P.427

a) $v = \omega R \Rightarrow \omega = \dfrac{v}{R} \Rightarrow [\omega] = \dfrac{[v]}{[R]} \Rightarrow [\omega] = \dfrac{LT^{-1}}{L} \Rightarrow \boxed{[\omega] = M^0L^0T^{-1}}$

b) $M_F = Fd \Rightarrow [M_F] = [F] \cdot [d] \Rightarrow [M_F] = MLT^{-2} \cdot L \Rightarrow \boxed{[M_F] = ML^2T^{-2}}$

c) $\dfrac{Q}{\Delta t} = \dfrac{K \cdot A \cdot \Delta\theta}{e} \Rightarrow K = \dfrac{Q \cdot e}{A \cdot \Delta\theta \cdot \Delta t} \Rightarrow [K] = \dfrac{[Q] \cdot [e]}{[A] \cdot [\Delta\theta] \cdot [\Delta t]} \Rightarrow$

$\Rightarrow [K] = \dfrac{ML^2T^{-2} \cdot L}{L^2 \cdot \theta \cdot T} \Rightarrow \boxed{[K] = MLT^{-3}\theta^{-1}}$

P.428

a) $F = B \cdot i \cdot L \Rightarrow B = \dfrac{F}{i \cdot L} \Rightarrow [B] = \dfrac{[F]}{[i] \cdot [L]} \Rightarrow [B] = \dfrac{MLT^{-2}}{I \cdot L} \Rightarrow \boxed{[B] = ML^0T^{-2}I^{-1}}$

b) $B = \dfrac{\mu_0 \cdot i}{2\pi r} \Rightarrow \mu_0 = \dfrac{B \cdot 2\pi r}{i} \Rightarrow [\mu_0] = \dfrac{[B] \cdot [r]}{[i]} \Rightarrow$

$\Rightarrow [\mu_0] = \dfrac{ML^0T^{-2}I^{-1} \cdot L}{I} \Rightarrow \boxed{[\mu_0] = MLT^{-2}I^{-2}}$

c) $\Phi = BA \cdot \cos\alpha \Rightarrow [\Phi] = [B] \cdot [A] \Rightarrow [\Phi] = ML^0T^{-2}I^{-1} \cdot L^2 \Rightarrow \boxed{[\Phi] = ML^2T^{-2}I^{-1}}$

P.429

$E = \dfrac{kx^2}{2} \Rightarrow k = \dfrac{2E}{x^2} \Rightarrow [k] = \dfrac{[E]}{[x^2]} \Rightarrow [k] = \dfrac{ML^2T^{-2}}{L^2} \Rightarrow \boxed{[k] = ML^0T^{-2}}$

P.430

a) $[v^2] = (M^0LT^{-1})^2 = M^0L^2T^{-2}$

$[\alpha \cdot \Delta s] = [\alpha] \cdot [\Delta s] = M^0LT^{-2} \cdot L = M^0L^2T^{-2}$

b) $[U] = ML^2T^{-3}I^{-1}$

$[Ed] = [E] \cdot [d] = MLT^{-3}I^{-1} \cdot L = ML^2T^{-3}I^{-1}$

P.431 Sabemos que x, a, bt, ct^2 e dt^3 têm a mesma dimensão em relação a L. Assim:

$[a] = L \Rightarrow [a] = M^0LT^0$

$[bt] = L \Rightarrow [b] \cdot [t] = L \Rightarrow [b] \cdot T = L \Rightarrow [b] = M^0LT^{-1}$

$[ct^2] = L \Rightarrow [c] \cdot [t^2] = L \Rightarrow [c] \cdot T^2 = L \Rightarrow [c] = M^0LT^{-2}$

$[dt^3] = L \Rightarrow [d] \cdot [t^3] = L \Rightarrow [d] \cdot T^3 = L \Rightarrow [d] = M^0LT^{-3}$

P.432 $a = v^\alpha \cdot \omega^\beta$

$[a] = [v]^\alpha \cdot [\omega]^\beta$

$M^0LT^{-2} = (M^0LT^{-1})^\alpha \cdot (T^{-1})^\beta$

$M^0LT^{-2} = M^0L^\alpha T^{-\alpha-\beta}$

$\boxed{\alpha = 1}$ e $-\alpha - \beta = -2$

$-1 - \beta = -2$

$\boxed{\beta = 1}$

P.433 $v = g^\alpha \cdot R^\beta$

$[v] = [g]^\alpha \cdot [R]^\beta$

$M^0LT^{-1} = (M^0LT^{-2})^\alpha \cdot L^\beta$

$M^0LT^{-1} = M^0L^{\alpha+\beta}T^{-2\alpha}$

$\alpha + \beta = 1$ e $-2\alpha = -1$

$\boxed{\alpha = \frac{1}{2}}$ e $\boxed{\beta = \frac{1}{2}}$

Portanto, a fórmula da velocidade v do satélite é dada por: $\boxed{v = \sqrt{gR}}$

P.434 a) massa, comprimento e tempo; quilograma, metro e segundo, respectivamente.

b) Os expoentes α, β e γ são as dimensões de G em relação a M, L e T.

$$G = Pot = \frac{\mathcal{T}}{\Delta t} \Rightarrow [Pot] = \frac{[\mathcal{T}]}{[\Delta t]} \Rightarrow [Pot] = \frac{ML^2T^{-2}}{T} \Rightarrow [Pot] = ML^2T^{-3}$$

Portanto: $\alpha = 1$, $\beta = 2$ e $\gamma = -3$

P.435 a) $Q = h \cdot A \cdot \Delta T \cdot \Delta t \Rightarrow h = \dfrac{Q}{A \cdot \Delta T \cdot \Delta t}$

Assim, a unidade de h em termos das unidades do SI que aparecem no enunciado é: $J/m^2 \cdot K \cdot s$

b) Sendo $J = kg \cdot m^2/s^2$, temos para a unidade de h: $\dfrac{kg \cdot \frac{m^2}{s^2}}{m^2 \cdot K \cdot s} = kg/K \cdot s^3$

P.436 $v = p^x \cdot \mu^y \Rightarrow [v] = [p]^x \cdot [\mu]^y \Rightarrow M^0LT^{-1} = (ML^{-1}T^{-2})^x \cdot (ML^{-3})^y \Rightarrow$

$\Rightarrow M^0LT^{-1} = M^{x+y}L^{-x-3y}T^{-2x}$

Então, temos:

$$\begin{cases} x + y = 0 \\ -x - 3y = 1 \\ -1 = -2x \end{cases}$$

$$x = \frac{1}{2} \quad \text{e} \quad \frac{1}{2} + y = 0$$

$$y = -\frac{1}{2}$$

Portanto: $v = p^{\frac{1}{2}} \cdot \mu^{-\frac{1}{2}} \Rightarrow \boxed{v = \sqrt{\frac{p}{\mu}}}$

P.437 $\ell = K \cdot h^\alpha \cdot G^\beta \cdot c^\gamma \Rightarrow [\ell] = [h]^\alpha \cdot [G]^\beta \cdot [c]^\gamma$ ①

$[\ell] = M^0LT^0$

$$E = h \cdot f \Rightarrow h = \frac{E}{f} \Rightarrow [h] = \frac{[E]}{[f]} \Rightarrow [h] = \frac{ML^2T^{-2}}{T^{-1}} \Rightarrow [h] = ML^2T^{-1}$$

$$G = \frac{Fd^2}{m_1m_2} \Rightarrow [G] = \frac{[F] \cdot [d^2]}{[m_1] \cdot [m_2]} \Rightarrow [G] = \frac{MLT^{-2} \cdot L^2}{M^2} \Rightarrow [G] = M^{-1}L^3T^{-2}$$

$[c] = M^0LT^{-1}$

Substituindo $[\ell]$, $[h]$, $[G]$ e $[c]$ em ①, temos:

$M^0LT^0 = (ML^2T^{-1})^\alpha \cdot (M^{-1}L^3T^{-2})^\beta \cdot (LT^{-1})^\gamma$

$M^0LT^0 = M^{\alpha-\beta}L^{2\alpha+3\beta+\gamma}T^{-\alpha-2\beta-\gamma}$

Assim, temos:

$$\begin{cases} \alpha - \beta = 0 \\ 2\alpha + 3\beta + \gamma = 1 \\ -\alpha - 2\beta - \gamma = 0 \end{cases}$$

$$\alpha = \beta = \frac{1}{2} \quad \text{e} \quad \gamma = -\frac{3}{2}$$

Portanto: $\ell = K \cdot h^{\frac{1}{2}} \cdot G^{\frac{1}{2}} \cdot c^{-\frac{3}{2}} \Rightarrow \boxed{\ell = K \cdot \sqrt{\frac{h \cdot G}{c^3}}}$