$^{8}/_{10}$

G2 Gas Laws

Don't forget that one mole of gas contains 6.02×10^{23} molecules, and that the mass of this number of molecules is called the 'molar mass'. Take the gases to be ideal.

G2.1 What is the volume of a mole of gas at atmospheric pressure (1.01×10^5 Pa) and at 20 °C?

G2.2 Calculate the density of nitrogen gas at atmospheric pressure and at 20 °C if the molar mass of nitrogen is 0.028 kg.

G2.3 How many molecules of gas do you need in a 100 cm^3 cylinder to exert a pressure of 1.0×10^8 Pa at a temperature of 800 °C?

G2.4 In the table fill out the missing initial ('$_1$') or final ('$_2$') values:

P_1 /Pa	V_1 /cm^3	T_1 /K	P_2 /Pa	V_2 /cm^3	T_2 /K
1.01×10^5	30	300	(a)	20	300
1.01×10^5	30	300	(b)	30	373
1.01×10^7	2	600	1.01×10^5	(c)	300
1.01×10^5	500	(d)	1.01×10^7	10	4

G2.5 A tyre contains 800 cm^3 of air at a pressure of about 5.0×10^5 Pa at 9.0 °C. After a cycle ride, the volume is 810 cm^3 and the temperature is now 25 °C. Assuming that none of the gas has leaked, what is the new pressure?

G2.6 A tyre contains 800 cm^3 of air at a pressure of about 5.0×10^5 Pa at 9.0 °C. After a cycle ride, the volume is 760 cm^3, the temperature is now 25 °C, and the pressure is 4.0×10^5 Pa. What percentage of the gas molecules have leaked out?

G2.7 A water fire extinguisher contains 4.0 litres of air at 10^7 Pa and 20 °C. When the extinguisher is used, this gas forces the water out. Calculate the pressure when the volume has increased to 10 litres and the temperature has dropped to 3.0 °C.