



GCSE MARKING SCHEME

SUMMER 2022

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

INTRODUCTION

This marking scheme was used by WJEC for the 2022 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

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

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

WJEC GCSE APPLIED SCIENCE (DOUBLE AWARD)
UNIT 1: ENERGY, RESOURCES AND THE ENVIRONMENT
SUMMER 2022 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)		Any 2 × (1) from: (Absorbed by /used by /uptake by) plants / photosynthesis (1) (Absorbed by animals) in shells/limestone deposits (from dead animals) (1) (formation of) fossil fuels (1) Not: burning {Dissolved/absorbed/taken up} in oceans (1)	2			2		
		(ii)		Any 3 × (1) from: Present day: Nitrogen has increased OWTTE (1) Oxygen has increased OWTTE (1) Methane no longer present/decreased (1) Ammonia no longer present/decreased (1) Other gases have increased (1) Accept converse Accept more gases today Do not credit reference to carbon dioxide		3		3		
	(b)			Correct tick - 2, 3, 6 1 mark for each correct tick 4 ticks – if three correct 2 marks max if two correct 1 mark max		3		3		
				Question 1 total	2	6	0	8	0	0

Question				Marking details	Marks Available											
					AO1	AO2	AO3	Total	Maths	Prac						
2.	(a)	(i)		Protons (1) neutrons (1) (Either order)	2			2								
		(ii)		Electrons	1			1								
		(iii)		Electrons	1			1								
	(b)	(i)		2,6		1		1								
		(ii)		Sulfur (S)/ selenium (Se) / tellurium (Te)/ polonium (Po) / livermorium (Lv)		1		1								
		(iii)		Lithium (Li) /Beryllium (Be) / Boron (B) / Carbon (C) / Nitrogen (N) / Fluorine (F) / Neon (Ne)		1		1								
	(c)	(i)		<table><tr><th>Element</th><th>Relative atomic mass</th></tr><tr><td>Hydrogen</td><td>1 (1)</td></tr><tr><td>Oxygen</td><td>16 (1)</td></tr></table>	Element	Relative atomic mass	Hydrogen	1 (1)	Oxygen	16 (1)		2		2	2	
Element	Relative atomic mass															
Hydrogen	1 (1)															
Oxygen	16 (1)															
		(ii)		18 (1) (ecf)		1		1	1							
				Question 2 total	4	6		10	3							

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3.				<p>Indicative content:</p> <p>Series circuit the current is the same through the circuit Current $A1 = A2 = A3$ / lamps the same brightness the total voltage is the sum of the voltages across each component Voltage $V1 = V2 + V3$ $V2 = V3$ voltages smaller than in parallel circuit</p> <p>Parallel circuit In a parallel circuit, the total current before it splits at a junction equals the sum of the currents in the branches Current $A1 = A2 + A3$ The voltage across each component in parallel is the same $V2 = V3$</p> <p>Accept $V1$ equal on both circuits (don't accept $A1$ equal) Accept greater power output from parallel</p> <p>5-6 marks At least 5 valid points from either circuit – there must be correct reference to both circuits <i>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.</i></p> <p>3-4 marks At least 3 valid points from either circuit <i>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.</i></p>	6			6		6

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				1-2 marks Up to 2 correct references to current or voltage readings, from either circuit <i>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.</i> 0 marks No attempt made or no response worthy of credit.						
				Question 3 total	6			6		6

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)	(i)		23%		1		1	1	
		(ii)		1 mark for calculation 1 mark for correct answer: 15.18 / 15.2 / 15 Correct answer only (2) 15.1 (1) e.g. $23 \text{ (ecf)} \times 66 = 1\,518 \text{ (1)}$ $1\,518 \text{ kW} / 100 = 15.18 \text{ kW (1)}$ $23 \text{ (ecf)} / 100 \text{ (1)}$ $\times 66 = 15.18 \text{ (1)}$ $66 / 100 \text{ (1)}$ $\times 23 \text{ (ecf)} = 15.18 \text{ (1)}$		2		2	2	
		(iii)		Any 2 \times (1) from Streamlined / aerodynamic shape (1) Lighter (less dense materials)/use of plastics (1) Lower gear ratio – more efficient burn (1) Better tyres / correct tyre pressure (1) Stop-start / eco mode / blue motion (1) Energy regeneration / hybrid cars / electric cars (1) Not: reducing noise energy loss	2			2		
	(b)	(i)		2 400/20 (1) = 120 (1) Correct answer only (2)		2		2	2	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		144 000/480 (1) = 300 (1) Correct answer only (2)		2		2	2	
		(iii)		Cost fuel for petrol car = 50 (litres) \times £1.30 = £65 (1) Cost of recharge for EV = £0.30 \times 144 (kWh) = £43.20 (1) (Agree with sales team as) its (£21.8) cheaper (1) For (1) allow correct judgement based on incorrect values			3	3	3	
				Question 4 total	2	7	3	12	10	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	(a)	(i)		gas use increases until 2010 (1) and decreases until 2018 (1) increases and decreases only (1) (overall) decrease (1) Anything beyond 2018 neutral		2		2		
		(ii)		$396 - 345 = 51$ (1)		1		1	1	
		(iii)		$33\% \times 396$ (1) $= 130.68 / 130.7 / 131$ (1)		2		2	2	
	(b)			$950 \times 1\,000\,000$ (1) $/1840$ (1) $= 516\,304$ (so agree) (1) 516×10^n (2) OR $1840\text{ W} \times 400\,000$ (1) $= 736\,000\,000\text{ W} / 736\text{ MW}$ (1) This is less than 950 MW (so agree) (1) OR $950 \times 1\,000\,000$ (1) $950\,000\,000 / 400\,000$ (1) $= 2375\text{ W}$ (1) (so this is more power than required) 2.37×10^n (2)			3	3	3	
				Question 5 total		5	3	8	6	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)	(i)		Both correct for 1 mark X= carbon dioxide / CO ₂ Y = oxygen /O ₂ / accept O	1			1		
		(ii)		Capillary	1			1		
	(b)	(i)		6 000 (1) 1 000 (1)		2		2	2	
		(ii)		Deeper breaths/more heavily / increased depth / larger volume / bigger breaths (1) Faster/quicker/increase <u>rate</u> / more frequent (1) Allow increases with no qualification for (1)		2		2		
		(iii)		Volume of oxygen = 21-16 = 5% (1) × 40 000 (1) = 2 000 cm ³ (Yes she has) (1) OR 21% × 40 000 = 8 400 (1) 16% × 40 000 = 6 400 (1) Difference is 2 000 (so yes she has) (1)			3	3	3	
	(c)	(i)		without air/oxygen	1			1		
		(ii)		Advantage – quick/fast (release of energy) / allows muscles to carry on (working when oxygen levels are low) (1) Disadvantage - produces small quantities of energy / produces lactic acid / causes cramp / oxygen debt (1)	2			2		
				Question 6 total	5	4	3	13	5	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7./1.	(a)	(i)		Any 4 × (1) from: Glucose would {move/diffuse} out (1) because it is small (enough to pass through the holes in the VT) (1) diffusion gradient (conc gradient) exists (1) Starch molecules don't {move /diffuse} (1) They are too large (to pass through VT) (1)	4			4		4
		(ii)		Glucose; Benedict's (and heat) (1) (Blue) to (brick) red/orange/ green/yellow/amber (1) Starch; Iodine (1) no color change/stays brown (1)	2	2		4		4
	(b)	(i)		{Digests/breaks down} starch (1) <u>more</u> glucose (could pass out / in the water) / less starch present(1)			2	2		2
		(ii)		More (kinetic) energy/particles move faster (1) so more glucose would diffuse/quicker diffusion (1)			2	2		2
		(iii)		No diffusion (of glucose out of Visking tubing) (1) Concentration of glucose is the same inside and outside/no diffusion gradient (1)			2	2		2
	(c)			No blood supply / cannot maintain a concentration gradient	1			1		2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			<p>Any 2 points with corresponding explanation</p> <p>Large surface area (1) – increased rate of diffusion / increased rate of absorption (1)</p> <p>Good blood supply (1) – more efficient transport / maintains diffusion gradient (1)</p> <p>Moist (1) - allows food to dissolve (1)</p> <p>Thin (1) – short diffusion pathway / easier absorption / faster absorption / faster diffusion (1)</p> <p>Accept: enzymes present (1) allows digestion (to be completed) (1)</p>	4			4		
				Question 7 total	11	2	6	19		16

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2.	(a)			8 protons (1) 8 neutrons (in the nucleus) (1) 8 electrons /electronic structure 2,6 (1)	1	1 1		3		
	(b)	(i)		Na ⁺ - 2,8 O ²⁻ - 2,8 Accept correct diagrams of electronic structures		1 1		2		
		(ii)		Sodium hydroxide/NaOH		1		1		
	(c)			(2 × 16) or (2 × 23) (1) (2 x 16) + (2 × 23) = 78 (1)		2		2	2	
				Question 2 total	1	7		8	2	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3.				<p>Indicative content</p> <ul style="list-style-type: none"> • Elements arranged according to their atomic number • Arranged in periods and groups • Groups are arranged in columns • Periods are arranged in rows • Same group having similar properties • With examples from table – (group 1 and group 7 expected) chemical and physical • Same number of electrons in the outer shell in a group • Number of electrons in the outer shell determine their properties • Two main classes are metals to the left and non-metals to the right of the table <p>5-6 marks Students give a comprehensive description of the periodic table. A description of the arrangements of periods and groups with examples, linked to number of shells. Using physical and chemical properties as examples. Reference to numbers of electrons determining properties. Description of arrangement of metals and non metals. At least 6 points <i>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.</i></p> <p>3-4 marks Students describe the periodic table with reference to the periods and groups. Some examples of physical or chemical properties may be given but not all correct. There may be some reference to size of elements or their reactivity. 3-5 points <i>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.</i></p>	6					

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				<p>1-2 marks Candidate briefly describe the arrangements of the elements in the periodic table, namely due to size. There may be some reference to reactivity or reactivity in a particular group or period. Up to 2 points <i>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.</i></p> <p>0 marks No attempt made or no response worthy of credit.</p>						
				Question 3 total	6			6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)	(i)		<p>(annual saving) $12 \times 50 = £600$ (1) (Total insulation cost) $3\,800 + 2\,900 = £6\,700$ (1) Pay back time = $6\,700(\text{ecf})/600(\text{ecf}) = 11.17$ years (1) (so not true)</p> <p>OR</p> <p>(Total insulation cost) $3\,800 + 2\,900 = £6\,700$ (1) $6\,700(\text{ecf})/50 = 134$ months (1) $134(\text{ecf})/12 = 11.17$ years (1) (so not true)</p> <p>If ecf gives less than 10 years – so true (if the ecf calculation is correct only 2 marks)</p> <p>1 mark for correct judgement based on incorrect answer.</p> <p>Accept: Total insulation cost = $£3\,800 + £2\,900 = £6\,700$ (1) Amount paid back in 10 years = $10 \times 12 \times 50 = £6\,000$ (1) £700 not paid off so not true / more needed to pay off cost (1)</p>			3	3	3	
		(ii)		<p>Any 3 × (1) from: Maintenance costs (1) Tilt/angle of panel/not facing the Sun (1) Cost of electricity may decrease (1) less sunshine hours than expected / more cloud (1) Panels are dirty (1) Electricity consumption decreases (1)</p>		3		3		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			14 000W conversion to 14 kW (1) $14 \times 1\,500(1)$ $= 21\,000 \text{ kWh} (1)$ $23\% \times 21\,000 = 4\,830 \text{ kWh (so claim is valid) (1)}$ OR 14 000W conversion to 14 kW (1) $14 \times 23 / 100 = 3.22 \text{ kW} (1)$ $3.22 \times 1\,500 (1)$ $= 4\,830 \text{ kWh (so claim is valid) (1)}$			4	4	4	
	(c)	(i)		$3.5 \times 10^6 = 3\,500\,000 \text{ kW} (1)$ $3\,500\,000 / 4\,420 = 791.9 \text{ homes} (1)$ Accept any answer 791-792		2		2	2	
		(ii)		$5.3 \times 10^{10} / 3.5 \times 10^6 (1)$ $= 15\,142.857 (1)$ Accept any answer 15 142 – 15 143		2		2	2	
				Question 4 total		7	7	14	11	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	(a)			(biological) catalysts / Speed up rate of reaction	1			1		
	(b)			Liquid form would be digested in the stomach (1) Would not reach small intestine (1)	1		1	2		
	(c)			Small intestine is alkali (around pancreas) (1) so C is most suitable (1) optimum in higher pH/ pH 8 / pH 7.5 (1) A and B would denature (1) Or Small intestine is alkali (around pancreas) (1) A and B not suitable (not alkaline) (1) C optimum pH is alkali (1) A and B would denature (1)	1	3				
	(d)	(i)		Stains caused by different types of food/food contains different types of molecules	1					
		(ii)		Any 3 × (1) from Enzymes will denature (1) Active site changed/deforms (1) affects lock and key model (1) Bonds broken (1) Prevents enzyme-substrate complex forming (1) + Food stain wouldn't be broken down (1)	4					
				Question 5 total	8	3	1	12		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)	(i)		Voltage	1			1		1
		(ii)		Current	1			1		1
		(iii)		Scale (1) Plot ($\pm < 1$ small square) (2) smooth curve (1)		4		4	4	4
		(iv)		Correct reading from graph = 1.4 approx. (1) 7.2/1.4 (ecf) (1) 5.14 (1)	1	2		3	3	3
		(v)		At lower voltages the graph is steeper (1) So resistance is 1/gradient (1) So resistance is lower at the start (1) OR At lower voltages the graph is straight (1) Resistance is constant (1) Then curves so resistance increases (1) OR Calculation of two resistances may be shown for 2 marking points + statement for 3 rd mark (As current increases) temperature of the lamp increases (1) Increasing the resistance (1) Non linear (1)	1	2		3		3

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			Any 4 × (1) from: Resistance for resistor is constant (for all voltages) (1) Resistance of a diode changes / decreases (1) The resistance of the diode is {very large/infinite} for negative voltages (1) The resistance of the diode is {very large/infinite} for small positive voltages (1) as the voltage reaches a particular level the resistance decreases / (accept: as the voltage increases the resistance decreases) (1)	2	2		4		4
				Question 6 total	6	10		16	7	16