

Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Mark Schemes

Q1.

Question number	Answer	Additional guidance	Mark
(i)	0.45 (s) (1)	Allow any value ≥ 0.4 and ≤ 0.5	(1)

Question number	Answer	Additional guidance	Mark
(ii)	An explanation that combines improvement of the experimental procedure (1 mark) and justification/reasoning which must be linked to the improvement (1 mark) - take pictures more frequently (1) - in order to determine exact time of the release. (1)	other responses may be acceptable	(2)

Question number	Answer	Additional guidance	Mark
(iii)	Substitution (1) $F = 7.26 \times 20.6$ Evaluation (1) 150 (N)	Accept 149.6 (N) full marks will be awarded for correct numerical answer without working	(2)

Question number	Answer	Additional guidance	Mark
(iv)	Rearrangement (1) $v = a \times t$ Substitution (1) $v = 23 \times 0.48$ Evaluation (1) 11 m/s	Accept 11.04(m/s) full marks will be awarded for correct numerical answer without working	(3)

Question Number	Answer	Mark
	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO1 (6 marks) Stage 1 • (At the beginning) maximum force is applied • With zero resistive force(s) • And maximum acceleration Stage 2 • As the speed increases the increasing resistive force results in a decreasing resultant forward force • And a decreasing acceleration • So velocity increases at a decreasing rate Stage 3 • Eventually thrust = resistive force(s) • Then no resultant force forward and no acceleration • Submarine continues forward at a constant speed	(6)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. momentum • momentum is product of mass and velocity • $p = mv$ • momentum is a vector quantity • momentum of P = mv • momentum of Q = $-mv$ • total momentum before collision is zero • $mv_p + (-mv_q) = 0$ • momentum after collision must be zero • total momentum before = total momentum after	6 AO1.2 AO2.2

	energy • before collision each trolley has kinetic energy • $KE = \frac{1}{2}mv^2$ • total KE before collision is sum of KE of both trolleys • KE after collision is zero • KE transferred to thermal (store) • KE transferred by heating and by sound • energy dissipated to surroundings Ignore references to equal and opposite forces and the laws of motion	
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Level	Mark	Descriptor
	0	No awardable content
Level 1	1-2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)
Level 2	3-4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)
Level 3	5-6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)

Level	Mark	Additional Guidance	General additional guidance – the decision within levels e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1-2	<u>Additional guidance</u> isolated fact(s) about the momentum and/or energy of trolleys, before or after collision	<u>Possible candidate responses</u> momentum before collision equals momentum after collision momentum is mass x velocity momentum is a vector energy cannot be created or destroyed $KE = \frac{1}{2}mv^2$
Level 2	3-4	<u>Additional guidance</u> limited description of conservation of momentum and limited description of conservation of energy OR detailed description of either conservation of energy or conservation of momentum	<u>Possible candidate responses</u> momentum/velocities of trolleys is equal and opposite before collision / zero before collision/zero after collision. trolleys have kinetic energy before collision OR the trolleys have kinetic energy before the collision which is transferred to thermal energy after the collision.

Level 3	5-6	<u>Additional guidance</u> detailed description of conservation of momentum before and after collision and limited description of conservation of energy OR detailed description of energy conservation and limited description of conservation of momentum	<u>Possible candidate responses</u> momentum of trolleys before collision is equal and opposite giving zero, and momentum is zero after collision so momentum is conserved energy is dissipated thermally after collision OR the trolleys have kinetic energy before the collision which is transferred to thermal energy after the collision. momentum of trolleys is equal and opposite before collision / zero before collision/zero after collision.