1) a) $V_{final} = 0$ $V_0 = 1$ $V_{final}^2 = V_0^2 + 2a.d_{max}$

$\Sigma F = m \cdot a \Rightarrow -Kd_{máx} - f_{at} = m \cdot a$

$-250.d_{máx} - 0,5.5.10 = 5.a \Rightarrow a = -50d_{max} - 5$

$V_{final}^2 = V_0^2 + 2a.d_{máx}$

$0 = 1 - 2.(50d_{max} + 5)d_{max} \Rightarrow 0 = 1 - 100d_{max}^2 - 10d_{máx}$

$100d_{max}^2 + 10d_{max} - 1 = 0$

$\Delta = 100 + 4.100.1 = 500 = 5 \cdot 100$

$d_{máx} = \frac{-10 \pm 10\sqrt{5}}{2 \cdot 100} = \frac{-1 + \sqrt{5}}{20} \Rightarrow d_{max} \cong 6,2\ cm$

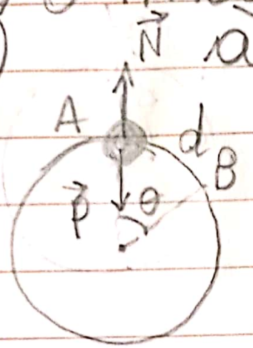
b) $E_i = \frac{mV_0^2}{2} = \frac{5.1}{2} = 2,5\ J$

$W_{atrito} = f_{at} \cdot d_{máx} = 0,5 \cdot 5.10 \cdot 0,062 = 1,55\ J$

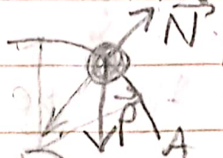
$\frac{1,55}{2,5} = 62\%$

c) O movimento inverte o sentido.

2)



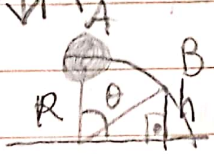
a)



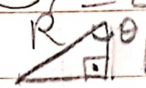
$N = P\cos\theta$

$W = mg\cos\theta\, d = mg(\cos\theta)R\theta$

b)



$E_i = E_f$



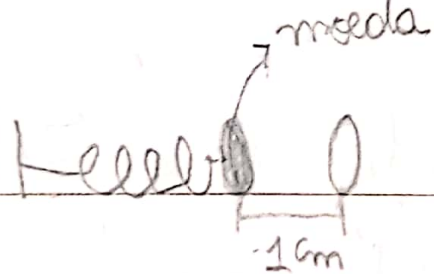
$\cos\theta = h/R \Rightarrow h = R\cos\theta$

$mgR = \frac{mV^2}{2} + mgh \Rightarrow gR = \frac{V^2}{2} + gR\cos\theta$

$V = \sqrt{2.gR(1-\cos\theta)}$

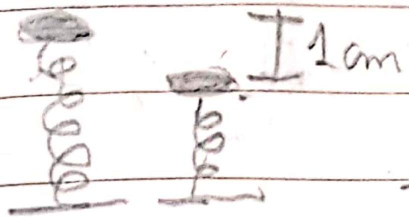
c) $W_P = mgd = mgR\theta$

$\tau_{Fel} = \frac{K \Delta x^2}{2}$

3) 

$E_i = \frac{Kx^2}{2}$ $\quad E_f = \frac{KA^2}{2}$

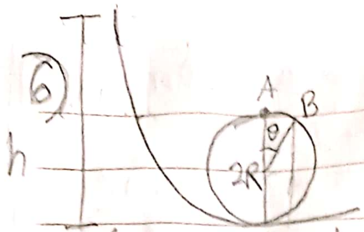
$\frac{Kx^2}{2} = \frac{KA^2}{2} \Rightarrow A = X = 1\ cm$

4) 

$E_i = E_f$

$\frac{Kx^2}{2} = mg(x+h) \Rightarrow \frac{40(0,01)^2}{2} = 0,02 \cdot 10(0,01+h)$

$\frac{0,002}{0,2} = 0,01 + h \Rightarrow h = 0,02\ m = 2\ cm$

6) 

a) $E_i = E_f$

Velocidade do carrinho em A:

$P + N = \frac{mV_A^2}{R} \Rightarrow P + 0 = \frac{mV_A^2}{R}$

$mg = \frac{mV_A^2}{R} \Rightarrow V_A^2 = gR$

$V_A = \sqrt{gR}$

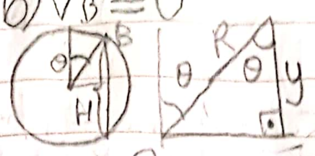
$E_{mi} = E_{mA}$

$mgh_{min} + \frac{m \cdot 0^2}{2} = mg2R + \frac{mV_A^2}{2}$

$\cancel{mg}h_{min} = \cancel{mg}2R + \frac{\cancel{mg}R}{2}$

$h_{min} = 2R + \frac{R}{2} = \frac{5R}{2}$

b) $V_B = 0$



$\cos\theta = \frac{y}{R}$

$y = R\cos\theta$

$H = R + y = R + R\cos\theta$

$H = R(1 + \cos\theta)$

$E_i = E_f$

$mgh = mgH$

$h = H$

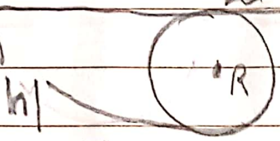
$h = R(1 + \cos\theta)$

$1 + \cos\theta = \frac{h}{R}$

$\cos\theta = \frac{h}{R} - 1$

$\theta = \cos^{-1}\left(\frac{h-R}{R}\right)$

c)



$h < R$ $\quad E_i = E_f \Rightarrow mgh = mgh$

A altura máxima atingida é igual a altura inicial

11) $W_f = E_f - E_i$

$-\mu_K \cdot \cancel{m}g \cdot d = \cancel{m}gh - \frac{\cancel{m}V_0^2}{2} \Rightarrow -\mu_K g d = gh - \frac{V_0^2}{2}$

$-0{,}60 \cdot 10d = 10 \cdot 1{,}1 - \frac{6^2}{2} \Rightarrow -6d = 11 - 18 \Rightarrow d = 7/6\ m$

8) a) $F = -\nabla U = -\frac{\partial U}{\partial x} - \frac{\partial U}{\partial y} = -6xy + 7 - 3x^2$

$F(x,y) = -3x^2 - 6xy + 7$

b) $W = \int F dx + \int F dy = \Delta K$

$\Delta K = \int(-3x^2 - 6xy + 7)dx + \int(-3x^2 - 6xy + 7)dy$

$\Delta K = \left(-\frac{3x^3}{3} - \frac{6x^2y}{2} + 7x\right) + \left(-3x^2y - \frac{6xy^2}{2} + 7y\right)$

/ /

Dá pra fazer com integral ou com $\Delta K = -\Delta U$ ✓

$\Delta K = -x^3 - 3x^2y + 7x - 3x^2y - 3xy^2 + 7y$

(0,0) e (1,1)

$\Delta K = -1 - 3 + 7 - 3 - 3 + 7 = 4\,J$

Ou $\Delta K = W = -\Delta U = -(3 \cdot 1^2 \cdot 1 - 7 \cdot 1) = -(-4) = 4\,J$

não porque a força é conservativa

9) a) Equilíbrio Estável: $x = 4\,m$

Equilíbrio Instável: $x = 8{,}6\,m$

Equilíbrio neutro: $x > 11{,}2\,m$

b) $x = 8\,m$ e $x = 9{,}5\,m$

c) $K = 0$

d) $\Delta U = -W = -\int_{x_1}^{x_2} F(x)\,dx$

$W = -\Delta U = -(2 - 0) = -2\,J$

e) 2J, 2J

questao 5:
https://www.youtube.com/watch?v=7QP5yXo_bsw

PDFs pra estudar sobre conservação de energia:

https://wp.ufpel.edu.br/mllsilva/files/2019/11/Aula_10_Conservacao_energia.pdf
https://www.fisica.ufjf.br/~sjfsato/fisica1/conservacao_cap7/Conservacao_2p.pdf