FÍSICA GERAL E EXPERIMENTAL I

RESOLUÇÃO DA LISTA III

UNIVERSIDADE CATÓLICA DE GOIÁS

Departamento de Matemática e Física

Disciplina: Física Geral e Experimental I (MAF 2201)

RESOLUÇÃO DA LISTA III

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1. $E_k = \frac{1}{2}mv^2$, como o módulo da velocidade é o mesmo em todos os itens a energia cinética é a mesma.

2.

$T = \vec{F}.\vec{d}$ ou $T = Fd\cos\theta$

a) cos 30º > 0 $\Rightarrow$ T > 0

b) cos 100º < 0 $\Rightarrow$ T > 0

c) $T = \vec{F}.\vec{d} = -2.4 - 3.0 = -8\,j$

3.

O trabalho é numericamente igual à área limitada pela força e o eixo *x*. Sendo que para área acima do eixo x o trabalho é positivo e abaixo é negativo $\Rightarrow T_b > T_a > T_c > T_d$

4.

$T = mgh \Rightarrow T_a = T_b = T_c$

5.

$K_a > K_b \qquad T = \frac{1}{2}kx^2$

a) $x_1 = x_2 \Rightarrow T_a > T_b$

b)

$$F_A = F_B \Rightarrow k_A.X_A = k_B X_{B.}, k_A > k_B \Rightarrow x_B > x_A$$

$$\left.\begin{aligned} T_A &= \frac{1}{2}k_A x_A^2 = \frac{1}{2}k_A x_A.x_A \\ T_B &= \frac{1}{2}k_B x_B^2 = \frac{1}{2}k_B x_B.x_B = \frac{1}{2}k_A x_A x_B \end{aligned}\right\} x_B > x_A \Rightarrow T_B > T_A$$

6.

a) $F_R = F' + F'' = kd + kd = 2kd \Rightarrow F_R = 2F_1$

sistema equivalente a uma única mola de constante 2k

b) $w = w' + w'' = w_1 + w_1 \Rightarrow w = 2w_1$

7.

$E_k = 6,7.10^{-19}\,J$

$E_k = \frac{1}{2}mv^2 \Rightarrow 6,7.10^{-19} = \frac{1}{2}.9,11.10^{-31}.v^2$

$v = 1,21.10^6\,m/s$

8.

a) $m = 110\,kg,\ v = 8,1m/s \Rightarrow E_k = \frac{1}{2}110.(8,1)^2 \Rightarrow E_k = 3608,55J$

b) $m = 4,2g = 4,2.10^{-3}kg,\ v = 950\ m/s \Rightarrow E_k = \frac{1}{2}.4,2.10^{-3}.950^2 \Rightarrow E_k = 1895,25J$

c)

$m = 91400ton = 9,14.10^4\,ton = 9,14.10^7\,kg$

$v = 32\,nos = 32.1,852\,km/h = \frac{32.1,852}{3,6}\ m/s = 16,46m/s$

$\Rightarrow E_k = \frac{1}{2}.9,14.10^7.(16,46)^2 \Rightarrow E_k = 1,24.10^{10}\ J$

9.

$E_{op} = \frac{1}{2}E_{0f} \Rightarrow \frac{1}{2}m_p v_{0p}^2 = \frac{1}{2}.\frac{1}{2}m_f v_{0f}^2 \Rightarrow 2m_f v_{0p}^2 = \frac{1}{2}m_f v_{0f}^2 \Rightarrow 4v_{0f}^2 = v_{0f}^2$

$m_f = \frac{m_p}{2}$

$E_p = E_f \Rightarrow \frac{1}{2}m_p(v_{0p}+1)^2 = \frac{1}{2}m_f v_{0f}^2 \Rightarrow 2m_f(v_{0p}+1)^2 = m_f\,v_{0f}^2$

$\Rightarrow 2(v_{0p}+1)^2 = v_{0f}^2 \Rightarrow 2(v_{0p}+1)^2 = 4v_{0p}^2 \Rightarrow v_{0p}^2 + 2v_{0p} + 1 = 2v_{0p}^2$

$\Rightarrow v_{0p}^2 - 2v_{0p} - 1 = 0 \Rightarrow v_{0p} = 2,41m/s\ \ e\ \ v_{0f} = 4,82\,m/s$

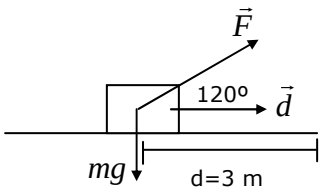
10.

$\vec{d} = (15m)\hat{i} - (12m)\hat{j},\ \vec{F} = (210N)\hat{i} - (150N)\hat{j}$

$w = \vec{F}.\vec{d} = 15.210 + 12.150 = 4950J$

11.

$m = 50kg,\ \ F = 210N$



a) $w_F = F.d.\cos\theta = 210.3.\cos 20^\circ = 592J$

b) $w_P = P.d.\cos 90^\circ \Rightarrow w_P = 0$

c) $w_h = h.d.\cos 90^\circ \Rightarrow w_h = 0$

d) $w_{total} = w_F + w_P + w_h = 292J$

12.

$m = 3kg, \quad x = 3t - 4t^2 + t^3 \Rightarrow v = \frac{dx}{dt} = 3 - 8t + 3t^2$

$p/t_i = 0 \Rightarrow v_i = 3m/s$

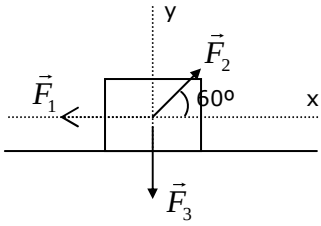
$p/t_f = 4s \Rightarrow v_f = 3 - 8.4 + 3.4^2 = 19m/s$

$w = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 = \frac{1}{2}.3(19^2 - 3^2)$

$\Rightarrow w = 528J$

13.

a. $\vec{d} = -(3m)\hat{i}, \; F_1 = 5N; \; F_2 = 9N; \; F_3 = 3N$



$\sum F_x = F_2 \cos 60^o - F_1 = 9.\cos 60^o - 5 = -0,5N$

$\sum F_y = F_2 \, sen60^o - F_3 = 9sen60^o - 3 = 4,79N$

$\Rightarrow \vec{F}_R = -(0,5N)\hat{i} + (4,79N)\hat{j}$

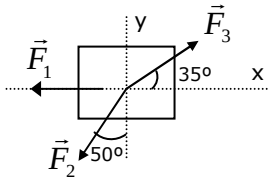
$\Rightarrow w = \vec{F}_R.\vec{d} = (-3).(-0,5) + 0.479 \Rightarrow w = 1,5J$

b) $w = E_{kF} - E_{ki}$, como w > 0 □ $E_{kF} > E_{ki}$ □ aumenta

14.

$v_0 = 0, \; F_1 = 3N, \; F_2 = 4N, \; F_3 = 10N, \; d = 4m$

como $v_0 = 0 \Rightarrow \vec{F}_R$ e $\vec{d}$ tem a mesma direção e o mesmo sentido $\Rightarrow w = F_R.d$



$\sum F_x = F_3 \cos 35^o - F_1 - F_2 \, sen50^o$

$\Rightarrow \sum F_x = 10\cos 35^o - 3 - 4 \, sen50^o = 2,13N$

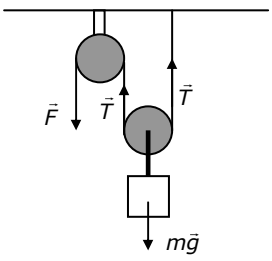
$\sum F_y = F_3 \, sen35^o - F_2 \cos 50^o = 10 \, sen35^o - 4\cos 50^o = 3,16N$

$F_R = \sqrt{(2,13)^2 + (3,16)^2} \Rightarrow F_R = 3,81N$

$w = 3,81.4 \Rightarrow w = 15,24J$

15.

$m = 20kg \quad F = T$



a) isolando a lata, temos que:

$\sum F_y = 0 \Rightarrow T + T - mg = 0 \Rightarrow 2T = mg \Rightarrow T = \frac{20.9,8}{2}$

$\Rightarrow F = 98N$

b) 4 cm

c) $w_{t'} = ? \quad T' = 2T = 2.9,8 = 196N \Rightarrow w_{T'} = T.d.\cos 0^o = 196.0,02 = 3,92J$

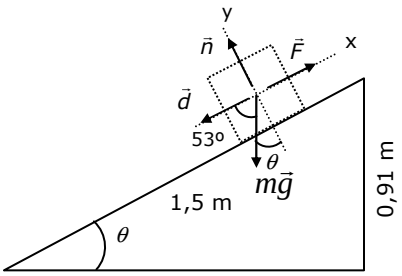
d) $w_p = mg.d.\cos 180^o = 20.9,8.0,02 = -3,92J$

16.

a)

$m = 45kg,\ v \to \text{constante} \to a = 0,\ sen\theta = \dfrac{0,91}{1,5} \Rightarrow \theta = 37^o$

$\sum F_x = 0 \to F - mg\,\text{sen}\,\theta = 0 \Rightarrow F = 45.9,8.\text{sen}\,37^o \Rightarrow F = 265,4N$



b) $w_F = F.d.\cos 180^o = -265,4.1,5 \Rightarrow w_F = -398,1J$

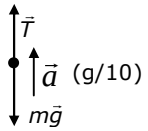
c) $w_p = mg.d.\cos 53^o = 45.9,8.1,5.\cos 53^o \Rightarrow w_p = 398,1J$

d) $w_n = n.d.\cos 90^o \Rightarrow w_n = 0$

e) $w_{total} = w_f + w_P + w_n = -398,1 - 398,1 = 0$

17.

$m = 72\,kg,\ \ h = 15\,m,\ v_0 = 0$



a) $w_T = ?$, cálculo de T

$\sum F_y = m.a \Rightarrow T - mg = m\dfrac{g}{10} \Rightarrow T = 72.9,8(1 + \dfrac{1}{10}) = 776,16N$

$w_T = T.h.\cos\theta \Rightarrow w_T = 776,16.15 \Rightarrow w_T = 1,2.10^4\,J$

b) $w_p = mgh\cos 180^o = -72.9,8.15 \Rightarrow w_p = -1,1.10^4\,J$

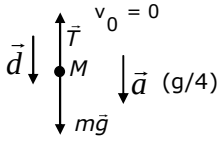
c) $w_{total} = E_{kf} - E_{ki} \Rightarrow w_T + w_P = E_{kf} \Rightarrow 1,2.10^4 - 1,1.10^4 = E_{k_f} \Rightarrow E_{kf} = 1000\ J$

d) $E_{kF} = \dfrac{1}{2}mv_f^2 \Rightarrow 1000\ = \dfrac{1}{2}.72.v_f^2 \Rightarrow v_F = 5,3m/s$

18.

$v_0 = 0$

$w_T = T.d.\cos 180^o = -T.d$



a)

$\sum F_y = m.a \Rightarrow Mg - T = M\dfrac{g}{4} \Rightarrow T = Mg - \dfrac{Mg}{4} = \dfrac{3Mg}{4} \Rightarrow w_T = \dfrac{-3Mgd}{4}$

b) $w_p = Mgd\cos 0^o \Rightarrow w_p = Mgd$

c) $w_{total} = \Delta E_k \Rightarrow w_T + w_P = E_{kf} - E_{ki} \Rightarrow \dfrac{-3Mgd}{4} + Mgd = E_{kf} \Rightarrow E_{kf} = \dfrac{Mgd}{4}$

d) $E_{kf} = \frac{1}{2}Mv_f^2 \Rightarrow \frac{Mgd}{4} = \frac{1}{2}Mv_f^2 \Rightarrow v_f = \sqrt{\frac{gd}{2}}$

19.

$k = 15\ N/cm = 1500\,N/m$

a)

$x_i = 0, x_f = 7,6\,mm = 7,6.10^{-3}m$

$w = \frac{1}{2}k(x_i^2 - x_f^2) = \frac{1}{2}.1500[(0 - (7,6.10^{-3})^2] \Rightarrow w = -4,3.10^{-2}\,J$

b)

$x_i^{'} = 7,6.10^{-3}m,\ \ x_f^{'} = 15,2.10^{-3}m$

$w^{'} = \frac{1}{2}k(x_i^{'2} - x^{'2}_f) = \frac{1}{2}.1500[(7,6.10^{-3})^2 - (15,2.10^{-3})^2] \Rightarrow w^{'} = -0,13J$

20.

$m = 250g = 0,25kg,\ \ k = 2,5\,N/cm = 250\ N/m,\ \ d = 12\ cm = 0,12m$

a) $w_p = mgd\cos 0^o = 0,25.9,8.0,12 \Rightarrow w_p = 0,294J$

b) $w = \frac{1}{2}k(x_i^2 - x_f^2) = \frac{1}{2}.250[0 - (0,12)^2] \Rightarrow w = -1,8J$

c)

$w_{total} = \Delta E_k \Rightarrow w_p + w = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$\Rightarrow 0,294 - 1,8 = -\frac{1}{2}.0,25.v_i^2 \Rightarrow v_i = 3,47\,m/s$

d)

$v_i^{'} = 2v_i = 2.3,47 = 6,94\,m/s$

$w_{total} = \Delta E_k \Rightarrow mgd^{'} + \frac{1}{2}k(y_i^2 - y_f^2) = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$\Rightarrow 0,25.9,8d - \frac{1}{2}.250.d^2 = \frac{0,25}{2}.(6,94)^2$

$\Rightarrow 2,45.d - 125d^2 = -6,02 \Rightarrow 125d^2 - 2,45d - 6,02 = 0$

Resolvendo esta equação do 2º grau teremos $d = 0,23m$

21.

$m = 2kg,\ \ F_x = -6x \Rightarrow k = 6\,N/m$

a)

$p/\ x_i = 3m \Rightarrow v_i = 8m/s$

$x_f = 4m,\ v_f = ?$

$w_{F_x} = \Delta E_k \Rightarrow \frac{1}{2}k(x_i^2 - x_f^2) = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$\Rightarrow \frac{6}{2}(3^2 - 4^2) = \frac{2}{2}v_f^2 - \frac{2}{2}.8^2 \Rightarrow v_f = 6,56\,m/s$

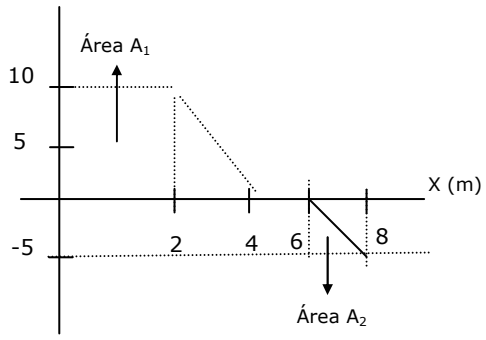
b)

$w_{Fx} = \Delta E_k \Rightarrow \frac{1}{2}.6(3^2 - x'^2_f) = \frac{1}{2}.2.5^2 - \frac{1}{2}.2.8^2 \Rightarrow x'_f = 4,7m$

22.

$m = 5kg$

$\left.\begin{array}{l} A_1 = \frac{(4+2).10}{2} = 30 \\ A_2 = \frac{2.5}{2} = 5 \end{array}\right\} \overset{n}{w} = A_1 - A_2 = 30 - 5 \Rightarrow w = 25J$



23.

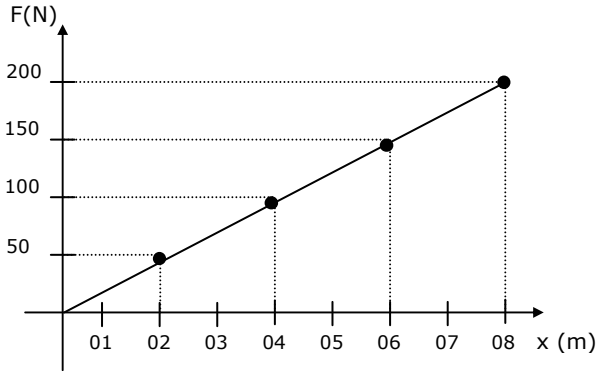
$m = 10kg$

$a_0 = 0 \Rightarrow F_0 = 0$

$a_1 = 5\,m/s^2 = F_1 = 50N\ em\ x = 2m$

$a_2 = 10\,m/s^2 \Rightarrow F_2 = 100N\ em\ x = 4m$

$a_3 = 20m/s^2 \Rightarrow F_3 = 200N\ em\ x = 8m$

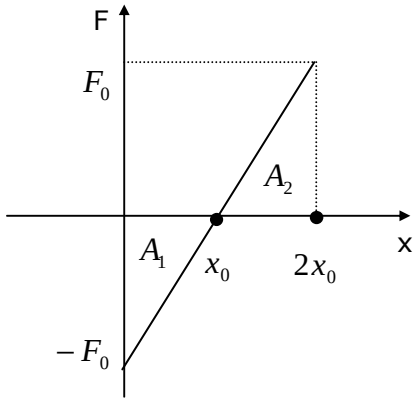


como a aceleração varia linearmente com a posição *x*, a força varia linearmente com *x*.

$\overset{n}{w} = A = \frac{8.200}{2} = 800 \Rightarrow w = 800J$

24.

$F = F_0(\frac{x}{x_0} - 1) \rightarrow$ função do 1º grau $\rightarrow$ o gráfico é um reta



a)

$p/\ x_i = 0 \Rightarrow F_i = -F_0,$

$p/\ x_f = 2x_0 \Rightarrow F_f = F_0$

$\overset{n}{w} = A_1 - A_2,\ A_1 = A_2 \Rightarrow w = 0$

b)

$$w = \int_{xi}^{xf} F d_x = \int_0^{2x_0} F_0 \left(\frac{x}{x_0} - 1 \right) dx$$

$$\Rightarrow w = F_0 \int_0^{2x_0} \left(\frac{x}{x_0} - 1 \right) dx = F_0 \left(\frac{x^2}{2x_0} - x \right) \Big|_0^{2x_0} = F_0 \left[\frac{(2x_0)^2}{2x_0} - 2x_0 \right] \Rightarrow w = 0$$

25.

$$\vec{F} = (2xN)\hat{i} + (3N)\hat{j}, \;\; \vec{r}_i(2m)\hat{i} + (3m)\hat{j}; \;\; \vec{r}_f = (-4m)\hat{i} - (3m)\hat{j}$$

$$w' = \int_{ri}^{rf} \vec{F}.d\vec{r} = \int_{xi}^{xf} F_x dx + \int_{yi}^{yf} F y dy = \int_2^{-4} 2x dx + \int_3^{-3} 3 dx$$

$$\Rightarrow w = \frac{2x^2}{2} \Big|_2^{-4} + 3x \Big|_3^{-3} = 4^2 - 2^2 + 3.(-3) - 3.3 = -6J$$

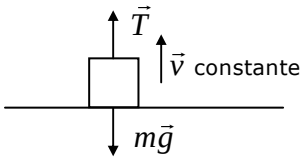
26.

$$m = 3.10^3 kg, \; h = 210m, \; \Delta t = 23s$$

$$P_m = \frac{w_T}{\Delta t}, \;\; a = 0 \Rightarrow T = mg$$

$$w_T = T.h\cos 0^o = mgh = 3.10^3.9,8.210 = 6,17.10^6 J$$

$$P_m = \frac{6,17.10^6}{23} = 2,68.10^5 w$$



27.

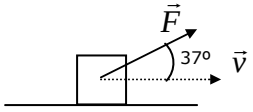
$$m = 100kg$$

$$v = 5m/s \rightarrow \text{constante}$$

F=122N

$$P = ?$$

$$P = \vec{F}.\vec{v} = F.v.\cos\theta = 122.5.\cos 37^o \Rightarrow P = 487,17w$$



28.

$$v_0 = 8m/s$$

a) $E_{ki} = \frac{1}{2} m v_0^2 \Rightarrow$ são todas iguais

b)

$E_i = E_f \Rightarrow \Delta E_k = Au,$ como Δu é a mesma em todos os casos $\Rightarrow$

$\Delta E_k \rightarrow$ será a mesma $\Rightarrow E_{k_f} \rightarrow$ é a mesma em todos os casos

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29.

a) $w_p = mgd$ em cada uma das rampas $\Rightarrow w_1 = w_2 = w_3 \rightarrow$ são todos iguais

b) $w_p = \Delta E_k \rightarrow$ em cada rampa $\rightarrow$ $\Delta Ek_1 = \Delta Ek_2 = \Delta Ek_3 \rightarrow$ são todas iguais

30.

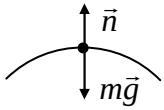
a) $h_{\max} = 3m \Rightarrow$ a crista 4

b) volta ao ponto de partida e repete o percurso

c) $R_1 = R_2 < R_3 = R_4$, $h_{\min} \Rightarrow V_{\max} \rightarrow$ na crista 1, $a = \dfrac{v^2}{R} \Rightarrow a_1$ é máxima $\Rightarrow$ crista 1

d)

$$mg - n = m\frac{v^2}{R} \Rightarrow n = mg - m\frac{v^2}{R}$$



$V_{\max} \Rightarrow n_{\min}$, crista 1

31.

$u = 25J$

$x = 7,5cm = 7,5.10^{-2}m$

$$u = \frac{1}{2}kx^2 \Rightarrow 25 = \frac{1}{2}k.(7,5.10^{-2})^2 \Rightarrow k = 8,9.10^3\ N/m$$

32.

$m = 2kg$

a) $w_g = mgh = 2.9,8.5 = 166,6J$

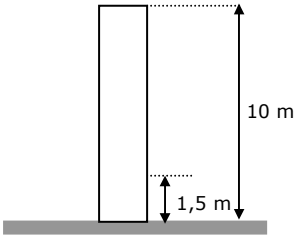
b) $\Delta u = mgh_f - mgh_i = mg(h_f - h_i) = 2.9,8(1,5 - 10) \Rightarrow \Delta u = -166,6J$

c) $u_i = mgh_i = 2.9,8.10 = 196J$

d) $u_f = mgh_f = 2.9,8.1,5 = 29,4J$

e) $w_g = mgh = 2.98.8,5 = 166,6J$

f) $\Delta u = mg(h_f - h_i) = 2.9,8(1,5 - 10) = -166,6J$



g) $\Delta u = u_f - u_i \Rightarrow -196 = 100 - u_i \Rightarrow u_i = 296J$

h) $\Delta u = u_f - u_i \Rightarrow -166,6 = u_f - 296 \Rightarrow u_f = 129,4J$

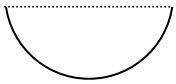
33.

$m = 2g = 2.10^{-3}kg$

$r = 22\,cm = 0,22\,m$

a) $T = mgr = 2.10^{-3}.9,8.0,22 = 4,31.10^{-3}\,J$

b) $T = -\Delta u \Rightarrow \Delta u = -4,31.10^{-3}\,J$



c) $u_f - u_i = -4,31.10^{-3} \Rightarrow u_i = 4,31.10^{-3}\,J$

d) $u_f - u_i = -4,31.10^{-3} \Rightarrow u_f = -4,31.10^{-3}\,J$

e) todos aumentariam

34.

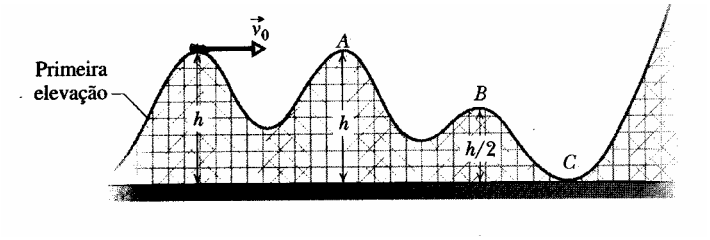
a) $h_i = h_f \Rightarrow T = 0$

b) $T = mgh/2$

c) $T = mgh$

d) $u_B = mg\dfrac{h}{2}$

e) $u_A = mgh$



f) aumentaria

35.

a) $T = mgL\cos 0^o \Rightarrow T = mgL$

b) $T = mgL\cos 180^o \Rightarrow T = -mgL$

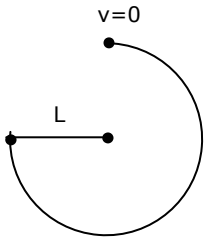
c) $h_i = h_f \Rightarrow T = 0$

d) $u = -mgL$

e) $u = mgL$

f) $h_i = h_f \Rightarrow u = 0$

h) $\Delta h \rightarrow$ é o mesmo $\rightarrow \Delta u \rightarrow$ é a mesma



36.

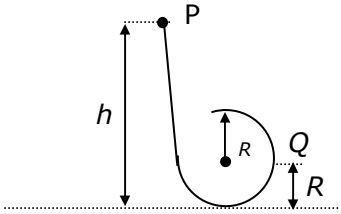
$h = 5R$

a) $T = mgd\cos 0^o = mg\,4R = 4mgR$

b) $T = mg\,3R\cos 0^o = 3mgR$

c) $u_p = mgh = mg5R = 5mgR$

d) $u_Q = mgR$



e) $u = mg2R = 2mgR$

f) $T\ e\ u$ não dependem de $v_0 \Rightarrow$ todas permanecem as mesmas

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37.

a) $E_i = E_f \Rightarrow mgh_i + \frac{1}{2}mv_i^2 = mgh_f + \frac{1}{2}mv_f^2$

$\Rightarrow gh_i = \frac{1}{2}v_f^2 \Rightarrow v_f = \sqrt{2gh_i} \Rightarrow v_f = \sqrt{2gr} = \sqrt{2.9,8.0,22} \Rightarrow V_f = 2,08 m/s$

b) v_f não depende da massa $\Rightarrow$ seria a mesma

c) $gh_i + \frac{1}{2}v_i^2 = \frac{1}{2}v_f^2 \Rightarrow v_f = \sqrt{2gh_i + v_i^2} \Rightarrow$ aumentaria

---

38.

a)

$E_i = E_f \Rightarrow mgh_i + \frac{1}{2}mv_i^2 = mgh_f + \frac{1}{2}mv_f^2 \Rightarrow gh_i = \frac{1}{2}v_f^2 \Rightarrow$

$v_f = \sqrt{2gh_i} = \sqrt{2.9,8.8,5} = 12,9 m/s$

b) a mesma (ver exercício 37)

c) aumentaria (ver exercício 37)

39.

a) $E_i = E_f \Rightarrow mgh_i + \frac{1}{2}mv_i^2 = mgh_f + \frac{1}{2}mv_f^2 \Rightarrow \frac{1}{2}v_i^2 = gL \Rightarrow v_i = \sqrt{2gL}$

b) $E_i = E_f \Rightarrow mgh_i + \frac{1}{2}mv_i^2 = mgh_f + \frac{1}{2}mv_f^2 \Rightarrow gL + \frac{1}{2}2gL = \frac{1}{2}v_f^2 \Rightarrow v_f = 2\sqrt{gL}$

c) $E_i = E_f \Rightarrow mgh_i + \frac{1}{2}mv_i^2 = mgh_f + \frac{1}{2}mv_f^2$

$h_i = h_f \Rightarrow v_i - v_f \Rightarrow v_f = \sqrt{2gL}$

d) as velocidades não dependem da massa $\longrightarrow$ todas permaneceriam as mesmas

---

40.

a) $E_i = E_A \Rightarrow mgh_i + \frac{1}{2}mv_0^2 = mgh_A + \frac{1}{2}mv_A^2$ *como* $h_i = h_A \Rightarrow v_A = v_0$

b) $E_A = E_B \Rightarrow mgh_A + \frac{1}{2}mv_A^2 = mgh_B + \frac{1}{2}mv_B^2 \Rightarrow gh + \frac{1}{2}v_0^2 = g\frac{h}{2} + \frac{1}{2}v_B^2 \Rightarrow v_B = \sqrt{gh + v_0^2}$

c) $E_A = E_C \Rightarrow mgh_A + \frac{1}{2}mv_A^2 = mgh_c + \frac{1}{2}mv_c^2 \Rightarrow gh + \frac{1}{2}v_0^2 = \frac{v_c^2}{2} \Rightarrow v_c = \sqrt{v_0^2 + 2gh}$

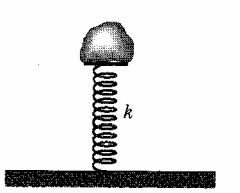
d) $E_A = E_f \Rightarrow mgh_A + \frac{1}{2}mv_A^2 = mgh_f + \frac{1}{2}mv_f^2 \Rightarrow gh + \frac{1}{2}v_0^2 = ghf \Rightarrow h_f = \frac{2gh + v_0^2}{2g}$

e) as mesmas

41.

$m = 8kg$

$\Delta_x = 10cm = 0,1m$



a) $mg = k.\Delta x \Rightarrow k = \frac{mg}{\Delta x} = \frac{8.9,8}{0,1} = 784\,N/m$

b) $u = \frac{1}{2}kx^2 = \frac{1}{2}.784.(0,4)^2 = 62,72J$

c) $v_i = v_f = 0 \Rightarrow \Delta u(\text{mola}) = \Delta u(\text{gravitacional}) \Rightarrow \Delta u_g = 62,72J$

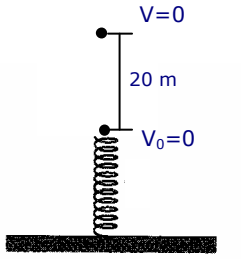
A energia potencial elástica é transformada em energia potencial gravitacional.

d) $\Delta u_g = mgh_{\max} - mgh_i \Rightarrow 62,72 = 8.9,8h_{\max} \Rightarrow h_{\max} = 0,8m$

42.

$m = 5g = 5.10^{-3}kg$

$\Delta x = 8cm = 8.10^{-2}m$



a) $\Delta u_g = mgh = 5.10^{-3}.9,8.20 = 0,98J$

b) $v_i = v_f = 0 \Rightarrow E_{ki} = E_f = 0 \Rightarrow \Delta u_g = -\Delta s \Rightarrow \Delta u_s = -0,98J$

a energia potencial elástica é transformada em energia potencial gravitacional

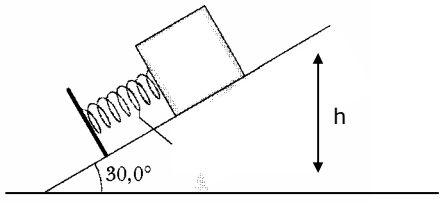
c) $u_{so} = \frac{1}{2}kx_0^2 \Rightarrow 0,98 = \frac{1}{2}k.(8.10^{-2})^2 \Rightarrow k = 306,25\,N/m$

43.

$m = 2kg$

$k = 19,6\,N/cm = 1960\,N/m$

$x_0 = 20cm = 0,2m$



a) $u = \frac{1}{2}kx_1^2 = \frac{1}{2}.1960.(0,2)^2 = 39,2J$

b) $v_i = v_f = 0 \Rightarrow \Delta u_{(mola)} = \Delta u_{(gravitacional)} \Rightarrow \Delta u_g = 39,2J$

c)

$\Delta ug = mgh \Rightarrow 39,2 = 2.9,8h \Rightarrow h = 2m$

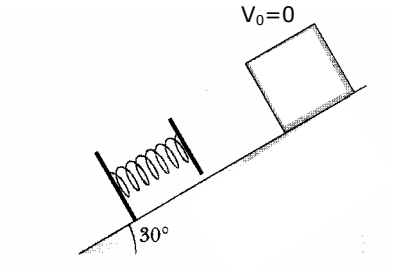
$\text{sen}\,30^o = \frac{h}{d} \Rightarrow d = \frac{h}{\text{sen}\,30^o} = \frac{2}{\text{sen}\,30^o} \Rightarrow d = 4m$

44.

$m = 12kg$

$x = 2cm = 2.10^{-2}\,m \Rightarrow F = 270N$

$F = kx \Rightarrow 270 = k.2.10^{-2} \Rightarrow k = 13500\,N/m$



a) $u_f = \frac{1}{2}kx^2 = \frac{1}{2}.13500.(5,5.10^{-2}) = 20,4J,\ v_i = v_f = 0$

$\Rightarrow$ A energia potencial gravitacional é transformada em energia potencial da mola.

$u_i = u_f \Rightarrow mgh = 20,42 \Rightarrow 12.9,8h = 20,42 \Rightarrow h = 0,174m$

$\text{sen}\,30^o = \frac{h}{d} \Rightarrow d = \frac{h}{\text{sen}\,30^o} = \frac{0,174}{\text{sen}\,30^o} \Rightarrow d = 0,347m$

b)

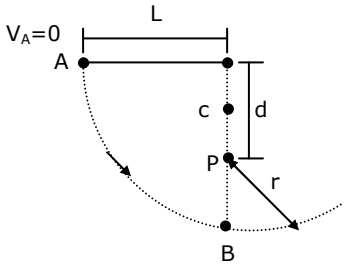
$u_i = E_f \Rightarrow mgh' = \frac{1}{2}mv_f^2 \Rightarrow v_f = \sqrt{2gh'},\ d' = 34,5 - 5,5 = 29cm$

$\text{sen}\,30^o = \frac{h'}{d'} \Rightarrow h' = 29.\text{sen}\,30^o = 14,5cm = 0,145m \Rightarrow v_f = \sqrt{2.9.8.0,145} \Rightarrow v_f = 1,68m/s$

45.

$l = 120cm = 1,2m$

$d = 75cm \Rightarrow r = 120 - 75 \Rightarrow r = 45cm = 0,45m$



a)

$v_B = ?\quad E_A = E_B \Rightarrow mgh_A + \frac{1}{2}mv_A^2 = mgh_B + \frac{1}{2}mv_B^2$

$\Rightarrow V_B = \sqrt{2gL} = \sqrt{2.9,8.1,2} \Rightarrow V_B = 4,85m/s$

b) $V_c = ?$

$E_A = E_C \Rightarrow mgh_A + \frac{1}{2}mv_A^2 = mgh_C + \frac{1}{2}mv_C^2$

$\Rightarrow gL = g2r + \frac{1}{2}v_C^2 \Rightarrow v_C = \sqrt{2gL - 4gr}$

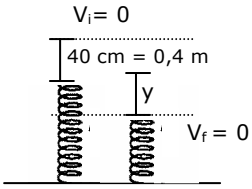
$\Rightarrow v_C = \sqrt{2.9,8.1,2 - 4,98.0,45} \Rightarrow V_C = 2,42m/s$

46.

$m = 2kg, \quad k = 1960\,N/m$

$E_i = E_f$

$\Rightarrow mgh_i + \frac{1}{2}mv_i^2 = \frac{1}{2}ky^2 + \frac{1}{2}mv_f^2$



$\Rightarrow mg(0,4+y) = \frac{1}{2}.1960.y^2 \Rightarrow 19,6y + 7,84 = 980y^2 \Rightarrow y = 0,099\,cm$

47.

a) O valor da força é igual a inclinação da reta em cada intervalo $\Rightarrow F_{AB} > F_{CD} > F_{BC} = F_{DE} = 0$

b) $E_{\max} = U_{\max} = 5J$

c) $E = 5J$

d) $E = 6J$

e) $E_{k_{\max}} \Rightarrow U_{\min} \Rightarrow FG$

f) $V_{\min} \Rightarrow E_{k_{\max}} \Rightarrow U_{\max} \Rightarrow DE$

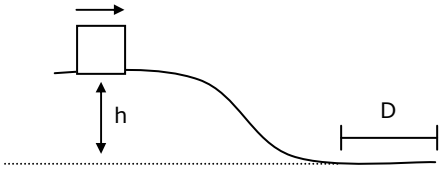
48.

$\Delta E = w_{fat}$

a) $\Rightarrow mgh_f + \frac{1}{2}mv_f^2 - (mgh_i + \frac{1}{2}mv_i^2) = -\mu_c.mgD \Rightarrow gh + \frac{1}{2}v_0^2 = \mu_c.gD$

h □ diminuir □ D □ diminui $\Rightarrow$ menor

b) D não depende da massa $\Rightarrow$ igual



49.

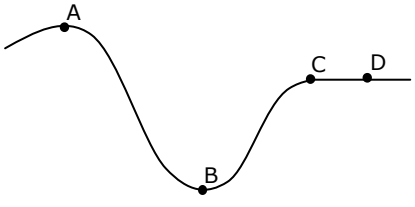
a) $E_A = E_B \rightarrow u \rightarrow$ diminui $\Rightarrow E_k \rightarrow$ aumenta

b) $E_B = E_C \rightarrow u \rightarrow$ aumenta $\Rightarrow E_k \rightarrow$ diminui

c) $u \rightarrow$ é constante e $v \rightarrow$ diminui $\rightarrow E_k \rightarrow$ diminui

d) AB e $BC \rightarrow$ é constante

$CD \rightarrow$ diminui



50.

$m = 25kg, \; v_i = 0, \; h = 12\,m, \; v_f = 5,6\,m/s$

a) $\Delta u_g = mgh_f - mgh_i = -25.9,8.12 = -2940J$

b) $E_{k_f} = \frac{1}{2}mv_f^2 = \frac{1}{2}.25.(5,6)^2 = 392J$

c)

$$\Delta E = w_{fat} \Rightarrow mgh_f + \frac{1}{2}mv_f^2 - (mgh_i + \frac{1}{2}mv_f^2) = -F_{at}.h$$
$$\Rightarrow 392 - 2940 = -F_{at}.12 \Rightarrow F_{at} = 212,33N$$

51.

$m = 30g = 3.10^{-2}kg \quad \Delta x = 12cm = 0,12m$
$v_i = 500m/s$
$v_f = 0$

a)

$\Delta E = ? \quad h_i = h_f \Rightarrow \Delta u = 0$

$$\Delta E = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 = -\frac{1}{2}.3.10^{-2}.500^2 \Rightarrow \Delta E = -3750J$$

b) $\Delta E = w_{fat} \Rightarrow -3750 = -F_{at}.0,12 \Rightarrow F_{at} = 3,12.10^4 N$

52.

$m = 2kg$
$\Delta_{x_o} = 15cm = 0,15m \qquad v_i = v_f = 0 \Rightarrow E_{k_i} = E_{k_f} = 0$
$k = 200N/m$
$d = 75cm = 0,75m$
$\mu = ?$

$$\Delta E = w_{fat} \Rightarrow E_{k_f} + u_f - (E_{k_i} + u_f) = -F_{at}.d$$
$$\Rightarrow -\frac{1}{2}k\Delta x_0^2 = -\mu_c.mg.d$$
$$\Rightarrow \frac{1}{2}.200(0,15)^2 = \mu_c.2.9,8.0,75 \Rightarrow \mu_c = 0,153$$