GCSE MARKING SCHEME

SUMMER 2022

GCSE
SCIENCE (DOUBLE AWARD) – UNIT 3
FOUNDATION TIER
3430U30-1

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.

GCSE SCIENCE (DOUBLE AWARD) – UNIT 3 – PHYSICS 1

FOUNDATION TIER

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.

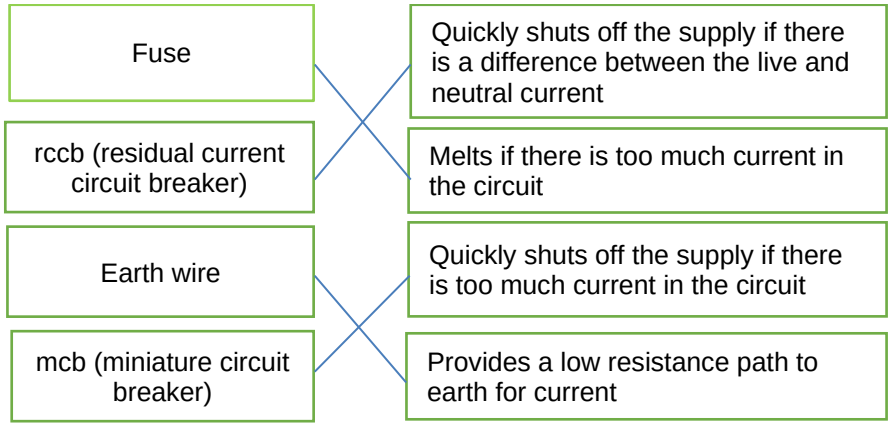
Extended response question

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 statement.

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)			Tick in 1st box Additional tick award no marks	1			1		
	(b)	(i)		 4 correct = 3 marks 2 or 3 correct = 2 marks 1 correct = 1 mark	3			3		
		(ii)		Prevent or stop [electric] shock / electrocution Don't accept to prevent harm or injury	1			1		
				Question 1 total	**5**	**0**	**0**	**5**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2.	(a)	(i)		5 points plotted correctly < 1 small square (2) 4 points plotted correctly < 1 small square (1) 3 or less points plotted correctly < 1 small square (0) Straight line between 1.0 – 5.0 cm wavelength < 1 small square (1)		3		3	3	3
		(ii)	I	Increases		1		1		1
			II	Decreases		1		1		1
		(iii)	I	2[.0] [cm]		1		1		1
			II	v = 2.0 **ecf** × 10 (1) v = 20 [cm/s] (1)	1	1		2	2	2
	(b)	(i)		Transverse (1) Geostationary (1) Microwaves (1) Equator (1)	4			4		
		(ii)	I	Distance = 264 789.9 [km] **OR** 264 924.2 [km]		1		1	1	
			II	Substitution: $\frac{264\,924.2\ \textbf{ecf}}{24}$ (1) Speed = 11 032.9 [km/h] **OR** 11 038.5 [km/h] (1) Award 1 mark for an answer of 1 756.8 [km/h] using orbit radius if no answer in (ii)I	1	1		2	2	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		Satellite has further to travel (1) so must travel faster / in the same time / in 24 hours (1) [so she is incorrect]			2	2		
				Question 2 total	**6**	**9**	**2**	**17**	**8**	**8**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3.	(a)	(i)		Convection	1			1		1
		(ii)	I	Dye / purple moves upwards **or** upwards arrow from the crystal shown on the diagram Don't accept purple crystal moves		1		1		1
			II	Because hot water rises / hot water is less dense Don't accept heat rises	1			1		1
	(b)			Copper identified as best (1) Other 3 in order: aluminium / brass / iron (1)			2	2		2
				Question 3 total	**2**	**1**	**2**	**5**	**0**	**5**

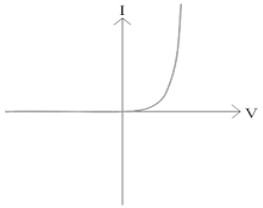
Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)			**Indicative content: Treat as neutral reference to cost.** **Coal** Coal is non-renewable. It is reliable and produces large amounts of electricity. Coal is a fossil fuel which produces CO_2 and SO_2 when burned. CO_2 is a greenhouse gas which contributes to climate change. SO_2 produces acid rain. Mining coal damages habitats and the transport of coal also has significant environmental impact. **Nuclear** Nuclear is non-renewable. It is reliable and it produces very large amounts of electricity and no greenhouse gases. Nuclear produces nuclear waste which is highly radioactive for very long periods of time making it costly and difficult to store. **Wind** Wind is renewable and it does not produce CO_2, there is also no fuel cost. It is unreliable and to produce sufficient electricity would require very large numbers of turbines. It causes visual and noise pollution. **5–6 marks** Discusses advantages and disadvantages of all 3 types of power station. *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.*	6			6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				3–4 marks Discusses some advantages and disadvantages of 2 of the 3 types of power station or provides a limited treatment of all. *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** Discusses some advantages and disadvantages of 1 of the 3 types of power station or provides a limited treatment of 1 or 2 types. *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure*. *The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** *No attempt made or no response worthy of credit.*						
	(b)	(i)		10.0 [MWh]		1		1		
		(ii)		Selection and substitution: $\frac{5}{15}[\times 100]$ (1) % efficiency = 33.3 or 33 (1) Award 1 mark for answer only of 0.33		2		2	2	
				Question 4 total	**6**	**3**	**0**	**9**	**2**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	(a)	(i)		Units saved = 3 000 [kWh]		1		1	1	
		(ii)		Substitution: 3 000 **(ecf)** × 0.2 (1) Saving = [£]600 (1) Award 1 mark for an answer of [£]60 000	1	1		2	2	
		(iii)	I	$\frac{150\,000}{600\,\textbf{ecf}}$ = 250 [weeks] (1)		1		1	1	
			II	$\frac{250\,\textbf{ecf}}{52}$ = 4.8 [years] (1) Accept 5 [years]		1		1	1	
	(b)	(i)		60 × 0.095 = 5.7 [kWh] Accept 6 [kWh]		1		1	1	
		(ii)		$\frac{3\,000}{5.7\,\textbf{ecf}}$ = 526.3 Accept 526 or 527 Accept 500 if 6 [kWh] is used		1		1	1	
	(c)			GWP of CO_2 is 1 (1) which is lower than methane / methane has a GWP of 25 (1) [so disagree] **Alternative:** CO_2 has a lower GWP (1) than methane (1) [so disagree]			2	2		
				Question 5 total	**1**	**6**	**2**	**9**	**7**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)			Variable resistor added in series with lamp (1) accept any size box with an arrow through it Voltmeter added in parallel with lamp (1)	2			2		2
	(b)	(i)		When current is 0.5 [A] the voltage is 0.9 ± 0.1 [V] (1) When current is 1 [A] the voltage is 2.4 ± 0.1 [V] (1) Triple would give 2.7 [V] **or** this is not triple (1) so not true To award 3 marks conclusion must be present **Alternative 1:** When the current doubles from 0.5 to 1 [A] (1) The voltage changes from 0.9 to 2.4 [V] (1) which is 2.7 times bigger **or** this is not triple (1) so not true To award 3 marks conclusion must be present **Alternative 2:** When current is 1 [A] the voltage is 2.4 ± 0.1 [V] (1) When current is 2 [A] the voltage is 8.4 ± 0.1 [V] (1) Triple would give 7.2 [V] **or** which is 3.5 times bigger **or** this is not triple (1) so not true To award 3 marks conclusion must be present **Alternative 3:** When the current doubles from 1 to 2 [A] (1) The voltage changes from 2.4 to 8.4 [V] (1) which is 3.5 times bigger **or** this is not triple (1) so not true To award 3 marks conclusion must be present **N.B. 1** When current is 0.5 [A] the voltage is 0.8 [V] (1) When current is 1 [A] the voltage is 2.4 [V] (1) This is 3 times bigger **or** this is triple (1) so true To award 3 marks conclusion must be present			3	3		3

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				N.B. 2 When voltage triples from 2 [V] to 6 [V] (1) Current changes from 0.9 [A] to 1.7 [A] (1) This is not double (1) so not true To earn credit voltages must be withing the range of 0.9 V to 8.4 V **N.B.3** A correct conclusion based on incorrect voltage readings taken from the graph award 1 mark.						
		(ii)		Voltage = 12 [V] (1) Current = 2.25 ± 0.05 [A] (1) both readings from graph Power = 27 [W] **or** 26.4 [W] **or** 27.6 [W] (1)		3		3	3	3
	(c)	(i)		Substitution: $\frac{12}{6}$ (1) = 2 [A] (1)	1	1		2	2	2
		(ii)		Straight line from origin through (12,2 **ecf**)		1		1	1	1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		Connect in series one way **and** see if lamp lights **or** the resistance will be low **or** current will be high (1) Reverse the cell / battery / + and - / connection / box (1) See if the lamp still lights **or** the resistance will be much higher **or** diode only lets current flow one way **or** current will be zero (very small) (1) **Alternative:** Replace lamp with sealed box / add in series [with lamp] (1) Vary R and take series of reading of current and voltage (1) Reverse box / polarity of cell and repeat step 2 (1)			3	3		3
		(ii)		 Don’t accept S shapes or curve with a decreasing gradient	1			1		1
				Question 6 total	**4**	**5**	**6**	**15**	**6**	**15**

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SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5	0	0	**5**	0	0
2	6	9	2	**17**	8	8
3	2	1	2	**5**	0	5
4	6	3	0	**9**	2	0
5	1	6	2	**9**	7	0
6	4	5	6	**15**	6	15
TOTAL	**24**	**24**	**12**	**60**	**23**	**28**