COOPERATIVE GROUP REVIEW - SOLUTIONS

1. a) GIVEN:

$m = 150\ kg$

$h_i = 10\ m$

$h_f = 0$

$v_i = 0$

$v_f = ?$

$v_i = 0$, $h_f = 0$

$$E_i = E_f$$

$$E_{k_i} + E_{p_i} = E_{k_f} + E_{p_f}$$

$$mgh_i = \frac{1}{2}mv_f^2$$

$$v_f^2 = 2gh_i$$

$$v_f = \sqrt{2gh_i}$$

$$= \sqrt{2(9.8)(10)}$$

$$= 14\ \frac{m}{s}$$

b) GIVEN:

$m = 150\ kg$

$h_i = 10\ m$

$h_f = 8\ m$

$v_i = 0$

$v_f = ?$

$v_i = 0$

$$E_i = E_f$$

$$E_{k_i} + E_{p_i} = E_{k_f} + E_{p_f}$$

$$mgh_i = \frac{1}{2}mv_f^2 + mgh_f$$

$$v_f^2 = 2(gh_i - gh_f)$$

$$v_f = \sqrt{2g(h_i - h_f)}$$

$$= \sqrt{2(9.8)(10-8)}$$

$$= 6.3\ \frac{m}{s}$$

c) NO CHANGE (ASSUMING NO FRICTION)

2. a) 20 m (SAME HEIGHT)

b) GIVEN:

$m = 70\ kg$

$h_i = 20\ m$

$h_f = 18\ m$

$v_i = 0$

$v_f = 0$

$Q = ?$

$E_i = E_f + Q$

($v_i = 0$, $v_f = 0$)

$E_{k_i} + E_{p_i} = E_{k_f} + E_{p_f} + Q$

$mgh_i = mgh_f + Q$

$Q = mgh_i - mgh_f$

$= mg(h_i - h_f)$

$= (70)(9.8)(20-18)$

$= 1372$

$\rightarrow 1400\ J$

3. GIVEN:

$h_i = 6\ m$

$h_f = 8\ m$

$v_i = ?$

$v_f = 0$

$E_i = E_f$

($v_f = 0$)

$E_{k_i} + E_{p_i} = E_{k_f} + E_{p_f}$

$\frac{1}{2}mv_i^2 + mgh_i = mgh_f$

$v_i^2 = 2(gh_f - gh_i)$

$v_i = \sqrt{2g(h_f - h_i)}$

$= \sqrt{2(9.8)(8-6)}$

$= 6.3\ \frac{m}{s}$

4. GIVEN:

$m = 8.0\ kg$

$h_i = 0$

$h_f = 0$

$v_i = ?$

$v_f = 4.0\ \frac{m}{s}$

$Q = 36\ J$

$E_i = E_f + Q$

$E_{k_i} + E_{p_i} = E_{k_f} + E_{p_f} + Q$ ($h_i = 0$, $h_f = 0$)

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

$v_i^2 = \frac{2}{m}\left(\frac{1}{2}mv_f^2 + Q\right)$

$v_i = \sqrt{v_f^2 + \frac{2Q}{m}}$

$= \sqrt{(4.0)^2 + \frac{2(36)}{8.0}}$

$= 5.0\ \frac{m}{s}$

5. a) GIVEN:

$m = 60\ kg$

$h_i = 10\ m$

$h_f = 8\ m$

$v_i = 0$

$v_f = 0$

$W = ?$

$W = \Delta E$

$= \Delta E_p + \Delta E_k$ ($\Delta E_k = 0$)

$= E_{p_f} - E_{p_i}$

$= mgh_f - mgh_i$

$= mg(h_f - h_i)$

$= (60)(9.8)(10 - 8)$

$= 1176\ J$

b) HEAT, SOUND

6. a) ALONG THE RAMP

i: TOP OF RAMP ; f: BASE OF RAMP

GIVEN:

$m = 6\ kg$

$h_i = 10\ m$

$h_f = 0$

$v_i = 0$

$v_f = ?$

$E_i = E_f$

$E_{K_i} + E_{P_i} = E_{K_f} + E_{P_f}$ ($v_i = 0$, $h_f = 0$)

$mgh_i = \frac{1}{2}mv_f^2$

$v_f^2 = 2gh_i$

$v_f = \sqrt{2gh_i}$

$= \sqrt{2(9.8)(10)}$

$= 14\ \frac{m}{s}$

b) ALONG THE HORIZONTAL SURFACE

i: BASE OF RAMP ; f: AFTER 3m

GIVEN:

$m = 6\ kg$

$v_i = 14\ \frac{m}{s}$

$v_f = ?$

$h_i = 0$

$h_f = 0$

$\mu = 0.2$

$d = 3\ m$

$E_i = E_f + Q$

$E_{K_i} + E_{P_i} = E_{K_f} + E_{P_f} + F_f \cdot d$ ($h_i = 0$, $h_f = 0$)

$\frac{1}{2}mv_i^2 = \frac{1}{2}mv_f^2 + \mu F_N d$

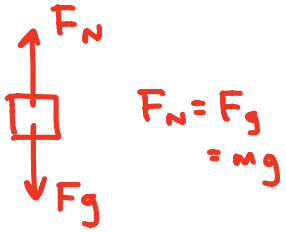
$\frac{1}{2}mv_i^2 = \frac{1}{2}mv_f^2 + \mu mgd$

$v_f^2 = v_i^2 - 2\mu gd$

$v_f = \sqrt{v_i^2 - 2\mu gd}$

$= \sqrt{(14)^2 - 2(0.2)(9.8)(3)}$

$= 13.6\ \frac{m}{s}$



$F_N = F_g$

$= mg$

c) ALONG THE HORIZONTAL SURFACE

i : BASE OF RAMP ; f : WHEN IT STOPS

GIVEN:

$m = 6\ kg$

$v_i = 14\ \frac{m}{s}$

$v_f = 0$

$h_i = 0$

$h_f = 0$

$\mu = 0.2$

$d = ?$

$$E_i = E_f + Q$$

$$E_{k_i} + E_{p_i} = E_{k_f} + E_{p_f} + F_f \cdot d$$

(E_{p_i}: $h_i = 0$; E_{k_f}: $v_f = 0$; E_{p_f}: $h_f = 0$)

$$\frac{1}{2} m v_i^2 = \mu F_N d$$

$$\frac{1}{2} m v_i^2 = \mu m g d$$

$$d = \frac{v_i^2}{2\mu g}$$

$$= \frac{(14)^2}{2(0.2)(9.8)}$$

$$= 50\ m$$