PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



MARK SCHEME

TOPIC 15: FORCES AND MATTER

SCORE	PERCENTAGE
/143	%

STEMUP

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Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(i)	50.0 to 55.0 (mm) inclusive		**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	a description including note the original length (1) note the final length and subtract (1)		**(2)**

Question number	Answer	Additional guidance	Mark
(iii)	any two from: use a ruler with a smaller/millimetre divisions (1) use interim values of weight (1) add more weights (to increase the range) (1) move the ruler closer to the spring (1) use of pointer (1) repeat **and** average (1)	 ignore more accurate add fixed values of weights eye level / no parallax	**(2)**

Question number	Answer	Additional guidance	Mark
(iv)	the coils are {pushed together /touching} (1) or spring is fully compressed /cannot be made shorter (1)		**(1)**

Q2.

Question number	Answer	Additional guidance	Mark
(i)	50.0 to 55.0 mm inclusive		**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	a description including note the original length (1) note the final length and subtract (1)		**(2)**

Question number	Answer	Additional guidance	Mark
(iii)	any two from: use a ruler with a smaller/millimetre divisions (1) use interim values of weight (1) add more weights (to increase the range) (1) move the ruler closer to the spring (1) use of pointer (1) repeat **and** average (1)	 ignore more accurate add fixed values of weights eye level / no parallax	**(2)**

Question number	Answer	Additional guidance	Mark
(iv)	the coils are {pushed together /touching} (1) or spring is fully compressed /cannot be made shorter (1)		**(1)**

Q3.

Question Number:	Answer	Additional Guidance	Mark
(i)	a description to include 4 of the following: • note position of pointer before current is switched on (1) • measure position of pointer when current in coil (1) • (use an ammeter to) measure current (1) • calculate the extension / stretch of the spring (1) • use force (of attraction) is proportional to extension / stretch (of spring) (1) • repeat with different currents (1)	measure length of spring before current is switched on how far nail moves calculate force from spring constant and extension calibrate spring increase the current calculate the extension of the spring using new position of pointer minus starting position of pointer is worth 3 marks	**(4)** AO 2 2

Question Number:	Answer	Additional Guidance	Mark
(ii)	select and substitute (1) (E =) ½ x 24 x 0.12^2 evaluation (1) (E =) 0.17 (J)	 ½ x 24 x 12^2 max 1 mark accept answers that round down to 0.17 e.g. 0.1728 POT error (e.g. 1728) max 1 mark award full marks for correct answer without working	**(2)** AO 2 1

Q4.

Question Number:	Answer	Additional Guidance	Mark
(i)	a description to include 4 of the following: • note position of pointer before current is switched on (1) • measure position of pointer when current in coil (1) • (use an ammeter to) measure current (1) • calculate the extension / stretch of the spring (1) • use force (of attraction) is proportional to extension / stretch (of spring) (1) • repeat with different currents (1)	measure length of spring before current is switched on how far nail moves calculate force from spring constant and extension calibrate spring increase the current calculate the extension of the spring using new position of pointer minus starting position of pointer is worth 3 marks	**(4)** AO 2 2

Question Number:	Answer	Additional Guidance	Mark
(ii)	select and substitute (1) (E =) ½ x 24 x 0.12^2 evaluation (1) (E =) 0.17 (J)	 ½ x 24 x 12^2 max 1 mark accept answers that round down to 0.17 e.g. 0.1728 POT error (e.g. 1728) max 1 mark award full marks for correct answer without working	**(2)** AO 2 1

Q5.

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)**

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)**

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	

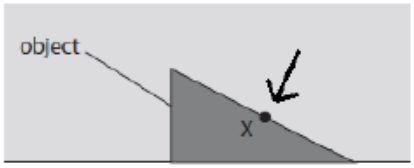
Descriptor
• No awardable content
• Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) • The explanation attempts to link and apply knowledge and understanding of scientific ideas, 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)

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.

Q6.

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**

Q7.

Question number	Answer	Additional guidance	Mark
(i)	substitution (1) (pressure =) $\frac{2500}{4 \times 0.022}$ evaluation (1) 28 000 (Pa)	 any number rounding to 28 000 e.g. 28 400, 28 410, 28 409 award full marks for the correct answer without working award **one** mark for numbers that round to 110 000 (Pa) (missing 4 in denominator) award 1 mark for 454 545 (times by 4)	**(2)** **AO2.1**

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking any **two** from camel is less likely to sink into the soft ground (1) (same) force / weight is distributed / spread out (1) camel's hoof has greater (surface) area (than donkey) (1) camel's hoof exerts less pressure (than it would if hoof were smaller) (1)	ORA for donkey ignore pressure is spread out wider if no other marks scored then allow 1 mark for split in camel hoof enables better grip (as it walks)	**(2)** **AO3.1**

Q8.

Question number	Answer	Additional guidance	Mark
	substitution (1) $0.14 = ½ \times 175 \times x^2$ rearrangement for x^2 (1) $(x^2=)\ \frac{0.14 \times 2}{175}$ or $\frac{0.14}{0.5 \times 175}$ evaluation (1) 0.04 (m)	substitution and rearrangement in either order $x^2 = \frac{E}{\frac{1}{2} \times k}$ 1.6×10^{-3} seen gains 2 marks 0.02(m) gains 2 marks 0.028 gains 1 mark award full marks for the correct answer without working	**(3)**

Q9.

Question number	Answer	Additional guidance	Mark
	substitution (1) $0.14 = ½ \times 175 \times x^2$ rearrangement for x^2 (1) $(x^2=)\ \frac{0.14 \times 2}{175}$ or $\frac{0.14}{0.5 \times 175}$ evaluation (1) 0.04 (m)	substitution and rearrangement in either order $x^2 = \frac{E}{\frac{1}{2} \times k}$ 1.6×10^{-3} seen gains 2 marks 0.02(m) gains 2 marks 0.028 gains 1 mark award full marks for the correct answer without working	**(3)**

Q10.

Question number	Answer	Additional guidance	Mark
(i)	substitution (1) (p) = 1000 x 10 x 0.200 evaluation of pressure difference (1) 2000 final evaluation (1) 103000 (Pa)	 accept e.c.f for addition of atmospheric pressure seen for 1mark award 1 mark for selecting correct equation if no other mark awarded award full marks for correct answer without working.	**(3)**

Question number	Answer	Additional guidance	Mark
(ii)	an explanation linking use of $P = h \times \rho \times g$ (1) no area in the equation (1)	 P /pressure, ρ /density (and g /gravitational field strength) are constant/the same Area does not affect result h /height of water is independent of area P, ρ, and g are all constant gains 2 marks	**(2)**

Q11.

Question number	Answer	Additional guidance	Mark
	recall and use of $P = \frac{F}{A}$ (1) evaluation (1) = 450 (Pa)	$P = \frac{0.15 \times 10}{3.3 (\times 10^{-3})}$ 454 (Pa)	**(2)**

Q12.

Question number	Answer	Additional guidance	Mark
	recall and substitution (1) $0.5 = k \times 13 (\times 10^{-3})$ rearrangement (1) $\frac{0.5}{13(\times 10^{-3})}$ evaluation (1) 38 (N/m)	$k = \frac{F}{x}$ allow 38.5 (N/m) or 38.46 (N/m) or 39 (N/m) 0.04/0.038 (N/m) gains 2 marks 2958 (N/m) gains 1 mark (x^2 used in equation) award full marks for the correct answer without working	**(3)**

Q13.

Question number	Answer	Additional guidance	Mark
	recall and substitution (1) $0.5 = k \times 13 (\times 10^{-3})$ rearrangement (1) $\frac{0.5}{13(\times 10^{-3})}$ evaluation (1) 38 (N/m)	 $k = \frac{F}{x}$ allow 38.5 (N/m) or 38.46 (N/m) or 39 (N/m) 0.04/0.038 (N/m) gains 2 marks 2958 (N/m) gains 1 mark (x^2 used in equation) award full marks for the correct answer without working	**(3)**

Q14.

Question Number	Answer	Additional guidance	Mark
(i)	recall (1) $(P =) \frac{E}{t}$ substitution and evaluation (1) (P=) 75 (W)	P = work done ÷ time $P = \frac{45}{0.6}$ award full marks for the correct answer without working	**(2)**

Question Number	Answer	Additional guidance	Mark
(ii)	substitution into $E = \frac{1}{2} \times k \times x^2$ (1) $45 = \frac{1}{2} \times 140 \times x^2$ rearrangement (1) $(x =) \sqrt{\frac{2 \times 45}{140}}$ evaluation (1) 0.8(0) (m)	allow substitution and rearrangement in either order $x^2 = (\frac{E}{0.5k} =) \frac{2 \times 45}{140}$ $x^2 = 0.64(28571)$ accept values that round to 0.80 e.g. 0.80178 award full marks for the correct answer without working	(3)

Q15.

Question Number	Answer	Additional guidance	Mark
(i)	recall (1) $(P =) \frac{E}{t}$ substitution and evaluation (1) (P=) 75 (W)	P = work done ÷ time $P = \frac{45}{0.6}$ award full marks for the correct answer without working	(2)

Question Number	Answer	Additional guidance	Mark
(ii)	substitution into $E = \frac{1}{2} \times k \times x^2$ (1) $45 = \frac{1}{2} \times 140 \times x^2$ rearrangement (1) $(x =) \sqrt{\frac{2 \times 45}{140}}$ evaluation (1) 0.8(0) (m)	allow substitution and rearrangement in either order $x^2 = (\frac{E}{0.5k} =) \frac{2 \times 45}{140}$ $x^2 = 0.64(28571)$ accept values that round to 0.80 e.g. 0.80178 award full marks for the correct answer without working	(3)

Q16.

Question number	Answer	Mark
(i)	pressure = force ÷ area	(1)

Question number	Answer	Additional guidance	Mark
(ii)	rearrangement (1) $(F =) P \times A$ calculation of area (1) $2.4 \times 1.5 = 3.6$ substitution (1) $(F =) 12\,000 \times 3.6$ answer (1) 43 200 (N)	award full marks for correct numerical answer without working maximum 3 marks if kPa not converted to Pa	(4)

Q17.

Question number	Answer	Additional guidance	Mark
	any two from pressure(s) would be greater (values) (1) steeper gradient of graph (1) both straight lines (1) intercept (on pressure axis) the same (1)	**credit mark points seen on graph** bigger gradient / steeper line (of best fit) both linear pressure at surface is the same	**(2)** **AO3.2**

Q18.

Question number	Answer	Additional guidance	Mark
(i)	rearrange $p = \rho g h$ to give $\rho = p / (g h)$ (1) substitution using any point from graph (1) e.g. depth = 50km and pressure = 1.5 GPa $\rho = p / (g h)$ $= 1.5 \times 10^9 / (10 \times 50 \times 10^3)$ Evaluation (2) $= 3000$ (kg/m^3)	rearrangement and substitution in any order allow any combination from the graph and ignore 'pot' error here 'pot' error scores 2 marks maximum	**(4)**

Question number	Indicative content	Mark
(ii)	Answers will be credited according to the 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 of the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO2 (3 marks) A03 (3 marks)** **A03 Interpretation and evaluation from the graph** Similarities: • both show increasing pressure with depth • both show a range of pressures over kilometre depths / heights Differences: • ocean water shows a linear relationship (straight line) but atmosphere gives a non-linear (curved) relationship • density of ocean water not changing with depth but density of atmosphere changes as you go higher • The pressures in the ocean recorded are much bigger (GPA compared with kPa) The depth of the ocean shown is up to 100km whereas the height of the atmosphere involved is only up to 10km **A02 Link between graph shapes and underlying physics** Similarities: • pressure is due to (increasing) weight of fluid (liquid / gas) above • more molecules above Differences: • atmosphere becomes thinner the higher you go molecules in the ocean stay (on average) the same distance apart but in the atmosphere they get further apart (on average) as you go higher up	(6)

Level	Mark	Descriptor
	0	• No awardable content
Level 1	1–2	• 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)
Level 2	3–4	• 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)
Level 3	5–6	• 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)

Q19.

Question Number	Answer	Additional guidance	Mark
(i)	A description including any one from the following (1) **measure** a length or a specific distance related to the rubber or weights on a hanger OR with a **named device** (e.g. metre rule / stick / ruler / measuring tape) OR note position of a fixed point on rubber / weight carrier **AND** extension calculated / measured as the change in or difference between two positions or lengths or extensions (1)	evidence may be taken from additions to the diagram ignore vague statements such as see how it much it extends	(2)

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation linking graph of rubber band is non-linear / curved / not directly proportional (1) graph for unloading does not go through same points as loading (1)	 (graph for) spring would be straight (graph for) spring would only have one line / go through the same points ignore reference to returning to original shape / length	(2)

Q20.

Question Number	Answer	Additional guidance	Mark
(i)	A description including any one from the following (1) **measure** a length or a specific distance related to the rubber or weights on a hanger OR with a **named device** (e.g. metre rule / stick / ruler / measuring tape) OR note position of a fixed point on rubber / weight carrier **AND** extension calculated / measured as the change in or difference between two positions or lengths or extensions (1)	evidence may be taken from additions to the diagram ignore vague statements such as see how it much it extends	(2)

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation linking graph of rubber band is non-linear / curved / not directly proportional (1) graph for unloading does not go through same points as loading (1)	 (graph for) spring would be straight (graph for) spring would only have one line / go through the same points ignore reference to returning to original shape / length	(2)

Q21.

Question number	Answer	Additional guidance	Mark
	an explanation linking the area (of contact between person and bed) is smaller when standing up (1) same weight (over smaller area) so the pressure is greater when standing up (1)	accept reverse arguments weight is more concentrated / not distributed /not spread across bed (when standing up) uses p = F/A argument (as a consequence of the smaller area, pressure is bigger)	**(2)** **AO2**

Q22.

Question number	Answer	Additional guidance	Mark
	An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (2 marks): • pressure in A is the highest and pressure in C is the lowest (pressure in B is between them) (1) • pressure depends on depth of liquid (so) can compare A and C because same liquid (hence) pressure in A is twice that of C (1) • pressure depends on density of liquid (so) can compare A and B since same depth hence pressure in A greater than pressure in B (1)	allow a mathematical approach, i.e. calculating all three pressures from the relevant data	**(3)**

Q23.

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. **AO1 (3 marks)** • upthrust is the force on the submarine in the water (submerged) in a fluid • upthrust on the submarine and its weight act in opposite directions • upthrust is equal to the weight of water displaced by the submarine • the difference in pressures on the upper and lower surfaces of the submarine causes the upthrust **AO2 (3 marks)** • the volume of the submarine is fixed so the upthrust on the submarine is constant • increasing/decreasing volume of water in tanks increases/ decreases weight of submarine but does not affect upthrust • if weight increases to become greater than upthrust there is a resultant downward force on the submarine so the submarine sinks • if weight decreases to become less than upthrust there is a resultant upward force on the submarine so the submarine rises	**(6)**

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)

Q24.

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 (example) content below is not prescriptive and candidates are not required to include the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO2 **Pressure** • difference in pressure between top and bottom of boat • top pressure is atmospheric • pressure on bottom of boat atmospheric plus that due to depth of water. **Unloaded boat** • density of boat less than density of water • floating objects are partially immersed • floating objects displace fluid / water • upthrust is due to the difference in pressure • upthrust is equal to the weight of the boat • upthrust is equal to the weight of fluid / water displaced **Boat with load** • the weight/density of the boat increases because of the load added • more upthrust is needed to balance the extra weight of the boat • more water has to be displaced to provide the upthrust • when the boat floats lower in the water it displaces more water • the weight of water displaced is the upthrust and is equal to the weight of the boat	**(6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	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. Lines of reasoning are unsupported or unclear. (AO2)
Level 2	3–4	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. Lines of reasoning mostly supported through the application of relevant evidence. (AO2)
Level 3	5–6	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. Lines of reasoning are supported by sustained application of relevant evidence. (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	Additional guidance Elements of physics present i.e. isolated knowledge of principles **two** unconnected statements from any section	Possible candidate responses pressure difference upthrust water displaced displacement floating
Level 2	3–4	Additional guidance Some knowledge of principles with a logical connection made in one section and statement from one other section	Possible candidate responses upthrust and weight are balanced /upthrust is equal to the weight of the boat when load added upthrust increases difference in pressure between the top and bottom of the boat
Level 3	5–6	Additional guidance Detailed knowledge of principles with logical connections made in two sections.	Possible candidate responses upthrust is equal to the weight of water displaced. when load is added, weight increases more water is displaced

Q25.

Question number	Answer	Additional guidance	Mark
i	data points correctly identified (1) 50 ±2 80 ±2 evaluation (1) (-)30 ±4 kPa	award 1 mark if 80 and 50 seen ignore the lack of minus sign allow ecf from incorrect reading of either pressure at 2000m or pressure at 6000m for one mark	**(2)** **AO3**

Question number	Answer	Additional guidance	Mark
	any **one** suggestion of greater density of atmosphere (1) greater depth of atmosphere (above the aeroplane) (1) greater temperature (of the atmosphere) (1)	accept reverse argument more particles (per cubic metre) the air gets thicker greater weight of the atmosphere	**(1)** **AO1**

Q26.

	Answer	Acceptable answers	Mark
(i)	 (1) air resistance (1)	upward arrow on any part of line vertical line from any point on the diagram air friction, upthrust, drag Ignore any downward arrow labelled weight or gravity	**(2)**
(ii)	Balanced (1) Zero (1)		**(2)**

Q27.

Question Number:	Answer	Additional Guidance	Mark
	an explanation linking: use of $P = \frac{F}{A}$ (1) **area** of piston Y is less than area of piston Z (1) (therefore) force K is less than force L (1)	accept answers in terms of work = force x distance accept reverse arguments accept K for piston Y and L for piston Z	**(3)** AO 3 2a AO 3 2b

Q28.

Question number	Answer	Mark
	B	**(1)**

Q29.

Question number	Answer	Mark
	C  A,B and D are incorrect because pressure increases with depth	**(1)**

Q30.

Question number	Answer	Additional guidance	Mark
(a)	evidence that anomalous reading excluded (1) evaluation (1) average length = 20.31 (mm)	accept 101.57 (÷5) for first mark accept 20.314 (mm)	(2)

Question number	Answer	Additional guidance	Mark
(b)(i)	• Axes with linear scales that use more than half of each edge of the grid and labelled with units from table (1) • All points correctly plotted to ± half a square (1) • Single straight line passing through all points and the origin (1)	allow 1 mark if only one plotting error and correct line drawn for points plotted	(3)

Question number	Answer	Additional guidance	Mark
(b)(ii)	A comment that makes reference to the following points: (using table) • idea that equal increments of force/weight/mass cause equal increments of extension (1) • correct reference to figures in the table (1) OR (using graph) • the graph line is straight (1) • the graph line passes through the origin (1) AND therefore the student's conclusion is correct (1)	last marking point can only be achieved if at least one of the other two marks is awarded	(3)

Question number	Answer	Additional guidance	Mark
(c)	An answer that combines points of interpretation/evaluation to provide a logical description: • above 37.5 N/4 mm there are large increases of extension for small increases in load (1) • the maximum extension of the wire is about 16.5 mm before it breaks (1) • above 12 mm the wire keeps on extending when the load is reduced below 46 N (1)	accept extension is (much) greater for each 1 N increase in load above 37.5 N	(3)

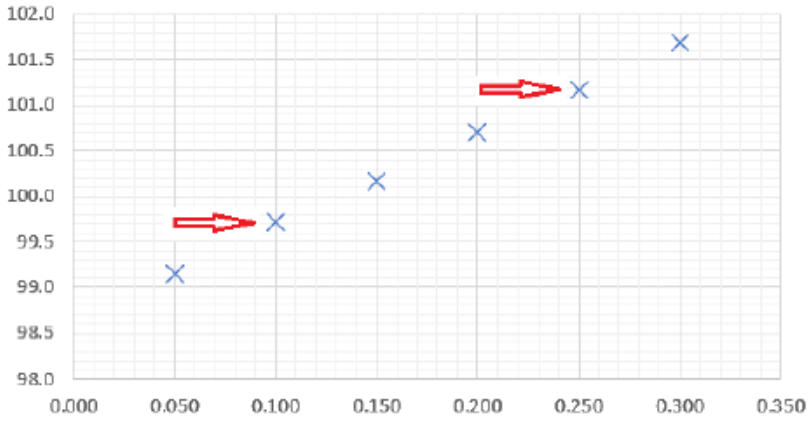
Q31.

	Answer	Acceptable answers	Mark
(a)(i)	B to the left ←		(1)
(a)(ii)	A accelerating		(1)
(a)(iii)	substitution 625x 10 (1) Evaluation 6250 (N) (1)	625 x 9.8 6125 (N) give full marks for correct answer, no working	(2)
(b)(i)	 (1) air resistance (1)	upward arrow on any part of line vertical line from any point on the diagram air friction, upthrust, drag Ignore any downward arrow labelled weight or gravity	(2)
(b)(ii)	Balanced (1) Zero (1)		(2)

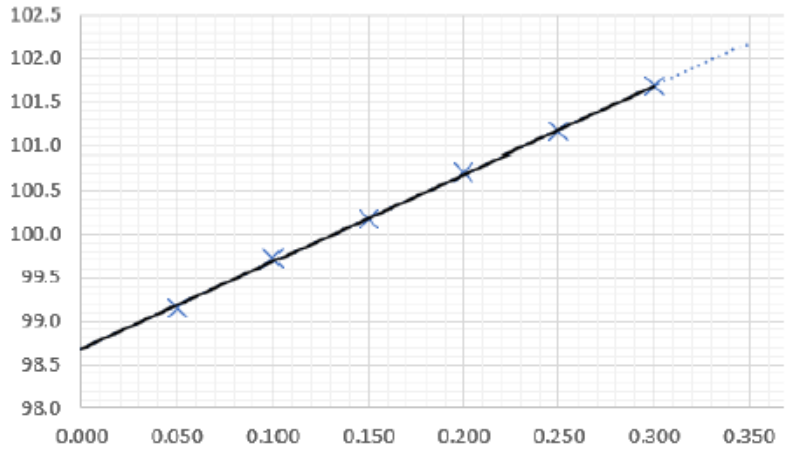
Total for marks for question = 8

Q32.

Question number	Answer	Additional guidance	Mark
(i)	points plotted to within ± 1 small square (0.100, 99.7) (1) (0.250, 101.15) (1)		(2) AO2.1



Question number	Answer	Additional guidance	Mark
(ii)	best fit straight line passing through at least four of the points (1)	do not accept tramlining (multiple lines / curves) ignore slight shakiness in drawing	(1) AO2.1



Question number	Answer	Mark
(iii)	D $y = mx + c$ Figure 10 shows a linear graph with a positive gradient and intercept	(1) AO1.1

Question number	Answer	Additional guidance	Mark
(iv)	answer between 98.6 and 98.8 (kPa)	allow ecf from their line of best fit in b(ii)	(1) AO3.2

Q33.

Question number	Answer	Mark
	An answer that combines the following points to provide a logical description of the plan: EITHER • (determine upthrust) by adding weights until the block of wood is fully immersed and recording the load required (1) • calculate upthrust by adding load and weight of block (1) OR • (determine the weight of water displaced) by using a ruler to measure the dimensions of the block and multiplying them together to find the volume (1) • calculate the weight of water from volume × density × g (1)	**(2)**