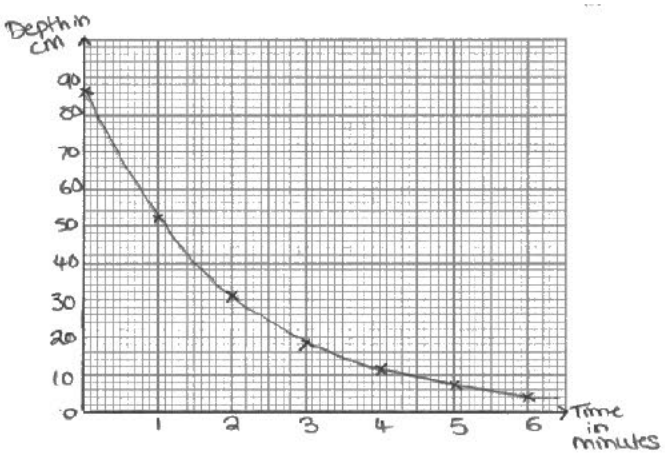
Question number	Answer	Notes	Marks
1 (a)	metre rule(r); stop watch / stop clock;	allow (metal) tape measure / measuring tape / metre stick ignore timer either order	2
(b) (i)	suitable scale chosen (>50% of grid used); axes labelled with quantities and unit; plotting correct to nearest half square (minus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

Total 10 marks

Question number	Answer	Notes	Marks
2 (a)	B (hit the walls of the container harder)		1
(b)	(average) **KE** (of particles) **decreases** (as the temperature falls); AND one of • (because) they move slower; • idea that at 0 K the particles have no kinetic energy; • idea that at 0 K the particles are not moving;	ignore • ` particles freeze' • KE is lost allow • 'it' for average KE • absolute zero for 0 K	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 $(P_2) = 250$(kPa) this is 3 marks	no mark for equation as it is given on page 2 **allow** • $\frac{210\ 000}{27} = \frac{P_2}{81}$ for 1 mark • 630 (kPa) for 2 marks • bald answer 248 (kPa) for 3 marks • answers which round to 250 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 (b)	Any two of: Yes / No (no mark) MP1 Good way of measuring small values / Measures a larger value; MP2 Taking a larger measurement might reduce (%) errors; MP3 Not actually measuring what is required (a particular coin); MP4 Possible to make a maths error e.g. when dividing / counting /rounding; MP5 Not all coins are necessarily the same / idea of anomalous coin / bent / worn;	Accept reverse arguments Ignore comments about human error Ignore reference to caliper precision Ignore comments about gaps		2

Question number	Answer	Accept	Reject	Marks
3 (c)	Any three of: MP1Measure/find <u>mass</u>; MP2 Using a named instrument - e.g. (top pan) balance, scale(s); MP3 A sensible experimental precaution: e.g. Repeat readings / measure mass of several of coins and divide/ check balance zero; MP4 Formula to use (density = mass ÷ volume); MP5 A correct <u>density</u> unit mentioned (e.g. kg/m^3);	Ignore information about calculating or finding volume Accept "Weighing" to find <u>mass</u> Ignore measuring weight Ignore volume = $\pi r^2 h$		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. ρ = m/V, d = m/V or rearrangements	1
(ii)	substitution OR rearrangement; evaluation; e.g. 2300 = 1000/volume = 0.43 (m^3)	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%, ¼ 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 **after** fission/**after** U breaks up; plus any **one** 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_1 instead of K, then max mark = 2 answer of 19.7 (MPa) with no working = 1 mark total marks = 12	3