Quiz 6

Friday, October 30, 2015 9:45 AM

(1) $\Delta U_g = mg(y_2 - y_1) = mg\Delta y$

$\Rightarrow \Delta y = \frac{\Delta U_g}{mg} = \frac{500}{2 \cdot (9.8)} = 26\,m$

$\Rightarrow$ height $= 26 + 20 = 46\,m$

(2) $U_1 + K_1 = U_2 + K_2$

$U_1 = U(1) = 10\,J$

$K_1 = \frac{1}{2}mv^2 = \frac{1}{2}(0.2)25 = 2.5\,J$

$U_2 = U(6) = 0$

$\Rightarrow K_2 = U_1 + K_1 = 12.5$

$\Rightarrow v_2 = \sqrt{\frac{2(12.5)}{0.2}} = 11\,m/s$

(3) $U_1 + K_1 = U_2 + K_2$

$mgy_1 + K_1 = mgy_2 + 0$

$\Rightarrow K_1 = mg(y_2 - y_1) = mgh$

(4) $U_1 + K_1 = U_2 + K_2$

$mgy_1 + 0 = mgy_2 + \frac{1}{2}mv_2^2$

$\Rightarrow v_2 = \sqrt{2g(y_1 - y_2)}$

$= \sqrt{2(9.8)\,1.85} = 6\ m/s$

(5) $U_1 + K_1 = U_2 + K_2$

$\frac{1}{2}kx^2 + 0 = 0 + K_2$

$\Rightarrow K_2 = \frac{1}{2}(20)(0.07)^2 = 4.9 \times 10^{-2}\ J$

(6) $U_1 + K_1 + W_{other} = U_2 + K_2$

$mgy_1 + 0 - F_{fs} = mgy_2 + K_2$

$\Rightarrow \Delta E = -F_{fs} = -\mu_k N s$

$= -\mu_k (mg\cos\theta)\, s$

$= -0.25(2.2)(9.8)\cos 25)2 = -9.8\ J$

(7) $U_1 + K_1 = U_2 + K_2$

$\frac{1}{2}kx_1^2 + 0 = \frac{1}{2}kx_2^2 + \frac{1}{2}mv_2^2$

$\Rightarrow v_2 = \sqrt{\frac{k(x_1^2 - x_2^2)}{m}}$

$$\Rightarrow v_2 = \sqrt{\frac{k(x_1 - x_2)}{m}}$$

$$= \sqrt{\frac{10\left((0.05)^2 - (0.01)^2\right)}{0.006}}$$

$$= 2\ \frac{m}{s}$$

(8) $U_1 + K_1 = U_2 + K_2$ $\quad 1 = \text{bottom}$, $2 = \text{top}$

At top $\quad F_c = mg$

$$\Rightarrow \frac{mv_2^2}{R} = mg \Rightarrow v_2^2 = gR$$

$$mgy_1 + \tfrac{1}{2}mv_1^2 = mgy_2 + \tfrac{1}{2}mv_2^2$$

$$\Rightarrow v_1 = \sqrt{2g(y_2 - y_1) + v_2^2}$$

$$= \sqrt{2g(2R) + gR} = \sqrt{5gR}$$