Answer on Question# 36960 – Physics - Mechanics

Eight raindrops each of radius R fall through air terminal velocity 6 cm / s.what is the terminal velocity of the bigger drop formed by coalescing these drops together ?

Solution

Let r be the radius of the bigger drop formed. The volume of the big drop is equal to the total volume of the 8 small drops, that is,

$$\frac{4}{3}\pi r^3 = 8 \cdot \frac{4}{3}\pi R^3 \rightarrow r = 2R.$$

By the Stoke's law, the terminal velocity of the drop of radius R is

$$v_R = \frac{2R^2(\rho - \rho_0)g}{9\eta}.$$

The terminal velocity of the drop of radius $r = 2R$ is

$$v_r = \frac{2(2R)^2(\rho - \rho_0)g}{9\eta} = 4 \cdot \frac{2R^2(\rho - \rho_0)g}{9\eta} = 4 * v_R = 4 * 6\frac{cm}{s} = 24\frac{cm}{s}.$$

Answer: $24\frac{cm}{s}$.