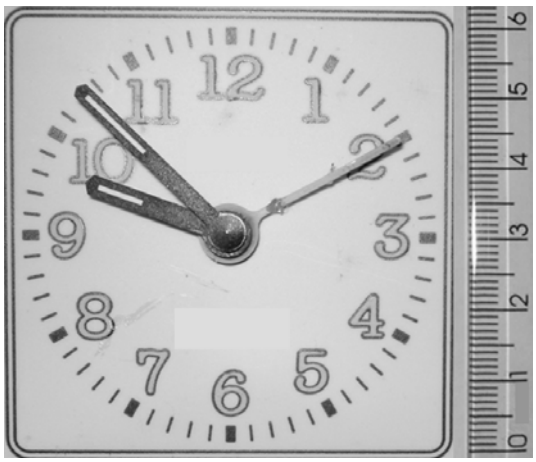
# RESPOSTAS ESPERADAS – FÍSICA

## Questão 1



a)
Usando a régua da figura para medirmos o raio do movimento circular do ponteiro, temos:

$$r = 2,8\,\text{cm}$$

$$v = \omega r = \frac{2\pi}{T} r = \frac{2 \times 3}{60\,\text{s}} \times 2,8\ \text{cm} = 2,8\ \text{mm/s}$$

b)

$$i_{\text{média}} = \frac{q}{Dt} = \frac{2,4\,\text{Ah}}{400 \times 24\text{h}} = \frac{1}{4000}\,\text{A} = 2,5 \times 10^{-4}\,\text{A} = 0,25\,\text{mA}$$

## Questão 2

a)
Cada jogador se desloca 6 m até a posição do encontro. Assim,

$$x = 6,0\text{m} = \frac{1}{2} a t^2 = \frac{1}{2}(3,0\text{m/s}^2) t^2 \Rightarrow t = \sqrt{4,0}\,\text{s} = 2,0\,\text{s}$$

b)
A distância mínima entre A e Z é dada por:

$$\Delta x = v_{rel}\,\Delta t = (12\text{m/s}) \times 0,1s = 1,2\text{m}$$

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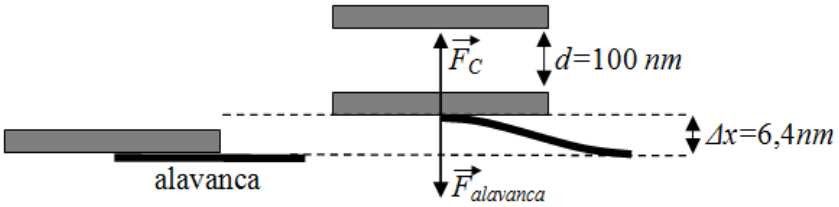
## Questão 3




a)

$$F = \frac{9{,}6\times10^{-39}}{d^4} = k\Delta x$$

$$k = \frac{9{,}6\times10^{-39}}{d^4\Delta x} = \frac{9{,}6\times10^{-39}}{\left(10^{-7}\right)^4 6{,}4\times10^{-9}} = 0{,}015\ \text{N/m}$$

b)

$$\frac{1}{2}kx^2 = 1{,}4\times10^{-23}T$$

$$x = \sqrt{\frac{2\times1{,}4\times10^{-23}T}{k}} = \sqrt{\frac{2\times1{,}4\times10^{-23}\times300}{2{,}1\times10^{-1}}} = 2\times10^{-10}m = 0{,}2\ \text{nm}$$

## Questão 4

a)

$T_{rotação} = T_{translação}$

$T_{translação}$ = 27 dias = 648 horas

$$v_{orb} = \frac{2\pi r}{T} = \frac{6\times380000\ \text{km}}{648\ \text{h}} = 3519\ \text{km/h}$$

b)

$$E = \frac{1}{2}mv^2 = \frac{1}{2}m(2gR) = mgR$$

$$E = 10\times6400000\times70 = 4{,}48\times10^9\ \text{J}$$

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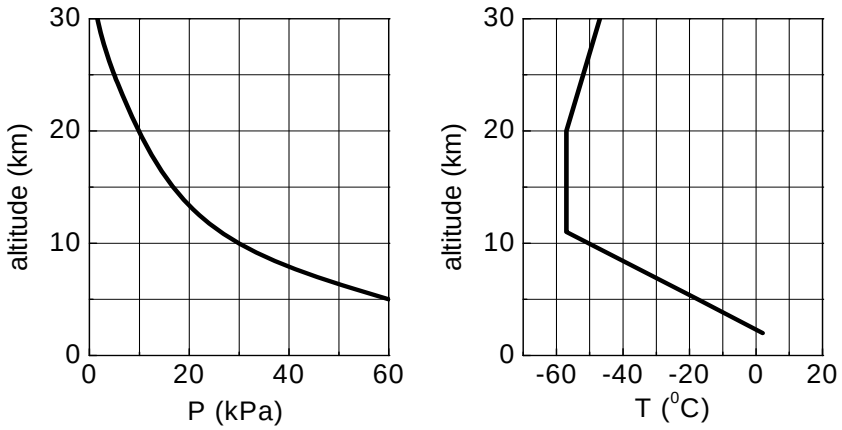
## Questão 5




a)

$PV = nRT \Rightarrow V = \dfrac{nRT}{P}$

$n = 1$

$\theta = -50\ ^0C \Rightarrow T = 223\ K$

$P = 30\ kPa = 30\times10^3\ Pa$

$V = \dfrac{1\times8,3\times223}{30\times10^3}m^3 = \dfrac{1851}{30}l = 61,7l$

b)

$P = P_0 - \rho gh \Rightarrow \rho = \dfrac{P_0 - P}{gh}$

$\rho = \dfrac{(100 - 94)\times10^3}{700\times10}kg/m^3 = \dfrac{6}{7}\ kg/m^3 = 0,86\ kg/m^3$

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## Questão 6

a)

A fórmula correta para as frequências naturais da corda é: $f_N = N\left(v/2L\right)$. Assim,

$$\tau = \mu v^2 = \mu\left(2L f_1^{fina}\right)^2 = 5\times10^{-3}\,\frac{kg}{m}\times(1{,}0\ m\times 220Hz)^2$$

$$\tau = 5\times10^{-3}\times(220)^2\,\frac{kgm}{s^2} = 242\ N$$

Com a fórmula fornecida no enunciado, a solução seria:

a)

$$\tau = \mu v^2 = \mu\left(L f_1^{fina}\right)^2 = 5\times10^{-3}\,\frac{kg}{m}\times(0{,}5\ m\times 220Hz)^2$$

$$\tau = 5\times10^{-3}\times(110)^2\,\frac{kgm}{s^2} = 60{,}5\ N$$

b)

$$f_{bat} = f_1^{fina} - f_2^{grossa} \Rightarrow f_2^{grossa} = f_1^{fina} - f_{bat} = (220-4)Hz = 216Hz$$

$$f_1^{grossa} = \frac{1}{2} f_2^{grossa} = \frac{216}{2}Hz = 108Hz$$

## Questão 7

a)

$$\left|\tau_{atrito}\right| = E_C$$

$$\left|\tau_{atrito}\right| = \bar{F}_{atrito}\,d = \bar{F}_{atrito}\times 1{,}5\times10^{3}\,m \Rightarrow \bar{F}_{atrito} = \frac{4{,}5\times10^{4}\,J}{1{,}5\times10^{3}\,m} = 30N$$

b)

$$Q = mc\Delta\theta = 0{,}1g\times 0{,}9\,\frac{J}{g\,^oC}\times 2400\,^oC = 216\ J$$

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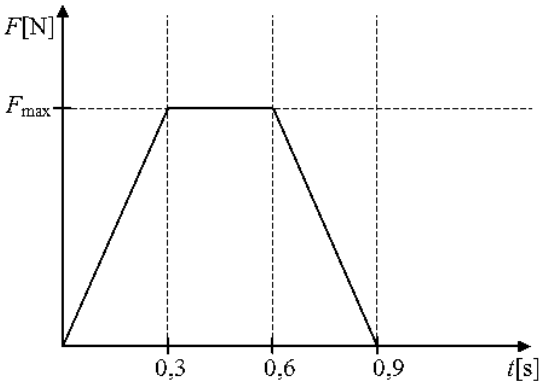
## Questão 8

a)

$m_a v_a + m_p v_p = 0$

$v_a = -\frac{m_p}{m_a} v_p = -\frac{80}{60} 0{,}15 = -0{,}2 \text{ m/s}$




b)

$|Q_p| = m_p v_p = 80 \times 0{,}15 = 12 \text{ kgm/s}$

$|I| = área(F \times t) = F_{max} \times 0{,}6 = 12$

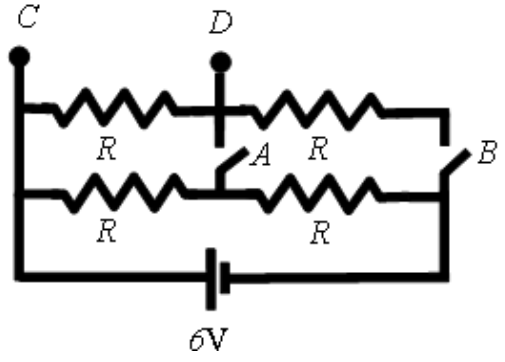
$F_{max} = 20 \text{ N}$

## Questão 9

a)

Estimando uma força exercida pelo dedo de 0,5 N, temos:

$P = \frac{F}{A} = \frac{0{,}5}{0{,}25 \times 10^{-4}} = 2{,}0 \times 10^4 \text{ N/m}^2$




b)

$R_T = 3\,\text{k}\Omega, I = \frac{6}{3} \times 10^{-3} = 2 \times 10^{-3} \text{A}$

$V_{CD} = 1\,\text{k}\Omega \times 2 \times 10^{-3} = 2 \text{ V}$

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## Questão 10

a)

$$\frac{\Delta t}{t_{Terra}} = \frac{\Delta U}{mc^2} = \frac{mgR_T\left(1 - R_T/r\right)}{mc^2}$$

$$\Delta t = t_{Terra}\frac{gR_T\left(1 - R_T/r\right)}{c^2} = 86400\frac{10 \times 6,4 \times 10^6 \times \left(1 - \frac{1}{4}\right)}{9 \times 10^{16}}$$

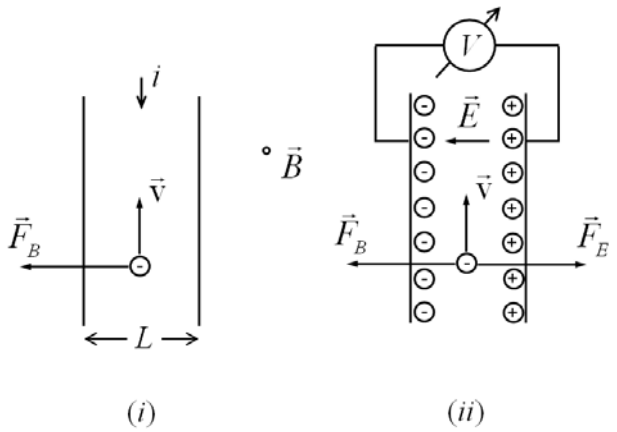
$$\Delta t = 46080\text{ns}$$

b)

$$\frac{\Delta t}{t_{Terra}} = 10^{-16} = \frac{\Delta U}{mc^2} = \frac{mgh}{mc^2}$$

$$h = \frac{10^{-16}c^2}{g} = \frac{10^{-16} \times 9 \times 10^{16}}{10} = 0,9\text{m}$$

## Questão 11




(i) (ii)

a)

$$\Delta V = EL = 1,0 \times 10^{-4}\,\frac{\text{N}}{\text{C}} \times 2,0 \times 10^{-2}\,\text{m} = 2,0 \times 10^{-6}\,\text{V}$$

b)

$$qE = qvB \Rightarrow v = \frac{E}{B} = \frac{1,0 \times 10^{-4}}{0,2} = 5,0 \times 10^{-4}\ \text{m/s}$$

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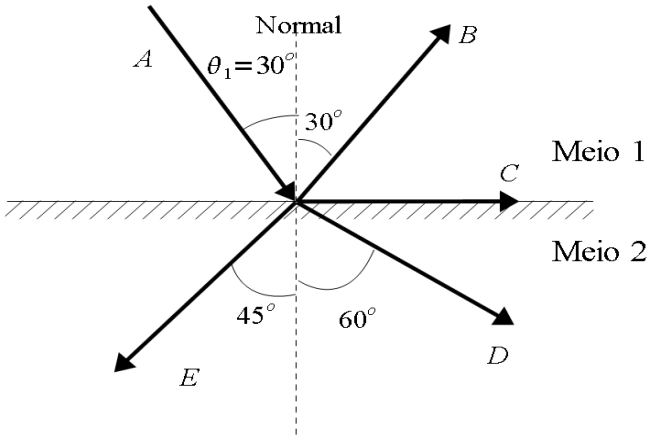
## Questão 12




a)

O raio E representa a trajetória do raio de luz quando o meio 2 é um metamaterial.

$$|n_1| sen\theta_1 = |n_2| sen\theta_2$$

$$1,8 \times \frac{1}{2} = |n_2| \times \frac{\sqrt{2}}{2}$$

$$|n_2| = \frac{1,8}{1,4} \approx 1,28$$

b)

$$v = \frac{1}{\sqrt{2,0 \times 10^{-11} \times 1,25 \times 10^{-6}}} = 2,0 \times 10^8 \text{ m/s}$$

$$n = \frac{c}{v} = 1,5$$