TUTORIAL QUESTIONS IDEAL GASES

1.) Two molecules of a gas have speed of 1 kms^{-1} and 9 kms^{-1}. Find their root mean square speed.

2.) Calculate the rms speed of nitrogen molecules if its density at pressure 1 x 10^5 Pa is 1.23 kg m^{-3}.

3.) Find the internay energy of 1 mole of ideal gas molecules at 300 K

4.) Find the rms speed of oxygen molecules at 200 K (O = 16)

5.) Find the rms speed of CO_2 molecules at 30˚C. (CO_2 = 44)

6.) An ideal gas has a molar mass of 4 g. Total K.E. of a mass M of this gas is 375 J at 27˚C.
Calculate (i) its K.E. at 127˚C (ii) value of M.

7.) Find the average K.E. of (i) hydrogen. (ii) nitrogen molecule at 500 K.
Which type of molecule moves faster at 500 K?

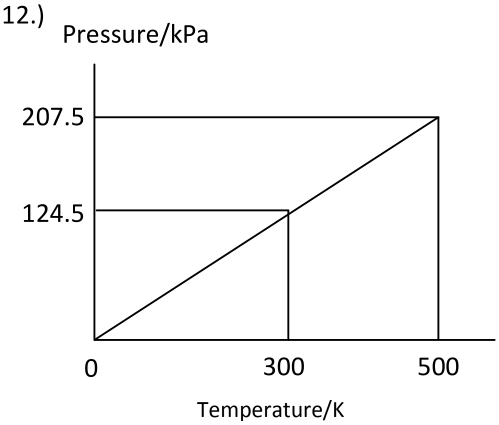
8.) A vessel of 50 cm^3 contains hydrogen at 27˚C and pressure 1 x 10^5 Pa. Find the total K.E. of the hydrogen.

9.) Find the temperature at which the rms speed of nitrogen molecules is twice as great as their rms speed at 300 K.

10.) The pressure and volume of a fixed mass of gas in a gass thermometer at the triple point of water are 1.00×10^5 Pa and 1.00×10^{-3} m^3. When the gas pressure is 1.10×10^5 Pa and its volume is 1.20×10^{-3} m^3, what is the temperature of the gas ?

11.) A vessel of volume 1.00×10^{-3} m^3 contains helium gas at a pressure of 2.0×10^5 Pa when the temperature is 300K. (nucleon number of helium = 4)
a.) What is the mass of helium in the vessel?
b.) How many helium atoms are there is the vessel?
c.) Calculate the rms speed of the helium atoms.

12.)



a.) A fixed mass of helium gas is enclosed in a container which has a fixed volume of 1.00×10^{-3} m^3. The diagram shows a graph of pressure against temperature for temperatures between 300K to 500K.
Calculate:
i.) the number of moles of gas present.
ii.) the mass of gas present.

b.) A second container, identical to that described in (a), contains a mixture consisting of equal masses of hydrogen and helium, the total mass being the same as the original mass in (a).
Calculate:
i.) the pressure exerted by this mixture of gases at a temperature of 300K.
ii.) State how you would expect the gradient of a pressure against temp graph for this mixture of gases to differ form that shown above.

(Molar gas constant = 8.31 J mol^{-1} K^{-1}. Molar mass of hydrogen = 2.0g , molar mass of helium = 4.0g)

13.) i.) Explain how molecular movement causes a pressure to be exerted by a gas.
ii.) A gas molecule in a cubical box travels with speed c at right angles to one wall of the box. Show that the average force the molecule exerts on the wall is proportional to c^2.

14.) The air cylinder for a diver has a volume of $9.00x10^{3}$ m^{3} and when the cylinder is filled, the air has a presure of $2.10x10^{7}$ Pa at 24˚C. The diver is swimming in water of density $1.03x10^{3}$ kgm^{-3} and temperature 24˚C at the depth of 15.0m. When the diver breathes in, the pressure of the air delivered form the cylinder to the diver is always equal to the pressure of the surrounding water. Atmospheric pressure is $1.01x10^{5}$ Pa.

a.) Calculate, for the depth of 15.0 m:

i.) The total pressure on the diver

ii.) The volume of air available at this pressure from the cylinder

b.) The supply of air in (a), is sufficient for the diver to remain at a depth of 15.0 m, for 45 mins. Assuming tha te diver always breathes at the same rate, (same volume of air required per min, regardless of pressure), how long would the air in the cylinder last for the diver at a depth of 35.0 m and a water temperature of 20˚C ?

15.) The table gives measrued values of pressure and dnesity for a fixed mass of gas at constant temperature of 27˚C.

Pressure (10^{5} Pa)	0.60	0.80	1.00	1.20	1.40
Density (kgm^{-3}	0.68	0.91	1.14	1.37	1.60

i.) Plot a graph of pressure against density. Does your graph indicate that the gas behaves as an ideal gas under these conditions? Justify your answer.

ii.) Use your graph to calculate the root mean square speed of the molecules of the gas.

iii.) The temperature of the gas is raised to 57˚C. Calculate the pressure when the density is 1.00 kgm^{-3}, and hence draw the corresponding graph of pressure against density at 57˚C, using the same axes as before.