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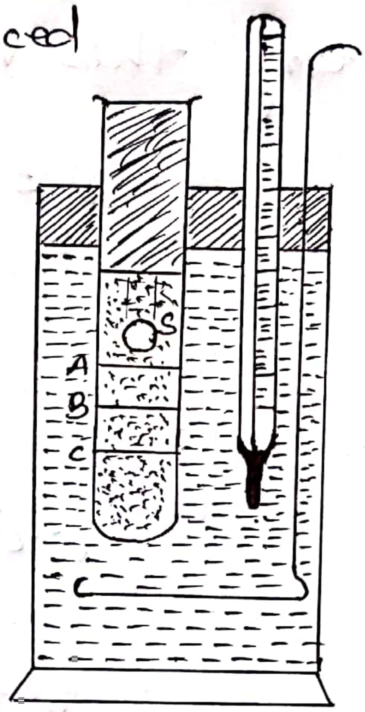
B.Sc (part-1) Hons

Determination of viscosity of a very viscous Liquid.



viscous liquid is placed in a tube kept vertically within a cylinder containing water at a constant temprature. A spherical steel ball S is dropped in to the tube along the axis by means of a narrow guide tube and the time of its falling through two successive equal distances AB and BC are noted. If they are equal, it means the sphere has acquired a constant velocity. If not, then other balls of smaller size are similarly examined. In this way a few balls are selected for each of which the time of fall through AB and BC is same. These balls are wetted throughly in the liquid. Now, one of them is dropped in the cylinder and the time taken in falling through the distance AB or BC is noted. This is done for all the balls.

Let s be the distance between AB and BC, and t the time of fall. Then the internal velocity of ball is given by

$$v = \frac{s}{t}$$

putting this value of v in equation

$$\eta = \frac{2}{9}\frac{r^2}{v}(\rho-\sigma)g$$

$$\eta = \frac{2}{9}\frac{r^2(\rho-\sigma)gt}{s}$$

or, $$r^2t = \frac{9}{2}\cdot\frac{\eta s}{(\rho-\sigma)g}$$

$$\therefore r^2t = \text{Constant}$$

The raddi of the various balls are measured by a micrascope with a Callbrated eye-piece scale.

Finally a graph is plotted between r^2 and $1/t$. This is a Straigh line. Its slope directly gives $r^2t = \frac{9}{2}\frac{\eta s}{(\rho-\sigma)g}$.

From this the viscosity η can be Calculated since the formula halds for an infinite extension of a liquid, a Correction due to Landenburg is applied. According to him

$$\eta_{true} = \frac{\eta_{measured}}{\left(1+2.4\frac{r}{R}\right)\left(1+3.3\frac{r}{h}\right)}$$

whe r = radius of sphere, R = radius of tube Contaning the liquid and h = height of the tube Containing the liquid.