Mark Scheme

Q1.

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

Q2.

Question Number:	Answer	Additional guidance	Mark
	recall and substitution (1) (density ρ)=$\frac{380}{410}$ evaluation (1) 0.93 (g/cm^3)	 allow substitution of a mass / a volume accept any value that rounds to 0.9 allow truncated 0.92 (g/cm^3) only accept 1(g/cm^3) if working shown. award full marks for correct answer without working	**(2)** AO 2 1

Q3.

Question number	Answer	Additional guidance	Mark
	substitution (1) 100 ÷ 13 answer (1) 7.7 (g/cm^3)	award full marks for correct numerical answer without working allow 7.692 (g/cm^3)	**(2)**

Q4.

Question number	Answer	Additional guidance	Mark
	An answer that provides a description by making reference to: • part fill a measuring cylinder with water and record the starting volume (1) • completely immerse the stone in the water and record the final volume of water and stone (1) • volume of stone = final volume – initial volume (1)	accept valid alternative methods, e.g. fill a displacement can until some water overflows/flows out of spout completely immerse the stone in the displacement can and collect the displaced water in a measuring cylinder volume of water displaced = volume of stone	**(3)**

Q5.

Question Number	Answer	Additional guidance	Mark
	A description including: find mass of marble(s) (1) put marble(s) into water (in cylinder) and measure **change** in water level (1) divide mass by volume (1) suitable idea to improve accuracy such as use several marbles (1)	 weigh marble(s) accept volume for water level note level before and after marble(s) added find **volume** of water displaced density = mass/volume in words or symbols subtract mass of bag from total mass of marbles and bag ensure water measured at eye level use appropriately sized measuring cylinder ignore reference to repeating and taking average	**(4)**

Q6.

Question Number	Answer	Additional guidance	Mark
(i)	29(g)		(1)

Question Number	Answer	Additional guidance	Mark
(ii)	25(cm^3)		(1)

Question Number	Answer	Mark
(iii)	**D** density = $\frac{\text{mass}}{\text{volume}}$ **D** is the only correct answer **A** is incorrect because the equation density = mass+ volume is incorrect **B** is incorrect because the equation density = mass – volume is incorrect **C** is incorrect because the equation density = mass x volume is incorrect	(1)

Question Number	Answer	Additional guidance	Mark
(iv)	Any two improvements from: use balance that reads to one or more decimal places/more decimal places (1) use tare/zero balance for first measurement (1) use measuring cylinder with smaller divisions (1) use larger volume of liquid (1) repeat and average (1) read measuring cylinder at eye level (1)	 Accept use more accurate/precise balance in this context Allow reset for tare Allow more accurate/ different scale / different divisions / thinner measuring cylinder Allow use more liquid / larger mass of liquid Allow avoid parallax error / read from bottom of meniscus	(2)

Q7.

Question Number	Answer	Additional guidance	Mark
(i)	29(g)		(1)

Question Number	Answer	Additional guidance	Mark
(ii)	25(cm^3)		(1)

Question Number	Answer	Mark
(iii)	**D** density = $\frac{\text{mass}}{\text{volume}}$ **D** is the only correct answer **A** is incorrect because the equation density =mass**+** volume is incorrect **B** is incorrect because the equation density =mass – volume is incorrect **C** is incorrect because the equation density =mass x volume is incorrect	(1)

Question Number	Answer	Additional guidance	Mark
(iv)	Any two improvements from: use balance that reads to one or more decimal places/more decimal places (1) use tare/zero balance for first measurement (1) use measuring cylinder with smaller divisions (1) use larger volume of liquid (1) repeat and average (1) read measuring cylinder at eye level (1)	 Accept use more accurate/precise balance in this context Allow reset for tare Allow more accurate/ different scale / different divisions / thinner measuring cylinder Allow use more liquid / larger mass of liquid Allow avoid parallax error / read from bottom of meniscus	(2)

Q8.

Question number	Answer	Additional guidance	Mark
(i)	Substitution: Density = mass/ volume (1) = 28 x10^{-3}/ 3.6 x 10^{-6} (1) Evaluation = 7777 kg / m^3 (1)	 (recalled / used) ignore any power of ten (pot) error here do not penalise any sf errors (7.77 etc. would get 2 marks: losing the pot mark in the evaluation)	(3)

Question number	Answer	Additional guidance	Mark
(ii)	(Use $\Delta Q = m \times c \times \Delta\ \theta$) substitution thermal energy gained = 0.028 x 510 x 80 (1) evaluation = 1100 (J) (1)	 ignore any pot error here 1142 (J)	(2)

Question number	Answer	Mark
(iii)	An explanation that combines identification – knowledge (2 marks) and reasoning / justification (1 mark) Solid state → particles vibrate (1) → about fixed positions (1) Liquid state → particles move randomly / freely (1)	(3)

Q9.

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)