

Problem 54

Suppose $[V] = L^3$, $[\rho] = ML^{-3}$, and $[t] = T$. (a) What is the dimension of $\int \rho dV$? (b) What is the dimension of dV/dt ? (c) What is the dimension of $\rho(dV/dt)$?

Solution**Part (a)**

Consider the dimensions of this expression.

$$\begin{aligned}\left[\int \rho dV\right] &= [\rho][V] \\ &= (ML^{-3}) \cdot L^3 \\ &= M\end{aligned}$$

Part (b)

Consider the dimensions of this expression.

$$\begin{aligned}\left[\frac{dV}{dt}\right] &= \frac{[dV]}{[dt]} \\ &= \frac{L^3}{T} \\ &= L^3T^{-1}\end{aligned}$$

Part (c)

Consider the dimensions of this expression.

$$\begin{aligned}\left[\rho \frac{dV}{dt}\right] &= [\rho] \left[\frac{dV}{dt}\right] \\ &= [\rho] \frac{[dV]}{[dt]} \\ &= (ML^{-3}) \cdot \frac{L^3}{T} \\ &= MT^{-1}\end{aligned}$$