Motion of Particles in an Ideal Gas

Abstract

The experiment determines the **probability distribution of particles in an ideal gas.** Ideal gas is a hypothetical gas, theorised by the assumptions of the Kinetic Theory of Gases; it is composed of randomly moving particles without interparticle interactions.

Ideal gas obeys the Ideal Gas Law (given below), from which other gas laws can be derived.

$$PV=nRT$$

where, P = pressure, V = volume

n = number of moles, R = universal gas constant

T = temperature

Maxwell-Boltzmann distribution provides a statistical framework to understand the microscopic behaviour of particles in a gas. It describes the distribution of speed of particles in a gas at thermal equilibrium. From this probabilistic distribution, we find the values of (i)most probable speed (ii)mean speed (iii) root mean square speed.

The required experiment, **Motion of Particles in an Ideal Gas**, is provided in **Apps on Physics**, under **Thermodynamics**. The app shows a virtual interface of particles moving in a box. Variable values within certain limits can be entered such as the amount of substance, temperature and, pressure, which yields the volume.

The app provides the (i) component of velocity of the particles in an ideal gas and (ii)magnitude of velocity. The latter provides the varied speeds of particles in the ideal gas in accordance with Maxwell-Boltzmann distribution. On selecting any of the four gases provided in the app, and varying the values of pressure, temperature and, amount of substance, we deduce the component of velocity, most probable speed, mean speed and, root mean square speed.

While the ideal gas model simplifies the complexity of real gases, it is in fact a fundamental tool for analysing the macroscopic and microscopic dynamics of gases.