$$W = F.d\cos\theta$$

$$P = \frac{dW}{dt} = \frac{d}{dt}(Fx\cos\theta)$$

$$W = \vec{F}.\vec{d} = F\cos\theta\frac{dx}{dt}$$

$$P = \vec{F}.\vec{V} = FV\cos\theta$$

$$= \vec{F}.\vec{V}$$

#1

a)

$$2300 = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

$$= \frac{1}{2}m\left(v_2^2 - v_1^2\right)$$

$$2300 = \frac{1}{2}(1050)\left(v_2^2 - 0\right)$$

$$v_2 = \sqrt{\frac{92}{21}}$$

$$\approx 2.09 \text{ m/s}$$

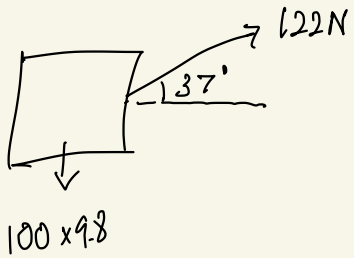
b)

$$W_d = F \times d$$

$$2300 = F \times 17.8$$

$$F \approx 129 \text{ N}$$

#2



$$P = \frac{F.d\cos\theta}{t} \qquad \text{since } \frac{d}{t} = v$$

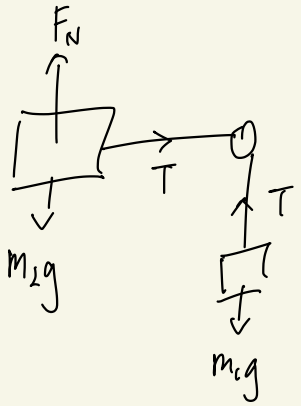
$$= F.v\cos\theta$$

$$= 122(5)\cos 37^\circ$$

$$= 487$$

$$\approx 4.9 \times 10^2 \, W$$

#3



Work-energy theorem: $\Delta K = W$

$$W_{m_1} = (m_1 g - T)\,d = \cancel{\tfrac{1}{2} M V_2^2}^{\,0} - \tfrac{1}{2} M V_1^2$$

$$\rightarrow \quad 2(6)(9.8) - 2T = -\tfrac{1}{2}(6)(0.9)^2$$

$$-2T = -120.03$$

$$T = 60.015$$

$$W_{m_2} = (T - F_k)\,d = \cancel{\tfrac{1}{2} M V_2^2}^{\,0} - \tfrac{1}{2} M V_1^2$$

$$(T - M_2 g \cdot \mu_k)\,d = -\tfrac{1}{2} M V_1^2$$

$$2\left[60.015 - (8)(9.8)\cdot \mu_k\right] = -\tfrac{1}{2}(8)(0.9)^2$$

$$\mu_k = 0.786$$

$$W^A_{F_{fr}} + W^B_{gravity} = 0 - \tfrac{1}{2}(m_A + m_B) V_i^2$$

$$-F_{fr}\,\Delta y + m_B g \Delta y = -\mu_k m_A g \Delta y + m_B g \Delta y$$

#4 a)

$= -\frac{1}{2}(m_A + m_B)v_i^2$

$\frac{1}{2}m(V_2 - V_1)^2 = \frac{1}{2}(5)(0-6)^2$

$= 90$

$90 = \frac{1}{2}k(x_1^2 - x_2^2)$

$\frac{1}{2}(500)(0 - x_2^2) = 90$

$-x_2^2 = 0.36$

$-x_2 = 0.6$

$\therefore$ max. dist. spring is compressed : 0.6m

b)

$\frac{1}{2}(500)(0.15^2) = \frac{1}{2}(5)V^2$

$V = 1.5\ m/s$

4 a) By CE

$$TE_{initial} = TE_{final}$$

$$KE_{final} + P.E_{final} = KE_{initial} + P.E_{initial}$$

$$0 + \frac{1}{2}kx^2 = \frac{1}{2}mv_1^2 + 0$$

$$\Rightarrow x = \sqrt{\frac{mv_1^2}{k}} = 0.6\ m$$

b) $$v_1 = \sqrt{\frac{kx^2}{m}} = 1.5\ m/s$$

Extra exercise

#1

a) $\Delta K = KE_{final} - KE_{initial}$

$= 0 - \frac{1}{2}(0.2)(20)^2$

$= -40\,J$

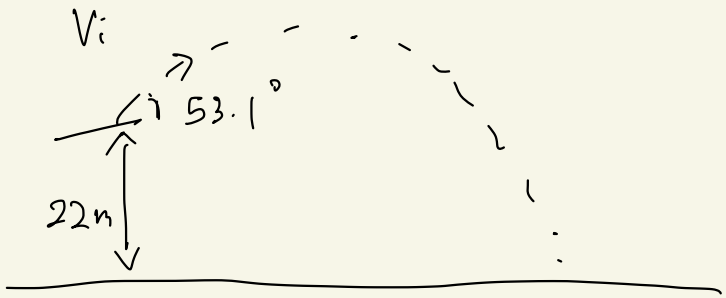
b) $W_{gravity} = -mgh$

$= -35\,J$

negative because displacement opposite to force of gravity

#2

a)



By CE $T.E_1 = T.E_2$

$$KE_i + P.E_i = KE_f + PE_f$$

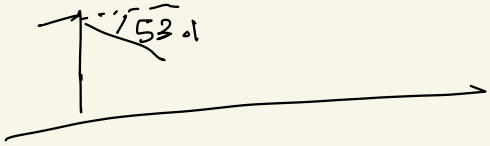
$$\frac{1}{2}mv_i^2 + mgh = \frac{1}{2}mv_f^2 + 0$$

$$v_i^2 + 2gh = v_f^2$$

$$v = \sqrt{12^2 + (2 \times 9.8 \times 22)}$$

$$= 24.0 \text{ m/s}$$

b)



$$v = 14.0 \text{ m/s}$$

c) part b.