Answer on Question #75214, Physics / Mechanics | Relativity

The volume V of liquid that flows through a pipe in time t is given by the equation

$$\frac{V}{t} = \frac{\pi P r^4}{8Cl}$$

where P is a pressure difference between the end of the pipe of radius r and the length L. The constant C depends on the frictional effects of the liquid.

Determine the base unit of C.

Solution:

V units: m^3

V / t units: $m^3\ s^{-1}$

Pressure units (allow use of P = F/A): kg·m·s^{-2} / m²= kg·s^{-2} / m

Clear substitution of units for P, r^4 , l

$$C = \frac{\pi P r^4 t}{8Vl}$$

$$C = \frac{\text{kg} \cdot \text{s}^{-2} \cdot \text{m}^4 \cdot \text{s}}{\text{m} \cdot \text{m}^3 \cdot \text{m}} = \frac{\text{kg} \cdot \text{s}^{-1}}{\text{m}} = \text{kg m}^{-1}\,\text{s}^{-1}$$

Answer: $\text{kg m}^{-1}\,\text{s}^{-1}$