Name of the Student:_____
Max. Marks :18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

Question Number	Answer	Additional guidance	Mark
(i)	recall (1) (P =) $\frac{F}{A}$ re-arrangement and evaluation (1) A = 0.62 (m^2)	accept for recall 66 000 = $\frac{41\ 000}{A}$ or A = $\frac{41\ 000}{66\ 000}$ allow values that round to 0.62 e.g. 0.621 award full marks for the correct answer without working	(2)

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Question Number	Answer	Additional guidance	Mark
(ii)	substitution into $P = h \times \rho \times g$ (1) 66000 = h x 1000 x 10 re-arrangement and evaluation (1) (h =) 6.6 (m)	award substitution mark if it is clear that all values have been substituted ($h = \frac{66\,000}{1\,000 \times 10}$) award full marks for the correct answer without working	(2)

Question Number	Answer	Additional guidance	Mark
(iii)	An explanation linking the pressure at the bottom of the block is greater than the pressure at the top of the block (for the same area) (1) the force on the bottom is greater than the force on the top (1)	accept in terms of weight of fluid displaced the block displaces some water weight of water displaced is less than weight of (same volume) of concrete **or** water is less dense than concrete allow the upthrust (of water) is equal to the weight of the water displaced for **2** marks	(2)

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Question Number	Answer	Mark
(iv)	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. **Between 0 and 120 seconds** • the (apparent) weight of the block is less than in air (AO2) • force in the cable is less (than weight of block) (AO3) • force remains constant because upthrust is constant (AO3) • upthrust is constant because submerged volume of block is constant (AO3) • upthrust = (17.0 – 10.2) = 6.8 kN (AO3) • lifting speed = (distance for top to reach surface / time to start to emerge) = 6.6 /120 = 0.055 m/s **Between 120 and 140 seconds** • block is emerging from water (AO3) • less volume of the block remaining submerged (AO2) • upthrust is reducing (AO3) • force in the cable is increasing (AO2) • it takes 20 seconds to fully emerge from water (AO3) • height of block = lifting speed x time for top emerge = 0.055 x 20 = 1.1 m (AO3)	(6)
	140 seconds onwards • block is clear of the water (AO3) • no upthrust (from water) on the block (AO2) • force in cable is equal to weight of block (AO2) • force is constant because weight is constant (AO2) • mass of block = weight in air / 10 = 17000 / 10 = 1700 kg (AO3) • height of lorry = lifting speed x time to reach end of lift = = 0.055 x 30 s = 1.7 m (AO3) **At all times** • (speed is constant) so no force required to accelerate the block (AO2) • so force is resultant of weight and upthrust (AO2) **Other calculations are possible, eg:** • Volume of block = height x area = 1.1 x 0.62 = 0.68 m^3 • Density of block = 1700 / 0.68= 2500 kg/m^3	

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Descriptor
• No awardable content
• Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) • 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)
• Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3) • 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)
• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) • 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)

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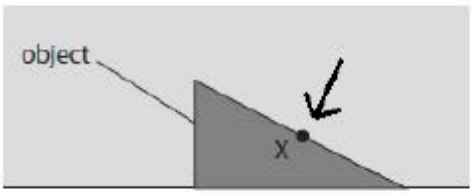
Summary for guidance			
Level	**Mark**	**Additional Guidance**	**General additional guidance – the decision within levels** e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance Isolated facts with limited quantitative work e.g. identifies the change in lifting force and gives a reason why it changes.	Possible candidate responses The lifting force increases because the block is being lifted out of the water
Level 2	3–4	Additional guidance Limited explanation that includes extracting data (from either one section of the graph or elsewhere in the question) to provide a reason why the force changes	Possible candidate responses Between 120 and 140s the lifting force increases. This is because the block is being lifted out of the water and there is less upthrust.
Level 3	5–6	Additional guidance Detailed explanation that includes calculation(s) relevant to one section of the graph and correct explanation relevant to the middle section and one other section.	Possible candidate responses When underwater, the lifting force is smaller because of upthrust from the water. The upthrust = 17-10.2 = 6.8 kN The lifting force increases after 120s because it is being lifted out of the water and the upthrust is getting smaller.

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Q2.

Question number	Answer	Additional guidance	Mark
i	recall (1) $P = \frac{F}{A}$ substitution (1) (p) $= \frac{2400}{0.8}$ evaluation (P) = 3000 (Pa) (1)	may be implied by a correct substitution award full marks for the correct answer without working	**(3)** **AO2**

Question number	Answer	Additional guidance	Mark
ii	an explanation linking greater pressure (on bottom of tank) (1) with greater force **due to water** (above bottom of tank) (1)	 more weight of water more depth/height of water ignore simply 'more water' or 'greater amount of water'	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
iii	 an arrow perpendicular to the sloping side **and** pointing towards X	judge by eye	**(1)** **AO1**

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