

Question number	Answer	Notes	Marks																
1 (a)	<p><u>metre</u> rule(r);</p> <p>stop watch / stop clock;</p>	<p>allow (metal) tape measure / measuring tape / <u>metre</u> stick</p> <p>ignore timer</p> <p>either order</p>	2																
(b) (i)	<p>suitable scale chosen (&gt;50% of grid used);</p> <p>axes labelled with quantities and unit;</p> <p>plotting correct to nearest half square (minus one for each plotting error);;</p> <p>line (curve) of best fit acceptable;</p> <div> </div>	<p>reject 'm' for minutes</p> <p>orientation unimportant</p> <p>i.e. two plotting errors = no marks for plotting</p> <p>i.e. smooth curve within 1 small square of each point</p> <table border="1"> <thead> <tr> <th>time in minutes</th> <th>water depth in cm</th> </tr> </thead> <tbody> <tr><td>0</td><td>6</td></tr> <tr><td>1</td><td>2</td></tr> <tr><td>2</td><td>1</td></tr> <tr><td>3</td><td>8</td></tr> <tr><td>4</td><td>1</td></tr> <tr><td>5</td><td></td></tr> <tr><td>6</td><td></td></tr> </tbody> </table>	time in minutes	water depth in cm	0	6	1	2	2	1	3	8	4	1	5		6		5
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5																			
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(ii)	<p>idea that <b>depth</b> decreases with time;</p> <p>idea that relationship is non linear;</p>	<p>allow RA</p> <p>ignore 'negative correlation'</p> <p>Ignore all references to 'proportional' and 'curved'</p> <p>allow idea of rate arguments</p> <p>e.g. 'depth decreases more slowly with time' gets 2 marks</p> <p>allow exponential decrease for 2 marks</p>	2																

(c)	any 1 of: MP1. idea of pressure decreasing (with depth / time); MP2. idea of force changing with {pressure / depth / time}; MP3. idea of (available) GPE decreasing;	allow RA  allow 'weight' for force ignore 'mass'	1
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Total 10 marks

Question number	Answer	Notes	Marks
2 (a)	B (hit the walls of the container harder)		1
(b)	(average) <b>KE</b> (of particles) <b>decreases</b> ( as the temperature falls);  AND one of <ul style="list-style-type: none"> <li>(because) they move slower;</li> <li>idea that at 0 K the particles have no kinetic energy;</li> <li>idea that at 0 K the particles are not moving;</li> </ul>	ignore <ul style="list-style-type: none"> <li>' particles freeze'</li> <li>KE is lost</li> </ul> allow <ul style="list-style-type: none"> <li>'it' for average KE</li> <li>absolute zero for 0 K</li> </ul>	2
2 (c) (i)	300 K;		1
(c) (ii)	both temperatures seen in Kelvin; Substitution; (Rearrangement and) Evaluation;  e.g. $\frac{210\,000}{300} = \frac{P_2}{354}$ this would get 2 marks if seen  $\frac{210\,000 \times 354}{300} = P_2$ this would get 2 marks if seen  $(P_2) = 250(\text{kPa})$ this is 3 marks	no mark for equation as it is given on page 2 <b>allow</b> <ul style="list-style-type: none"> <li><math>\frac{210\,000}{300} = \frac{P_2}{81}</math> for 1 mark 27</li> <li>630 (kPa) for 2 marks</li> <li>bald answer 248 (kPa) for 3 marks</li> <li>answers which round to 250</li> </ul> Power of Ten error (POT) = -1	3

(Total for Question 2 = 7 marks)

Question number	Answer	Accept	Reject	Marks
3 (a) (i)	Anomaly clearly identified (20.44 mm);			1
	(ii) Averaging seen /162.7÷8 /142.26 ÷7; Anomaly excluded/ ÷7 seen ; Final answer rounded to 2 decimal places; e.g.: 20.32 (m	Ignore sig figs in working  Allow full marks for correct answer, no working, i.e.: 20.32 (mm) = 3 marks  If no working accept these other bald answers: 20.3228.. etc (mm) = 2 marks 20.34 (mm) = 2 marks 20.3375.. (mm) = 1 mark 20.33 (mm) = 1 mark		3



Question number	Answer	Accept	Reject	Marks
3 (c)	<p>Any three of:</p> <p>MP1 Measure/find <u>mass</u>;</p> <p>MP2 Using a named instrument - e.g. (top pan) balance, scale(s);</p> <p>MP3 A sensible experimental precaution: e.g. Repeat readings / measure mass of several of coins and divide/ check balance zero;</p> <p>MP4 Formula to use (density = mass ÷ volume);</p> <p>MP5 A correct <u>density</u> unit mentioned (e.g. kg/m<sup>3</sup>);</p>	<p>Ignore information about calculating or finding volume</p> <p>Accept "Weighing" to find <u>mass</u></p> <p>Ignore measuring weight</p> <p>Ignore volume = <math>\pi r^2 h</math></p>		3

**Total 9 marks**

Question number	Answer	Notes	Marks
4 (a)	10 000; N;	allow 9800, 9810, $10^4$ allow "newton(s)" marks are independent	2
(b) (i)	density = mass / volume;	allow abbreviation, e.g. $\rho = m/V$ , $d = m/V$ or rearrangements	1
(ii)	substitution OR rearrangement; evaluation;  e.g. $2300 = 1000/\text{volume}$ $= 0.43 \text{ (m}^3\text{)}$	award if either seen in working  allow 0.4, 0.434, 0.435, 0.4347... condone 0.44	2
(c) (i)	bar chart / bar graph;	condone histogram	1
(ii)	any 1 from: MP1. idea that (density) data is discontinuous; MP2. materials have non-numerical values / are not quantifiable; MP3. material types identified as categories; MP4. idea that a line graph would indicate continuity;	discrete, categoric, non/not continuous	1
(iii)	cork is less dense OR water is denser; cork 25%, $\frac{1}{4}$ as dense OR water four times denser;	accept correct calculation of <u>both</u> densities for 2 marks	2

**Total 9 marks**

Question number	Answer	Notes	Marks
5 (a) (i)	uranium/plutonium;	allow chemical symbols	1
(ii)	(particles) formed <b>after</b> fission/ <b>after</b> U breaks up;  plus any <b>one</b> from: - neutron; daughter nuclei; named products;	do not allow after decay  allow gamma (radiation)	2
(iii)	MP1 they are (still) radioactive/ emit ionising radiation /eq;  MP2 they last for a very long time/have a long half-life/eq;	allow harmful to people/environment	2
(iv)	it slows down neutrons/eq;	ignore absorbs neutrons	1
(v)	any two ideas from: - MP1 fewer neutrons would be absorbed;  MP2 fission rate would increase / /(reactor) become critical ;  MP3 too much energy produced (too fast);  MP4 meltdown of core/reactor;	more neutrons available  the reaction would go out of control do not accept "turns into a bomb"  meltdown of 'it'	2



(b) (i)	773(K);		1
	(ii) substitution; rearrangement; evaluation; e.g.  $\frac{8.4}{773} = \frac{P_2}{1170}$  $P_2 = \frac{8.4 \times 1170}{773}$  13 (MPa)	no mark for the equation  rearrangement and substitution in either order   12.7 allow ecf from (b)(i) for all 3 marks  if calculation seen with °C for T <sub>1</sub> instead of K, then max mark = 2  answer of 19.7 (MPa) with no working = 1 mark total marks = 12	3