$+$ $\times$

$-$ $\div$

EXERCISE A calculation yields the result

$$P = \frac{g^2m^2}{Fv^2t^2}$$

where P is pressure, m is mass, F is force, g is acceleration, v is velocity, t is time. Is this result consistent with dimensional analysis?

$$P = \frac{\frac{N^2}{\cancel{kg^2}}\,\cancel{kg^2}}{\cancel{N}\cdot\frac{m^2}{\cancel{s^2}}\,\cancel{s^2}} = N/m^2$$

$$P = \frac{g^2M^2}{F\,v^2t^2} = \frac{[gM]^2}{F[vt]^2} = \frac{F^2}{\cancel{F}L^2} = \frac{F}{L^2}$$

EXERCISE A calculation yields the result

$$E = W + F\Delta S + PV + \frac{5}{8}mv^2 + 2mg,$$

where E is energy, W is work, F is force, ΔS is displacement, P is pressure, V is volume, m is mass, v is velocity, m is mass, g is acceleration. Is this result consistent with dimensional analysis?

$$E = W + F\Delta S + PV + \frac{5}{8}mv^2 + 2mg$$

$$E = \underbrace{FL + FL + FL}_{} + M\frac{L}{T} + M\frac{L}{T^2}$$

$$E = FL +$$

$$E = N\cdot\Delta S + N\Delta S + \frac{N}{\cancel{m^2}}\cancel{m^2} + \underbrace{kg\,\frac{m^2}{s^2}}_{J} + \underbrace{\cancel{kg}\cdot\frac{N}{\cancel{kg}}}_{N}$$

EXERCISE Assuming $\{M, L, T\}$ (mass, length, time) as the set of fundamental dimensions, and $\{F, V, \rho\}$ as the set of relevant physical quantities, use Rayleigh's method to find an expression for the energy density ϵ (i.e., energy per unit volume). F is force, V is volume, ρ is volumetric density.

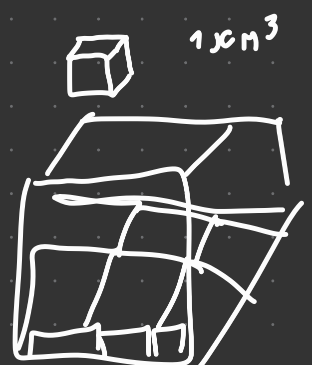
$$F = \frac{ML}{T^2}$$

$$V = M^3$$

$$\rho = M^{-3}$$

$$\rho = \frac{ML^2/T^2}{L^3} \Rightarrow \rho = \frac{M}{LT^2}$$

EXERCISE A cube of copper, whose side is 1 centimeter long, can be modelled into a 1 meter long electric wire. How long a wire can be made with a cube whose side is 3 centimeters?



1 cm^3

1 m

27 m^3