WJEC GCSE BIOLOGY

BIOLOGY



EXAM QUESTION PACK

UNIT B1 HIGHER TIER 4461 PAPERS

STEMUP

These questions belong to WJEC, not to us.

The examination questions, mark schemes and examiner reports in this pack were written and published by WJEC. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with WJEC and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. WJEC has not endorsed, approved or been involved in the production of it. WJEC and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

WJEC publishes its past papers, mark schemes and examiner reports free of charge. Always check the current specification at wjec.co.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4461/02

S16-4461-02-R1

SCIENCE A/BIOLOGY

BIOLOGY 1
HIGHER TIER

P.M. WEDNESDAY, 15 June 2016

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**7**	
3.	**5**	
4.	**6**	
5.	**6**	
6.	**5**	
7.	**7**	
8.	**5**	
9.	**7**	
10.	**6**	
Total	**60**	

4461
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to questions **4** and **10**.

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

Answer **all** *questions.*

1. *(a)* (i) Gregor Mendel crossed purple flowered pea plants with white flowered pea plants. All the **F1** generation were purple flowered. Show this cross by completing the Punnett square below.
Use the letter **D** to represent the purple allele and the letter **d** to represent the white allele. [2]

	Gametes		
F1			

(ii) When Mendel selfed the **F1** generation he obtained a ratio of 3 purple : 1 white flowered pea plants in the **F2** generation. In the space below construct and complete a Punnett square to show this cross. [2]

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) Mendel's experiments on genetics were carried out with garden peas *(Pisum sativum)*. In each of his experiments he used thousands of pea plants.
State the importance of the use of such a large number of plants. [1]

.....

(c) Mendel published his work on the genetics of pea plants in 1866. The significance of his work was not recognised until it was replicated in the early 1900s. Why is it important for scientists to replicate the work of other scientists? [1]

.....

6

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

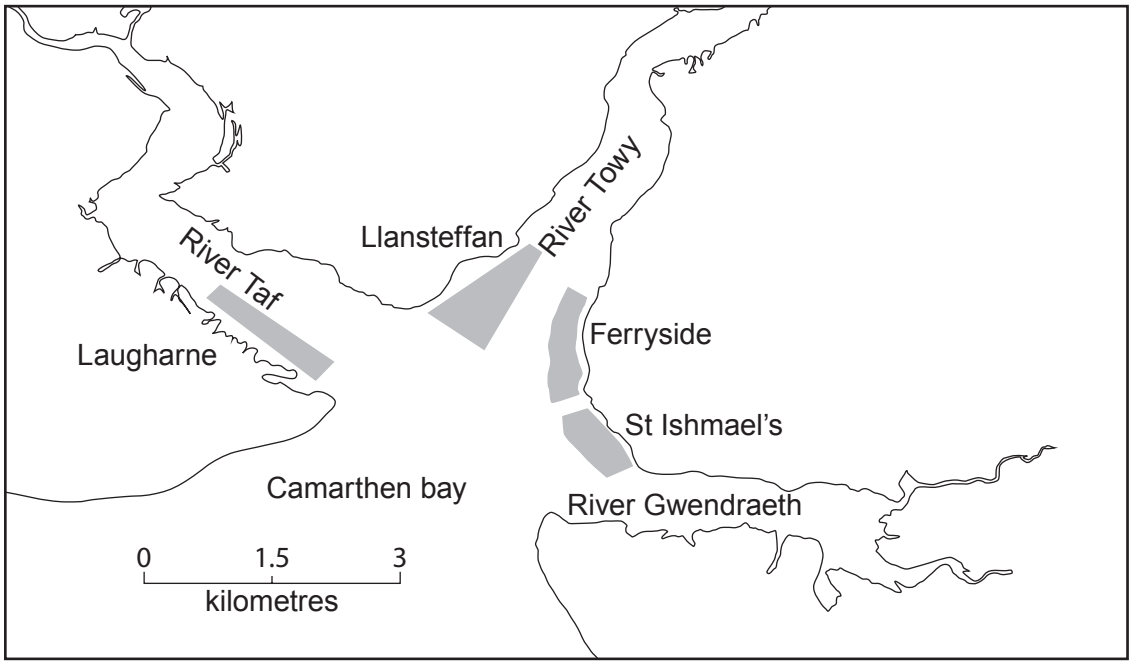
2. There is an increasing demand for food to feed the growing human population. This has both worldwide and local effects on wildlife and on the environment.

Cockles *(Cerastoderma edule)*



In 1984 a survey found that there was a small cockle fishery in the Three Rivers area of Carmarthenshire, South Wales with a few people harvesting the cockles. By 2014 the Three Rivers Cockle Fishery had become an important industry in South Wales with many fishermen harvesting the cockles for human consumption. The cockles are harvested from sandy mudflats at low tide.

Map showing the Three Rivers Cockle Fishery



cockle beds

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

The table shows the number of fishermen that harvested cockles from the Llansteffan cockle bed on 4 days in the summer of 2007.

Date	Number of fishermen	Mass of cockles harvested (tonnes)
Tuesday 26 June	292	129
Tuesday 3 July	257	102
Tuesday 10 July	330	142
Tuesday 17 July	100*	37

*Tide not suitable for harvesting cockles

(a) Calculate the mean mass of cockles harvested per fisherman on Tuesday 26 June. Use the space below for your calculation. [2]

mean mass = ... tonnes

(b) (i) Cockles can only be harvested if there is a minimum of 50 cockles per m^2 of mud flats. If the number falls below this level then the Welsh Government closes the fishery. Suggest a reason why the fishery is closed if the number of cockles is less than 50 cockles per m^2. [1]

.....

(ii) Suggest a way in which the mass of cockles harvested could be managed effectively. [1]

.....

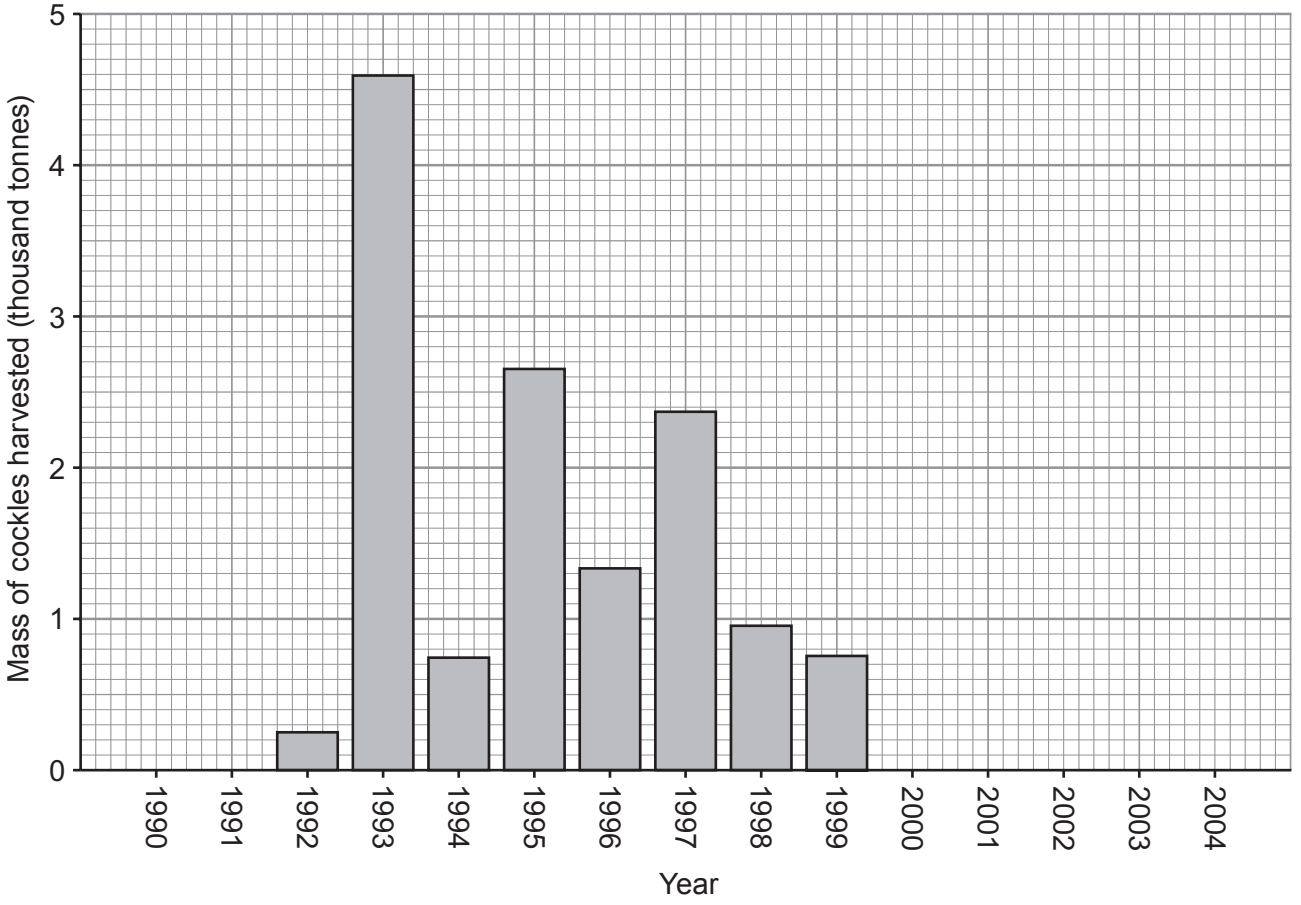
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

(c) The graph below shows the mass of cockles harvested in the Three Rivers Fishery between 1990 – 2004.



Adapted from South Wales Sea Fisheries Committee

Suggest **two** possible reasons why no cockles were harvested from 2000 to 2004. [2]

I. .....

II. .....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(d) Oystercatchers *(Haematopus ostralegus)* are birds which often feed on cockles.



In recent years there has been an increase in the number of oystercatchers *(Haematopus ostralegus)* moving into the Three Rivers area. Cockles are a major source of food for oystercatchers.

Suggest **one** possible reason for this increase. [1]

.....

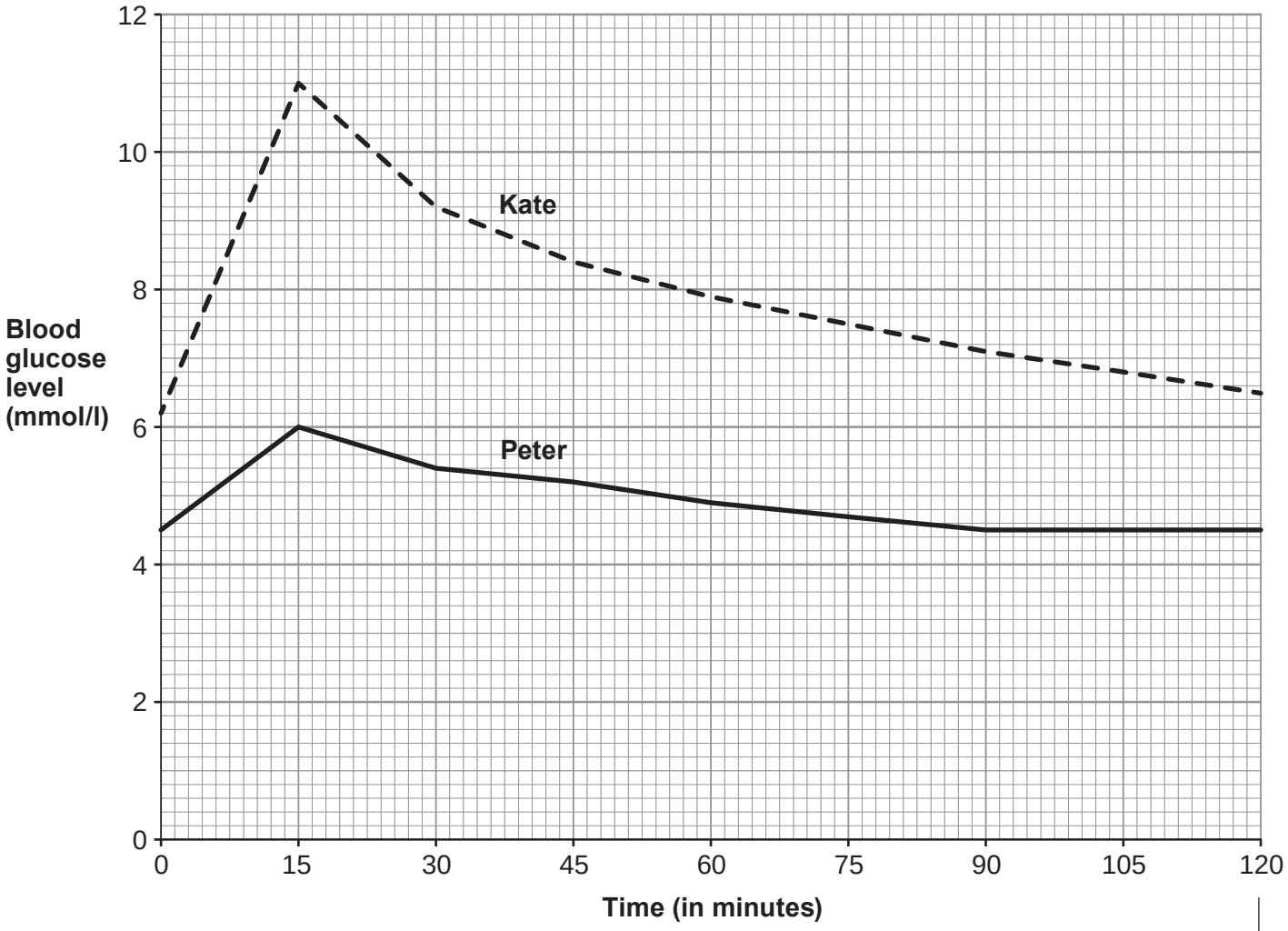
4461 020007

7

STEMUP.CO.UK

Examiner only

3. The graph below shows the blood glucose levels of Kate and Peter, after eating the same mass of sugary cereal at breakfast time. The normal blood glucose range before meals is 4.0 – 5.9 mmol/l.



(a) Explain why Peter's blood glucose level rises then falls. [3]

.....

.....

.....

.....

.....

(b) State **two** pieces of evidence, shown in the graph, which indicate that Kate has diabetes. [2]

I. .....

II. .....

5

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

4. Explain how the leakage of untreated sewage into an unpolluted pond can result in the death of fish living in the pond. [6 QWC]

4461
020009

6

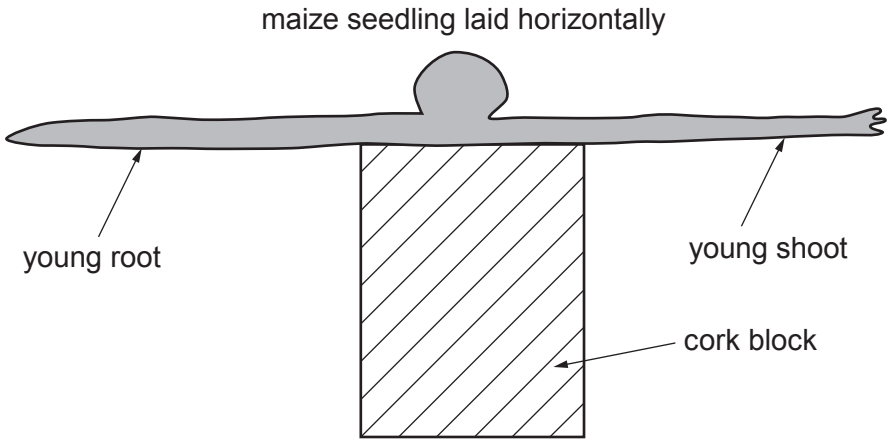
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

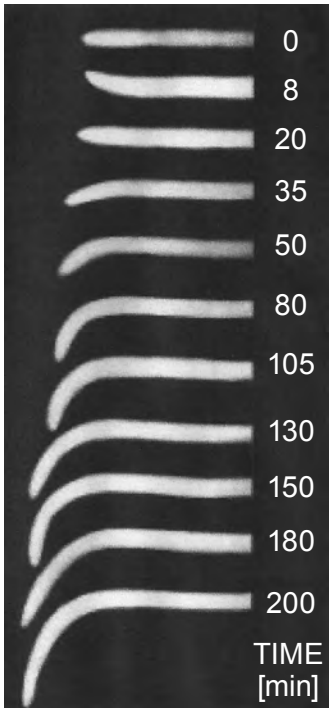
Examiner only

5. A young maize seedling was laid horizontally in a dark room.



A series of time-lapse photographs was taken of the **young root**, at various time intervals, over a 200 minute period.

The series of photographs is shown below.



(a) (i) State three observations, **shown in the photographs**, about the young root over the time of the investigation. [3]

I. .....

II. .....

III. .....

(ii) Name the response shown by the young root between 35 and 200 minutes. [1]

.....

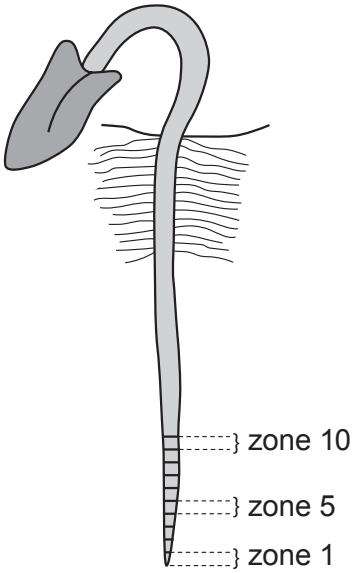
© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

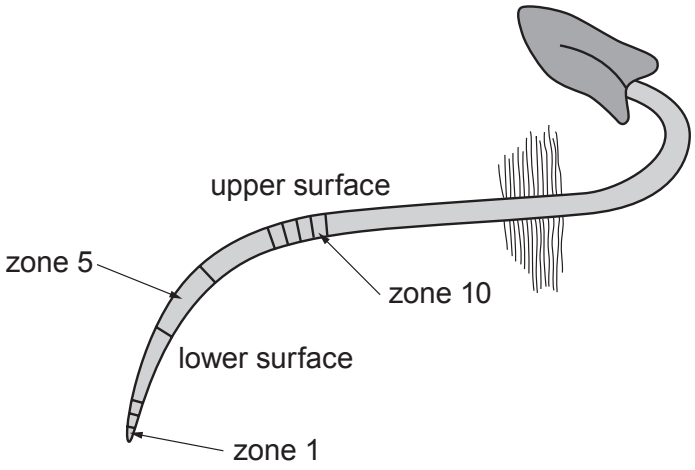
(b) The root tip of a young seedling was marked with ink at 2 mm intervals. Each of the 2 mm divisions is known as a zone and three zones are labelled in the drawing.

Drawing 1



The seedling was laid horizontally for 180 minutes after which time a drawing was made. This is shown below.

Drawing 2



(i) **Using Drawing 2 only** compare the growth rate of the upper and lower surfaces of the young root. [1]

.....

.....

(ii) Name the type of chemical responsible for the curvature of the young root. [1]

.....

6

STEMUP.CO.UK

Examiner only

6. The following is part of a code of good farming practice concerning the use of nitrate-based fertiliser:

- do not apply nitrate fertiliser in autumn
- do not leave the soil bare during winter
- sow winter crops early in autumn
- do not spread slurry (animal manure) near lakes or rivers
- aerate soils (allow air to enter the soils) before spreading slurry
- plough straw into the soil to increase nitrate production in the long term

(a) Explain why nitrate-based fertiliser, used when the crop is actively growing, will cause less nitrate loss from the soil than if it is used on bare soil in autumn. [2]

.....

.....

.....

(b) Give the reason why air in the soil helps the nitrogen cycle to take place. [1]

.....

(c) Explain why ploughing straw into the soil leads to increased nitrate production in the long term. [2]

.....

.....

.....

5

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

7. Bananas that are cultivated commercially do not produce gametes. They are all grown as clones by asexual reproduction.

(a) What is meant by the term clone? [1]

.....

(b) Explain why populations of cloned bananas grown without the use of pesticides have very little chance of surviving outbreaks of diseases caused by fungi. [2]

.....

.....

(c) In 1963, a fungus infected bananas grown in Costa Rica in Central America and spread throughout all of the banana crops there. A pesticide was sprayed on the banana crops to kill the fungus. In recent years, more than 70 different pesticides have been sprayed on the banana crops in Costa Rica.



Caiman *(Caiman crocodilus)* are similar to alligators and are fourth stage consumers.

Explain why the excessive use of pesticide sprays has led to the decrease in populations of caiman in the rivers of Costa Rica. [4]

.....

.....

.....

.....

.....

.....

7

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

8. In 2013 specimens of sea snails (molluscs) were collected from a deep sea trench near the north of Scotland. They were sent to a scientist at the National Museum of Wales, Cardiff, for identification.

Most of the specimens were known as *Volutopsius norwegicus* but one showed some differences in appearance to the known specimens and also showed some similarities.

It was concluded that the unknown specimen belonged to the same genus as the known specimens. The scientist reported that the differences might be due to:

EITHER

A – the sea snail's development under different environmental conditions

OR

B – natural selection from a group of snails showing continuous variation

(a) Give the letter A or B which suggests that the known and unknown snails have: [2]

(i) different genotypes; .....

(ii) the same genotype .....

(b) Name the technique that could be used to confirm the scientist's conclusions. [1]

.....

(c) It was decided that the unknown specimen was of the genus *Volutopsius* but it was given the second name *scotia*. What term, used in classification, does this second name represent? [1]

.....

(d) Underline the correct statement from the list below. [1]

The scientific name of all newly discovered organisms is decided by:

(i) the person who discovered the organism;

(ii) the name of the place where it was discovered;

(iii) an international committee;

(iv) the National Museum of Wales;

(v) a committee from the United Kingdom.

5

© WJEC CBAC Ltd.

STEMUP.CO.UK

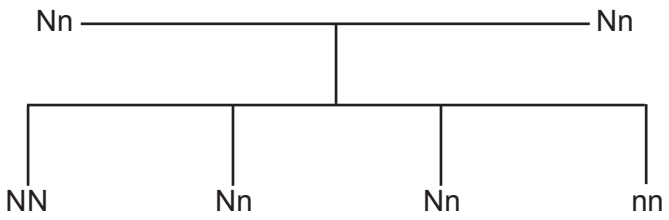
BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

9. The family tree shows how two parents, heterozygous for the cystic fibrosis allele, have a 1 in 4 chance of having a child who has cystic fibrosis.



Key:

N = the normal allele n = the cystic fibrosis allele nn = child with cystic fibrosis

(a) It is estimated, that one person in 25 in the population of the United Kingdom is heterozygous for the cystic fibrosis allele. Therefore the probability of both parents being heterozygous for the cystic fibrosis allele in the population of the United Kingdom is:

$$\frac{1}{25} \times \frac{1}{25}$$

(1 in 25 × 1 in 25)

If one in 4 of their children is nn, calculate the probability of a person having cystic fibrosis in the population of the United Kingdom.

Show your working: [2]

probability = ...

(b) State how cystic fibrosis affects the lungs. [1]

.....

(c) People with cystic fibrosis may be given a lung transplant. Give a reason why the transplanted lungs would not produce the symptoms of cystic fibrosis. [1]

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(d) (i) Gene therapy has been used to treat the symptoms of cystic fibrosis. State how lung cells are targeted with normal alleles. [1]

.....

(ii) Suggest why this type of gene therapy would have to be regularly repeated. [1]

.....

.....

(e) It took more than 20 years between the first research into this type of gene therapy and its final approval by the European Union. Suggest why this time was needed for detailed testing. [1]

.....

.....

7

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

10. Cockroaches are pests which spoil food and spread disease. They have a gene which makes them attracted to sugar. In the 1980s pest controllers used a mixture of insecticide and sugar as a means of pest control. The sugar attracted the cockroaches and the insecticide killed them. In the 1990s certain populations of cockroaches had changed so that they were no longer attracted to sugar. The insecticide was still lethal but the cockroaches avoided eating it when it was mixed with sugar.



Explain how the cockroaches evolved to survive the pest control that was used in the 1980s.
[6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

END OF PAPER

6

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

GCSE MARKING SCHEME

SUMMER 2016

SCIENCE – BIOLOGY B1
4461/01/02

INTRODUCTION

This marking scheme was used by WJEC for the 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)			3	1 C/ bacteria 2 B/insects 3 A *(given)* 4 D/ mosses 5 E/ mammals all 4 correct = 3; 2/3 correct = 2; 1 correct = 1;			
		(b)			1	Fungus **and** bacteria; *either order* *BOTH required for the mark*			letters
		(c)			1 1	insects ***and*** mammals; *either order.* *BOTH required for the mark* animal; 2nd MP linked to first - cannot access second mark if wrong organisms or no organisms given in first marking point If B and E given for first marking point – no credit, but can award second mark if correct			letters
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
2		*(a)*	(i)		2	all six bars plotted and drawn accurately;; 2 marks one error; 1 mark ±½ small square tolerance on height Ignore differing widths Reject line/ stick graphs			
			(ii)		1	40;			
		(b)			1	<u>age</u>;			
		Total Mark			4				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)			2	(pesticide) {kills/ destroys} {pests/animals/weeds/insects/fungi }; that would {eat/kill/harm/damage/compete with/ feed on} {it/them/crop/plant};	named pest	get rid of/ stop named weed	 Bacteria
		(b)			4	DDT; toxic; fertility; consumers;			
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		(a)	(i)		2	X = (clamp)stand; Y = boiling tube;	test tube		
			(ii)		3	Any three from • measuring cylinder/syringe • thermometer • Bunsen (burner) • balance • safety glasses/ goggles	weighing scales/ digital scale		measuring jug scales glasses
		(b)	(i)		1	1.5; No unit needed	answer not in table but in answer space (must have unit - °C)		
			(ii)		1	to make a fair comparison/ OWTTE; e.g. to work out if the results would be the same if the sweets weighed the same			Fair test
			(iii)		2	more {heat/energy} lost (in Megan's method); as the {sweet/flame} was held {lower/further away} (from the boiling tube); ORA			

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
		(c)	(i)		1	42.9;	answer not in table but in answer space must have unit (g)		
			(ii)		1	22.9; Ecf from (i) Answer from (i) – 20 = award 1 mark			
		(d)			1	fat;	glycogen		
		Total Mark			12				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		(a)	(i)		1	<u>erector muscle</u>;			
			(ii)		1	Hair shaft to be shown raised; Hair should be higher than first diagram and no higher than 90° and should attach to the correct end of the muscle. Hair must protrude from the surface of the skin.			
			(iii)		1	it contracts/ contracting/ contraction;			Tenses/ pulls/ tightens/ shortens
			(iv)		2	traps layer of air; which is an insulator	Holds air/ keeps layer of air Poor conductor of heat	 Keeps heat in	Traps heat
		(b)			3	• <u>more</u> sweat produced (on a hot day); • {comes onto/spread over} the {skin/surface}/ comes through the (sweat) pore; evaporation (takes heat out);			
		Total Mark			8				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6	**1**	(a)	(i)			**F1** Gametes: **D** **D** **d**: **Dd** **Dd** **d**: **Dd** **Dd**			
					1 1	Gametes correct 1 mark Mechanics of cross correct 1 mark If use different letters cannot award gametes mark but can award mechanics mark			

© WJEC CBAC Ltd.

STEMUP.CO.UK

<table>
<tr><th colspan="2">Question Number</th><th colspan="3" rowspan="2">Sub-section</th><th rowspan="2">Mark</th><th rowspan="2">Answer</th><th rowspan="2">Accept</th><th rowspan="2">Neutral answer</th><th rowspan="2">Do not accept</th></tr>
<tr><th>FT</th><th>HT</th></tr>
<tr><td>6</td><td>1</td><td>(a)</td><td>(ii)</td><td></td><td>1
1</td><td>F2
<table>
<tr><td>Gametes</td><td>D</td><td>d</td></tr>
<tr><td>D</td><td>DD</td><td>Dd</td></tr>
<tr><td>d</td><td>Dd</td><td>dd</td></tr>
</table>
Gametes correct 1 mark
Must use any two of their F_1 offspring from (i)
Mechanics of cross correct (must generate a 3:1 ratio)
[If incorrect letters are used in (a)(i) allow ECF for (a)(ii) to access both marks]
If different letters used in second punnett square to first = 0 marks</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>(b)</td><td></td><td></td><td>1</td><td>repeatability/increased confidence in results</td><td>Identify anomalies</td><td></td><td>Reliability/ accuracy/ validity/ reproducibility</td></tr>
<tr><td></td><td></td><td>(c)</td><td></td><td></td><td>1</td><td>So that the {work/results/experiments} can be {verified/confirmed}/
to see if they get the {same/ similar/different} results/ reproducibility;</td><td></td><td>To see if Mendels work was right/ correct/ true</td><td>Repeatability/ validity/ accuracy/ reliability</td></tr>
<tr><td colspan="3"></td><td colspan="2">Total Mark</td><td>6</td><td></td><td></td><td></td><td></td></tr>
</table>

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	**2**	(a)			1 1	0.44/ 0.4/ 0.442/ 0.44178082 (tonnes) Correct answer = 2 marks If answer incorrect allow 1 mark for 129 ÷ 292			
		(b)	(i)		1	Any one from: • to allow stocks time to recover • ref to sustainability • because unless harvesting stops fishery will die out/ • conserve stock • allows them to reproduce to reach harvestable levels		Conservation/ to allow cockles to breed	Extinction/ species running out
			(ii)		1	• restrict harvesting to specified time e.g. once a week/ • quota scheme/ • collect a certain {mass/ weight} • limit number of fishermen allowed If state a {mass/ weight} it must be realistic (less than 2 tonnes/ day)			

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
		(c)			2	Any two from: fishery closed/ disease/ pollution/ number of cockles dropped below 50/m^2 / cockle beds have died out	All the cockles have been harvested		
		(d)			1	Any one from: other (cockle) beds have died out/ more {food/cockles/prey} (in Three Rivers area) must be comparative		Lots of food	
		Total Mark			7				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	**3**	(a)			3	• (it rises because) glucose is {absorbed into/enters} the blood (stream); • pancreas {secretes/ releases/ produces/ makes} insulin; • which converts (excess) glucose to glycogen (in liver) (so blood glucose falls); Correct spelling for glycogen			
		(b)			2	any two from: • {glucose/ sugar} level is above {5.9 mmol/l/ normal}{before her meal/ at the start}/ {glucose/ sugar} level was higher than normal before she ate; • rises to a {very/abnormally/ unusually} high level; • hasn't fallen back to her starting level (after 120 minutes)/ takes longer to return to her starting level; • Her (blood) glucose level is always above normal;			
		Total Mark			5				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number			
FT	HT	Mark	Answer
9	**4**	6 QWC	**Indicative content:** • untreated sewage contains nutrients/nitrate/phosphate (NOT fertilisers) • which are (absorbed/ taken in/ taken up/ enters) by {plants/algae/photosynthesisers} • results in {growth/excessive growth/overgrowth (of plants)/ algal bloom/ rapid growth} • {sunlight/ light} blocked • plants die and are decayed by microbes/bacteria/ decomposers • microbes/bacteria increase in number • use up O_2 in respiration • fish suffocate/ fish die from lack of oxygen NOT fish die unqualified **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.
Total Mark		6	

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	(a)	(i)		3	**Any three from:** • At {0/ 20} minutes the root is horizontal; • At 8 minutes the root {curves/ turns/ grows } upwards; • The root gets longer; • The {curvature increases/angle of curvature increases/ roots bend more/ root dips more }; • {At 35min/ after 20 min} the roots start to {bend/ grows/ curves/ turns/ dips } downwards;	Shows negative gravitropism Shows positive gravitropism	roots grow downwards at any point between 50-200	Roots grow towards gravity/ roots grow downwards unqualified
			(ii)		1	<u>positive</u> gravitropism/geotropism;			
		(b)	(i)		1	The tissues/cells/part of root on the upper grow {quicker/ more} (than on the lower surface) ;	reverse argument		
			(ii)		1	hormone/plant hormone/phytohormone;	auxin		
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)			2	{Plants / crops} {absorb / take up} nitrates (when growing in the autumn); (More) run off (from bare soil) / (less) run off {when plants are growing/ in growing season};	Not washed away	Fertiliser	Nitrogen
		(b)			1	Provides <u>oxygen</u> for {microorganisms / decomposers/ bacteria / fungi} for <u>respiration</u>;			
		(c)			2	<u>Protein</u> {changed/ broken down} to ammonia by bacteria; Ammonia {changed/ built up} to nitrates by (nitrifying) bacteria;			Denitrifying bacteria Ammonia broken down to nitrates
		Total Mark			5				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)			1	Genetically identical/ {identical / same} {genes / alleles/ genomes / DNA/ genetic code/ genotype/ genetic makeup};			
		(b)			2	Cannot show variation; So cannot have types resistant to the fungi;			They are all the same immune
		(c)			4	• Pesticides enter {rivers/water}; • Bioaccumulation/ {build up/ accumulate} in food chain/ OWTTE; • Pesticide reaches toxic {concentration / level/ amount}/ OWTTE Answer must be in context of food chain; • Reduces fertility / prevents {reproduction / egg laying} in Caiman;			
		Total Mark			7				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	8	(a)	(i)		1	B;			
			(ii)		1	A;			
		(b)			1	{Genetic/ DNA/ gene} <u>profiling;</u>			Genetic analysis/ DNA testing/ chromosome profiling/ genetic fingerprinting
		(c)			1	Species; (correct spelling)			
		(d)			1	iii;			
		Total Mark			5				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	9	(a)			2	25 × 25 = 625 ×4 = 2 500 Answer = 1 in 2 500 or 1/2500 or 1:2500 or 0.04% or 0.0004 or 4 x 10^{-4}; Correct answer = 2 marks Incorrect answer but evidence of correct working = 1 mark			
		(b)			1	They produce {increased / more/ build up/ thick} mucus;		Sticky mucus	Too much mucus
		(c)			1	Healthy lungs have donor's {allele/ genes} / do not have cf {allele/ gene} /they are not nn;	They have dominant/ normal alleles		
		(d)	(i)		1	Use of inhaler / they are inhaled/ they are breathed in;	Asthma type inhaler	virus	Asthma inhaler
			(ii)		1	Lung cells with introduced alleles wear out and are replaced by cells with cf allele / owtte;			
		(e)			1	To check there are no side effects / check there are no long term (harmful) effects;	To check that it is safe		
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number			
FT	HT	Mark	Answer
	10	6 QWC	**Indicative content:** • The gene for sugar attraction was mutated. • This led to variation – some populations/ individuals/ cockroaches} were not attracted to sugar. • Those not attracted to sugar did not eat the poison so survived/ selective advantage/ natural selection • these then reproduce • And passed on the advantageous gene. No upper or middle band for those who describe{ resistance/ immunity} <u>to insecticide.</u> **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.
Total Mark		7	

© WJEC CBAC Ltd.

STEMUP.CO.UK

Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4461/02

W16-4461-02

SCIENCE A/BIOLOGY

BIOLOGY 1
HIGHER TIER

A.M. THURSDAY, 7 January 2016

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**7**	
3.	**5**	
4.	**6**	
5.	**6**	
6.	**7**	
7.	**5**	
8.	**6**	
9.	**6**	
10.	**6**	
Total	**60**	

4461
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to questions **4** and **10**.

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

Answer **all** *questions.*

1. Phenylketonuria (PKU) is an inherited disease caused by a recessive allele. PKU results in damage to the nervous system in the early years of life.

Key – **N** represents the allele for **not** having PKU

n represents the allele for having PKU

A couple, neither of whom suffer from PKU, have a child who is found to have PKU.

(a) (i) State the genotype of: [1]

I. the mother .....

II. the father .....

(ii) Complete the Punnett square below to show the possible genotypes of the children produced by this couple. [2]

Gametes		

(iii) Place a circle in the Punnett square around the genotype of a child suffering from PKU. [1]

(iv) From your Punnett square, what is the probability of a child **not** having PKU? [1]

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) At birth a sample of blood is taken from babies to check for PKU.



Suggest why the screening of newborn babies for genetic conditions like PKU is important. [1]

.....

.....

4461 020003

6

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

2. Vitamin A deficiency occurs when humans do not obtain enough of this vitamin from their food. It is very common in developing countries. It can result in blindness and between 250 000 and 500 000 children in these countries go blind each year from vitamin A deficiency. Approximately half of these children die within one year of becoming blind.

Golden Rice is a genetically modified (GM) crop plant which contains high levels of vitamin A. It was developed to help prevent vitamin A deficiency and has been grown in field trials in the Philippines, Taiwan and other countries.



(a) State the meaning of the term genetically modified (GM). [1]

.....

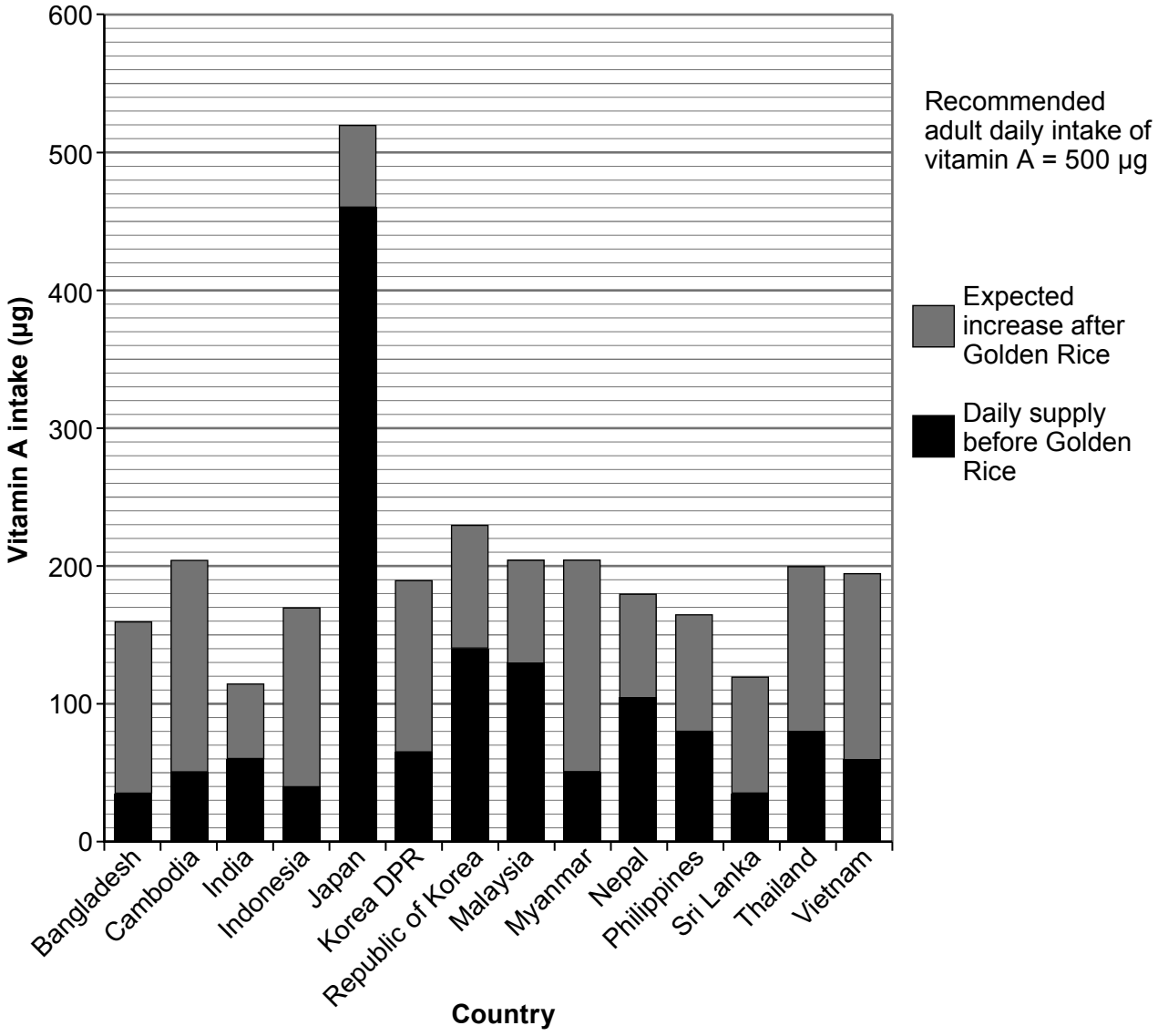
.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) The graph below shows the mass of additional vitamin A which could be obtained each day if the countries indicated were to replace the rice varieties they grow with Golden Rice.



(i) In which of the countries in the graph would the people have sufficient vitamin A each day if they grew Golden Rice? [1]

.....

(ii) In how many of the countries shown could the people increase the intake of vitamin A per day by 50% or more, if they grew Golden Rice? [1]

.....

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

(iii) Since the data for the graph were obtained, a new variety of golden rice, Golden Rice 2, has been developed. The table below shows the potential benefits of Golden Rice 2 in Bangladesh.

	Adults	Children under 7 years of age
Recommended daily intake of vitamin A (µg)	500	450
Vitamin A provided by Golden Rice 2 (µg)	775	338
Vitamin A provided by other food eaten (µg)	245	112

Explain the effect of a diet containing Golden Rice 2 on the number of cases of blindness caused by vitamin A deficiency in Bangladesh. [2]

.....

.....

(c) In August 2013 a crop of Golden Rice that was being grown in a field trial was destroyed by protesters in the Philippines. The protesters said they had many concerns about the growth of GM crops.

Suggest what **two** of these concerns might have been. [2]

.....

.....

.....

7

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

3. *(a)* (i) What is meant by the term indicator species? [1]

.....

(ii) Name **one** factor of water quality which can be assessed by using indicator species. [1]

.....

(b) Lichens can be used as indicators of air quality and are often found covering the bark of trees. The amount of tree bark covered with lichen is known as the percentage cover. In the photograph below the lichen is covering about 40% of the bark i.e. the percentage cover is 40%.

Lichen on the bark of a tree



The table below shows the pH of the bark of ash trees and the percentage (%) cover of a lichen which is very sensitive to air quality. The data were collected along a 19 mile line, starting from the centre of a large industrial city.

Distance from city centre (miles)	0	1.0	1.7	3.0	4.7	6.0	6.5	7.0	8.0	9.0	9.5	10.5	12.5	14.5	16.5	19.0
pH	3.2	3.4	3.4	3.5	3.4	3.6	3.6	3.7	3.6	3.9	4.4	4.4	4.3	4.3	4.5	4.5
% cover of lichen	0	0	0	0	0	0	0	0	1	12	23	25	54	57	66	66

Describe and explain the change in the percentage (%) cover of lichen as you move out of the city centre. [3]

.....

.....

.....

.....

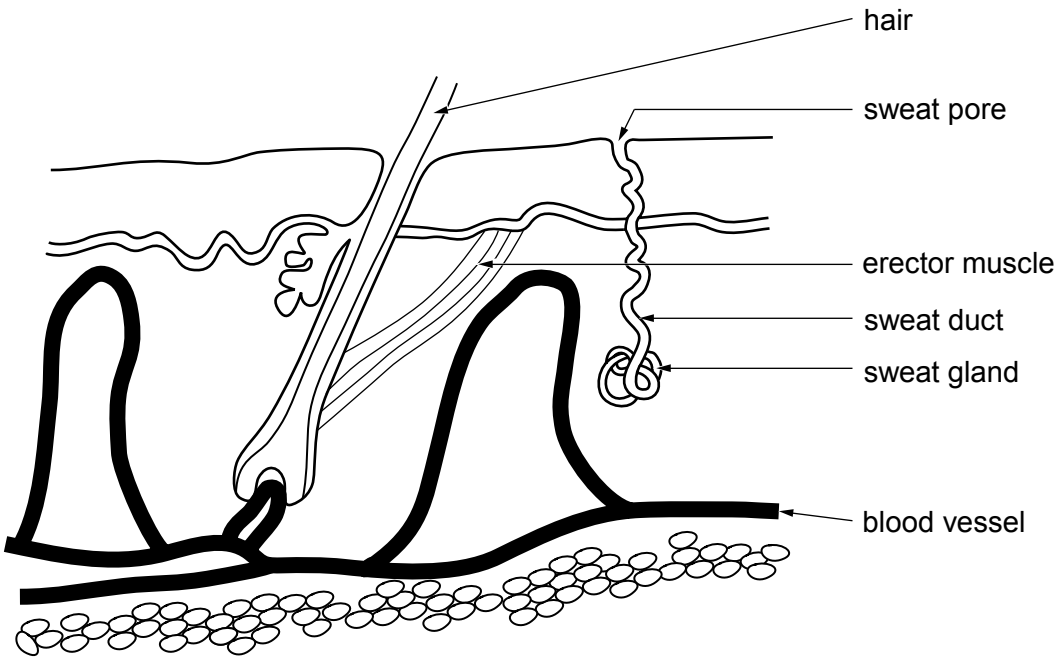
4461 020007

5

STEMUP.CO.UK

Examiner only

4. Explain how human skin helps to control body temperature in hot conditions. Use the features labelled on the diagram below to help with your answer. [6 QWC]



6

© WJEC CBAC Ltd.

STEMUP.CO.UK

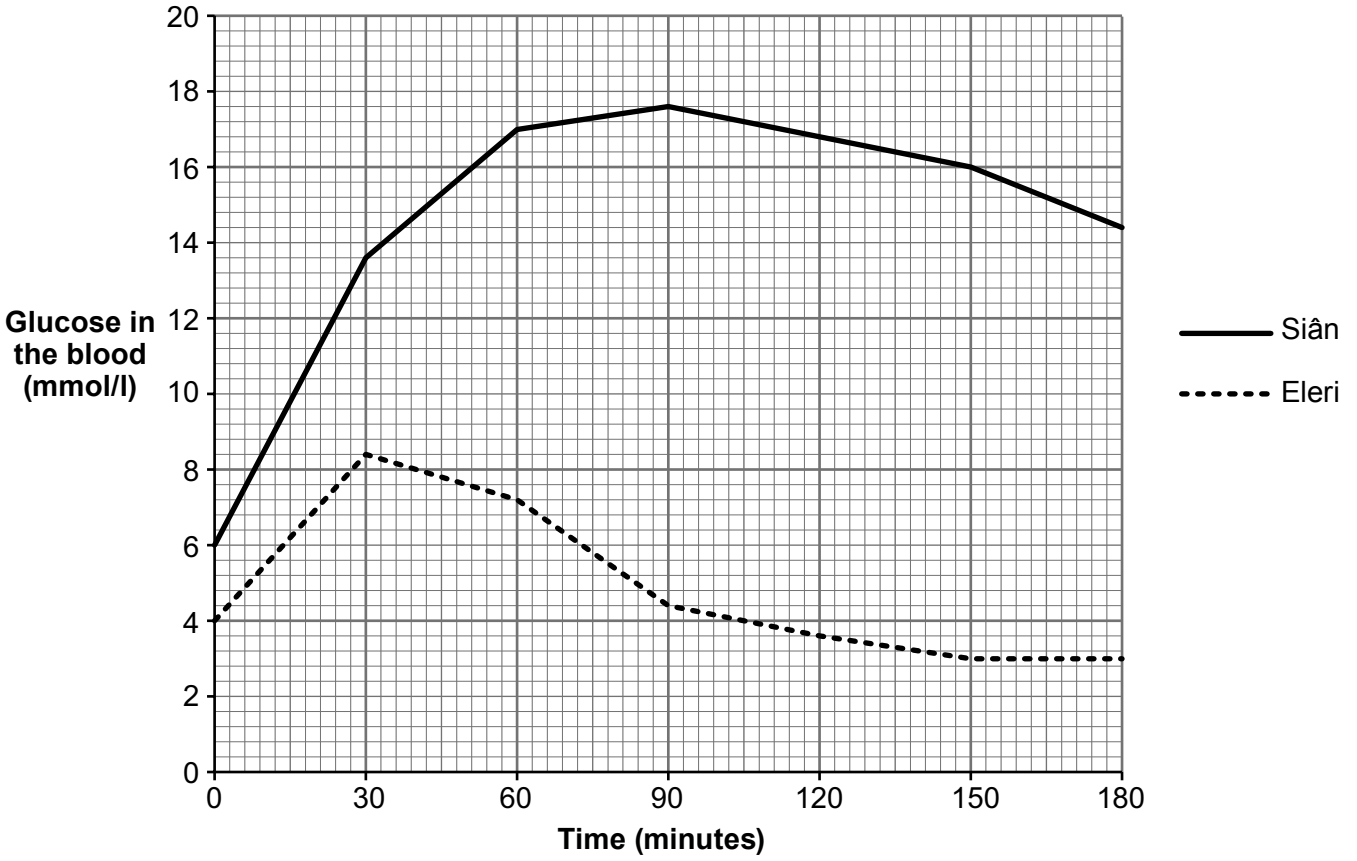
BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

5. Eleri and Siân ate identical meals. After the meal the concentration of glucose in their blood was measured at regular intervals over the next 180 minutes. The graph below shows the results obtained.



(a) The meal both Eleri and Siân ate contained no added glucose or other sugars. Suggest which type of food in the meal could have caused the increase in blood sugar. [1]

.....

(b) It is important that the concentration of glucose in the blood remains between 3.5 and 7.5 mmol/l. Explain how the level of glucose in Eleri's blood is reduced after 30 minutes. [2]

.....

.....

.....

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(c) What evidence, shown in the graph, suggests that Siân is suffering from diabetes? [1]

.....

.....

(d) A student tested an artificial urine sample for the presence of glucose.

In the table below **circle**

- **one** correct **chemical test** for glucose.
- the correct **process** for that test.

Complete the third column to show a positive result for the artificial urine test you have chosen. [2]

chemical test	process	colour of positive result for glucose
Biuret test	dip in urine sample	
Benedict's test	mix with urine sample and heat gently	.....
Iodine test	mix with urine sample and cool in refrigerator	
Diastix / Clinistix	mix with urine sample and heat strongly	

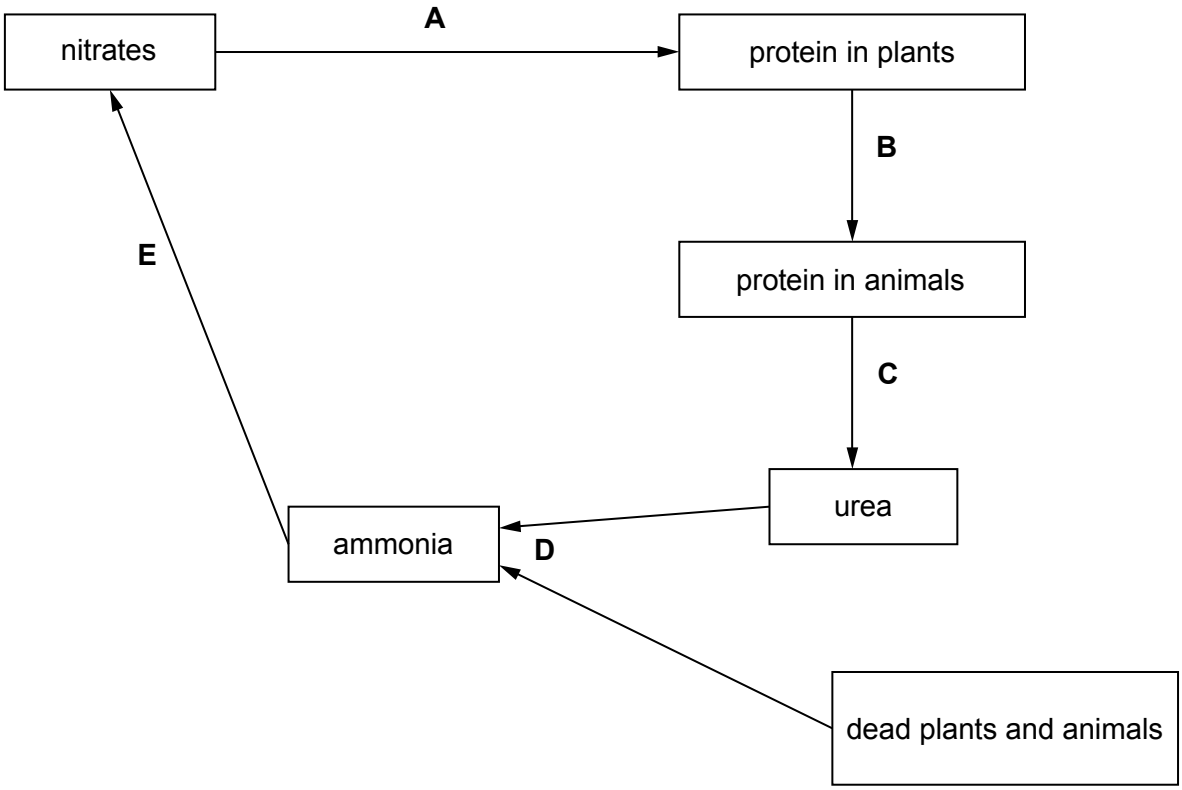
6

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

6. *(a)* The diagram below shows some stages of the nitrogen cycle.



Use the diagram to match the correct letter with the name of the process given in the table below. [2]

process	letter
absorption by plants	
decay by decomposers	
feeding	
excretion	

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) During the severe flooding in North Wales in November 2012, raw sewage was washed into a lake. The concentration of nitrate in this lake was measured before and after the flooding. The table below shows the results.

time	concentration of nitrate (mg/l)
October 2012	0.4
November 2012	1.0
January 2013	2.2
May 2013	63.0

Use the data in the table above, the diagram of the nitrogen cycle in part *(a)* and your knowledge to describe and explain the change in the nitrate concentration throughout this period. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

7

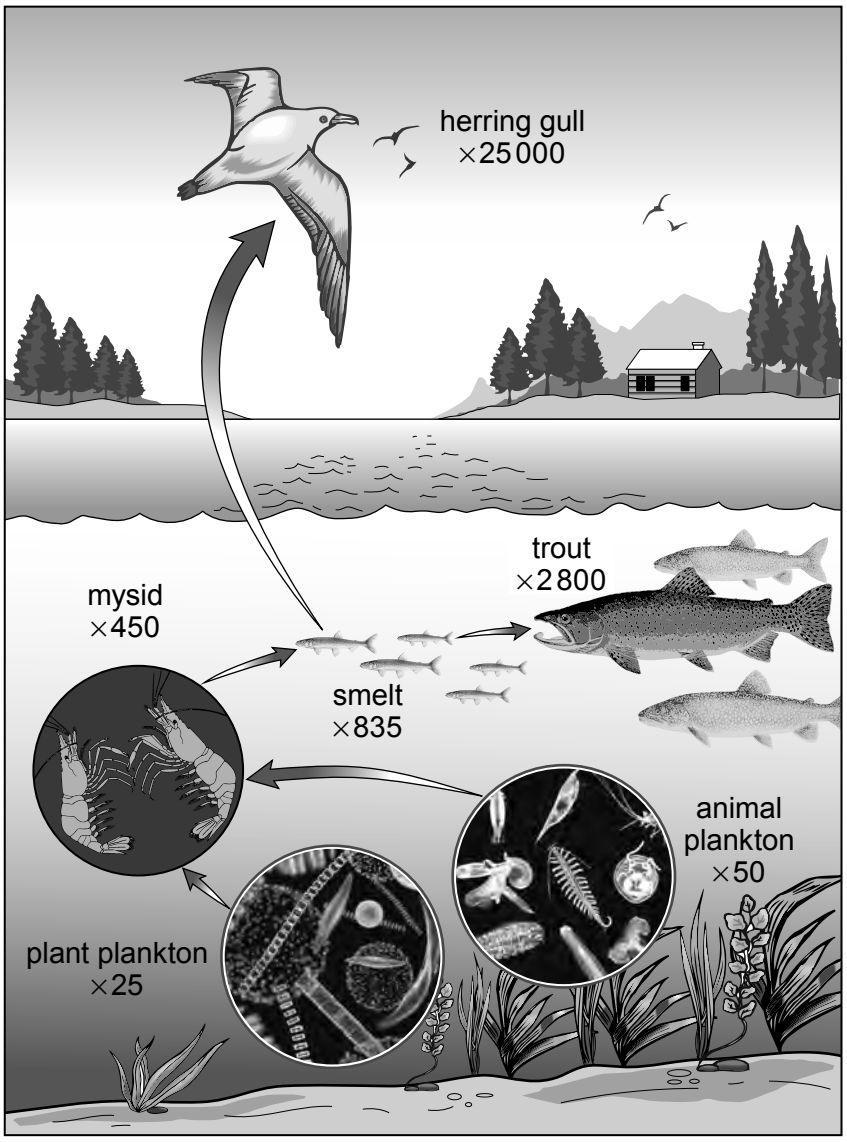
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

7. A factory producing polyvinyl chloride plastics (PVC) discharged its waste chemicals into a lake in Canada. Lead is used in the manufacture of PVCs.

The diagram below shows a food web for the lake.



The numbers represent the increase in concentration of lead through the food chains of the food web when compared to the water. For example, smelt has ×835 times more lead than the water.

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(a) If the concentration of lead in the water of the lake was 0.002 ppm (parts per million), calculate the concentration in the herring gull. [1]

..... ppm

(b) The herring gull population in a breeding colony near the lake is decreasing. Use the food web and your knowledge to give reasons for this. [3]

.....

.....

.....

.....

.....

(c) In order to reduce this form of pollution, scientists have developed a type of plastic called Biopol. It is decomposed by micro-organisms when buried in the soil.

Name the gas which is produced during the decomposition of Biopol in the soil. [1]

.....

5

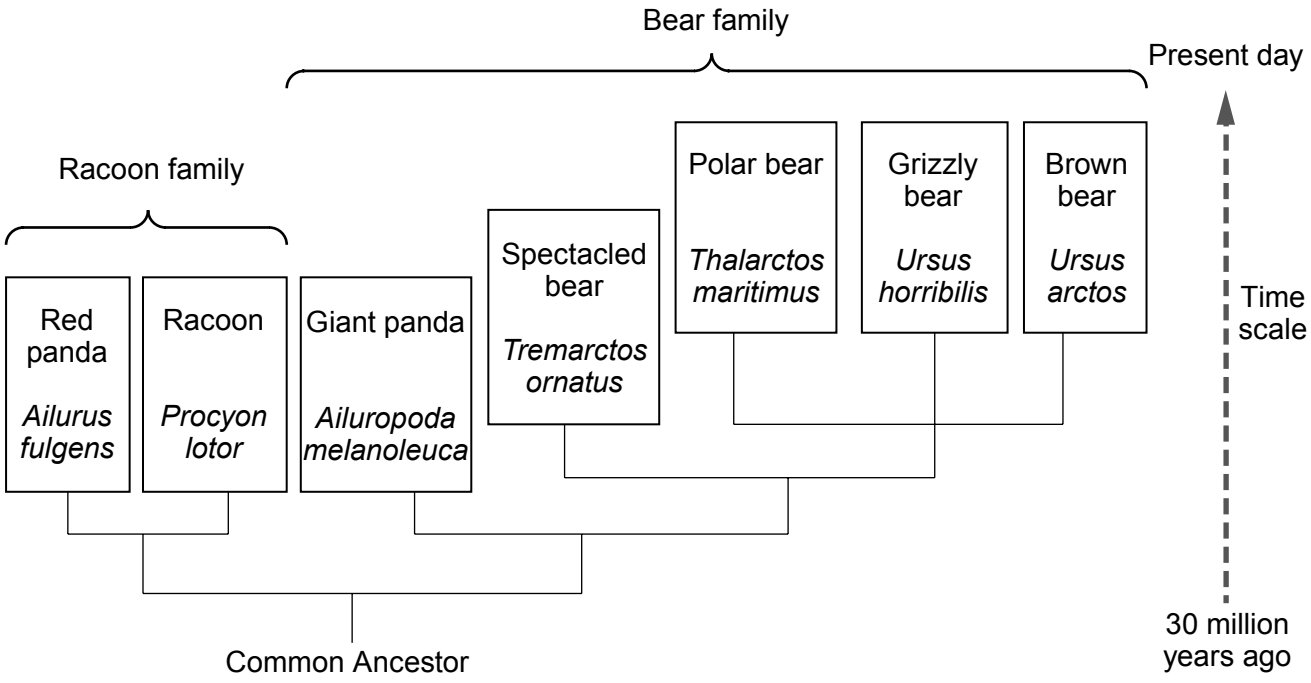
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

8. The diagram shows a suggested simplified evolutionary history for bears, racoons and pandas.



(a) Which animals in the diagram have the most recent common ancestor? [1]

.....

(b) (i) Name the **two** animals which you would expect to have the most similar DNA and give a reason for your choice. [2]

.....

.....

.....

(ii) Name the technique that would be used to analyse DNA samples from these animals. [1]

.....

(c) How does the diagram show that the red panda is more closely related to the racoon than it is to the giant panda? Give **two** reasons. [2]

.....

.....

.....

6

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

9. *Plasmodium falciparum* is a single-celled organism which causes malaria when it is in human blood.

Chloroquine is a medication which kills *Plasmodium falciparum*.

In the early 20th century a lot of chloroquine was used throughout Africa and was very successful. By the 1980s *Plasmodium falciparum* showed widespread resistance to chloroquine.

The mutation which caused resistance was originally very rare in the population.

(a) (i) Name the chemical that had become mutated. [1]

.....

(ii) Explain how natural selection caused the mutated *Plasmodium falciparum* to become very common in the 1980s. [4]

.....

.....

.....

.....

.....

.....

.....

(b) In the 1980s, some Health Authorities in Africa stopped using chloroquine. In 2011, a trial using chloroquine again took place in the African country of Senegal. It was then found that 70% of *Plasmodium falciparum* had been killed by chloroquine.
Suggest a reason for this observation. [1]

.....

.....

6

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

10. Explain why obesity and drinking alcohol are two of the highest risk factors for the loss of healthy years of life. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

END OF PAPER

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

GCSE MARKING SCHEME

JANUARY 2016

SCIENCE – BIOLOGY 1
4461/ 01/02

© WJEC CBAC Ltd.

INTRODUCTION

This marking scheme was used by WJEC for the January 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

© WJEC CBAC Ltd.

Biology 1 Foundation Tier

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
1		(a)			1	herbivores;			
		(b)			1	A;			
		(c)	i		1	5 and 7;			
			ii		1	400;			
			iii		1	5(m^2);	ecf (ii)		
			iv		1	220;			
		(d)			3	**any three from:** • {not enough/ competition for} {food/grass}/ not enough to eat; • disease; • (qualified reference to weather/climate) e.g. too hot/ too cold; • increase in {predators/ hunters/OWTTE}; • {not enough/ competition for} water;	drought	Ref to reproduction alone	No/ less/ lack of food illness Climate change
		Total Mark			9				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		(a)	i		4	**one mark** for **correct adaptation** plus **one** for a **correct explanation**. **any two from:** • <u>thick</u> hair; good insulator/ reduces heat loss; • <u>black</u> coat colour; {absorbs/takes in} heat ; • <u>small</u> ears; <u>reduced surface area</u> for heat loss;	Keeps <u>more</u> heat in solar energy /sun's <u>energy</u>		Keeps heat in/ keeps it warm Attracts heat
			ii		1	it has finger like ends on the trunk;			
		(b)			3	<u>{Too/very}</u> cold/ temperature is low}; for {bacteria/fungi/micro-organisms/decomposers}; so no {decay/decomposition};	Correct reference to micro-organisms		Killing bacteria/ no bacteria
		Total Mark			8				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
3		(a)	i		1	pancreas;			pancrease
			ii		1	liver;			
			iii		1	in the blood(stream);	blood vessels/ veins/ arteries/ capillaries		in blood cells
		(b)			1	C;	1,2 and 3		
		(c)			1	glucose;	sugar		blood sugar
		(d)			2	{regular / description of regular} exercise/ exercise often; eat less {carbohydrate/starch/ sugar/ fat};			more exercise/ keep fit eat less food/ control the quantity of fat/ eat no fat
		Total Mark			7				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		(a)	i		1	photosynthesis;			
			ii		1	respiration;			
			iii		1	carbon dioxide;	CO_2		
		(b)			1	{releases/ adds/ produces/ more} carbon dioxide;	CO_2/ gas X if named in iii		CO^2/ Co_2
		Total Mark			4				

© WJEC CBAC Ltd.

STEMUP.CO.UK

<table>
<tr><th colspan="2">Question Number</th><th colspan="3" rowspan="2">Sub-section</th><th rowspan="2">Mark</th><th rowspan="2">Answer</th><th rowspan="2">Accept</th><th rowspan="2">Neutral answer</th><th rowspan="2">Do not accept</th></tr>
<tr><th>FT</th><th>HT</th></tr>
<tr><td>5</td><td></td><td>(a)</td><td>i</td><td></td><td>1</td><td>lips;</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>ii</td><td></td><td>1</td><td>elbow;</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>(b)</td><td></td><td></td><td>2</td><td>{skin becomes/ it becomes/ fingertips, cheek and elbow become} less sensitive;
no effect on lip sensitivity/ lip sensitivity stays the same;</td><td>skin becomes less sensitive except the lips = 2 marks</td><td></td><td>reference to any less than the three areas for the 1st mark point</td></tr>
<tr><td></td><td></td><td>(c)</td><td></td><td></td><td>4</td><td><table><tr><th>sense organ</th><th>stimulus detected</th></tr><tr><td>given</td><td>touch/ pressure;</td></tr><tr><td>given</td><td>light;</td></tr><tr><td>ear;</td><td>given</td></tr><tr><td>given</td><td>chemical(s);</td></tr></table></td><td></td><td></td><td></td></tr>
<tr><td colspan="3" colspan="3">Total Mark</td><td>8</td><td></td><td></td><td></td><td></td></tr>
</table>

© WJEC CBAC Ltd.

STEMUP.CO.UK

<table>
<tr><th colspan="2">Question Number</th><th colspan="3" rowspan="2">Sub-section</th><th rowspan="2">Mark</th><th rowspan="2">Answer</th><th rowspan="2">Accept</th><th rowspan="2">Neutral answer</th><th rowspan="2">Do not accept</th></tr>
<tr><th>FT</th><th>HT</th></tr>
<tr><td>6</td><td>1</td><td>(a)</td><td>i</td><td></td><td>1</td><td>the mother Nn and
the father Nn ;
(both correct for 1 mark)</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>ii</td><td></td><td>1
1</td><td>gametes correct from ai;
mechanics of cross correct – this mark can be awarded even if the gametes are incorrect;
<table>
<tr><td></td><td>N</td><td>n</td></tr>
<tr><td>N</td><td>NN</td><td>Nn</td></tr>
<tr><td>n</td><td>Nn</td><td>nn</td></tr>
</table></td><td>ecf from ai

Use of wrong letters from ai (except X and Y)</td><td></td><td>Any reference to X and Y</td></tr>
<tr><td></td><td></td><td></td><td>iii</td><td></td><td>1</td><td>circle around nn;</td><td></td><td></td><td>any other letters</td></tr>
<tr><td></td><td></td><td></td><td>iv</td><td></td><td>1</td><td>¾/ 75%/ 0.75/ three out of four;
must relate to their Punnett square</td><td></td><td></td><td>ratio/ no credit if any letters other than Nn used</td></tr>
<tr><td></td><td></td><td>(b)</td><td></td><td></td><td>1</td><td><u>early</u> {treatment/ cure}/ treatment straight away/ {quicker/ sooner} treatment;</td><td>gene therapy as equivalent of treatment</td><td></td><td></td></tr>
<tr><td colspan="4">Total Mark</td><td>6</td><td></td><td></td><td></td><td></td></tr>
</table>

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	**2**	(a)			1	the transfer of {genes/DNA} from one organism to another/ the {modification/altering} of {genes/ DNA} within an organism; (OWTTE)	species/ living thing as equivalent to organism		
		(b)	i		1	Japan;			
			ii		1	9;			
			iii		2	number of cases of blindness decreases/ no blindness/ prevents blindness; Because {they / both groups} are now {reaching RDA/ having enough vitamin A}; **2nd mark linked to 1st**	plenty of vitamin A/ stops vitamin A deficiency		more vitamin A
		(c)			2	health concerns from <u>eating</u> GM foods/ <u>eating</u> GM crops {will harm them/ have side effects}; concerns about GM organisms breeding with native organisms;	eating GM crops will poison them/ they do not if it is safe to eat		
		Total Mark			**7**				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	**3**	(a)	i		1	{organism/species/ animal/ plant} which {indicates/shows} the {presence/level} of {pollution/pollutants/ named pollutant};			
			ii		1	pH/ {oxygen/ O_2};	numbers of bacteria		sewage/ PH/ ph
		(b)			3	(greater the distance from city) pH {increases/ becomes less acidic}/ less acidic gases/ less correctly named gases}; (greater the distance from city) {lichen increases/ less lichen destroyed/ more lichen survives }; (greater the distance from city) less <u>pollution</u>; **3rd marking point linked to 1st or 2nd marking point**	reverse argument for all marking points it= lichen		
		Total Mark			**5**				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number			
FT	HT	Mark	Answer
9	**4**	6 QWC	**Indicative content** • under warm conditions erector muscle relaxes • hair lies flat • reducing insulation • blood vessel widens/dilates/ vasodilates • more blood flows through skin • more heat lost • more sweat produced • onto the surface of the skin/ out of the sweat pore • evaporation removing heat **TOP BAND** must have reference to all three structures. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.
Total Mark		6	

© WJEC CBAC Ltd.

STEMUP.CO.UK

<table>
<tr><th colspan="2">Question Number</th><th colspan="3" rowspan="2">Sub-section</th><th rowspan="2">Mark</th><th rowspan="2">Answer</th><th rowspan="2">Accept</th><th rowspan="2">Neutral answer</th><th rowspan="2">Do not accept</th></tr>
<tr><th>FT</th><th>HT</th></tr>
<tr><td></td><td>5</td><td>(a)</td><td></td><td></td><td>1</td><td>carbohydrate/starch/bread/potato/rice/pasta;</td><td>any other source of carbohydrate /starch</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(b)</td><td></td><td></td><td>1
1</td><td>pancreas {secretes/ produces/ makes/ releases} insulin;
which converts glucose into glycogen;</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>(c)</td><td></td><td></td><td>1</td><td>blood glucose {<u>rises/ increases</u>} to high level/
<u>slow fall</u> in blood glucose levels/
blood glucose levels do not fall to {between 3.5 – 7.5 mmol/l/ normal};</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>(d)</td><td></td><td></td><td>2</td><td>1 mark for first two columns circled correctly
1 mark for correct result (linked to first column, even if process incorrect)
<table>
<tr><th>Chemical test used</th><th>Process used</th><th>Result of test</th></tr>
<tr><td>Biuret test</td><td>Dip in urine sample</td><td rowspan="4">Brown (diastix)
blue/purple (clinistix)

yellow/ green/ orange/ (brick) red (Benedicts)</td></tr>
<tr><td>Benedict’s test</td><td>Mix with urine sample
and heat gently</td></tr>
<tr><td>Iodine test</td><td>Mix with urine sample
and cool in refrigerator</td></tr>
<tr><td>Diastix/ Clinistix</td><td>Mix with urine sample
and heat strongly</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Total Mark</td><td>6</td><td colspan="5"></td></tr>
</table>

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)			2	4 correct – 2 marks 2/ 3 correct – 1 mark **A** **D** **B** **C**			
		(b)			5	protein/urea in sewage; protein/urea changed to ammonia; ammonia changed to nitrate; by bacteria; (must be correct context if mentioned) reference to higher temperature (in May) affecting bacteria;			
		Total Mark			7				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)			1	50 (ppm);			
		(b)			3	<u>lead</u> {accumulates/ not broken down/ passed up / builds up / concentration increases} in the {food chain/tissues/ organism}/ lead bioaccumulates; {poisons/ kills} gulls/is toxic to gulls; reduces {fertility/reproduction/breeding};			It accumulates
		(c)			1	carbon dioxide;	methane		biogas
		Total Mark			5				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8	(a)			1	polar bear + grizzly bear + brown bear;			
		(b)	i		2	Grizzly bear + brown bear; same genus;		same family/ both Ursus	
			ii		1	genetic profile /DNA profiling;			Fingerprinting
		(c)			2	Red panda and giant panda are in different families; Red panda and racoon share <u>more recent</u> common ancestor;	Red panda and racoon are in the same family		
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	9	(a)	i		1	DNA;			
			ii		4	chloroquine killed (most) non-resistant Plasmodium ; resistant ones were at an advantage / OWTTE; (survived/selected) to breed/reproduce/ multiplied; {gene <u>for resistance</u> / <u>mutated</u> gene / <u>advantageous</u> gene} passed on;			
		(b)			1	some non-resistant ones had survived the chloroquine previously/ (another) mutation had taken place;			
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number			
FT	HT	Mark	Answer
	10	6 QWC	**Indicative content** **Obesity:** • Link between diet and obesity e.g. excess fat in diet: • (High cholesterol) resulting in {cardio-vascular disease / heart disease / Blood (/coronary) vessels blocked / heart attack/ high blood pressure} • Joint problems/ mobility reduced • Type 2 diabetes • Cancer **Alcohol:** • Cardio vascular / heart disease • Liver damage/ Brain damage/ kidney damage • Cancer • Addiction • Reaction time increased (qualified) **TOP BAND** answers must refer to both obesity and alcohol and include diet for obesity and a range of factors for alcohol **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.
Total Mark		6	

© WJEC CBAC Ltd.

STEMUP.CO.UK

Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4461/02

S15-4461-02

SCIENCE A/BIOLOGY

BIOLOGY 1
HIGHER TIER

P.M. TUESDAY, 9 June 2015

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**6**	
3.	**5**	
4.	**6**	
5.	**6**	
6.	**5**	
7.	**7**	
8.	**6**	
9.	**6**	
10.	**6**	
Total	**60**	

4461
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to questions **4** and **10**.

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

© WJEC CBAC Ltd.

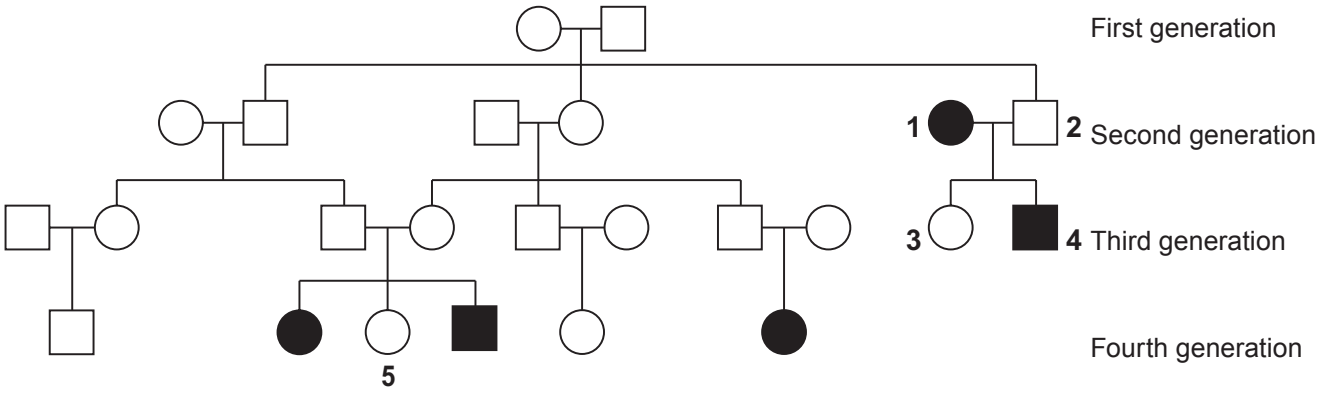
STEMUP.CO.UK

Examiner only

Answer **all** *questions.*

1. Cystic fibrosis is a hereditary disease that affects around 1 in every 2 500 babies born in the UK. It affects several organs in the body including the lungs and pancreas. The disease is caused by a recessive allele (**n**).

The family tree below shows the history of the inheritance of cystic fibrosis.



(a) (i) State the genotype of person number **2**. ..... [1]

(ii) Explain your answer. [2]

.....

.....

.....

(b) (i) State the genotype of person number **3**. ..... [1]

(ii) Explain your answer. [2]

.....

.....

.....

(c) What is the probability of person number **5** being homozygous dominant? [1]
Place a circle around the correct answer.

25% 50% 75% 100%

4461 020003

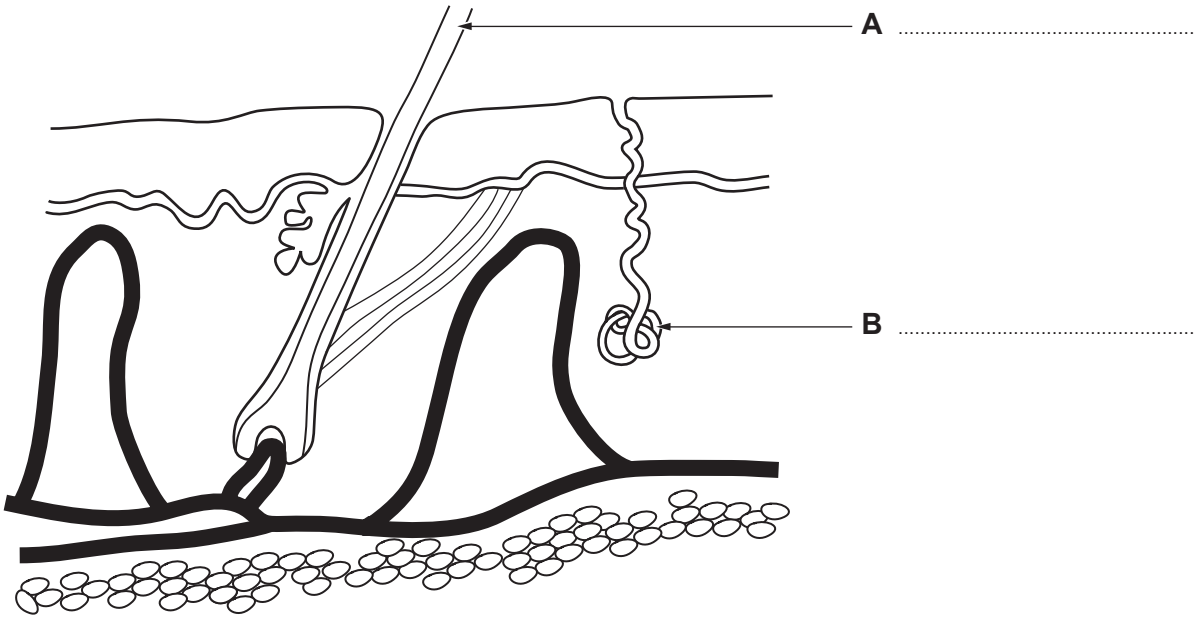
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

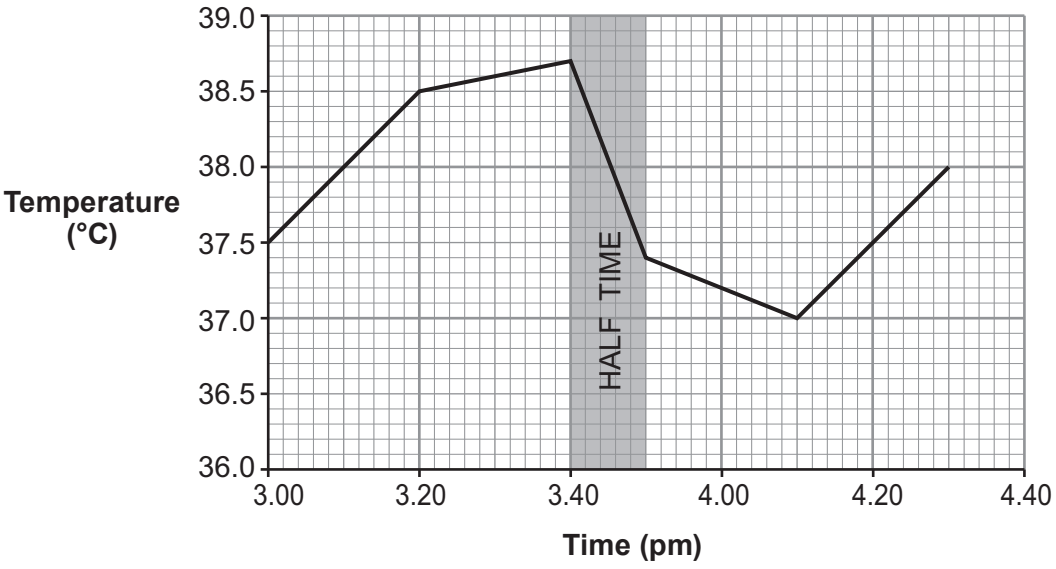
Examiner only

2. The diagram shows a section through the skin.



(a) Label parts **A** and **B** on the diagram. [2]

(b) The graph shows the body temperature of a player during the course of a rugby match.



© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(i) State **two** responses made by the skin to cause the change in body temperature observed between 3.40pm and 4.10pm. [2]

I. .....

II. .....

(ii) Explain how the narrowing of blood vessels in the skin helps maintain body temperature in cold conditions. [2]

.....

.....

.....

.....

6

4461 020005

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

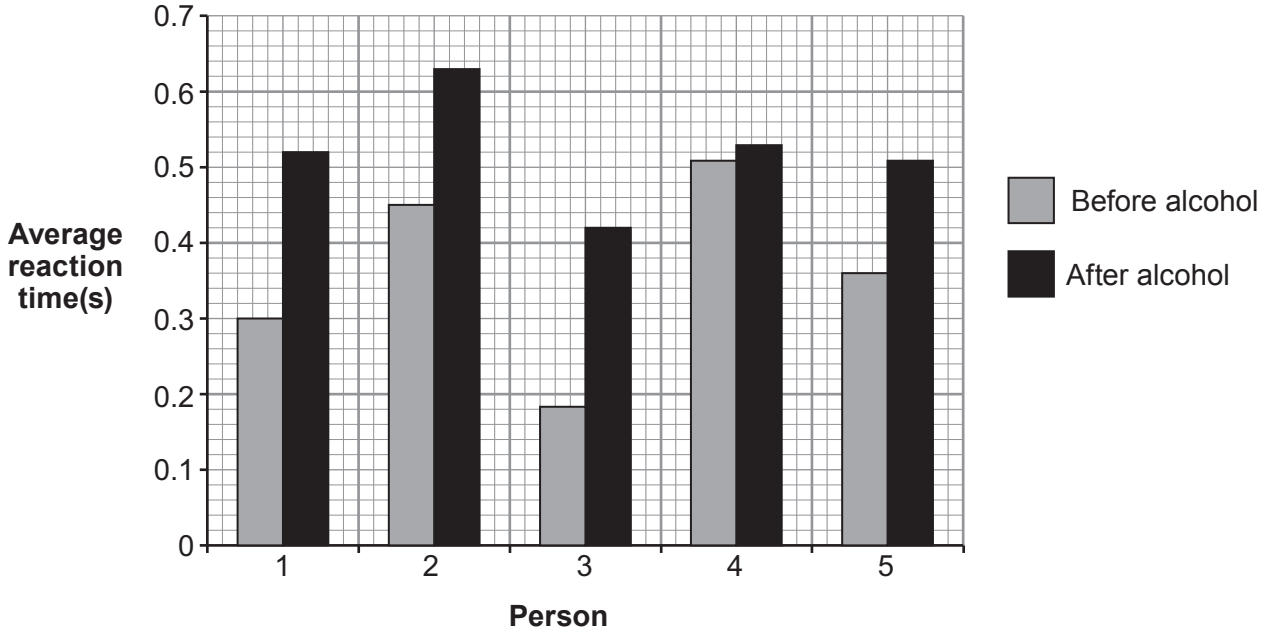
Examiner only

3. *(a)* State **two** ways in which excessive alcohol consumption can cause long-term physical damage to the body. [2]

(i) .....

(ii) .....

(b) An investigation was carried out into the effect of alcohol on reaction times. Five people were asked to drink some alcohol and the time taken to respond to a stimulus was recorded. Reaction times before drinking the alcohol were also recorded. The results are shown in the graph below.



(i) What conclusion can be drawn from the results shown in the graph? [1]

.....

.....

(ii) Which person has the longest reaction time after drinking alcohol? [1]

.....

(iii) How does drinking alcohol before driving a car increase the risk of having a road traffic accident? [1]

.....

.....

5

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

4. John is a severely obese 27 year old man. He weighs 31 stone and takes no exercise. For his height John should weigh about 14 stone. A typical lunch for John would include:

- 2 double cheeseburgers
- 2 litre bottle of cola.

The table below shows the nutrition facts for **one** double cheeseburger and **one** litre of cola. It also shows the Guideline Daily Amount (GDA) for an adult man.

Nutrition Facts

	Guideline Daily Amount (GDA)	double cheeseburger (220g serving)	cola (per litre)
energy (kcal)	2500.0	1120.0	400.0
carbohydrate (g)	300.0	47.0	108.0
of which sugars (g)	70.0	8.0	108.0
fat (g)	95.0	105.6	0.0
protein (g)	55.0	25.0	0.4
sodium – from salt (g)	2.4	2.0	0.12

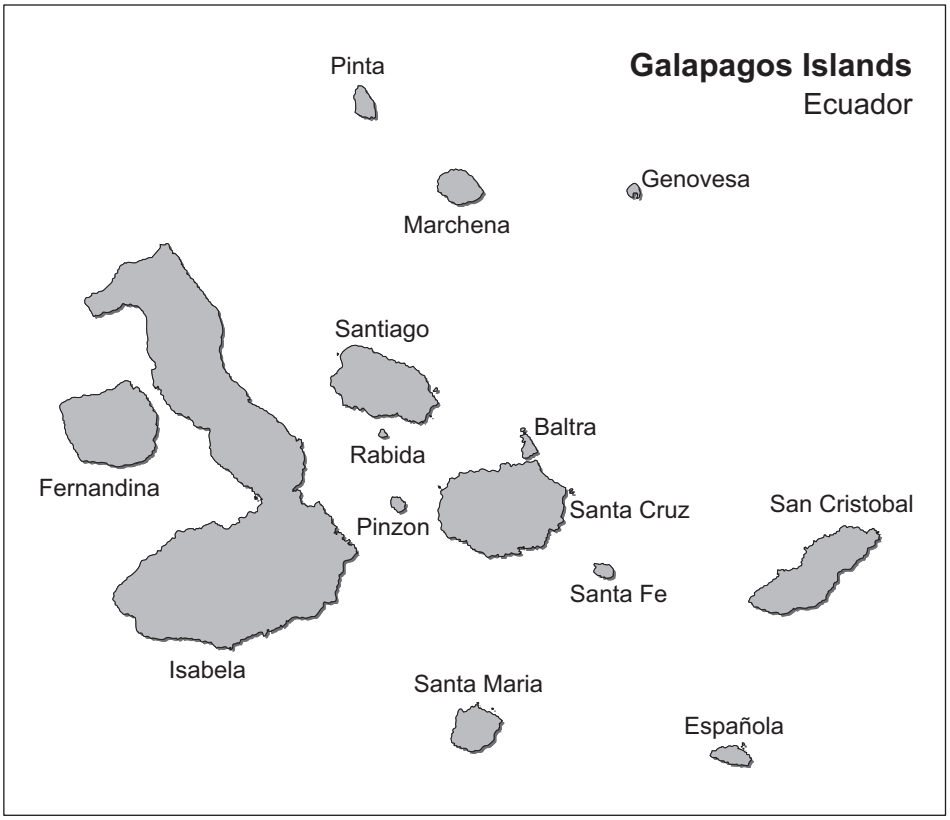
Using the information and data above, and your own knowledge, describe the ways in which John's lifestyle and diet could lead to health problems. [6 QWC]

4461 020007

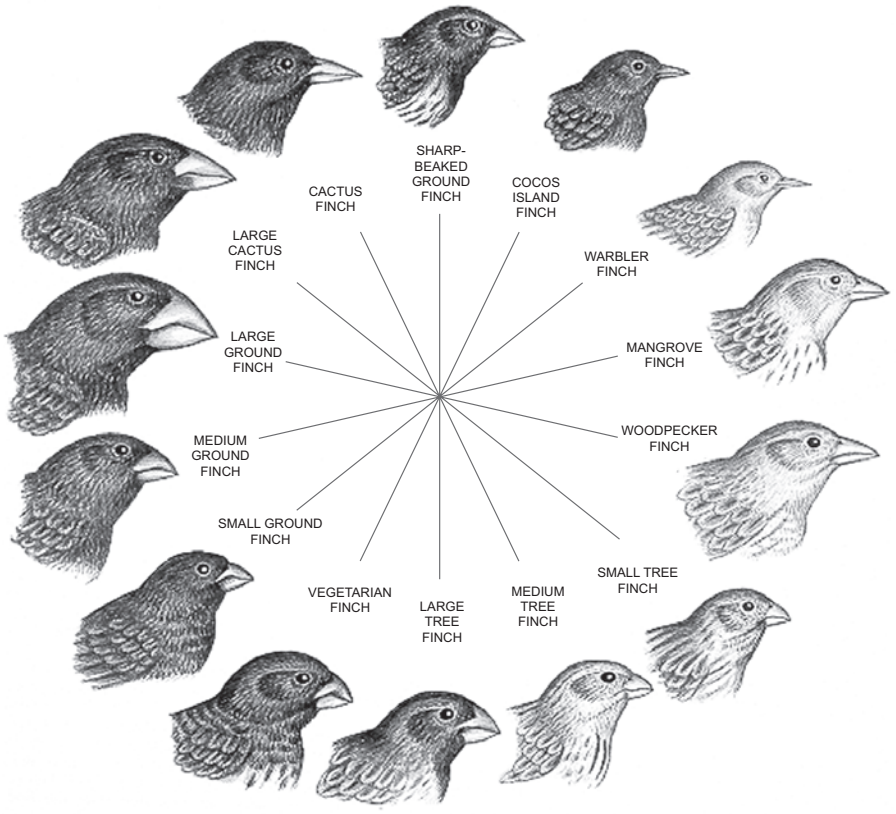
© WJEC CBAC Ltd.

STEMUP.CO.UK

5. When Charles Darwin visited the Galapagos Islands he collected birds from the different islands. On his return to Britain he studied the birds and thought that they had all evolved from a single bird type. These birds became known as Darwin's Finches.



Darwin's Finches (drawn to scale)



© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(a) (i) What **two** observations can be made from the drawings opposite about the birds' beaks? [2]

I. .....

II. .....

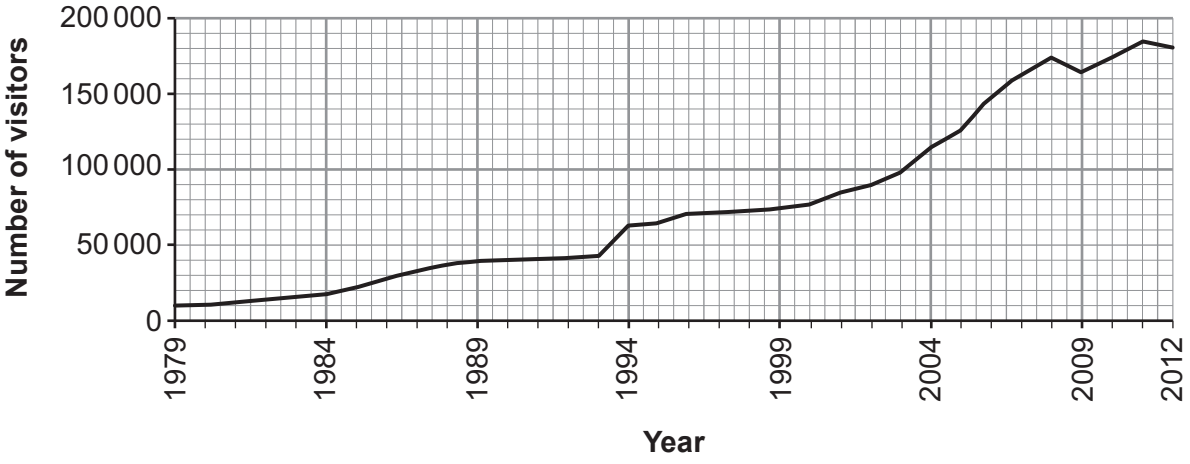
(ii) Suggest the advantage to the birds of the variation in their beaks. [1]

.....

.....

(b) The Galapagos Islands contain 1 300 species found nowhere else on earth. In 1978 the islands were named one of the first UNESCO World Heritage Sites. Since then human activity has had a devastating effect. The human population and economy of the islands are expanding rapidly and unsustainably. Annual visitor numbers have increased from 12 000 in 1979 to over 180 000 in 2012.

Galapagos Islands – annual visitor numbers 1979 – 2012



Suggest **three** ways in which the Galapagos Conservation Trust (GCT) could reduce the impact that increasing tourism has on the islands. [3]

(i) .....

.....

(ii) .....

.....

(iii) .....

.....

4461 020009

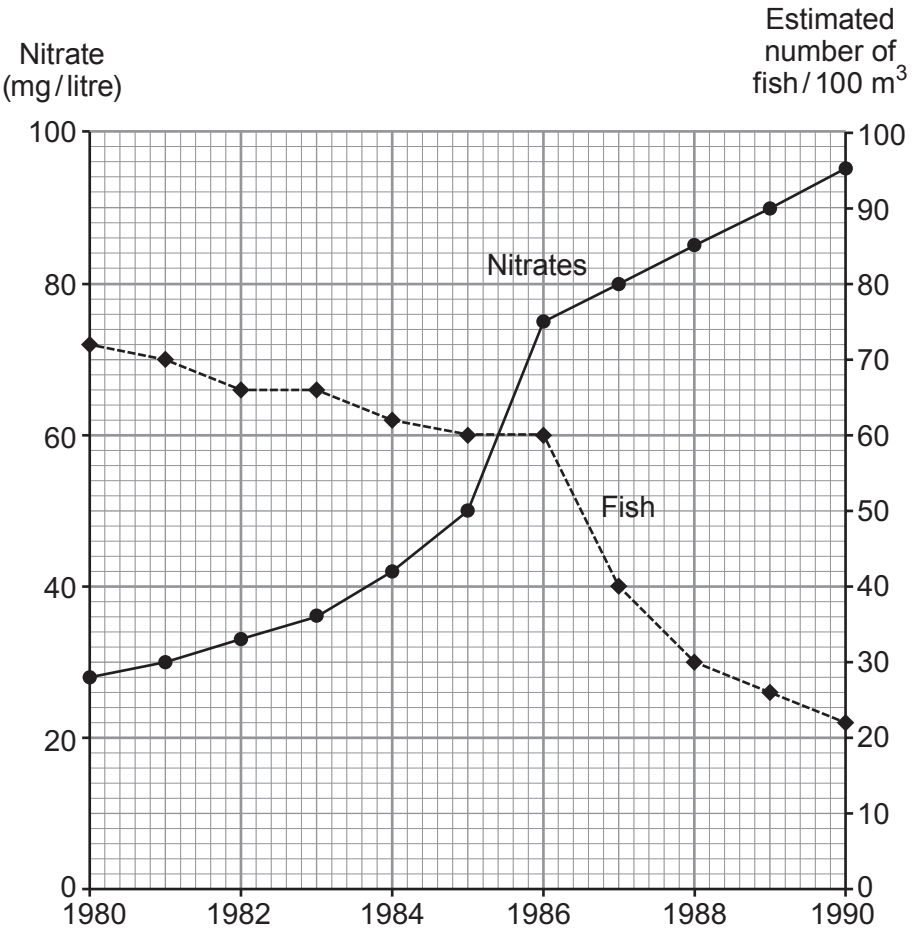
6

STEMUP.CO.UK

Examiner only

6. The Welsh Environmental Authority (Natural Resources Wales) monitors the concentration of nitrate and fish populations in rivers and lakes.

The graph shows the results for a lake near farmland which was regularly treated with fertiliser from 1980 to 1990.



Use the graph and your knowledge of indicator species and pollution by fertilisers to answer the following.

(a) Between which years was the highest **rate** of increase of nitrate pollution in the lake? [1]

.....

(b) In which year would you expect the highest concentration of: [1]

(i) oxygen in the lake, ...

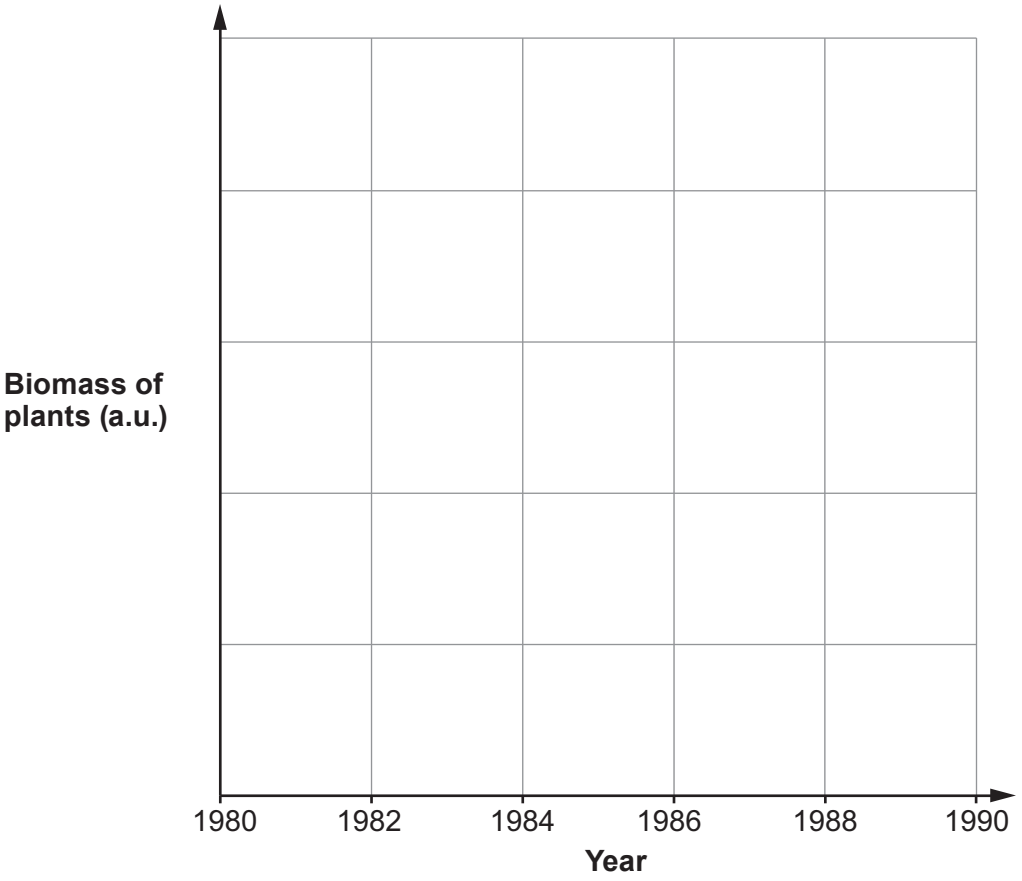
(ii) bacteria in the lake? .....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(c) On the grid below sketch a line graph to show the **expected** changes in the biomass of plants in the lake from 1980 to 1990. [3]



4461 020011

5

STEMUP.CO.UK

BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

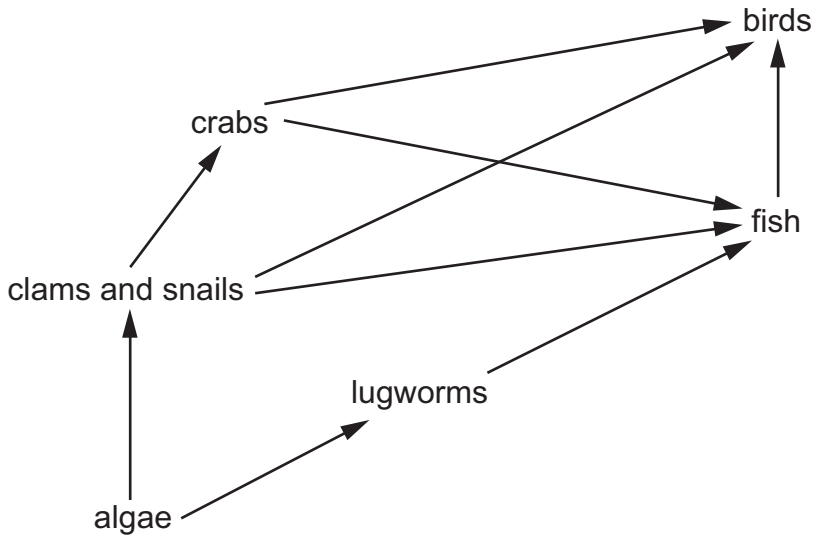
7. A very large biomass and variety of organisms live in the sand and mud of seashores. The table shows the composition of invertebrates living in sand and mud on a seashore in Cardigan Bay in west Wales.

	living in mud	living in muddy sand	living in sand
total invertebrates (per m^3)	15 000	700	200
average number of different species of invertebrate herbivores (per m^3)	25	45	28
average number of different species of invertebrate carnivores (per m^3)	10	20	15

(a) Underline the type of seashore that has the greatest variety of organisms. [1]

mud muddy sand sand

(b) A simplified food web for a muddy shore is shown below.



Certain species can be used to monitor pollution of sea water by heavy metals.
Which organism in the food web would be expected to have the highest concentration of heavy metals? [1]

.....

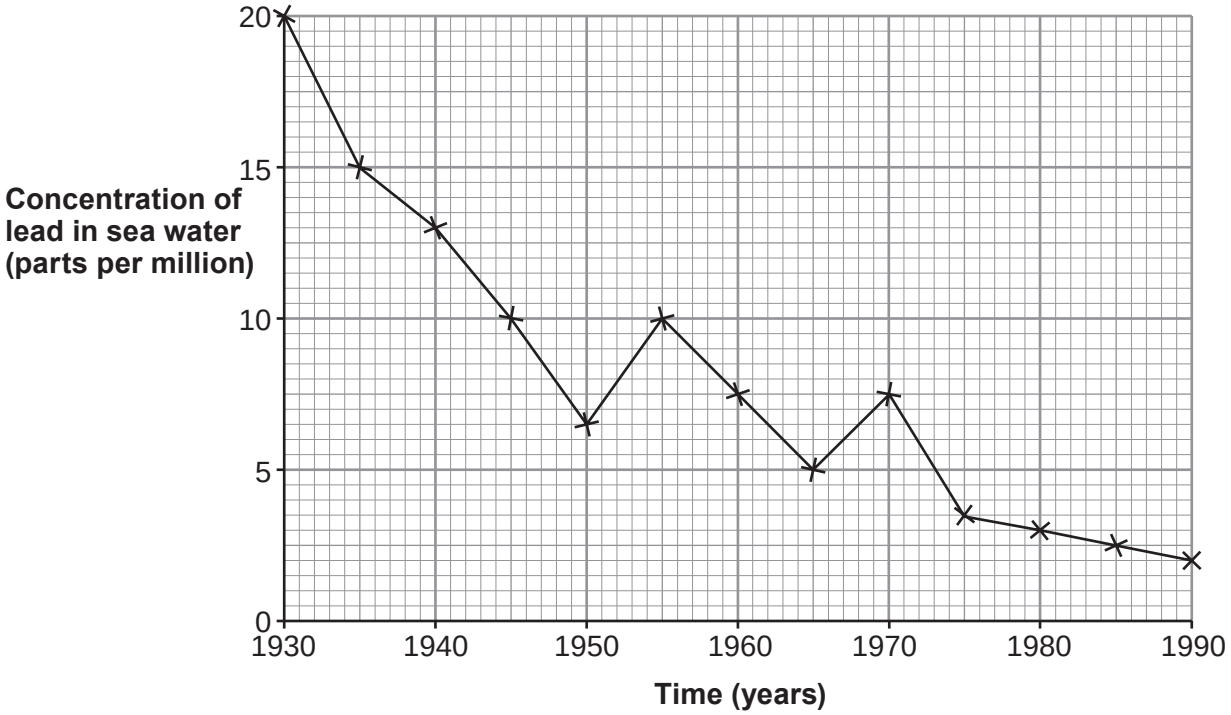
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

(c) Lead pollution has been monitored in Cardigan Bay for many years. The results are shown in the graph below.



(i) What was the general trend in the concentration of lead pollution in Cardigan Bay from 1930 to 1990? [1]

.....

(ii) Use the graph to calculate the percentage decrease between the maximum and minimum concentrations of lead. Show your working in the space below. [2]

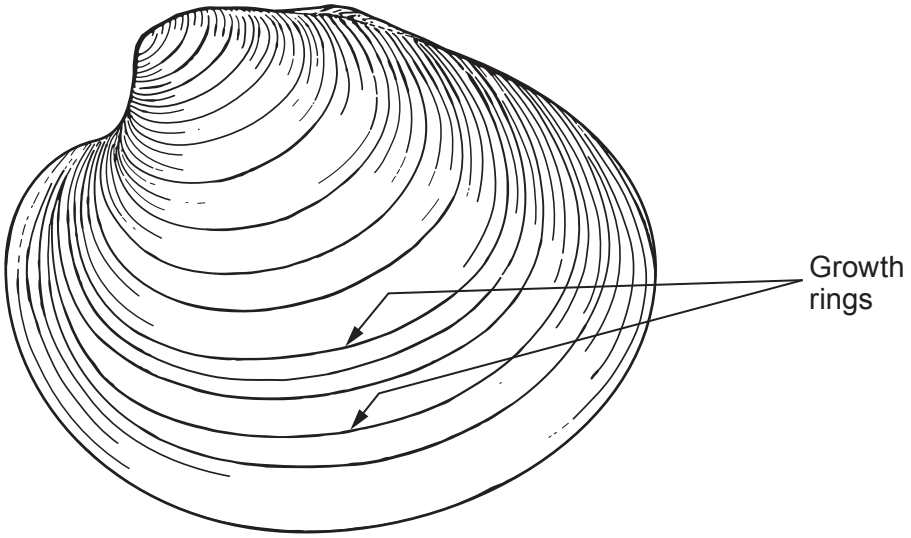
Percentage decrease ..... %

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(iii) The drawing shows a 60 year old clam, *Arctica islandica* from Cardigan Bay.



Arctica islandica has growth rings on its shell. Each year, it adds a growth ring made of chemicals absorbed from sea water during that particular year. Scientists at Aberystwyth University have developed a method of analysing the chemical composition of each separate growth ring.

Suggest how *Arctica islandica* can be used to produce the graph shown opposite. [2]

.....

.....

.....

7

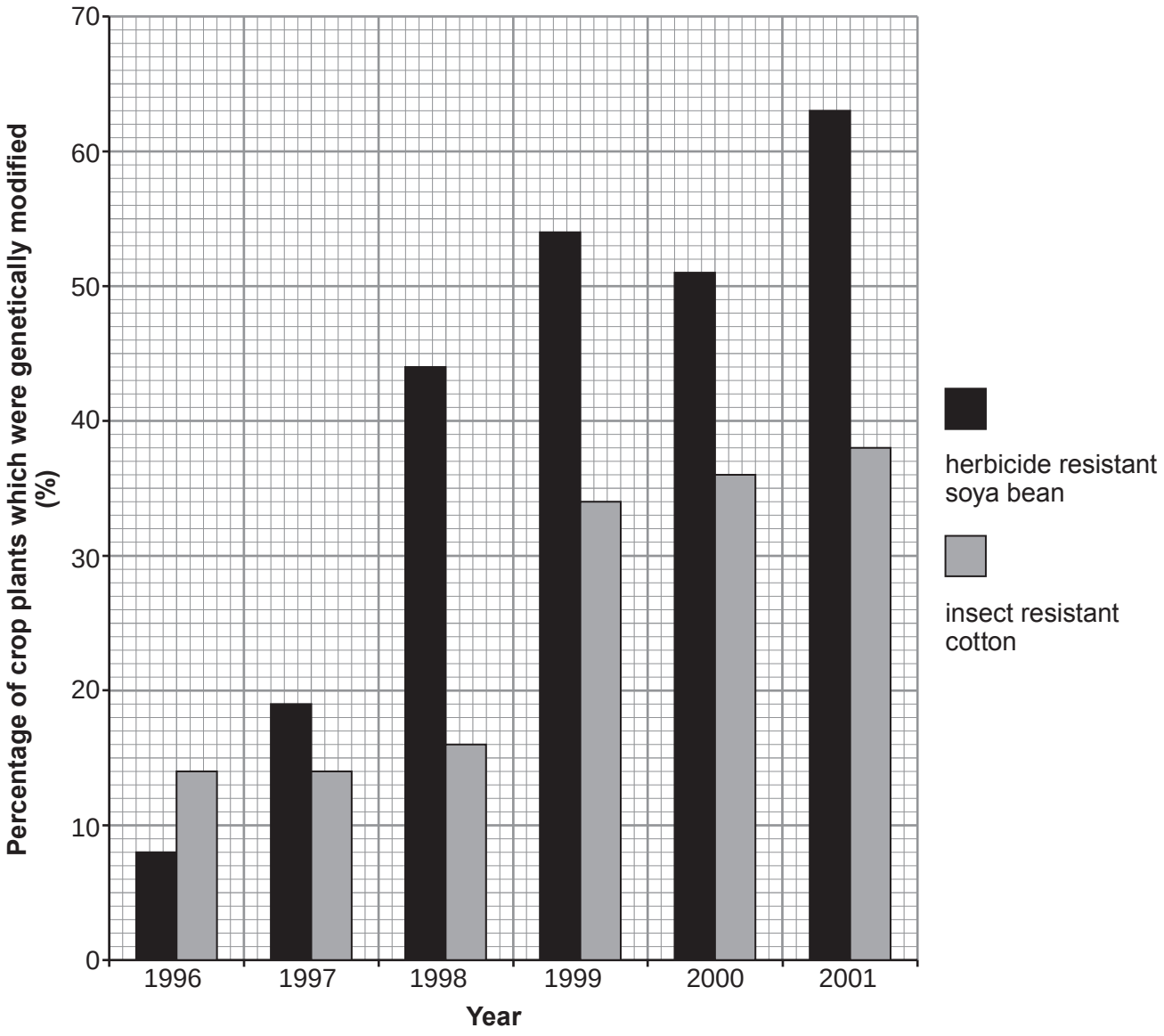
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

8. Soya bean and cotton are crop plants grown in the USA. The bar chart shows the percentage of these crops grown between 1996 and 2001 which were genetically modified (GM).



(a) What does the general trend shown in the bar chart suggest about the attitude towards planting GM crops between 1996 and 2001 in the United States? [1]

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) Describe how soya bean plants could be made resistant to herbicide using GM crop technology. [2]

.....

.....

.....

.....

.....

(c) The effect of insects on the yield of cotton has been investigated for GM insect resistant cotton plants and for non-GM cotton plants. The results are shown in the table:

	GM insect resistant cotton plants	non-GM cotton plants
mean number of insecticide sprays per month needed to control leaf eating insects	0.6	3.7
mean number of insecticide sprays per month needed to control sap sucking insects	3.6	3.5
yield (kg per hectare)	1 500.0	800.0

State **three** conclusions that can be drawn from the data in the table. [3]

I. .....

.....

II. .....

.....

III. .....

.....

6

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

9. *(a)* Until the 1960s, turkeys, bred for meat on turkey farms, all had black feathers. Then, mutant pure white-feathered turkeys were hatched in a turkey farm. Turkey farmers used the mutant turkeys to produce all white-feathered flocks of turkeys. Almost all turkeys sold in supermarkets today are of the white-feathered variety.





(i) What type of genetic variation is shown by the feather colour of turkeys? [1]

.....

(ii) Why is it not possible to breed black-feathered turkeys from white-feathered turkeys? [1]

.....

.....

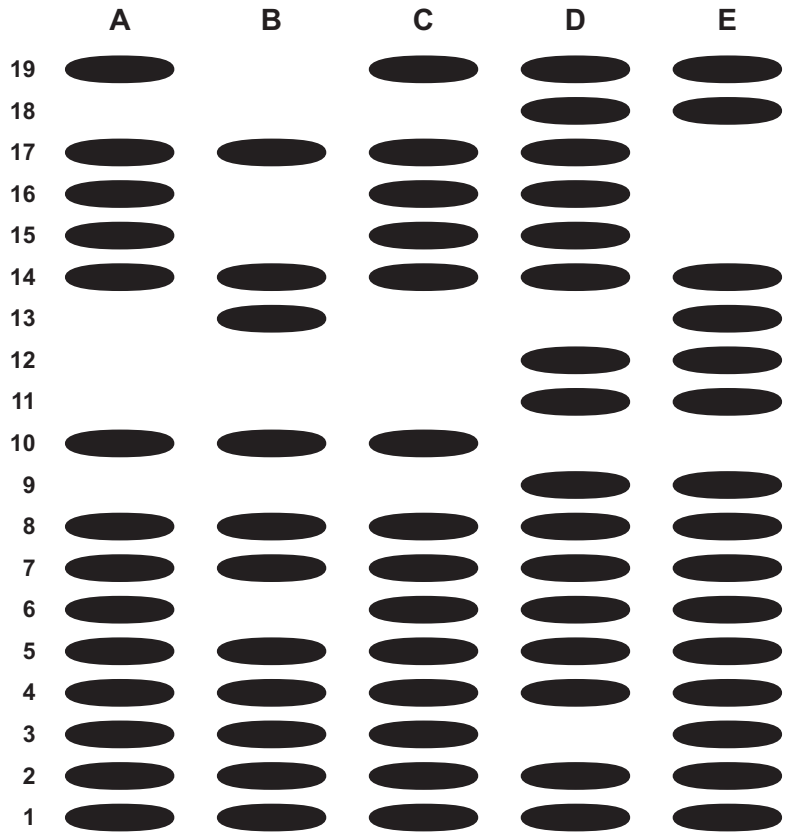
.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) Research into breeding turkeys for various characteristics is taking place. Scientists have attempted to genetically modify some varieties to increase meat production. The genetic profiles of five turkeys (**A**, **B**, **C**, **D** and **E**) are shown below.



The turkeys are shown by the letters **A** to **E**. The positions of the bands of the profiles are shown by the numbers **1** to **19**.

(i) Two of the turkeys were hatched from the same egg. Use the genetic profiles to identify them. [1]

.....

(ii) The absence of a band at position **10** leads to an inherited disease caused by the altered DNA. Identify the **two** turkeys with this inherited disease and suggest why it would not be a good idea to clone these two turkeys. [2]

.....

.....

.....

(iii) All the turkeys, except **D**, are white-feathered. Which number shows the position of the mutation for feather colour? [1]

.....

6

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

10. Describe how nitrogen is recycled through the activity of soil bacteria and fungi to make it available to plants. In your description you should also refer to the factors that affect the activity of soil bacteria and fungi during the recycling process. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

END OF PAPER

© WJEC CBAC Ltd.

STEMUP.CO.UK

GCSE MARKING SCHEME

SCIENCE - BIOLOGY

SUMMER 2015

© WJEC CBAC Ltd.

STEMUP.CO.UK

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2015 examination in GCSE SCIENCE - BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

	Page
B1	1
B2	19
B3	34

© WJEC CBAC Ltd.

STEMUP.CO.UK

<table>
<tr><td colspan="2">Question Number</td><td colspan="3"></td><td></td><td></td><td></td><td></td></tr>
<tr><td>FT</td><td>HT</td><td colspan="3">Sub-section</td><td>Mark</td><td>Answer</td><td>Accept</td><td>Neutral answer</td><td>Do not accept</td></tr>
<tr><td>1</td><td></td><td>(a)</td><td></td><td></td><td>1</td><td>Eats meat/ other animals;</td><td></td><td>insects</td><td></td></tr>
<tr><td></td><td></td><td>(b)</td><td></td><td></td><td>3</td><td><table><tr><th>factor</th><th>Tick (✓) the three correct boxes</th></tr><tr><td>A disease harming the badgers</td><td></td></tr><tr><td>An increase in the number of foxes</td><td>✓;</td></tr><tr><td>The arrival of a new second stage consumer species</td><td>✓;</td></tr><tr><td>An increase in the number of beetles</td><td></td></tr><tr><td>A decrease in the area of woodland</td><td>✓;</td></tr></table></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Total Mark</td><td>4</td><td></td><td></td><td></td><td></td></tr>
</table>

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		*(a)*	i		1	0.5;	0.55		
			ii		2	larger; more slits/number slits from 3 to 5;			
			iii		1	dies out/ *idea of* gone for ever/ no longer exists/ wiped out;	None left		disappeared
			iv		1	no {shells/fossils} {in top layer/ in layer A/ in that layer}/ no shells after {5 million years/ 2 million years}/ last found in layer B;			
		(b)			1	(Charles) Darwin;	(Alfred) Wallace		
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)	i		1	2;			
			ii		1	pH <u>falls</u>/ water <u>becomes</u> {acidic/pH5};			PH/ Ph/ pH is acidic
		(b)	i		1	mayfly (nymph);			
			ii		2	¶ (mayfly nymph) is not found in acid water/ <u>only</u> found in {neutral <u>and</u> alkaline water/ water at pH 7 and above}; ¶ {bloodworms/rat tailed maggots/ the others} are found in acidic (water); The only <u>one</u> that is found in <u>only</u> neutral <u>and</u> alkaline water/ only <u>one</u> not found in acidic water = 2 marks			
		Total Mark			5				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		(a)	i		4	I accurate plotting;; all correct = 2 marks one error = 1 mark more than one error = 0 marks II one accurate line through centre of plots; III lines labelled – 1.0 mm **and** 0.1mm;			
			ii		1	{1 mm/large/larger/ higher} mesh size has {higher/ more} (%) decay/ ORA;			Not quicker decay
			iii		2	any **two** from: mass; (leaf) area; {species/tree}; age; moisture content;	weight		type of leaf/ type of tree/ size of leaf/ amount of leaf/ same shape leaf
			iv		1	bacteria/fungi/mould;			
			v		1	too {cold/hot/dry/wet}/ hotter/ colder/ drier/ wetter;	pH too {high/ low}		Climate/ weather
		(b)			1	{Releases/ puts back/ restores/ gives/ recycles} {nutrients/ minerals/ ions/ named nutrient};			
		Total Mark			10				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		(a)			3	3 → 2 → 5 → 1 → 4 Correct placement All 5 correct;;; 3 marks 4/3 correct;; 2 marks 2 correct; 1 mark 0/1 0 marks			
		(b)			2	one mark for a named sense organ and the second mark for the <u>correct</u> stimulus;; one correct pair from: ear; sound/vibrations; or tongue/nose; chemical; or skin; touch/pain/temperature/pressure;			Noise Taste Heat
		Total Mark			5				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6		(a)			1	<u>hormone</u>;			
		(b)			3	pancreas; (phonetic spelling) glucose; (correct spelling) glycogen; (correct spelling)			pancrease
		(c)			2	(type 1 or type 2) diabetes; **one** from: <u>low</u> {sugar/ carbohydrate} {diet/foods}/ {injections/shots} of insulin/ insulin pen/ insulin pump/ pancreas transplant/ <u>named</u> tablets (e.g. novonorm/metformin);			Take insulin/ take tablets
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	**1**	(a)	i		1	Nn;	heterozygous		
			ii		2	He does not have cystic fibrosis therefore must have a {**N/dominant allele**} / He has to have a {**N /dominant allele**} to give to {the child without cystic fibrosis/ child **3**}; Has to have a {**n/recessive allele/ allele for cystic fibrosis** } to give to {child with cystic fibrosis/ child **4**} {child **4**/ child with cystic fibrosis} has to have a {**n/recessive allele**} from him**;**			
		(b)	i		1	Nn;	heterozygous		
			ii		2	She does not have cystic fibrosis and therefore must have a{ **N** allele/dominant allele}/ person **3** gets { **N** allele/dominant allele} from person **2**; Her mother has {cystic fibrosis/ **nn**} and therefore must give one {**n** allele/recessive allele}/ person **3** gets {**n** allele/recessive allele} from person **1**;			
		(c)			1	25%;			
		Total Mark			7				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	**2**	(a)			2	A hair B sweat gland			Hair follicle Sweat duct
		(b)	i		2	any **two** from ¶ sweating/ produces sweat; ¶ vasodilation/ blood vessels widen; ¶ hairs lying flat/ hairs lie {flat/down}/ hairs lowered;		Erector muscle relaxes	sweat Blood vessels {open/ get bigger/ larger/thicken/ enlarge}/ expand. hairs are flat
			ii		2	<u>Less/not as much</u> blood flowing (through the blood vessels); therefore <u>less/not as much</u> heat is {lost/ radiated} 2nd mark linked to 1st mark			Any reference to blood vessels moving {up to/ down from} skin surface. No heat is lost
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
9	**3**	(a)			2	any **two** from: ¶ liver {damage/ failure/disease}/ cirrhosis of the liver; ¶ circulatory disease; ¶ heart {damage/failure/disease}; ¶ brain damage; ¶ {throat/tongue/oesophagus/liver/breast/bowel} cancer; ¶ kidney {disease/damage/failure};	kills brain cells		Liver problems Heart attack
		(b)	i		1	alcohol consumption {increases/slows} reaction time/ alcohol consumption slows {reactions/ reaction speed};			Less reaction time/ reaction time decreases
			ii		1	person 2;			
			iii		1	take longer to {react/brake/swerve} to avoid an accident/ longer to react to {danger/changes in road};		take longer to stop (needs to be qualified)	
		Total Mark			5				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number			
FT	HT	Mark	Answer
10	**4**	6 QWC	*Indicative content:* *Credit should only be given where health issue is linked to the excess in the diet* ¶ **ENERGY**: too much energy (taken in at lunch – excess energy stored as fat) leading to obesity ¶ **SUGAR:** too much sugar (taken in at lunch) - this could possibly lead to diabetes (type 2)/ obesity/tooth decay ¶ **FAT:** too much fat (taken in at lunch) - (possibly) leading to obesity/ heart disease/circulatory disease ¶ **SODIUM:** too much salt (taken in at lunch) - could lead to high blood pressure ¶ **EXERCISE**: ref to lack of exercise affecting circulation/heart For marks in 5-6 range: Account needs to recognise, at least once **EITHER** that the GDA is being exceeded **OR** that only one meal is being looked at and therefore when all the daily meals are considered then the overshoot of the GDAs are very great indeed. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.
Total Mark		6	

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	(a)	i		2	<u>different</u> {size/ length/ depth/ width}; <u>different</u> shape;			They are all pointed
			ii		1	They can eat <u>different</u> types of food/prey;		More food	
		(b)			3	any **three** from: ¶ restriction on {number of tourists/ months allowed to land/ time allowed on island}; ¶ restrict access to wildlife sites; ¶ restrict building houses/ restrict building {hotels/ accommodation for tourists}; ¶ educate tourists about endangered species; ¶ {development/ road building} is carried out which causes minimal harm to wildlife/limit number of vehicles; ¶ reduction of {litter/ pollution} from increased number of visitors and residents;			Stop tourism
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)			1	1985-1986;			
		(b)	I& II		1	1980 **and** 1990;			
		(c)			3	Line begins at 1980 above 0 and rises; peaks between1985-7; Then drops but not to 0;			
		Total Mark			5				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)			1	*Muddy sand;*			
		(b)			1	birds*;*			
		(c)	i		1	(The level/concentration of lead) decreases/ becomes less;			
			ii		2	(18/20) x 100; 90; Correct answer = 2 marks			
			iii		2	Measure the {concentration/mass} of lead; In each (growth) ring/ in every fifth growth ring;	Measure how much lead		amount
		Total Mark			7				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	8	(a)			1	Less objection/ more agreement / more positive /more accepted /more popular;			Crop increased
		(b)			2	<u>gene for herbicide resistance</u> from {bacteria / plant / organism /species}; {Inserted into/ added into} {chromosome/ DNA} (of host plant / soya plant);	weed		
		(c)			3	Any **three** from ¶ Crop yield increases with use of GM; ¶ GM crop not 100% resistant; ¶ GM plants not resistant to sap sucking insects/ sap sucking insects are not affected; ¶ GM effective against leaf eating insects/ GM plants are resistant to leaf eating insects; ¶ Less <u>total</u> insecticide used with GM crops/ less insecticide used to control leaf eating insects with GM crops; ¶ A correct statement relating to data in table;			
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	9	(a)	i		1	Discontinuous;			
			ii		1	No black <u>allele</u> in white turkeys/ white allele is recessive/ white turkey is homozygous recessive;	Homozygous expressed as symbols		gene
		(b)	i		1	A **and** C;			
			ii		2	D **and** E; All (of the clones with the inherited disease) would <u>pass it on</u>;			
			iii		1	3;			
		Total Mark			6				

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question Number			
FT	HT	Mark	Answer
	10	6 QWC	Indicative content Bacteria and Fungi are decomposers Decomposers decay dead organisms/waste Conversion of protein to ammonia Conversion of urea to ammonia Ammonia converted to nitrate Nitrate taken up by plant (roots) Nitrate used to make protein Factors that affect the activity should include oxygen, temperature, pH and heavy metals (some factors must be present to access marks in the range 5-6) **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.
Total Mark		6	

© WJEC CBAC Ltd.

STEMUP.CO.UK

Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4461/02

W15-4461-02

SCIENCE A/BIOLOGY

BIOLOGY 1
HIGHER TIER

A.M. WEDNESDAY, 7 January 2015

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**6**	
3.	**6**	
4.	**6**	
5.	**6**	
6.	**3**	
7.	**4**	
8.	**6**	
9.	**7**	
10.	**4**	
11.	**6**	
Total	**60**	

4461
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **4** and **11**.

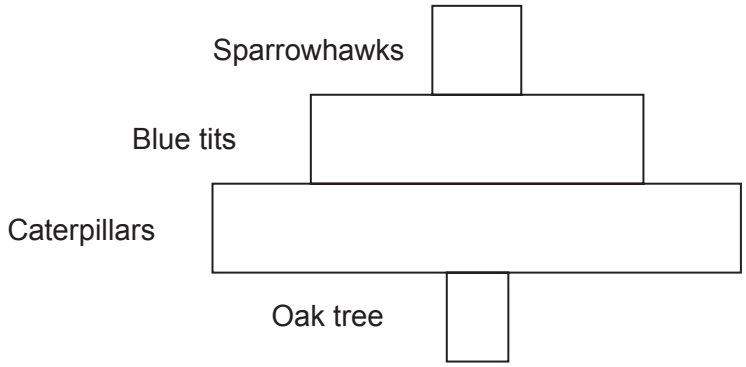
© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

Answer **all** *questions.*

1. The diagram below shows the pyramid of numbers for a food chain found in a small wood.



(a) (i) Show the correct relationship in the food chain by adding **one** of the following numbers to **each** of the feeding levels in the above pyramid of numbers. [1]

1 17 3456 2

(ii) I In the space below draw a **labelled** pyramid of biomass for this food chain. [1]

II Show the correct relationship in the food chain by adding **one** of the following masses to **each** of the feeding levels in **your pyramid** of biomass shown in a(ii) I. [1]

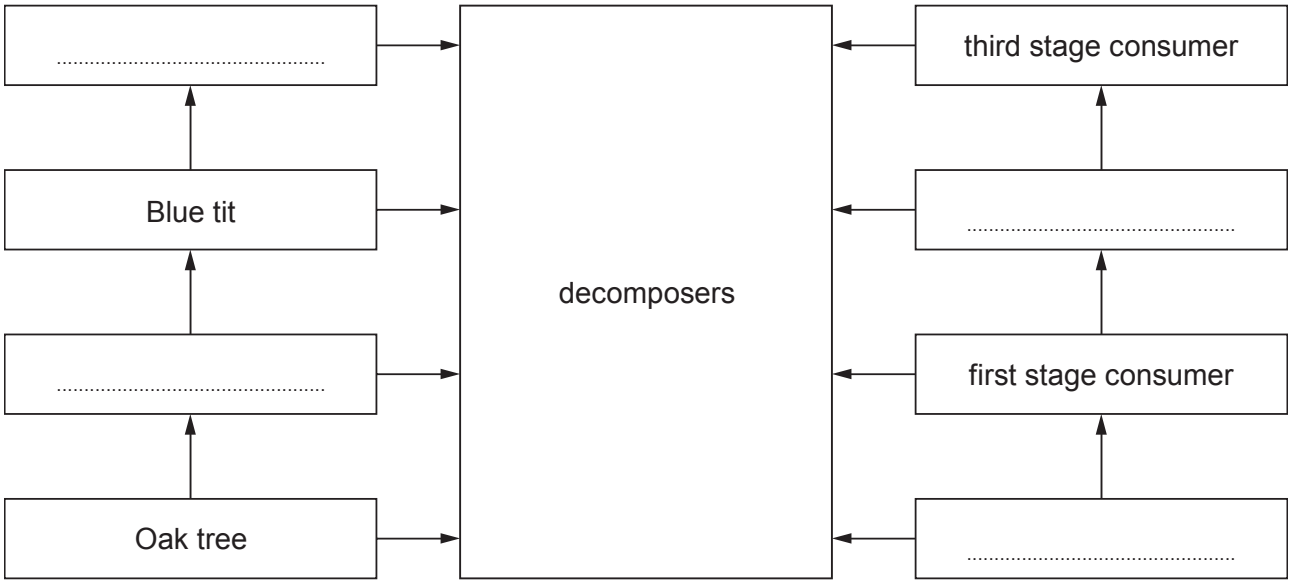
0.18 kg 5137 kg 1.2 kg 43 kg

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) Use the information on the opposite page and your own knowledge to complete the following diagram. [2]



(c) In which of the following do **all** of the processes **add** carbon dioxide to the air? Underline the correct answer. [1]

(i) decomposition *and* respiration *and* photosynthesis

(ii) decomposition *and* respiration *and* photosynthesis *and* combustion

(iii) respiration *and* combustion *and* photosynthesis

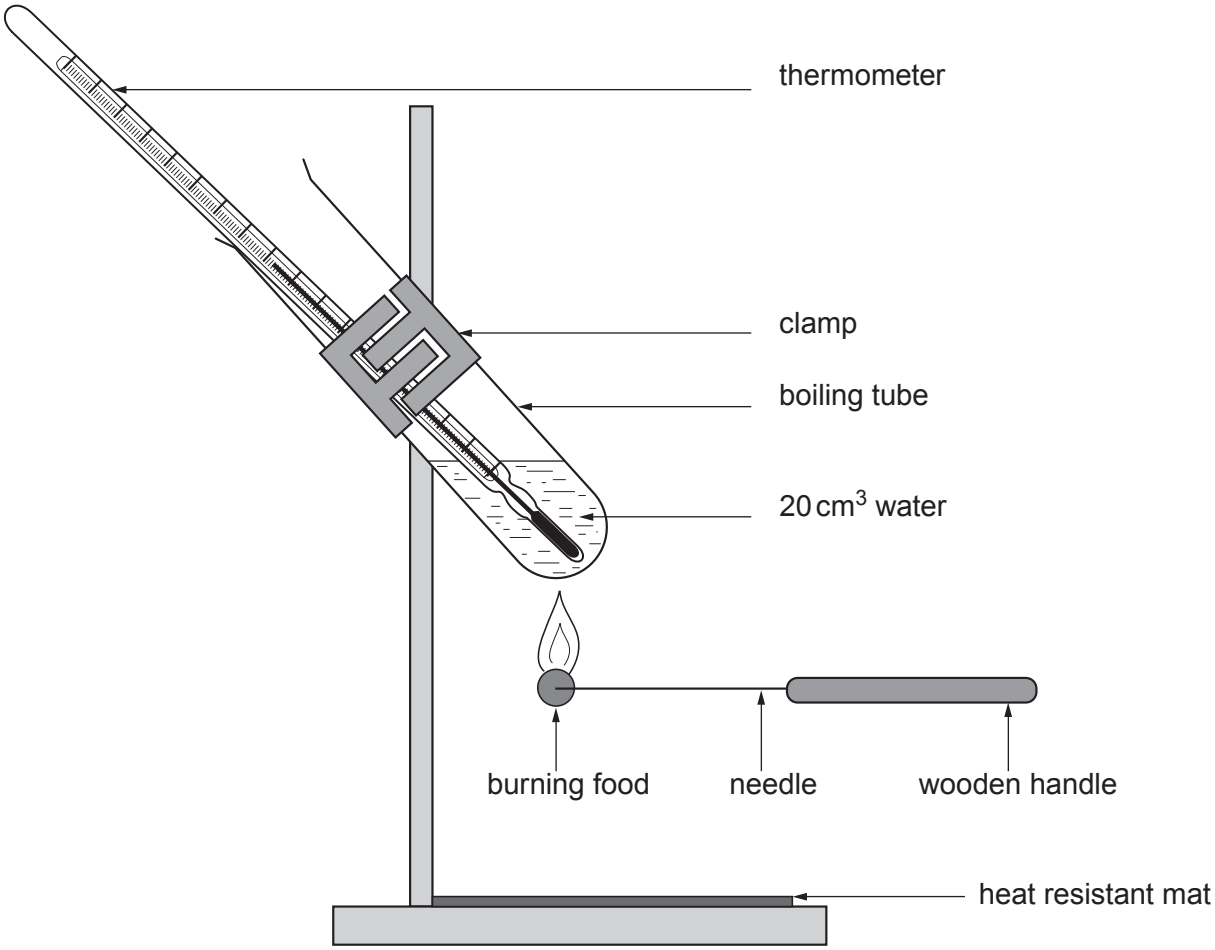
(iv) respiration *and* combustion *and* decomposition

4461 020003

6

STEMUP.CO.UK

2. Rhys used the apparatus shown below to find the energy in a piece of food.



(a) The first time Rhys carried out the experiment he obtained the following results.

initial temperature of water (°C)	final temperature of water (°C)
19	35

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(i) Use the formula below to calculate the energy content of this piece of food. Show your working. [2]

Energy content (J)= rise in temperature (°C) x volume of water (cm^3) x 4.2

Energy content ..... J

(ii) The mass of this piece of food was 0.2 g. Calculate the energy content of 1 g of this food. [1]

Energy content ..... J

Rhys repeated the experiment and obtained the following results.

repeat	energy content of food (J/g)
1	5049
2	7260
3	6800
4	4896
5	5724

(b) Suggest **three** possible reasons why the measured energy content in J/g of the food differed each time Rhys carried out the experiment. [3]

(i) .....

.....

(ii) .....

.....

(iii) .....

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

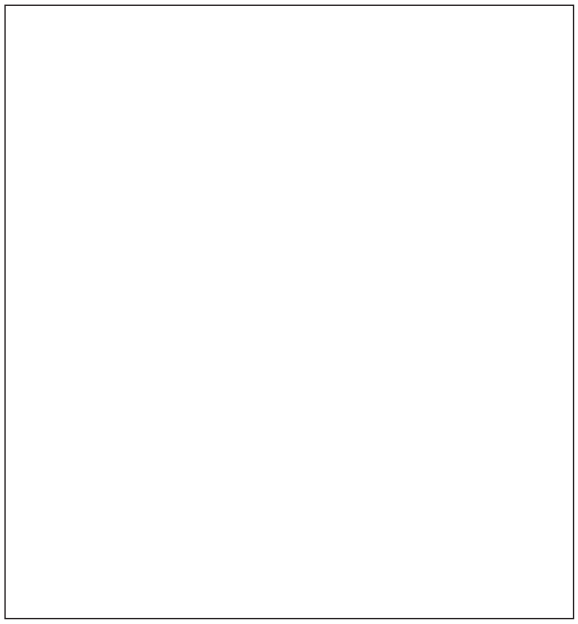
© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

3. Intensive farming methods use very large amounts of chemical pesticides to increase crop yields.

The Western flower thrips *(Frankliniella occidentalis)* is an insect which eats crops, including fruit and vegetables, causing world-wide damage.



A Western flower thrips

Scientists at Swansea University have done research into pest control using bacteria which naturally live only in the thrips. The bacteria affect a gene which controls eating in the thrips. The thrips stops feeding and dies. The bacteria pass naturally between the thrips.

(a) Use the information above to suggest **one** advantage to the farmer of using this new method of pest control over the use of chemical pesticides. [1]

.....

.....

(b) Apart from the use of pesticides state **one** *other* method farmers use to increase crop yields. [1]

.....

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

(c) DDT is a powerful insecticide which was extensively sprayed onto crops in the middle part of the twentieth century. Its use is now banned in many regions of the world because it resulted in the death of many top predators. One of the top predators affected was the American Bald Eagle *(Haliaeetus leucocephalus)* whose numbers in the USA dropped to only 834 in 1963.

The food chain below shows the concentration of DDT in ppm (parts per million) in the tissues of the organisms in a food chain.

American Bald Eagle
13.8 ppm

large fish
2.07 ppm

small fish
0.23 ppm

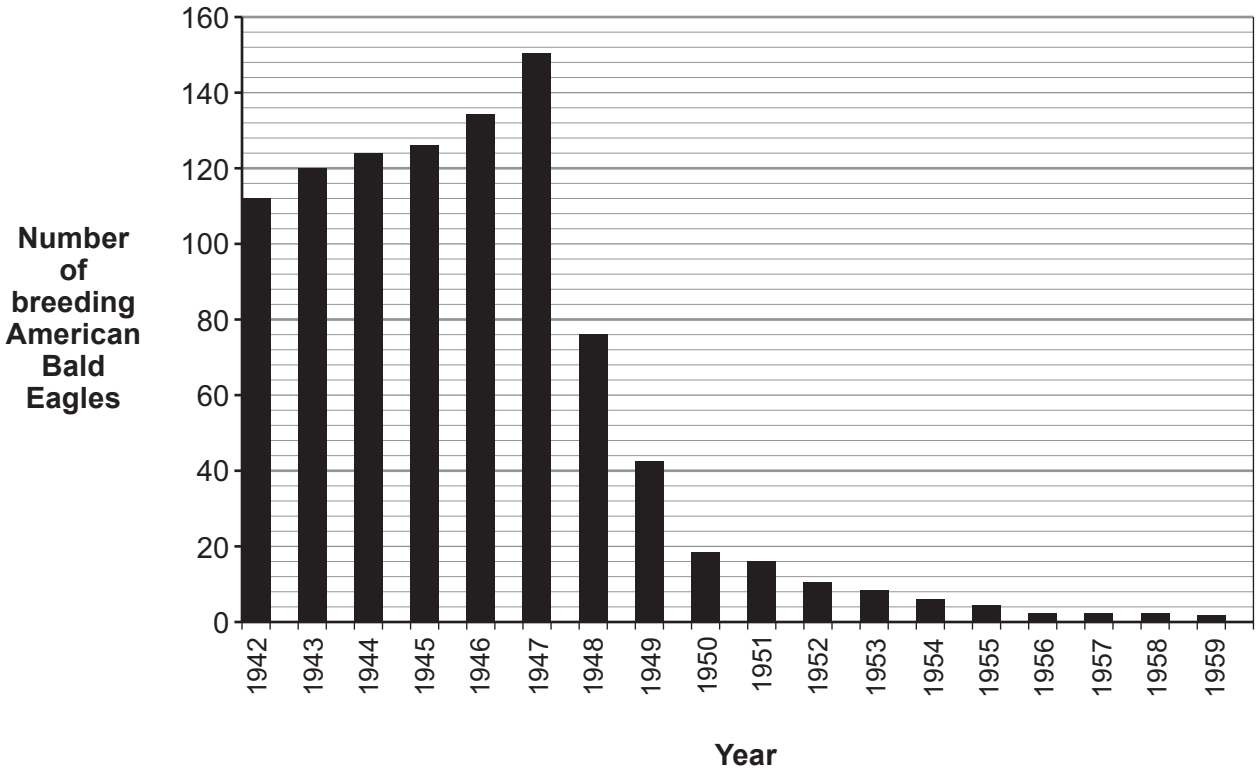
aquatic plants
0.04 ppm

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

The graph below shows the number of breeding American Bald Eagles in Florida between 1942 and 1959.



(i) From the graph, suggest the year in which DDT was first used in Florida as an insecticide. [1]

.....

(ii) Suggest why DDT is found in the aquatic plants if it is only sprayed onto crops grown on land. [1]

.....

.....

(iii) The aquatic plants and fish are not killed by the DDT but the American Bald Eagle is. Explain the reason for this. [2]

.....

.....

.....

.....

4461 020009

6

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

4. The level of blood glucose must be kept within a very narrow range. It must not be allowed to rise too high or fall too low.

After a meal the blood glucose level begins to rise. Describe the processes which occur in the human body to bring the level of glucose in the blood back down to its normal level. [QWC 6]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

5. A high level of blood cholesterol increases the risk of heart disease. One cause of high blood cholesterol is the inherited condition known as FH (familial hypercholesterolaemia).

FH is caused by a dominant allele (**B**). The recessive form of this allele (**b**) results in low levels of cholesterol (non-FH).

(a) State the meaning of the terms:

(i) allele; [1]

.....

.....

(ii) recessive. [1]

.....

.....

.....

(b) (i) Complete the Punnett square below to show the possible genotypes of the children produced by parents both of whom are heterozygous for FH.

Use the letters **B** and **b**. [2]

Gametes		

(ii) What is the probability of two heterozygous parents producing a child with FH? [1]

.....

(iii) What is the phenotypic ratio of the children produced? [1]

..... FH : ..... non-FH

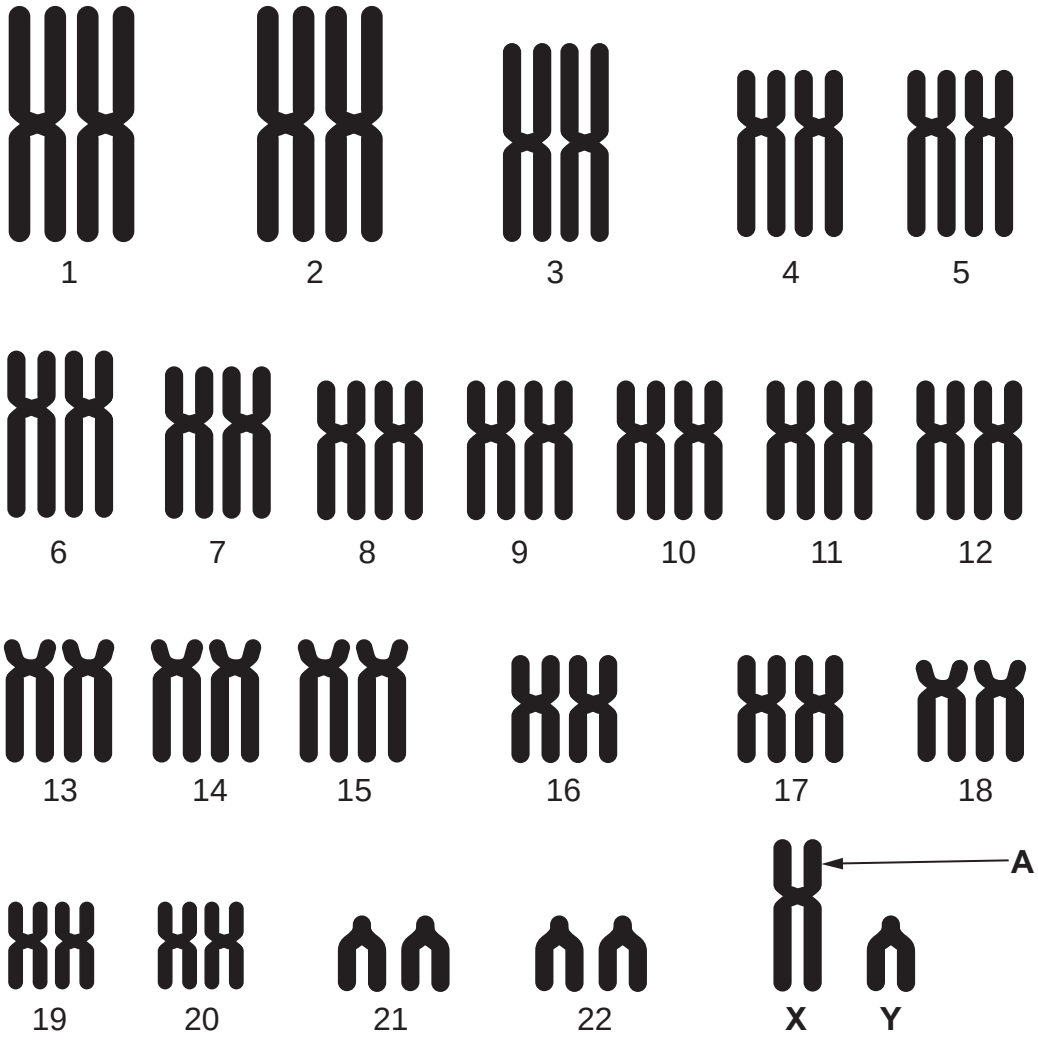
4461 020011

6

STEMUP.CO.UK

Examiner only

6. The drawing shows the chromosomes from a human cell.



(a) How does the drawing show that the cell is not a gamete? [1]

.....

(b) Point A on the X chromosome shows the position of an allele. Give the reason why a male cannot be heterozygous for this allele. [1]

.....

.....

(c) Describe how genes are arranged on a chromosome. [1]

.....

.....

3

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

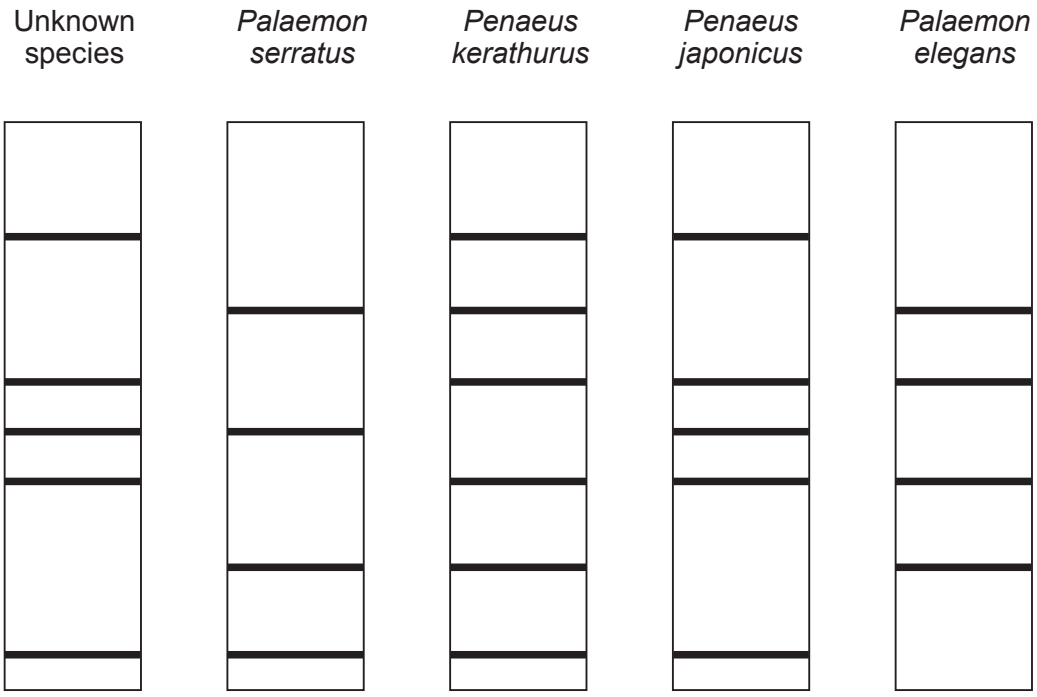
© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

7.

In 1989, fishermen in the English Channel caught specimens of a species of prawn which they could not identify. They sent the prawns to a marine biologist who said that the species had not been recorded in British waters before. He identified the species by comparing its genetic profile with those of known species of prawn. The results are shown below.



(a) Use the genetic profiles to identify the unknown species. [1]

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) Which of the other prawn species would be most likely to cross breed with the unknown species? Give a reason for your answer. [2]

.....

.....

(c) Prawns have different names in different languages. For example: Italian – gamberi and French – crevette. State precisely, how marine biologists avoid confusing the names of the organisms that they study. [1]

.....

.....

4

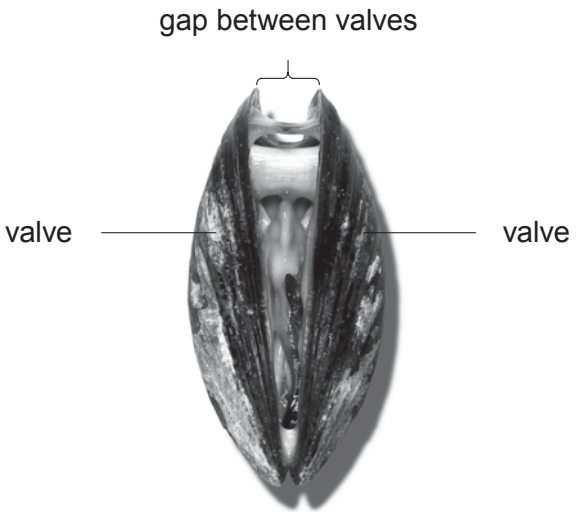
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

8. Mussels are bivalve invertebrates where the shell is made of two valves.

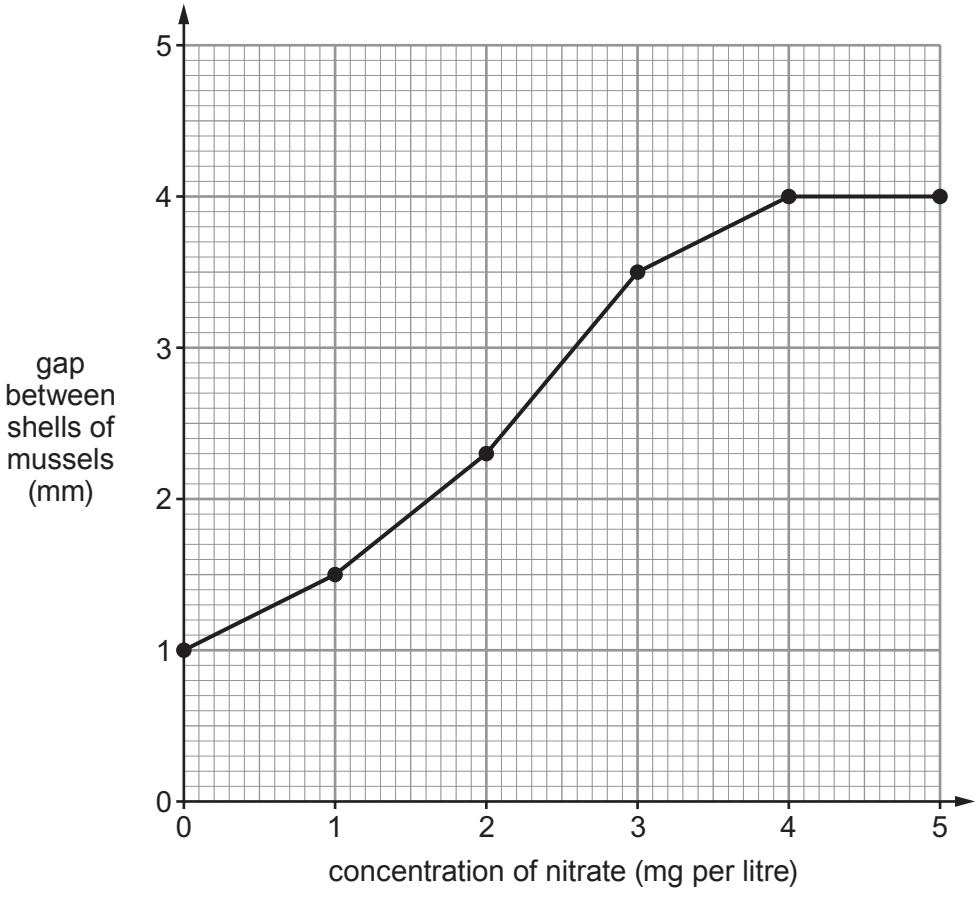


In 2013, scientists investigated whether mussels could be used to monitor nitrate pollution in water.

Mussels feed by filtering food particles out of the water. Mussels open their shells when feeding.

Sensors were placed on mussels in aquarium tanks to measure the size of the gap between the valves in different concentrations of nitrate.

The results of the laboratory investigation are shown in the graph below.



© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(a) Describe the trend shown by the graph opposite. [1]

.....

.....

(b) Scientists carried out trials to see if mussels with 'nitrate monitoring sensors' could be used where the Mississippi river meets the Gulf of Mexico.

Suggest **two** factors that may have affected these trials that would **not** have affected the results in the laboratory investigation. [2]

(i) .....

(ii) .....

(c) Scientists think that nitrate pollution could result in 'dead zones' in which marine life could suffocate. Explain how this might happen. [3]

.....

.....

.....

.....

.....

.....

.....

6

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

9. Waders are species of birds which feed in shallow water and nest on land. The table below shows numbers of breeding pairs of four species of waders on two Scottish islands, Islay and Arran, in 1983 and 2000.

	number of breeding pairs of waders			
	Islay		Arran	
wader	1983	2000	1983	2000
Lapwing	1869	1287	1104	1364
Redshank	1288	760	486	733
Dunlin	2016	884	803	558
Snipe	655	280	172	154

(a) Calculate the percentage decrease in the number of breeding pairs of snipe on Islay between 1983 and 2000. [2]

Percentage decrease ..... %

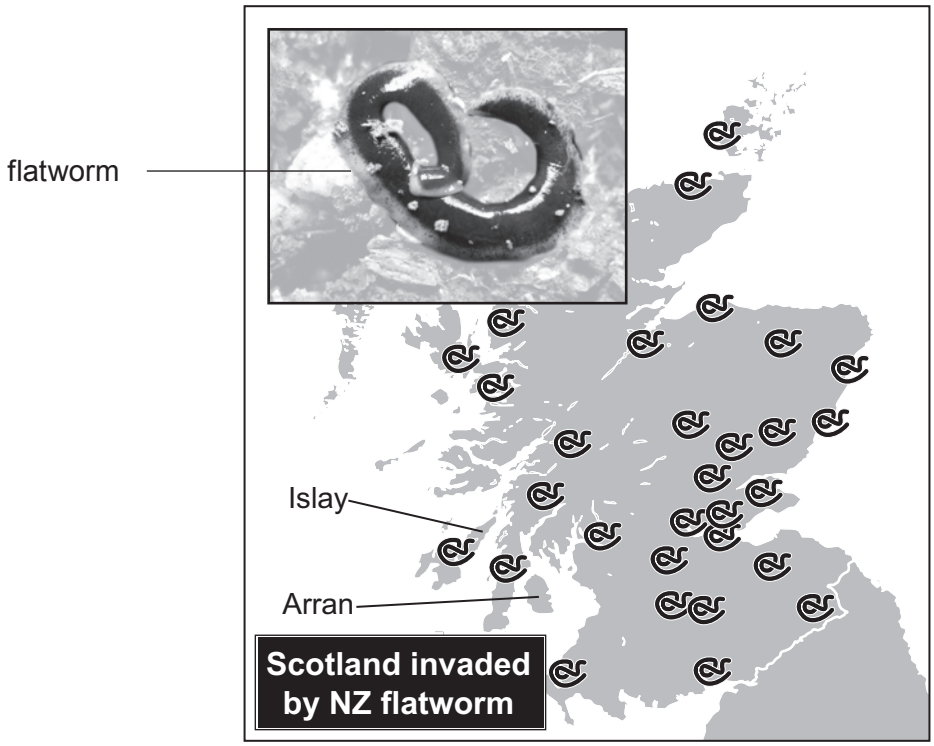
(b) Four hedgehogs were introduced to Islay in 1974. No other carnivorous mammals live on the island. By 1983, the population of hedgehogs on the island was very large.

In the 1980s, a species of flatworm from New Zealand, was accidentally introduced to Islay.
Arran has remained free of hedgehogs and flatworms.

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only



- Hedgehogs eat invertebrates and the eggs of waders.
- Flatworms do not eat birds' eggs, but eat the same types of invertebrates as hedgehogs.
- Hedgehogs do not eat flatworms.

(i) Explain why the number of waders on Islay has decreased since the introduction of the flatworm. [2]

.....

.....

.....

(ii) How does the data from Arran suggest that predation may **not** be the only reason for the decrease in the number of waders? [1]

.....

.....

(iii) Suggest **two** factors that have allowed a large increase in the population of hedgehogs on Islay. [2]

.....

.....

7

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

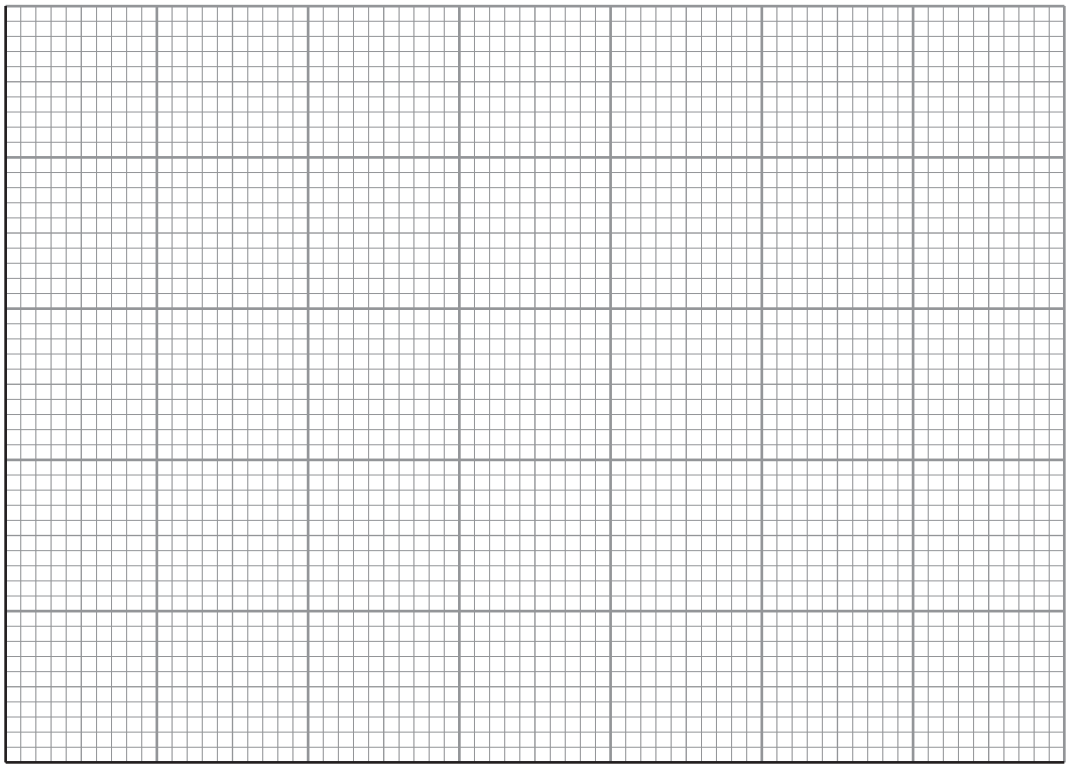
Examiner only

10. Some students collected leaves from a number of different beech trees.

The students measured the length of each leaf. The results are shown in the table below.

	length of leaf (mm)				
	21-30	31-40	41-50	51-60	61-70
number of leaves	51	72	74	66	47

(a) Use the data shown in the table to construct a bar graph in the grid below to show the variation in the length of beech leaves. Label the axes and use a suitable scale. Use a ruler for the bars. [3]



(b) Name the type of variation shown on your bar graph. [1]

.....

4

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

11.



Deer mice live in the sand hills of Nebraska, USA. The genetic analysis of ancient remains of deer mice has shown that 10 000 years ago, the only genes for their coat colour were for dark coloured fur.

Their environment changed about 10 000 years ago when sand hills formed. Deer mice, living today, have sand coloured fur which is controlled by a gene called 'agouti'. This gene has not been found in the ancient remains of deer mice.

Write an explanation of the evolution of the coat colour in deer mice. In your explanation, refer to the processes of natural selection and the importance of genetic analysis in finding evidence for evolution. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

END OF PAPER

6

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

GCSE MARKING SCHEME

SCIENCE - BIOLOGY

JANUARY 2015

© WJEC CBAC Ltd.

STEMUP.CO.UK

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2015 examination in GCSE SCIENCE - BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

	Page
UNIT B1	1
UNIT B2	18

© WJEC CBAC Ltd.

STEMUP.CO.UK

GCSE BIOLOGY - B1

JANUARY 2015 MARK SCHEME

Question			Marking details	Marks Available
1	*(a)*	(i)	Bunting	1
		(ii)	Starling	1
	(b)	(i)	any **two** from: ¶ {some/most} hedges {gone/cut down}/{fewer/ loss of} hedges; ¶ {Less/loss of} grassland; ¶ reduced crop {variety/ types/OWTTE}/ no {peas/potatoes} grown/only wheat grown; ¶ more buildings; NOT less trees	2
		(ii)	any **two** from: habitat/ place to live/shelter/cover/hide from predators; NOT hide alone Food/ to get prey; nest sites/place to lay eggs;	2
			Question 1 total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
2	*(a)*		vertebrates; *Equus;* *ferus;* correct spelling for all three answers upper case 'E', lower case 'f'	3
	(b)	(i)	DNA;	1
		(ii)	<u>species</u>;	1
			Question 2 Total	**[5]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
3	*(a)*		<table><tr><th rowspan="2">condition</th><th rowspan="2">bacteria</th><th colspan="3">excess</th></tr><tr><th>alcohol</th><th>energy in food</th><th>salt in food</th></tr><tr><td>**high blood pressure**</td><td></td><td></td><td></td><td>given</td></tr><tr><td>**infection**</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>**drug dependence**</td><td></td><td>✓</td><td></td><td></td></tr><tr><td>**obesity**</td><td></td><td></td><td>✓</td><td></td></tr></table>	3
	(b)	(i)	infection;	1
		(ii)	obesity;	1
	(c)		{Thick/excessive} mucus; NOT mucus alone {Blocking/clogging} bronchioles; Reject lungs/trachea	2
			Question 3 Total	**[7]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
4	*(a)*	(i)	all plots correct;; +/- ½ small square tolerance 0 errors = 2 marks 1 error = 1 mark 2 errors = 0 marks	2
		(ii)	correct line through the plots;	1
		(iii)	(nitrate makes it) increase, then fall;	1
	(b)		To show that the {effect/difference} is due to nitrate;	1
	(c)	(i)	I 7; II 7;	2
		(ii)	1 number of dead/decaying plants increase; 2 (bacteria/decomposers/fungi) use oxygen/respire; *point 2 is dependent on point 1* Alternative 1 number of living plants increase; 2 plants produce oxygen/photosynthesise; *point 2 is dependent on point 1*	2
			Question 4 Total	**[9]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
5	*(a)*		23;	1
	(b)		X;	1
			<table><tr><td></td><td>given</td><td>X</td></tr><tr><td>given</td><td>given</td><td>XX</td></tr><tr><td>Y</td><td>XY</td><td>XY</td></tr></table>	2
			one mark for correct gametes; one mark for correct mechanics from correct gametes; NO ecf from (i)	
			Question 5 total	**[4]**

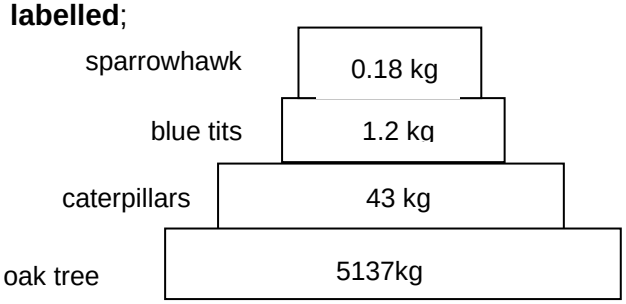
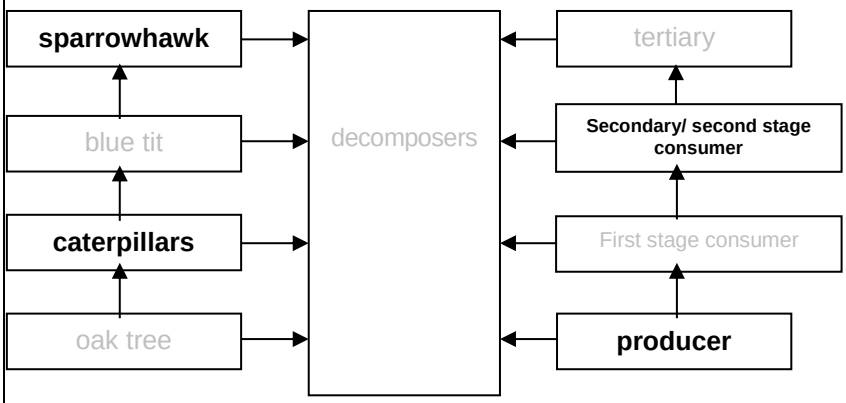
© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
6	*(a)*		Sweat gland {produces/releases/creates} sweat; Travels up sweat duct **and** onto the (skin) surface;	2
	(b)		¶ blocks {pore/duct}/sweat cannot get out/no sweat on surface; NOT no sweat {produced/released} alone/no sweating ¶ {less/no} {cooling/heat loss}; ¶ {No/less} evaporation;	3
			Question 6 Total	**[5]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
7/1	*(a)*	(i)	2 17 3456 1 all correct 1 mark	1
		(ii)	I **Four** trophic levels showing the correct **shape** and **labelled**;  II All masses correct including units; (independent of shape)	1 1
	(b)		Food chain column correct; Trophic level column correct;  	1 1
	(c)		iv	1
			Question 7/1 total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
8/2	*(a)*	(i)	1344;; *If answer incorrect award 1 mark for* *16 x 20 x 4.2*	2
		(ii)	6720 (ecf from a(i));	1
	(b)		**Any 3 from: 1 mark each** ¶ Time between igniting the food and placing it under the boiling tube varies (OWTTE); ¶ Distance of the burning food from the boiling tube varied/ not placed in the same spot; ¶ {Type/ kind} of food (burnt) varied; ¶ Incomplete burning; NOT {mass/size} of food varied/different volume of water/ not burnt for same length of tome/ different food	3
			Question 8/1 total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
9/3	*(a)*		Any **one** from: ¶ Does not kill/ harm} {insects/ organisms} {which are beneficial/ that pollinate crops/ which are useful}/ ORA; ¶ Only 1 application/ it is cheaper/ ORA; NOT bioaccumulation ¶ No (chemical) pollution/ ORA;	1
	(b)		Fertilizers/GM (crops)/ selective breeding/named fertilizer/ manure/slurry/biological control/genetic engineering; NOT reference to pesticide use/herbicides	1
	(c)	(i)	1947/ 1948 ;	1
		(ii)	Leaching/run off/spray carried by air onto water/(rain) {carried/ washed} it into rivers ; NOT DDT sprayed onto water/rain leaked it into rivers	1
		(iii)	It (bio)accumulates/builds up (in tissues)/it is persistent/it concentrates in tissues/it is not destroyed after it enters the body; At the concentration found in the Bald Eagle it is {toxic/poisonous}/ORA; NOT kill/lethal 2nd mark linked to 1st	2
			Question 9/3 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
10/4			**Indicative content:** Pancreas Secretes insulin Travels in blood stream To liver Glucose is converted to glycogen Glycogen stored in the liver **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit. **Question 10/4 Total**	6 **[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

<table>
<tr><th colspan="3">Question</th><th>Marking details</th><th>Marks Available</th></tr>
<tr><td>5</td><td>(a)</td><td>(i)</td><td>One {form/version/variant} of <u>a</u> gene/{two/different}{forms/ types/versions} of {the <u>same/a</u>} gene;</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>¶ In a {heterozygous organism/OWTTE} the allele that is not {expressed/shown}/
¶ only {expressed/shown} {when homozygous/when in a pair of recessive alleles}/</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Gametes correct (must use correct letter for this mark);

Mechanics of cross correct;
Allow ECF of incorrect gametes but must use B/b

<table>
<tr><td>Gametes</td><td>B</td><td>b</td></tr>
<tr><td>B</td><td>BB</td><td>Bb</td></tr>
<tr><td>b</td><td>Bb</td><td>bb</td></tr>
</table></td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>75%/ 0.75/ ¾/ 3 in 4;
NOT ratio</td><td>1</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>3 : 1 ;</td><td>1</td></tr>
<tr><td></td><td></td><td></td><td>Question 5 Total</td><td>[6]</td></tr>
</table>

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
6	*(a)*		There are {46 chromosomes/(23) pairs/has a diploid number/ not haploid/has both X and Y;	1
	(b)		No {corresponding/matching} part of chromosome (for paired allele)/only has one X chromosome/ only has one {copy of the gene/allele};	1
	(c)		Linearly/in a line/in a row;	1
			Question 6 total	**[3]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
7	*(a)*		*Penaeus japonicus;* *Correct spelling and format*	1
	(b)		*Penaeus kerathurus;* *Correct spelling and format* The {DNA/genetic} profile is <u>most</u> similar to the unknown species/ both are in the same genus/both have the same first {scientific/latin} name/<u>most</u> similar <u>DNA banding pattern</u>; NOT genetic fingerprint/ genotypes/genus	2
	(c)		They use the same name of genus and species/same {scientific/universal/Latin/international/binomial} name/scientific name is universal;	1
			Question 7 total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
8	*(a)*		As the nitrate concentration increases, the gap between the shells increases (up to 4mm) and <u>levels off</u>;	1
	(b)		Any two from: Predation; Disease; flow of water/tides/current other named chemical (e.g. phosphates/sewage/oil/salt) competition for {food/space}; pH; temperature; oxygen; NOT weather/climate	2
	(c)		(Nitrate causes) excess plant growth/ algal bloom/OWTTE; Plants {die/decay}/OWTTE; NOT bacteria eat plants {Bacteria/decomposers/ fungi} use oxygen for respiration; 3rd mark point linked to 2nd mark point	3
			Question 8 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
9	*(a)*		655 – 280 = 375 375 x 100 = 655 = 57.25/ 57.3% NOT 57.0/57 Correct answer = 2 marks Allow 1 mark for correct working but incorrect answer	2
	(b)	(i)	Flatworms compete with hedgehogs for {food/ invertebrates}; Therefore hedgehogs eat more birds' eggs (avoiding the competition); (must be linked for second mark)	2
		(ii)	Numbers of {some birds/named birds (Snipe/Dunlin)} dropped (without introduction of hedgehogs);	1
		(iii)	{Lack of/no/less} {predators/carnivorous mammals/carnivores}; Abundance of {food/ eggs}/large variety of food/less competition for food;	2
			Question 9 Total	**[7]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
10	*(a)*		One axis labelled- number of leaves and other axis labelled – length of leaf(mm); Suitable linear scales (including origin) + at least half of grid used; Bars correct heights (drawn with ruler);	3
	(b)		Continuous;	1
			Question 10 Total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
11			**Indicative content** Agouti/coat gene appeared as a mutation led to variation in the fur colour colour change was an advantage because of camouflage allowed the mutant to survive to breed mutant gene was passed on DNA comparison between modern deer mice and the remains of ancient ones. **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit. **Question 11 Total**	6 **[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4461/02

SCIENCE A/BIOLOGY

BIOLOGY 1
HIGHER TIER

P.M. TUESDAY, 10 June 2014

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**6**	
3.	**6**	
4.	**6**	
5.	**6**	
6.	**4**	
7.	**7**	
8.	**8**	
9.	**5**	
10.	**6**	
Total	**60**	

4461
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **4** and **10**.

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

Answer **all** *questions.*

1. Some organisms living in a large lake and their total biomass in kg are shown below.

They are **not** drawn to scale.

Snails
4 500 kg

Pike
250 kg

Aquatic plants
45 000 kg

Minnows
500 kg

Beetles
800 kg

(a) (i) Which of the organisms above are likely to be present in the least numbers? [1]

.....

(ii) The organisms above all form part of the same food chain.
In the space below, draw a **labelled** diagram to show a pyramid of biomass containing **all** of these organisms. [2]

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

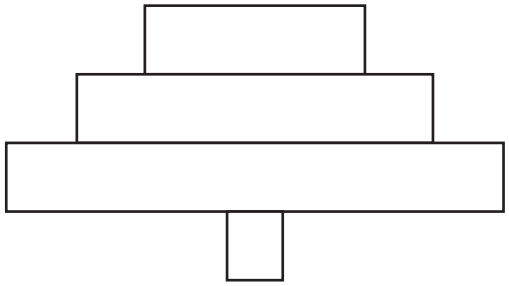
(iii) The pike in the lake are affected by a parasite, called a fish louse, which lives on their skin. There would be many of these parasites on each pike but their biomass would be less than the biomass of the pike.

How would you add this information to the pyramid you drew in *(a)*(ii)?

Tick (✓) the correct answer. [1]

- Place them at the tier above the pike ☐
- Place them at the bottom of the pyramid ☐
- Place them below the minnows ☐
- Place them in the tier below the pike ☐

(b) Explain how a pyramid of numbers, for some organisms living on land, could look like the one shown below: [2]



.....

.....

.....

6

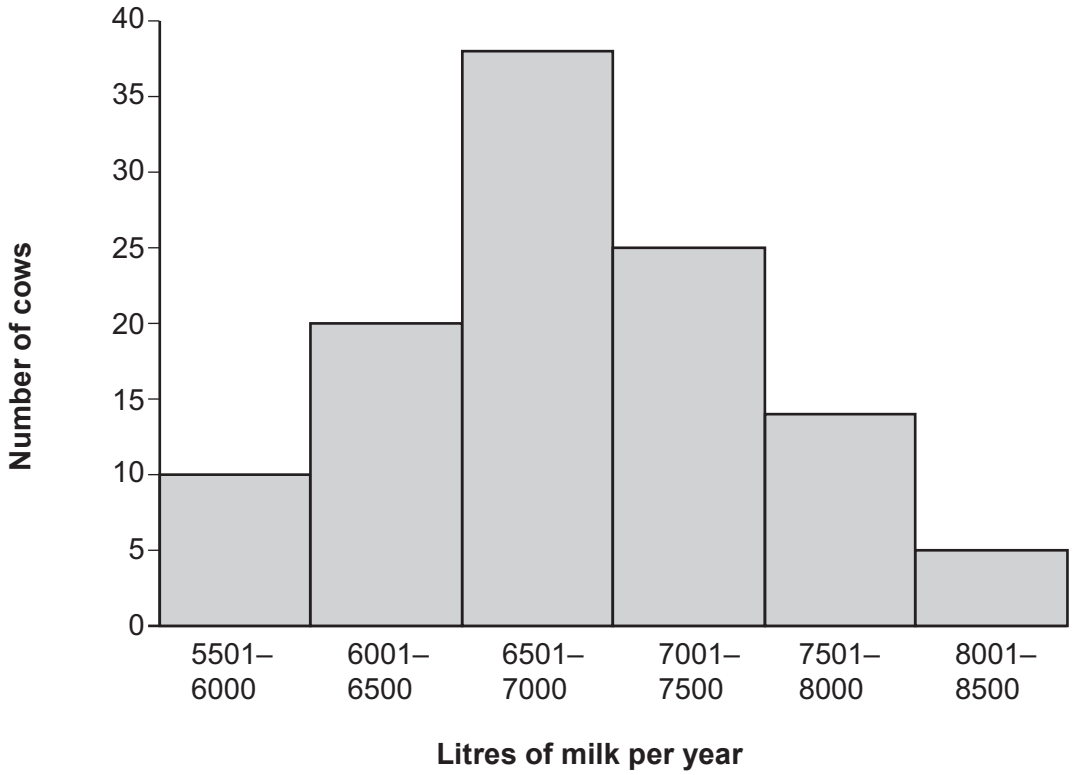
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

2. *(a)* The graph below shows the variation in the volume of milk produced by a herd of cows in one year. All the cows were the same breed.



(i) During the winter months, the herd is kept indoors in large barns. All the cows in the herd are fed exactly the same quality and quantity of food. Suggest a reason why the volumes of milk produced by the cows varied during the winter months. [1]

.....

.....

© WJEC CBAC Ltd.

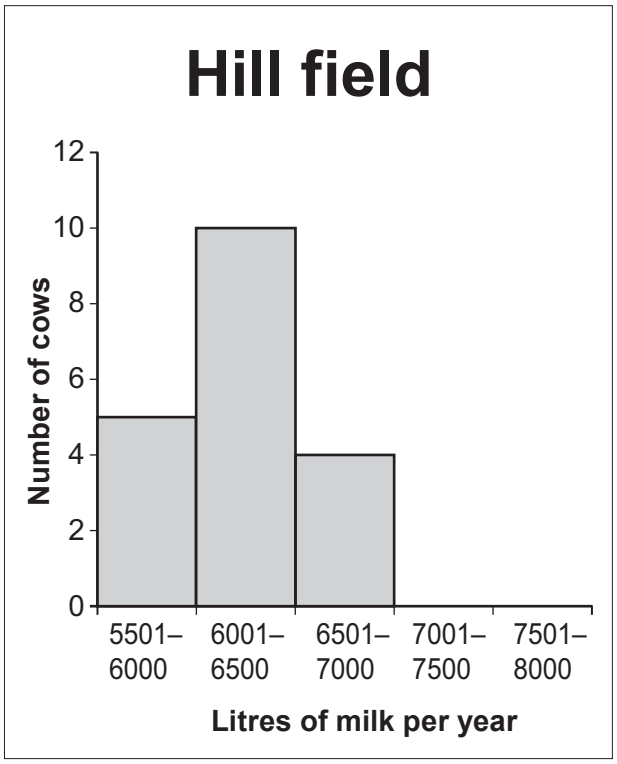
STEMUP.CO.UK

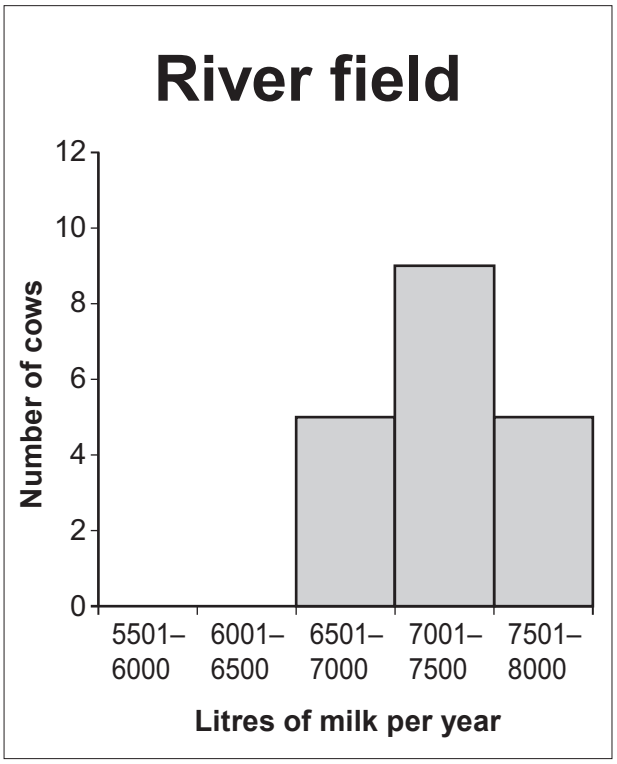
Examiner only

During the summer months, the farmer noticed that the volume of milk produced by the cows varied depending on which fields on the farm the cows were grazing on.

He divided the cows that produced 6501 – 7000 litres of milk per year into two groups. One of these groups grazed on a field by the river and the other on a field on the hill.

The graphs below show the results.





(ii) Explain the differences in the results shown in the graphs. [2]

.....

.....

.....

.....

(iii) When the farmer breeds from his cows he uses a method called artificial insemination (AI). The sperm are introduced into the cows mechanically rather than by using a bull directly.
How does this information suggest that AI is a method of sexual reproduction? [1]

.....

.....

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

(b) The table below shows the milk composition of five breeds of dairy cattle.

	milk composition (g/l)		
breed	fat	protein	milk sugar
Ayrshire	3.97	3.26	4.63
Brown Swiss	3.80	3.18	4.80
Guernsey	4.58	3.49	4.78
Holstein	3.56	3.02	4.61
Jersey	4.97	3.03	4.70

Milk from which breed of cattle would you recommend to a person suffering from heart disease? Give a reason for your answer. [2]

.....

.....

.....

.....

6

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

3. The diagram below shows the hairs on the surface of the skin of a cat at different air temperatures.

Diagram A

Mean air temperature 6.4°C

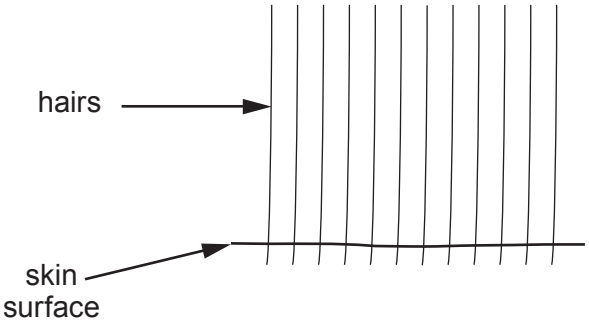
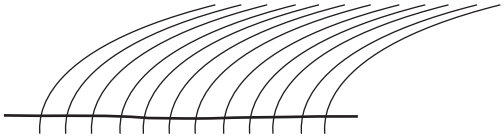


Diagram B

Mean air temperature 22.7°C



(a) Name the structures in the skin that raise each hair to the position shown in **Diagram A**. [1]

.....

(b) Explain why the skin in **Diagram A** loses less heat to the air than the skin in **Diagram B**. [3]

.....

.....

.....

.....

.....

.....

(c) State **two** *other* ways in which the skin reduces heat loss from the body. [2]

I .....

II .....

6

4461 020007

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

4. Describe an experiment you would set up to investigate the positive growth response (phototropism) of plant shoots to light coming from one side.
In your account you must explain the use of a control in your investigation. [6 QWC]

6

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

5. In mice the allele for black eye colour (**B**) is dominant over the allele for red eye colour (**b**).

(a) What is the phenotype of each of the following mice? [1]

Mouse 1 **BB** .....

Mouse 2 **Bb** .....

Mouse 3 **bB** .....

Mouse 4 **bb** .....

(b) (i) If mouse 1 and mouse 4 were mated together and had 12 offspring, how many of these would you expect to have black eyes?

Number with black eyes ..... [1]

(ii) Complete the Punnett square below to help explain your answer. [1]

Gametes		

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(c) (i) If mouse 2 and mouse 4 were mated together and had 50 offspring over several litters, how many of their offspring would you expect to have red eyes?

Number with red eyes ..... [1]

(ii) Complete the Punnett square below to help explain your answer. [1]

Gametes		

(d) If mouse 2 and mouse 3 were mated together and had 48 offspring over several litters the expected Mendelian ratio is 3 black eyed mice : 1 red eyed mouse.
Suggest **one** reason why the expected ratio does not always occur in practice. [1]

.....

.....

6

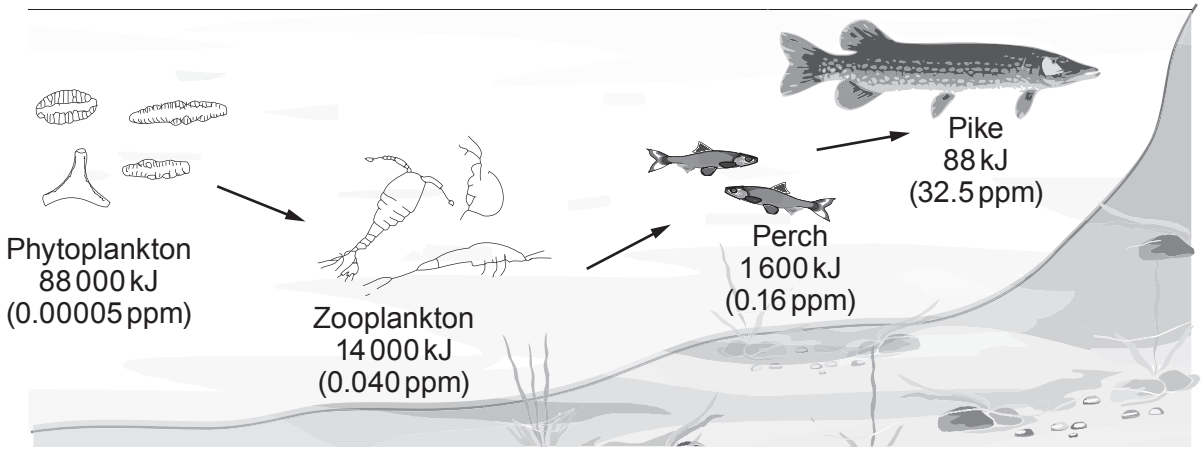
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

6. The drawing below shows a food chain in a river into which a pesticide has been washed.



The organisms are not drawn to scale.

The unit, kJ, indicates the energy in organisms at each level of the food chain and represents kJ per m^3 of water per year.
The numbers in brackets show the pesticide concentration in parts per million (ppm).

(a) Calculate, the percentage of the energy in the producer that has reached the third stage consumer. **Show your working**. [2]

Answer ..... %

(b) Over a period of three years, the number of fertilised eggs per fish decreased in the river. Use the data shown in the drawing and your knowledge to explain a reason for this decrease. [2]

.....

.....

.....

4

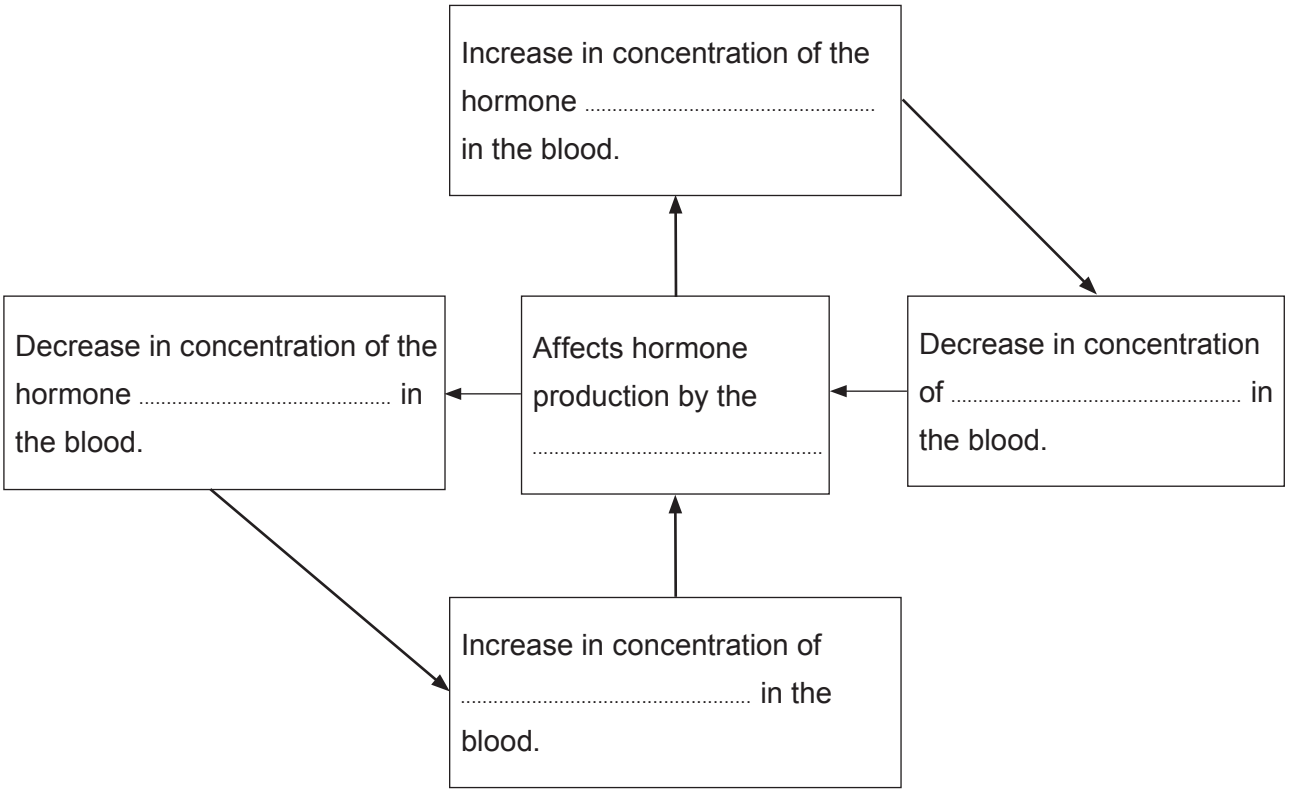
© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

7. The principles of negative feedback can be summarised by the flow chart shown below.

(a) Fill in the blank spaces to show how the source of energy in the blood is maintained at a constant concentration. [5]



(b) State **two** features of hormones shown in the flow chart. [2]

I .....

II .....

7

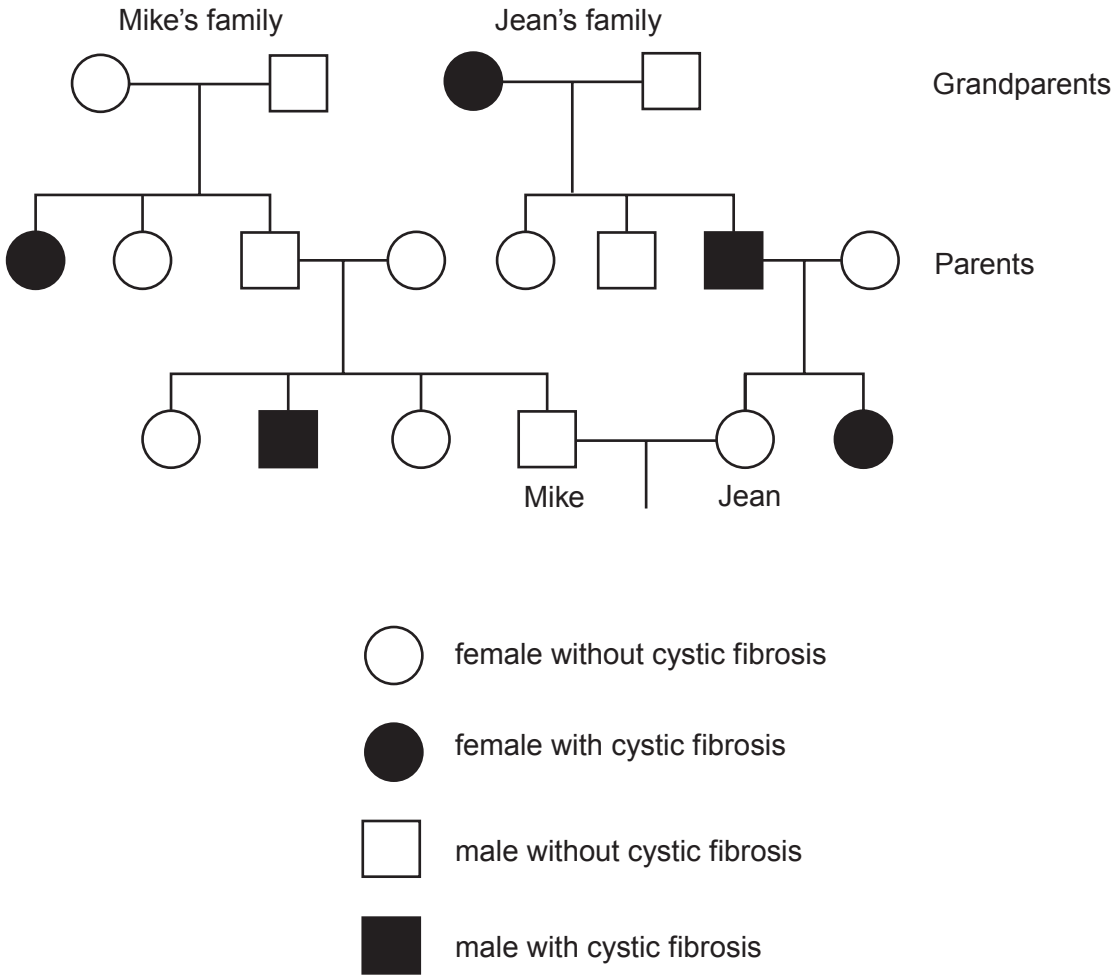
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

8. The patterns of inheritance of cystic fibrosis in two families is shown as a family tree below.



Cystic fibrosis results from a homozygous pair of recessive alleles. People who are heterozygous for cystic fibrosis have one normal allele and one cystic fibrosis allele. They are carriers of cystic fibrosis but do not suffer from it.

(a) In the family trees shown, if **N** = the normal allele and **n** = the allele for cystic fibrosis, what is the genotype of: [2]

(i) Mike's grandfather; .....

(ii) Jean? .....

(b) What is the percentage chance that Mike is a carrier of cystic fibrosis? [1]

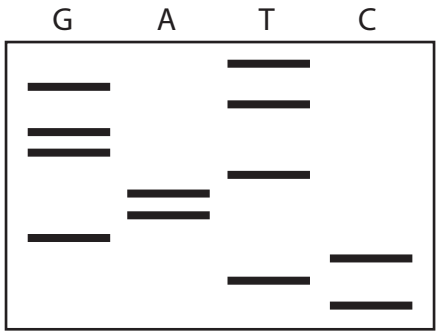
.....

© WJEC CBAC Ltd.

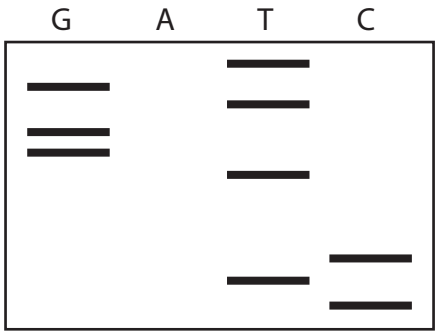
STEMUP.CO.UK

Examiner only

(c) Chromosomes from Mike and Jean's developing baby and from Mike were examined. A genetic analysis of the alleles present was carried out. The results are shown below as a sequence of bars.



Genetic analysis of Mike's alleles



Genetic analysis of Mike and Jean's developing baby's alleles

(i) What term is used for this sequence of bars? [1]

.....

(ii) Cystic fibrosis is caused by a change in protein made in the cells.
Explain why the protein made in the cells of the developing baby is different from the protein being made in Mike's cells. [2]

.....

.....

.....

.....

(d) Explain why genetic analysis is a more accurate method of predicting the inheritance of cystic fibrosis than using information from family trees. [2]

.....

.....

.....

.....

8

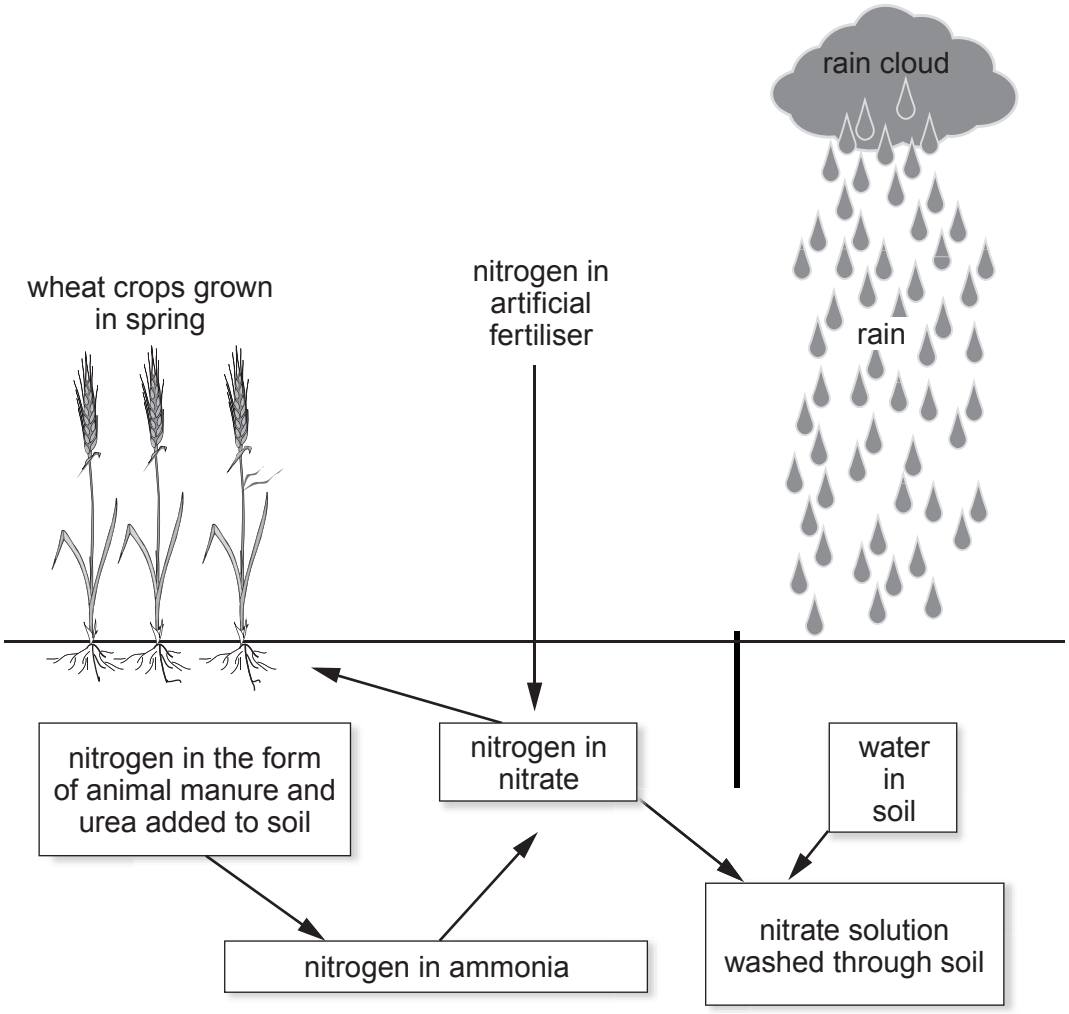
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

9. The diagram below shows how some nitrates enter water in the soil and how some enter the roots of wheat.



(a) Nitrate Vulnerable Zones (NVZs) are areas of land where nitrates in fertilisers are likely to enter water supplies.
Suggest why:

(i) the annual deadline for spreading animal manure (slurry) on NVZs in Wales is October 31st; [1]

.....

.....

(ii) it is more environmentally friendly to add nitrate fertiliser to wheat crops in the Spring than in the Winter. [1]

.....

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) Some genetically modified plants are able to absorb nitrates more rapidly than others so that they increase their yield.
State another way in which plants may be genetically modified as an economic advantage. [1]

.....

.....

(c) Suggest how ploughing dead plants back into the soil may lead to increased nitrate production in the long term. [2]

.....

.....

.....

5

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

10. There is a gene (FOXI 1) in humans which controls how much water is lost from the body in sweat and urine. Scientists found that 85% of a large sample of people who lived in the Sahara desert had a form of the FOXI 1 gene which had changed over time.
It has been estimated that climate change caused the Sahara desert to form between 10 000 and 20 000 years ago at the same time that the change in the FOXI 1 gene took place.
Explain how evolution has resulted in the changed FOXI 1 gene increasing in frequency in people living in the Sahara desert. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

END OF PAPER

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

© WJEC CBAC Ltd.

GCSE MARKING SCHEME

SCIENCE-BIOLOGY

SUMMER 2014

© WJEC CBAC Ltd.

STEMUP.CO.UK

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2014 examination in GCSE Science-Biology. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

	Page
B1	1
B2	18
B3	32

© WJEC CBAC Ltd.

STEMUP.CO.UK

GCSE SCIENCE - BIOLOGY

B1

MARK SCHEME - SUMMER 2014

Question		Marking details	Marks Available
1	*(a)*	No {backbone/ vertebral column/ spinal column/ vertebrae};	1
		NOT spinal cord/ bone	
	(b)	**ANY ORDER** B C D F;	3
		all four correct = 3	
		three correct = 2	
		two correct = 1	
		Question 1 total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
2	*(a)*		Sun/ solar; NOT light/ sunlight	1
	(b)		<u>Energy;</u>	1
	(c)	(i)	20; Correct answer = 2 marks If incorrect answer allow one mark for (500/2500) x 100	2
		(ii)	<u>Respiration/ respiring/ respires</u>;	1
			Question 2 Total	**[5]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
3	*(a)*	2.5;	1
	(b)	0.25;	1
	(c)	Any **three** from: light/ sunlight; NOT sun water; NOT moisture/ rain nutrients/ minerals/ salts/ named mineral; NOT food/ salt space; NOT room/ area carbon dioxide/ CO_2;	3
	(d)	(**A** and **B** are) <u>different</u> {types/sorts/species/genes/DNA}/ genetically different/genetic variation/ there has been a mutation; NOT different chromosomes	1
		Question 3 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
4	*(a)*	(i)	Soldiers whose wounds had maggots were <u>more</u> likely to survive (than soldiers who did not have maggots)/ ORA; (comparison is needed)	1
		(ii)	Maggots ate bacteria (and dead flesh around the wound);	1
		(iii)	Make his findings known widely/ allow reproducibility/ others to test/ to confirm findings; NOT to help more soldiers;	1
	(b)		<u>Fewer</u> side effects/ drug toxicity/ bacterial resistance/ maggots are more widely available (in some parts of the world)/ some people are allergic to antibiotics; NOT some people react to antibiotics (unqualified)/ easier (unqualified)/ no side effects/ safer/ act quicker	1
			Question 4 Total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
5	*(a)*		Nucleus; Gene; Protein;	3
	(b)	(i)	I 8; II Kangaroo; (8 is/ gametes have) {half the body cell number/ half the diploid number}/ 8 is the haploid number/ {reference to fertilisation restoring the body cell chromosome number/OWTTE}; NOT half the number of chromosome 2nd mark only accessed if 1st mark credited	1 2
		(ii)	36;	1
			Question 5 total	**[7]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
6	*(a)*	(2) 3 4 1 5; one mark for each number correctly positioned	4
	(b)	Become extinct/ die out/ wiped out; NOT die (unqualified)/ become endangered	1
		Question 6 Total	**[5]**

© WJEC CBAC Ltd.

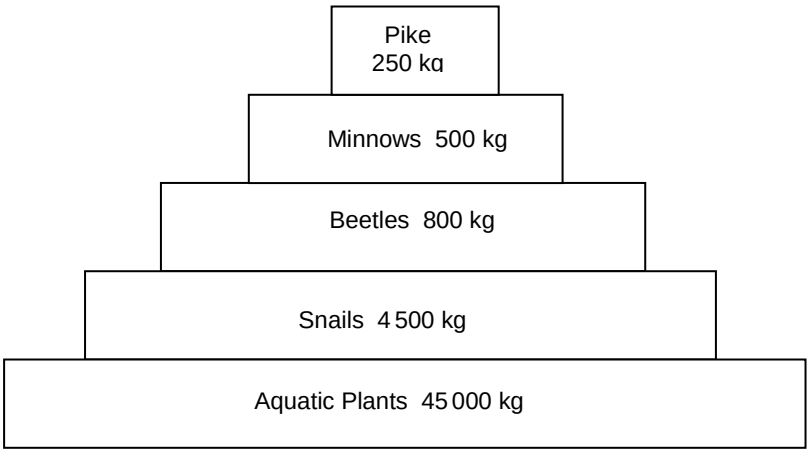
STEMUP.CO.UK

Question			Marking details	Marks Available
7	*(a)*		1. (Playing) music {increases/slows} reaction time/ slows reactions *OR Reverse answer* Not playing music decreases reaction time/ makes reactions faster/ speeds up reaction time; NOT worse/better/improved reaction time 2. With music, reaction times are variable/ reaction time decreases with {trial number/ practice} *OR Reverse answer* Without music reaction time is constant/ steady/ the same; NOT the longer Bob listens to music the quicker his reaction time	max 2
	(b)	(i)	Eye;	1
		(ii)	Impulses/<u>electrical</u> signals; Along neurones/nerve/ nerve cells;	2
			Question 7 total	**[5]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
8/1	*(a)*	(i)	Pike	1
		(ii)	Pyramid correctly drawn (accept triangle) with correct labels and biomasses with units = 2 marks Pyramid correctly drawn with names of organisms on own without masses = 1 mark Pyramid correctly drawn with biomasses on own with units without named organisms = 1 mark Incorrect order or level missing = 0 marks	2



		(iii)	Tier above the pike;	1
	(b)		{Single/one} {plant/ tree / named plant/ producer}; NOT aquatic plant On which {many organisms/ named organisms} {feed/ live off};	2
			Question 8/1 total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
9/2	*(a)*	(i)	The cows are <u>genetically</u> different/have different <u>genes</u>/ show <u>genetic</u> variation/ different ages/ variation in the milk producing genes; NOT different genetics/ sizes/ inherited it from their parents/ mutation	1
		(ii)	River field cows' milk production is higher/ ORA; there are <u>environmental</u> differences/ named environmental difference e.g. temperature/soil/nutrients/water content/ {richer/better <u>quality</u>} grass (must be comparative); 2nd mark only awarded if 1st is credited	2
		(iii)	Sperm (are used)/ two parents/ bull and cow;	1
	(b)		Holstein; it has the {low<u>est/least</u>} fat content/ lower fat than the other cows; 2nd mark point only accessed if first correct sugar=neutral	2
			Question 9/2 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
10/3	(a)	Erector muscle;	1
	(b)	1. Hairs {erect/raised/ stand up/ stick up/ are lifted/ pulled up/ straight up/ up};	3
		2. Trap thicker layer of air/ more air trapped; NOT trap layer of warm air (can be neutral)	
		3. Which is {an insulator/ poor conductor} / which lets less heat pass out/ which insulates/ harder for heat to escape; NOT no heat passes out	
		3rd mark only awarded if 2nd awarded	
		ACCEPT REVERSE ARGUMENT	
	(c)	Any **two** from:	2
		1. Vasoconstriction/ {capillaries/ blood vessels} {narrow/ constrict/ thinner}/ diameter gets smaller; NOT contract/ get smaller/ blood vessels moving up and/or down	
		2. shivering; {reduced/ no} sweating/ less sweat {produced/ secreted};	
		Question10/3 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question	Marking details	Marks Available
11/4	*Indicative content:*	6

All plants/seedlings/flowers are growing vertically straight up.

{Place plants on a window sill/ in a (blacked out) box with a hole in one side/ any method of one sided illumination}.

Leave plants for specified length of time.

Plants show growth towards light/ tips 'bend' towards light.
NOT move

Reference to involvement of hormone e.g. hormone cause shoots to bend.

Reference to control by eliminating the effect of one sided light. This should be uniform illumination.
NOT darkness

Shoots/tips don't bend towards light.

5 – 6 marks
The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

3 – 4 marks
The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

1 – 2 marks
The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

0 marks
The candidate does not make any attempt or give a relevant answer worthy of credit.

Question 11/4 Total **[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details		Marks Available
5	*(a)*		All correct 1 mark Mouse 1 **BB** - black Mouse 2 **Bb** - black Mouse 3 **bB** - black Mouse 4 **bb** - red		1
	(b)	(i)	12;		1
		(ii)	All correct no errors		1

Gametes	**B**	**B**
b	**Bb**	**Bb**
b	**Bb**	**Bb**

	(c)	(i)	25;		1
		(ii)	All correct no errors		1

Gametes	**B**	**b**
b	**Bb**	**bb**
b	**Bb**	**bb**

		(d)	Fertilization is random/ reference to death of embryos;		1
			Question 5 Total		**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
6	*(a)*	(88/88 000) x 100; 0.1%; Correct answer = 2 marks	2
	(b)	Accumulation of pesticides/ bioaccumulation/ increase in concentration of pesticide; Can reduce fertility/ makes them infertile/ reduce reproductive rate; NOT kills fish before they can reproduce/ less eggs fertilised 2nd mark only awarded if 1st awarded	2
		Question 6 total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
7	*(a)*	Hormone = insulin in both boxes ;	2
		Organ = pancreas;	1
		Increase = glucose;	1
		Decrease = glucose;	1
	(b)	Any **two** from	2
		Chemical messengers;	
		Carried in blood;	
		Controls {body/a} {function/process};	
		(Insulin) decreases glucose in the blood;	
		Hormones produced by {pancreas/ glands};	
		Question 7 total	**[7]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
8	*(a)*	(i)	Nn;	1
		(ii)	Nn;	1
	(b)		50(%);	1
	(c)	(i)	{Genetic/ DNA} {profile/ profiling}; NOT genetic fingerprinting	1
		(ii)	DNA {has coded information/ codes for protein}; Baby's DNA is different to Mike's/ In the {DNA profiles/ genetic analysis} above, the baby {does not have any (base) A/ has one less G};	2
	(d)		Family tree only shows the {<u>chance/probability</u>} of having CF; {Profile/ analysis/it} shows the (presence of) {alleles/mutation/gene}; NOT the genotype	2
			Question 8 Total	**[8]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
9	*(a)*	(i)	More {rainfall/ precipitation} therefore more {slurry/nitrates/manure} could be washed into water;	1
		(ii)	{More/ faster} absorption of nitrates (as plants are growing); NOT Less rainfall in spring	1
	(b)		{Herbicide/ pest/ fungus/ drought/ low temperature/ disease} resistance/ increase rate of photosynthesis/ any correct point; NOT pesticide resistance/ immune to herbicides/ increased yield	1
	(c)		Protein converted to ammonia/ Ammonia is converted to nitrate; By decomposers/ bacteria/ fungi; If named, bacteria must be correct. e.g. **Nitrifying** bacteria change protein to ammonia = 1 mark	2
			Question 9 Total	**[5]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question	Marking details	Marks Available
10	Indicative content A gene mutates. This resulted in variation. The variation reduced water loss. This {was an advantage/ had survival value} (in the desert.) Resulted in natural selection/ survival of the fittest to breed (Advantageous altered) gene was passed on. 5 – 6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. 3 – 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. 1 – 2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. 0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.	6
	Question 10 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4461/02

SCIENCE A/BIOLOGY

BIOLOGY 1
HIGHER TIER

A.M. WEDNESDAY, 8 January 2014

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**6**	
3.	**6**	
4.	**7**	
5.	**6**	
6.	**7**	
7.	**4**	
8.	**4**	
9.	**3**	
10.	**6**	
11.	**6**	
Total	**60**	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **4** and **11**.

© WJEC CBAC Ltd.

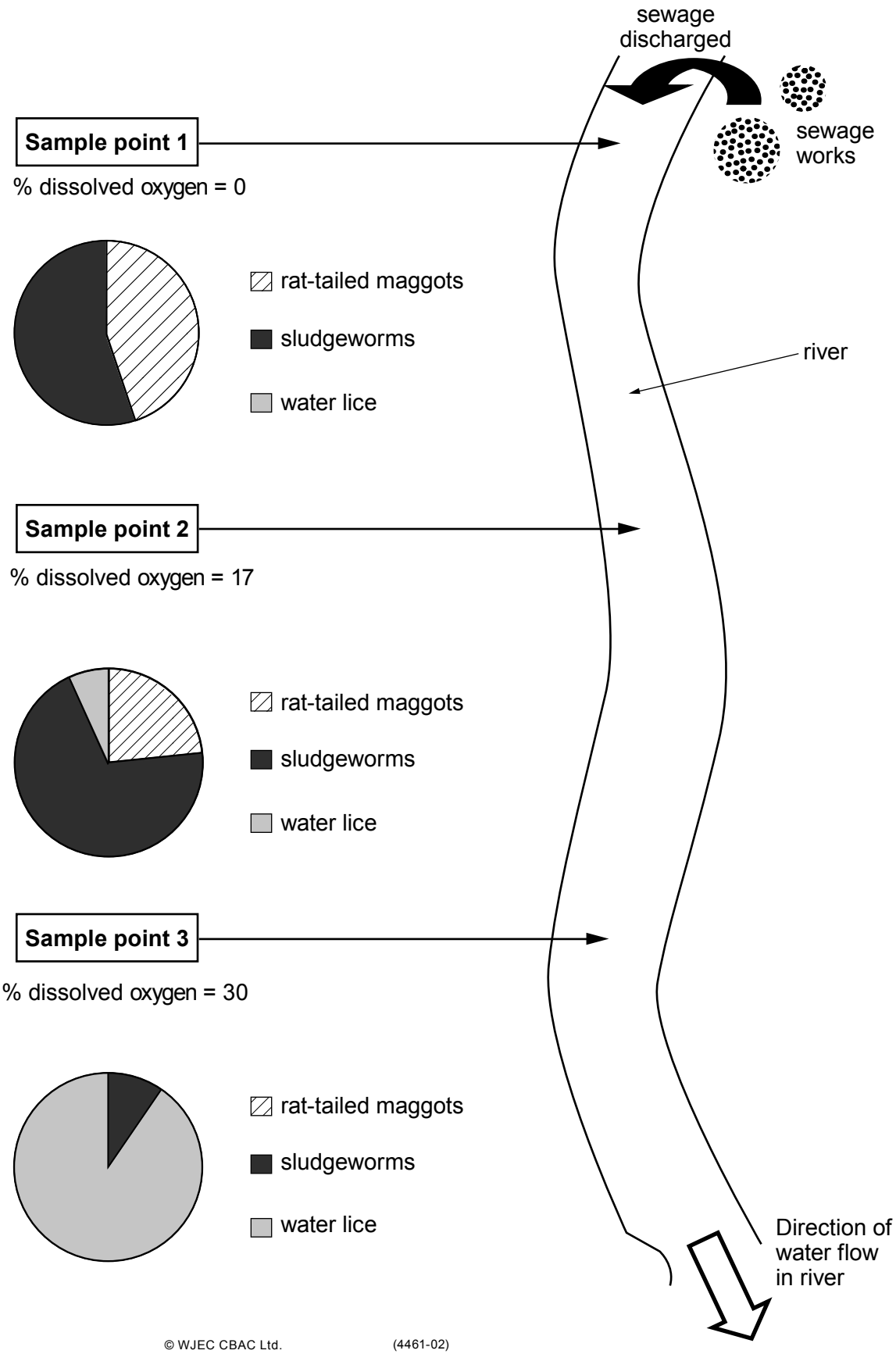
STEMUP.CO.UK

4461 020001

Answer **all** *questions.*

1. Recent flooding in the UK caused a sewage discharge into a river. Two weeks after the discharge the Environment Agency took samples of river water at 3 sample points 0.5 km apart.

The percentage (%) of dissolved oxygen in the sample was measured and the animals in the samples were counted and the data plotted as pie charts. The results are shown below.



© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

Use the information from the diagram opposite to answer the following questions.

(a) The presence of which **two** animals in the samples indicates **high** levels of water pollution? [2]

....

(b) Which animal cannot live in highly polluted water? [1]

.....

(c) (i) What happens to the percentage of dissolved oxygen as the water flows downstream? [1]

.....

(ii) Rat-tailed maggots need oxygen to live. Suggest how they can live at **Sample point 1** where there is no oxygen dissolved in the water. [1]

.....

.....

5

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

2. Anna has been a diabetic for 6 months. She injects herself with insulin before meals in order to control the level of glucose in her blood. Like all diabetics who have not been injecting insulin for very long she finds it difficult to get the dose correct.
Before every meal Anna carries out the following procedure.

1. Measures the concentration of glucose in her blood.

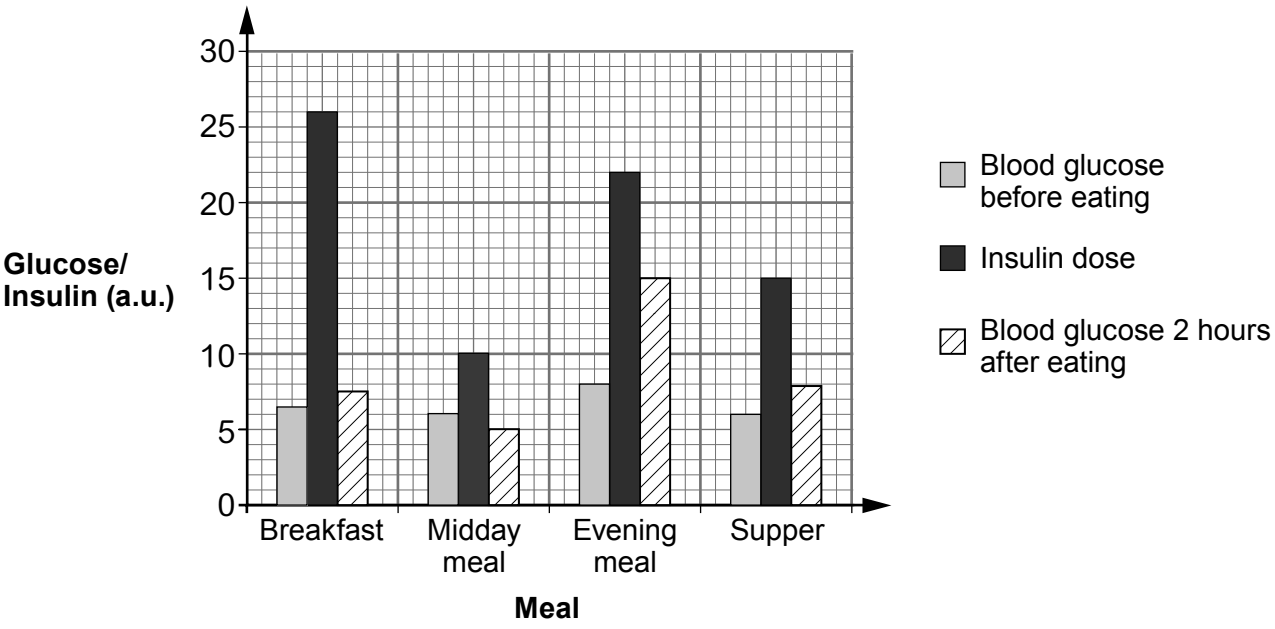
2. Estimates whether the meal she is about to eat has a high, medium or low level of glucose (sugar) in it.

3. Inject insulin, the dose of which depends on the level of glucose in the meal.

Two hours after the meal she measures the concentration of glucose in her blood again.

Anna records all this information on an App, called ***Glucose Buddy***, on her iPhone.

The chart below shows Anna's complete record for one day on ***Glucose Buddy***.



Examiner only

(a) (i) Which meal of the day did Anna estimate contained the lowest level of glucose? Give a reason for your answer. [2]

Meal .....

Reason .....

.....

(ii) Anna tries to keep her blood glucose level below 8 a.u. Using only the chart and the information opposite suggest reasons why her blood glucose level was still 15 a.u. two hours after she ate her evening meal. [2]

.....

.....

.....

(b) How does insulin lower the level of glucose in the blood? [2]

.....

.....

.....

4461 020005

6

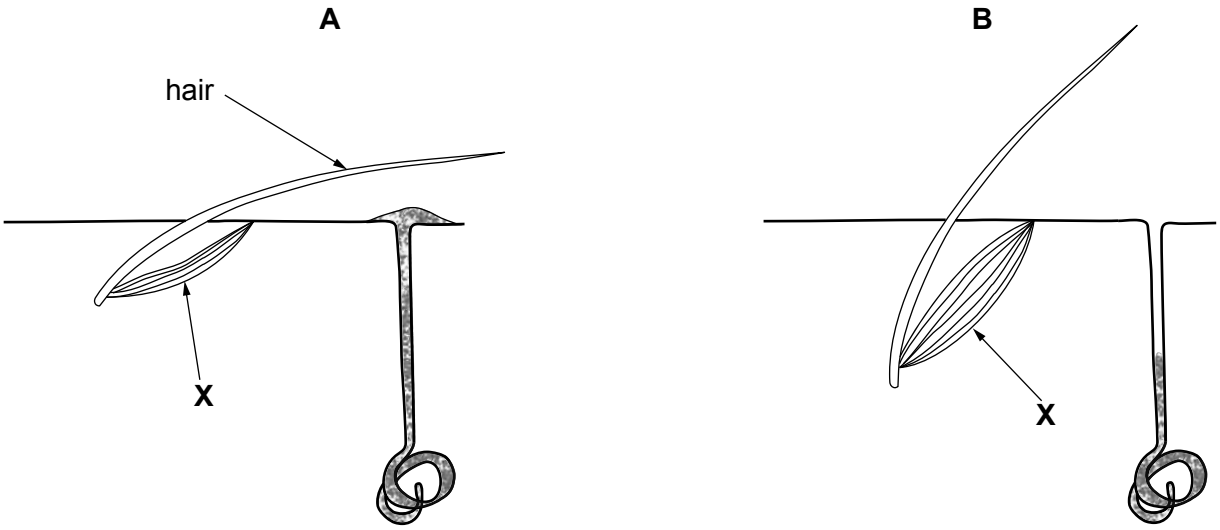
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

3. Diagrams **A** and **B** below show the skin under two different environmental conditions.



(a) (i) Which of the diagrams shows the skin in hot conditions? ..... [1]

(ii) Give **two** reasons for your answer. [2]

I. .....

.....

.....

II. .....

.....

.....

(b) If blood vessels had been drawn on the diagrams, the blood vessels in the skin in diagram **B** would be narrower than in diagram **A**. Explain how this helps to control body temperature. [2]

.....

.....

.....

(c) State how structure **X** on the diagrams above causes the hair to appear as it does in diagram **B**. [1]

.....

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

4. In 1960, a survey of a large pond on a farm found that it contained a rich variety of aquatic insects, snails and four different fish species.

In 1965, the farmer started growing cereal crops on his land. Pellets containing nitrate were spread on the crops several times a year. By 1975, the pond had become overgrown with algae and other aquatic plants and a new survey found that there were very few aquatic insects and no fish species.



Pellets containing nitrate

(a) State why the farmer spread nitrate on the cereal crops. [1]

.....

.....

(b) Use the information above and your own knowledge to explain the changes which occurred to the pond. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(lines continued overleaf)

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

.....

.....

.....

.....

.....

7

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

5. Mrs Hughes is a well known breeder of both yellow and black Labrador dogs. The allele for black coat (**B**) is dominant to the allele for yellow coat (**b**). Mrs Hughes finds it easier to sell black Labrador puppies because they are more popular. She does however produce yellow Labrador puppies when there is a demand for them.

Mrs Hughes has recently bought a black Labrador dog because it has many of the features which judges look for in dog shows, but she does not know its genotype.

(a) State the meaning of the term *genotype*. [1]

.....

.....

(b) (i) Mrs Hughes wants to breed from the black Labrador she has just bought but needs to know its genotype. How could she find out its genotype? Give a full explanation of the cross she could carry out and the expected results. [3]

.....

.....

.....

.....

.....

(ii) Complete the Punnett squares below to show the **possible** results of this cross. [2]

Gametes		

Gametes		

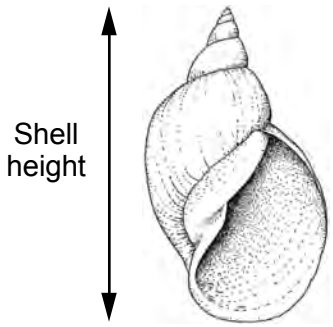
6

© WJEC CBAC Ltd.

Turn over.

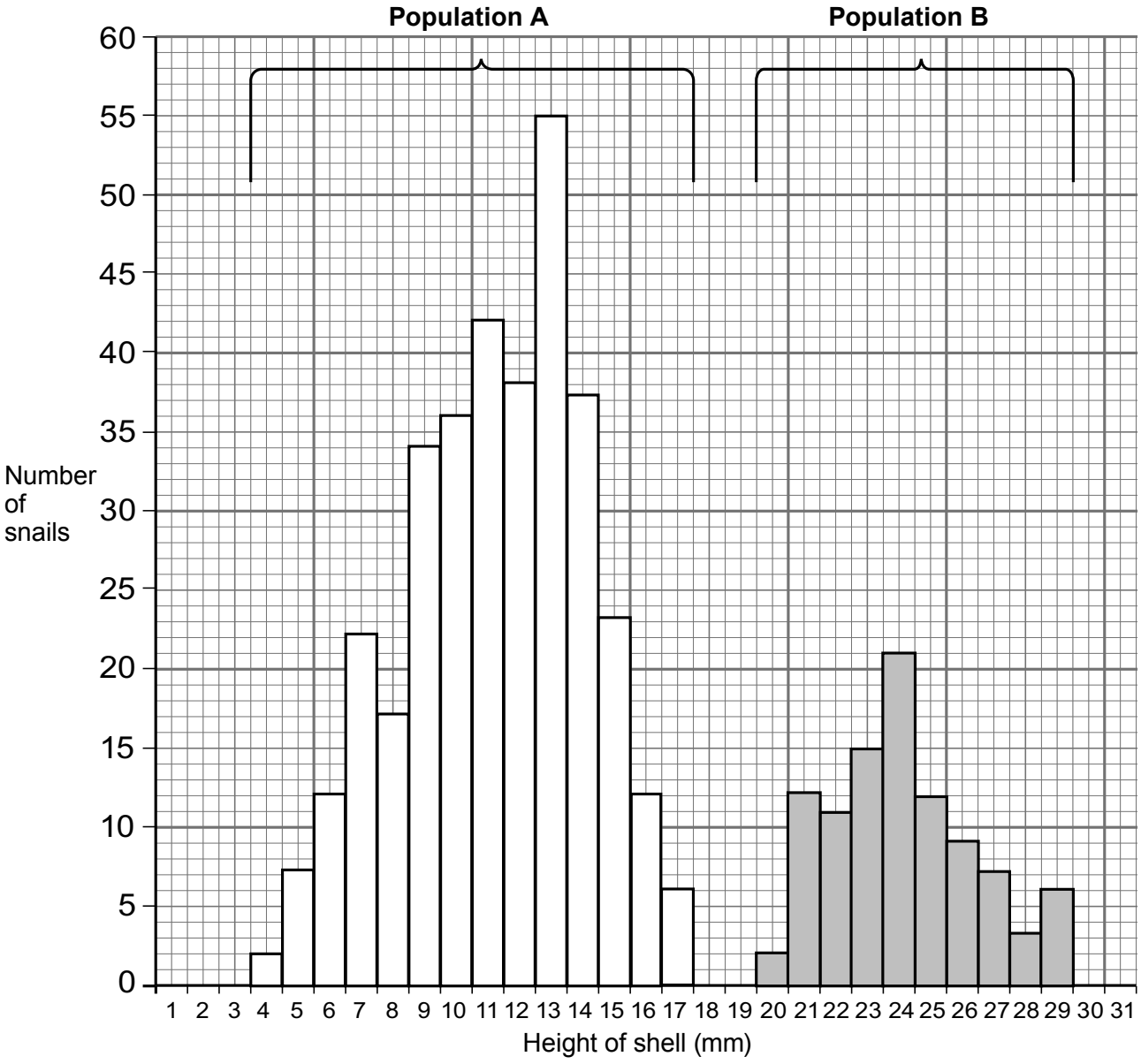
STEMUP.CO.UK

6. The heights of the shells of two separate populations of the pond snail, *Lymnaea stagnalis*, were measured in an investigation into variation.



Lymnaea stagnalis

The bar charts below show the results for the two populations, labelled population **A** and population **B**.



(a) (i) Populations **A** and **B** show the same type of variation. Name the type of variation. [1]

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(ii) What evidence is shown in the bar charts to suggest that population **B** is older than population **A**? [1]

.....

(iii) What are the **two** least common shell heights in population **A**? [1]

..... and .....

(iv) Calculate the difference in the **maximum** shell height between population **A** and population **B**. [1]

.....

(b) Suggest **three** environmental factors that could account for the variation shown in the separate populations. [3]

I. .....

II. .....

III. .....

7

7. The owner of a garden centre wanted to know whether young strawberry plants in two boxes **X** and **Y** had been grown from seeds or had been grown asexually. He allowed them to grow to maturity in identical conditions.

Plants from box **X** produced identical flowers, all at the same time.
Plants from box **Y** produced flowers which varied in shape and size, some of which were produced earlier than others.

(a) State why plants from box **X** could be described as *clones*. [1]

.....

(b) (i) Explain how sexual reproduction results in the variation seen in the plants in box **Y**. [2]

.....

.....

.....

.....

(ii) Give **one** advantage to the species of variation produced by sexual reproduction. [1]

.....

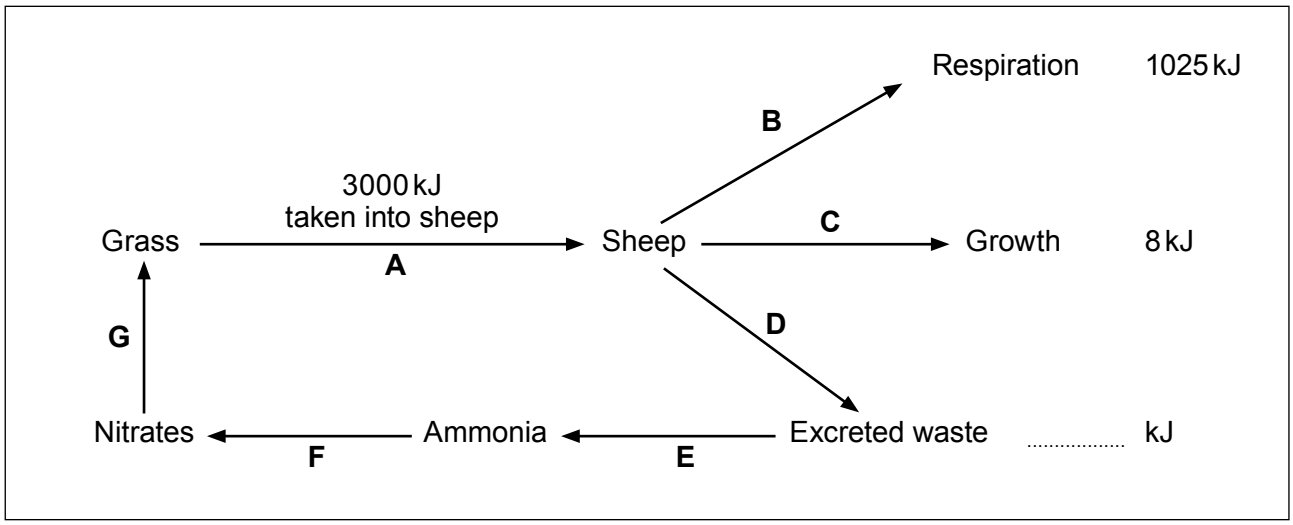
.....

4

STEMUP.CO.UK

Examiner only

8. The following flow chart shows part of the nitrogen cycle. It also shows the energy relationships between some organisms and their environment.



(a) (i) Complete the flowchart above to show how much energy is in the excreted waste. [1]

(ii) Calculate the percentage of the energy taken into the sheep which is used in growth. Show your method in the space below. [1]

Answer ..... %

(b) Use the flow chart above to state

(i) the letter which represents the action of urease ..... [1]

(ii) a letter which represents protein production ..... [1]

4

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

9.



Leeches help in hunt for rare species

Leeches feed on the blood of mammals. Leeches can keep blood cells in their digestive systems for four months.
It was suspected that several endangered species of mammals existed on an island. These mammals had not been seen on the island for 25 years, but their genetic profiles had been stored in laboratories.

Explain how scientists could use leeches, collected on the island, and the technique of genetic profiling to prove that the endangered species of mammals still exist. [3]

.....

.....

.....

.....

.....

.....

3

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

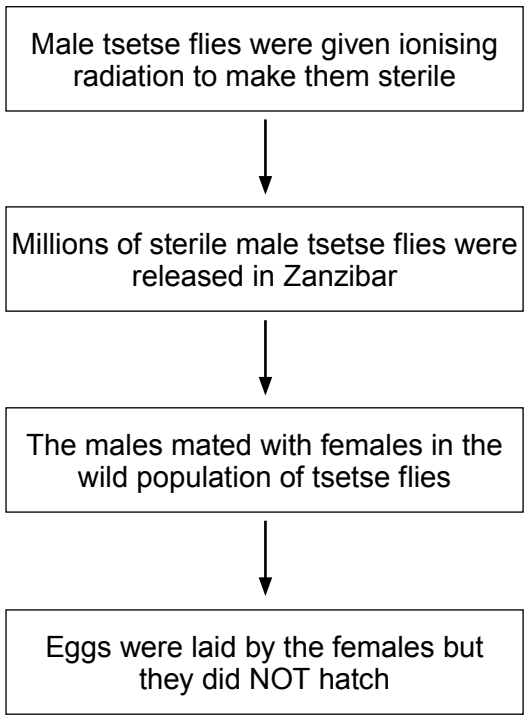
10. The photograph below shows a male tsetse fly *(Glossina palpalis)*.



© Ray Wilson/Alamy

- The tsetse fly *Glossina palpalis* is a pest.
- One method of pest control relies on releasing sterile male insects (insects which cannot produce sex cells) into wild populations.
- Sterile male tsetse flies have been used in pest control in this way, in a successful attempt at controlling the tsetse fly population in Zanzibar.
- Zanzibar is a small island off the coast of the continent of Africa.

The principle of this method of pest control is as follows:



(a) State how ionising radiation caused the tsetse flies to become sterile. [1]

.....

.....

STEMUP.CO.UK

Examiner only

(b) State **three** disadvantages of using insecticides compared to the method of pest control described opposite. [3]

I. .....

.....

II. .....

.....

III. .....

.....

(c) Suggest why the use of sterile male tsetse flies as a method of pest control is more likely to be successful on the small island of Zanzibar than it would be on the mainland of Africa. [2]

.....

.....

.....

.....

6

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

11. A bacterial gene which gives resistance to herbicides and can increase photosynthesis has been transferred into soya plants. A field of these genetically modified (G.M.) soya plants was sprayed with herbicide.

Explain fully the expected effects on the yield of soya beans. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

END OF PAPER

© WJEC CBAC Ltd.

STEMUP.CO.UK

GCSE MARKING SCHEME

SCIENCE - BIOLOGY

JANUARY 2014

© WJEC CBAC Ltd.

STEMUP.CO.UK

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2014 examination in GCSE SCIENCE - BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

	Page
B1 - 4461	1
B2 - 4471	18

© WJEC CBAC Ltd.

STEMUP.CO.UK

B1

Question				Marking details	Marks Available
1	*(a)*			Backbone/vertebrae/bones/spine (NOT spinal cord);	1
	(b)	(i)		Genus;	1
		(ii)		Species;	1
	(c)			Eats plants/vegetation; (NOT - does not eat meat/they are vegetarians) neutral – eats {grass/ vegetables/ veg}	1
	(d)	(i)	I	{percentage/ %} dark sheep;	1
			II	correct plotting +/- $^1/_2$ small square;;	2
			III	straight line joining the plots;	1
		(ii)	I	as temperature rises the {%/ proportion} dark sheep falls; (NOT {number/ amount} of sheep/reverse argument)	1
			II	Any two from: (differential) predation/camouflage; disease; food; water; correct genetic reason; NOT different genes (NOT hunting)	max 2
				Question 1 Total	**[11]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
2	*(a)*	{Badgers/ they} {spread/pass on/transmit} {TB/it} (to cattle)/ORA	1
	(b)	Public disquiet/animal rights issues/protests/people might try to stop it;	1
	(c)	Badgers from {outside the area/nearby} move in;	1
	(d)	(if) not all badgers killed/some (infected) badgers would {escape spread TB to other farms};	1
	(e)	Any two from vaccination (reject injection/jab) of cattle; vaccination (reject injection/jab) of badgers; Accept vaccination (cattle/badgers not specified)= 1 mark fencing/ prevention of badgers entering {cattle housing/ troughs} keep badgers away from farm/keep cattle in sheds (idea of separation); control of cattle movement; testing of {cattle/badgers}; kill {infected/diseased} cattle;	max 2
		Question 2 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
3	*(a)*	Heart disease/circulatory disease/stroke/clogged arteries/mobility issues/diabetes; NOT heart attack/failure	1
	(b)	{Burns/ uses up} {fat/<u>stored</u> energy}; NOT burns {calories/energy}/ lose weight	1
		Question 3 Total	**[2]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
4	*(a)*	(i)	bronchioles;	1
		(ii)	production of thick mucus;	1
		(iii)	an inhaler;	1
	(b)	(i)	C/from his father and his mother;	1
		(ii)	A/heterozygous for cystic fibrosis;	1
		(iii)	C/homozygous recessive for cystic fibrosis;	1
		(iv)	A/25%;	1
		(v)	C/males and females;	1
			Question 4 Total	**[8]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
5	*(a)*		Bacteria/ fungi;	1
	(b)		{The leaves/they} have {decayed/rotted/decomposed}; {More/faster} at {15 ^{o}C / the high temperature/highest temperature}; ORA	2
	(c)	(i)	Any two from: same type of leaves/from same tree; NOT same leaves same size of leaf; equal volumes of soil; NOT amount/ type/moisture content same {length amount} of time/both one month;	max 2
		(ii)	To make a (*qualified)* conclusion (e.g. meaningful/valid)/to make a comparison/to avoid invalid results/to determine that the temperature causes the difference; NOT to make more {reliable/accurate}/ avoid bias	1
	(d)		Carbon dioxide/CO_2; NOT CO^2/Co	1
	(e)		(Nitrates) released/produced by/come from the leaves; during decay;	2
			Question 5 Total	**[9]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
6/1	*(a)*		Rat-tailed maggots; Sludgeworms; NOT maggots/worms	2
	(b)		Water lice ; NOT lice	1
	(c)	(i)	Increases/gets higher/goes up;	1
		(ii)	{Uses atmospheric oxygen/comes to the surface} to breathe/ description of adaptation-they {have a breathing tube/use their tail to breathe}/ takes oxygen out of the air/can breathe out of water ; NOT lift their heads to breathe	1
			Question 6/1 Total	**[5]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
7/2	*(a)*	(i)	Midday meal; smallest/ lowest {dose/ amount} of insulin (injected); NOT lowest level of glucose/ sugar/ carbohydrate in the meal	2
		(ii)	She underestimated the amount of glucose/sugar/carbohydrate in the meal/more glucose than she {thought/estimated/ calculated} there would be; {Injected/dose/gave}too little insulin;	2
	(b)		{Converts/ changes} glucose to glycogen (correct spelling); Stored/in the liver; NOT insulin stores glucose as glycogen 2nd mark only credited if reference to glycogen	2
			Question 7/2 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
8/3	*(a)*	(i)	**A;**	1
		(ii)	Hairs {lying flat/lying down/hairs not stood up/lower}/ {erector muscle/ X} is relaxed; Sweat on the surface of the skin/A {shows/ is} sweating/more sweat; NOT sweat produced/sweat in the sweat duct/sweat is produced	2
	(b)		Reduced blood flow (in the skin)/less blood in the capillaries; NOT less blood flowing through <u>the body</u> {Reduces/less} heat loss (reject no heat loss); ORA (Must state letter A)	2
	(c)		It <u>contracts;</u> NOT tenses/gets shorter	1
			Question 8/3 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
9/4	*(a)*	As a fertilizer for growth/to make crops grow/to increase growth (rate)/to increase the {crop/ yield};	1
	(b)	**Indicative content** Nitrate pellets dissolve. Nitrate runs off into pond. Increased growth of aquatic plants/algal bloom. Sunlight blocked. Plants die. Decay. Decay microbes/ bacteria use oxygen in water for respiration. Aquatic animals/insects/fish die. **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6
		Question 9/4 Total	**[7]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
5	*(a)*		{the genes/all the alleles} in {an organism/dog/it}/ the {set/pair/two/both} alleles that {determine/control} {a characteristic/colour} of the dog/ the genetic make-up of {an organism/dog};	1
	(b)	(i)	{Cross/mate/breed} {the (black) Labrador/ it} with {a yellow Labrador/bb}/do a test cross; If all the {puppies/litter} are black then {the (black) Labrador/ it} is {homozygous/BB}; If there are yellow puppies in the litter then {the (black) Labrador/ it} is {heterozygous/Bb};	3
		(ii)	1 mark for each correct Punnett square;;	2

Gametes	B	B
b	B b	Bb
b	B b	Bb

Gametes	B	b
b	Bb	b b
b	Bb	b b

Alternative marking option

(b)		(i)	Cross/mate/breed} the black Labrador with another Black Labrador which is known to be {heterozygous/Bb}; If all the puppies are black then the black Labrador is {homozygous/BB}; If there are some yellow puppies in the litter then the black Labrador is {heterozygous/Bb};	3

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question	Marking details	Marks Available
(ii)	1 mark for each correct Punnett square;	2

Gametes	B	B
B	BB	BB
b	Bb	Bb

Gametes	B	b
B	BB	BB
b	Bb	bb

If bi not completed then first marking option must be used for marking punnett squares

[6]

Question 5 Total

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
6	*(a)*	(i)	Continuous;	1
		(ii)	{heights/lengths/shells/they} are bigger; NOT population bigger	1
		(iii)	4mm **and** 17mm (units required);	1
		(iv)	(29-17) = 12mm (units required);	1
	(b)	(i)	Any three from: food; temperature NOT climate/weather/heat (can be neutral); pH; NOT PH/Ph oxygen; parasites; disease; predation; pollution; NOT space/size of {pond/habitat} (not neutral)	Max 3
			Question 6 Total	**[7]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
7	*(a)*		They are genetically identical/same {genotypes/DNA/genes};	1
	(b)	(i)	{Genetic composition/DNA/genes} of {gametes/sex cells} is {not identical/varies}; They inherit different {genes/DNA/chromosomes} from {both parents/at fertilisation};	2
		(ii)	Evolution/ natural selection/adaptation to environment/survival value/survival of the fittest/ref to disease resistance;	1
			Question 7 Total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
8	*(a)*	(i)	1967;	1
		(ii)	0.27/ 0.3 / 0.266 / 0.267/ 0.26^{r}/; NOT 0.2/ 0.26	1
	(b)	(i)	E;	1
		(ii)	G/A/C;	1
			Question 8 Total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question	Marking details	Marks Available
9	Collect the blood from the {gut/digestive system/stomach} of leeches/collect the ingested blood; Compare {genetic/DNA} profiles with the {known/stored} {genetic/DNA} profiles; {A correct match/if they are the same} shows the endangered species exist; 3rd point is linked to 2nd point	3
	Question 9 Total	**[3]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
10	*(a)*	(Radiation) causes mutation/ {damages/changes} the{genes/DNA/ chromosomes}; NOT mutation of cells or organs	1
	(b)	Any three from: insecticides bioaccumulate/increases in concentration through a food chain; NOT passed along food chain can destroy {useful/other/all} insects is not selective; can affect fertility of animals at top of food chains; insects can develop{resistance/ immunity} to insectides;	max 3
	(c)	Any two from: size of population on mainland is larger than island population/ ORA; more insect predators on mainland than on island/ORA; fertile males (from mainland) cannot get to island; fewer sterile flies are needed (because the island is small);	max 2
		Question 10 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question	Marking details	Marks Available
11	**Indicative content** Soya has increased rate of photosynthesis because of inserted bacterial gene. Therefore increased growth. Yield is increased. Soya withstands/ resistant to herbicide because of inserted bacterial gene. Weeds are killed. Reduces competition for resources (minerals/light/space/water/CO_2). **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit	
	Question 11 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4461/02

SCIENCE A/BIOLOGY

BIOLOGY 1
HIGHER TIER

P.M. MONDAY, 10 June 2013

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**6**	
3.	**6**	
4.	**6**	
5.	**6**	
6.	**6**	
7.	**6**	
8.	**4**	
9.	**8**	
10.	**6**	
Total	**60**	

4461
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **4**. and **10**.

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

Answer **all** *questions.*

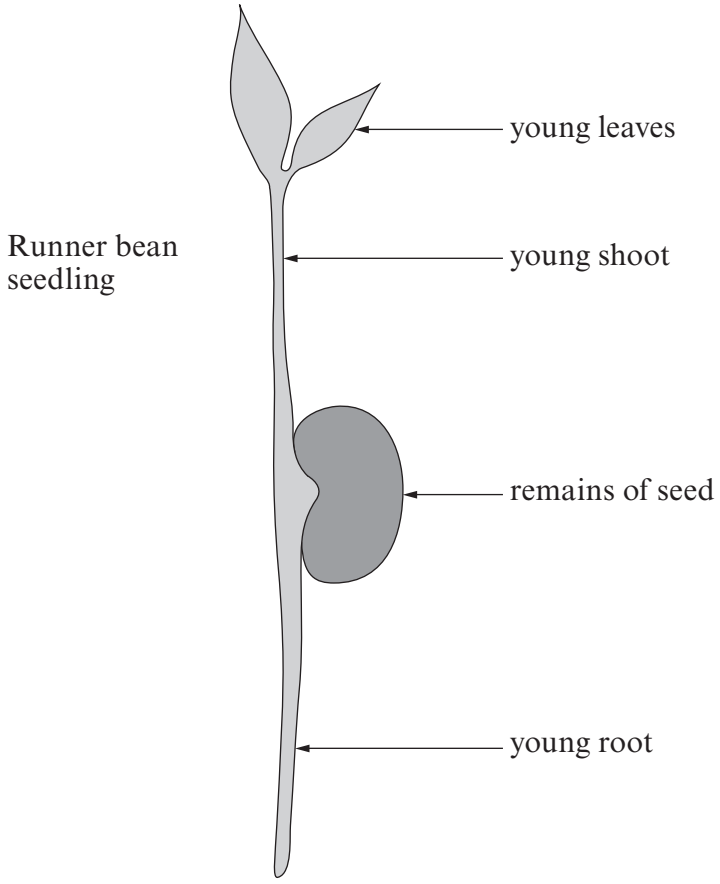
1. *(a)* What is a *tropism*? [2]

.....

.....

.....

(b) A number of runner bean seedlings were grown in soil in a laboratory. After 5 days the seedlings were removed from the soil and their young roots were washed. The straightest of the seedlings was then selected.

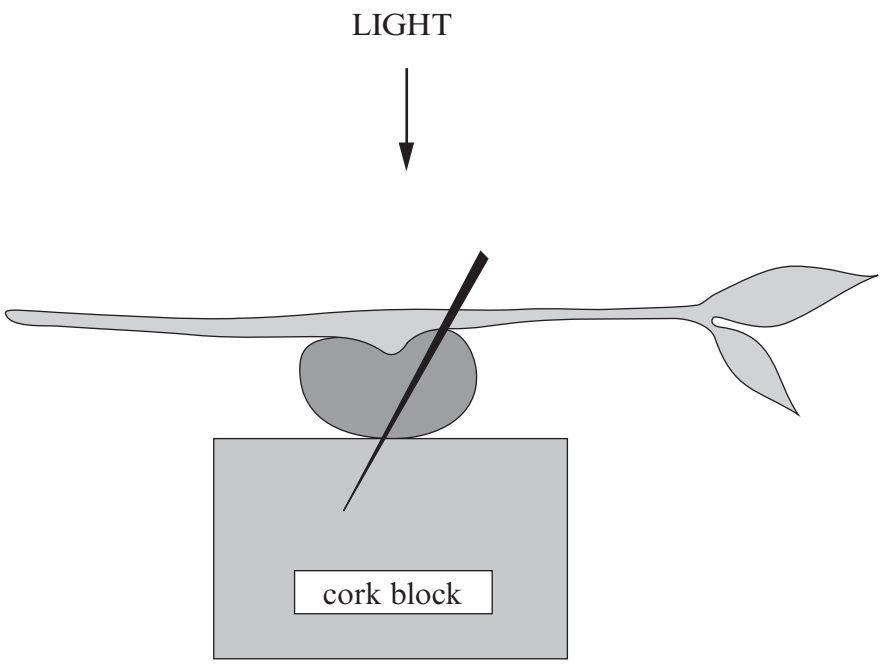


© WJEC CBAC Ltd.

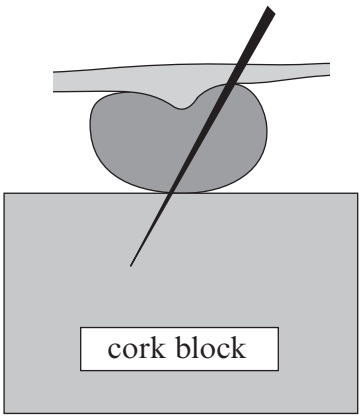
STEMUP.CO.UK

Examiner only

The runner bean seedling was positioned horizontally and pinned to a cork block as shown below.



(i) After 3 days the seedling was examined.
Complete the diagram below by sketching the expected appearance of the young root **and** shoot. [2]



(ii) Name the response shown by

I the root, ... [1]

II the shoot. ..... [1]

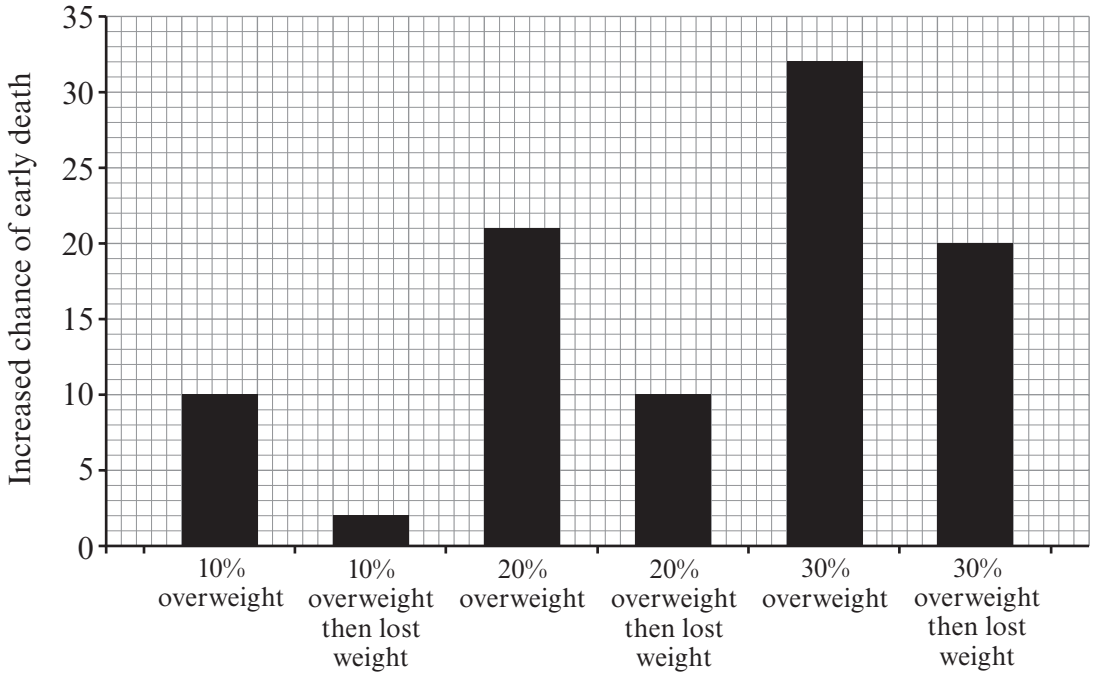
© WJEC CBAC Ltd.

STEMUP.CO.UK

4461 020003

Examiner only

2. The chart below shows the relationship between being overweight and increased chance of an early death in the human population in the UK.



(a) From the evidence in the chart state **two** relationships between being overweight and an increased chance of early death. [2]

(i) .....

(ii) .....

(b) The recommended daily energy intake for a man is 10 500 kJ.
The table below shows the energy content of some foods.

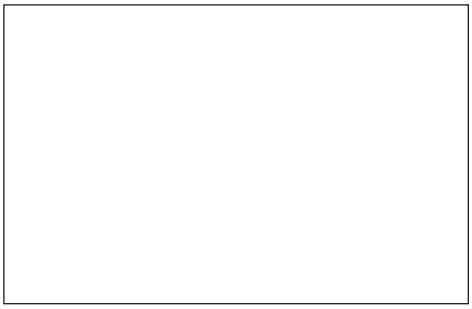
food	energy (kJ)
milk 100 g	272
1 egg	15
1 bacon rasher	200
soup 100 g	300
bread & butter 1 slice	520
marmalade 100 g	500
chocolate 100 g	3300

food	energy (kJ)
fried fish 100 g	550
chips 100 g	1065
apple pie 100 g	1200
custard 100 g	500
cheese 100 g	1682
biscuits 100 g	500
sugar /teaspoon	170

© WJEC CBAC Ltd.

STEMUP.CO.UK

John is a 42 year old man who is severely obese. His typical lunch is shown in the table below:



©iStockphoto

John's lunch	energy content (kJ)
large portion of chips 300 g	3195
4 slices of bread and butter	.....
large fried fish 250 g	1375
2 cups of black coffee with 4 teaspoons of sugar per cup	1360
portion of apple pie 200 g	.....
portion of custard 50 g	.....
Total energy content of John's lunch	.....

(i) Complete the table above by using the table opposite to calculate the energy content of the foods John has eaten and the total energy content of his lunch. Some of the table has been completed for you. [2]

(ii) John has exceeded his recommended daily energy intake in this single meal alone. Calculate how many kJ he has eaten in excess of his recommended daily energy intake. [1]

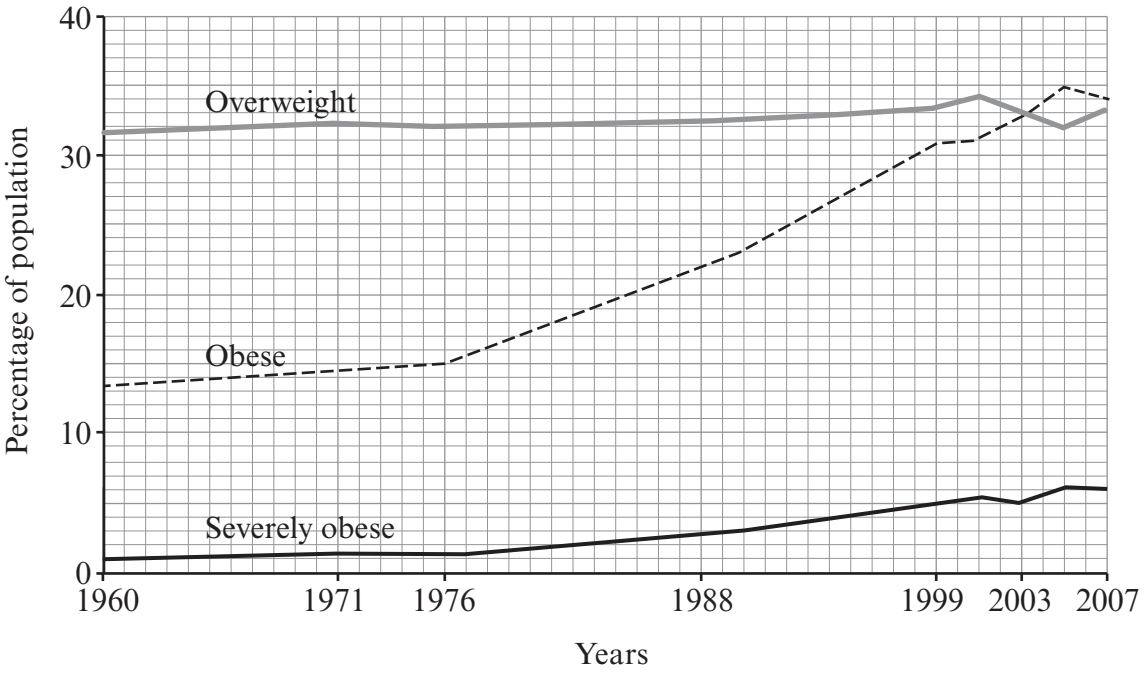
..... kJ

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(iii) John's eating habits are typical of many adults living in developed countries. The graph below shows the trends in being overweight, obese and severely obese among adults aged 20 - 74 in the USA between 1960 and 2007.



Use the graph above to **calculate** the increase in the percentage of obese adults in the USA between 1976 and 2007. [1]

..... %

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

3. The diagrams below show the skin under two different environmental conditions.

Diagram **P**

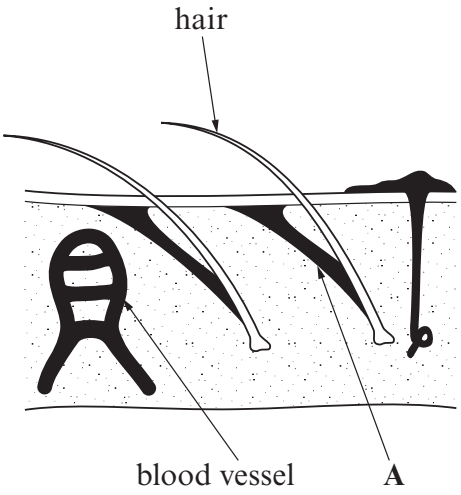
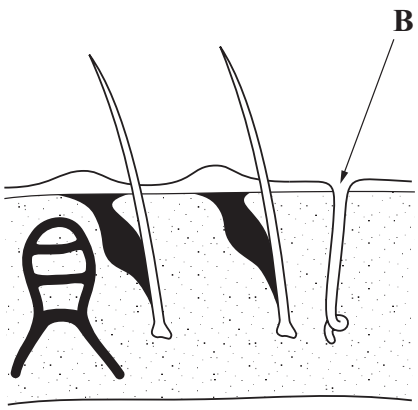


Diagram **Q**



(a) Name the parts **A** and **B** labelled on the diagrams. [2]

A .....

B .....

(b) Diagram **P** shows how the skin responds to cool the body down.
Identify **two** of these responses and explain how each cools the body.

(i) Response ..... [1]

Explanation of cooling effect. ..... [1]

.....

(ii) Response ..... [1]

Explanation of cooling effect. ..... [1]

.....

4461 020007

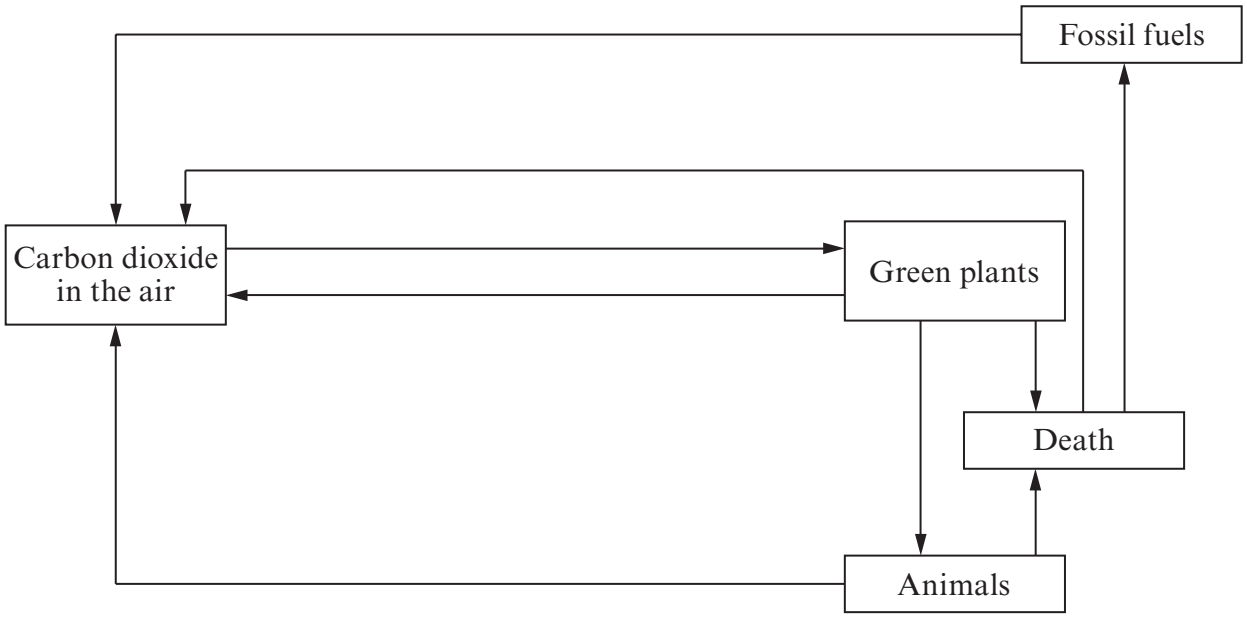
© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

4. The diagram shows the basic outline of the carbon cycle.



Use the diagram above **and your own knowledge** to explain **in detail** how carbon is cycled in nature. Start your account with carbon dioxide being taken up by green plants. [6 QWC]

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

5. In mice the allele for black colour **(B)** is dominant over the allele for white colour **(b)**. Two heterozygous black mice are mated together. They produce a litter of 8 young mice.

×

(a) (i) Which of the following results would you expect in the litter? [1]

Underline the correct answer.

A 4 black and 4 white

B 6 black and 2 white

C all black

D 2 black and 6 white

(ii) Complete the Punnett square below to help explain your answer to part *(a)*(i). [2]

Gametes		

Images: ©Emilia Stasiak/Shutterstock

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) The sex of mice is determined by which sex chromosomes are present.

(i) State the sex chromosomes present in the body cells of [1]

I the father, ...

II the mother. .....

(ii) Complete the Punnett square below to show the expected sex chromosomes of the offspring in the litter. [2]

Gametes		

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

6. In the 1850s it was thought that there were two species of elephants living on Earth. In the 1950s some scientists suggested that three species of elephants existed. These were:

1. *Elephas indicus*, the Indian elephant
2. *Loxodonta africana*, the African plains elephant
3. *Loxodonta cyclotis*, the African forest elephant

In 2011, an analysis of the chemical structure of chromosomes of African, Indian and fossil elephants was carried out. This provided evidence that African and Indian elephants had a common ancestor 2.5 million years ago and confirmed that three species of elephants exist today.

(a) Name: [2]

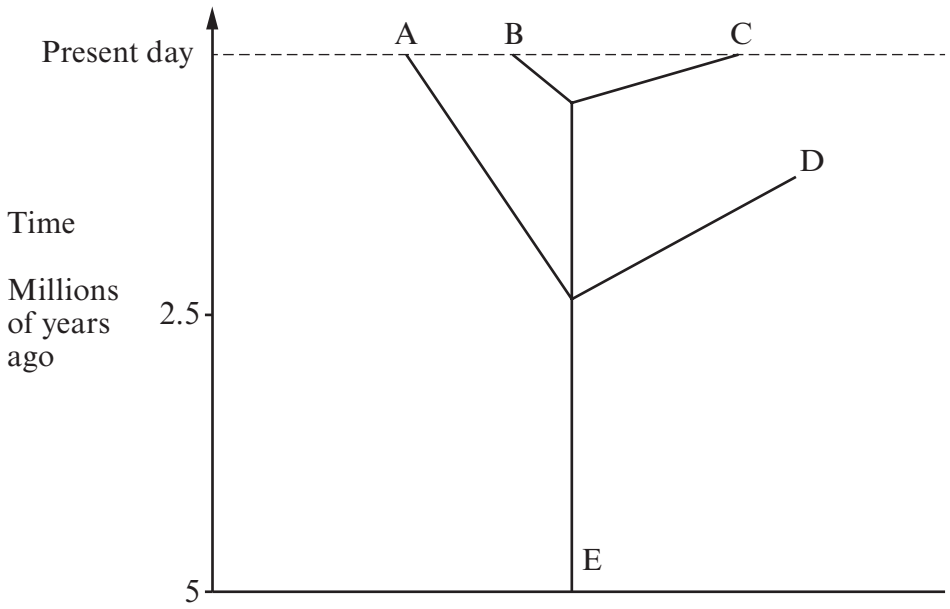
(i) the chemical in the chromosomes that was analysed;

.....

(ii) the units made of this chemical which make up chromosomes.

.....

The diagram below is a simplified family tree showing the evolution of elephants and their ancestors. Each letter represents a species.



© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) Refer to all of the information given opposite and answer the following questions. [4]

Which **letter** or **letters** in the diagram opposite represent:

(i) a common ancestor to more than one species; .....

(ii) an extinct species; .....

(iii) *Elephas indicus*; .....

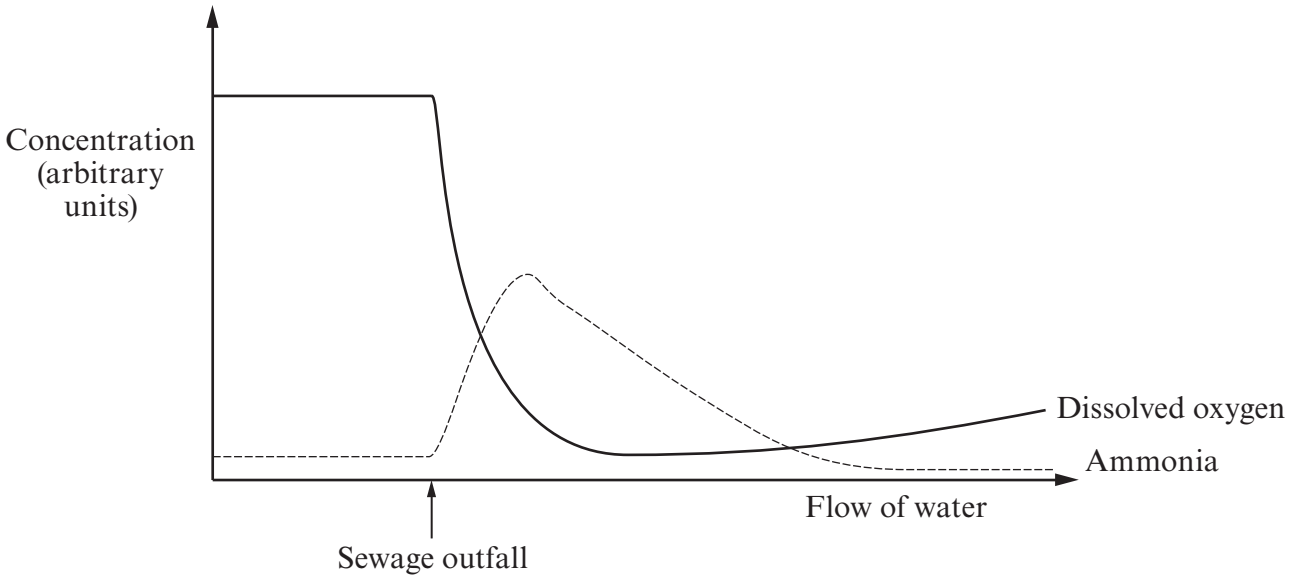
(iv) the **two** closest related species? ..... and .....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

7. In order to monitor environmental pollution, measurements of some chemical factors of water were made in a river at points above and below a sewage outfall. The results are shown in the graph below.



(a) Use the graph **and your own knowledge** of water pollution to explain why the sewage caused the decrease in the dissolved oxygen. [2]

.....

.....

.....

(b) Use the graph **and your own knowledge** of the nitrogen cycle to describe and explain the changes in concentration of ammonia shown in the graph. [4]

.....

.....

.....

.....

.....

.....

.....

.....

6

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

8. A scientist investigated the transfer of energy between an oak tree and organisms living on it. She recorded the data in the following table:

use of the energy	kJ per m^2 per year
absorbed by the oak tree	4 600 000
transferred to carbohydrates	44 000
transferred to herbivores	2 920
transferred to carnivores	700

(a) Calculate the percentage of the energy absorbed by the oak tree that is transferred to carbohydrates. Show your working and give your answer to the **nearest whole number**. [2]

Answer ..... %

(b) Explain why only a small proportion of the total energy is transferred to the carnivores. [2]

.....

.....

.....

.....

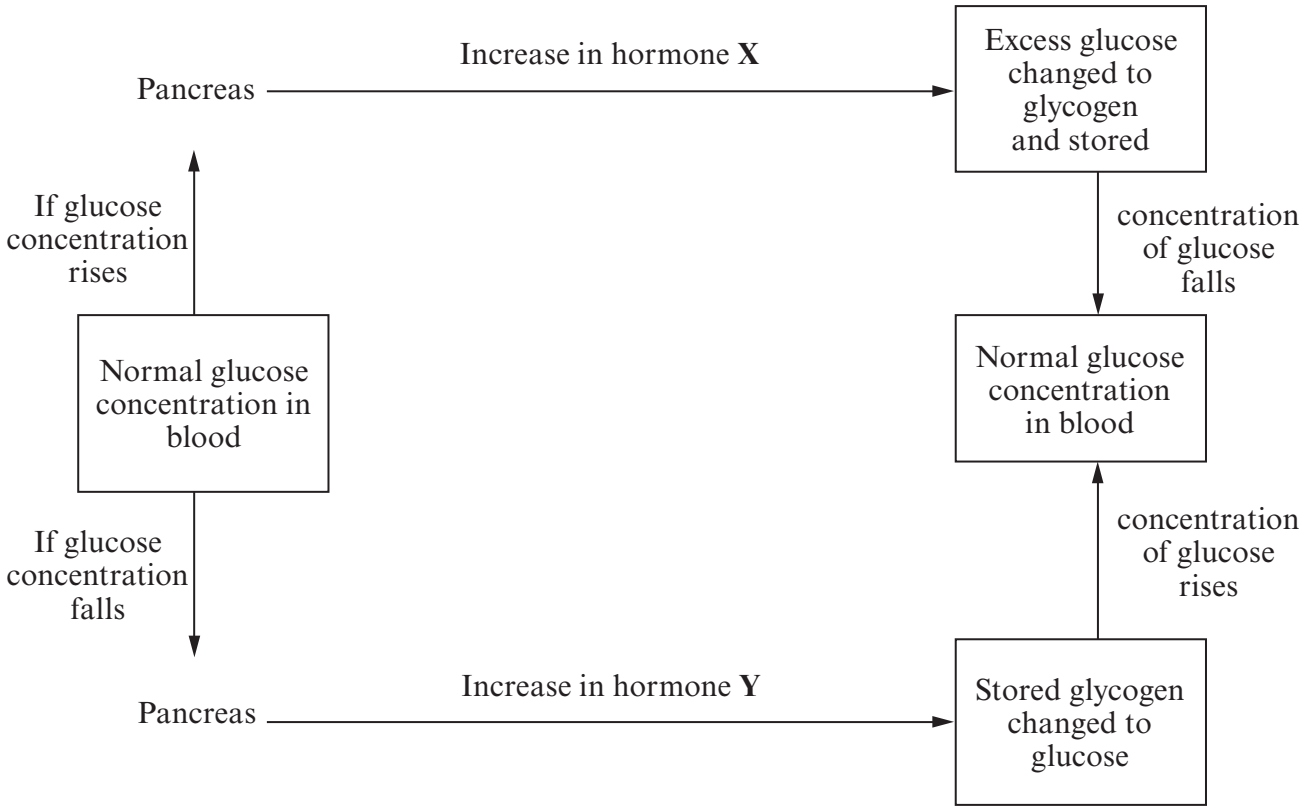
4

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

9. It is important to keep the concentration of glucose in the blood constant. The flow diagram shows how this happens.



(a) What term would you use to describe the control mechanism shown in the diagram? [1]

.....

(b) Name the hormones, **X** and **Y**, shown in the diagram. [2]

(i) **X** .....

(ii) **Y** .....

(c) Name the organ of the body which stores glycogen. [1]

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(d) If the body is unable to change excess glucose into glycogen, the glucose is excreted in urine. Describe how you would test a urine sample for glucose.

(i) Procedure. [2]

.....

.....

.....

(ii) Expected observations: [2]

If glucose is present .....

If glucose is absent .....

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

10. Henderson Island in the Pacific Ocean is very small and has eight endangered species of birds. Rats live on the island and eat 95% of the birds' eggs. Scientists hope to kill all of the rats on the island by using a poison.

In Wales, a population of rats, resistant to the poison were discovered in the 1960s.

Write an account to explain how this resistance developed and spread throughout Britain. Suggest why using poison as a method of control on Henderson Island might be more successful. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

END OF PAPER

6

© WJEC CBAC Ltd.

STEMUP.CO.UK

GCSE MARKING SCHEME

BIOLOGY

SUMMER 2013

© WJEC CBAC Ltd.

STEMUP.CO.UK

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2013 examination in GCSE BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

© WJEC CBAC Ltd.

STEMUP.CO.UK

Science - Biology

B1

Question			Marking details	Marks Available
1	*(a)*		fruticose;	1
	(b)	(i)	west;	1
		(ii)	E;	1
		(iii)	A;	1
			Question 1 total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
2	*(a)*	(i)	E;	1
		(ii)	A or B;	1
		(iii)	A, B or C;	1
	(b)	(i)	3;	1
		(ii)	5;	1
		(iii)	4;	1
	(c)	(i)	I 16.00-20.00; Accept 16-20	1
			II 04.00-07.00; Accept 4-7	1
			(either order)	
		(ii)	Most/ more of the hamsters; Accept 90%	2
			Reject All	
			Are {below ground/ below surface/ in their burrows/ do not come out} at {night/ when it is dark};	
			reverse argument	
			Less hamsters; Accept only 10%	
			Are {above ground/ active} when it is {dark//at night};	
			Reject All	
			Question 2 total	**[10]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
3	*(a)*	(i)	23;	2
		(ii)	46;	
	(b)		50%;	1
			Question 3 Total	**[3]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
4	*(a)*	algae/ (water) plants/ moss/ named plants; accept weeds/ algal bloom	1
	(b)	bacteria; fungi; Reject germs/ microbes	2
	(c)	oxygen; accept correct symbols	1
		Question 4 Total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
5	*(a)*	(i)	liver;	1
		(ii)	brain;	1
		(iii)	harm/ hurt/ damage/ reduce growth of } {baby/ child/ foetus/ embryo};	1
	(b)	(i)	4.5;	2
		(ii)	1.5 (ecf);	
	(c)		Deter people from drinking/ cut down consumption of alcohol/ less people spending money on alcohol/ people buy less alcohol; Reject stop people drinking/ buying alcohol;	1
			Question 5 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
6	*(a)*		Kills the weeds/ plants (reject animals/ pests); Reject stop weeds growing that compete (with the crop)/ {more room/ nutrients/ light} for crop;;	2
	(b)	(i)	2 4 (5) 3 1 6 ;;;; 5 correct = 4 4 correct = 3 3 correct = 2 2 correct = 1 1 correct = 0	4
		(ii)	<table><tr><th>Argument</th><th>✓ or ×</th></tr><tr><td>Increased crop yield</td><td>given</td></tr><tr><td>Less herbicide used</td><td>given</td></tr><tr><td>Reduced biodiversity</td><td>×</td></tr><tr><td>Cheaper food</td><td>✓</td></tr><tr><td>Long term effects unknown</td><td>×</td></tr></table> All 3 correct for 1 mark;	1
		(iii)	Any two from, <u>Cost</u> of <u>extra</u> herbicide/ farmers have to <u>buy</u> <u>extra</u> herbicide; Competition from (resistant)soya/ description of competition; Herbicide kills maize;	2
			Question 6 Total	**[9]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
7/1	*(a)*		growth (response) shown by plants;	1
			to a {one sided/unilateral} stimulus;	1
			Accept example of growth of plant towards {light source/ pull of gravity/ source of gravity} / sun;	1
	(b)	(i)	shoot drawn growing up from the horizontal;	2
			root shown growing down from the horizontal;	
			Must show at least slight curvature in the correct direction	
			Shoot should have leaves/ root should have an end	
		(ii)	I positive gravitropism/ geotropism;	2
			Accept negative gravitropism/ geotropism if relates to drawing	
			Reject negative phototropism	
			II positive phototropism;	
			(Accept: negative gravitropism/ geotropism)	
			ANSWERS MUST RELATE TO THEIR DRAWING	
			Question 7 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
8/2	*(a)*		Any 2 from: the more overweight the greater the chance (of early death); the more overweight a person is initially the greater the chance (of early death) after losing weight; losing weight decreases the chance (of early death); Reject greater chance of death (not qualified by 'early')	2
	(b)	(i)		2

John's lunch	kJ
large portion of chips (300g)	3195
4 slices of bread and butter	2080
large fried fish 250g	1375
2 cups of black coffee with 4 teaspoons of sugar per cup	1360
200g portion of apple pie	2400
50 g portion of custard	250
Total energy content of John's lunch	10,660

Foods = 1 mark;

Total = 1 mark; (ecf)

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
	(ii)	160 (kJ); Allow ECF from (b)(i) as long as candidate's answer is greater than 10 500	1
	(iii)	19%	1
		Question 8/2 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details		Marks Available
9/3	*(a)*	A	erector muscle;	2
		B	sweat pore;	
	(b)	Any two of the following.		4
		1 mark for response 1 mark for explanation(2x2)		
		Response	hairs flattened; NOT hairs relax/ lie down	
		Explanation	{thin layer of / insulating layer of/ less} air trapped so more heat {can escape/ be lost}; NOT no air trapped	
		Response	sweat (present)/ sweating/ sweat produced;	
		Explanation	heat lost by evaporation/ heat {removed from the body/ used} to evaporate sweat;	
		Response	vasodilation/blood vessels wider; NOT larger/ increase in size/ grow/ expand/ bigger	
		Explanation	more blood near skin surface more heat lost; NOT blood gets nearer to skin surface	
		Question 9/3 Total		

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question	Marking details	Marks Available
10/4	**Indicative content** Carbon dioxide taken up by plants for photosynthesis. Carbon used in manufacture of carbohydrates/ sugar/ starch/ protein/ fat. Plants eaten by animals. Plants and / or animals respire and return carbon (dioxide) to air. Plants and/ or animals die. Decay/ named organisms release carbon (dioxide) to air. Reference to fossilisation due to lack of decay. Combustion/ burning of fossil fuels releases carbon (dioxide). **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the Indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit	6
	Question 10/4 Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
5	*(a)*	(i)	B- 6 black and 2 white;	
		(ii)	Allow ECF from (a) (i)	
			Gametes correct; Must be B	1
			Must link to answer to a(i)	1
			Cross correct;	

Gametes	B	b
B	BB	Bb
b	Bb	bb

	(b)	(i)	I XY both correct 1 mark	1
			II XX;	
			Gametes correct; (ECF)	
			Cross correct;	1
				1

Gametes	X	Y
X	XX	XY
X	XX	XY

Question 5 Total **[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
6	*(a)*	(i)	DNA;	1
		(ii)	Genes/ alleles;	1
	(b)	(i)	E;	1
		(ii)	E and/ or D;	1
		(iii)	A;	1
		(iv)	B and C;	1
			Question 6 total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
7	*(a)*	Bacteria/ microorganisms/ microbes/ decomposers use oxygen; NOT (de)nitrifying bacteria for respiration;	2
	(b)	Any 4 from Bacteria/ microorganisms/ microbes/ decomposers; Change {protein/urea} to ammonia (compounds); Increase and then a decrease in ammonia; (decrease is) due to dilution; (Some) ammonia is changed to nitrates;	4
		Question 7 total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
8	*(a)*	$\frac{44\ 000}{4\ 600\ 000} \times 100$ (working shown);	2
		Answer = 1% ; correct answer = 2 marks	
	(b)	Any two from	2
		Energy used by organisms for	
		cell {repair/ maintenance};	
		growth;	
		movement;	
		reproduction;	
		Energy transferred to environment (lost)	
		during respiration (as heat);	
		excretion; Accept correctly named waste	
		Question 8 total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
9	*(a)*		Negative feedback; NOT homeostasis	1
	(b)	(i)	Insulin;	1
		(ii)	Glucagon; correct spelling	1
	(c)		Liver;	1
	(d)	(i)	Use Benedicts; Boil/ heat at 80ºC or above/ heat strongly; NOT heat unqualified/ warm/ hot **OR** Use clinistix/ urinalysis strips/ uristix/ multistix ; Dip (clinistix) into sample;	2
		(ii)		2

Reagent	Present	Absent
Benedicts	brown/ orange/ reddish brown/ brick red/ brownish red/ green; NOT red unqualified/ yellow	blue/ light blue/ clear blue; NOT dark blue/ purple
Clinistix/ multistix	Dark blue/ purple/ dark purple;	pink/ red;
Uristix	Brown;	Green;

Question 9 total **[8]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question	Marking details	Marks Available
10	**Indicative content** A mutation in one or more genes caused variation in the rat population. One variety became resistant to poison. This was an advantage to the resistant individuals and due to natural selection/ survival of the fittest to breed, allowed the resistant gene to be passed on to the offspring of the surviving rats. Success in Henderson Island will depend on the smaller population (small island) and killing all the rats initially. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the Indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit **Question 10 Total**	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Surname	Centre Number	Candidate Number
Other Names		0

New GCSE

4461/02

SCIENCE A
HIGHER TIER
BIOLOGY 1

A.M. WEDNESDAY, 9 January 2013

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**6**	
2	**6**	
3	**3**	
4	**3**	
5	**6**	
6	**6**	
7	**7**	
8	**7**	
9	**10**	
10	**6**	
Total	**60**	

4461
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **5** and **10**.

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

Answer **all** *questions.*

1. A grey-bodied fruit fly was mated with a black-bodied fruit fly. All the F1 offspring were grey-bodied.



Grey-bodied fly

×



Black-bodied fly

↓



All the F1 offspring are grey-bodied

(a) Using the letters **A** and **a** to represent the alleles for the two different body colours, complete the Punnett square below to show the offspring produced from the mating between the grey-bodied and black-bodied fruit flies. [2]

	Gametes		
F1			

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) (i) Complete the Punnett square below to show the offspring produced when two of the F1 offspring are selfed (bred together). [2]

	Gametes		
F2			

(ii) What is the ratio of the different phenotypes in the F2 offspring? [1]

..... : .....

(c) Name the 19th Century scientist whose work on garden pea plants led to the understanding of the mechanism of inheritance. [1]

.....

4461 020003

6

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

2. A scientist investigated the range of heights of a flowering plant species at two different locations; in the middle of a woodland and in a hedgerow. He measured the heights of 20 plants in each location.

Heights of plants from **woodland** (mm)			
125	134	139	126
135	149	144	135
130	137	128	136
136	141	143	133
131	129	133	138

Heights of plants from **hedgerow** (mm)			
115	134	127	117
127	123	131	122
132	126	118	123
121	125	124	128
134	137	129	138

(a) (i) Complete the tally chart below by scoring the height ranges of the **hedgerow** plants. Some have been done for you. [1]

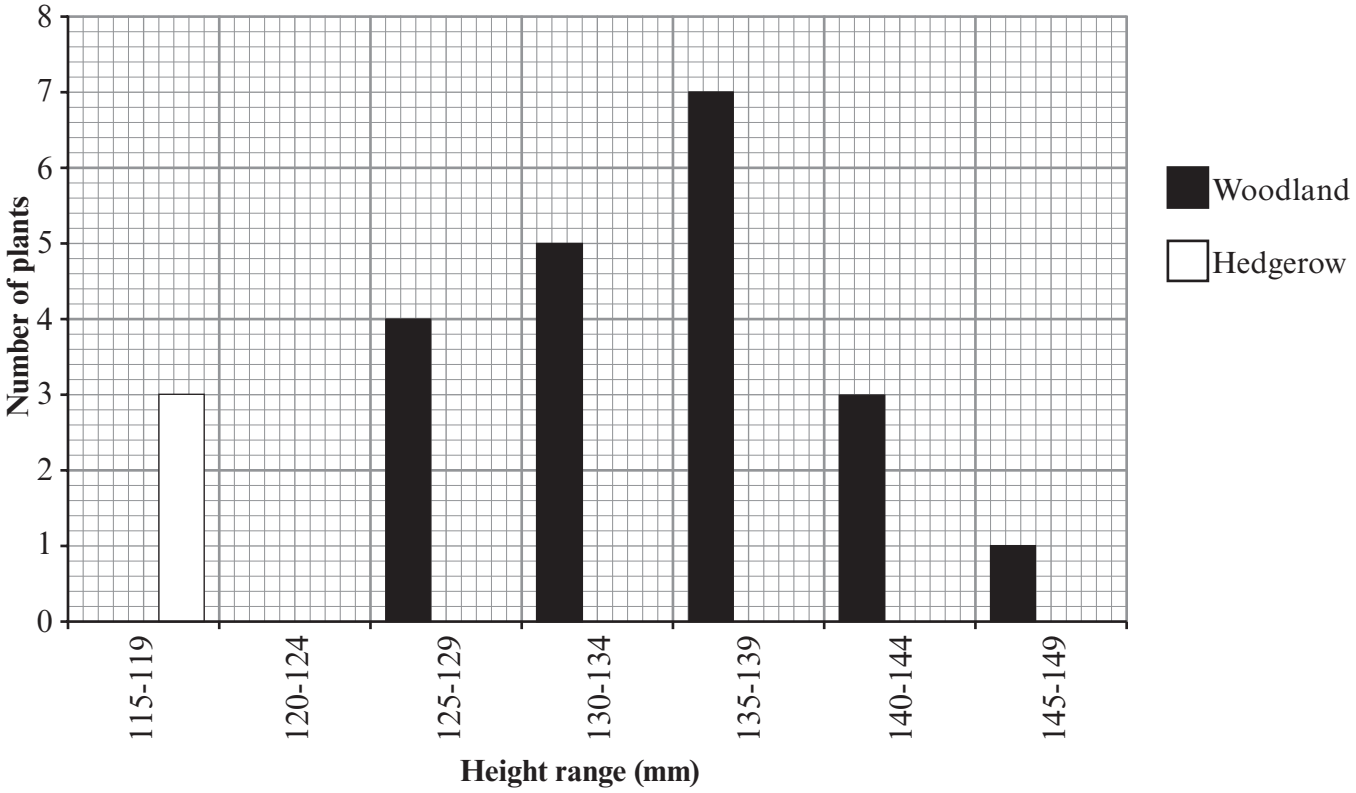
	Tally of plants at each location	
Range (mm)	Woodland	Hedgerow
115-119	0	|||
120-124	0	
125-129	||||	
130-134	𝍸	
135-139	𝍸 ||	
140-144	|||	
145-149	|	

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(ii) The woodland data have been plotted below. Complete the bar chart by plotting the data for hedgerow plants. One bar has been done for you. Use a ruler to carefully draw the bars. [2]



4461 020005

(iii) Using the data and graph only what conclusion can you make about the plants growing in the hedgerow? [1]

.....

(b) Suggest a way in which the scientist could find out whether the difference in height of the flowering plant species found at the two locations is due to environmental or genetic causes. [2]

.....

.....

.....

6

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

3. *(a)* Explain what is meant by the term *genetic profiling.* [1]

.....

.....

(b) State **two** uses of genetic profiling. [2]

(i) .....

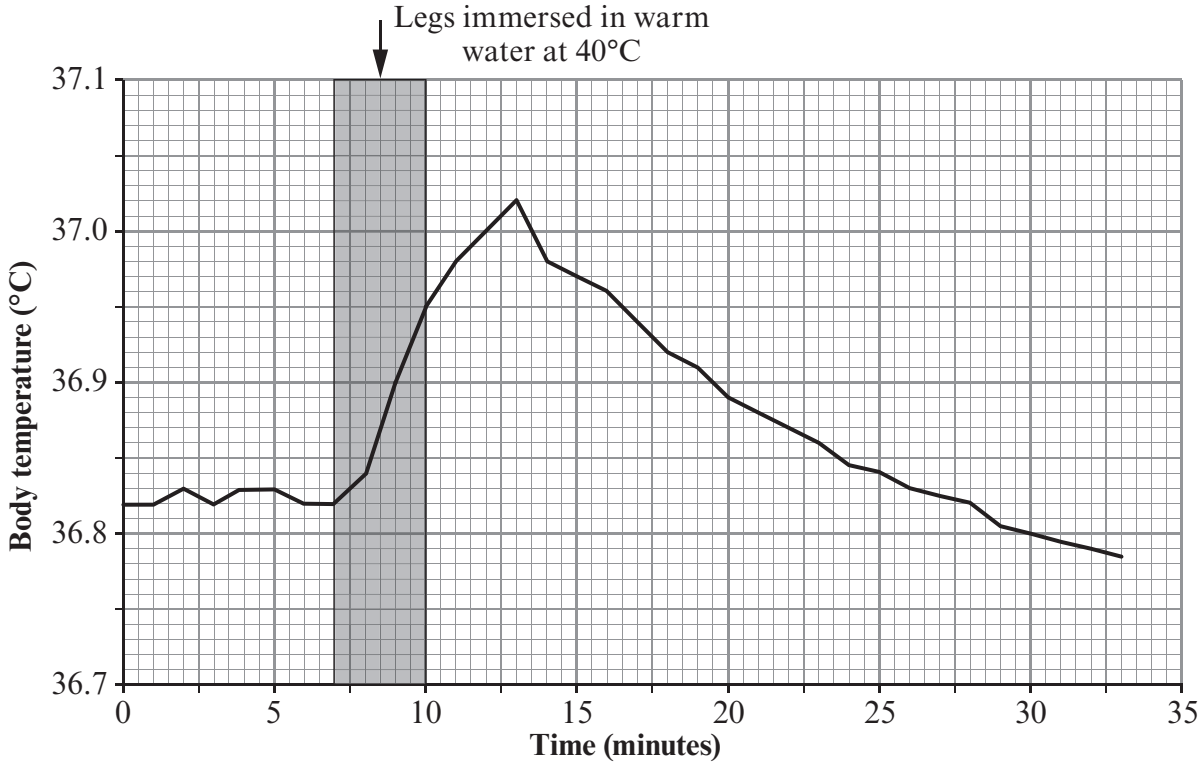
.....

(ii) .....

.....

3

4. A scientist carried out an investigation into the body temperature of a man. The changes in the man's body temperature were measured by a clinical thermometer in his mouth. The graph below shows his body temperature over a 35 minute period. Between 7 and 10 minutes he immersed his legs, from the knees downwards, in a bath of warm water at 40°C. He then stepped out of the bath and dried his legs.



(a) Explain why the body temperature increased even though it was only the legs which were immersed in the warm water. [1]

.....

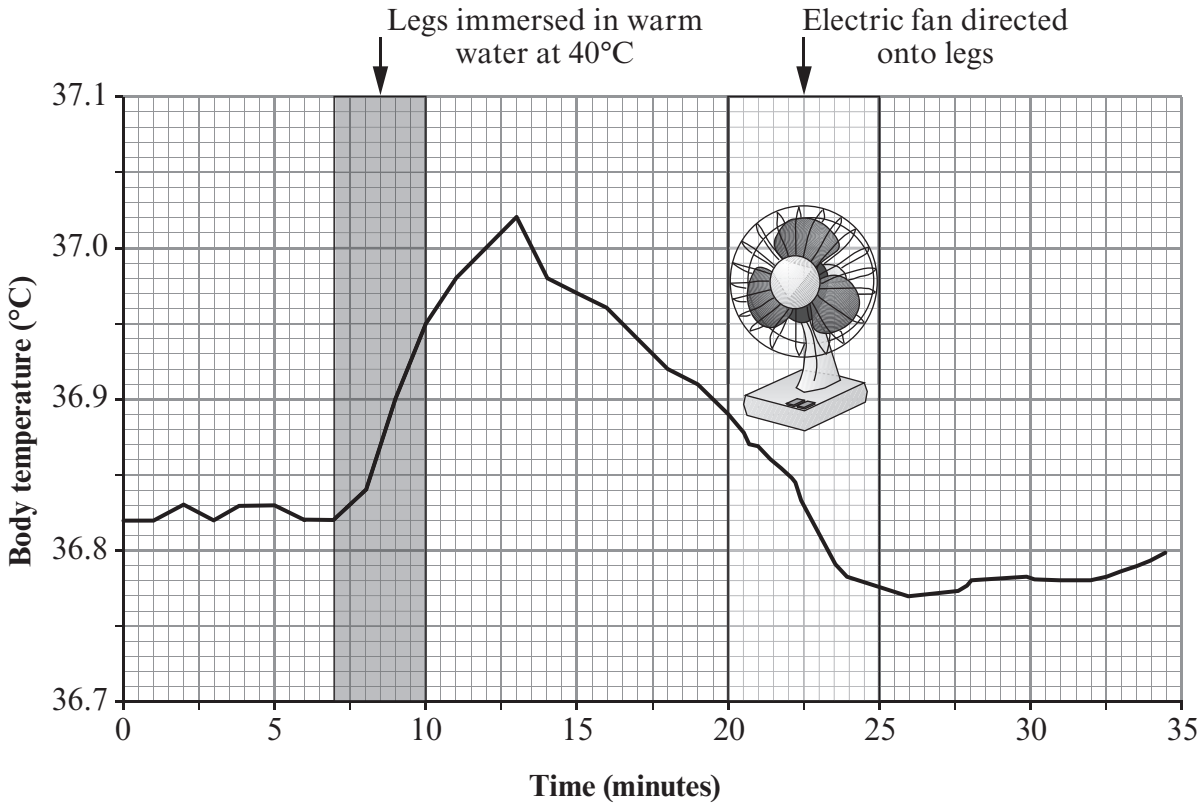
.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) The experiment was repeated. After 20 minutes an electric fan was directed onto the man's legs. The results are shown in the graph below.



Explain why the body temperature of the man dropped more quickly between 20 and 25 minutes when the fan was used. [2]

.....

.....

.....

.....

3

4461 020007

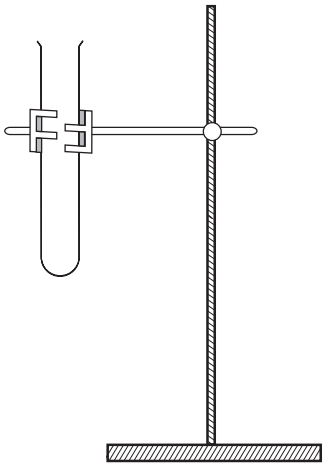
© WJEC CBAC Ltd.

STEMUP.CO.UK

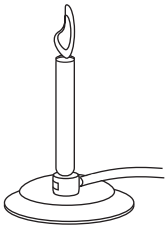
Examiner only

5. Describe how the following apparatus and materials could be used to compare the energy content of two different food samples A and B. [6 QWC]

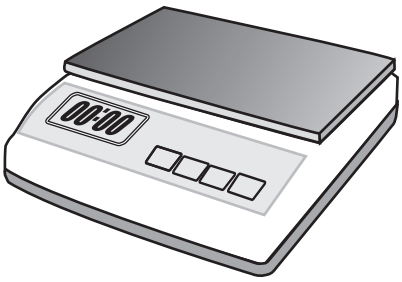
stand and boiling tube



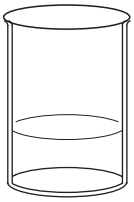
lit Bunsen burner



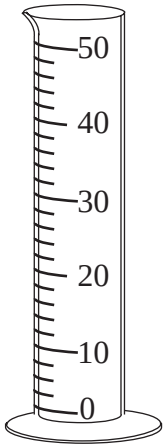
digital balance



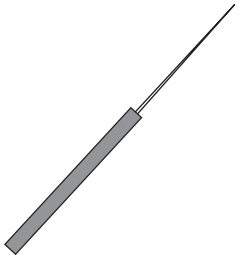
beaker of water



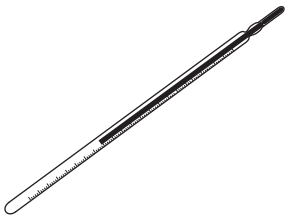
50 cm^3 measuring cylinder



mounted needle with wooden handle



thermometer



.....

.....

.....

.....

.....

.....

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

.....

.....

.....

.....

.....

.....

.....

.....

6

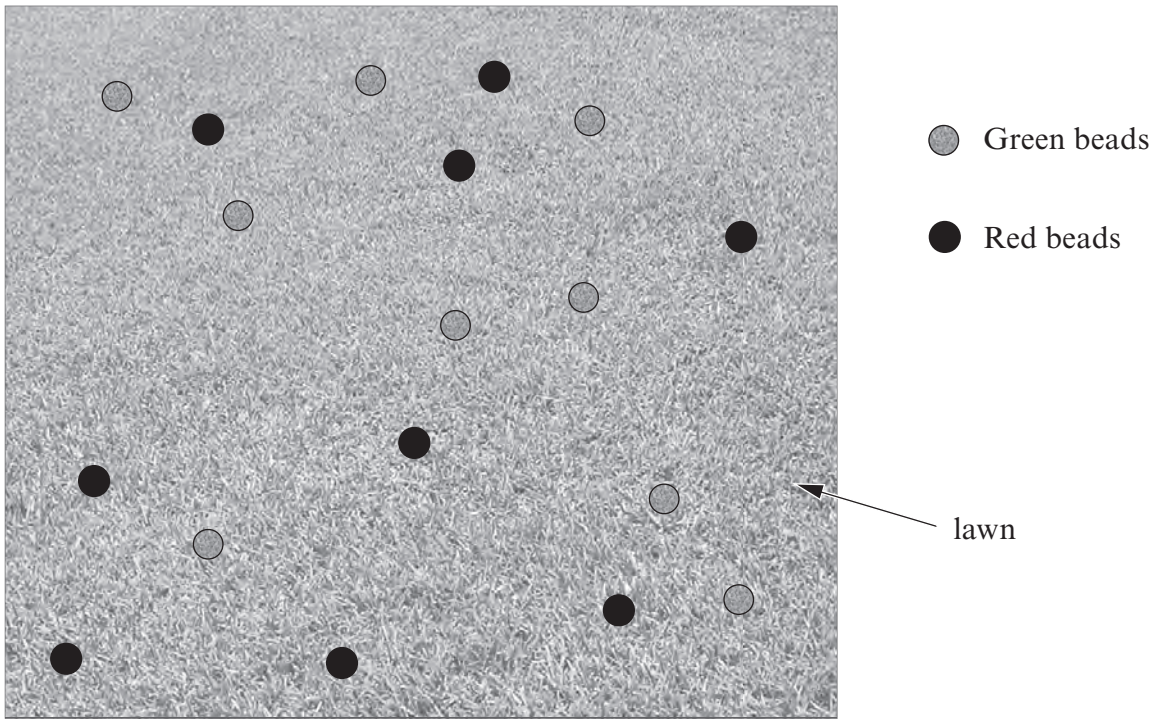
STEMUP.CO.UK

6. John designed a model to represent a predator-prey relationship.

This is part of his design:

- He marked out a 1 m^2 area of well mown lawn.
- In a beaker he mixed together 50 green coloured beads and 50 red coloured beads.
- He shook the beaker and scattered the beads randomly over the 1 m^2 of lawn.

The diagram below shows part of the marked out area of the lawn.



- John asked another student Susan to pick out as many beads as possible from the 1 m^2 of lawn in one minute.
- John then calculated the number of green and red beads that were left in the 1 m^2 of lawn.
- John added more beads to the 1 m^2 of lawn to make the total up to 100 again. An equal number of each coloured bead was added to make up the 100.
- Susan then repeated the exercise another two times.

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

The results are shown in the table below:

	Number of beads remaining in $1m^2$ of lawn		Number of beads added to $1m^2$ of lawn	
	Green	Red	Green	Red
At start			50	50
After 1 pick	46	26	14	14
After 2 picks	52	22	13	13
After 3 picks	54	16	15	15

(a) In this predator-prey relationship model what do the following represent:

(i) the coloured beads; ..... [1]

(ii) Susan; ..... [1]

(iii) the process of adding beads to the $1m^2$ of lawn? [1]

.....

(b) After 10 picks the number of red beads had fallen to zero. [1]

Use the term that would best describe this process in nature.

.....

(c) Why are fewer green beads removed from $1m^2$ of lawn at each pick than red? [1]

.....

(d) Suggest **one** way in which this model is not a true representation of what happens in nature. [1]

.....

.....

6

© WJEC CBAC Ltd.

Turn over.

STEMUP.CO.UK

Examiner only

7. In 2011 a contact lens was invented with a sensor that can measure the concentration of glucose in tears. It can be used to detect diabetes.

(a) Name **two** body fluids, other than tears, which can be tested to detect diabetes. [2]

.....

(b) State **three** methods which are used to treat diabetes. [3]

(i) .....

(ii) .....

(iii) .....

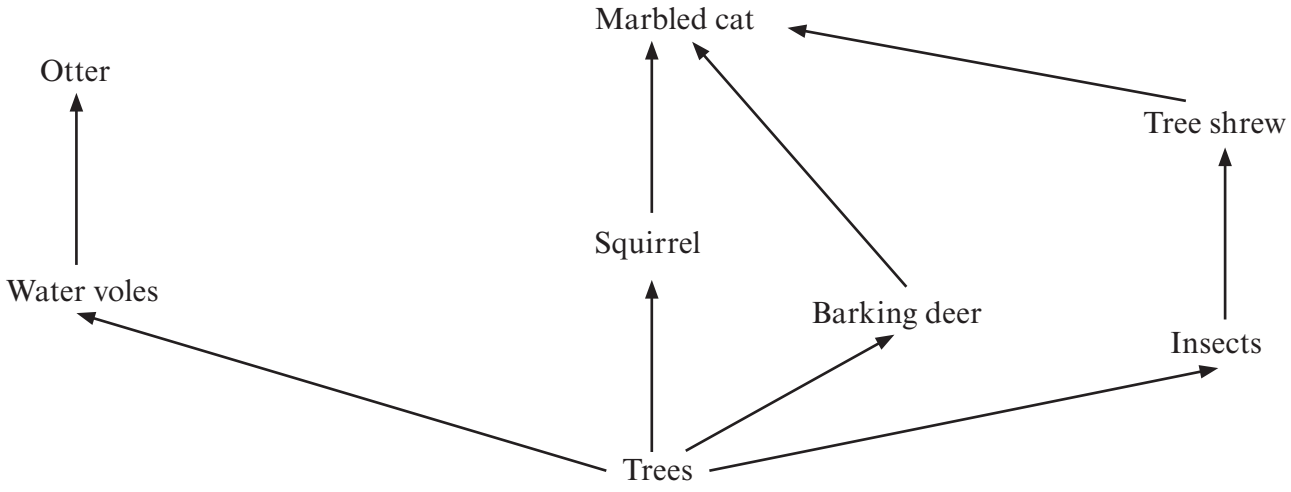
(c) A poor diet in pregnant women increases the risk of their children developing diabetes. These children show abnormal development of cells in the pancreas. State **two** reasons why this could prevent the control of glucose concentration. [2]

(i) .....

(ii) .....

7

8. The diagram below shows a food web in a rainforest in Sarawak in South East Asia.



© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

The removal of trees by logging has been allowed in the forest in a part of Sarawak. A study was carried out to investigate the effect of logging on the animals living in the forest. Numbers of six different mammals per km^2 were estimated before logging and regularly for four years after logging. The table below shows the results.

Mammal	Mean number of animals per km^2			
	Before logging	1 year after logging	2 years after logging	4 years after logging
Marbled cat	1	0	0	0
Otter	1	0	0	0
Water vole	5	0	0	0
Squirrel	16	24	104	19
Tree shrew	10	5	10	38
Barking deer	3	1	10	1

(a) Use the food web opposite and the data in the table above to give reasons for the results for

(i) the otter; [1]

.....

(ii) the squirrel. [3]

.....

.....

.....

.....

(b) Some insects feed on healthy living trees. Others feed on decaying remains of trees. Use all the given information to explain the data for tree shrews over the four years. [3]

.....

.....

.....

.....

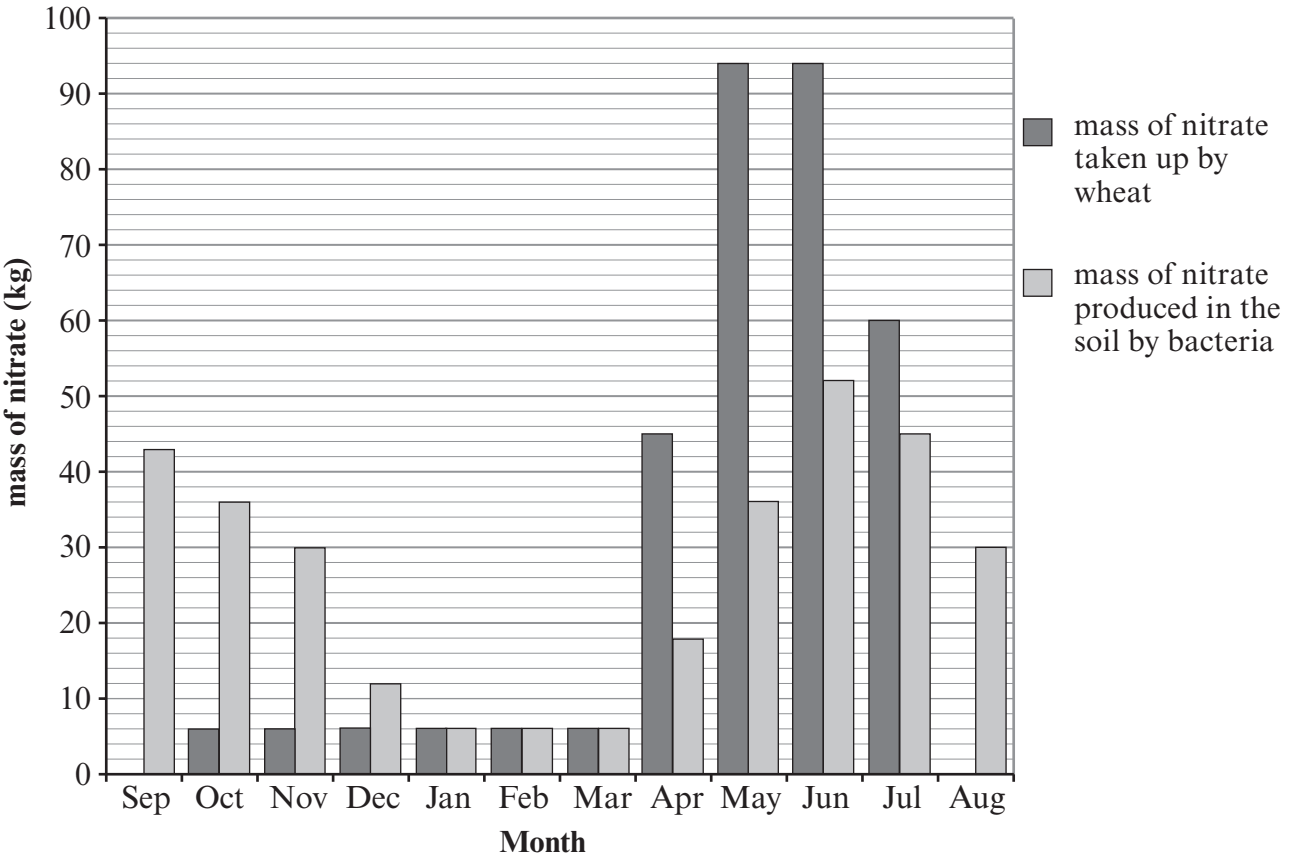
7

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

9. Computer modelling was used to predict the effects of environmental factors on nitrate production by bacteria and the mass of nitrate taken up by wheat. The results are shown as a bar chart below.



The wheat is planted in September and harvested in August of the following year.

(a) Suggest reasons for the following observations.

(i) The mass of nitrate taken up by the wheat is greater in May than in March. [1]

.....

.....

(ii) The mass of nitrate produced in the soil by bacteria is much greater in September than in January. [1]

.....

.....

(b) Some bacteria use an enzyme to break down the urea in natural fertilizer which may be added to the soil. Name this enzyme. [1]

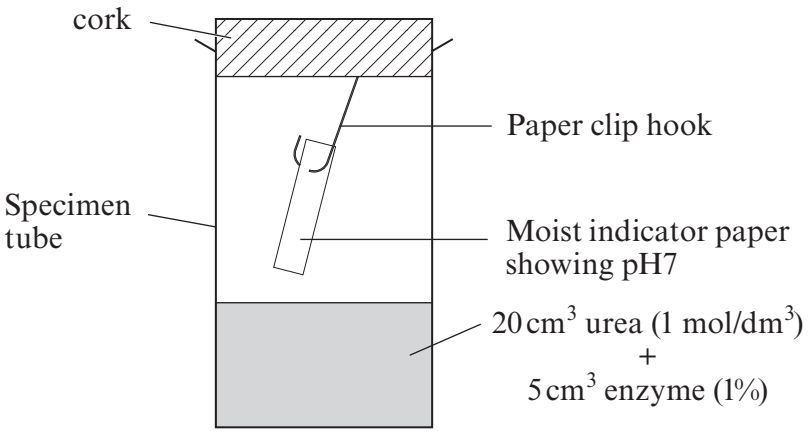
.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(c) (i) An investigation was carried out to determine how bacteria in soil break down urea.
The following apparatus was used and left for one hour at 20°C.

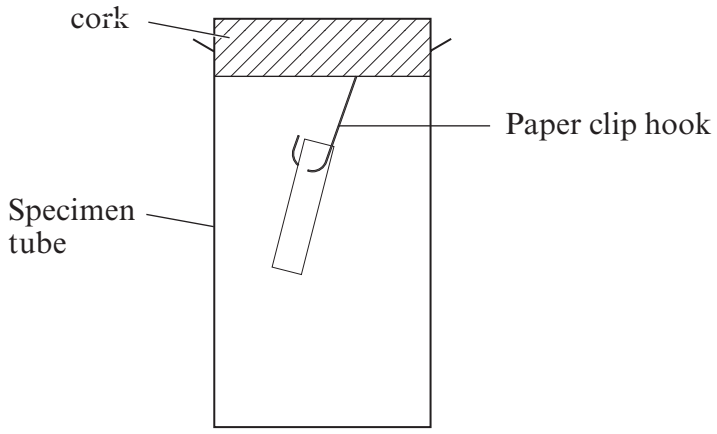


After one hour the indicator paper showed that the pH had changed to 9. Explain this observation. [2]

.....

.....

(ii) Complete the diagram below and **label** it to show the contents of the specimen tube in a control that you would set up to show that the change in pH was due to the enzyme. [3]



(iii) State **two** *other* factors that would be necessary for the control. [2]

.....

.....

PLEASE TURN OVER FOR QUESTION 10

10

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

10. *Anopheles gambiae* is a species of mosquito which is responsible for the spread of a disease, malaria, in West Africa.
In the 1990s a pesticide, dieldrin, was used to kill mosquitoes.
In areas which were sprayed with dieldrin for the first time, only 10% of mosquitoes were resistant to it.
After spraying areas with dieldrin, for 2 months, 99% of mosquitoes were resistant to it.
Explain these results. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

END OF PAPER

© WJEC CBAC Ltd.

STEMUP.CO.UK

WJEC
CBAC

GCSE MARKING SCHEME

SCIENCE - BIOLOGY (NEW)

JANUARY 2013

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2013 examination in GCSE SCIENCE - BIOLOGY (NEW). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

Unit	Page
BIOLOGY 1 (NEW) FOUNDATION TIER	1
BIOLOGY 1 (NEW) FOUNDATION & HIGHER TIER	7
BIOLOGY I (NEW) HIGHER TIER	13
BIOLOGY 2 (NEW) FOUNDATION TIER	19
BIOLOGY 2 (NEW) FOUNDATION & HIGHER TIER	25
BIOLOGY 3 (NEW) HIGHER TIER	31

© WJEC CBAC Ltd.

STEMUP.CO.UK

BIOLOGY 1 (NEW) MARK SCHEME - JANUARY 2013

FOUNDATION TIER

Question		Marking details	Marks Available
Q.1	(a)	copepods;	[1]
	(b)	sandeels;	[1]
	(c)	less food for sandeels/ fewer sandeels/ no food for sandeels;	[2]
		so less food for puffins/puffins starve/ puffin has nothing to feed off;	
		must make link to food and fall in numbers at least once	
		Question Total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
Q.2	(a)	Animal; Mammal; Alopex; lagopus;	[4]
	(b)	*White hair:* Idea of camouflage/ blending in/ match environment; NOT hide/ disguise *Thick hair:* Insulation/ traps (warm) layer of air/ keeps heat in/ let out less body heat; NOT keep it warm/ so it doesn't get cold *Small ears:* Idea of reduced surface area/ {reduces/ less} heat loss; NOT stop heat escaping/ no heat loss/ keeps heat in (can be neutral if used with reduced surface area)	[3]
	(c)	Universal/ unique/ unchanging/ they all use the same name/ same in all languages/ international/ common name is different in different languages;	[1]
		Question Total	**[8]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
Q.3	(a)		(3) 2 5 1 (6) 4;;; All 4 correct = 3marks 2/3 correct = 2 marks 1 correct = 1 mark	[3]
	(b)		glucose; NOT sugar	[1]
	(c)	(i)	0.8;	[1]
		(ii)	Reference {eating/ take in / ingest/ consume} too much fat/ too much fat in diet; Reference {eating/ take in / ingest/ consume} too much sugar/ carbohydrates; NOT carbs (Alternative if first two not awarded) eat too much/ too many calories/ energy; NOT too much chocolate Sedentary/ lack of exercise/ not enough sport;	[3]
			Question Total	**[8]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
Q.4	(a)	(i)	Light;	[1]
		(ii)	Growth/ grows towards the light/ positive phototropism; NOT bends/ moves/ leans	[1]
	(b)		hormone	[1]
	(c)		To get more light/ for more photosynthesis;	[1]
			Question Total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
Q.5	(a)	10;	[1]
	(b)	4.5; 3.2;	[2]
	(c)	Any two from: Competition for/ shortage of/ less/ running out of: light; water; nutrients/ minerals; space/ room; carbon dioxide;	[2]
		Question Total	**[5]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
Q.6	(a)	(i)	fewer {species/ animals} recorded (2012)/ ref to a correctly named animal (snail/ tadpole/ newt)/ biodiversity reduced/ lots of animals are no longer present; Reference to a {fall in / lowered} pH/ pH has gone from 7 to 4/ {became/ now} acidic; Must have some ref to change NOT more acidic	[2]
	(b)	(i)	annual or several years/same month/more frequent in each year;	[1]
		(ii)	quantitative data/ / count them/ tally/ find out how many;	[1]
		(iii)	longer observation period/ observe several times in the day;	[1]
	(c)	(i)	increased increased decreased; all **three** required for one mark	[1]
		(ii)	Bacteria/ fungi/ mould; NOT decomposers/ microbes/ algae	[1]
			Question Total	**[7]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available

Q.7/1 (a)

Gametes	A	A
a	Aa	Aa
a	Aa	Aa

[2]

Award 1 mark for all 4 gametes being correct (Must use **A** and **a**);
Award 1 mark for the mechanics of the cross; Award this mark even if the gametes are incorrect or the wrong letters are used.

(b) (i)

Gametes	A	a
A	AA	Aa
a	Aa	aa

[2]

Award 1 mark for all 4 gametes being correct;
Award 1 mark for the mechanics of the cross; Award this mark even if the gametes are incorrect
ECF- both these marks can be awarded if letters used in (a) are carried forward into (b). Also award the marks if **any** two F1 individuals are selfed.

(ii) 3 grey bodied: 1 black bodied (or correct ratio from given answer); [1]

(c) (Gregor) Mendel; [1]

Question Total **[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
Q.8/2	(a)	(i)	5 6 4 2 0 (not required for mark) 0 (not required for mark)	[1]
		(ii)	All bars correct height – according to candidate's tally;;	[2]
		(iii)	They are shorter than the woodland plants;	[1]
	(b)		Collect seeds from the plant growing in each locality and sow (plant) in opposite locality (Accept reference to the transplanting of seedlings)	[1]
			If plant height changes then caused by environment/ if plant height doesn't change then due to genetics;	[1]
			Question Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
Q.9/3	(a)	The analysis of the DNA of an organism/ looking at the {patterns/ bands} in DNA;	[1]
	(b)	Any 2 from : {Identifying/ finding out who is} the {culprit/ suspect} from evidence at a crime scene/ or example; NOT solving crimes/ catching criminals {Paternity/ maternity} testing/ finding out who the {father/ mother} is/ identify relatives; Comparison between species for classification purposes; Identification of genes associated with an {inherited disease/ named inherited disease}/ to find out if parents may have children with cystic fibrotic disease/ determine risk of developing breast cancer; Identification of dead bodies;	[2]
		Question Total	**[3]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
Q.10/4	(a)	Heat being transported around the body via the blood;	[1]
	(b)	Fan increasing the rate of <u>evaporation</u> of sweat; Therefore increased rate of cooling/ more heat removed from the {blood/ body};	[2]
		Question Total	**[3]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question	Marking details	Marks Available
Q.11/5	Indicative content Use the measuring cylinder to measure 20cm^3 of water into the boiling tube. (Accept any reasonable volume of water) Measure the initial temperature of the water with the thermometer and record the temperature (in a suitable results table) Choose a piece of food and find it's mass using the balance. Record the mass (in the results table). Accept measure 1g of the food sample. (Accept any reasonable mass of food sample) Impale/ attach/ stick the piece of food carefully on the mounted needle. Hold the food in the Bunsen burner flame until it catches alight/ Light the food in the Bunsen flame Hold burning food sample under the boiling tube until all the food has burnt. Measure the final temperature of the water with the thermometer and record the temperature (in a suitable results table) Calculate the rise in temperature of the water Repeat with other food sample If an equal mass of the two foods has not been used accept reference to : Energy released from food/g (J) = $\frac{\text{mass of water(g) x temperature rise (°C) x 4.2}}{\text{Mass of food sample(g)}}$	

© WJEC CBAC Ltd.

STEMUP.CO.UK

5-6 marks
The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar

3-4 marks
The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

1-2 marks
The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

0 marks
The candidate does not make any attempt or give a relevant answer worthy of credit

Question Total [6]

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
Q.6	(a)	(i)	Prey;	[1]
		(ii)	Predator;	[1]
		(iii)	Reproduction/ accept immigration;	[1]
	(b)		Extinction/ natural selection;	[1]
	(c)		Camouflage/ blend in/ green beads are less easily seen/ ORA;	[1]
	(d)		Prey is static/ prey is only identified on the basis of colour;	[1]
			Question Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
Q.7	(a)	Blood; Urine;	[2]
	(b)	Any three from Insulin injections/ jabs; {Metformin/ novonorm/ actose/ named correct} tablets/ take tablets for type 2 diabetes/ take tablets to control blood {glucose/ sugar} level; NOT take tablets unqualified Controlled intake of carbohydrate/ fat/ named foods rich in carbohydrate or fat; Pancreatic tissue transplant; Regular exercise;	[3]
	(c)	Not able to produce insulin; Not able to produce glucagon;	[2]
		Question Total	**[7]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
Q.8	(a)	(i)	(Reduced because of) lack of food/ water voles;	[1]
		(ii)	*Any two from*	[3]
			Increase Lack of/ less marbled cats;	
			high rate of reproduction/ more squirrels survive;	
			Less competition from voles and deer;	
			One from	
			Decrease they outgrow food supply/ competition for food/ not enough food for them;	
	(b)		At first, a decrease in insects leads to decrease in shrews;	[3]
			Then an increase due to lack of predators;	
			And an increase in food because insects increase due to food from decaying remains of trees;	
			Question Total	**[7]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
Q.9.	(a)	(i)	The {higher temperature/ increased light} in May causes greater rate of {growth/ root formation};	[1]
		(ii)	Low temperature in January slows down {<u>bacterial growth/ enzyme action</u>};	[1]
	(b)		urease;	[1]
	(c)	(i)	Urea is broken down by the enzyme/ urease; to {ammonia/ ammonium compounds};	[2]
		(ii)	Moist indicator paper pH7; 20cm^{3}urea at 1mol/dm^3; 5cm^3 {boiled/ denatured} (and cooled) 1% {enzyme/ urease}; NOT no enzyme	[3]
		(iii)	Leave for 1 hour/ time; at 20°C/ temperature;	[2]
			Question Total	**[10]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question	Marking details	Marks Available
Q.10	Indicative content Correct reference to data shows that the pesticide has been a selective pressure on a mutated gene for resistance. This results in variation and natural selection/ survival of the fittest TO BREED and the resistant genes are passed on. 5-6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. 3-4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. 1-2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. 0 marks The candidate does not make any attempt or give a relevant answer worthy of credit	
	Question Total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Surname	Centre Number	Candidate Number
Other Names		0

New GCSE

4461/02

SCIENCE A
HIGHER TIER
BIOLOGY 1

P.M. WEDNESDAY, 30 May 2012

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**6**	
2	**4**	
3	**7**	
4	**7**	
5	**6**	
6	**4**	
7	**4**	
8	**6**	
9	**9**	
10	**7**	
Total	**60**	

4461
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **3** and **9**.

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

Answer **all** *questions.*

1. In cats, the allele for short hair **(D)** is dominant to the allele for long hair **(d)**.

A cat with short hair was mated with a cat with long hair. All the offspring (**F1**) had short hair.





(a) (i) Complete the following to show the genotypes of the parents. [1]

I. The cat with short hair. .....

II. The cat with long hair. .....

(ii) Complete the Punnett square to show the cross between the cat with short hair and the cat with long hair. [2]

	Gametes		
F1			

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) (i) Complete the Punnett square to show the offspring produced on selfing (breeding together) two of the **F1** generation. [2]

F2

Gametes		

(ii) Complete the following to show the ratio of the different types of offspring appearing in the **F2** generation. [1]

..... homozygous dominant: ..... heterozygous: ..... recessive

4461 020003

© WJEC CBAC Ltd.

STEMUP.CO.UK

2. In 1982 the same species of pine tree was planted on both sides of a river valley in Wales. In 2011 the trees were surveyed at points **A**, **B** and **C** and the average heights of the trees were recorded.

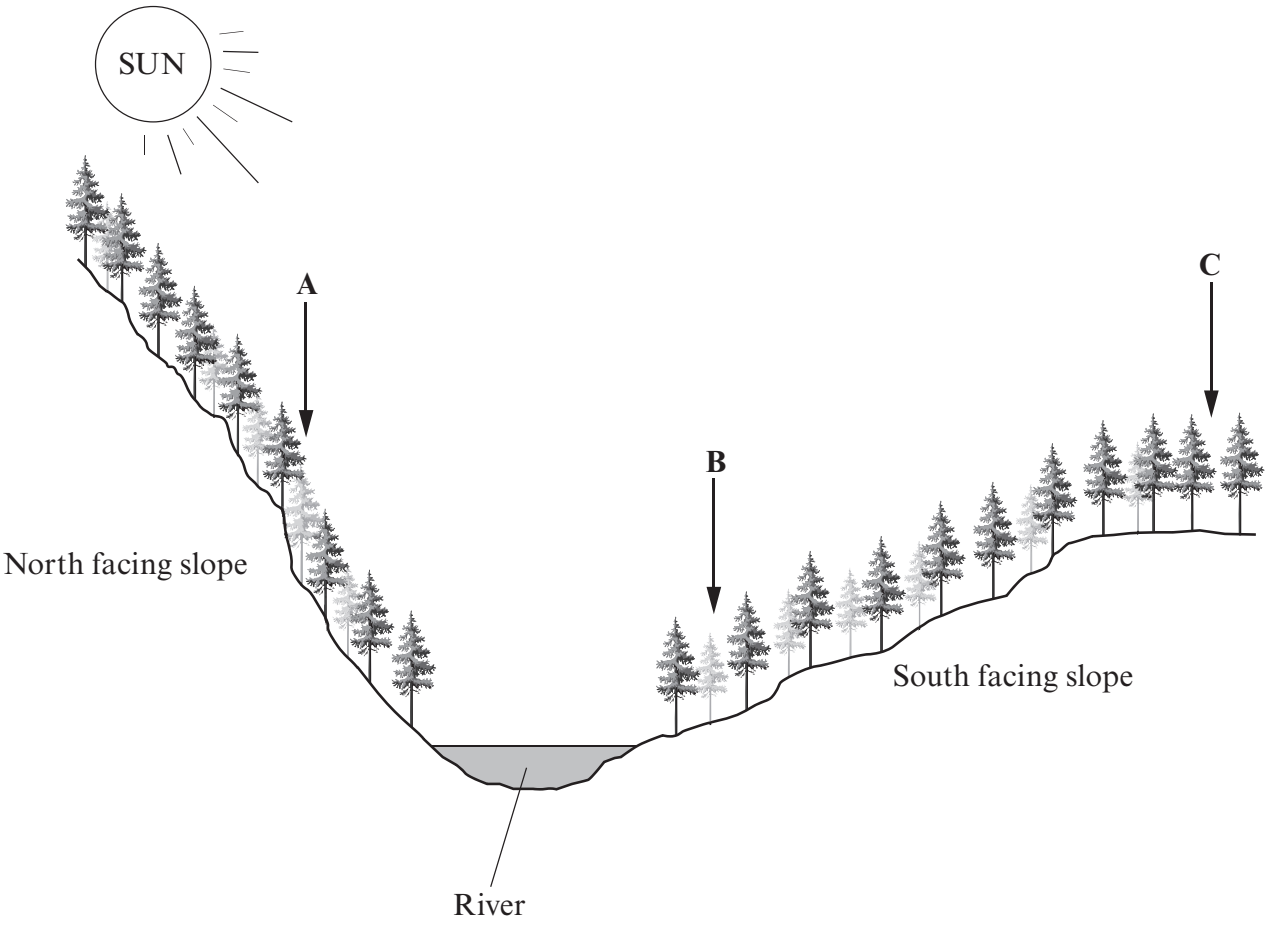


Table showing the average heights of the trees at survey points, **A**, **B** and **C**.

Survey point	Average height of trees (m)
A	8.6
B	11.4
C	10.7

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(a) What term is used to describe the differences found between members of the same species? [1]

.....

(b) Suggest **two** environmental reasons for the differences in the average height of the trees growing at survey points **A** and **B**. [2]

(i) .....

.....

(ii) .....

.....

(c) All the trees growing at survey point **C** were growing under exactly the same environmental conditions, but the difference in height between the individual trees was as much as 0.5 m. Suggest a reason for this difference. [1]

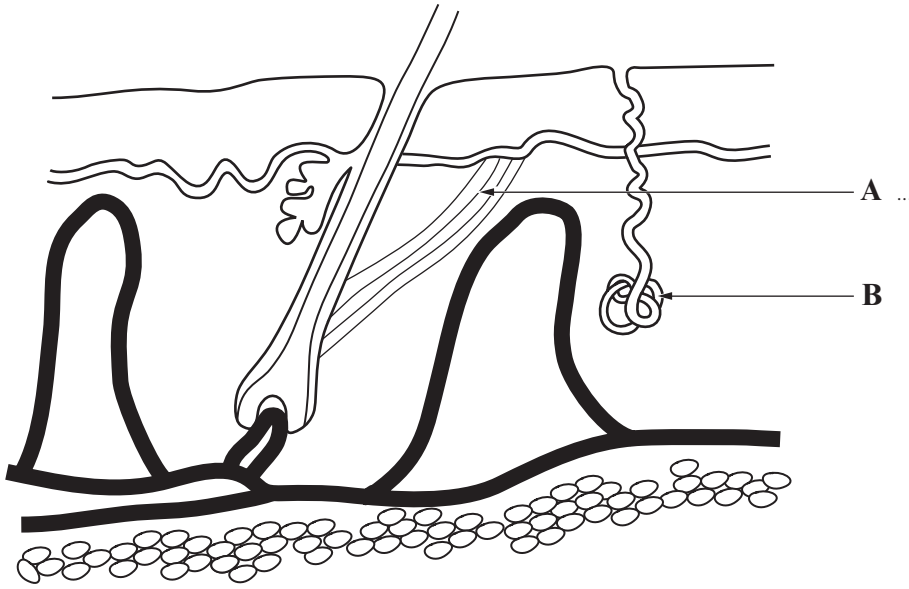
.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

3. The diagram shows a section through the skin.



(a) Label part **A** on the diagram. [1]

(b) Explain in detail the role part **B** plays in lowering the body temperature in warm conditions. [6 QWC]

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

4. The information below shows the information on the packaging of two different breads, *Multi-Seeded* and *White sliced*.

	Multi-Seeded (100g)	White Sliced (100g)	Guideline Daily Amount (GDA) for an adult
Energy (kJ)	1110	992	8400
Protein (g)	10.5	9.5	45
Total carbohydrates (g)	33.5	15.7	230
Sugars (g)	4.1	4.2	90
Total fat (g)	9.9	1.3	70
Saturated fat (g)	1.5	0.1	20
Salt (g)	0.85	0.4	6

(a) Use the information in the table to calculate the mass of a *White Sliced* loaf which an adult needs to eat to reach their GDA of energy. [2]

Answer .....

(b) Which of the breads would you recommend to:

(i) a person suffering from coronary heart disease; [1]

Bread .....

Reason .....

(ii) a person suffering from high blood pressure? [1]

Bread .....

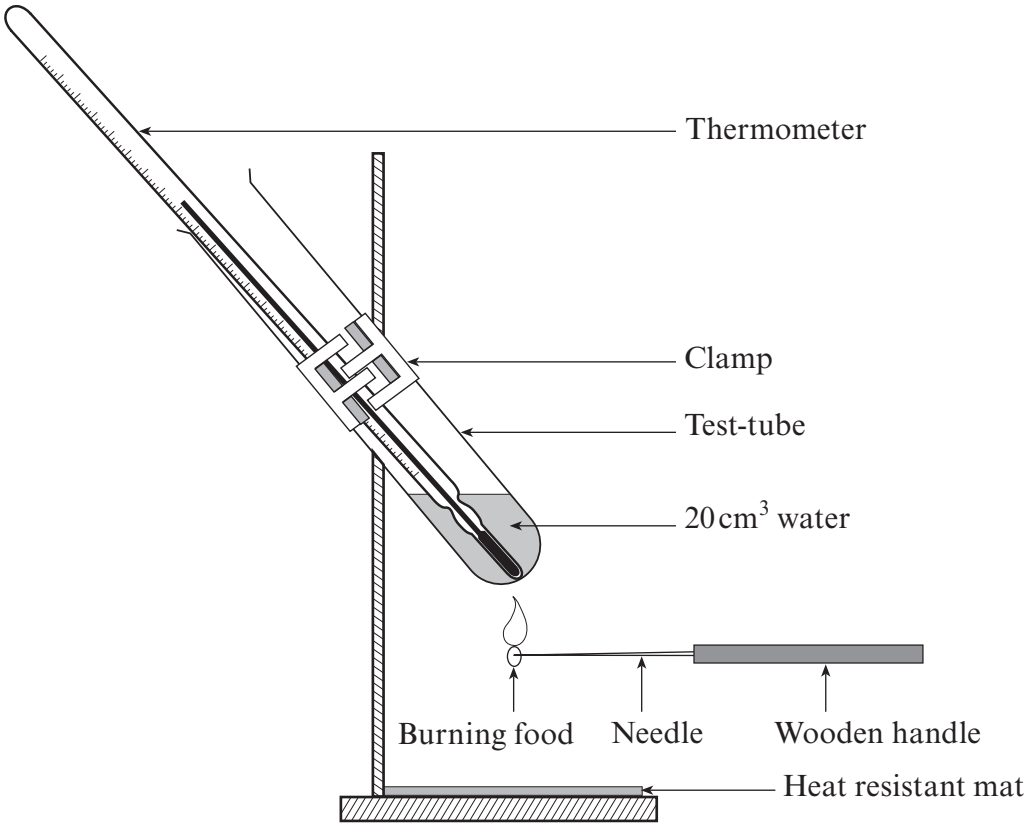
Reason .....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(c) Bethan wanted to check the energy content of the *Multi-Seeded* bread. She set up the apparatus shown below.



(i) Apart from the volume of water used, state **two** *other* measurements that Bethan must take in order to find the energy content of the bread. [2]

I. .....

II. .....

(ii) Why will the apparatus which Bethan uses not give an accurate reading of the energy content of the bread? [1]

.....

.....

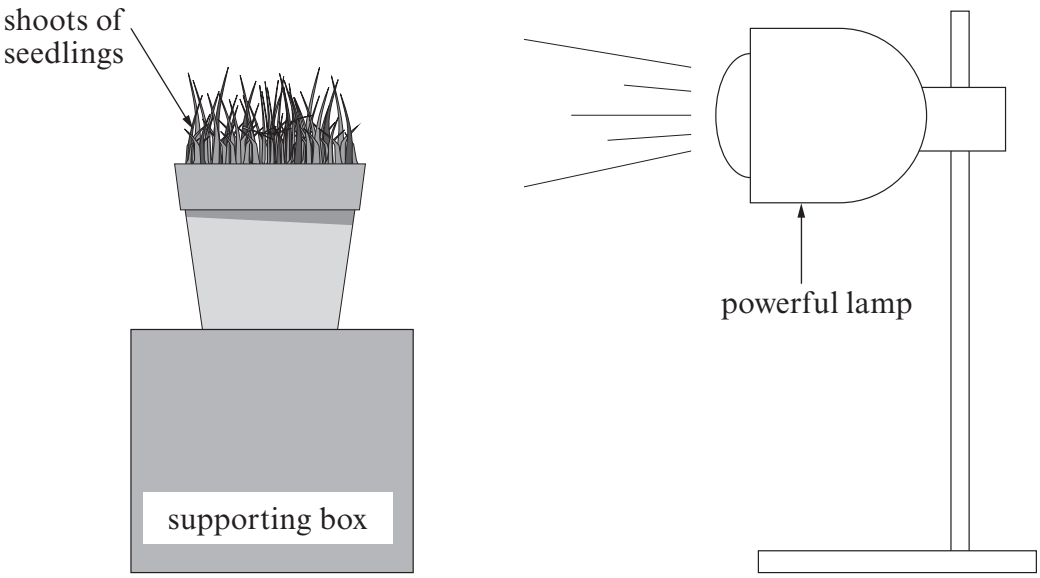
4461 020009

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

5. John grew some seedlings in small flower pots in a school laboratory. When the shoots were long enough he placed one of the pots on a supporting box on a bench and illuminated the shoots **from one side only** using a powerful bench lamp.



(a) (i) After 48 hours John examined the shoots of the seedlings.
State how the appearance of the seedlings will have changed. [1]

.....

(ii) State the name of the response shown by the shoots of the seedlings. [1]

.....

(iii) Name the group of chemicals that controls this type of response. [1]

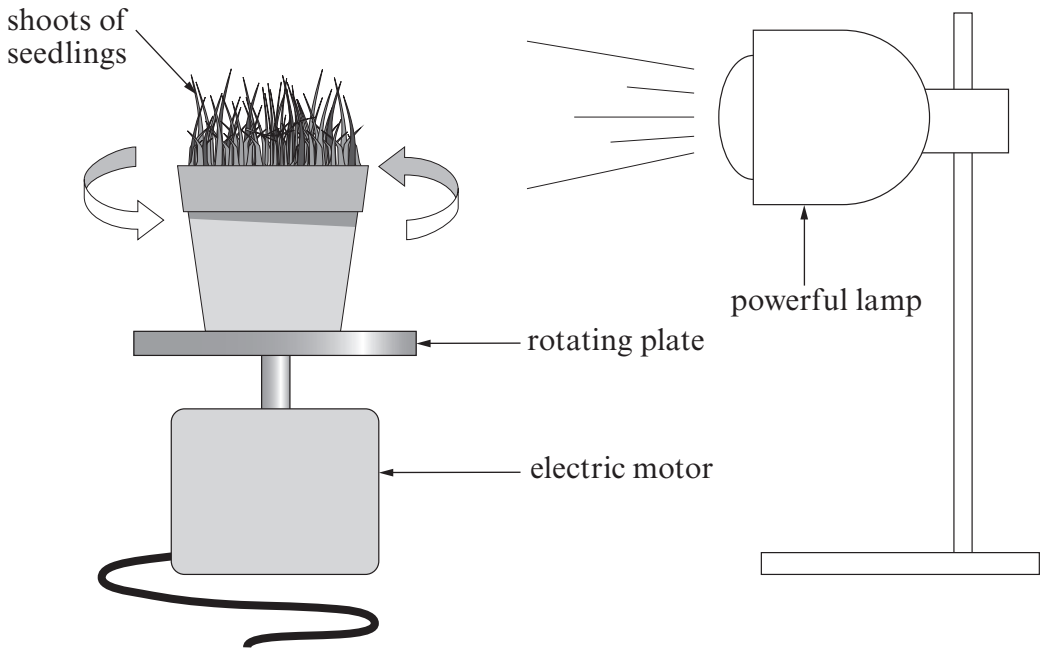
.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(b) John placed another pot of seedlings on a rotating plate. The plate completed one revolution every 20 minutes. The seedlings were illuminated **from one side only** by a powerful bench lamp.



(i) After 48 hours John stopped the electric motor. When he examined the shoots of the seedlings he found that they were growing: [1]

Underline the correct answer.

A. away from the light

B. towards the light

C. straight up.

(ii) Explain your answer to *(b)*(i). [2]

.....

.....

.....

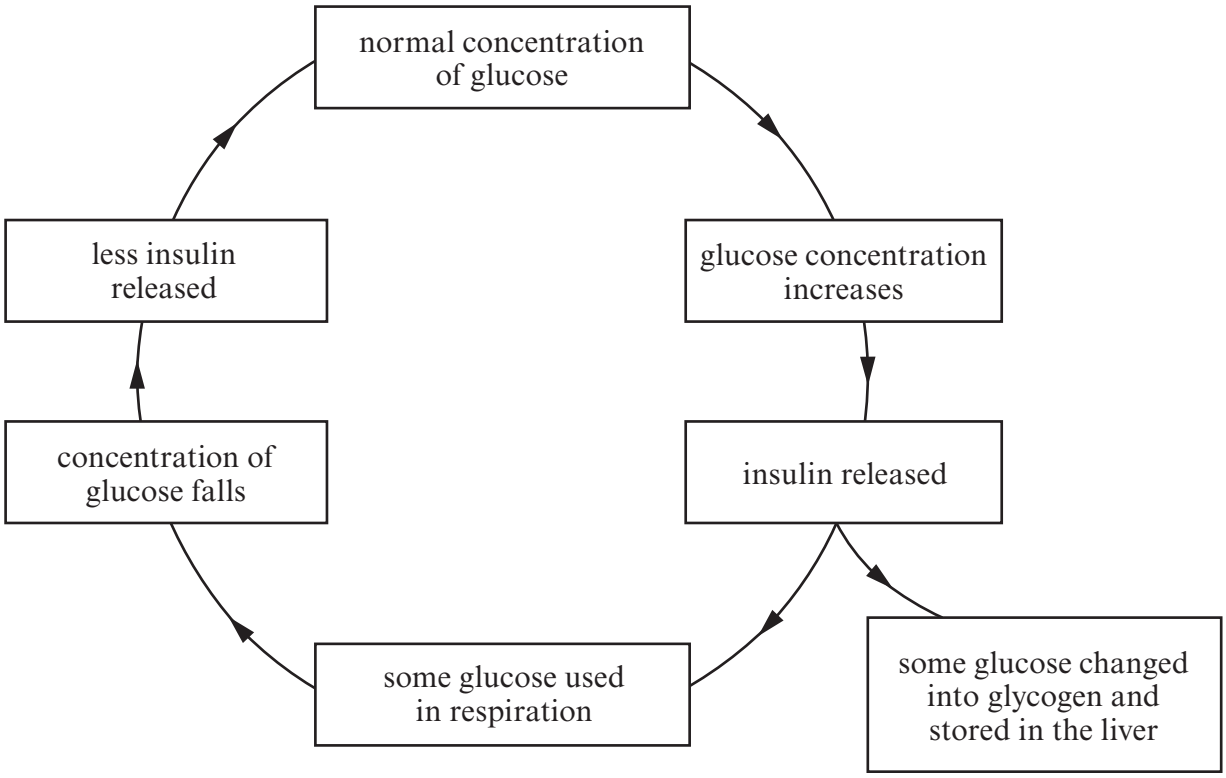
4461 020011

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

6. The flow chart below shows the relationship between glucose and insulin concentrations in the blood of a person.



(a) Write the word **EAT** on the flow chart to show clearly when the person eats a meal. [1]

(b) Suggest why some of the glucose is changed to glycogen and stored in the liver. [1]

.....

.....

(c) Mark with an **X** on the flow chart, the box which would **not** be true in a person with Type 1 diabetes. [1]

(d) What term is used to describe the control mechanism shown in the flow chart? [1]

.....

4

© WJEC CBAC Ltd.

STEMUP.CO.UK

BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

7.



A Soya crop

The flow chart below shows the principles of a process used to improve crop plants by genetic modification **IN THE CORRECT ORDER**.

Flow chart	
Principles of genetic modification of a crop plant	
A	A useful gene is identified.
	↓
B	The useful gene is transferred to cells of a crop plant.
	↓
C	The crop plant's cells produce many genetically modified plants.
	↓
D	The new genetically modified crop plants undergo trials to find out if the useful gene has the desired effect.

© WJEC CBAC Ltd.

STEMUP.CO.UK

The table below lists the stages used in the genetic modification of soya. The stages are listed in the **WRONG ORDER**.

Stages in the genetic modification of soya	Letter
Soya plants of the new variety are tested in the field to find out if they resist herbicides.	.....
Whole soya plants are grown from genetically modified cells of soya plants.	.....
Agrobacterium tumefasciens infects soya plant cells passing on the gene which controls herbicide resistance.	.....
Agrobacterium tumefasciens has a gene which controls herbicide resistance.	.....

(a) Use the letters **A**, **B**, **C** and **D** shown in the flow chart opposite to complete the table above, matching the **principles** with the **stages** in the genetic modification. [3]

(b) State **one** reason why farm scale field trials are needed before a genetically modified crop is grown. [1]

.....

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

8. Cystic fibrosis is an inherited condition that mainly affects the lungs. People with cystic fibrosis cannot make a type of protein.

(a) Cystic fibrosis is controlled by a pair of alleles. If one allele is found on one chromosome of pair number 7, where exactly would you find the second allele? [2]

.....

.....

(b) During gene therapy, people with cystic fibrosis have been treated by having normal alleles transferred into their lungs.
The first attempts at this treatment used micro-organisms called viruses to carry normal alleles into the lung cells.

(i) Suggest a possible problem as a result of using viruses to carry normal alleles into the lung cells. [1]

.....

(ii) Lung cells wear out and are replaced by new lung cells.
Suggest why this could be a problem for this type of gene therapy. [1]

.....

.....

(c) Explain how the results of a DNA profile could help inform people who intend to become parents and who have a family history of cystic fibrosis. [2]

.....

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

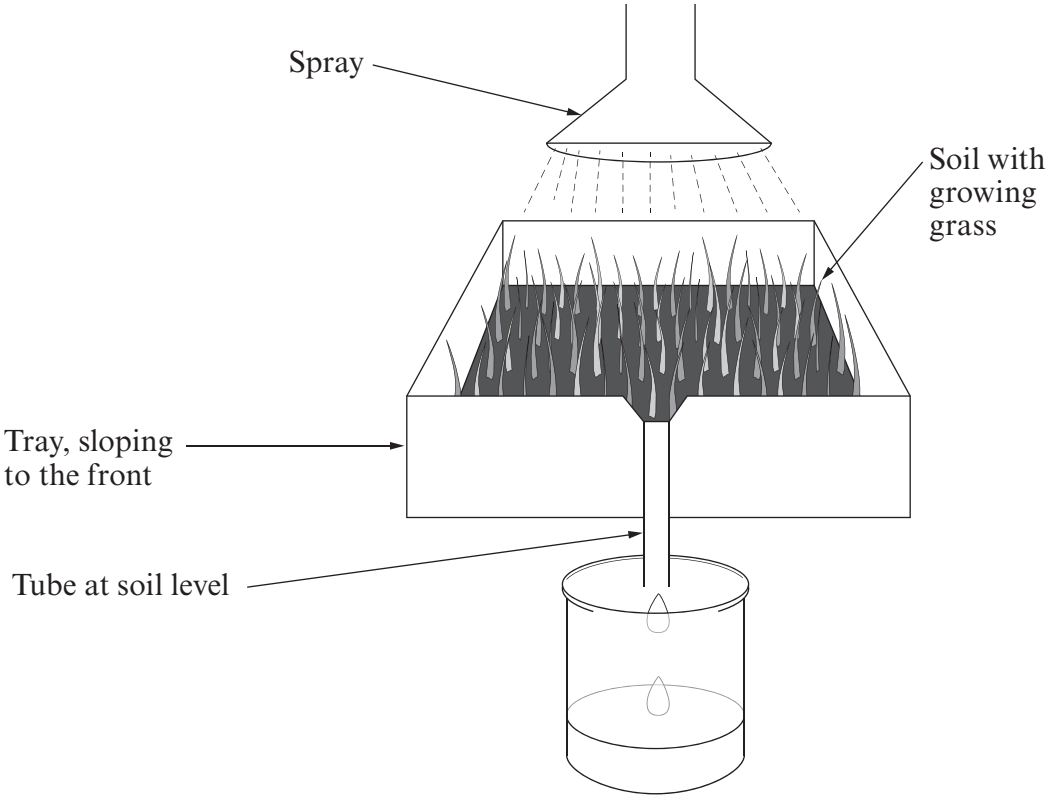
BLANK PAGE

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

9. An investigation was carried out to find out how much fertiliser is wasted when it is sprayed on crops. The diagram shows the apparatus used.



10 litres of a solution of fertiliser were sprayed on the tray for 1 hour. After 1 hour 7 litres of the solution had drained out of the tray.

(a) Suggest **two** ways in which the investigation does not accurately represent the effects of spraying fertiliser on crops grown on a farm. [2]

(i) .....

(ii) .....

(b) Suggest **two** plant nutrients present in artificial fertiliser. [1]

(i) .....

(ii) .....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(c) Use the information given and your knowledge of the harmful effects of pollution to explain why some chemicals in fertiliser can harm fish in their natural habitat.

[6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

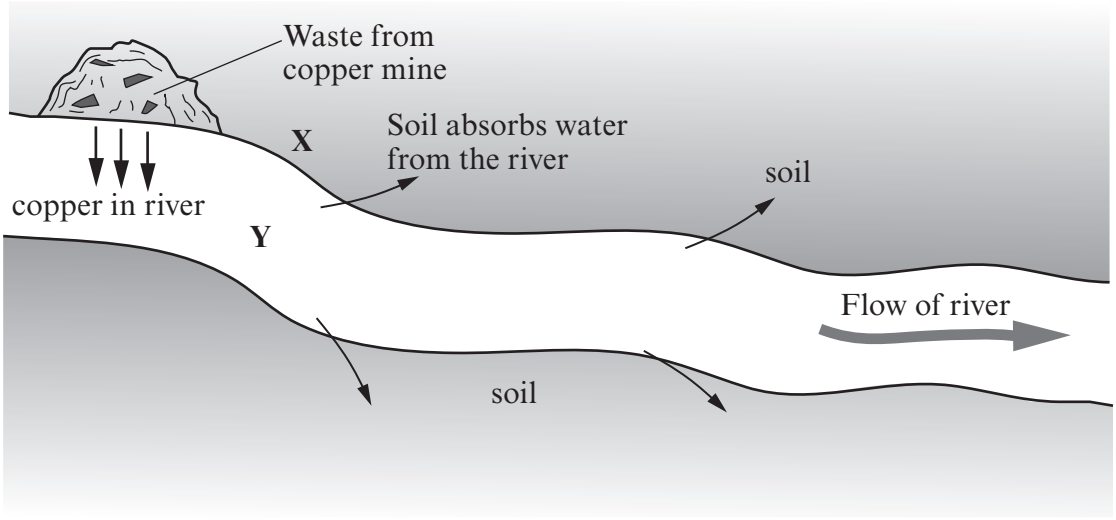
9

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

10. Waste from a copper mine has been left near a river for a 100 years.
Copper is a poisonous heavy metal.
The map below shows the waste from the copper mine in relation to the river.



A sample of seeds from the grass *Agrostis tenuis* was collected at point **X** shown on the map and from 10 miles away from the river where there was no pollution from copper.
Both samples of seeds were planted in soil and regularly watered with river water collected at point **Y** on the map.
After three weeks the % seeds that had grown from both samples was recorded:

Seeds growing (%)	
Sample from point **X**	Sample from 10 miles away from the river
90	0.2

(a) State **two** factors other than time that would ensure that this was a fair test. [2]

(i) .....

(ii) .....

(b) Suggest how you would set up a control for this investigation. [1]

.....

.....

.....

© WJEC CBAC Ltd.

STEMUP.CO.UK

Examiner only

(c) Describe how natural selection can explain the results. [4]

.....

.....

.....

.....

.....

THERE ARE NO MORE QUESTIONS IN THIS EXAMINATION.

7

© WJEC CBAC Ltd.

STEMUP.CO.UK

GCSE MARKING SCHEME

SCIENCE - BIOLOGY

SUMMER 2012

© WJEC CBAC Ltd.

STEMUP.CO.UK

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE SCIENCE - BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

© WJEC CBAC Ltd.

STEMUP.CO.UK

UNIT B1

FOUNDATION TIER

Question		Marking details	Marks Available
1.	(a)	Earthworm – invertebrate Fern – non-flowering plant Fox – vertebrate Dandelion – flowering plant Algae – microorganism 4 or 5 = 4 marks;;;; 3 = 3 marks 2 = 2 marks 1 = 1 mark	4
	(b)	Presence of {backbone/ spine} in vertebrates (or converse); Must be clear reference to vertebrates/ invertebrates	1
	(c)	Bacteria / virus / fungi/ yeast; NOT named species/ plant plankton/ mould	1
	(d)	Scientific name is always the same / common names different/ scientific name is the {same all over the world/ universal}/ scientific names are the same in <u>all</u> languages;	1
		Question total	**[7]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
2.	(a)	(i)	Answer 120;; Suitable part calculation (eg 620 – 500) allow 1 mark	2
		(ii)	Less food has to be bought/ lower labour costs/ can keep more chickens in the same space; NOT lower heating costs/ security costs/ cheaper – unqualified/ less food – unqualified	1
	(b)		Have less food/ {crushing/ cramped/ squashed/ squeezed together/ crammed} (against cage wall)/ less room so less exercise; Must be clear reference to caged/ uncaged NOT restricted movement/ less space/ cooped up/ squished up/ standing on top of each other/ fighting	1
	(c)		Poor feather growth/ less feathers; NOT no feathers	1
	(d)		More room to move / stretch legs or wings more /more movement/ more exercise/ movement is less restricted. NOT more ethical/ cruel/ less broken bones	
			Question total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
3.	(a)	(i)	I hawk or stoat;	1
			II Any two from:	
			Mice / beetles / moths / rabbits / caterpillars / snails;	1
			III green plants;	1
		(ii)	Badger: eats {beetles/ mice/ rabbits} and plants;	1
			No mark if any wrong animal named	
		(iii)	Sun (light);	1
			NOT light/ sunshine	
		(iv)	Arrows/ ⟶;	1
	(b)	(i)	Decrease;	1
		(ii)	More {variety of herbivores/ herbivore species} to feed on;	1
			NOT more food/ more herbivores	
			Question total	**[8]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
4.	(a)	(i)	26, 48;	1
		(ii)	Plots 4 plots all correct (-1 per error) (+/- ½ small square);;	2
			Line quality;	1
	(b)	(i)	30 min (from graph) (units must be present);	1
		(ii)	Rise <u>and</u> then fall;	1
	(c)	(i)	Insulin;	1
		(ii)	Diabetes/ diabetic;	1
			Question total	**[8]**
5.	(a)		Pairs;	1
			DNA;	1
			Genes;	1
			Inherited;	1
	(b)	(i)	X X **and** X Y;	1
		(ii)	23;	1
		(iii)	Gametes/ sex cells;	1
			Question total	**[7]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
6/1	(a)	(i)	I DD II dd; Allow e.c.f from (a)(i)	1
		(ii)	Gametes correct;	1
			Cross correct;	1

FI

Gametes	D	D
d	Dd	Dd
d	Dd	Dd

(b) (i) Allow e.c.f from (a)(ii)
Gametes correct; 1
Cross correct (mark independently of gametes); 1

Gametes	D	d
D	DD	Dd
d	Dd	dd

(ii) Answer from candidate's Punnett square

1 homozygous dominant : **2** heterozygous : **1** recessive; 1
NOT 25:50:25/ 2:4:2/ ¼: ½: ¼

Question total **[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
7/2	(a)	Variation; NOT {environmental/ genetic} variation/ mutation	1
	(b)	Any **two** from: (Trees in region) A have <u>less</u> water/ furth<u>er</u> away from {water/ river} ORA; (Trees in region) A have <u>less</u> (sun)light /ORA; Accept south facing slope has <u>more</u> sunlight (Trees in region) A are growing on thinn<u>er</u> soils/ ORA; (Trees in region) A are growing higher up the hillside therefore at a low<u>er</u> temp/ ORA; NOT REFERENCES TO DIFFERENCES IN O_2 OR CO_2 CONCENTRATIONS <u>Candidates must make it clear which survey points they are referring to in their answer</u>	2
	(c)	They are <u>genetically</u> different / <u>genetic</u> differences / <u>genes</u> are different / DNA is different/ genetic variation/ variation in inherited genes; NOT: Chromosomes are different/ They come from seeds from different parents/ mutations/ genetics	1
		Question total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
8/3	(a)	Erector muscle;	1
	(b)	Indicative content: Sweat gland Removes {sweat / water and salts} from blood/ produces sweat Sweat travels up sweat duct Through sweat pore onto surface of skin Water in sweat evaporates / accept sweat evaporates Removing heat The order of these two statements can be reversed as shown below: Heat is removed from the body to Evaporate the water in sweat / accept to evaporate the sweat	

© WJEC CBAC Ltd.

STEMUP.CO.UK

5 – 6 marks 6

The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

3 -4 marks

The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

1 – 2 marks

The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

0 marks

The candidate does not make any attempt or give a relevant answer worthy of credit

Question total [7]

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
9/4	(a)		8400 ÷ 992 x 100 = 846.8g (accept 846.77g);; Award 2 marks for correct answer – unit required Award 1 mark for correct answer if no unit indicated. If answer is incorrect award 1 mark for 8400 ÷ 992 x 100 NOT 847	2
	(b)	(i)	White sliced because it has the {lowest/ lower/ less} {fat / saturated fat} content (salt is neutral) NOT low fat	1
		(ii)	White sliced because it has the {lowest/ lower/ less} salt content NOT low salt	1
	(c)	(i)	Any 2 from: Initial temperature (of water**);** Final temperature (of water); {Rise/ Change} in temperature of water = 2 marks NOT temperature alone Mass (accept weight) of {bread/ food (being burned)} NOT amount	2
		(ii)	Much of the heat from the burning {food sample / bread} is {not transferred to the water / lost to the surroundings}/ incomplete burning / apparatus is not insulated.	1
			Question total	**[7]**
			PAPER TOTAL	**[60]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

HIGHER TIER

Question			Marking details	Marks Available
5.	(a)	(i)	{Grown / bent/ curved/ leaning/ turned} towards the {light/ lamp} NOT moves towards light	1
		(ii)	Positive phototropism	1
		(iii)	Hormones / plant hormones / phytohormones / auxins	
	(b)	(i)	C (straight up)	1
		(ii)	All {sides/ parts} of the {shoot/ seedlings} receive an equal amount of light/ correct reference to distribution of auxin; In each revolution / every 20 minutes/ as plant {revolves/ rotates/ turns}; All shoots receive an equal amount of light as it is rotating = 1 mark Accept an answer which states: The effect of one sided illumination has been cancelled out by the fact that the shoots are revolving (OWTTE) for 2 marks	2
			Question total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
6.	(a)	'Eat' marked between 'normal conc of glucose' and bottom of 'glucose conc increases' box;	1
	(b)	To keep glucose constant/ too much glucose in the blood/ control glucose level in blood/ lower level (in blood)/ help level return to normal; It = glucose level	1
	(c)	'X' on "insulin released" box; Accept 'X' on "glucose changed to glycogen" box.	1
	(d)	Negative feedback;	1
		Question total	**[4]**
7.	(a)	D C B A ;;; 3/ 4 correct = 3 marks 2 correct = 2 marks 1 correct = 1 mark	3
	(b)	To understand the possible effects on environment / health (safe to eat)/ health problems/ to check there is no transfer of genes to other species; NOT to see if genetic modification is successful	1
		Question total	**[4]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question			Marking details	Marks Available
8.	(a)		On pair 7;	1
			Opposite (defective allele)/ at the same locus/ at the same position;	1
	(b)	(i)	Could cause disease (leukaemia / cancer); NOT makes you ill/ gives you health problems/ side effects	1
		(ii)	New cells / replaced cells / copies would have {cystic fibrosis/ defective} allele/ copy would not have the virus/ gene therapy would have to be repeated;	1
	(c)		Profile would show {cystic fibrosis/ defective} gene/ show if parents were carriers (of the disease); would show chances/ risk of having a child with cystic fibrosis / (counsellor could) predict/ determine risk;	2
			Question total	**[6]**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
9.	(a)	Any 2: Depth of soil; constant flow of spray/ Ref to rain e.g. rain is not constant; allowance for wind; evaporation; capacity of soil to soak up solution/ soil composition; ref to slope;	Max 2
	(b)	Any 2 for 1 mark; Nitrate/ NO_3^- Phosphate/ PO_4^- Potassium/ K Named trace element e.g. Magnesium Allow correct formulae NOT NPK	Max 1

© WJEC CBAC Ltd.

STEMUP.CO.UK

(c) **Indicative content** 6

The fertiliser {runs off / leaches into} the water. The fertiliser causes {overgrowth of plants/ algal bloom} in the water. Top layers of plants {stop light reaching the lower layers/ stops photosynthesis underneath} so the lower layers of plants die. They decay by the action of bacteria which use up oxygen for respiration. This causes the fish to die because of lack of oxygen.

5 – 6 marks

The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

3 – 4 marks

The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

1 – 2 marks

The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

0 marks

The candidate does not make any attempt or give a relevant answer worthy of credit

Question total [9]

© WJEC CBAC Ltd.

STEMUP.CO.UK

Question		Marking details	Marks Available
10.	(a)	Any 2 Same <u>volume</u> of water; same soil/ pH/ mineral (content); same temperature; NOT heat NOT light	Max 2
	(b)	<u>Keep all factors the same</u> but use {pure water / tap water/ distilled water/ unpolluted water/ water without copper} NOT clean/ normal water	1
	(c)	Mutation; Variation; Survival value – {some were tolerant to/ not poisoned by/ resistant to copper}; NOT immune to copper Gene passed on.	4
		Question total	**[7]**
		PAPER TOTAL	**60**

© WJEC CBAC Ltd.

STEMUP.CO.UK

Surname	Centre Number	Candidate Number
Other Names		0

New GCSE

4461/02

SCIENCE A
HIGHER TIER
BIOLOGY 1

A.M. THURSDAY, 12 January 2012

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**8**	
2	**6**	
3	**4**	
4	**6**	
5	**6**	
6	**3**	
7	**8**	
8	**6**	
9	**7**	
10	**6**	
Total	**60**	

4461
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions 2 and 8.

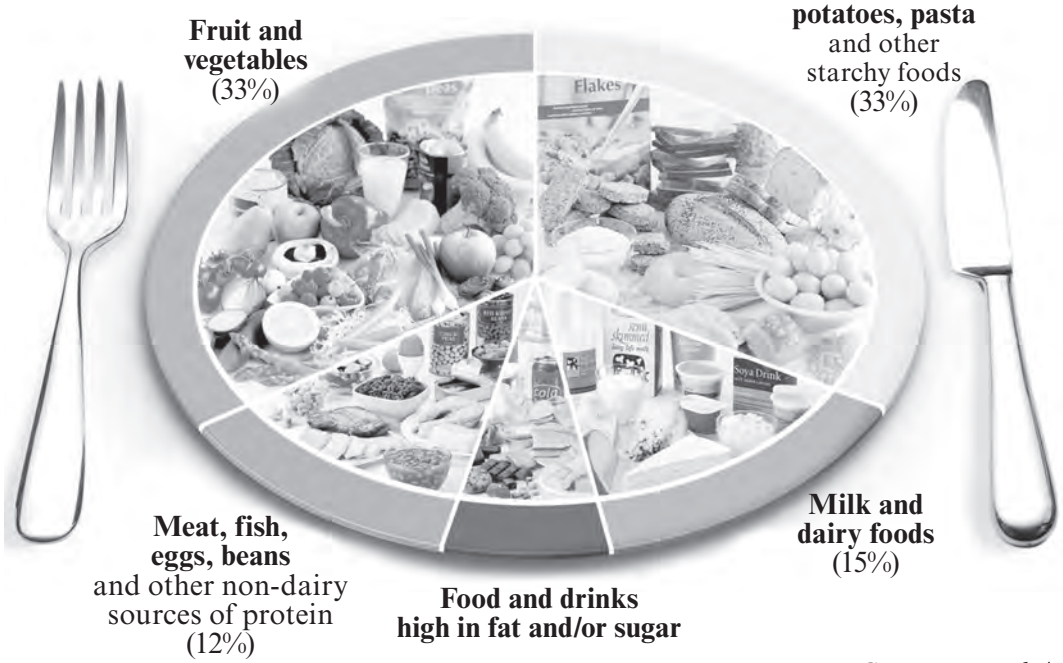
STEMUP.CO.UK

Examiner only

Answer **all** *questions*

1. *(a)* The eatwell plate shows the types and percentages of foods that we should eat for a healthy diet.

The eatwell plate



Crown copyright/FSA

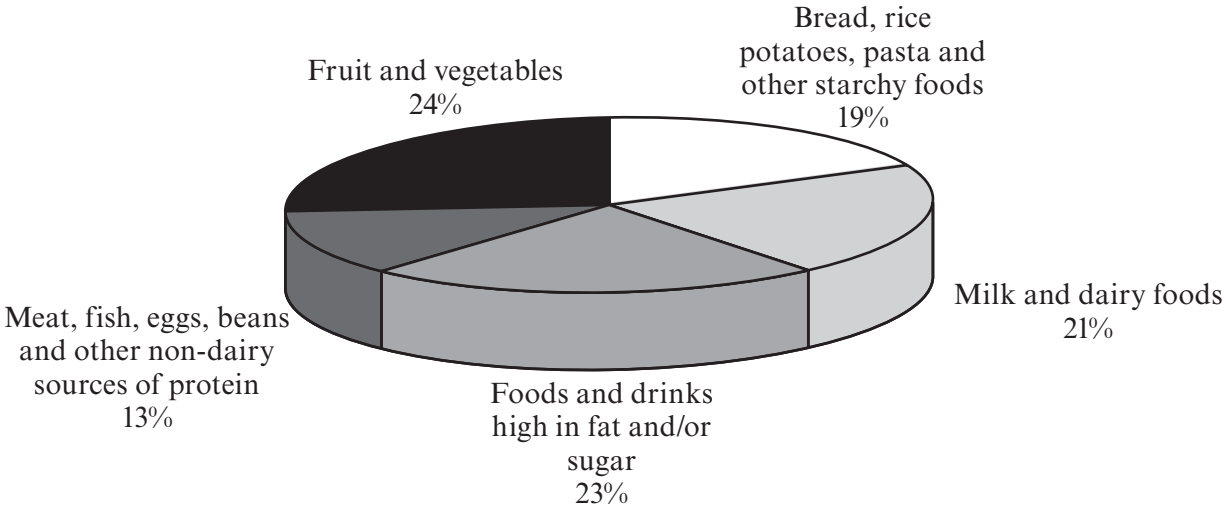
Calculate the percentage of the eatwell plate that should come from **Foods and drinks high in fat and/or sugar**. Show your working. [2]

Answer ..... %

STEMUP.CO.UK

Examiner only

(b) The chart below shows the percentages of different types of food bought at the shops.



Crown copyright/FSA

Which **three** types of food are bought in a greater percentages than shown in the eatwell plate? Tick (✓) the three boxes. [1]

Meat, fish, eggs ☐

Fruit and vegetables ☐

Bread, rice, potatoes, pasta ☐

Milk and dairy foods ☐

Foods and drinks high in fat and/or sugar ☐

4461 020003

STEMUP.CO.UK

Turn over.

(c) The table below shows the fat content of a meal.

Food	Fat content (g)
Doner kebab	50.2
Mayonnaise	11.5
Packet of crisps	11.5
Doughnut	13.3
Total	86.5

The Guideline Daily Amount of fat for an average female is 70g.
Calculate the excess fat content of this meal. [1]

Answer ..... g

(d) Why do food labels often give information on fat content **per 100g of food**? [1]

.....

(e) Explain why it is unhealthy to eat too much fat. [2]

.....

.....

.....

.....

(f) Give **one** use for fat in the human body. [1]

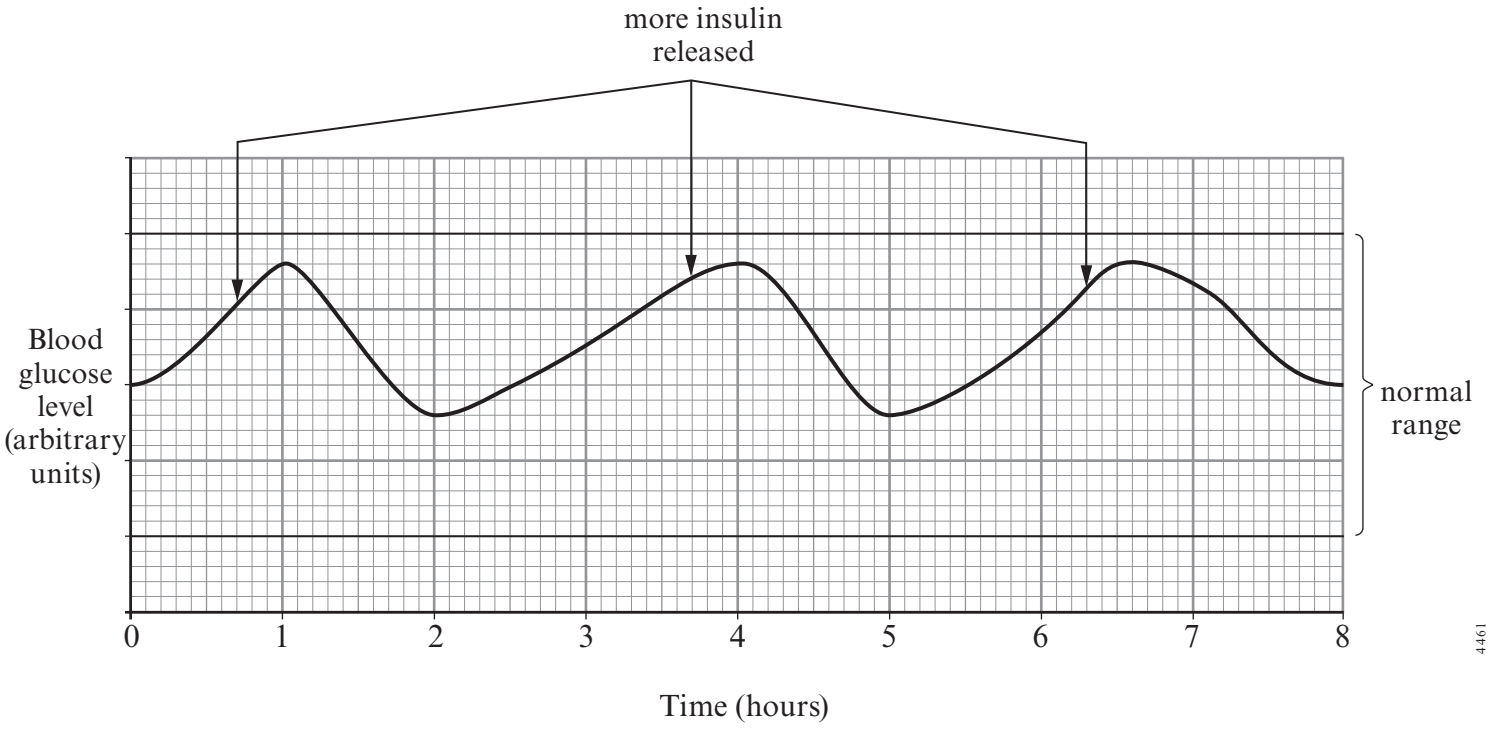
.....

STEMUP.CO.UK

Examiner only

2. The hormone insulin helps to keep blood glucose levels within a narrow, normal range.

The graph shows changes in blood glucose levels during a period of eight hours and the points when more insulin was released into the blood.



4461 020005

Use the above information, **and your own knowledge**, to explain how blood glucose levels are controlled in the human body. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

Turn over.

STEMUP.CO.UK

Examiner only

3. The legal blood alcohol limit for driving in the UK is 80 mg of alcohol per 100 ml of blood. In some countries, it is illegal to drive with **any** alcohol in the blood. This is the zero limit.

(a) (i) Why is it dangerous to drive after exceeding the legal limit of blood alcohol? [1]

.....

.....

(ii) Give **one** reason why some people think that there should be a **zero** limit in the UK. [1]

.....

.....

(*b*) Alcohol is an addictive drug.
Explain what is meant by 'an addictive drug'. [2]

.....

.....

.....

STEMUP.CO.UK

4. Red squirrels and grey squirrels live in woodland. The two squirrel species compete for similar resources. Where the two species share the same habitat, the greys usually outcompete the reds.



Red squirrel



Grey squirrel

The island of Anglesey used to have a large population of red squirrels. In the early 1970s, grey squirrels started to arrive across the road bridges. The number of grey squirrels on the island grew rapidly. By the mid 1980s, red squirrels had disappeared from many parts of the island. In 1998, conservation groups started to control the numbers of grey squirrels and the red squirrel was re-introduced into several woodlands.

(a) Anglesey is 710 km^2 in area. Only 3% of the area is mature woodland suitable for red squirrels.

Calculate the area of woodland suitable for red squirrels. Show the working. [2]

..... km^2

(b) Give **two** resources for which both squirrel species compete. [2]

1. .....

2. .....

(c) Apart from competition between the squirrels for resources, give **two** *other* factors that might limit the size of the squirrel populations. [2]

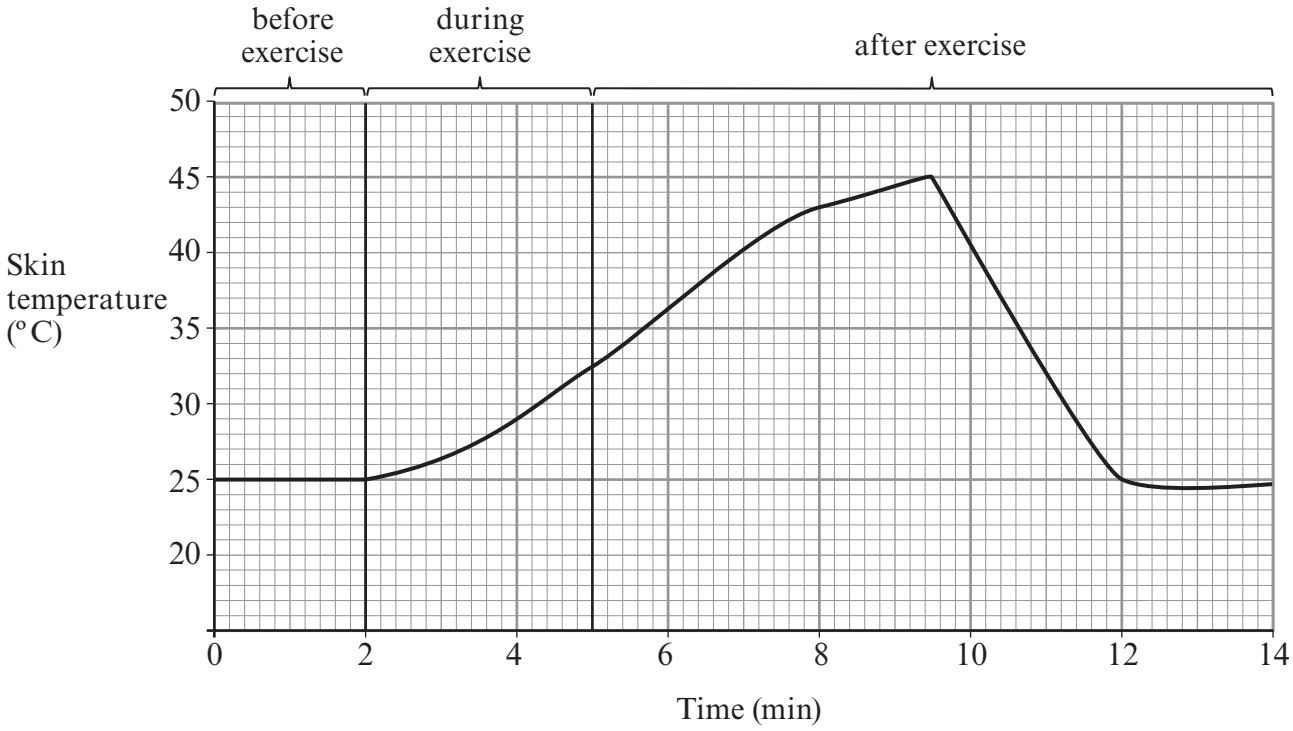
1. .....

2. .....

STEMUP.CO.UK

Examiner only

5. *(a)* Gareth's skin temperature was measured before, during and after exercise. The results are shown on the graph.



From the graph:

(i) State the rise in skin temperature during exercise. [1]

..... °C

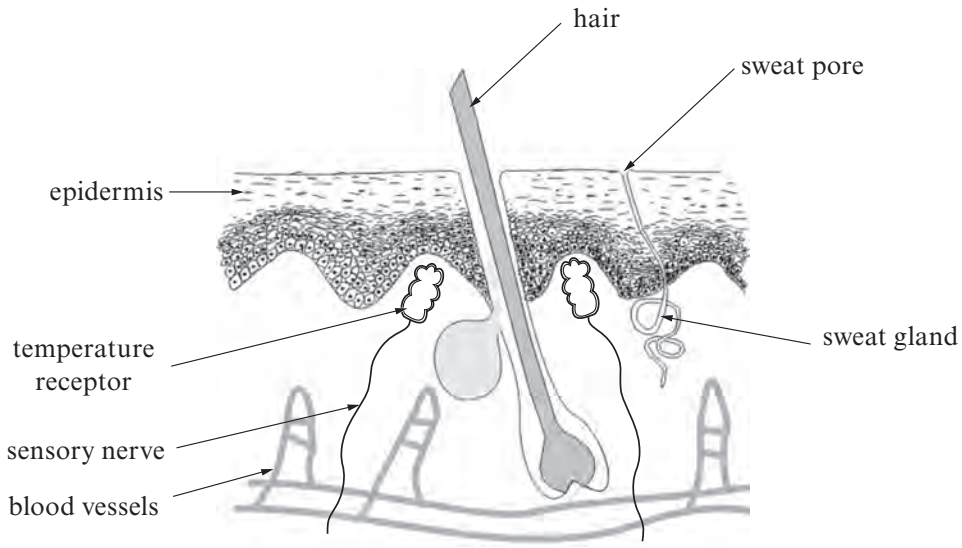
(ii) For how long after the exercise stops does skin temperature continue to rise? [1]

..... min

STEMUP.CO.UK

Examiner only

(b) The diagram shows a section through Gareth's skin.



Using the diagram and your own knowledge:

(i) Describe how information about the rise in skin temperature reaches the brain. [2]

.....

.....

(ii) Explain how changes in blood vessels near the skin surface help release excess heat from the body. [2]

.....

.....

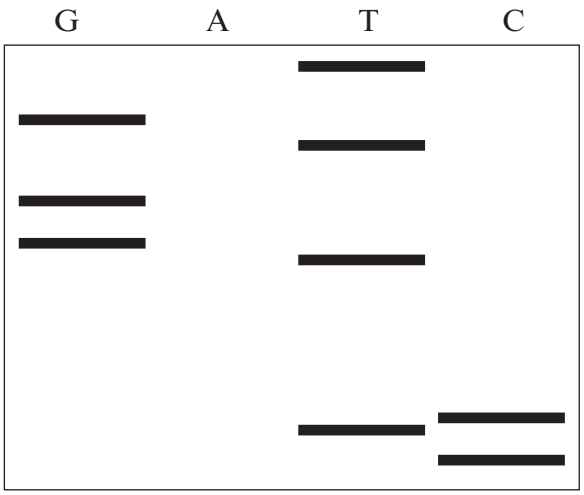
.....

STEMUP.CO.UK

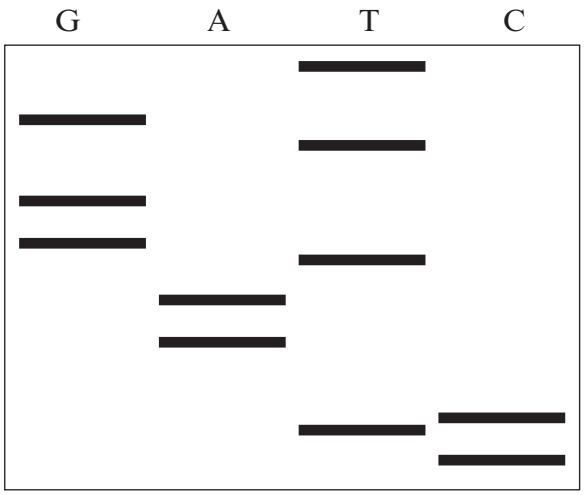
Examiner only

6. Tortoises can be legally bred in captivity. It is illegal to export or import wild tortoises. Scientists wanted to know if tortoises in a pet shop had been bred in captivity or imported. Those bred in captivity for many generations have a different pattern of chemicals in their DNA compared to the patterns of those from wild populations,
The patterns can be shown as bands. Examples from four tortoises are illustrated below.

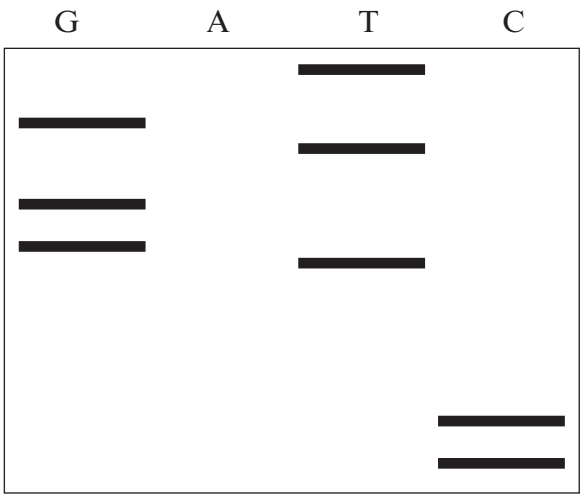
Tortoise known to be bred in captivity



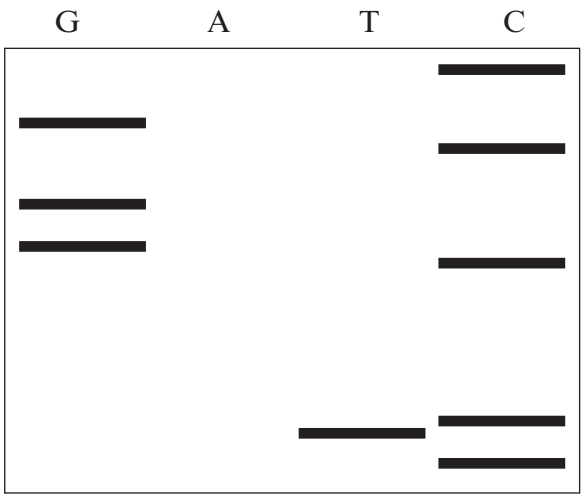
Tortoise 1



Tortoise 2



Tortoise 3



STEMUP.CO.UK

Examiner only

(a) What name is given to the patterns of DNA? [1]

.....

(b) Explain how this information can be used to show that a tortoise belongs to a wild population and not to a captive population. [2]

.....

.....

.....

.....

.....

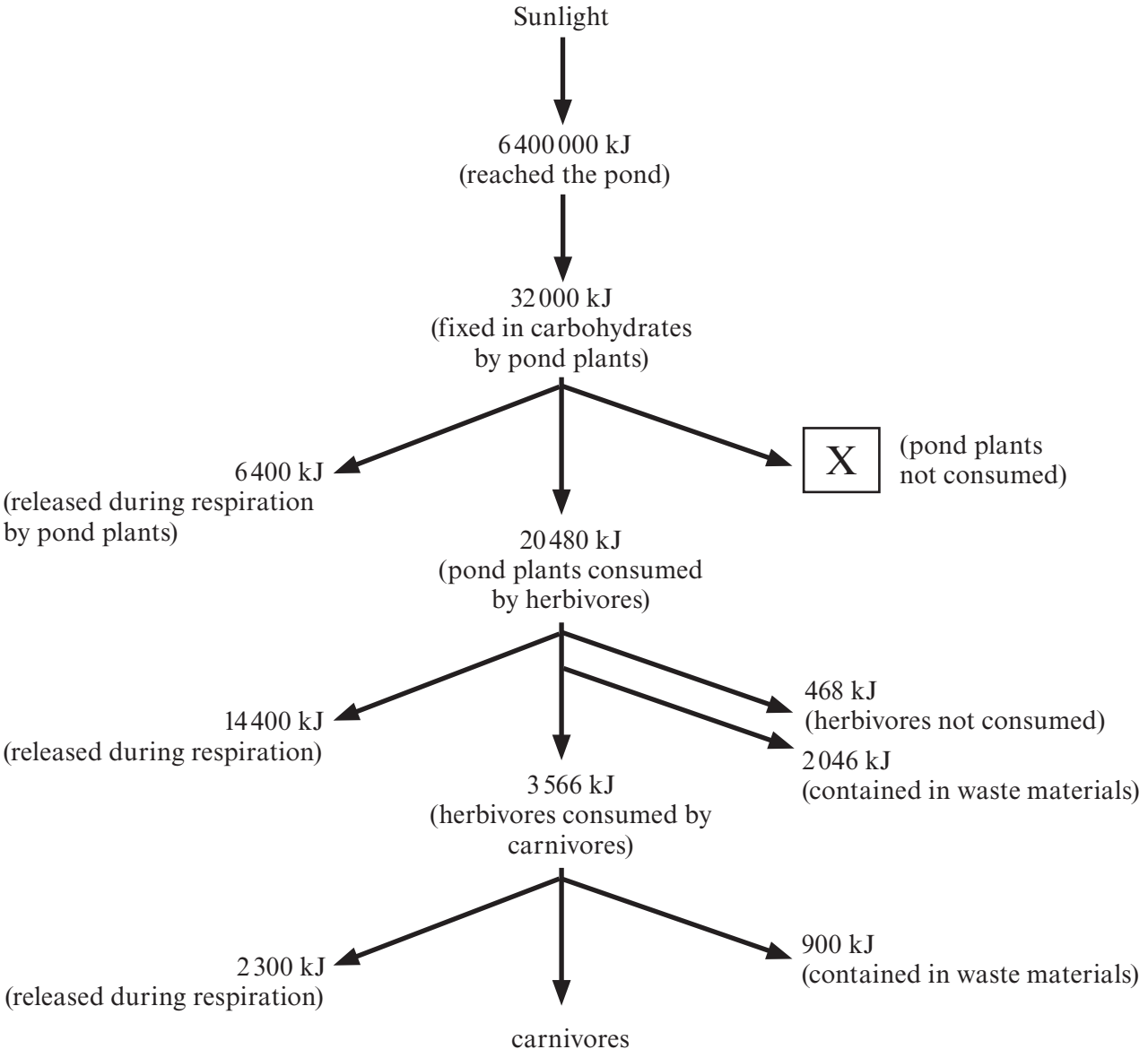
3

Turn over.

STEMUP.CO.UK

Examiner only

7. The diagram represents the energy flow through a food web in a pond during one year.



(a) (i) By which process is the energy from sunlight fixed into carbohydrates? [1]

.....

(ii) Calculate the percentage of light reaching the pond which was fixed into carbohydrates by the pond plants. [1]

Answer .....

STEMUP.CO.UK

Examiner only

(b) Only 20480kJ per year reach the herbivores. Calculate the energy still contained in the pond plants which were not consumed, as shown at **X** in the diagram. [1]

Answer .....

(c) Suggest **one** reason for the difference in the energy released during respiration by pond plants and by herbivores. [1]

.....

.....

(d) Explain how the animal waste material, containing nitrogen, is recycled and used again in the food web. [4]

.....

.....

.....

.....

.....

.....

.....

.....

Turn over.

STEMUP.CO.UK

Examiner only

8. In 1859, Europeans released 24 rabbits in Australia but there were hardly any natural predators of rabbits there.
By the 1950s the rabbit population had risen to over 60 million and they were a serious pest to crops.
In 1954 the myxoma virus, which caused a disease in rabbits, was purposely introduced to Australia to control the rabbit population.
By 1960, the rabbit population had decreased by 90%.
By 2010 the population had increased again to over 30 million.
Use the idea of natural selection to explain the changes in the rabbit population in Australia, over the last 150 years. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

STEMUP.CO.UK

BLANK PAGE

Examiner only

9. *(a)* (i) In the space below sketch bar graphs to represent continuous and discontinuous variation. [2]

Continuous

Number with characteristic

Characteristic

Discontinuous

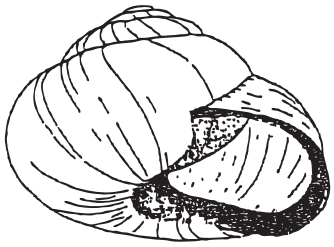
Number with characteristic

Characteristic

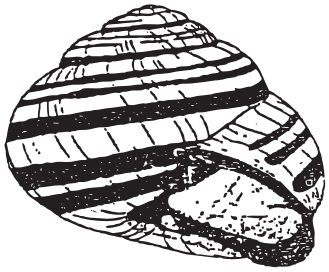
(ii) Which type of variation is controlled by more than one gene? [1]

.....

(b) The snail, *Cepaea nemoralis* has either a plain or banded shell.



plain



banded

A biologist mated two snails that had plain shells. 48 offspring were produced, of which 36 had plain shells and 12 had banded shells.

STEMUP.CO.UK

Examiner only

(i) Using the letters **B** and **b** to represent the alleles for plain and banded shells, show this cross in a Punnett square. [2]

(ii) Explain these results in terms of the type of variation and genetic dominance. [2]

.....

.....

.....

.....

STEMUP.CO.UK

Examiner only

10. Biogas is a mixture of carbon dioxide and methane. It is produced in the soil in land-fill waste dumps and is sometimes collected and sold as fuel.
The same type and mass of waste was regularly dumped in a land-fill site for many years. The volume of biogas produced decreased after the heavy metal, lead, was illegally dumped there.

(a) Explain how carbon dioxide is produced in the land-fill site. [2]

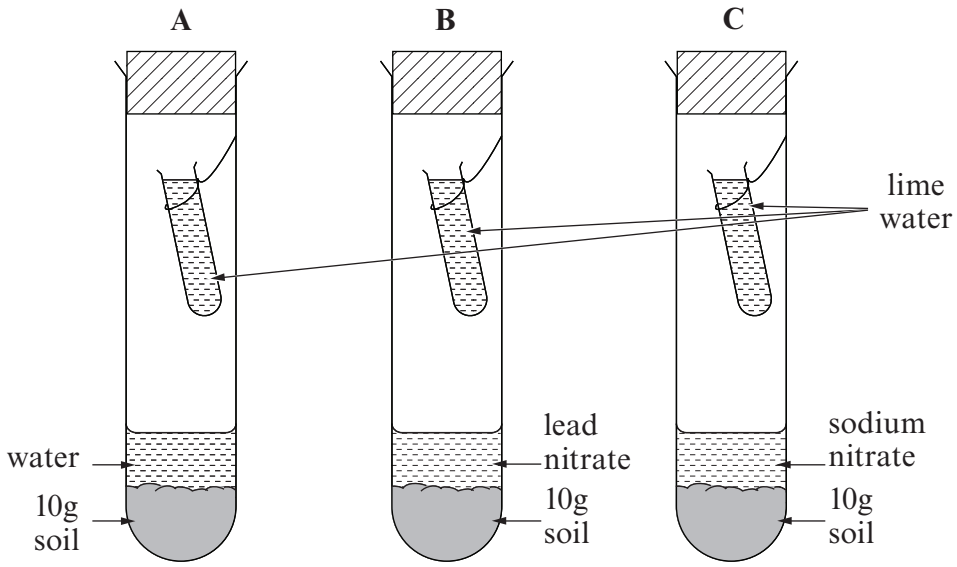
.....

.....

.....

(b) In order to prove that lead caused the decrease in the production of carbon dioxide, an investigation took place using the following apparatus.

NOTE: Lime water changes from clear to milky in the presence of carbon dioxide.



The apparatus was left for 24 hours and the results were as follows:

	Tube		
	A	**B**	**C**
Lime water	milky	clear	milky

STEMUP.CO.UK

Examiner only

(i) Explain the results in **B**. [2]

.....

.....

.....

(ii) Explain the purpose of sodium nitrate in **C**. [1]

.....

.....

(iii) Describe how you would set up a fourth tube D, to show that microorganisms were responsible for causing the colour change in the lime water. [1]

.....

.....

.....

STEMUP.CO.UK

WJEC
CBAC

GCSE MARKING SCHEME

SCIENCE - BIOLOGY
SPEC A (NEW)

JANUARY 2012

STEMUP.CO.UK

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2012 examination in GCSE BIOLOGY – SPEC A (NEW). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

UNIT B1

FOUNDATION TIER

Question	Answer	Mark
1. (a) (i)	Sun/ sunlight/sunshine NOT sun alone	1
(ii)	greenfly(ies); NOT fly	1
(b)	pyramid correct; Blue tit Greenfly	1
(c)	One mark for each correct tick;	3

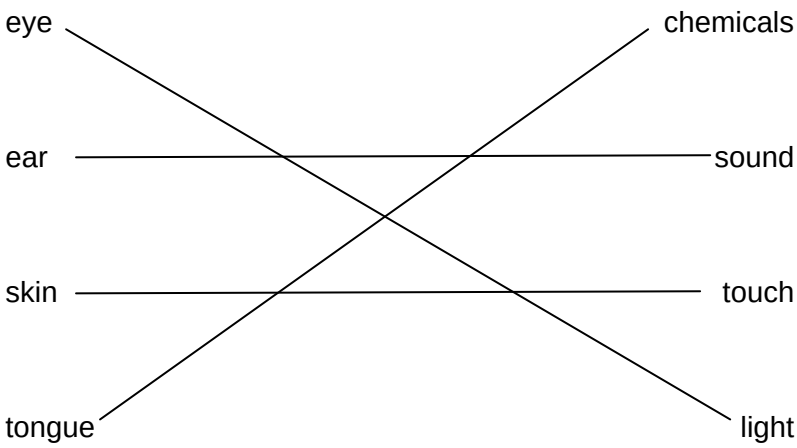
Organism	Feature	Group			
		Plant	Vertebrate	Invertebrate	Microorganisms
Oak tree	has flowers	given			
Greenfly	has no backbone			✓	
Blue tit	has backbone		✓		
Bacteria	Brings about decay				✓

Total for the Question 6

STEMUP.CO.UK

Question	Answer	Mark
2. (a)	C;	3
	A;	
	D;	
(b)	carbon dioxide; (accept CO_2, if written correctly)	1
	NOT CO^2	
(c)	photosynthesis; accept phonetic spelling	1
	Total for the question	**5**

3.



3 or 4 correct;;;	3
2 correct;;	2
1 correct;	1
Total for the Question	**3**

STEMUP.CO.UK

Question	Answer	Mark
4. (a) (i)	I suitable scale on the time axis; If no scale cannot access mark points I or II/ Scale must start at origin and use at least half of grid	1
	II correct plotting ± ½ small square;	2
	III straight line joining the plots;	1
(ii)	rises and plateaus/levels; ecf from graph Accept : goes up and then stays the same	1
(b) (i)	A - sweat gland;	
	B - blood vessel;	2
(ii)	evaporation;	1
(iii)	<table><tr><th>Feature of skin</th><th>Response</th></tr><tr><td>Sweat from sweat gland</td><td>more / **less** / stays the same</td></tr><tr><td>Blood flow in vessels near surface</td><td>more / **less** / says the same</td></tr></table>	
	One for each correct answer;;	2
(iv)	I muscle/erector muscle NOT erector alone	1
	II muscle/X contracts/pulls hair vertical up/hair is pulled up;	2
	Traps air/insulates;	
	Total for the Question	**13**

STEMUP.CO.UK

Question	Answer		Mark
5. (a)	genetic;		1
	sexual;		1
(b)	mutation in a gamete;	✓	1
	broken bone		
	eye colour;	✓	1
	mutation in a skin cell		
	Total for the Question		**4**

STEMUP.CO.UK

Question		Answer		Mark
6.	(a)	i DNA/ dna	accept deoxyribonucleic acid (phonetic)	1
		ii chromosomes		1
		iii protein		1
	(b)	23 and 23		1
		46		1
			Total for the Question	5

STEMUP.CO.UK

FOUNDATION AND HIGHER TIER

Question	Answer	Mark
7/1.(a)	7 Two marks for correct answer; One mark for working if incorrect answer (100 – 93)	2
(b)	Meat, fish, eggs ✓ Fruit and vegetables Bread, rice, potatoes, pasta Milk and dairy foods ✓ Foods and drinks high in fat and/or sugar ✓	
	All three boxes required;	1
(c)	16.5;	1
(d)	reference to comparison; NOT fair testing	1
(e)	Any two from: Overweight/fat/obese/ put on too much weight NOT put on weight mobility problem; joint damage; heart disease/ heart attack NOT heart problems/ damage cholesterol/circulatory disease/stroke/ clogging diabetes; infertility;	2
(f)	energy (store)/membranes/nerves/ insulation NOT keeping warm	1
	Total for the Question	**8**

STEMUP.CO.UK

Question	Answer	Mark
8/2	Indicative content as blood glucose rises (more) insulin released; ref to pancreas; to the liver; in the blood; glucose changed to glycogen; insoluble/stored; ignore references to glucagon	

STEMUP.CO.UK

Question	Answer		Mark
8.	**QWC Marking**		
	Indicative content:		
	5 - 6 marks	The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.	
	3 - 4 marks	The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.	
	1-2 marks	The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.	
	0 marks	The candidate does not make any attempt or give a relevant answer worthy of credit.	

STEMUP.CO.UK

Question		Answer	Mark
9/3 (a)	(i)	increased (allow slower) reaction time/impaired judgement/	1
		lose concentration/ adverse effect on nervous system	
		NOT car crash/ reduces reaction time/ slows nerve impulses	
	(ii)	effect starts even at low alcohol level	1
		NOT stops any chance of alcohol affecting the driver/ some	
		People are more affected than others	
	(b)	dependency idea/ craves/ hard to give up/ can't live without	
		it/ keep wanting more NOT hooked	
		withdrawal symptoms idea/ cold turkey	2
		Total for the Question	**4**
10/4	(a)	21.3; one mark for working (710 x0.03) or two marks for correct answer if no working	2
	(b)	Any two from	2
		food; NOT named food e.g. nuts	
		water;	
		space/ area NOT land	
		habitat/ places to live NOT homes/ shelter	
	(c)	Any two from	2
		disease;	
		predation;	
		adverse weather, cold, drought/ global warming	
		NOT weather/ climate	
		pollution;	
		'management'/hunting/ culling/ poisoning/ shooting	
		Not able to find a mate	
		Total for the Question	**6**

STEMUP.CO.UK

HIGHER TIER

Question	Answer	Mark
5. (a) (i)	7.5	1
(ii)	4.5 / 4 ½ ;	1
(b) (i)	either: any two from receptor/sensory cells; impulses/ electrical signals NOT message/ electric signal along sensory neurones/nerves; or: in the blood; in the form of heat;	2
(ii)	Any two from Vasodilation/ dilate/increase in width/ diameter/ get wider NOT bigger/ expand/ thicker/ nearer to surface more blood; radiation/conduction;	2
	Total for the Question	**6**

STEMUP.CO.UK

Question	Answer	Mark
6. (a)	(Genetic) profile/genetic code/ profiling NOT fingerprinting	1
(b)	Captive tortoises would have all the same patterns	1
	NOT similar	
	(Ref to 'It' = wild population of tortoise)	
	Wild populations would all be different to captive tortoises	1
	Total for the question	**3**
7. (a) (i)	Photosynthesis	1
(ii)	0.5 no unit needed	1
(b)	5120kJ Unit must be unambiguous	1
(c)	Herbivores are more active/ move more or converse/ higher	1
	metabolic rate NOT herbivores excrete	
(d)	Decay/decomposition/ bacteria break down	1
	NOT it breaks down	
	urea to ammonia	1
	ammonia to nitrates	1
	which are taken up by plants and used to make <u>protein</u>	1
	Total for the Question	**8**

STEMUP.CO.UK

Question	Answer	Mark
8.	Indicative content: Few predators/no virus/other answers relating to availability of food/space/suitable climate. Mutation caused resistance/ immunity caused variation which was an advantage/had survival value allowed survival of the fittest TO BREED (Mutated) GENE passed on	
	Total for the Question	**6**

STEMUP.CO.UK

QWC Marking

Question	Answer	Mark
8.	Indicative content:	
	5 - 6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.	
	3 - 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.	
	1 - 2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.	
	0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.	

STEMUP.CO.UK

Question	Answer	Mark
9. (a) (i)	Continuous: bell-shaped bar profile NOT continuous line	1
	Discontinuous: Two bars or more – different heights	1
(ii)	Continuous	
(b) (i)	B b B BB Bb b bB bb	
	Gametes	1
	Cross	1
(ii)	Shows discontinuous variation	1
	Plain is dominant/banded recessive	1
	NOT plain is more/ most dominant	
	Total for the Question	**7**

STEMUP.CO.UK

Question	Answer	Mark
10. (a) (i)	By microorganisms / bacteria/ microbes/ fungi	1
	as a result of respiration NOT respirate/ breathe	1
(b) (i)	Lead killed bacteria/fungi/decomposers OR denatured enzymes/ lead stops bacteria respiring/ working	1
	No carbon dioxide produced	1
(ii)	To show lead was responsible (and not nitrate)/to show nitrate was not responsible (but lead was) (not: as a control)	1
(iii)	sterilised soil/ disinfected soil/ use boiled soil/ use soil with dead microbes NOT soil with no micro-organisms(same volume of reagents as tube A or C)	
	Total for the Question	**6**

STEMUP.CO.UK