

Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
	An explanation that makes reference to the following points: - There is an increase in the potential energy of molecules leaving the liquid Or latent heat must be supplied to convert liquid to gas Or only faster molecules have enough energy to escape (1) Or work is done by the expanding gas - The internal energy of the liquid decreases Or the average kinetic energy of the molecules remaining in the liquid decreases (1) - so the temperature of the liquid decreases Or some of the energy for latent heat is provided by the internal energy of the canister (1)		3

Q2.

Question Number	Acceptable answers	Additional guidance	Mark
(i)	- Use of $V = \pi r^2 l$ (1) - Use of $pV = NkT$ (1) - Conversion of °C to K (1) $N = 4.7 \times 10^{23}$ (1)	<u>Example of calculation:</u> $V = \pi \times 0.11^2 (\text{m})^2 \times 0.23(\text{m})$ $= 8.74 \times 10^{-3} \text{ m}^3$ $T = 21^\circ\text{C} + 273 = 294 \text{ K}$ $2.2 \times 10^5 \text{ Pa} \times 8.7 \times 10^{-3} \text{ m}^3 =$ $N \times 1.38 \times 10^{-23} \text{ J K}^{-1} \times 294 \text{ K}$ $N = 4.74 \times 10^{23}$	4
(ii)	- Use of $\frac{1}{2} m \langle c^2 \rangle = \frac{3}{2} kT$ (1) - r.m.s. speed = 360 m s^{-1} (1) Or - Use of $pV = \frac{1}{3} Nm \langle c^2 \rangle$ (1) - r.m.s. speed = 360 m s^{-1} (1) (ecf from (i))	Give full credit if a mistake has been made calculating temperature in part (i) e.g if $T = 21^\circ\text{C}$ then r.m.s. speed = 95 m s^{-1} Similarly for V <u>Example of calculation:</u> $\frac{1}{2} \times 9.6 \times 10^{-26} \text{ kg} \langle c^2 \rangle =$ $\frac{3}{2} 1.38 \times 10^{-23} \text{ J K}^{-1} \times 294 \text{ K}$ $\langle c^2 \rangle = 127000 \text{ m}^2 \text{ s}^{-2}$ r.m.s. speed = 356 m s^{-1}	2
		Alternative: $2.2 \times 10^5 \text{ Pa} \times 8.7 \times 10^{-3} \text{ m}^3 =$ $\frac{1}{3} 4.7 \times 10^{23} \times 9.6 \times 10^{-26} \text{ kg} \langle c^2 \rangle$ r.m.s. speed = 360 m s^{-1}	

Q3.

Question Number	Acceptable answers	Additional guidance	Mark
	- Use of $V = \frac{4}{3} \pi \left(\frac{d}{2}\right)^3$ (1) - Use of $pV = NkT$ (1) - Conversion of temperature to kelvin (1) $N = 6.5 \times 10^{17}$ (1)	<u>Example of calculation:</u> $V = \frac{4}{3} \pi (0.080 \text{ m})^3 = 2.14 \times 10^{-3} \text{ m}^3$ $N = \frac{1.25 \text{ Pa} \times 2.14 \times 10^{-3} \text{ m}^3}{1.38 \times 10^{-23} \text{ N m K}^{-1} \times (273 + 25) \text{ K}}$ $= 6.50 \times 10^{17}$	4

Q4.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following points: - The intercept represents the temperature of the air at which the volume occupied would be zero (1) - This is the absolute zero (of temperature) (1) - Absolute zero is the lowest attainable temperature (1) Or absolute zero is the temperature at which the atoms/molecules of the gas have zero kinetic energy	For MP3 accept atoms/molecules stop moving	3
(ii)	MAX 4 Resolution: - It is correct that uncertainties would be reduced by using high resolution instruments (1) - But the instruments are not high resolution (1) - There could be a systematic error (in the measurements) (1) Graph: - The points do not lie on a perfect straight line (1) - Or the true relationship may not be linear (1) - Temperature intercept may not be accurate (1) - Or there may be extrapolation errors - More points are needed Or a wider range is needed (1)		4