

GCSE

WJEC GCSE

The Sciences (Double Award)

Approved by Qualifications Wales

Sample Assessment Materials

Unit 4: Biology - Continuity of Life
Foundation Tier

Teaching from 2026
For award from 2028



This Qualifications Wales regulated qualification is not available to centres in England.

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Surname	Centre number	Candidate number
First name(s)		0



GCSE

3455U4

**The Sciences (Double Award) – Unit 4
Biology - Continuity of Life**

FOUNDATION TIER

1 hour 15 minutes

**SAMPLE ASSESSMENT
MATERIALS**

Additional materials

A calculator and ruler are permitted.

Instructions to candidates

Use black ink or black ball-point pen. Do **not** use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

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

Answer **all** questions.

For examiner's use only		
Question	Maximum mark	Mark awarded
1.	5	
2.	5	
3.	10	
4.	9	
5.	11	
6.	8	
7.	6	
8.	10	
Total	64	

Write your answers in the spaces in this booklet. If you need more space, use the additional page(s) at the back of this booklet. Number the question(s) correctly.

Information for candidates

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

The total number of marks available is **64**.

You should think carefully about how you use your time.

Your responses must be clear, accurate and well presented.

Answer **all** questions

1. There are two types of cell division, mitosis and meiosis.

(a) Underline the purpose of meiosis from the following list:

Growth of organism

Repair of tissues

Production of gametes

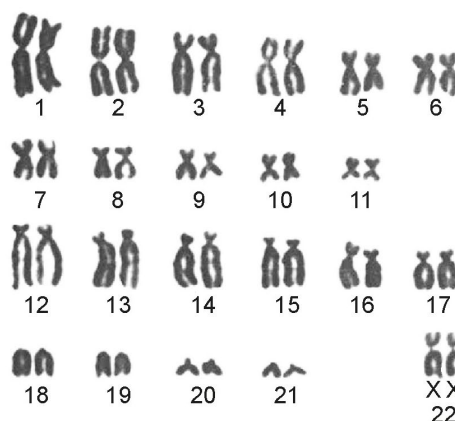
[1]

- (b) **Image 1.1** shows a rabbit and **Image 1.2** shows the chromosomes from a body cell of a female rabbit.

Image 1.1



Image 1.2



- (i) State how many chromosomes are in the body cell of a rabbit.

[1]

.....

- (ii) I Circle which of the following pairs of chromosomes in **Image 1.2** would differ if it showed the chromosomes from a male rabbit.

[1]

Pair 1

Pair 7

Pair 21

Pair 22

- II Describe how they would be different.

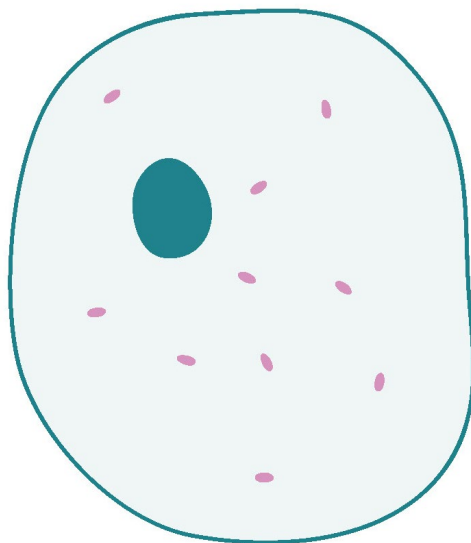
[1]

.....

.....

Image 1.4 is a diagram of a rabbit cell.

Image 1.4



- (c) Draw an arrow on **Image 1.4** to show where the chromosomes are found in a cell.

[1]

5

2. (a) A farmer used a fertiliser containing nitrate in the fields to increase the yield of his crop. The fields were close to a lake and resulted in the death of the fish in the lake.

The steps below explain how the fertiliser caused the death of the fish, but they are in the wrong order.

1. Plants die due to lack of light.
2. Bacteria decompose dead plants.
3. Nitrates from fertilisers are washed into the lake by rainwater.
4. Fish suffocate and die due to low oxygen levels.
5. Algal blooms form on the surface of water, blocking sunlight from reaching other plants.
6. Bacteria use up oxygen in the water.

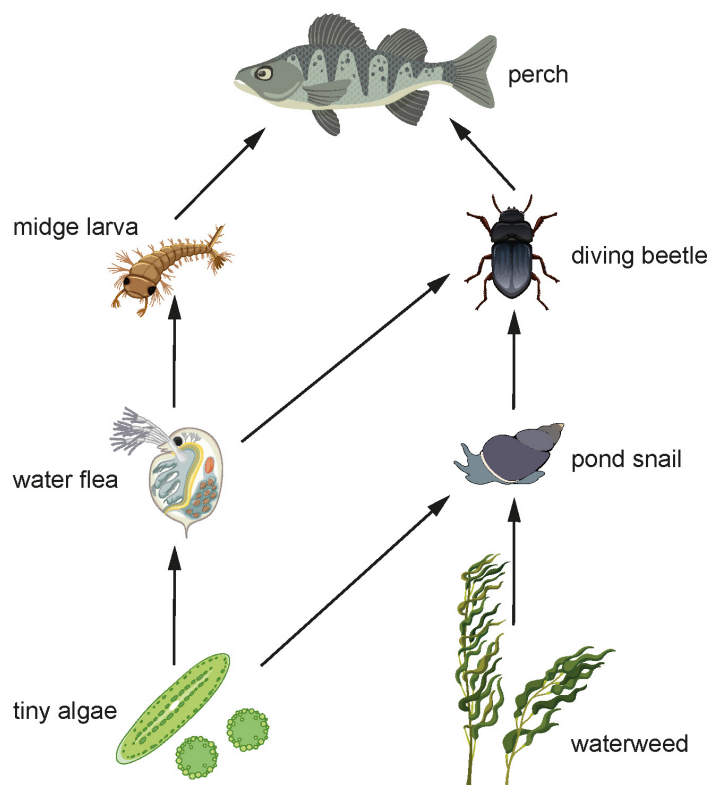
Place the steps in the correct order in the boxes below.
Two have been done for you.

[3]

	5				4
--	---	--	--	--	---

- (b) **Image 2** shows a food web from the lake.

Image 2



Use the food web in **Image 2** to answer the following questions.

- (i) Underline the correct number of secondary consumers in the food web in **Image 2** from the choices below.

[1]

one

two

three

four

- (ii) Conclude why the number of water fleas increased after the fertiliser was used.

[1]

.....

.....

3. Image 3.1 and Image 3.2 show two different breeds of Welsh horses.

Image 3.1 - Welsh Section D



Image 3.2 - Welsh Section A



- (a) (i) These horses show variation.
Tick (✓) the correct definition of the term variation shown in these horses from the choices below.

[1]

Differences between individuals of different species	☐
Similarities between individuals of the same species	☐
Differences between individuals of the same species	☐
Similarities between individuals of different species	☐

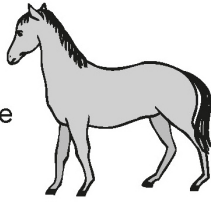
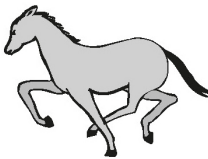
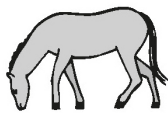
- (ii) Variation is due to **genes**, the **environment** or **both**.
Complete the following table by putting ticks in the boxes to show the cause(s) of variation for each of the characteristics shown. One row has been done for you.

[3]

Characteristic	Caused by genes	Caused by the environment
Height	✓	✓
Weight		
Fur colour		
Eye colour		
Scars		

- (b) **Image 3.3** shows the fossil record of the horse. This provides evidence for how the horse has evolved over time.

Image 3.3

1 million years ago	Modern horse			height: 1.6 m
10 million years ago	Pilohippus			height: 1.0 m
30 million years ago	Merychippus			height: 1.0 m
40 million years ago	Meshippus			height: 0.6 m
60 million years ago	Eohippus			height: 0.4 m

The horse evolved due to a change in the environment.

- The modern horse lives on hard ground with short grass.
- When Eohippus lived 60 million years ago, the ground was much softer, and the grass was much taller.

- (i) Underline the name of the process which explains how the horse evolved over time.

[1]

Natural selection

Artificial selection

Selective breeding

- (ii) Use **Image 3.3** to describe **one** way that the horse has changed to adapt to the change in the environment.

Suggest **one** reason why this change is an advantage.

[2]

Change

Advantage

.....

- (iii) Suggest what would have happened to the horse if it had not been able to adapt to the changing environment.

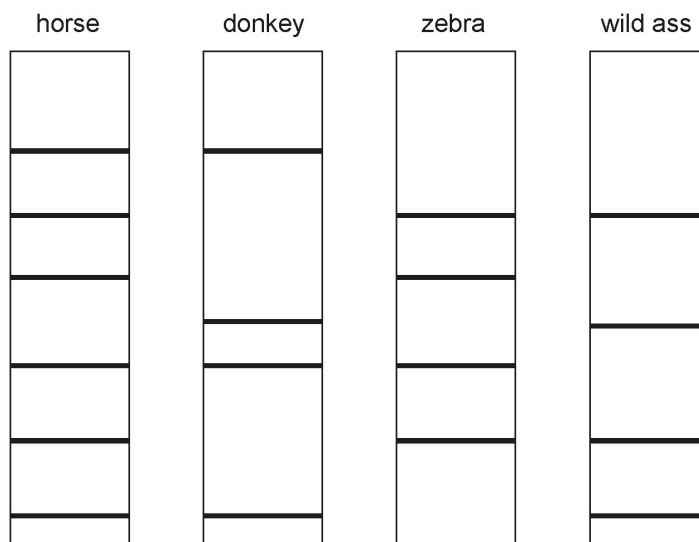
[1]

.....

.....

- (c) Genetic profiling can be used to show how closely related different organisms are. **Image 3.4** shows the genetic profile of the horse, the donkey, the zebra and the wild ass.

Image 3.4



Use **Image 3.4** to state which species is most closely related to the horse and give a reason for your answer.

[2]

Species

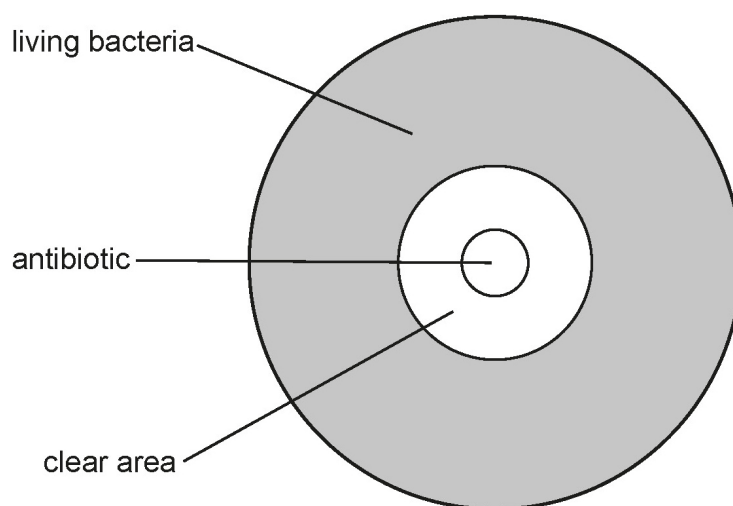
Reason

.....

4. A scientist working for the Royal Glamorgan Hospital investigated three antibiotics which acted against a bacterium that caused infection in humans. They investigated which antibiotic was the most effective at treating infection. They added three antibiotics (**A**, **B** and **C**) one each to the centre of three agar plates which contained the bacteria. The plates were then incubated for 3 days.

Image 4.1 shows one of the plates after 2 days.

Image 4.1



- (a) Identify which of the following temperatures the agar plates should have been incubated at in the hospital laboratory.

[2]

Circle your answer and state the reason for your choice.

10 – 15°C

20 – 25°C

35 – 40°C

40 – 45°C

Reason

.....

- (b) (i) Suggest how the antibiotic moved through the agar and caused the clear area.

[2]

.....

.....

.....

.....

The scientist measured the diameter of the clear area for each of the plates every day. The results are recorded in **Table 4.2**.

Table 4.2

Antibiotic	Diameter of clear area (mm)		
	Day 1	Day 2	Day 3
A	18		42
B	29	39	45
C	16	38	67

- (ii) Complete **Table 4.2** by measuring the diameter of the clear area on **Image 4.1**. Write your answer in the table.

[1]

- (iii) State which antibiotic was **quickest** to act against the bacteria.

Give **one** reason for your answer.

[2]

Antibiotic

Reason

.....

- (iv) Antibiotics are taken by patients in the hospital for **5 days**.

Suggest which antibiotic the scientist would advise the hospital to use to treat bacterial infections in the Royal Glamorgan Hospital. Give **one** reason for your answer.

[2]

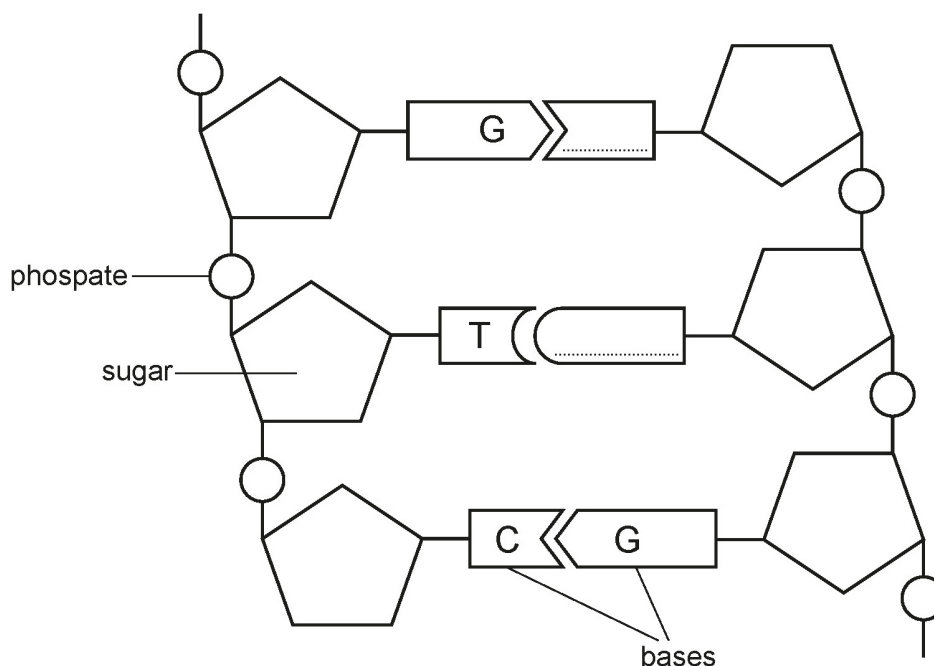
Antibiotic

Reason

.....

5. (a) **Image 5.1** shows the structure of DNA.

Image 5.1



- (i) Complete **Image 5.1** by adding the missing bases. [1]
- (ii) In a section of DNA, 20% of the bases are **G**. Calculate the percentage of bases that would be **T**. [2]

Space for working:

Percentage of **T** bases = %

- (iii) Choose terms from the box below to complete the sentences about DNA. [3]

double helix	dominant	gene	vacuole	nucleus
---------------------	-----------------	-------------	----------------	----------------

- DNA is found in a structure called the
- A short section of DNA is called a which codes for a certain characteristic.
- The shape of DNA is a

- (b) The coat colour of a cocker spaniel is controlled by a gene which has two alleles. The dominant allele **G** codes for black fur, as shown in **Image 5.2**. The recessive allele **g** gives brown fur as shown in **Image 5.3**.

Image 5.2**Image 5.3**

A dog breeder crossed two cocker spaniel dogs with black fur on five occasions. The phenotypes of the offspring produced are shown in **Table 5.4**.

Table 5.4

Cross number	Numbers of offspring	
	Black	Brown
1	4	2
2	6	1
3	5	3
4	6	2
5	6	1
Total		

- (i) Complete **Table 5.4** by calculating the totals for each phenotype. [1]
- (ii) Calculate the overall ratio of black to brown. [1]

Ratio = black : brown

- (iii) The genotypes of the two parent dogs which the breeder crossed were both heterozygous - **Gg**.

Complete the Punnett square below to show a cross between these two parent dogs.

[2]

Gametes		

- (iv) The breeder crossed a homozygous black dog with a homozygous brown dog.

Circle from the choices below the probability the offspring with the brown phenotype would be produced.

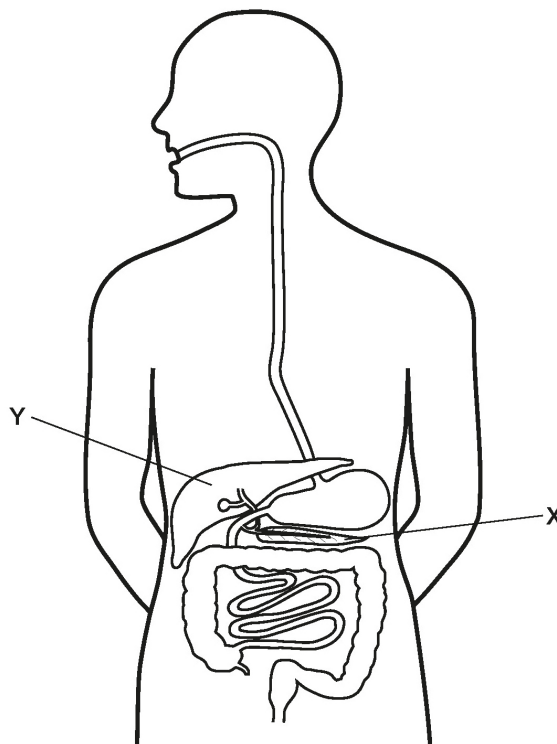
[1]

0% 25% 50% 75% 100%

6. The hormone insulin controls the concentration of glucose in the blood so that it normally remains within a narrow range.

Image 6.1 shows part of the human body with two labelled organs **X** and **Y**.

Image 6.1



- (a) (i) Insulin is produced in organ **X**.

State the name of organ **X**.

[1]

.....

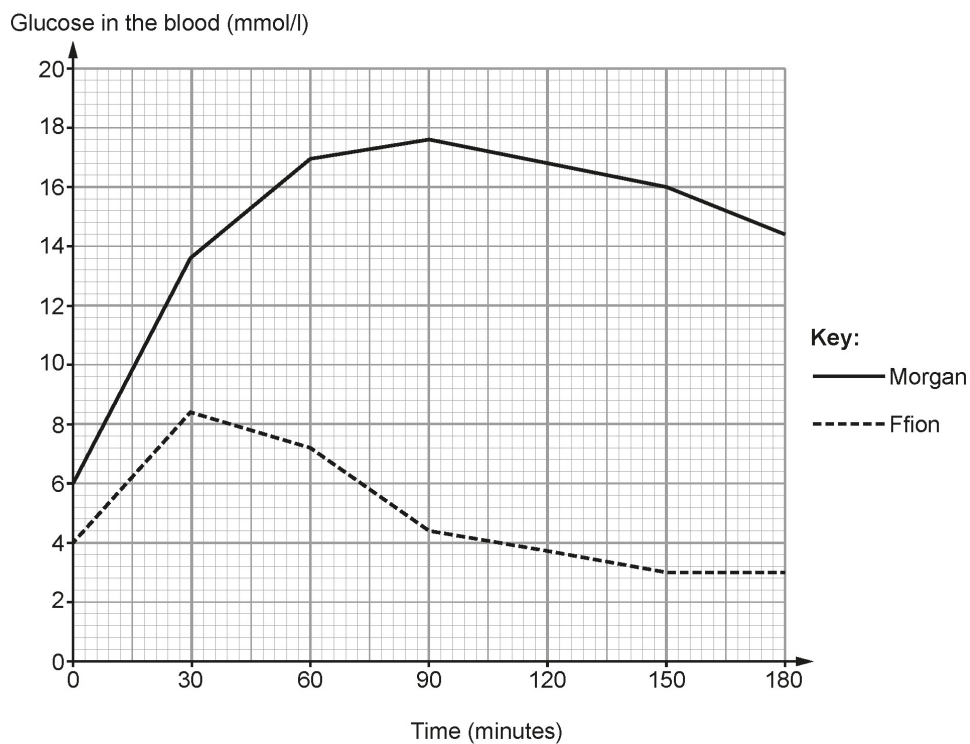
- (ii) State how insulin travels from organ **X** to organ **Y**.

[1]

.....

- (b) Morgan and Ffion ate identical sandwiches. After eating the sandwiches, the concentration of glucose in their blood was measured every 30 minutes for 180 minutes. **Graph 6.2** shows the results.

Graph 6.2



- (i) Describe the change in glucose in the blood for Ffion. [1]

.....

- (ii) The sandwich did not contain glucose.
Circle which of the following could have caused the change in glucose concentration when the sandwich was eaten. [1]

Fats Starch Protein Vitamins

- (iii) **Graph 6.2** suggests that Morgan has the medical condition diabetes.

Give **one** piece of evidence from **Graph 6.2** that suggests that Morgan has this medical condition. [1]

.....

(iv) To diagnose this medical condition, urine is tested for the presence of glucose.

Examiner
only

I **Underline** the correct chemical test for glucose from the list below. [1]

Biuret test

Benedict test

Iodine test

II **Underline** the correct process for the test for glucose from the list below. [1]

Mix with urine

Mix with urine and cool in the refrigerator

Mix with urine and heat strongly

III Conclude the colour that would be seen at the end of this chemical test for a patient who has diabetes. [1]

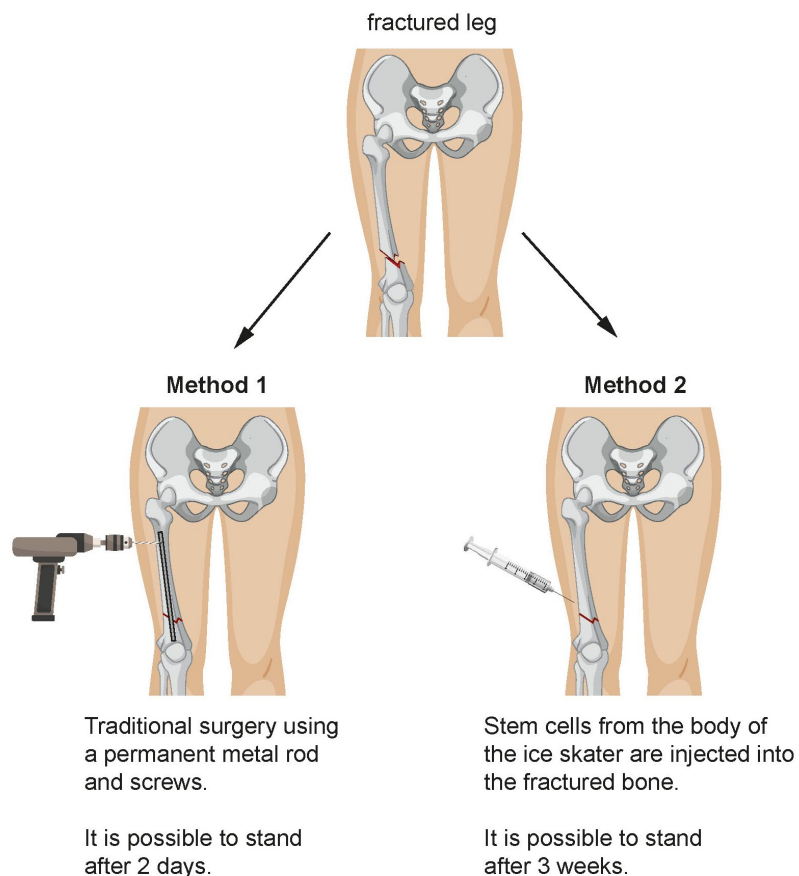
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8

7. An ice skater falls and fractures their leg in an ice rink in South Wales.

Image 7.1 shows two ways that the fractured leg could be treated in a large modern hospital.

Image 7.1



The expected results of treatment are shown in **Table 7.2**.

Table 7.2

Time after treatment (weeks)	Percentage of bone healing (%)	
	Traditional surgery	Injection of stem cells
10	10	12
20	14	25
30	19	38
40	28	55
50	41	70
60	59	82

- (a) (i) Give **one** reason why the ice skater might choose traditional surgery. [1]

.....

.....

- (ii) I. State the meaning of the term stem cell. [1]

.....

- II. Give **one** reason why the ice skater might prefer to be treated by an injection of stem cells. [1]

.....

.....

(b) Adult and embryonic stem cells are used in medicine and for medical research.

Examiner
only

- (i) Explain why adult stem cells from the body of the ice skater are less likely to be rejected than those from embryonic stem cells.

[2]

.....

.....

.....

.....

- (ii) Give **one** reason why some people have a strong personal objection to the use of embryonic stem cells in medical research.

[1]

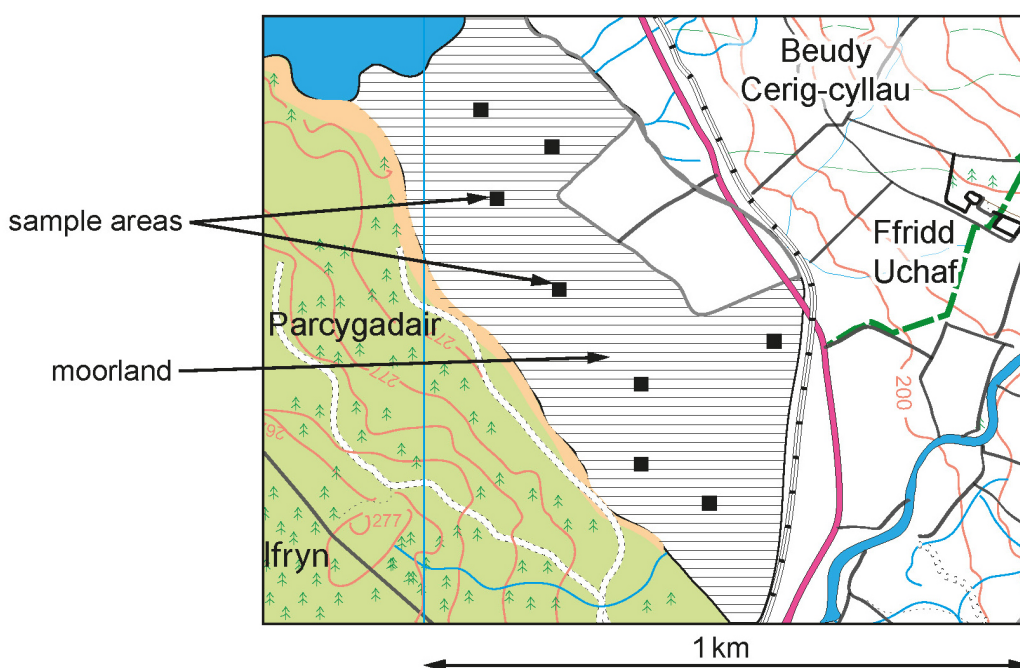
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6

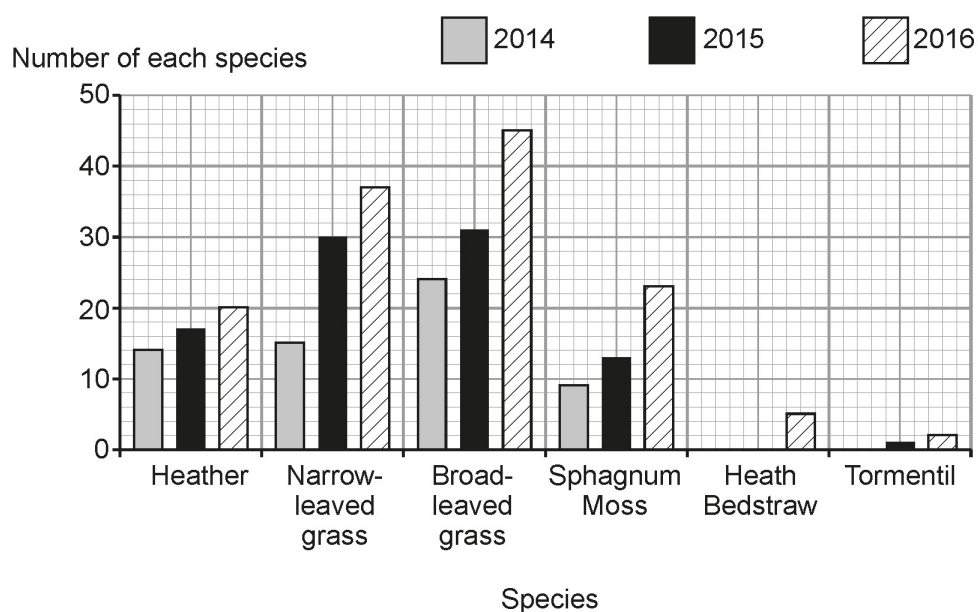
8. A group of students investigated the biodiversity of a moorland in Gwynedd over a period of three years. Two years before the investigation started, the drainage ditches in the moorland had been closed to increase the water content of the land. **Image 8.1** is a map showing the moorland (shaded area) being investigated. The black squares represent locations of eight sample areas. Each sample area is 625 m^2 ($25 \text{ m} \times 25 \text{ m}$).

Image 8.1



The results of the survey are shown in **Graph 8.2**.

Graph 8.2



- (a) Describe how students would have used quadrats to investigate the abundance of plant species in the moorland.

[2]

.....

.....

.....

.....

- (b) (i) Use the formula to calculate the percentage change in the number of narrow-leaved grass between 2014 and 2016.

[2]

$$\text{Percentage change} = \frac{\text{number of each species in 2016} - \text{number of each species in 2014}}{\text{number of each species in 2014}} \times 100$$

Percentage change = %

- (ii) Suggest **one** abiotic factor and **one** biotic factor that could have affected the number of narrow-leaved grass between 2014 and 2016.

[2]

Abiotic factor

Biotic factor

- (iii) The students concluded that the biodiversity of the moorland had increased between 2014 and 2016.

State **two** pieces of evidence from **Graph 8.2** that support the conclusion made by the students.

[2]

.....

.....

.....

.....

- (c) (i) Suggest why the students sampled several areas over the whole moorland.

[1]

Examiner
only

.....

.....

- (ii) Suggest the variables that should have been controlled over the three years, to ensure the investigation was valid.

[1]

.....

.....

10

END OF PAPER

**THE SCIENCES (DOUBLE AWARD)
UNIT 4**

Biology: Continuity of Life

FOUNDATION TIER

MARK SCHEME

Guidance for examiners

Generic marking principles

- Marks awarded are always whole marks (not half marks, or other fractions).
- Answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.
- Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
- Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Positive marking

It should be remembered that candidates are writing under examination conditions and credit should be given for what the candidate writes, rather than adopting the approach of penalising candidates for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Marks should not be deducted for a less than perfect answer if it satisfies the criteria of the mark scheme.

For questions that are objective or points-based, the mark scheme should be applied precisely. Marks should be awarded as indicated and no further subdivision made.

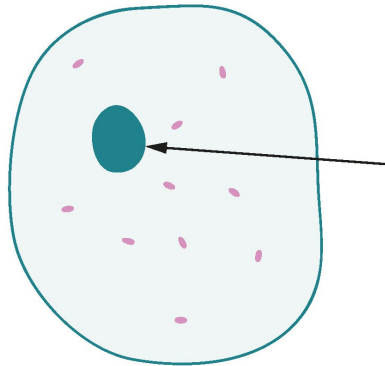
Mark schemes often list points which may be included in candidates' answers. The list is not exhaustive. The inclusion of '*Credit any other valid response.*' (or similar instruction) within mark schemes allows for the possible variation in candidates' responses. Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme. Credit should be given according to the accuracy and relevance of candidates' answers.

Appropriate terminology is reflected in exemplar responses in mark schemes. However, unless there is a specific requirement within a question, candidates may be awarded marks where the answer is accurate but expressed in their own words.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

ecf = error carried forward
bod = benefit of doubt

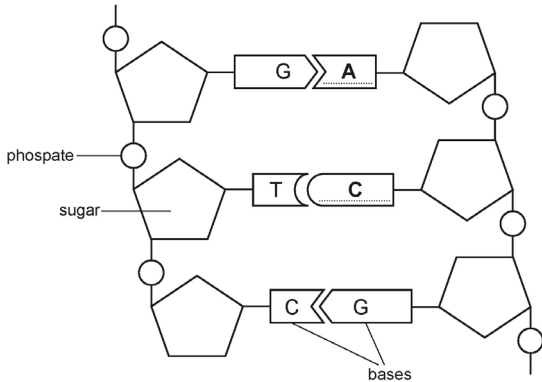
Question				Marking details		Marks available					
						AO1	AO2	AO3	Total	Maths	Enquiry Skills
1.	(a)		<u>Production of gametes</u>		1			1			
	(b)	(i)	44 (1)			1		1			
		(ii)	I	Pair 22		1		1			
			II	They would be XY		1		1			
	(c)	{Arrow/line} to nucleus									1
						1		1			
Question 1 total					1	4	0	5	0	0	1

Question				Marking details	Marks available						
					AO1	AO2	AO3	Total	Maths	Enquiry Skills	Connections Relationships
2.	(a)	3 (5) 1 2 6 (4)				3		3			
		Accept 3 (5) 1 6 2 (4) All 4 correct = 3 marks 3 correct = 2 marks 2 correct = 1 mark									
	(b)	(i)	two			1		1			1
		(ii)	Increase in algae mean the water fleas have more food				1	1			1
Question 2 total					0	4	1	5	0	0	2

Question			Marking details	Marks available																								
				AO1	AO2	AO3	Total	Maths	Enquiry Skills	Connections Relationships																		
3.	(a)	(i)	Differences between individuals of the same species	1			1																					
		(ii)	<table border="1"><thead><tr><th>Characteristic</th><th>Caused by genes</th><th>Caused by the environment</th></tr></thead><tbody><tr><td>Height</td><td>✓</td><td>✓</td></tr><tr><td>Weight</td><td>✓</td><td>✓</td></tr><tr><td>Fur colour</td><td>✓</td><td></td></tr><tr><td>Eye colour</td><td>✓</td><td></td></tr><tr><td>Scars</td><td></td><td>✓</td></tr></tbody></table> All rows correct = 3 marks 3 rows correct = 2 marks 2 rows correct = 1 mark	Characteristic	Caused by genes	Caused by the environment	Height	✓	✓	Weight	✓	✓	Fur colour	✓		Eye colour	✓		Scars		✓		3		3			
Characteristic	Caused by genes	Caused by the environment																										
Height	✓	✓																										
Weight	✓	✓																										
Fur colour	✓																											
Eye colour	✓																											
Scars		✓																										
	(b)	(i)	Natural selection underlined	1			1																					
		(ii)	Horses have become taller (1) Advantage because they can see further/run faster (1) Or Feet have become harder/only one toe (1) Advantage because they can run faster (1)			2	2																					
		(iii)	Become extinct			1	1																					

	(c)		Zebra (1) Shares {most bands/more bands than the others} (1)			2	2		2	
Question 3 total				2	3	5	10	0	2	0

Question			Marking details	Marks available						
				AO1	AO2	AO3	Total	Maths	Enquiry Skills	Connections Relationships
4.	(a)	35 – 40°C (1) Human body temperature/most suitable to grow human pathogen (1)		1	1		2		2	
	(b)	(i)	<i>Moved by diffusion (1)</i> And killed bacteria (1)		2		2		2	1
		(ii)	Measurement from final script - 25mm	1			1	1	1	
		(iii)	B (1) Largest clear zone on day 1 (1)		1	1	2		2	
		(iv)	C (1) Largest clear zone on day 3 (1)		1	1	2		2	
Question 4 total				2	5	2	9	1	9	1

Question			Marking details	Marks available						
				AO1	AO2	AO3	Total	Maths	Enquiry Skills	Connections Relationships
5.	(a)	(i)	 Both bases correctly added = 1 mark (1)		1		1		1	
		(ii)	30% = 2 marks 1 mark for any of the following: 20+20=40% 100 –40 =60 % 60% / 2		2		2	2		
		(iii)	nucleus (1) gene (1) double helix (1)	3			3			
	(b)	(i)	27 and 9		1		1			
		(ii)	3:1		1		1	1		

		(iii)	<table><tr><td>Gametes</td><td>G</td><td>g</td></tr><tr><td>G</td><td>GG</td><td>Gg</td></tr><tr><td>g</td><td>Gg</td><td>gg</td></tr></table>	Gametes	G	g	G	GG	Gg	g	Gg	gg		2		2			
Gametes	G		g																
G	GG		Gg																
g	Gg		gg																
		Gametes correct (1)																	
		Mechanism correct (1) ecf from gametes																	
		(iv)	0% circled			1	1												
Question 5 total				3	7	1	11	3	1	0									

Question				Marks available						
				AO1	AO2	AO3	Total	Maths	Enquiry Skills	Connections Relationships
6.	(a)	(i)	pancreas		1		1			
		(ii)	In the blood		1		1			
	(b)	(i)	Increase and decrease/return to normal			1	1			
		(ii)	<i>Starch</i> circled				1		1	1
		(iii)	Blood glucose increases more/ Stays high for longer/longer to return to normal (1)				1			
		(iv)	I	<i>Benedict test</i>	1		1		1	1
			II	Mix with urine and <i>heat strongly</i>	1		1		1	1
			III	<i>Green/yellow/orange/red</i>			1		1	1
Question 6 total					4	1	3	8	0	4

Question				Marking details		Marks available					
						AO1	AO2	AO3	Total	Maths	Enquiry Skills
7.	(a)	(i)	Traditional: can stand sooner/ after two days(1) Reject stand sooner because bone healed			1		1		1	
		(ii)	I	An undifferentiated cell that can become specialised (1)	1			1			
			II	Stem cell: faster healing/ higher percentage of bone healing / less invasive (1)		1		1		1	
	(b)	(i)	Any two (×1) from (Adult) stem cells from the ice skater {are recognised as self / have the same antigens} (1) - Immune response not triggered (1) - because the (adult) stem cells are genetically identical to (body cells of) the ice skater (1) Accept reverse answers if candidate refers to embryonic stem cells			2		2			
		(ii)	(The belief that) {taking/destroying} a {(potential) life/ embryo} (is wrong) (1) Reject references to babies/the foetus/emotive expressions		1			1		1	
Question 7 total					2	4	0	6	0	3	0

Question			Marking details	Marks available						
				AO1	AO2	AO3	Total	Maths	Enquiry Skills	Connections Relationships
8.	(a)	Any two (×1) from: • Correct reference to setting up a grid/ use a transect (1) • Correct reference to generation of <u>random</u> co-ordinates/ placing quadrat at regular intervals (1) • Count number of plants of each species (1)		2			2		2	
	(b)	(i)	= 146.666666666667% (2) Accept any correct rounding If incorrect award 1 mark (1) for (37-15)/15 x 100 Or Correct calculation incorrectly rounded		2		2	2		
		(ii)	<i>Abiotic factor: (1)</i> Climate / soil pH / soil temperature / water content of soil / waterlogging <i>Biotic factor: (1)</i> Competition for resources / grazing		2		2		2	2
		(iii)	Number of species has increased/new species introduced/more species in 2016 (1) Number of each species has increased (1)			2	2		2	

	(c)	(i)	Any one (×1) from: - To ensure the results were representative of the whole area (1) - To increase confidence in their conclusion (1) - To increase validity of their conclusion (1)			1	1		1	
		(ii)	Any one (×1) from: - Carry out sample at the same time each year (1) - Use same sample {sites/ area} each year (1)			1	1		1	
			Total mark for question 8	2	4	4	10	2	8	2

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question		AO1	AO2	AO3	TOTAL MARK	MATHS	Enquiry Skills	Connections Relationships
Non-overlap	1	1	4	0	5	0	0	1
	2	0	4	1	5	0	0	2
	3	2	3	5	10	0	2	0
	4	2	5	2	9	1	9	1
	5	3	7	1	11	3	1	0
	6	4	1	3	8	0	4	4
	Target	12	24	12	48	4 - 5	6	6
	TOTAL	12	24	12	48	4	16	8
Overlap	7	2	4	0	6	0	3	0
	8	2	4	4	10	2	8	2
	Target	4	8	4	16	1 - 2	2	2
	TOTAL	4	8	4	16	2	11	2
Paper total	Target	16	32	16	64	5-7	8	8
	TOTAL	16	32	16	64	6	27	10