Mark Scheme

Q1.

Question Number	Answer	Mark
	C The volume of the air inside the cylinder. **The only correct answer is C** ***A*** *is not correct because the mass remains unchanged* ***B*** *is not correct because the rate of collision decreases* ***D*** *is not correct because the pressure decreases*	**(1)** AO 1 1

Q2.

Question number	Answer	Mark
	A 293 K	**(1)**

Q3.

Question number	Answer	Mark
	An explanation that combines identification –knowledge and reasoning / justification • (particles / atoms / molecules) {hit / collide with} piston (1) • causing a force (on the piston) (1)	**(2)**

Q4.

Question number	Answer	Mark
	An explanation that combines identification – knowledge and reasoning / justification • volume decrease makes the density of particles increase / more crowded idea (1) • increasing the **rate** at which particles collide (with the piston) (1)	**(2)**

Q5.

Question Number:	Answer	Additional Guidance	Mark
(i)	at right angles / 90°	perpendicular / normal to the tube wall	**(1)** AO 1 1

Question Number:	Answer	Additional Guidance	Mark
(ii)	select and substitute into $P_1 \times V_1 = P_2 \times V_2$ (1) $400\,000 \times V_1 = 100\,000 \times 4.8$ rearrangement (1) $V_1 = \frac{100\,000 \times 4.8}{400\,000}$ evaluation (1) (V_1 =) 1.2 (litres)	substitution and rearrangement in either order award full marks for the correct answer without working POT error 2 marks	**(3)** AO 2 1

Question Number:	Answer	Additional Guidance	Mark
(iii)	an explanation linking: work is done (in compressing the air) (1) increases the **kinetic energy** of the (air) particles / thermal **energy** (of the system) (1)	heat for thermal accept answer in terms of p ΔV W = F x d = p x (A x d) = p ΔV	**(2)** AO 1 1

Q6.

Question Number	Answer	Acceptable answers	Mark
(i)	an explanation **linking** two of the following three points:- particles move (1) bombarding/colliding (1) with wall/side (1) (only give if one of the previous marks is there) (of container)	 molecules/they move hit ignore 'pushing' e.g. molecules push on walls = 0 bounce off inside of container =2	**(2)**

Question Number	Answer	Acceptable answers	Mark
(ii)	substitution $P_2 = \frac{101\,000 \times 340}{2.5}$ (1) Evaluation 13.7 to any power of 10 (1) 13 700 000(Pa), 13 700kPa (1)	 1.37(36) X 10^7/ 13736000 14 to any power of 10 14 000 000 (Pa), 14 000 (kPa) Full marks are awarded for the correct answer with no working	**(3)**

Q7.

Question Number	Answer	Acceptable answers	Mark
(a) (i)	10.8 + or – 0.2 (cm)	Any value between 10.6(cm) and 11.0 (cm) Accept 11 cm	**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	B $2.1 \times 10^{-2}\,cm^3$		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(iii)	Temperature conversion to K 50°C to 323K **OR** 100°C to 373K (1) Substitution $V_1 = \frac{2.31 \times 10^{-2} \times 373}{323}$ (1) Evaluation 2.67×10^{-2} (cm^3) (1)	 If equation is transformed to give V_2, allow correct substitution mark. $0.0267(cm^3)$, 2.7×10^{-2} (cm^3), $0.027(cm^3)$, 2.67×10^{-8} m^3, 2.7×10^{-8} m^3 Allow power of ten error for 2 marks e.g. 267 Allow 2.6×10^{-2} for 3 marks Full marks for correct answer with no working If temperature is not converted to Kelvin, maximum two marks e.g. $V_1 = \frac{2.31 \times 10^{-2} \times 100}{50}$ $4.62 \times 10^{-2}(cm^3)$ Allow power of ten error for 1 mark e.g. 4.62 2 marks for 4.62×10^{-2} (cm^3) with no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
(b)	A description including: (Average) KE/it increases as the temperature increases (1) Idea of proportionality / KE doubles when the temperature doubles (1) (when) temperature in Kelvin /K (1)	Allow energy for kinetic energy Or reverse argument - (Average) KE/it is (directly) proportional to the Kelvin temperature gets all three marks (Average) KE/it is (directly) proportional to the temperature gets first two marks Allow absolute scale	**(3)**

Q8.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	C stationary		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	(Average KE/it is) halved	divided by 2,multiplied by 0.5	**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	Explanation in terms of particles linking the following:- • particles collide with / hit /strike / bombard (1) • the wall / sides of the balloon (1) • (causing a) force / (rate of) change in momentum (1)	Accept "molecules/atoms" for particles Must mention particles etc to gain this mark Ignore "push"	**(3)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	-46 + 273 (1)	273-46 / any use of 273	**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	substitution: (1) $\frac{101 \times 9.1}{273} = \frac{1.12 \times V_2}{227}$ Transposition (1) $V_2 = \frac{101 \times 9.1 \times 227}{273 \times 1.12}$ evaluation: (1) 682 (m^3)	Accept either Pa or kPa for substitution substitution and transposition in any order ignore power of ten error until evaluation 680 (m^3), 682.4 (m^3), 682.35 (m^3) full marks for the correct numerical answer without working	**(3)**

Question Number	Answer	Acceptable answers	Mark
(c)(iii)	bursts/explodes or words to that effect		**(1)**

(Total marks for question = 10 marks)