Solutions (Chp 5) HW5

Solutions by Tommy Willis 10/1/03

Conceptual questions:

2 : Is work being done?

a) chicken scratching ground

No work, the chicken and ground are not displaced, unless stones or gravel are moved in scratching. Then WORK is done.

b) A person studying.

No work, nothing moves

c) crane lifting bucket.

Yes, the work is the Force exerted by the crane times the buckets displacement.

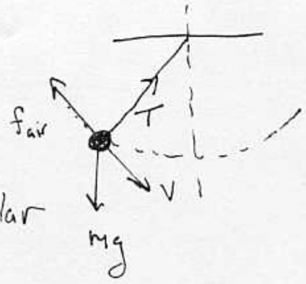
d). Gravity in part C

Yes $W_g = -mg \cdot \Delta x$

e) Legs while in the act of sitting down.

Yes, the legs apply a force and the body undergoes displacement.

7. a)



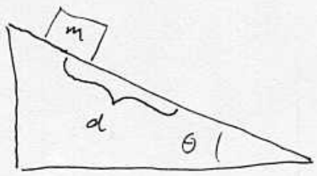
Tension does no work because it's always perpendicular to the displacement.

b) f_{air} always does negative work because it is always oposite to the displacement

c) If the pendulum is swinging down the work is positive. If it's swinging up the work is negative.

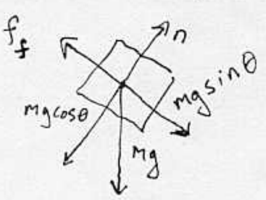
Problems

#5



$m = 5.00\,kg \quad \theta = 30.0^\circ$

$d = 2.50\,m \quad \mu_k = .436$



a) $W_g = d\,mg\sin\theta$

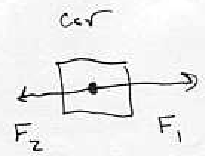
$= 61.3\,J$

b) $W_f = -\mu_k \cdot n \cdot d = -\mu_k\, mg\cos\theta \cdot d$

$= 46.3\,J$

c) $W_n = 0$ because it's perpendicular to the displacement.

(17.)



$F_1 = 1{,}000\,N \qquad d = 20\,m$

$F_2 = -950\,N \qquad m = 2{,}000\,kg$

$$\Delta KE = \Sigma W$$

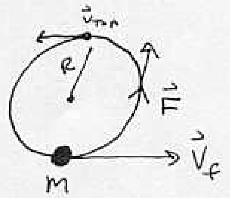
$$= F_1 \cdot d + F_2 \cdot d = (F_1 + F_2)\cdot d = (1{,}000 - 950)N\,(20m)$$

$$\Delta KE = 50N \cdot 20m = 1{,}000\,J$$

$$\tfrac{1}{2} m v_f^2 = 1{,}000\,J$$

$$v_f = \sqrt{\frac{2(1{,}000J)}{m}} = \sqrt{\frac{2(1{,}000)J}{2000\,kg}} = 1.0\,m/s$$

(24.)



$M = .250\,kg \qquad R = .600\,m$

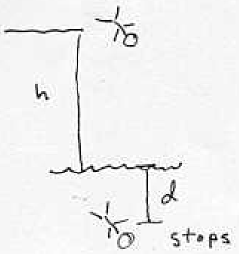
$V_{top} = 15.0\,\frac{m}{s} \qquad |\vec{F}| = 30.0\,N$

use $\quad \Sigma W = \Delta KE = \pi R \cdot |\vec{F}| = KE_f - KE_i = \tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_i^2$

So $\quad \tfrac{1}{2}mv_f^2 = \tfrac{1}{2}mv_i^2 + \pi R|\vec{F}|$

or $\quad v_f = \left(v_i^2 + \frac{2\pi R}{m}|\vec{F}|\right)^{\frac{1}{2}} = 26.0\,m/s$

(39.)



Do problem in 2 parts. 1st find his KE when he hits the water.

$$\Delta KE = \Sigma W = mgh = KE_f - \cancel{KE_i}^{\,0}$$

so $KE_f = mgh$ when he hits water.

Note that this is equivilent to conservation of Energy. $\quad E_f = E_i$

$$KE_f = mgh$$

↓

HW 5 Solutions

(35) cont

Now do second part. Let KE_i for part 2 be KE_f from part 1. We need to find F_R.

So $KE_i = mgh$

$\Delta KE = \Sigma W$

$-mgh = mgd - F_R \cdot d$

$\frac{mg(h+d)}{d} = F_R \underset{\substack{\uparrow \\ \text{using} \\ \text{book numbers}}}{=} 2100\ N$

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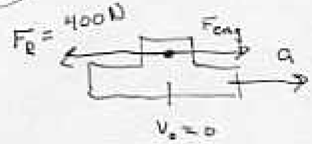
(53)

$\Delta t = 12.0 s$ $m = 1.5 \times 10^3 kg$



Find F_{eng} by $F_{eng} - F_R = ma$

use $a = \frac{v_f - v_i}{t} = \frac{3}{2}\ m/s^2$

So $F_{eng} = ma + F_R = 2.65 \times 10^3 N$

$\bar{P} = F_{eng} \bar{v} = 2.65 \times 10^3 N\ (9.00\ m/s) = 2.39 \times 10^4\ W$

At $t = 12.00 s$

$P = F_{eng} v_f = 2.65 \times 10^3 N \cdot 18.0 \frac{m}{s} = 4.8 \times 10^4\ W$

HW 5 Solutions

(55.) a) W is just the area under the curve

So from 0m to 8 m it's just 24 J

b) from 8 to 10 it's just -3 J

c) From 0 to 10 its (24 - 3) J = 21 J