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Notes for:

B. Sc. Part-I
Paper — Ist. "Effect of temperature and Pressure on Viscosity".

(1) Effect of temperature on viscosity —

The viscosity of liquids decreases with temperature. ie the viscosity of water decreases from 0.0101 Poise at 20°c to 0.0047 at 60°c and that of castor oil from 24.18 Poise at 10°c to 9.86 at 20°c.

No definit relation has been found to exist between viscosity and temperature. But various empirical formula have been suggested from time to time which are all approximate. One of these relations has given by —

$$\log \eta = a + \frac{b}{T}$$

where a and b are constants and T is the absolute temperature.

In the case of gases, the viscosity increases with temperature. According to the kinetic theory of gases,

The variation of viscosity with temperature is given by —

$$\eta = a\eta_0 T^{1/2} \quad \text{ie } \eta = a\eta_0 T^{\frac{1}{2}}$$

where a is constant, η_0 the viscosity at 0°c and T the absolute temperature at which the viscosity is η.

Sutherland taking in to consideration the small force of attraction

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(P.T.O)

→ (from Page-1)

→ between the neighbouring molecules, modified the formula to

$$\boxed{\eta = \eta_0 \frac{a T^{\frac{1}{2}}}{1 + \frac{S}{T}}} \longrightarrow (1)$$

where S is known as Sutherland's constant. For small range of temperatures, this formula holds true for many gases.

(2) Effect of Pressure on Viscosity :—

The viscosity of Pressure for liquids, in general, increases with increase of Pressure. For example, the viscosity of ether at 20°C is raised by about 60% when Pressure is increased to 500 atmosphers. In case of water at normal temperature, there is decrease in ~~viscosity~~ viscosity for the first few hundred atmosphers. For more viscous liquids the increase in viscosity with Pressure is much more than in case of fairly mobile liquids.

For moderate Pressures, the viscosity of gas is found to be independent of Pressure. But at very high Pressures, the viscosity increases with increasing Pressure.

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