GCSE MARKING SCHEME

SUMMER 2024

GCSE
APPLIED SCIENCE (DOUBLE AWARD) - UNIT 1
3445U10-1 & 3445UA0-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

WJEC GCSE APPLIED SCIENCE (DOUBLE AWARD)

UNIT 1: ENERGY, RESOURCES AND THE ENVIRONMENT

SUMMER 2024 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

Marking abbreviations

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

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1.	(a)	(i)		Cell membrane	1			1		
		(ii)		Chromosome	1			1		
		(iii)		Controls the activity of the cell	1			1		
	(b)			similar (1) particular (1)	2			2		
	(c)	(i)		High (1) lower (1)	2			2		
		(ii)		Carbon dioxide	1			1		
		(iii)	I	respiration	1			1		
			II	Glucose Carbon dioxide	2			2		
				Question 1 total	**11**	**0**	**0**	**11**	**0**	**0**

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>2.</td><td>(a)</td><td></td><td></td><td>1 (1) accept 1-6
Purple / blue (1)
H_2O (1)
Neutral (1)</td><td>4</td><td></td><td></td><td>4</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>5 correct plots with ± < 1 small square tolerance (2)
4 correct plots with ± < 1 small square tolerance (1)

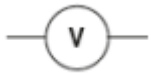
Point to point (1) No disjointed lines. 60 to 60 line must be flat</td><td></td><td>3</td><td></td><td>3</td><td>3</td><td>3</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>50 – 20 (1)
= 30 [°C] (1)</td><td></td><td>2</td><td></td><td>2</td><td>2</td><td>2</td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td><table><tr><th>Time (s)</th><th>Temp decreases</th><th>Temp stays the same</th><th>Temp increases</th></tr><tr><td>0-10</td><td></td><td></td><td>✓</td></tr><tr><td>10-20</td><td></td><td></td><td>✓</td></tr><tr><td>20-30</td><td></td><td></td><td>✓ (1)</td></tr><tr><td>30-40</td><td></td><td>✓ (1)</td><td></td></tr><tr><td>40-50</td><td>✓ (1)</td><td></td><td></td></tr></table></td><td></td><td>3</td><td></td><td>3</td><td></td><td>3</td></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>2 (1)
32 (1)

98 (1) (ecf)</td><td></td><td>3</td><td></td><td>3</td><td>3</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 2 total</td><td>4</td><td>11</td><td>0</td><td>15</td><td>8</td><td>7</td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3.				**Indicative content:** • Amylase is made in the mouth • Amylase is made in the pancreas • Acts in the mouth • Acts in the small intestine • Amylase {breaks down / substrate is} starch • Amylase' active site is the lock • Starch is the key • to sugars/glucose (product) • body temperature / 37^{o}C • (slightly) alkaline pH / neutral **5-6 marks** **At least 5 points** *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3-4 marks** **At least 3 points** *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1-2 marks** **1-2 points** *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate used limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** No attempt made or no response worthy of credit.	6			6		
				Question 3 total	**6**	**0**	**0**	**6**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)	(i)		Sodium / Na		1		1		
		(ii)	I	10-6 (1) / 10 × 100 Allow 6-10 = 40% (1)		2		2	2	
			II	More acidic		1		1		
			III	(pH) decrease			1	1		
		(iii)		Identification (1) Data (1) Judgement - can only be given if either identification or data mark given (1) e.g. for Mg Identification of Mg (1) 15.3, 15.4, 15.5 (1) Which are close together so agree / which are different in so disagree (1) e.g. for Ca Identification of Ca (1) 50.4, 50.1, 50.1 (1) Which are close together so agree / which are different in so disagree / only the same in two streams so disagree (1) Ignore reference to other ions			3	3		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		100	1			1		1
		(ii)		Most of the {water vapour / steam} leaving flask A is {not collected / lost} (1) In B the steam changes back into {water / liquid } (using a condenser) (1) (so disagree)			2	2		3
		(iii)		too costly / requires a lot of energy / environmental impact / must be near the coast	1			1		1
				Question 4 total	**2**	**4**	**6**	**12**	**2**	**4**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	(a)	(i) (ii)		Correct symbol for ammeter in series (1)  Correct symbol for voltmeter in parallel to thermistor (1)  		2		2		2
	(b)	(i)		Temperature (1)	1			1		1
		(ii)		Voltage (1)	1			1		1
	(c)	(i)		1.6 (2) Accept greater than 1.1 (1)		2		2	2	2
		(ii)		12/1.1 (1) subs = 10.9 / 10.91 / 11 (1) Accept 10.90 for 1 mark Do not accept 10	1	1		2	2	2
		(iii)		Any two sets of data: - 1 mark each line 0 ^{o}C – 20 ^{o}C AND changes from 240 to 120 Ω 20 ^{o}C – 40^{o}C AND changes from 120 to 60 Ω 40 ^{o}C – 60 ^{o}C AND changes from 60 to 30 Ω 60 ^{o}C – 80^{o}C AND changes from 30 to 15 Ω (so is correct)			2	2	2	2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		Difference is 90 Ω (less than 100Ω so not suitable) (2) Allow for (1): 120 and 30 Ω			2		2	
				Question 5 total	**3**	**5**	**4**	**12**	**8**	**10**

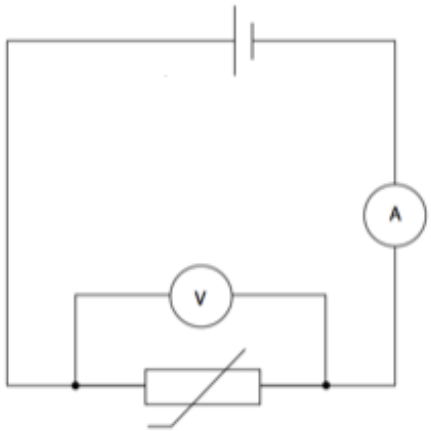
Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6/1	(a)	(i)		2500 ÷ 15 (1) 166.7 months (1) ÷ 12 = 13.89 yrs (1) Allow 13.8888888 / 13.9 / 14 / 13 yr 11 months OR 15 ×12 (1) = 180 2500 ÷ 180 (1) = 13.89 (1) Accept 13.8 / 13.88 / 13 / 166.7 for (2) Accept 166.6 / 180 for (1)		3		3	3	
		(ii)		3.6 ÷ 4 (1) (substituting selected data) ×100 = 90% (1) Accept 0.9 for (1)		2		2	2	
		(iii)		2 × 3 = 6 (1) 6 (ecf from multiplication shown) × 22 OR 6 × 0.22 (1) = 132p / £1.32 (1) (ans and correct unit) Accept for 2 marks : £0.66 / 66p / 132 (no unit) / 1.32 (no unit) / 105.6 p / £1.056 / 106 p / £1.06 Alternate for 2 marks: 3 × 1.6 = 4.8 (0) 4.8 (ecf) × 22 OR 4.8 × 0.22 (1) = 105.6 p / £1.056 (1) Accept for 1 mark 105 p / £1.05		3		3	3	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		Any 2 × (1) from: Heater 1 uses more energy / heater 1 is less efficient / heater 2 uses less energy / heater 2 is more efficient (1) Heater 1 heats up more water / heater 2 heats up less water / heater 1 heats up 150 **and** heater 2 heats up 50 litres / heater 2 only heats up 50 litres / 50 litres is closer to 40 litres (1) Heater 1 wastes more hot water / heater 2 wastes less hot water / heater 1 wastes 110 litres of water **and** heater 2 wastes 10 litres of hot water / heater 2 only wastes 10 litres of hot water (1) Heater 1 costs more money / Heater 2 costs less money / Heater 1 costs 132p **and** heater 2 costs 44p / heater 2 only costs 44p (1) Heater 1 takes more time / heater 2 takes less time / heater 1 takes 3 hours to heat the water **and** heater 2 takes half an hour / heater 2 only takes half an hour to heat the water (1) (So disagree) references to payback time neutral			2	2		
	(b)			Furred up / blocked pipes in boiler /rust /decreased water flow/ less efficient / takes longer to heat up the water / harder to heat up the water / hard water has a higher boiling point (1) (due to build up of) limescale / calcium or magnesium carbonates / scum / calcium and magnesium ions (1) Neutral: causes damage / makes bill go up	2			2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		Foam is a good insulator/poor conductor / reduces conduction (1) Not: stops conduction Because it has air trapped in in it (1) OR Shiny surfaces are poor emitters (1) of IR / radiation (1) OR Foam is a good insulator/poor conductor (1) Shiny surfaces are poor emitters (1) OR Shiny surfaces reflect (1) {IR / radiation} back in (1)	2			2		
		(ii)		Uses less electricity / less energy / less power (1) Less fuel required – fewer power stations / less mining (of fuel) / less pollution / less (additions to the) greenhouse effect (1)		2		2		
		(iii)		Convection (1) (Only) heats water above the heater / can't heat water below the heater (1) Because hot water rises / is less dense (1) not: heat rises or heat is less dense (So agree)			3	3		
				Question 6 total	**4**	**10**	**5**	**19**	**8**	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2.	(a)			Movement (of substances) from a high to low concentration / from where there are a high number of particles to a low(er) number of particles	1			1		
	(b)			The particles should move from higher (concentration) to lower (concentration) / from left hand side to right hand side (1) The concentration {should be the same / equal} (after 30 minutes) / number of particles should be the nearly the same either side (of the membrane after 30 minutes) (1) Wouldn't be A as they've all moved / Should be C (1) (so disagree)			3	3		
	(c)			Maintains a concentration gradient (1) (Replacing air in alveolus rich in O_2 and low in CO_2) by breathing / from the air (1) blood supply (to remove oxygen) (1)	3			3		
	(d)			Diffusion high to low conc <u>and</u> in AT low to high conc (1) Diffusion {passive / no ATP needed / no energy needed} <u>and</u> AT {active / ATP required / energy required} (1)	2			2		
				Question 2 total	**6**	**0**	**3**	**9**		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3.	(a)			Burning fossil fuels (1) sulfur dioxide / acid rain / carbon dioxide / nitrous oxides (1) pH has dropped / more acidic (1)			3	3		
	(b)			Accept for 3 marks: • Stream 3 contains more Mg and Ca (ions) (so harder) OR • Stream 1 contains less Mg (ions) than stream 3 / stream 3 contains more AND stream 1 contains {similar/less} Ca (ions) than stream 3 / stream 3 contains more Accept for 2 marks: • Stream 1 contains less Mg (ions) than stream 3 / stream 3 contains more OR stream 1 contains {similar/less} Ca (ions) than stream 3 / stream 3 contains more Accept for 1 mark: • (Hardness is caused by) Ca and Mg (ions) (1)			3	3		
	(c)	(i)		Water boils <u>and</u> turns into steam (1) {Steam / water vapour} enters the condenser (1) {Steam / water vapour} condenses into water (and it is collected) (1) Salt is left behind (1)	4			4		4
		(ii)		Any 3 × (1) from: Proximity to the sea (1) Availability of energy (1) Cost (1) Environmental impact (1)	3			3		
				Question 3 total	**8**	**0**	**5**	**13**	**0**	**4**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)			Thermistor symbol (1) Ammeter correct symbol and in series (1) Voltmeter correct symbol and in parallel across the thermistor (1)  		3		3		3
	(b)	(i)		Scale – 1kΩ per cm and 10°C per cm (1) 5 plots correct ±<1 small square (1) Smooth curve between 20 and 100 °C (1) Ignore below 20 and above 100 when judging line		3		3	3	3
		(ii)		Temperature increases resistance in thermistor decreases (1) at a decreasing rate / less and less (1) Relationship must match the graph		2		2		2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)	I	8.2 kΩ (+/- 0.2: reading from the candidate's graph) (1) 8.2 = 12 / current (substitution) (1) Current = 12 / 8.2 (Manipulation) (1) = 1.46 / 1.5 mA (1) Manipulation mark can be awarded for current = voltage / resistance $I = V/R$ If 8.4 kΩ is read off graph: Expect answer of 1.43 / 1.4 mA (4) If 8.6 kΩ is read off graph: Expect answer of 1.4 / 1.395 mA (4)		4		4	4	4
			II	0.00146 A (ecf) (1) conversion of candidate answer in part (I) above × 12 = 0.0175 / 0.0174W (1) Or $(0.00146)^2$ (ecf) × 8.2 × 10^{-3}(1) = 0.0174/0.0175W (1) Accept 17.52 for (1)		2		2	2	2
	(c)			Test at lower temperatures (1) obtaining lower temperature using ice (1)			2	2		2
				Question 4 total	**0**	**14**	**2**	**16**	**9**	**16**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5.				**Indicative content:** • Aluminium oxide / bauxite named • Heated in cryolite • Electrolysis is the use of electricity to split electrolyte • Electrolyte is molten aluminium ore • Anode is +ve – attracts oxygen ions • Oxide ions lose (2) electrons, released as oxygen gas • Aluminium ion is attracted to the cathode • collects aluminium +ve ions to form aluminium atoms • Cathode $Al^{3+} + 3e^- \rightarrow Al$ • Anode $2O^{2-} \rightarrow O_2 + 4e^-$ • molten aluminium tapped off periodically from bottom **5-6 marks** **At least 5 statements** *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3-4 marks** **At least 3 statements** *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.*	6			6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				1-2 marks **1 or 2 statements** *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate used limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** No attempt made or no response worthy of credit.						
				Question 5 total	**6**			**6**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)	(i)		(total) emission of greenhouse gases / methane / carbon (dioxide) (in gCO2eq) (1) Produced by an activity / organization / object (1)	2			2		
		(ii)		921 × 3.5 (1) × 10^9 (1) = 3.2235 × 10^{12} / 3223.5 billion g (1) = 3.2 × 10^{12} (1) Accept 3.2 for (3) Accept 3.22 for (2) Accept 9.21 × 10^{11} or 921 × 10^9 for (1) If calculated in part 3 answer is written as 2 sf award fourth mark		4		4	4	
		(iii)		Any 2 × (1) from: Building / commissioning (1) Decommissioning (1) Transporting materials to generator (1)	2			2		
		(iv)		plants take carbon dioxide when they grow / photosynthesis / carbon used is offset by growing plants (1)	1			1		
	(b)	(i)		Measures how much more than CO_2 a gas contributes to global warming / effect of the gas on GW compared to CO_2 / Measure of the contribution of a gas towards global warming compared to CO_2	1			1		
		(ii)		7 × 10^{18} / 2.8 × 10^{17} (1) =25 (1)		2		2	2	
				Question 6 total	**6**	**6**	**0**	**12**	**6**	**0**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
Question 1 total	4	11	0	15	9	7
Question 2 total	11	0	0	11	0	0
Question 3 total	6	0	0	6	0	0
Question 4 total	2	4	6	12	2	4
Question 5 total	3	5	4	12	8	10
Question 6 total	4	10	5	19	8	6
TOTAL	30	30	15	75	27	28

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
Question 1 total	4	10	5	19	8	0
Question 2 total	6	0	3	9	0	0
Question 3 total	8	0	5	13	0	4
Question 4 total	0	14	2	16	9	16
Question 5 total	6	0	0	6	0	0
Question 6 total	6	6	0	12	6	0
TOTAL	30	30	15	75	23	20