

COMPONENT 3 – Concepts in Physics**FOUNDATION TIER****MARK SCHEME****GENERAL INSTRUCTIONS**Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response questions).

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

GCSE COMBINED SCIENCE Sample Assessment Materials 177

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			460 [W]		1		1		
	(b)			Lamp			1	1		
	(c)			13 circled			1	1		
	(d)			Kettle			1	1		
	(e)			Microwave oven			1	1		
				Question 1 total	0	1	4	5	0	0

GCSE COMBINED SCIENCE Sample Assessment Materials 178

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		20 [°C]	1			1		1
		(ii)		22 [minutes]		1		1	1	1
		(iii)		80 – 28 = 52 [°C]		1		1		1
	(b)			line 1 volume/amount of water (1) line 3 distance between lamps and boiling tubes (1)			2	2		2
				Question 2 total	1	2	2	5	1	5

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		Tick in box 1 i.e. equal and act in opposite directions Any extra ticks don't award the mark	1			1		
		(ii)		Tick in box 3 Any extra ticks don't award the mark		1		1		
	(b)			Arrow pointing upwards		1		1		
	(c)	(i)		$20 - 5 = 15$ [N]		1		1		
		(ii)		Manipulation and substitution: $\frac{15}{0.5}$ (1) Acceleration = 30 [m/s ²] (1)		2		2	2	
				Question 3 total	1	5	0	6	2	0

GCSE COMBINED SCIENCE Sample Assessment Materials 180

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			Sprinkle iron filings on the card (1) Then follow the direction of a plotting compass around the circles to identify direction (1) Alternative answer: Place plotting compasses at a number of places on the card (1) And mark where the compasses point to build up the picture (1)	2			2		2
	(b)			Circles	1			1		1
	(c)			Direction reverses [but shape is unchanged]	1			1		1
	(d)			There is no field	1			1		1
	(e)			The distance of the point from the wire (1) The current in the wire (1)	2			2		2
				Question 4 total	7	0	0	7	0	7

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		The power station is within an area of outstanding natural beauty			1	1		
	(b)		Capable of responding to sudden changes in demand / small start-up time	1			1		
	(c)	(i)	It is generating electricity (1) Because the demand is greater than all the other power stations can supply (1)			2	2		
		(ii)	It is pumping water to the upper reservoir (1) Because the demand is smaller than all the other power stations can supply / most people are asleep and not using much electricity (1)			2	2		
	(d)	(i)	Recall of: $P = V \times I$ (1) Power from one generator is: Substitution: $P = 440\,000 \times 600 = 264\,000\,000$ [W](1) Total power = $6 \times 264\,000\,000 = 1\,584\,000\,000$ [W] (1)	1					
		(ii)	$\frac{1\,584\,000\,000}{2\,000} = 792\,000$	1	1		3	2	
					1		1	1	
			Question 5 total	3	2	5	10	3	0

GCSE COMBINED SCIENCE Sample Assessment Materials 182

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)	700 in both cells in the weight column (1) 700 in bottom cell in air resistance column (1)	1	1		2		
		(ii)	All 5 points plotted correctly award 2 marks 4 points plotted correctly award 1 mark only Good curve of best fit consistent with the data (1)		3		3	3	
	(b)	(i)	50 [m/s]			1	1		
		(ii)	Resultant force = 120 [N] from graph (1) Air resistance = $700 - 120 = 580$ [N] which is (just) over 550[N] and is therefore consistent with skydiver's estimate (1) Both 580[N] and explanation required to earn second mark		1	1	2		
			Question 6 total	1	5	2	8	3	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)		Nucleus on left side (1) Neutron on upper right side(1) Proton on lower right side (1)	3			3		
	(b)		They have equal and opposite charge to the protons in the nucleus (1) So need to have two for the atom to be neutral over all (1)	1	1		2		
	(c)		They both have the same number of protons / 2 protons (1) And the same number of electrons / 2 electrons (1) But the ${}^4_2\text{He}$ isotope has 1 more neutron in its nucleus (1)	3			3		
	(d)	(i)	Gravitational (accept gravity)	1			1		
		(ii)	Electrostatic (accept electric)	1			1		
	(e)	(i)	Electromagnetic radiation is a transverse wave / radiation that travels at the speed of light (1) Frequency is the number of waves produced by a source each second / 7×10^{25} waves produced by a source each second / 7×10^{25} waves per second / the number of waves per second (1)	2			2		
		(ii)	Wavelength = $\frac{300\,000\,000}{7 \times 10^{25}}$ (1) = 2.2×10^{-16} which is less than 1×10^{-12} (1) so it belongs to A (1) Allow ecf Conclusion must be consistent with calculations to award the mark		1	1 1	3	2	
			Question 7 total	11	2	2	15	2	0

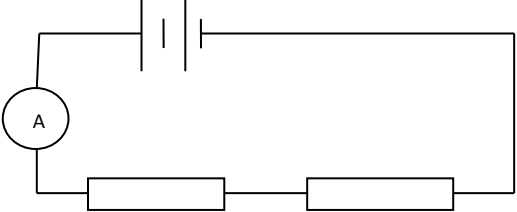
GCSE COMBINED SCIENCE Sample Assessment Materials 184

Question		Marking details		Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
8	(a)		<p>Indicative content: From A to B the speed increases uniformly from 0 m/s to 15 m/s in a time of 150 s, giving an acceleration value of 0.1 m/s². From B to C the speed stays constant at 15 m/s for 100 s. From C to D the speed drops uniformly from 15 m/s to 0 m/s between 250 s and 350 s giving an acceleration of – 0.15 m/s² (or a deceleration of + 0.15 m/s²).</p> <p>AO allocation AO1 – Description of motion AO2 – Acceleration and deceleration calculations</p> <p>5 – 6 marks Detailed description of motion with calculations of acceleration and deceleration present. <i>There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The information included in the response is relevant to the argument.</i></p> <p>3 – 4 marks A description of motion with calculation of either acceleration or deceleration present. <i>There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included in the response but there may be some minor errors or the inclusion of some information not relevant to the argument.</i></p> <p>1 – 2 marks A basic description of motion is given. <i>There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of information not relevant to the argument.</i></p> <p>0 marks No attempt made or no response worthy of credit.</p>	4	2		6	6	
	(b)	(i)	50		1		1	1	
		(ii)	BC		1		1		
		(iii)	<p>From BC: Distance travelled = 1 500 [m] (1) From FG: Distance travelled = 2 000 [m] (1) She travels 500 m more from F to G than from B to C (1)</p>		1 1	1	3	3	
			Question 8 total	4	6	1	11	10	0

Question				Marking details	Marks Available						
					AO1	AO2	AO3	Total	Maths	Prac	
9	(a)			Selection of: $v = u + at$ (1) Manipulation of equation: $a = \frac{(v-u)}{t}$ accept by implication (1) Substitution: $\frac{27}{6.5}$ (1) Acceleration = $4.2 \text{ [m/s}^2\text{]}$ (accept 4.1, 4.15) (1)	1	1					
	(b)			A car travelling at a slower speed has significantly less KE (1) So less time needed to stop the car / less stopping distance (1)		2		2			
				Question 9 total	1	5	0	6	3	0	

GCSE COMBINED SCIENCE Sample Assessment Materials 186

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)			720 in cell in the force needed column (1) 1 776 in cell in the work done column (1)		2		2	2	
	(b)	(i)		Smallest distance lifted compared to the other weightlifters (1) Relevant work done = force × distance comment e.g. weightlifter D has the lowest product of force and distance (1)	1			2		
		(ii)		Recall of: $\text{power} = \frac{\text{energy transferred}}{\text{time}}$ (1) $\frac{1600}{5} = 320 \text{ [W]}$ (1)	1			2	1	
		(iii)		Competitor D (1) Least work done in set time (1)		2		2		
				Question 10 total	2	6	0	8	3	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
11	(a)		Single complete loop (1) Resistor symbol correct (1) Ammeter symbol correct (1) 	3			3		3
	(b)	(i)	$4 + 2 = 6 \text{ } [\Omega]$	1			1		1
		(ii)	Recall of: $V = IR$ (1) Manipulation: $I = \frac{12}{6}$ (1) Ammeter reading = 2 [A] (1)	1	1		3		3
		(iii)	The 4 Ω resistor gets the hottest / has the biggest power (1) Identical (current) ² through each resistor but multiplied by higher resistance (1)			2	2		2
			Question 11 total	5	2	2	9	0	9

COMPONENT 3 – Concepts in Physics**FOUNDATION TIER****SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES**

Question	AO1	AO2	AO3	Total	Maths	Prac
1	0	1	4	5	0	0
2	1	2	2	5	1	5
3	1	5	0	6	2	0
4	7	0	0	7	0	7
5	3	2	5	10	3	0
6	1	5	2	8	3	0
7	11	2	2	15	2	0
8	4	6	1	11	10	0
9	1	5	0	6	3	0
10	2	6	0	8	3	0
11	5	2	2	9	0	9
TOTAL	36	36	18	90	27	21