** short diffusion pathway (so there is) more diffusion / osmosis (of water into the root)	 ignore absorption	1 1 1	AO1 / AO2 3.1.1h, 3.1.3b
Total			6	

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Question	Answers	Extra information	Mark	AO / spec ref.
4(a)(i)	defence against **or** destroy pathogens / bacteria / viruses / microorganisms	do **not** allow 'destroy disease' accept engulf pathogen / bacteria / viruses / microorganism accept phagocytosis accept produce antibodies / antitoxins allow immune response	1	AO1 3.2.2d
4(a)(ii)	they are small fragments of cells		1	AO1 3.2.2e
4(b)	liver kidney(s)	in this order only	1 1	AO1 3.2.2b
4(c)	any **two** from: • that it doesn't cause an immune response **or** isn't rejected / damaged by white blood cells • whether it is a long lasting material / doesn't decompose / corrode / inert • if it is strong (to withstand pressure) • it will open at the right pressure • that it doesn't cause clotting • that it doesn't leak **or** it prevents backflow • non toxic	ignore correct size	2	AO3 3.2
Total			6	

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Question	Answers	Extra information	Mark	AO / spec ref.
5(a)(i)	guard (cells)	allow phonetic spelling	1	AO1 3.1.3e
5(a)(ii)	any **one** from: • allow carbon dioxide to enter • allow oxygen to leave.	ignore reference to cells allow control loss / evaporation of water **or** control transpiration rate allow 'gaseous exchange'	1	AO1 3.1.3a, c,e
5(b)(i)	200	correct answer gains 2 marks with or without working allow 1 mark for 0.1 × 0.1 = 0.01 (mm^2)	2	AO2 3.1.3
5(b)(ii)	more / a lot of / increased water loss	allow plant more likely to wilt (in hot / dry conditions)	1	AO3 3.1.3d
5(c)(i)	0.12		1	AO2 3.1.3
5(c)(ii)	the lower surface has most stomata stomata are now covered / blocked (by grease) so water cannot escape / evaporate from the stomata	 ignore waterproof to gain credit stomata must be mentioned at least once	1 1 1	AO3 3.1.3c, d
Total			9	

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Question	Answers	Extra information	Mark	AO / spec ref.
6(a)(i)	1 hour 15 mins / 1.25 hours / 75 mins	allow 1:15 ignore 1.15 hours	1	AO3 3.3.2
6(a)(ii)	increase in (core / body) temperature	ignore numbers	1	AO1 / AO2 / AO3 3.3.2a
	(due to an) increase in <u>respiration</u> **or** more <u>muscle</u> contraction		1	
	releasing energy (as a waste product)	allow produces 'heat' do **not** allow making energy	1	
	skin temperature decreases		1	
	(because there is) sweating		1	
	(which) evaporates and cools the skin		1	
		ignore references to vasodilation or vasoconstriction		
6(a)(iii)	(there is) dilation of vessels (supplying skin capillaries)	allow vasodilation allow blood vessels widen ignore expand do **not** accept dilating capillaries or moving vessels	1	AO1 / AO2 3.3.2d
	(so) more blood flows (near skin) (surface) **or** blood is closer (to the skin)	ignore ref to heat	1	
6(b)	pancreas detects (low) blood glucose		1	AO1 3.3.3b
	produces glucagon	do **not** allow glucagon made in the liver	1	
	(so) glycogen is converted to glucose		1	
		allow adrenaline released which increases conversion of glycogen to glucose **or** reduced insulin production so less glucose into cells / less glucose converted to glycogen for 1 mark		
Total			12	

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Question	Answers	Extra information	Mark	AO / spec ref.
7(a)(i)	(initially there is) oxygen (so) <u>aerobic</u> respiration (by microorganisms) producing CO_2 (which does not burn)	accept: oxygen hasn't been used up yet (so not anaerobic conditions yet) (because) methane is produced in anaerobic (fermentation) there is no methane ignore inflammable	1 1 1	AO1 / AO2 3.4.3c
7(a)(ii)	(peelings had) the most carbohydrate / organic material	answer must be comparative accept contained more microorganisms / decomposers / bacteria ignore water do **not** allow fat or protein	1	AO3 3.4.3c
7(b)(i)	0.22 / 0.221	correct answer with or without working gains 2 marks allow 0.2 for 1 mark allow 22.1 for 1 mark allow 0.34 × 65 **/** 0.65 for 1 mark	2	AO2 3.4.3c
7(b)(ii)	(sheep manure) produces a higher volume of biogas / almost double **or** produces 0.27 (m^3 per kg) more (sheep manure) produces biogas with a higher percentage methane **or** produces 2% more methane	accept 0.408(7) / 0.41 / 0.409 (m^3) from sheep for 2 marks accept 0.1877 / 0.188 / 0.19 (m^3) more than cow's manure for 2 marks allow correct difference in volume calculated using 0.408(7) / 0.41 / 0.409 minus answer given in 7(b)(i) for 2 marks	1 1	AO2 3.4.3c
Total			8	

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2013

Biology

BL3HP

Unit Biology B3

H

Tuesday 14 May 2013 9.00 am to 10.00 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 1 hour

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 3(b) should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

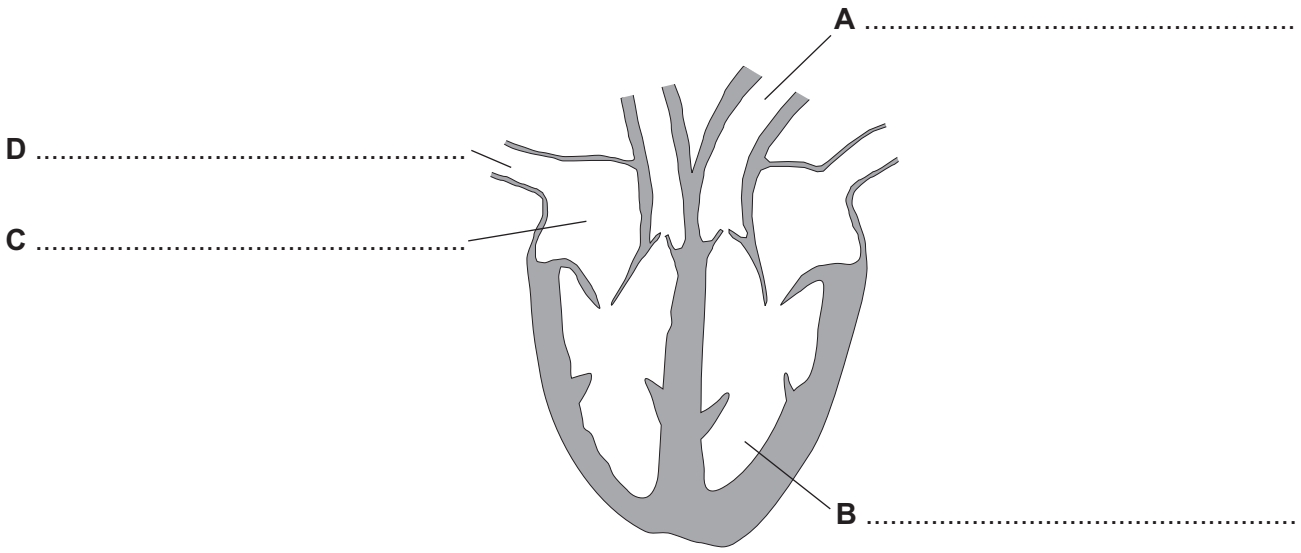
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Do not write outside the box

Answer **all** questions in the spaces provided.

1 **Diagram 1** shows a section through the heart.

Diagram 1



1 (a) On the diagram, name the parts labelled **A**, **B**, **C** and **D**.

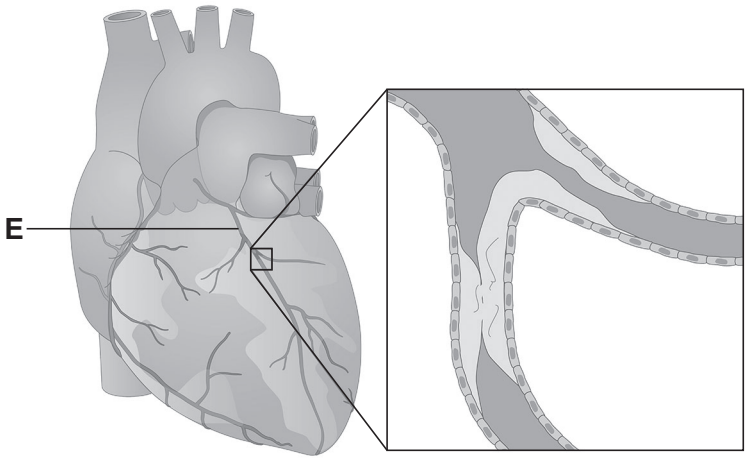
(4 marks)

Do not write outside the box

1 (b) **Diagram 2** shows the blood vessels that supply the heart muscle.

Part of one of the blood vessels has become narrower.

Diagram 2



Enlarged view of narrowed area of blood vessel **E**

1 (b) (i) Name blood vessel **E**.

.....

(1 mark)

1 (b) (ii) Give **one** method of treating the narrowed part of blood vessel **E**.

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(1 mark)

1 (b) (iii) Explain how the method of treatment works.

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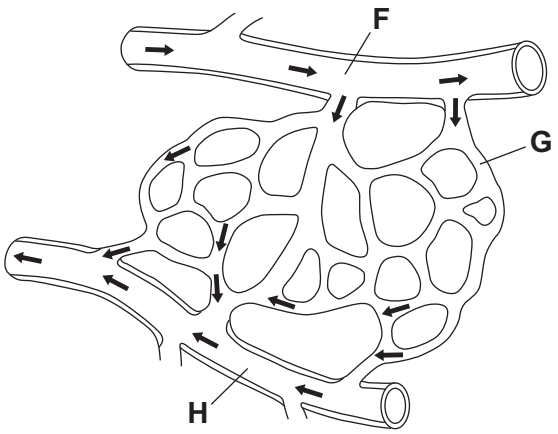
(2 marks)

Question 1 continues on the next page

Do not write outside the box

1 (c) **Diagram 3** shows part of the blood supply in the lungs.

Diagram 3



1 (c) (i) Name the types of blood vessel labelled **F**, **G** and **H**.

F .....

G .....

H .....

(3 marks)

1 (c) (ii) Give **one** way in which the composition of the blood in vessel **F** is different from the composition of the blood in vessel **H**.

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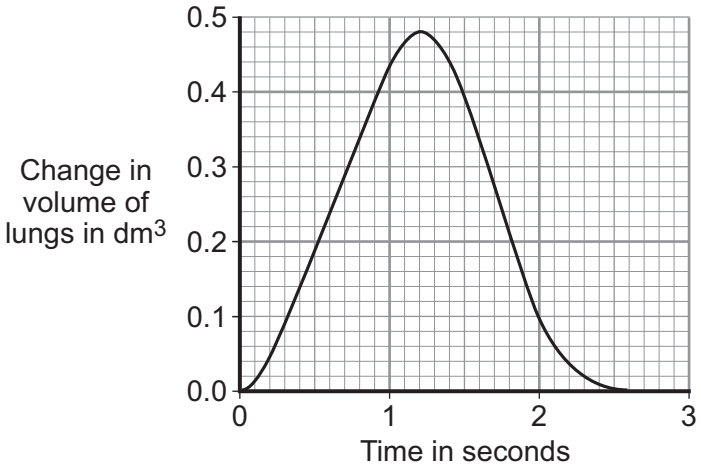
(1 mark)

12

Do not write outside the box

2 The diaphragm and ribcage move air into the lungs and out of the lungs.

The graph shows changes in the volume of the lungs in one breathing cycle.



2 (a) (i) Describe the changes in the volume of the lungs in one breathing cycle.

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(3 marks)

2 (a) (ii) Explain how the diaphragm and ribcage cause the changes in lung volume shown in the graph.

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(3 marks)

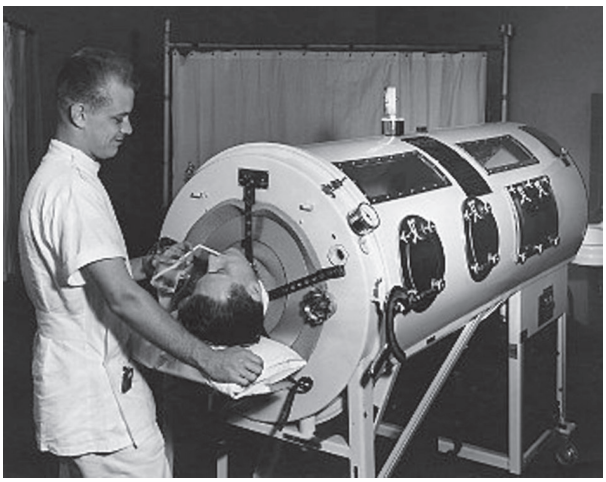
Turn over ▶

Do not write outside the box

2 (b) Sometimes patients are unable to breathe for themselves.
Mechanical ventilators are used to make these patients breathe.

Photograph 1 shows a patient in an iron lung ventilator.

Photograph 1



Air is pumped out of the iron lung, creating a very low pressure.
This low pressure causes the thorax to expand, causing air to flow into the lungs.
When air is pumped back into the iron lung the pressure inside the tank increases, causing air to move out of the lungs.

Photograph 2 shows a modern ventilator.

Photograph 2



Modern ventilators increase the pressure in the patient's airways using a tube put into the trachea.
The increased pressure in the patient's airways causes air to flow into the patient's lungs.
Then, the ventilator causes the pressure in the patient's airways to drop to zero, and the patient breathes out.

Do not write outside the box

2 (b) (i) The ventilators shown in **Photographs 1** and **2** make the patient inhale in a very different way.

Describe this difference.

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(2 marks)

2 (b) (ii) The iron lung ventilator was used mainly in the 1900s.

Most patients are now treated with the type of ventilator shown in **Photograph 2**.

Give **one** advantage and **one** disadvantage of using the modern ventilator rather than the iron lung ventilator.

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(2 marks)

10

Turn over for the next question

Do not write outside the box

3 There are many ways to increase the efficiency of food production.

3 (a) The table shows the energy available to humans from two different food chains.

Food chain	Energy transferred to humans in kJ per hectare of crop
Wheat → humans	900 000
Wheat → pigs → humans	90 000

3 (a) (i) Compare the amount of energy the two food chains transfer to humans.

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.....

(1 mark)

3 (a) (ii) Give **one** reason for the difference in the amount of energy the two food chains transfer to humans.

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(1 mark)

Do not write outside the box

3 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Give methods used in the factory farming of animals.
Explain the advantages and disadvantages of these methods.

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(6 marks)

8

Do not write outside the box

4 Plants exchange substances with the environment.

4 (a) Plant roots absorb water mainly by osmosis.
Plant roots absorb ions mainly by active transport.

Explain why roots need to use the two different methods to absorb water and ions.

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(4 marks)

4 (b) What is meant by the *transpiration stream*?

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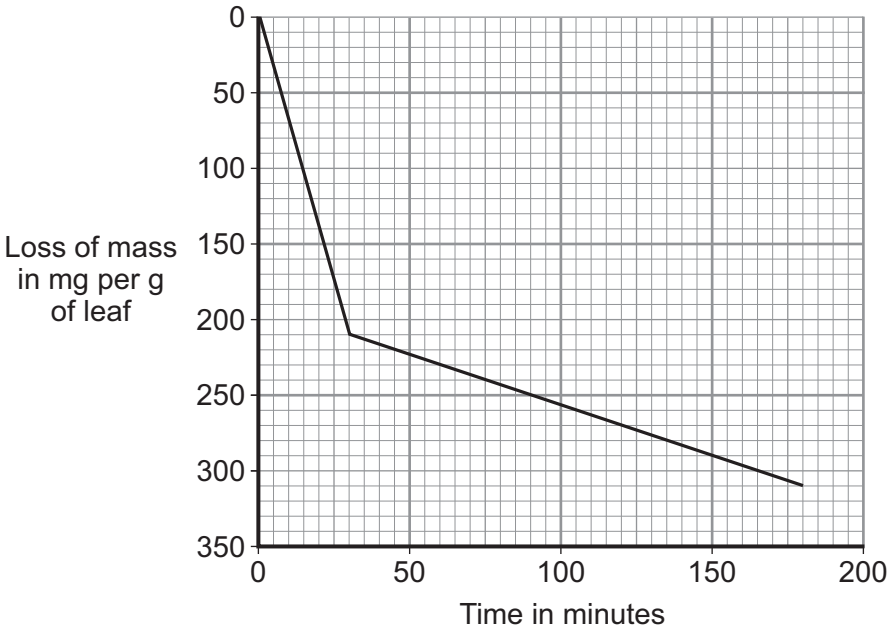
(3 marks)

Do not write outside the box

4 (c) Students investigated the loss of water vapour from leaves.

The students:
- cut some leaves off a plant
- measured the mass of these leaves every 30 minutes for 180 minutes.

The graph shows the students' results.



4 (c) (i) The rate of mass loss in the first 30 minutes was 7 milligrams per gram of leaf per minute.

Calculate the rate of mass loss between 30 minutes and 180 minutes.

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.....

Rate of mass loss = ... milligrams per gram of leaf per minute
(2 marks)

4 (c) (ii) The rate of mass loss between 0 and 30 minutes was very different from the rate of mass loss between 30 and 180 minutes.

Suggest an explanation for the difference between the two rates.

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(2 marks)

11

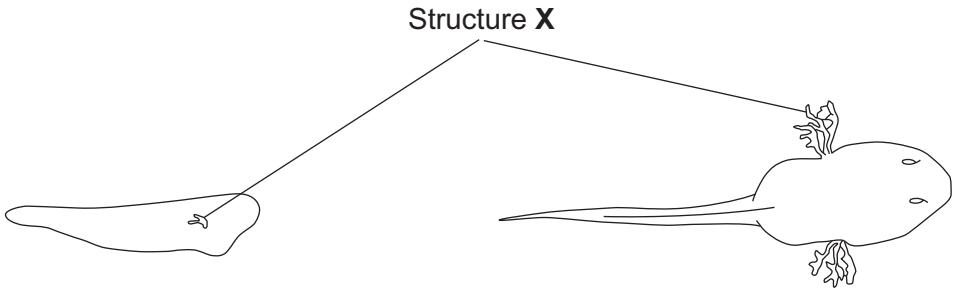
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5 The young stages of frogs are called tadpoles. The tadpoles live in fresh water.

The drawings show a tadpole just before hatching and three days after hatching.

Structure **X** helps in the exchange of substances between the tadpole and the water.



Tadpole just before hatching

Tadpole three days after hatching

5 (a) Name **one** substance, other than food, that the tadpole needs to exchange with the water in order to grow.

.....

(1 mark)

5 (b) Suggest how the changes in the tadpole shown in the drawings help it to survive as it grows larger.

You should **not** refer to movement in your answer.
To gain full marks you should refer to structure **X**.

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(4 marks)

5

Do not write outside the box

6 Humans maintain an almost constant body temperature.

6 (a) Describe the role of blood vessels in the control of body temperature.

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(4 marks)

6 (b) An athlete can run a marathon in 2 hours 15 minutes on a dry day in outside temperatures up to 35 °C.

If the air is dry, his body will **not** overheat.

In humid conditions the same athlete can run the marathon in the same time. However, in humid conditions, if the outside temperature goes over 18 °C then his body **will** overheat.

Suggest an explanation for the athlete overheating in humid conditions.

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(3 marks)

7

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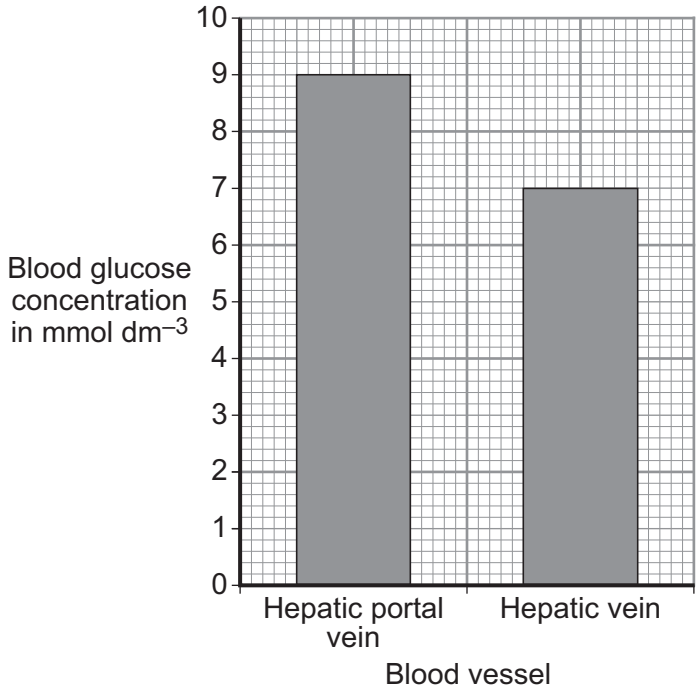
7 The pancreas and the liver are both involved in the control of the concentration of glucose in the blood.

The liver has two veins:
- the hepatic portal vein taking blood from the small intestine to the liver
- the hepatic vein taking blood from the liver back towards the heart.

Scientists measured the concentration of glucose in samples of blood taken from the hepatic portal vein and the hepatic vein. The samples were taken 1 hour and 6 hours after a meal.

Graph 1 shows the concentration of glucose in the two blood vessels 1 hour after the meal.

Graph 1



7 (a) The concentration of glucose in the blood of the two vessels is different.
Explain why.

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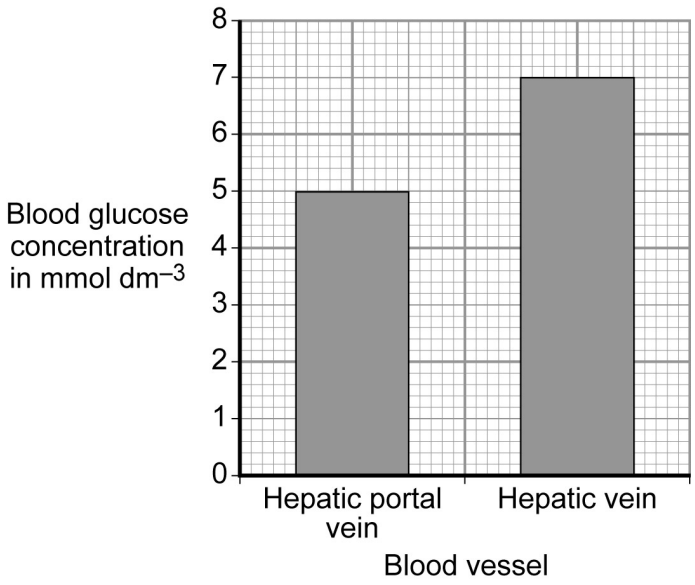
.....

(3 marks)

Do not write outside the box

7 (b) **Graph 2** shows the concentration of glucose in the two blood vessels 6 hours after the meal.

Graph 2



7 (b) (i) The concentration of glucose in the blood in the hepatic portal vein 1 hour after the meal is different from the concentration after 6 hours.

Why?

.....

.....

(1 mark)

7 (b) (ii) The person does **not** eat any more food during the next 6 hours after the meal.

However, 6 hours after the meal, the concentration of glucose in the blood in the hepatic vein is higher than the concentration of glucose in the blood in the hepatic portal vein.

Explain why.

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(3 marks)

7

END OF QUESTIONS

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There are no questions printed on this page

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Question 2 Photograph 2:© Getty Images

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Version 1.0



General Certificate of Secondary Education
June 2013

Biology BL3HP

(Specification 4401)

Unit 3: Biology 3

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from: aqa.org.uk

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

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Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

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Quality of Written Communication and levels marking

In Question 3(b) candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

Question 1

question	Answers	extra information	mark
1(a)	A aorta	ignore left and right	1
	B ventricle		1
	C atrium	allow atria	1
	D vena cava		1
1(b)(i)	(coronary) artery	allow arteriole	1
1(b)(ii)	stent / description	accept (coronary) by-pass operation allow statins allow diets low in cholesterol allow balloon (angioplasty)	1
1(b)(iii)	(stent) keeps artery open **or** (by-pass) new blood vessel / vein connecting around narrowed region; **or** (statins / low cholesterol diet) remove some of the cholesterol blockage **or** (balloon) widens / opens the blood vessel which allows (more) blood through or allows blood to go around the blockage	must relate to (b)(ii) ignore reference to capillary / vein	1 1

Question 1 continues on the next page . . .

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Question 1 continued

question	Answers	extra information	mark
1(c)(i)	F artery	accept arteriole / branch of pulmonary artery	1
	G capillary		1
	H vein	H accept venule / branch of pulmonary vein;	1
1(c)(ii)	F (Pulmonary artery) has less oxygen / more carbon dioxide / more glucose/sugar	accept F (Pulmonary artery) is deoxygenated accept converse for H (Pulmonary vein) 'It' refers to F	1
Total			**12**

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Question 2

question	Answers	extra information	mark
2(a)(i)	rise then fall		1
	to peak at 0.48 dm^3 / after 1.2s		1
	(fall) back to 0 / (falling) back after 2.5s	allow 2.6s allow after a further 1.3s / 1.4s	1
2(a)(ii)		ignore contraction and relaxation of muscles ignore reference to pressures, ribcage expanding	
	rise / air in caused by upward/outward movement of ribcage		1
	decrease / air out caused by return of ribcage to original position/downwards		1
	and (rise / air in) by downward movement / flattening of diaphragm **or** (decrease / air out) by upward movement / doming of diaphragm		1

Question 2 continues on the next page . . .

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Question 2 continued

question	Answers	extra information	mark
2(b)(i)	in iron lung atmospheric / outside pressure forces air into lungs	allow air sucked / drawn into lungs	1
	in modern respirator air forced (mechanically) into lungs		1
		allow for one mark pressures acts externally in iron lung and internally in modern ventilator	
2(b)(ii)		ignore cost	
	advantage any **one** from: • more freedom of movement for patient • more portable • does not affect blood flow in lower body		1
	disadvantage any **one** from: • (tube in trachea) uncomfortable • more difficult to eat/talk		1
		allow it can damage / overinflate the lungs / over breathe	
Total			**10**

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Question 3

question	Answers	extra information	mark
3(a)(i)	wheat → humans chain transfers 10 times more energy than wheat → pigs → humans chain or wheat → pigs → humans chain transfers 810 000 (kJ per hectare) less	allow 10% if given as a comparison e.g. one is 10% of the other ignore less unqualified	1
3(a)(ii)	any **one** reason for energy loss from pigs e.g.: • movement • (maintaining) body temperature • waste materials • not all parts of pig eaten by human • because there is an extra stage (pigs) in the food chain and energy is lost at each stage	ignore respiration, growth ignore heat unqualified allow named examples allow longer food chain so more energy lost	1

Question 3 continues on the next page . . .

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Question 3 continued

<table>
<tr><td>3(b)</td><td colspan="3">Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a ‘best-fit’ approach to the marking.</td><td>6</td></tr>
<tr><td>0 marks</td><td>Level 1 (1-2 marks)</td><td>Level 2 (3-4 marks)</td><td colspan="2">Level 3 (5-6 marks)</td></tr>
<tr><td>No relevant content.</td><td>There is a basic description of at least one factory farming method
or
identification of an advantage or disadvantage of factory farming.</td><td>There is a description of at least one factory farming method
and
an advantage or disadvantage is explained.</td><td colspan="2">There is a description of factory farming methods
and
advantage(s) and disadvantage(s) are explained.</td></tr>
<tr><td colspan="5">examples of biology points made in the response:
factory farming methods e.g.:
• Kept in cramped conditions / battery hens / calf crates / pig barns / fish tanks
• Controlled temperature / heating
• Controlled feeding / modified food given / growth hormones
• Controlled lighting
• Treated with prophylactic antibiotics

Advantages e.g.:
• Increased efficiency / profit / greater food production / cheaper food / faster growth
• Farmer can have more livestock
• Less energy is lost through movement
• Less energy is used keeping warm
• (Food is high in calories / protein) so animals will grow faster / lay more eggs
• Easier to vaccinate all the animals
• Easier to protect animals from predators
• Antibiotic treatment stops infections in animals

Disadvantages e.g.:
• Stress / cruelty / inhumane / unethical
• Restricted movement / overcrowding
• Faster spread of diseases
• Antibiotics in the food chain / residual chemicals in the food chain
• Wasting fossil fuels / increasing global warming
• Increased pollution from animal waste and from additional transport</td></tr>
</table>

Total			**8**

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Question 4

question	answers	extra information	mark
4(a)	solution in soil is more dilute (than in root cells)	concentration of water higher in the soil (than in root cells)	1
	so water moves from the dilute to the more concentrated region	so water moves <u>down</u> (its) concentration gradient **or** water moves from a high concentration <u>of water</u> to a lower concentration	1
	concentration of ions in soil less (than that in root cells)		1
	so energy needed to move ions **or** ions are moved against concentration gradient	the direction of the concentration gradient must be expressed clearly accept correct reference to water potential or to concentrations of water	1
4(b)	any **three** from: • movement of water from roots / root hairs (up stem) • via xylem • to the leaves • (water) evaporates • via stomata		3
4(c)(i)	0.67/0.7	accept 0.66, 0.6666666... or ⅔ or $0.\dot{6}$ correct answer gains **2** marks with or without working if answer incorrect allow evidence of $\frac{100}{150}$ for **1** mark do **not** accept 0.6 or 0.70	2

Question 4 continues on the next page . . .

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Question 4 continued

question	Answers	extra information	mark
4(c)(ii)	during the first 30 minutes any **one** from: • it was warmer • it was windier • it was less humid • there was more water (vapour) in the leaves		1
	so there was more evaporation **or** stomata open during first 30 minutes **or** closed after 30 minutes (1) so faster (rate of) evaporation in first 30min **or** reducing (rate of) evaporation after 30min (1)	ignore 'water loss'	1
Total			**11**

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Question 5

question	answers	extra information	mark
5(a)	oxygen / O_2 **or** carbon dioxide / CO_2	allow O2 do not accept O^2 allow CO2 do not accept CO^2	1
5(b)	any **four** from: • because structure X / gills has threads / filaments **or** is thin **or** tadpole has longer tail • there is an increased surface area • there is a shorter diffusion pathway • therefore an increase in exchange • eyes (now visible in older tadpole) • so that food / danger etc can be seen	ignore references to tail used for locomotion ignore reference to nostrils ignore food accept reference to a good blood supply accept increased water flow over gills / tail will increase diffusion of gases	4
Total			**5**

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Question 6

question	Answers	extra information	mark
6(a)	if body temperature too high blood vessels supplying skin (capillaries) dilate / widen	do **not** accept capillaries / veins dilate/constrict	1
	if body temperature is too low blood vessels supplying skin (capillaries) constrict / narrow	do **not** accept idea of blood vessels moving (through skin) ignore expand accept arteries / arterioles for 'blood vessels' if no reference to skin allow blood vessels dilate and blood vessels constrict for one mark	1
	so more / less blood flows through skin (capillaries) or nearer the surface of the skin	must correctly relate to dilation or constriction	1
	so more / less heat is lost (from the skin by radiation)	must correctly relate to dilation or constriction	1
6(b)	sweat released		1
	cannot evaporate because of high humidity / all the water vapour in the air		1
	so less heat lost / less cooling **or** it is evaporation of sweat that cools the body		1
Total			**7**

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Question 7

question	answers	extra information	mark
7(a)	(concentration high) in the hepatic portal vein is blood with glucose absorbed from the intestine		1
	concentration is lower in the hepatic vein because insulin		1
	(has caused) glucose to be converted into glycogen **or** allows glucose into liver cells		1
7(b)(i)	(after 6 hours) most of the glucose has been absorbed from the intestine **or** from food into the blood		1
7(b)(ii)		if biological terms incorrectly spelt they must be phonetically accurate	
	because glucagon (made in the pancreas) causes	do **not** accept glucagon made / produced by the liver	1
	glycogen to be converted into glucose		1
	glucose released into blood	allow the liver maintains the correct / constant level of glucose in the blood	1
Total			**7**

UMS Conversion Calculator: www.aqa.org.uk/umsconversion

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