

**UNIT 6: (Double Award) PHYSICS 2
HIGHER TIER**

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)		3 rd and 4 th boxes only ticked (2) -1 for additional boxes ticked			2	2	2	
	(b)		Thinking distance is increased by factors like tiredness and alcohol (1) Braking distance is increased by wet roads / poor brakes / heavy loads (1) Hence the distances given only correspond to best possible conditions (1)			3	3		
	(c)		As speed doubles braking distance increases (1) By a factor of 4 (1)		2		2		
	(d)		24 [m] (1) 96 [m] (1) Substitution: $24 + 96 = 120$ [m] (1) ecf	1	1		3	3	
	(e)	(i)	Air bags increase the time taken to stop / increase the distance the passenger travels whilst stopping (1) reducing the force acting on passenger (1)		2		2		
		(ii)	Any (1) from: <ul style="list-style-type: none"> • Crumple zone • Side impact protection bars • Seat belt 	1			1		
	(f)		Any 2 ×(1) from: <ul style="list-style-type: none"> • Use of speed bumps / speed cameras • Speed limits • Public awareness campaigns 			2	2		
			Question 1 total	2	6	7	15	5	0

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)		Dice are rolled and all those with a certain number facing upwards are removed (1) Number of dice remaining are recorded (1) Remaining dice re-rolled a number of times (1)	3			3		3
	(b)		Suitable scales (i.e. intervals of 50 on the y -axis and intervals of 1 on the x -axis) (1) All 9 points correctly plotted within $\pm \frac{1}{2}$ small square division (1) Smooth curve of best fit within $\pm \frac{1}{2}$ small square division of all points ignoring anomaly (1) Don't accept thick, double, wispy lines		3		3	3	3
	(c)	(i)	Half-life	1			1		1
		(ii)	Correct method clear from graph (1) Answer consistent with graph to 1 d.p.(1)		2		2		2
	(d)		Longer half-life / less dice decay each time (1) Since probability of decay is lower (1)			2	2		2
			Question 2 total	4	5	2	11	3	11

Question		Marking details		Marks Available						
				AO1	AO2	AO3	Total	Maths	Prac	
3	(a)		<p>Indicative content: Initially the star is fusing hydrogen, it is stable as the forces of gravitation and radiation pressure are equal and opposite. Once hydrogen is largely exhausted helium fuses, the radiation pressure is bigger than the inward gravity forces and the star's outer layers expand and cool, the star becomes a supergiant. Fusion of increasingly heavier elements occurs in layers around the core. Once fusion stops, the star's core rapidly collapses and then explodes in a supernova, scattering material from the outer layers of the star into space. The core then contracts and cools, becoming either a neutron star or a black hole.</p> <p>5 – 6 marks: Clear description of each stage in the life cycle with reference to role of fusion and the forces acting. <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: Each stage in the life cycle is named with some references to fusion / forces at each stage. <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> <p>1-2 marks: Name of each stage in the life is given. Some stages named / detail given. <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 uses 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>							
				6			6			

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(b)			Cloud of dust and gas (1) and heavy elements ejected by supernovae (1) collapse under gravitational attraction (1)	3			3		
				Question 3 total	9	0	0	9	0	0

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	If a body A exerts a force on body B (1) then body B exerts an equal and opposite force on body A (1) Accept: Every action has an equal and opposite reaction (1) which act on different bodies (1)	2			2		
		(ii)	Rocket / air exerts a downwards force on the water (1) so water exerts an upward force on the rocket (1)		2		2		
	(b)		Substitution: $KE = \frac{1}{2} \times 0.5 \times 22^2$ (1) KE = 121 [J] (1) PE = total energy = 126 [J] (1) Substitution: $0.5 \times 10 \times h = 126$ (1) $h = 25.2$ [m] (1)	1 1	1 1 1		5	5	
	(c)		Not all KE transferred to GPE (1) Some lost as work is done against air resistance (1)		2		2		
	(d)	(i)	Use of $F = ma$ (1) $F = 0.5 \times 4$ (1) $F = 2.0$ [N] (1)	1 1	1		3	3	
		(ii)	2.0 + 5.0 (ecf) (1) Thrust = 7.0 [N] (1)		2		2	2	
		(iii)	Rocket mass decreases reducing weight as water is ejected			1	1		
			Question 4 total	6	10	1	17	10	0

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		43	1			1		
		(ii)		Alpha decay (1) Helium nucleus (1) accept 2p + 2n	2			2		
		(iii)		2.5 days = 60 hours = 10 half-lives (1) Activity remaining = $\frac{5 \times 10^4}{2^{10}}$ (1) = 49 [Bq] (1)						
	(b)			Any technetium-98 initially present in the star would have all decayed (1) so it must have been made later (1)						
				Question 5 total	3	3	2	8	3	0

HIGHER TIER**SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES**

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	2	6	7	15	5	0
2	4	5	2	11	3	11
3	9	0	0	9	0	0
4	6	10	1	17	10	0
5	3	3	2	8	3	0
TOTAL	24	24	12	60	21	11

