Question number	Answer	Notes	Marks
1 (a) (i)	pressure = $\frac{\text{force}}{\text{area}}$	Allow symbols and rearrangements e.g. p=F/A	1
(ii)	substitute; rearrange; evaluate; **matching** unit; e.g. 270 000 = F ÷ 0.016 1 mark F = 270 000 x 0.016 2 marks 4320 3 marks N 4th mark	Substitution and rearrangement in either order allow in words Allow alternatives with matching unit, e.g. 4.32 3 marks kN 4th mark	4
(b)	Any three of MP1. idea of (continuous) random movement; MP2. collisions / impact/eq; MP3. with (inside) **walls** (of tyre); MP4. idea that force is produced (by bombarding molecules); MP5. idea of pressure as force on an area;	Allow momentum or NIII argument	3
(c)	any three of- MP1. (now) more particles/molecules in the tyre; MP2. molecules have more speed /more energy (because gas is warmer); MP3. more impacts/more frequent impacts / harder impacts (with walls of tyre); MP4. (hence) more force on the inside;	Allow change of momentum argument Allow collisions with walls do not award MP3 if the impacts are only with other molecules	3

Total 11 marks

Question number	Answer	Notes	Marks
2 (a) (i)	density = $\frac{\text{mass}}{\text{volume}}$	Allow symbols and rearrangements, e.g. $\rho = m / V$	1
(ii)	substitution into correct equation; calculation; matching unit; e.g. Density = 138 ÷ 16.3 = 8.47 g/cm^3	8.466, 8.5	3
(b)	B (incorrect and slightly too small)		1

Total 5 marks

Question number			Answer	Notes	Marks
3	(a)	(i)	substitution / rearrangement; final value for volume; final value for time; e. 8 x 200 = V x 1 V = 1600 (litres) time = 100 (minutes)	($p_1V_1 = p_2V_2$) – no mark as given on page 2. No credit for merely quoting the equation. Allow 99 minutes (i.e. assumption that the final 16 litres not available)	3
		(ii)	Any **two** suitable points, e.g. MP1. pressure decreases as depth decreases; MP2. reference to p = h˜g; MP3. reference to pV equation (if temperature constant); MP4. additional bubbles join together as they rise; MP5. temperature increases nearer surface;		2
3	(b)	(i)	displacement method described; measure water displaced (with measuring cylinder); OR measure radius / diameter / circumference; calculate volume (with equation);		2
		(ii)	not a fair test; change of temperature / volume;	ignore 'each pump will have different pressure'	2

Total 9 marks

Question number	Answer	Notes	Marks
4 (a)	Kalpana (no mark) ANY TWO – Density compares masses to volumes / reference to equation; So as mass increases, volume increases; In proportion;	If Christine is chosen, score = 0 for part (a)	2
(b) (i)	A / clearly identified; smallest scale divisions / measures to 0.2 (ml);	ALLOW 'the one measuring in ml' (identifies A in picture) MUST have chosen A DO NOT ALLOW 'it measures in ml'	1 1
(ii)	any ONE suitable, e.g. incorrect scale / calibration; misreading scale / parallax /not at eye level; meniscus makes it difficult to read; might not be level / flat; reading may be between divisions;	DO NOT ALLOW 'hard to measure'	1

Question Number	Answer		Marks
4 (c) (i)	density = mass / volume;	ALLOW standard symbols (ALLOW d for density)	1
(ii)	substitution into correct equation: evaluation: unit: e. 54/23 2.3 g/cm^3	 VALUE MUST be 2 s.f. to be given evaluation mark 2300 if unit is kg/m^3	1 1 1
(d) (i)	compare with / look it up in; a book / data table / internet;		1 1
(ii)	any ONE suitable, e.g. (many) rock types with similar / same values; uncertainty in value / inaccurate measurements; data tables incomplete;	 IGNORE human error ALLOW 'rock may not be pure'	1
		Total	**12**

Question number	Answer	Notes	Marks
5 (a)	ANY THREE of particles in constant motion / particles have kinetic energy; in random directions; colliding with walls; causing a force on the walls; Pressure = force /area;	Answers need to refer to particles / molecules rather than 'the gas is...' ALLOW 'Hitting the walls' / 'bouncing off the walls' ALLOW 'push' / 'pushing'	3
(b) (i)	(pressure would) increase;		1
(ii)	(higher temp) increases (average) speed / kinetic energy of particles; So collide with walls more often / at higher speed;	IGNORE references to 'heating the particles' ALLOW 'hit harder'	1 1
(c)	Use of $p_1V_1 = p_2V_2$ (equation given) /substitution; 2000 (cm^3);	2000 alone scores 2	2
		Total	**8**

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>6 (a)</td><td>density = mass/volume</td><td>ACCEPT equivalent rearrangement
ACCEPT suitable abbreviations e.g. ˜ = m/v or d = m/v
REJECT equation ‘triangles’ alone</td><td>1</td></tr>
<tr><td>(b)</td><td>D</td><td></td><td>1</td></tr>
<tr><td>(c)</td><td><table><tr><th>Measuring instrument</th><th>Quantity measured</th></tr><tr><td>measuring cylinder</td><td>volume</td></tr><tr><td>electronic balance</td><td>mass</td></tr></table></td><td>Reject weight</td><td>1</td></tr>
</table>

Question number	Answer	Notes	Marks
6 (d)	MAX TWO FOR EACH measuring cylinder – eyes to water level / perpendicular view; to avoid parallax; measurement at bottom of meniscus; measuring cylinder on flat surface / clean cylinder; electronic balance – place on stable surface /avoid disturbing balance; set to zero / check zero; finding mass without an with water – (tare or subtraction);	 Ignore repetition wherever seen Ignore clean balance	4
(e) (i)	temperature / type of water (e.g. salinity, not 'heavy')	DO NOT ACCEPT answers referring to keeping the apparatus the same	1
(ii)	can also affect the density / volume (DOP)	ACCEPT arguments that follow through e.g. increasing temperature will increase the volume, therefore decreasing the density REJECT idea that mass is affected by change in temperature	1