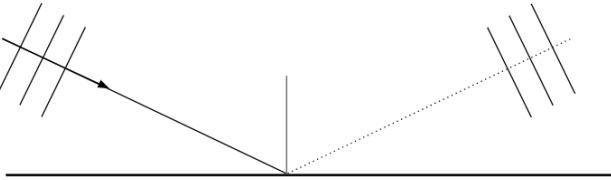


Question number	Answer	Notes	Marks
4 (a)	zero/0 (N);		1
(b) (i)	pressure = depth × density × gravitational field strength;	allow use of standard symbols e.g. $p = h \times \rho \times g$ allow 'd' for 'h' reject 'gravity' for 'g' in formula	1
(ii)	substitution; evaluation;  e.g. pressure = depth × density × gravitational field strength pressure = $0.041 \times 1000 \times 10$ pressure = 410 (Pa)	-1 POT error  allow use of 9.8(1) for 'g' giving 401.8...	2
(iii)	pressure = force ÷ area;	allow use of standard symbols e.g. $P = F \div A$	1
(iv)	substitution or re-arrangement;  evaluation;  e.g. pressure = force ÷ area $400 = \text{force} \div 0.0017$ force = $400 \times 0.0017 = 0.68$ (N)	substitution and rearrangement in either order allow correctly rounded values e.g. 0.697 allow use of candidate's unrounded value even if not approx 400	2
(v)	upwards force greater than weight of cube; <b>resultant</b> force upwards;	allow idea of ice being less dense than water for 1 mark.	2

(Total for Question 4 = 9 marks)

Question number	Answer	Notes	Marks
10 (a) (i)	any THREE from: trolley changes direction; induction depends on direction of relative motion;  idea that voltage has changed direction (as sign of voltmeter reading depends on direction of voltage); idea that at ends of motion, voltage is zero;	condone current for voltage ignore idea induction depending on speed	3
(ii)	speed may change/ magnetic field may not be uniform;	accept idea that magnetic field may change allow idea of entering or leaving field	1
(b) (i)	substitution; re-arrangement;  evaluation;  correct answer: $1.8 \times 10^{-4}$ (A)  e.g. charge = current $\times$ time $1.4 \times 10^{-4} = \text{current} \times 0.78$ current = $(1.4 \times 10^{-4}) \div 0.78 = 1.79 \times 10^{-4}$ (A)	substitution and rearrangement in either order -1 POT error	3
(ii)	substitution; re-arrangement;  evaluation; correct answer: $1.6 \times 10^{-2}$ (V)  e.g. energy = charge $\times$ voltage $2.3 \times 10^{-6} = 1.4 \times 10^{-4} \times \text{voltage}$ voltage = $(2.3 \times 10^{-6}) \div (1.4 \times 10^{-4}) = 1.64 \times 10^{-2}$ (V)	allow use of standard symbols e.g. $E = Q \times V$ allow $v, V$ for voltage reject $C, c$ for charge substitution and rearrangement in either order  -1 POT error	3

(Total for Question 10 = 10 marks)

Question number	Answer	Notes	Marks
11 (a) (i)	line drawn at 90 degrees to side of boat at point where direction of travel touches boat;	ignore normal inside boat	1
(ii)	66 (degrees);	accept in range 64-68 degrees	1
(iii)	three wavefronts parallel and constant wavelength;  to the right of the normal and above boat surface; correct angle of reflection;  	by eye; condone different wavelength to incident wavefronts  by eye;  allow 'reflected ray' if no other mark awarded	3
(b) (i)	transverse (waves/particles) vibrate at right angles to the direction of travel of the wave;  longitudinal (waves/particles) vibrate along line of direction of travel of the wave;	allow 'vibrations/oscillates at...' allow 'perpendicular to' for 'at right angles' allow 'energy transfer' for 'travel' allow '(anti-)parallel to' for 'along'	2
(ii)	wavelength or distance between wavefronts smaller; speed of waves is constant; reference to wave equation $v = f\lambda$ ;	if no other marks awarded, 1 mark for reference to Doppler effect	3

(Total for Question 11 = 10 marks)

Question number	Answer	Notes	Marks
12 (a)	<p>use of <math>u=0</math> (m/s);</p> <p>correct substitution into '<math>v^2 = u^2 + 2aS</math>';</p> <p>correct evaluation of <math>v^2</math>;</p> <p>correct evaluation of <math>v</math>;</p> <p>correct answer = 160 (m/s)</p> <p>e.g.  <math>v^2 = u^2 + 2aS</math>  <math>v^2 = 0^2 + (2 \times 10 \times 1300)</math>  <math>v^2 = 26000</math>  <math>v = 161.245... \text{ (m/s)}</math></p>	<p>accept loss of GPE = gain in KE</p> <p>reject use of <math>v=0</math> for this MP</p> <p><math>v^2 = 26000</math></p> <p>accept 25506, 25480</p> <p>reject <math>v^2 = 2600</math> if no <math>a=10</math> seen.</p> <p>ignore sign</p> <p>accept 159.7059..., 159.62....</p>	4
(b) (i)	<p>any THREE from:</p> <p>MP1. reference to weight <b>and</b> air resistance;</p> <p>MP2. air resistance larger than weight (when parachute opens);</p> <p>MP3. reference to '<math>F = ma</math>';</p> <p>MP4. acceleration is upwards;</p> <p>MP5. air resistance decreases as parachutist slows down;</p>	<p>ignore 'upthrust'</p> <p>accept drag for AR</p> <p>accept 'resultant or unbalanced force is upwards'</p> <p>allow idea of increased AR</p> <p>ignore 'decelerates' or 'slows down'</p>	3
(ii)	<p>any THREE from:</p> <p>MP1. GPE reduces as height above ground reduces;</p> <p>MP2. KE reduces as speed reduces;</p> <p>MP3. friction force does mechanical work on parachutist;</p> <p>MP4. thermal store of parachutist increases;</p> <p>MP5. thermal transfer between (warm) parachutist and (cold) air;</p> <p>MP6. thermal transfer happens by conduction or radiation;</p>	<p>accept 'works mechanically'</p> <p>accept 'energy lost to the surroundings'</p> <p>accept idea of conversion to heat energy via friction</p>	3

(Total for Question 12 = 10 marks)