GCSE

WJEC GCSE
The Sciences (Double Award)

Approved by Qualifications Wales

Sample Assessment Materials

Unit 4: Biology - Continuity of Life
Higher Tier

Teaching from 2026
For award from 2028

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

Made for Wales.
Ready for the world.

WJEC would like to thank the students and teachers of Fitzalan High School, Cardiff and Llanwern High School, Newport for their participation in the creation of these covers.

Contents

Surname	Centre number	Candidate number
First name(s)		0

GCSE

3455UD

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

HIGHER 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.	**6**	
2.	**10**	
3.	**8**	
4.	**12**	
5.	**8**	
6.	**5**	
7.	**7**	
8.	**8**	
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.

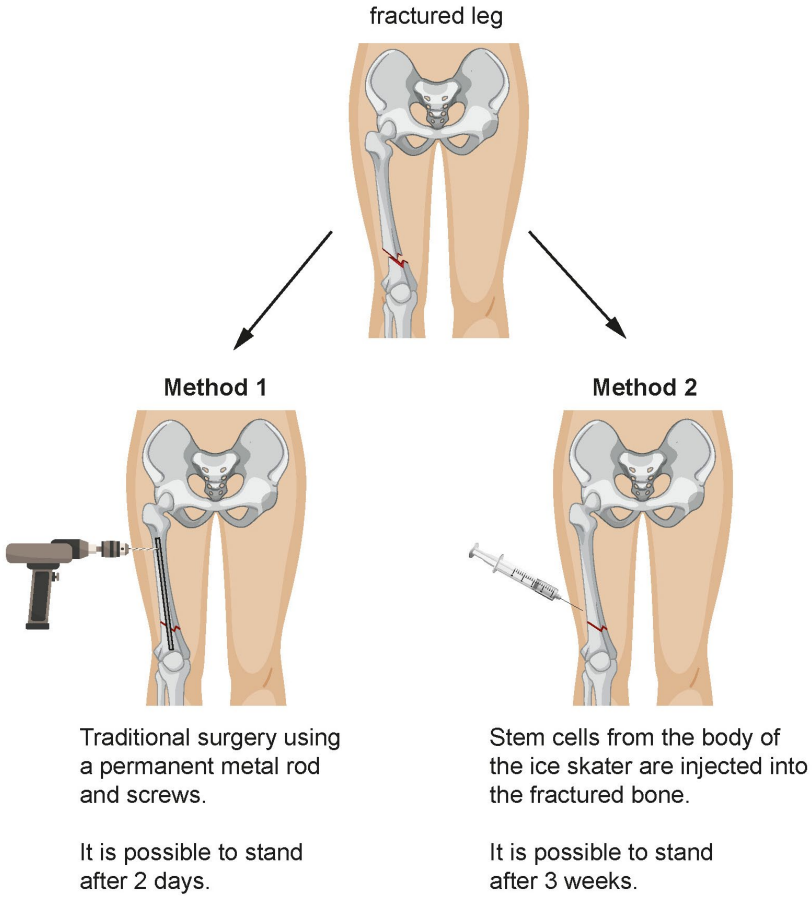
Answer **all** questions

Examiner only

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

Image 1.1 shows two ways that the fractured leg could be treated in a large modern hospital.

Image 1.1



Examiner only

The expected results of treatment are shown in **Table 1.2.**

Table 1.2

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]

……

……

Examiner only

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

(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]

……

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(ii) Give **one** reason why some people have a personal objection to the use of embryonic stem cells in medical research. [1]

……

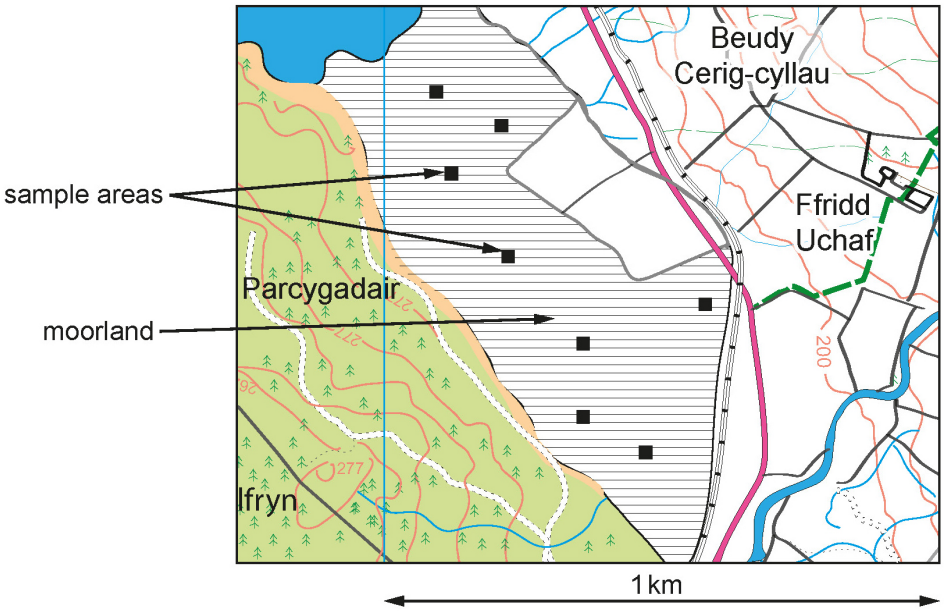
……

6

Examiner only

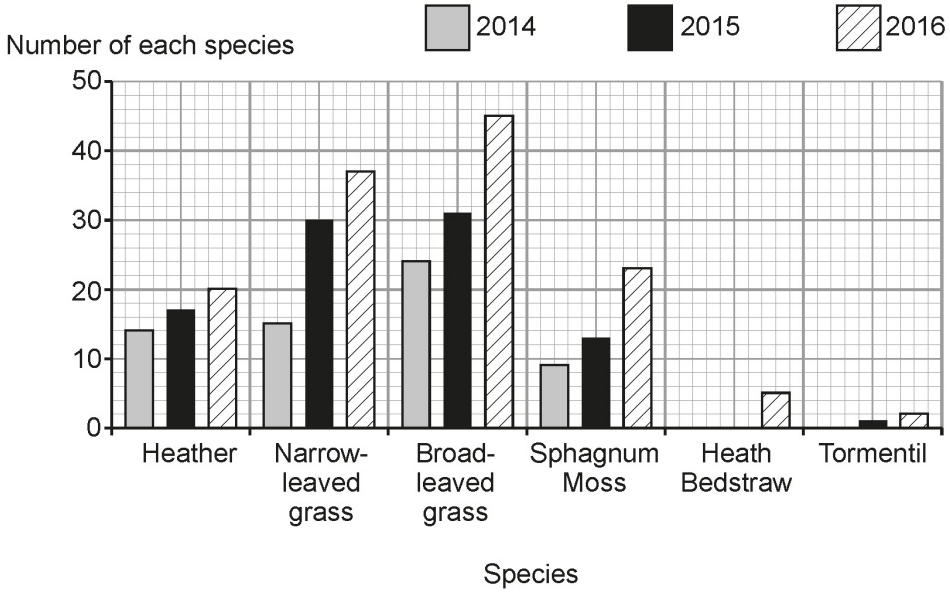
2. A group of students investigated the biodiversity of a moorland in Gwynedd over a period of three years. Two years before the investigation started, the drainage ditches in the moorland had been closed in order to increase the water content of the land. **Image 2.1** is a map showing the moorland (shaded area) being investigated. The black squares represent locations of eight sample areas. Each sample area is 625 m^2 (25 m × 25 m).

Image 2.1



The results of the survey are shown in **Graph 2.2**.

Graph 2.2



(a) Describe how students would have used quadrats to investigate the abundance of plant species in the moorland. [2]

Examiner only

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(b) (i) Use the formula to calculate the percentage change in the number of narrow-leaved grass between 2014 and 2016. [2]

Examiner only

(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 2.2** that support the conclusion made by the students. [2]

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(c) (i) Suggest why the students sampled several areas over the whole moorland. [1]

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(ii) Suggest the variables that should have been controlled over the three years to ensure the investigation was valid. [1]

……

……

10

Examiner only

3. The bacteria *M. luteus* is a non-pathogenic bacterium that can be grown in school laboratories. **Image 3.1** shows an electron microscope image of *M. luteus*.

Image 3.1

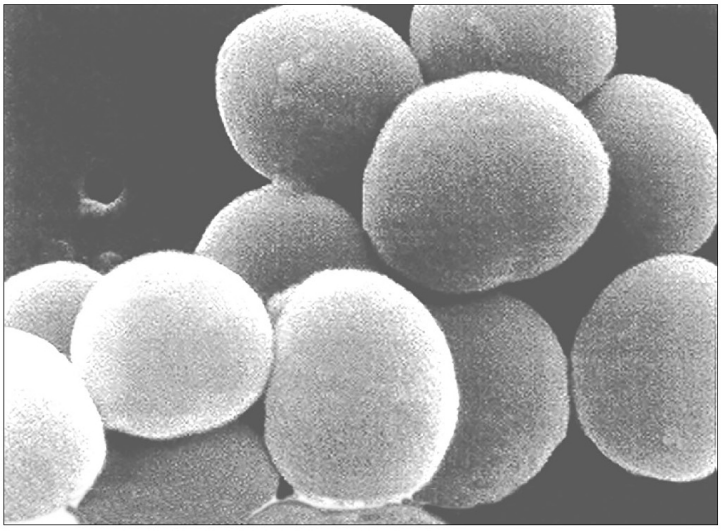
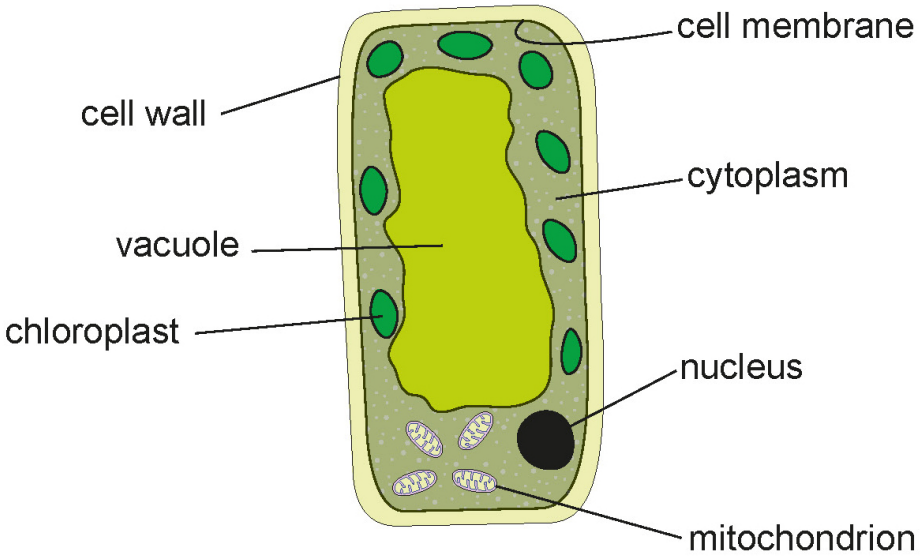


Image 3.2 shows a cell from a plant leaf.

Image 3.2



Examiner only

(a) (i) Name the **two** structures labelled in **Image 3.2** that would also be present in a bacterial cell. [1]

……

……

(ii) In an animal cell, genetic material is carried in a nucleus.
State where genetic material would be found in a bacterial cell. [1]

……

……

(b) The Pharmabees project is a collaboration between the National Botanic Garden of Wales and the University of Cardiff. Part of the project looked at using honey as an antimicrobial substance.

In response to the Pharmabees project, students decided to investigate whether the honey produced in their school beehives had antimicrobial properties. They used the following method.

1. Use forceps to dip a filter paper disc in a solution of the honey.
2. Allow the filter paper to dry for 5 minutes.
3. Use forceps to place the filter paper disc on an agar plate inoculated with the bacteria *M. luteus*.
4. Label the agar plate and incubate for 3 days.
5. Observe the plates after 3 days.

(i) State the purpose of basic aseptic techniques. [1]

……

……

Examiner only

(ii) Give **one** example of a basic aseptic technique that should be used when following the method above. [1]

……

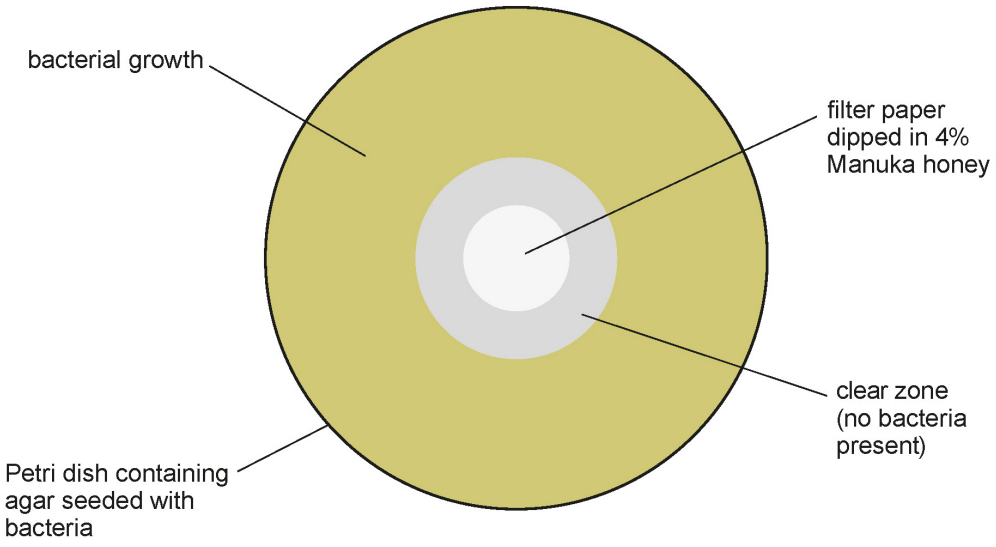
……

(iii) State a suitable temperature to incubate the agar plates in a school laboratory. [1]

…….. °C

(c) **Image 3.3** shows the result for an investigation testing a 4% concentration of manuka honey.

Image 3.3



(i) **Image 3.3** shows a clear zone. Explain why there are no bacteria present in the clear zone. [2]

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(ii) Suggest how the results shown on **Image 3.3** would be different if the bacteria developed resistance to the manuka honey. [1]

Examiner only

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8

Examiner only

4. The beach mouse, *Peromyscus polionotus*, is a species of mouse that lives in North America.

- Hair colour in the beach mouse is controlled by the MC1R gene.
- The MC1R gene codes for the MC1R protein in hair-producing cells.
- The MC1R protein causes hair-producing cells to make large quantities of eumelanin.
- Dark-coloured fur is produced when large quantities of eumelanin is made in hair-producing cells.

(a) A mutation can occur to the MC1R gene. The mutant allele cannot code for the MC1R protein.
If a mouse has two copies of the mutant allele, its hair-producing cells cannot make eumelanin. The mouse will have light-coloured fur. The mutant allele is recessive to the normal allele.

(i) Suggest the genetic term used to describe the genotype of mice that carry **two** copies of the mutant allele. [1]

……

(ii) State **one** environmental factor which could increase the probability of a mutation occurring. [1]

……

……

Examiner only

(b) **Table 4.1** shows the DNA triplet code for different amino acids.

Table 4.1

First letter	Second letter: T	Second letter: C	Second letter: A	Second letter: G	Third letter
T	TTT, TTC **phe**; TTA, TTG **leu**	TCT, TCC, TCA, TCG **ser**	TAT, TAC **tyr**; TAA stop; TAG stop	TGT, TGC **cys**; TGA stop; TGG **trp**	T C A G
C	CTT, CTC, CTA, CTG **leu**	CCT, CCC, CCA, CCG **pro**	CAT, CAC **his**; CAA, CAG **gln**	CGT, CGC, CGA, CGG **arg**	T C A G
A	ATT, ATC, ATA **ile**; ATG **met**	ACT, ACC, ACA, ACG **thr**	AAT, AAC **asn**; AAA, AAG **lys**	AGT, AGC **ser**; AGA, AGG **arg**	T C A G
G	GTT, GTC, GTA, GTG **val**	GCT, GCC, GCA, GCG **ala**	GAT, GAC **asp**; GAA, GAG **glu**	GCT, GGC, GGA, GGG **gly**	T C A G

The DNA base sequences in **Image 4.2** show part of the normal and mutant MC1R alleles found at the same position on a pair of chromosomes. It also shows the order of amino acids for which they code.

(i) Use the information provided in **Table 4.1** to insert the missing amino acids in **Image 4.2.** [2]

Image 4.2

Normal allele	**A C C A A A A A C C G C**
Amino acid sequence	**thr** – **lys** – ……– ……
Mutant allele	**A C C A A A A A C T G C**
Amino acid sequence	**thr** – **lys** – ……– ……

(ii) Explain how the mutant allele will give rise to light-coloured fur. [3]

Examiner only

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(c) A female mouse with dark fur and a male mouse with light fur produce 18 offspring during a period of one year. Ten of the offspring have dark fur and eight have light fur.

(i) **Complete the Punnett square below** to show how the approximate ratio described above can be achieved.

Use the **letter D** to represent the dominant allele and **d** to represent the recessive allele. [3]

Phenotype: Dark fur × Light fur

Genotype: **.....** × **.....**

(ii) State the ratio of mice with dark fur to light fur predicted in the Punnett square. [1]

..... : **.....**

(iii) Suggest why the 18 offspring born during the year do not show the same ratio of fur colour as predicted from the Punnett square. [1]

……

……

Examiner only

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Examiner only

5. On January 7th, 2018, the daytime air temperature in New South Wales, Australia reached 47 °C. By 2040, it is predicted that daytime air temperature in New South Wales could be more than 50 °C.

(a) (i) State why it is important that human body temperature remains between 36.5 °C and 37.5 °C. [1]

……

……

(ii) **Apart from sweating**, explain how the skin would have responded to the conditions in Sydney on January 7th, 2018. [3]

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Examiner only

(b) The temperature experienced by the human body depends on the combined effects of air temperature and relative humidity. **Image 5** shows the temperature experienced by the human body and the potential hazards.

Image 5

Air temperature (°C)	RELATIVE HUMIDITY (%)												
	40	45	50	55	60	65	70	75	80	85	90	95	100
27	27	27	27	27	28	28	28	29	29	29	30	30	31
28	28	28	28	29	29	29	30	31	32	32	33	34	35
29	29	29	29	30	31	32	32	33	34	36	37	38	39
30	30	31	31	32	33	34	35	36	38	39	41	42	44
31	31	32	33	34	35	37	38	39	41	43	45	47	49
32	33	33	35	36	38	39	41	43	45	47	50	53	56
33	34	36	37	38	41	42	44	47	49	52	55	58	
34	36	38	39	41	43	46	48	51	54	57			
36	38	40	42	44	47	49	52	56					
37	41	43	45	47	51	53	57						
38	43	46	48	51	54								
39	46	48	51	54									
40	48	51	55										
41	51	54											
42	54												
43	58												

Potential hazard
Caution
Fatigue possible
Extreme Caution
Sunstroke, muscle cramps, and/or heat exhaustion possible
Danger
Sunstroke, muscle cramps, and/or heat exhaustion likely
Extreme Danger
Possible death from heat stroke

(i) At 06:00 on the 13th of January 2018, the air temperature in New South Wales was 36 °C and the relative humidity was 70%.

Use **Image 5** to state the temperature experienced by the human body and the potential hazard arising. [2]

Temperature experienced by the human body

…… °C

Potential hazard

……

……

(ii) Individuals need to replace water that is lost during sweating. Too much sweating and not drinking enough water can cause dehydration. Dehydration makes blood plasma more concentrated compared to the cytoplasm of cells.

Explain how dehydration can be harmful to the cells of the human body. [2]

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Examiner only

8

Examiner only

6. **Table 6** shows recommended guidelines from NHS Wales for lifestyle factors that affect health. **Table 6** also shows data for two 30-year-old male individuals, **A** and **B**.

Table 6

		Individual	
Lifestyle factors	Recommended guidelines	**A**	**B**
energy intake (kJ/day)	7 500 – 8 800	9 500	7 600
tobacco smoking (cigarettes per day)	0	0	25 – 40
alcohol (units per week)	< 14	27	0
exposure to UV light from the sun	low – moderate	low	moderate – high

Use **Table 6** to compare how the lifestyle of individuals **A** and **B** could increase their risk of developing non-communicable diseases. [5]

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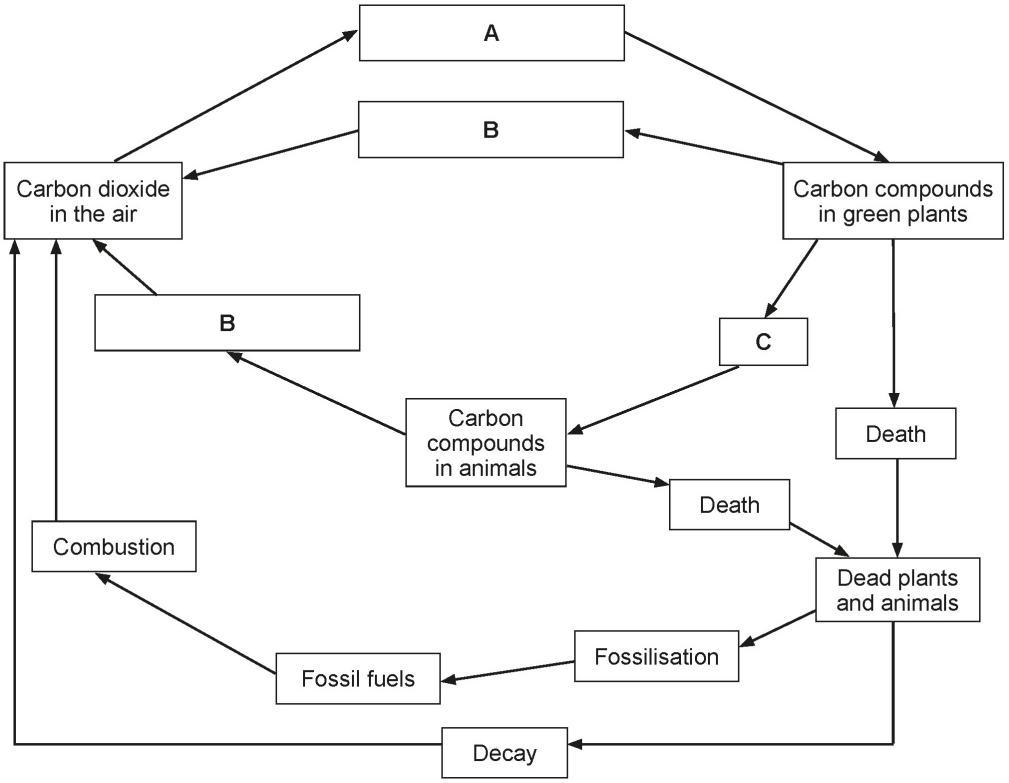
5

Examiner only

7. (a) **Image 7.1** shows the carbon cycle.

Image 7.1



Identify processes **A**, **B** and **C** shown on **Image 7.1**. [3]

A .....

B .....

C .....

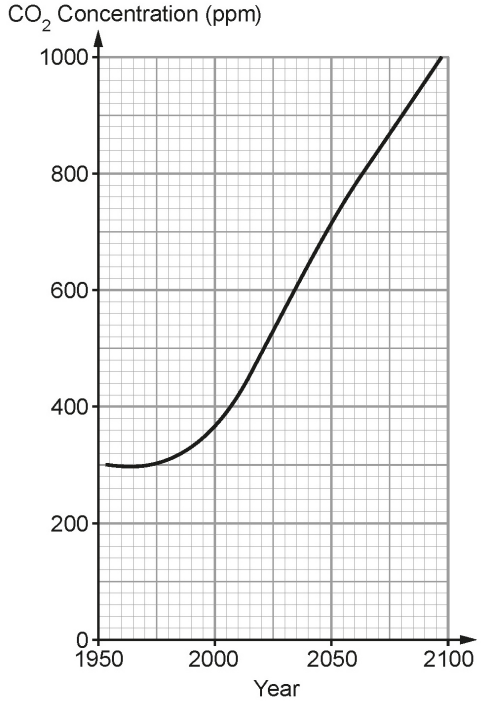
Examiner only

(b) The Climate Adaptation Strategy for Wales 2024 is a plan to help Wales deal with the effects of climate change and protect people, nature and the economy. The strategy uses information from the International Panel on Climate Change (IPCC) to understand climate-related risks.

The IPCC uses many different computer models to predict how CO_2 concentration in the atmosphere will change over time.

Graph 7.2 shows the results of one of the IPCC computer models.

Graph 7.2



(i) Use the information in **Graph 7.2** to estimate the CO_2 concentration in the atmosphere in 2050. [1]

CO_2 concentration in the atmosphere = …….. ppm

(ii) Use information from **Image 7.1** and your own knowledge to suggest how human activities have led to increasing CO_2 concentrations in the atmosphere. [3]

……

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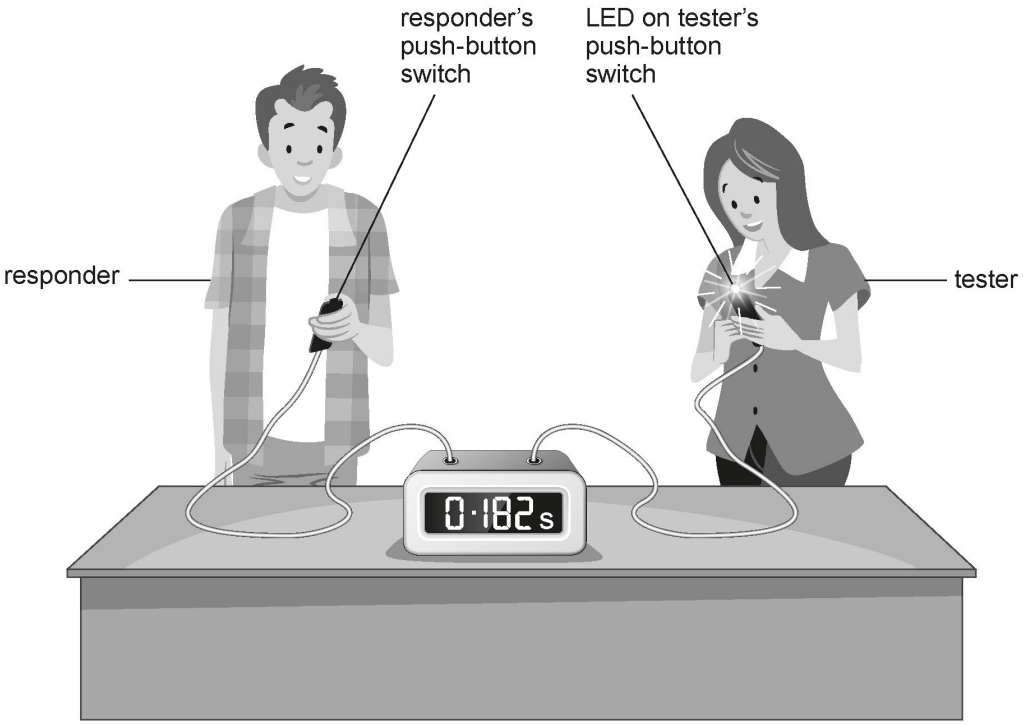
7

Examiner only

8. An experiment was set up to calculate the speed of a nervous impulse using a data logger and two push-button reaction switches. **Image 8.1 shows** how the experiment was set up.

Image 8.1



Method

1. The **distance between the eye to the thumb** tip of the responder is measured using a tape measure. (This is the distance the nervous impulse must travel)
2. The tester presses the push-button switch to make the LED light up.
3. The responder pushes their push button switch as soon as they see the LED on the tester's switch light up.
4. The **reaction time** for the responder to push their button is recorded.
5. The following formula is used to calculate the **speed** of the nervous impulse.

$$\text{speed} = \frac{\text{distance between eye and thumb}}{\text{reaction time}}$$

Examiner only

Image 8.2 shows how the distance between eye and thumb tip is measured.

Image 8.2

(a) (i) State the form in which a nervous impulse is passed along a neurone. [1]

……

……

(ii) State the name of a co-ordinator in the nervous system. [1]

……

……

Examiner only

Table 8.3 shows the reaction times and mean speeds for four individuals.

Table 8.3

Individual	Reaction time (s)				Mean speed of nervous impulse (m/s)
	Trial 1	Trial 2	Trial 3	Mean	
1	0.226	0.125	0.210	0.187	5.13
2	0.170	0.200	0.180	0.183	4.92
3	0.190	0.223	0.180	0.198	4.34
4	0.175	0.205	0.190	0.190	4.79

Table 8.4 shows the distance between the eye and the tip of the thumb for each of the four individuals.

Table 8.4

Individual	Distance between the eye and tip of the thumb (m)
1	0.96
2	0.90
3	0.86
4	0.91

(b) The students concluded that **Trial 2** for **Individual 1** was an anomalous result. Use all the information to calculate a more accurate mean speed of nervous impulse for the Individual 1. [3]

Mean speed of nervous impulse = ... m/s

Examiner only

(c) Synapses occur between neurones and between neurones and muscles. When a nerve impulse arrives at a synapse, a chemical is released from the neurone.

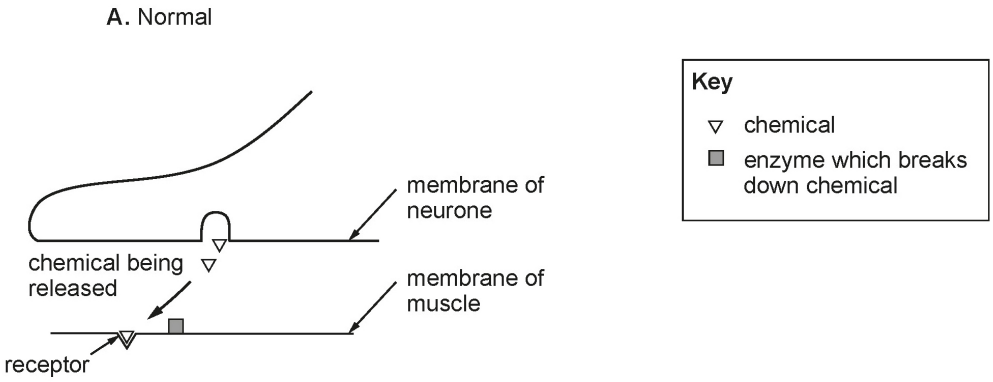
The chemical diffuses across the synapse and attaches to a receptor on the muscle cell membrane.

When the chemical attaches to the receptor, the muscle contracts.

The chemical is then broken down by an enzyme present on the cell membrane of the muscle and the muscle stops contracting.

Image 8.5 shows the normal functioning of a synapse between a neurone and a muscle.

Image 8.5

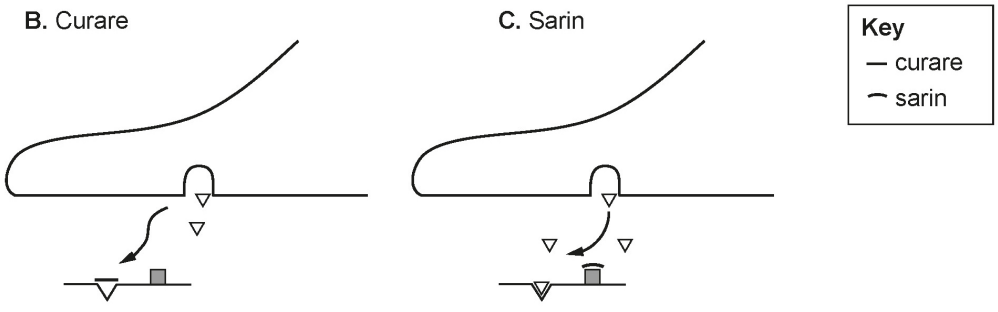


Some drugs can affect the functioning of a synapse.

Image 8.6 shows the effect of curare – a toxin used in poison arrows.

Image 8.7 shows the effect of sarin – a nerve gas.

Image 8.6 **Image 8.7**



Use **Images 8.6** and **8.7** to suggest why curare causes muscle paralysis whereas sarin causes uncontrollable muscle contraction. [3]

Examiner only

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8

END OF PAPER

Question number	Additional page, if required. Write the question number(s) in the left-hand margin.
	…… ……

Examiner only

THE SCIENCES (DOUBLE AWARD)
UNIT 4

Biology: Continuity of Life

HIGHER 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	Connections Relationships
1.	(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 1 total	**2**	**4**	**0**	**6**	**0**	**3**	**0**

Question			Marking details	Marks available						
				AO1	AO2	AO3	Total	Maths	Enquiry Skills	Connections Relationships
2.	(a)		**Any one (×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	0	0	2	0	2	0
	(b)	(i)	= 146.666666666667% (2) Accept any correct rounding If incorrect award 1 mark (1) for (37-15)/15x100 OR Correct calculation incorrectly rounded	0	2	0	2	2	0	0
		(ii)	*Abiotic factor: (1)* Climate / soil pH / soil temperature / water content of soil / waterlogging *Biotic factor: (1)* Competition for resources / grazing	0	2	0	2	0	2	2
		(ii)	Number of species has increased (1) Number of each species has increased /new species introduced/more species in 2016 (1)	0	0	2	2	0	2	0
	(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)	0	0	1	1	0	1	0

		(ii)	**Any one (×1) from:** • Carry out sample at the same time each year (1) • Use same sample {sites/ area} each year (1)	0	0	1	1	0	1	0
			Question 2 total	**2**	**4**	**4**	**10**	**2**	**8**	**2**

Question			Marking details	Marks available						
				AO1	AO2	AO3	Total	Maths	Enquiry Skills	Connections Relationships
3.	(a)	(i)	**Any two for 1 mark** • *cell membrane* • *cytoplasm* • *cell wall*		1		1			1
		(ii)	{DNA / genetic material} free in cytoplasm (1)		1		1			
	(b)	(i)	Prevent {bacteria / fungi/ microbes} getting into the agar / prevent bacteria from escaping into the environment (1)	1			1		1	
		(ii)	**Any one (×1) from:** Use sterilised forceps (1) Work next to a lit Bunsen burner (1) Lid of petri dish not to be lifted too high (1) Lid of petri dish sealed with adhesive tape (1)	1			1		1	
		(iii)	20-25^{O}C	1			1		1	
	(c)	(i)	*{Honey/solution} has diffused out (of disc into agar) (1)* Bacteria have been {killed/prevented from growing} (1)		2		2		2	1
		(ii)	No exclusion zone/bacteria will be growing all over the plate (1)			1	1		1	
			Question 3 total	**3**	**4**	**1**	**8**	**0**	**6**	**2**

<table>
<tr><th colspan="3" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="7">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Enquiry Skills</th><th>Connections Relationships</th></tr>
<tr><td>4.</td><td>(a)</td><td>(i)</td><td>Homozygous recessive</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Ionising radiation</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Normal allele (thr-lys)-asn-arg (1)
Mutant allele (thr-lys)-asn-cys (1)</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>• CGC / argenine/ arg} changed to {TGC / cysteine/ cys}/ {allele/ triplet code/ order of bases} changed (1)
• giving {different/ wrong} amino acid/ {different/ wrong} sequence of amino acids (1)
• MC1R protein {does not work/ not produced}/ {different/ wrong} protein is produced/ protein with different function is produced/ protein is changed (1)</td><td></td><td>1</td><td>2</td><td>3</td><td></td><td></td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>Dd × dd(1)<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>Correct gametes (1)
correct mechanics (1)</td><td></td><td>3</td><td></td><td>3</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>1 : 1
Ecf accept ratio from Punnett square</td><td></td><td>1</td><td></td><td>1</td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Punnett square only shows probability/ owtte/ fertilisation is random</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td><td></td></tr>
<tr><td colspan="4">Question 4 total</td><td>1</td><td>9</td><td>2</td><td>12</td><td>1</td><td>0</td><td>0</td></tr>
</table>

Question			Marking details	Marks available						
				AO1	AO2	AO3	Total	Maths	Enquiry skills	Connections Relationships
5.	(a)	(i)	*Optimum temperature for {enzymes/metabolism}/ {enzymes/metabolism} work within a narrow range of temperatures (1)*	1			1			1
		(ii)	**Any three (×1) from** • Vasodilation/blood vessels dilate/diameter of blood vessels increase (1) • More blood to skin to {carry heat away from core/ release heat} / more blood close to the surface of the skin releases heat (1) • Erector muscles relax/ hairs lie flat (1) • {no/less} insulating layer of air (next to skin) (1)		3		3			
	(b)	(i)	52 (° C) (1) {Sunstroke/ muscle cramp/ heat exhaustion} are likely (1)			2	2			
		(ii)	**Any two (x1) from** *Water moves out of the cells (1)* *Reference cells shrink (1)* *Accept correct ref. to osmosis (1)*		2		2			2
			Question 5 total	**1**	**5**	**2**	**8**	**0**	**0**	**3**

Question		Marking details	Marks available						
			AO1	AO2	AO3	Total	Maths	Enquiry Skills	Connections Relationships
6.	**Any five (x1) from** Individual **A** • Energy intake greater than recommended guidelines(1) • Excess energy stored as fat / ref . developing {type 2 diabetes / heart disease /obesity}(1) • Alcohol intake greater than recommended guidelines (1) • Ref. alcohol misuse leading to {addiction / liver)(1) • *Increased risk of cardiovascular disease (1)* Individual **B** • Smoking cigarettes more than recommended guidelines (1) • Increased risk of {cancer / CVD / emphysema} (1) • Exposure to UV light from sun greater than recommended guidelines (1) • Increased risk of cancer (1) **Max 3 marks if only one individual considered**		2	2	1	5	0	0	1
		Question 6 total	**2**	**2**	**1**	**5**	**0**	**0**	**1**

Question			Marking details	Marks available						
				AO1	AO2	AO3	Total	Maths	Enquiry Skills	Connections Relationships
7.	(a)		A = Photosynthesis (1) B = Respiration (1) C = Feeding Accept eating/ consumption (1)	3			3			
	(b)	(i)	710ppm		1		1			
		(ii)	Rainforests are being destroyed/ Deforestation (1) Less carbon dioxide absorbed in photosynthesis (1) (Increased) combustion of fossil fuels (1)			3	3			
			Question 7 total	**3**	**1**	**3**	**7**	**0**	**0**	**0**

Question			Marking details	Marks available						
				AO1	AO2	AO3	Total	Maths	Enquiry Skills	Connections Relationships
8.	(a)	(i)	Electrical impulse	1			1			
		(ii)	Brain / spinal cord	1			1			
	(b)		4.40 = 3 marks Calculation of mean speed of nervous impulse =0.96/0.218=4.403669724770642 = 2 marks calculation of mean reaction time =[0.226+0.210]/2 = 0.218 = 1 marks Ecf (i)		3		3	3	3	
	(c)		**Any three (×1) from:** **Curare** • Receptor blocked / OWTTE (1) • Muscles cannot contract (1) **Sarin** • Enzyme blocked / OWTTE (1) • Receptor not broken down and stays attached to receptor (1)			3	3			
Question 8 total				**2**	**3**	**3**	**8**	**3**	**3**	**0**

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question		AO1	AO2	AO3	TOTAL MARK	MATHS (7.5%-10%)	Enquiry Skills	Connections Relationships
Overlap	**1**	2	4	0	6	0	3	0
	2	2	4	4	10	2	8	2
	Target	**4**	**8**	**4**	**16**	**1 - 2**	**2**	**2**
	TOTAL	**4**	**8**	**4**	**16**	**2**	**11**	**2**
Non-overlap	**3**	3	4	1	8	0	6	2
	4	1	9	2	12	1	0	0
	5	1	5	2	8	0	0	3
	6	2	2	1	5	0	0	1
	7	3	1	3	7	0	0	0
	8	2	3	3	8	3	3	0
	Target	**12**	**24**	**12**	**48**	**4 - 5**	**6**	**6**
	TOTAL	**12**	**24**	**12**	**48**	**4**	**9**	**6**
Paper total	**Target**	**16**	**32**	**16**	**64**	**5 - 6**	**8**	**8**
	TOTAL	**16**	**32**	**16**	**64**	**6**	**20**	**8**