4.3 - Kinetic Theory of Gases

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- (1999) Write down the equation of state of an ideal gas defining all the symbols used.
- (1999) If the root-mean-square velocity of a hydrogen molecule at 0°C is 1840 m/s, find the root-mean-square velocity of the molecule at 100° C .
- (1999) State the main assumptions of the kinetic theory" of gases.
- (1999) Derive an expression for the pressure exerted by an ideal gas on the walls of its container.
- (1999) How does the average translational kinetic energy of a molecule of an ideal gas change if
  - the pressure is doubled while the volume is kept constant?
  - the volume is doubled while the pressure is kept constant?
- (1999) Calculate the value of the root mean-square speed of molecules of helium at 0°C .
- (2000) What factors lead the real gas to obey the ideal gas equation $PV = RT$?
- (2000) Define the root-mean-square (r.m.s.) speed of the gas molecules. Hence find the r.m.s. speed of oxygen gas molecules at 10^5 Pa pressure when the density is 1.43 kg/m^3 .
- (2000) Derive an expression for the work done per mole in an isothermal expansion of Vander Waals gas from volume V_1 to volume V_2 .
- (2007) Define an ideal gas.
- (2007) State the four (4) assumptions necessary for an ideal gas that are used to develop the expression $p = \rho C^2$.
- (2007) How is pressure explained in terms of the kinetic theory?
- (2007) Without a detailed mathematical analysis argue the steps to follow in deriving the relation $p = \rho C^2$.
- (2007) Define the temperature of an ideal gas as a consequence of the kinetic theory.
- (2007) A mole of an ideal gas at $300K$ is subjected to a pressure of $10^5 N/m^2$ and its volume is $2.5 \times 10^{-2} m^3$. Calculate the:
  - molar gas constant R
  - Boltzmann constant k

  - average transnational kinetic energy of a molecule of the gas.

- (2013) Define comprehensibility of a gas in terms of the elasticity of gases.
- (2013) Helium gas occupies a volume of 4×10^{-2} m^3 at a pressure of 2×10^5 Pa and temperature of 300 K. Calculate the mass of helium and the r.m.s speed of its molecules.
- (2014) One mole of a gas expands from volume, V_1 , to a volume V_2 . If the gas obeys the Van-der-Waals equation, $(p+a/v^2)(vb) = \mathrm{RT}$, derive the formula for work done in this process.
- (2019) Based on the kinetic theory of gases determine:
  - The average translational kinetic energy of air at a temperature of 290 K.
  - The root mean square seed (r.m.s) of air at the same temperature (above).