Août 2016

$m = 60\ kg \qquad t = 20\ sec \qquad v_f = 36\ km/h = 10\ m/sec$

1. $v_f = 10\ m/sec = a\,t = a \times 20\ sec$

$\rightarrow a = \frac{v_f}{t} = \frac{10}{20} = 0{,}5\ m\,sec^{-2}$

$v^2 = 2a(x - x_0) \rightarrow 10^2 = 2 \times \frac{1}{2}(x - x_0)$

$\rightarrow 100 = x - x_0$

$\rightarrow \underline{x - x_0 = 100\ m}$

2. $E_{kin}(0) = \frac{1}{2} m v^2 = \frac{1}{2} \times 60 \times 10^2 = 30 \times 100 = 3000\ J$

$U(0) = 0$

$\rightarrow E_{tot}(0) = U(0) + E_{kin}(0) = 3000\ J$

Au milieu de la montée :

$E_{kin} = \frac{1}{2} m v^2$ avec $v = 7.2\ km/h = 2\ m/sec.$

$= \frac{1}{2} 60\ 2^2 = 120\ J.$

$U_{pot} = mgh = 60 \times 10 \times \underline{1.5} = 900\ J.$

$h = 2.5 - 1 = 1.5\ m$

$\rightarrow E_{tot}(0) = E_{kin} + U_{pot} + E_{elas.}$

$3000\ J = 120 + 900 + E_{elas} \rightarrow E_{elas} = 1980\ J.$

g. Bolt 100 m 9.58 sec.

$$\left.\begin{array}{l} v_f = at \\ x = \frac{1}{2}at^2 \end{array}\right| \rightarrow v_f = \frac{2x}{t^2}\, t \rightarrow \frac{2x}{t^2} = a$$

$$\rightarrow v_f = \frac{2x}{t} = \frac{2 \times 100}{9.58} = 20.87 \text{ m/sec.}$$

h. $\frac{1}{2} m v^2 = m g (h - 1)$

$\frac{1}{2}(12.4)^2 = 10 (h - 1)$

$7.688 = h - 1$ $\qquad$ $h = 8.688$ m.

c. hauteur de la barre:

$$E_{kin}(0) = U + E_{kin}$$

$$3000 = mg(h-1) + \frac{1}{2} m v^2$$

$$= 60 \times 10 \times (h-1) + \frac{1}{2}\, 60 \times (0.1)^2$$

$$= 600 \times (h-1) + 30 \times 0.01$$

$$= 600\,(h-1) + 0.3.$$

$$\frac{2999.7}{600} = h-1 = 4.9995 \quad \rightarrow \quad h = 5.9995 \text{ m}$$

d. Conversion du mouvement horizontal en mouvement vertical.

e. $h = \frac{1}{2} g t^2$

$$6 = \frac{1}{2}\, 10\, t^2 \quad \rightarrow \quad \frac{12}{10} = t^2 \qquad t = 1.095 \text{ sec.}$$

f. Barre à 8 m

$$U_{pot} = 60 \times g \times (h-1) = 60 \times 10 \times 7 = 4200 \text{ J.}$$

$$4200 \text{ J} = \frac{1}{2} m v^2 = \frac{1}{2}\, 60\, v^2$$

$$\frac{4200}{30} = 140 = v^2 \quad \rightarrow \quad \underline{v = 11.8} \text{ m/sec.}$$

Q2

a. $\frac{g_s}{g_p} = \frac{N_s}{N_p} = \frac{6}{120} = \frac{1}{20}$

Or $N_p = 240 \rightarrow N_s = \frac{N_p}{20} = 12.$

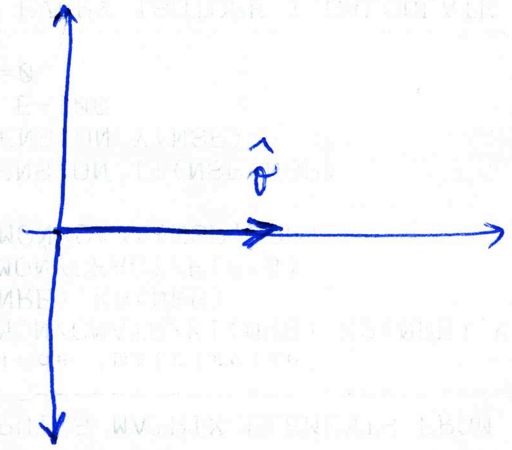
b. $Z_L = \omega L j$ où $\omega = 2\pi f = 2\pi \times 60 \text{ rad s}^{-1}$

$\simeq 1130\, j$ $L = 3\ H.$

c. $\frac{\hat{v}}{\hat{\imath}} = Z \rightarrow \hat{\imath} = \frac{\hat{v}}{Z} = \frac{V_o\sqrt{2}}{\omega L j} = \frac{120 \times \sqrt{2}}{2\pi \times 60 \times 3 j}$

$= -0{,}15\, j$

d.



e. $v_{eff} = |Z|\, i_{eff} \rightarrow i_{eff} = \frac{v_{eff}}{|Z|} = \frac{120}{2\pi \times 60 \times 3} = 0.106$

ou $i_{eff} = |\hat{\imath}| / \sqrt{2} = 0{,}106$ A

f. $\varphi = -90°$ g. $\langle p \rangle = i_{eff}\, v_{eff} \cos\varphi = 0$

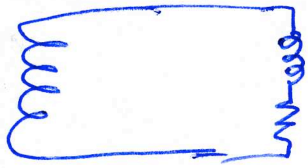
car $\varphi = -90°$

h. $L \propto N_{spire}$

Donc $\dfrac{L_S}{N_S} = \dfrac{L_p}{N_p} \rightarrow L_S = \dfrac{N_S}{N_p} L_p$

$= \dfrac{1}{20}\, 3 \quad H$

i.



$$Z = Z_{L_S} + Z_{L_{sonnette}} + Z_{R_{sonnette}}.$$

$$= \omega L_S j + \omega L_{sonnette} j + R_{sonnette}.$$

$$= R_{sonnette} + \omega \left(L_S + L_{sonnette} \right) j$$

$$= 10 + 2\pi \times 60 \left(\frac{3}{20} + 2 \right) j \quad \Omega.$$

$$= \left(10 + 810.5\ j \right) \Omega$$

j. $\operatorname{tg}\varphi = \dfrac{Im(Z)}{Re(Z)} = \dfrac{810.5}{10} = 81.05$

$\varphi = 89.29°$

$\langle p \rangle = v_{eff}\, i_{eff} \cos\varphi = 6 \times i_{eff} \times \cos(89.29)$

k. La même, non nulle.

l. non, elle change à cause de l'inductance mutuelle.

Q3: C1 : 4 kΩ C2: 1 kΩ

C3: 2.5 kΩ C4: 0.25 kΩ

Q4: a. $V_1 = V_{D2} + R_2 I_2 \rightarrow R_2 = \frac{V_1 - V_{D2}}{I_2} = \frac{10-2}{0.025} = 320\ \Omega.$

b. $V_1 = V_{D1} + R_1 I_1 \Rightarrow I_1 = \frac{V_1 - V_{D1}}{R_1} = \frac{10-0.7}{1000} = 9.3\ mA.$

d. $V = RI \rightarrow R = \frac{V}{I} = \frac{2}{0.025} = 80\ \Omega$