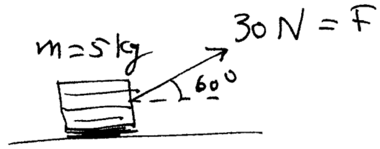
Ch. 6

Homework Solutions

1

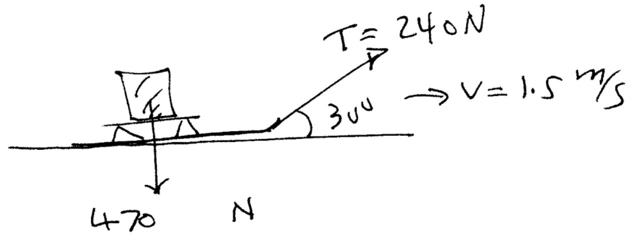


$W = F \Delta r \cos\theta$

$= (30)(5)(\cos 60^\circ) = \boxed{75\ J}$

There is no mention of friction. Thus, mass does not enter into the calculations.

2



since V = constant ⟹ $a = 0$

$\Delta x = V_i \Delta t + \cancel{\frac{1}{2} a_x \Delta t^2}$ (0)

$\Delta x = (1.5)(10) = 15\ m$

$W_{\text{by tension}} = (T)(\Delta x)\cos\theta = (240)(15)\cos 30^\circ$

$\boxed{= 3118\ J}$

(11) $m = 5\ kg \qquad v_f = 2.5\ m/s \qquad v_i = 0$

$W_{\text{on the briefcase}} = ?$

Using Work - energy Theorem:

$$W_{net} = \Delta K$$

$$W = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

$$= \left(\frac{1}{2}\right)(5)(2.5)^2 = \boxed{15.6\ J}$$

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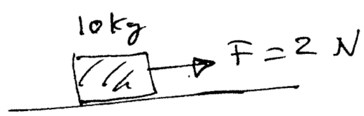
(13)



$V_i = 0$

$\Delta x = 0.35\ m$

$K_f = ?$

Using $W_{net} = \Delta K$

a) $(F \Delta x \cos\theta) = \Delta K \Rightarrow K_f - \cancel{K_i}^{\,0}$

$(2)(0.35)(\cos 0^\circ) =$

$$\boxed{K_f = 0.70\ J}$$

b) $K_f = \frac{1}{2} m v_f^2 \rightarrow v_f = \sqrt{\frac{2K_f}{m}} = \sqrt{\frac{2(0.7)}{10}}$

$$\boxed{v_f = 0.37\ m/s}$$

(18) Weight $= 220 \times 10^3$ N

$V_i = 67$ m/s

$V_f = 0$

$\Delta x = 0.84$ m

a) Work $= W = F \Delta x \cos\theta$

but we don't have F or $\cos\theta$. Thus

we use work - energy theorem:

$$W = \Delta K$$

$$W = \cancel{K_f}_{0} - K_i = -\underbrace{K_i}_{\frac{1}{2} m V_i^2} = -\left(\frac{1}{2}\right)\left(\frac{220 \times 10^3}{9.8}\right)(67)^2$$

$$\boxed{W = -5 \times 10^7 \text{ J}}$$

b) $W = F \Delta x \underbrace{\cancel{\cos\theta}}_{1}$

$$5 \times 10^7 = F\,(84) \Rightarrow \boxed{F = 6 \times 10^5 \text{ N}}$$

(21) $F = 340\,N$ $\Delta x = 5\,m$

a) $\Delta U = 0$ The position (height) with respect to the ground has not changed.

b) $W = (340)(5) + (340)(5)$

$= 3400\,J$

c) The work is done against work done by the force of friction. The energy is dissipated as heat.

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(26)

a) at Point 1 : $U_i + K_i = 0 + \frac{1}{2} m (20)^2 = 200\,m$

at Point 3 : $U_f + K_f = mg\Delta y + \frac{1}{2} m V_f^2$

$= m(9.8)(10) + \frac{1}{2} m V_f^2$

but $U_i + K_i = U_f + K_f$

$200 \cancel{m} = 98\cancel{m} + \frac{1}{2} \cancel{m} V_f^2$

$102 = \frac{1}{2} V_f^2 \rightarrow \boxed{V_f = 14.3\ m/s}$

b) At 4 : $U = mg(20) = 196\,m$

This is less than initial energy $200\,m$. so the answer is YES.

(31) $m = 750$ kg

$\begin{cases} V_i = 20 \text{ m/s} \\ y_i = 5 \text{ m} \end{cases}$

$\begin{cases} y_f = ? \\ v_f = 0 \end{cases}$

$$U_i + K_i = U_f + K_f$$

$$\cancel{m}g y_i + \frac{1}{2}\cancel{m}v_i^2 = 0 + \cancel{m}g y_f$$

$$(9.8)(5) + \frac{1}{2}(20)^2 = (9.8)\, y_f$$

$$\boxed{y_f = \cancel{20} \; 25.4 \text{ m}}$$

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(55) Using Conservation of energy:

$$E_i = E_f$$

$$\text{elastic PE} = \text{Gravitational PE}$$

$$\text{elastic PE} = mgh$$

Since it is using one leg, there is half of the total elastic PE available. From 6.12, this gives half height of 0.7 m or <u>0.35</u> m.

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$m = 51$ grams
$k = 320$ N/m
$\Delta x = 0.2$ m

$E_{elastic} = E_{gravity}$

$\downarrow$

$\frac{1}{2} k \Delta x^2 = mg\,\Delta y$

$\left(\frac{1}{2}\right)(320)(0.2)^2 = (0.051)(9.8)\,\Delta y$

$$\boxed{\Delta y = 13 \text{ m}}$$

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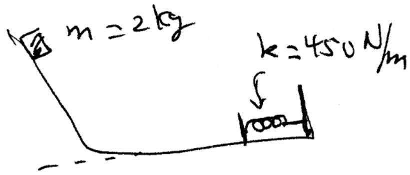

a) $K_i + U_i = K_f + U_f$

$\downarrow$

$0 + \cancel{m} g y_i = \frac{1}{2} \cancel{m} v_f^2 + \cancel{m} g y_f$

$\frac{1}{2} v_f^2 = 9.8(0.5 - 0.25) \Rightarrow \boxed{v_f = 2.2 \text{ m/s}}$

b) $\cancel{K_i} + U_i = K_f + U_f$

$\overset{0}{m g y_i} = 0 + \frac{1}{2} k \Delta x^2 \Rightarrow (2)(9.8)(0.5) = \frac{1}{2}(450)\Delta x^2$

$\Rightarrow \Delta x = 0.21$ m $=$ 21 cm

c) It returns to the same height $= 0.5$ m based on the conservation of energy.