GCSE

WJEC GCSE
The Sciences (Double Award)

Approved by Qualifications Wales

Sample Assessment Materials

Unit 1: Biology - Basis of Life
Higher Tier

Teaching from 2026
For award from 2028



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

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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.

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Surname	Centre number	Candidate number
First name(s)		0

GCSE

3455UA

The Sciences (Double Award)
Unit 1
Biology: Basis 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.	**7**	
2.	**7**	
3.	**8**	
4.	**5**	
5.	**9**	
6.	**10**	
7.	**10**	
Total	**56**	

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 **56.**

You should think carefully about how you use your time.

Your responses must be clear, accurate and well presented.

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Answer **all** questions

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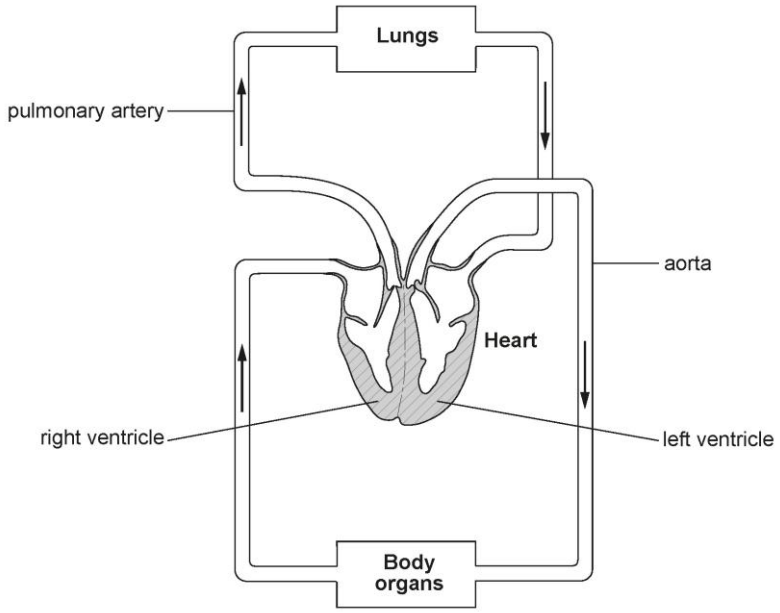
1. **Image 1.1** shows the double circulatory system in a human body.

Image 1.1



(a) State what is meant by a double circulatory system. [2]

……

……

……

……

(b) **Table 1.2** shows the blood pressure in some of the blood vessels in **Image 1.1.**

Table 1.2

Blood vessel	Blood pressure (kPa)	
	Maximum	Minimum
Aorta	18.0	11.0
Pulmonary artery	12.0	8.0

Use **Image 1.1** to explain why the maximum pressure in the aorta is greater than the maximum blood pressure in the pulmonary artery. [1]

……

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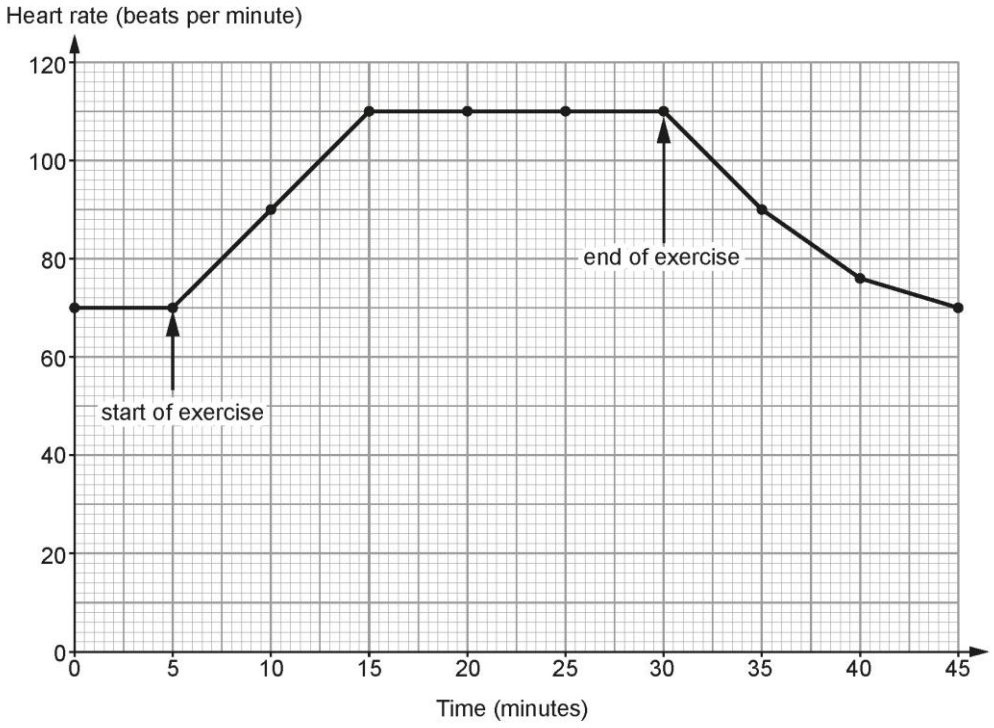
(c) Cardiac output is used as an indicator of cardiovascular fitness in athletes. Cardiac output is a measurement of the volume of blood pumped by a ventricle in one minute.

Graph 7.3 shows the heart rate of an individual during and after a session on an exercise bike.

Graph 7. 3



(i) The volume of blood in a ventricle of an average human is 70cm^3.

Use the equation below to calculate the cardiac output for the individual in **Graph 7.3** at **15 minutes**. [2]

cardiac output = volume of blood in ventricle × heart rate

Cardiac output = …….. cm^3

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(ii) The cardiac output of the individual at 5 minutes was 4900cm^3. Explain the increase in cardiac output between 5 and 15 minutes. [2]

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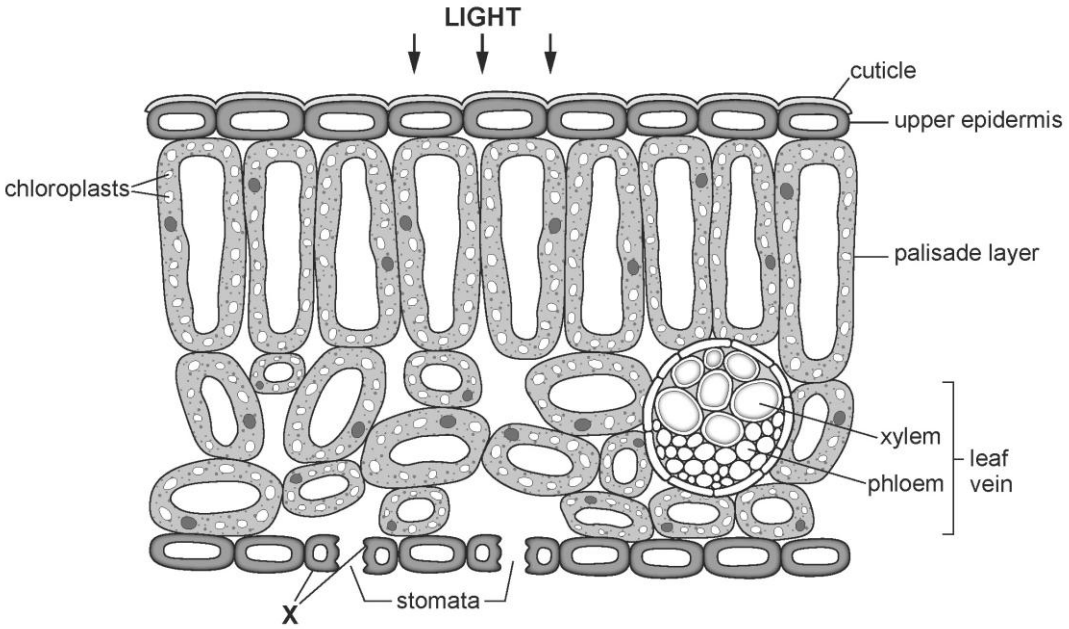
2. **Image 2.1** shows a section through a leaf of a plant.

Image 2.1



(a) Explain why most photosynthesis happens in the cells of the palisade layer. [2]

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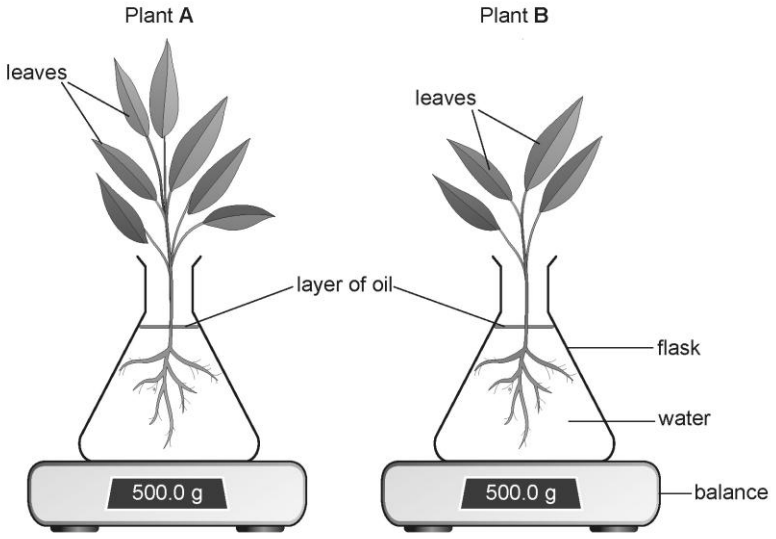
(b) A student investigated transpiration in two plants, **A** and **B**, of the same species.
Image 2.2 shows the apparatus used by the student.

Image 2.2



The student recorded the mass of the apparatus at the start of the investigation and at every hour for seven hours.

Table 2.3 shows the results of the investigation.

Table 2.3

Species	Mass (g)							
	Start	1 hour	2 hours	3 hours	4 hours	5 hours	6 hours	7 hours
A	500	495	485	480	465	450	440	425
B	500	496	492	488	484	483	482	481

(i) Name the tissue that transports water in plants. [1]

.....

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(ii) State the conclusion that can be made from the results of this investigation. Explain your answer [2]

.....

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(iii) Apart from species, suggest **two** other factors that should have been kept constant in this investigation. [2]

1.....

.....

2.....

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3. (a) Students used a light microscope to study cells. They used the method below to prepare a slide of human cheek cells

1. Gently rub the inside of your cheek with a cotton bud.
2. Wipe the end of the cotton bud on the glass slide.
3. Put a drop of methylene blue onto the cheek sample on the glass slide.
4. Place the cotton bud in the beaker of disinfectant.
5. Lower a coverslip gently over the cheek sample.

(i) State why the students carried out step 3. [1]

.....

.....

(ii) Explain why the students carried out step 4. [1]

.....

.....

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(b) **Image 3** shows two animal cells that the students observed.



(i) Draw **one** of the animal cells from **Image 3** in the space below. [1]

(ii) Name the structures labelled **B** on **Image 3**. [1]

……...

……...

(iii) Name **one** structure that could be found in a plant cell but not in an animal cell. [1]

……...

……...

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(iv) The magnification of **Image 3** is ×800.

Calculate the actual length of line **X – X** in **Image 3.** [3]

Express your answer in micrometres (μm).
1 mm = 1000 μm

Actual length of **X – X** = ... μm

8

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4. **Images 4.1** and **4.2** show two types of methods, **A** and **B**, that can be used to calculate the amount of energy stored in food.

Method **A** shows the apparatus that could be used by students in a school laboratory. Method **B** shows the apparatus that could be used by food producers.

In both methods, food is burnt and the chemical energy store of the food is transferred to heat a specific volume of water. The change in temperature of the water is measured using a thermometer. The increase in temperature is used to calculate the energy transferred from the food in kilojoules.

Image 4.1 **Image 4.2**

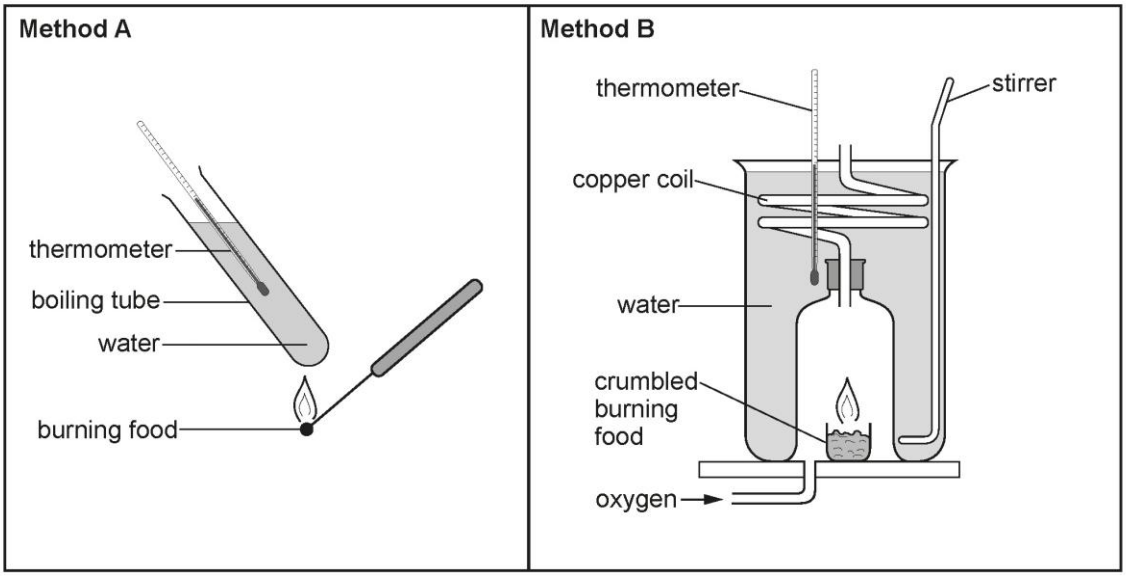

Table 4.3 shows a comparison of the data produced by both methods.

Table 4.3

Food	Energy content (kJ/g)	
	Method A	Method B
Pasta	3.19	15.53
Crisps	4.43	21.60
Coconut	3.04	14.81

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(a) Use **Images 4.1** and **4.2** to explain the higher numbers in the results for Method **B.** [2]

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(b) (i) State the importance of protein in a balanced diet. [1]

……...

……...

(ii) Explain why it is important to the health of individuals that food labels give information about the energy and sugar content in food. [2]

Energy content

……...

……...

Sugar content

……...

……...

5

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5. Black and white photographic film consists of a sheet of plastic coated with a mixture of gelatine, which is a protein, and silver halides. The gelatine holds the silver halides in place on the plastic sheet. If the photographic film is exposed to light the silver halides turn black in colour.

Trypsin is a protein digesting enzyme which is produced by the pancreas.

Students carried out an experiment to investigate the effects of pH on the action of trypsin.

The following method was used:

1. Place 5 cm^3 of a solution of 5% trypsin in a test tube.
2. Add 5 cm^3 of a buffer solution of pH 6 to the test tube. (A buffer solution keeps the pH constant without interfering with the reaction).
3. Add exposed photographic film to the test tube.
4. Record the time taken for the photographic film to become clear.
5. Repeat steps 1-4 once more.
6. Repeat steps 1-5 using buffer solutions of pH 7, 8, 9 and 10.

(a) In this investigation, state the:

(i) independent variable. [1]

……

(ii) dependent variable. [1]

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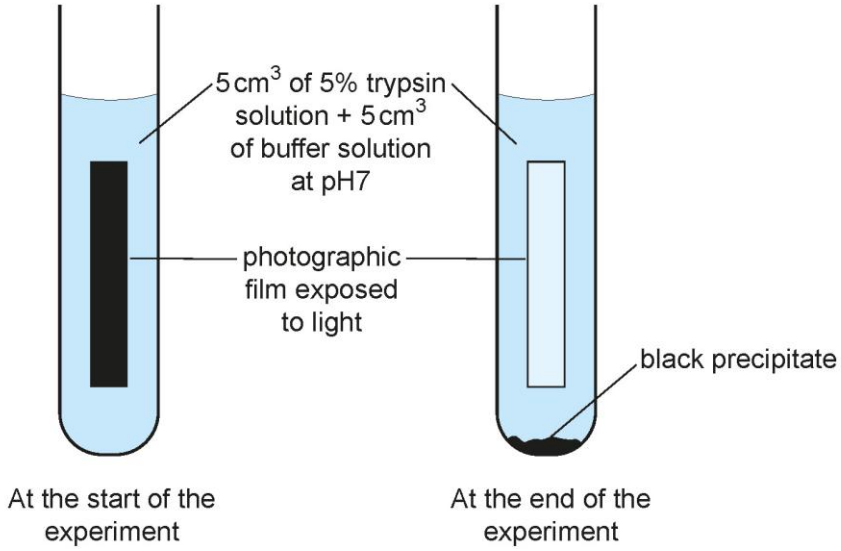
Image 5.1 shows the result for Trial 1 at pH7.

Image 5.1



(b) Explain why the photographic film in **Image 5.1** became clear. [2]

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(c) The results of the experiment are shown in **Table 5.2**.

Table 5.2

pH	Time taken for the photographic film to become clear (s)		
	Trial 1	Trial 2	Mean
6	No reaction	No reaction	No reaction
7	864	784	824
8	369	320	345
9	424	400	412
10	680	641	661

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(i) Use the results from **Table 5.2** to state the optimum pH for trypsin. [1]

……..

(ii) Explain why there was no reaction in the tubes at pH 6. [3]

……..

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The experiment was repeated using buffer solutions with a pH of 7, 7.5, 8, 8.5 and 9. The results are shown in **Table 5.3**.

Table 5.3

pH	Time taken for the photographic film to become clear (s)			
	Trial 1	Trial 2	Trial 3	Mean
7	768	834	784	795
7.5	341	432	362	378
8	305	379	341	342
8.5	319	324	408	350
9	504	499	414	472

(d) Use the results from **Table 5.2** and **5.3** to suggest why the experiment was repeated using buffer solutions with a pH of 7, 7.5, 8, 8.5 and 9. [1]

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6. Lemmings are small mammals found in the Arctic. Scientists use information on populations of lemmings as an indicator of the health of Arctic ecosystems. Understanding the biotic and abiotic factors that affect lemmings is important when studying these populations.

Lemmings live on land where they dig complex tunnel systems beneath the snow to stay warm and find food. Climate change is having a significant impact on lemmings.

Climate change is causing more rain in the Arctic. The rain then freezes and makes the snow harder. This makes it difficult for lemmings to dig tunnels for shelter.

Climate change contributes to overall warming in the Arctic which can alter the vegetation and snow conditions that lemmings depend on for food and shelter.

Climate change is causing a reduction in sea ice that can affect the distribution and behaviour of predators like Arctic foxes. With less sea ice, the Arctic foxes spend more time on land where lemmings live. Reduced sea ice can also influence weather patterns, potentially leading to changes in snow cover.

(a) Define the meaning of the term **biotic factor**. [1]

……..

……..

(b) Use the information to suggest **two abiotic factors** that could affect the population of lemmings. [2]

1. ……...

……...

2. ……...

……...

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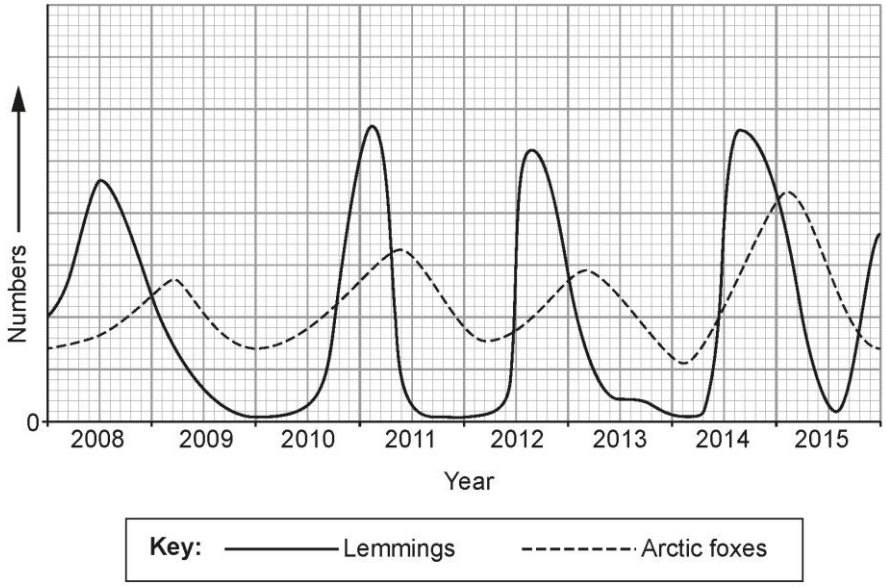
(c) **Graph 6** shows the population of lemmings and Arctic foxes studied by scientists between 2008 and 2015.

Graph 6



Use **Graph 6** to describe the relationship between the numbers of lemmings and Arctic foxes between 2008 and 2015. [2]

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(d) Suggest how climate change could lead to the population of lemmings decreasing in number. [5]

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7. Respiration is a chemical reaction that takes place in the body.

(a) State the word equation for aerobic respiration. [2]

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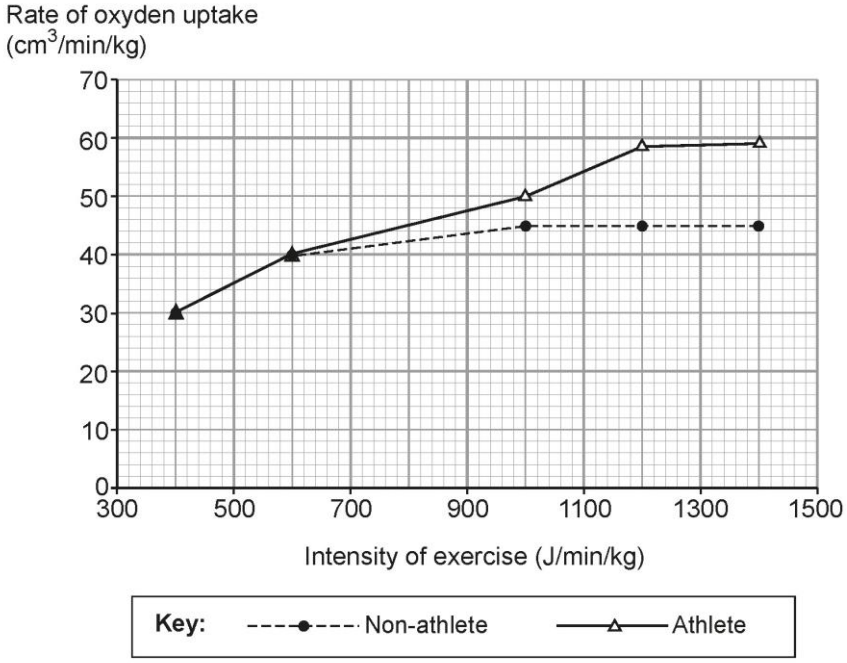
(b) Sports science students in Cardiff Metropolitan University carried out an investigation on two people: an athlete and a non-athlete. The two individuals carried out a standard exercise at increasing levels of intensity. The intensity of exercise was expressed as Joules per minute per kilogram of body mass. At each intensity level the rate of oxygen uptake and rate of lactic acid production were measured.

Graph 7.1 shows the effect of intensity of exercise on rate of oxygen uptake.



(i) The athlete had a mass of 82 kg.

Use **Graph 7.1** to calculate the volume of oxygen he would have used during a **seven-minute** period of exercise at an intensity of 800J/min/kg. [3]

Volume of oxygen used = …… cm^3

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(ii) Use the data from **Graph 7.1** to compare the rate of oxygen uptake in the athlete and non-athlete as the intensity of exercise increases. [3]

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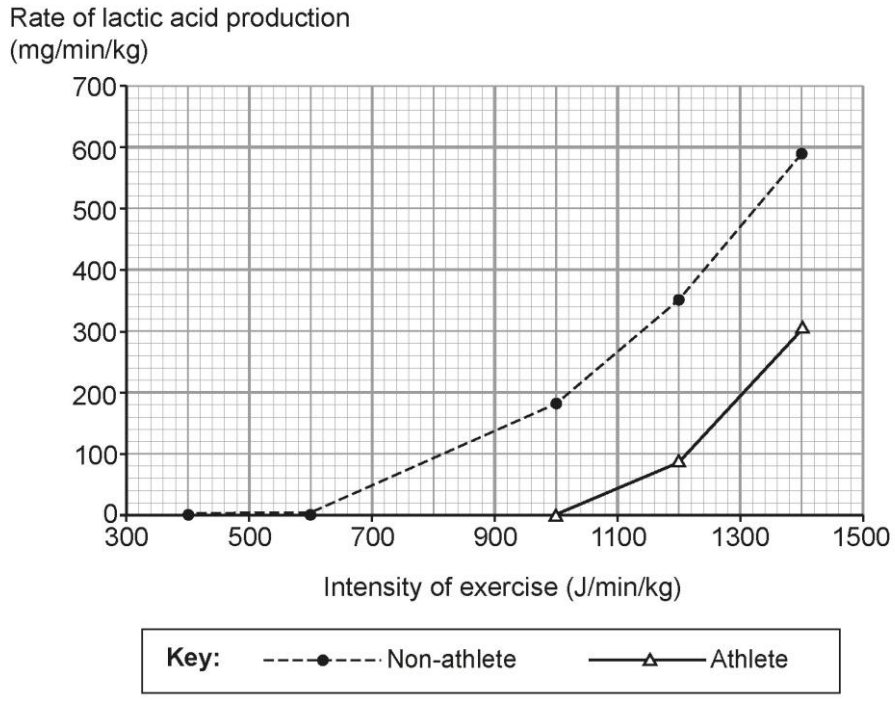
Graph 7.2 shows the effect of intensity of exercise on rate of lactic acid production.



(iii) **Graph 7.1** shows that the rate of oxygen uptake for a non-athlete at an intensity of exercise between 1000J/min/kg and 1400J/min/kg remains constant. Use **Graph 7.2** to suggest an explanation for this. [2]

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10

END OF PAPER

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

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THE SCIENCES (DOUBLE AWARD)
UNIT 1

Biology: Basis 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

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Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Enquiry Skills
1.	(a)		ref. systemic (1) and pulmonary circulation (1) Or Blood flows through the heart twice (1) in each full circuit (1) Or blood flows through body (1) and lungs in each circuit (1)	2			2		
	(b)		Correct ref. left ventricle wall is more muscular than the right ventricle wall (1)		1		1		
	(c)	(i)	Correct answer = 7700= 2 marks **If incorrect award 1 mark for** 110 × 70 = 7700		2		2	2	
		(ii)	**Any two (×1) from:** Body requires more energy for exercise (1) From (aerobic) respiration (1) Blood carries (more) oxygen (to muscles)/ Blood removes (more) {carbon dioxide/lactic acid} from muscle (1)		2		2		
			Question 1 total	**2**	**5**	**0**	**7**	**2**	**0**

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Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Enquiry Skills
2.	(a)		**Any two (×1) from:** Palisade cells have most chloroplasts (1) To absorb light (1) Palisade chloroplasts are closer to the (upper) surface (1)		2		2		
	(b)	(i)	Xylem (1)	1			1		
		(ii)	Plant A {loses more mass / loses more water / has an increased rate of transpiration} (1) Because (Plant A) has {more leaves / more stomata / greater surface area} (1) Accept reverse answers if Plant B referenced			2	2		2
		(iii)	**Any two (×1) from:** Light intensity / strength of light (1) (air) temperature (1) NOT <u>water</u> temperature Wind speed / air movement (1) Humidity (1) Age of shoot (1) Credit any other valid response			2	2		2
			Question 2 total	**1**	**2**	**4**	**7**	**0**	**4**

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Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Enquiry Skills
3.	(a)	(i)	{methylene blue/it} is a stain that makes the {cells/ structures} more visible / Owtte	1			1		1
		(ii)	It is a control measure to reduce risk/ kill {microbes/ bacteria/ viruses/ fungi/ pathogens}/		1		1		1
	(b)	(i)	Clear outline of cell + nucleus (1)		1		1		1
		(ii)	Mitochondria (1)	1			1		
		(iii)	**Any one (×1) from** Cell wall (1) Chloroplast (1) Vacuole (1)	1			1		
		(iv)	50μm = 3 marks If incorrect award 2 marks (2) Record of correct length + evidence of conversion of units 40mm = 40000μm Award 1 mark (1) Record of correct length OR evidence of conversion of units with incorrect measurement 40mm e.g. 27mm = 27000μm	1	2		3	2	3
			Question 3 total	**4**	**4**	**0**	**8**	**2**	**6**

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Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Enquiry Skills
4.	(a)		More energy transferred to thermometer / Less heat lost because (1) **Any one (×1) from:** • heat transferred to water not air (1) • crumbling of food leads to more energy transfer due to complete burning of food (1) • more oxygen leads to more energy transfer due to complete burning of food (1) • {stirrer/ copper coil} ensures consistent temperature throughout apparatus (1)			2	2		2
	(b)	(i)	For growth	1			1		
		(ii)	**Energy content** Reference to excess energy being stored as fat (1) **Sugar content** Reference to diabetes / tooth decay (1)	2			2		
			Question 4 total	**3**	**0**	**2**	**5**	**0**	**2**

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Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Enquiry Skills
5.	(a)	(i)	pH (1)		1		1		1
		(ii)	Time taken for photographic film to become clear (1)		1		1		1
	(b)		Trypsin {breaks down / digests} {gelatin / protein} (1) Silver halides released (from plastic sheet of film) (1)		2		2		1
	(c)	(i)	(pH)8 (1)		1		1		1
		(ii)	Trypsin denatured / inactivated (1) Shape of active site is changed (1) {gelatin / protein / substrate} cannot {bind / fit into} active site (1)	1	2		3		3
	(d)		To get a more accurate value of the optimum pH / {increases confidence / to confirm} that pH8 is the optimum (1)			1	1		1
			Question 5 total	**1**	**7**	**1**	**9**	**0**	**8**

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Question		Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Enquiry Skills
6.	(a)	A part of the environment of an organism that is living (1)	1			1		
	(b)	**Any two (×1) from:** • Amount of rain (1) • Hardness of snow / snow quality / snow cover (1) • Amount of sea ice (1) • Air temperature (1) • Soil conditions (1) • Weather (1)		2		2		
	(c)	**Any two (×1) from:** • as numbers of lemmings increase the numbers of foxes increase (1) • as numbers of foxes increase the numbers of lemmings decrease (1) • as numbers of lemmings decrease the number of foxes decrease (1)		2		2		2
	(d)	**Any five (×1) from:** 1. Harder to dig tunnels for shelter (1) 2. Due to changes in {snow cover / hardness of snow} (1) *m.p. 2 linked to m.p. 1* 3. Less food (1) 4. Due to change in vegetation (1) *m.p. 4 linked to m.p. 3* 5. Arctic foxes spending more time on land (1) 6. More predation (1) *m.p. 6 linked to m.p. 5*	0	0	5	5	0	0
		Question 6 total	**1**	**4**	**5**	**10**	**0**	**2**

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Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Enquiry Skills
7.	(a)		glucose + oxygen (1) → carbon dioxide + water (1) Max one mark if incorrect use or absence of arrow or equals sign	2			2		
	(b)	(i)	3 marks = 25830 2 marks = 45 × 7 × 82 1 mark = 45		3		3	3	
		(ii)	**Any three (×1) from:** • Oxygen uptake increases with intensity of exercise in both athletes and non-athletes (1) • Between 400 and 600 difference there is no difference between athletes and non-athletes (1) • Above 600 athletes increase more than non-athletes • Both lines plateau (1) • Correct reference to data (1)		3		3		3
		(iii)	**Any two (×1) from:** • lactic acid is being produced (1) • anaerobic respiration is taking place (1) • (anaerobic respiration) doesn't need oxygen (1)			2	2		2
			Question 7 total	**2**	**6**	**2**	**10**	**3**	**5**

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SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question		AO1	AO2	AO3	TOTAL MARK	MATHS	Enquiry Skills
Overlap	**1**	2	5	0	7	2	0
	2	1	2	4	7	0	4
	Target	**3**	**7**	**4**	**14**	**1**	**4**
	TOTAL	**3**	**7**	**4**	**14**	**2**	**4**
Non-overlap	**3**	4	4	0	8	2	6
	4	3	0	2	5	0	2
	5	1	7	1	9	0	8
	6	1	4	5	10	0	2
	7	2	6	2	10	3	5
	Target	**11**	**21**	**10**	**42**	**3 - 4**	**6**
	TOTAL	**11**	**21**	**10**	**42**	**5**	**23**
Paper total	**Target**	**14**	**28**	**14**	**56**	**5-6**	**12**
	TOTAL	**14**	**28**	**14**	**56**	**7**	**27**

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