Reading 7.1 - 7.3

H.W #7 available

chapter 6 and chapter 7

Extra chapter 6 practice
Questions on class web page

* Answers not guaranteed *
(Publishers sometimes make
mistakes)

Power

Rate at which energy is transferred

Energy transfer is done by external work

Power: rate that work is done

$$\underline{P = W/t}$$

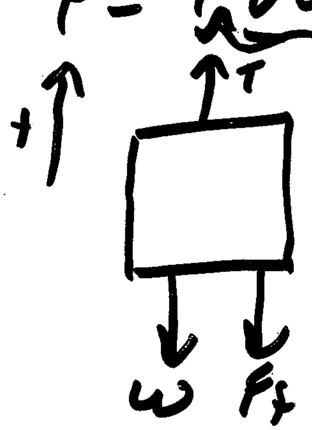
unit J/s = watt (W)

$$P = \frac{W}{t} = \frac{F d \cos\theta}{t} = \underline{F v \cos\theta}$$

$$\frac{d}{t} = v$$

ex) A 1000 kg elevator carries a 800 kg load. A frictional force of 4000 N retards its motion. What minimum power must motor deliver to lift elevator at a constant rate of 3.0 m/s?

$P = F v \cos\theta$



$T - mg - F_f = 0$

$T = mg + F_f$

$T = (1800\,kg)(9.8\,m/s^2) + 4000\,N$

$T = 2.16 \times 10^4\,N$

$\theta = 0°$

$P = F v \cos 0° = (2.16 \times 10^4\,N)(3.0\,m/s)$

$= 6.48 \times 10^4\,W$

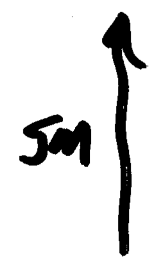
Interactive Question

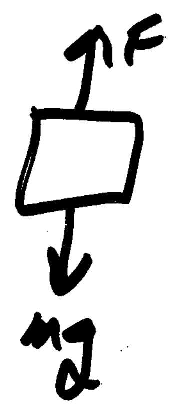
A 50 kg woman runs up a flight of stairs in 5 s. Her net upward displacement is 5 m. What power did the woman exert while she was running?

A) 250 W
B) 750 W
C) 0.5 kW
D) 1.0 kW
E) 5 kW

$P = W/t$

$W = Fd\cos\theta$

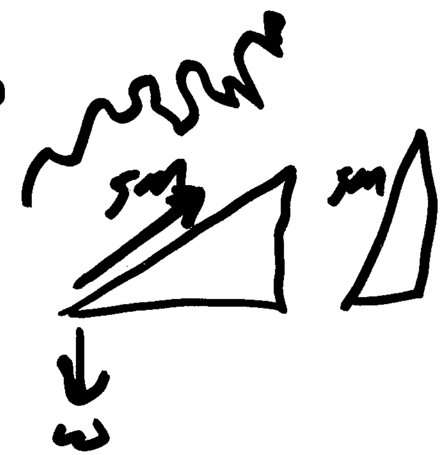




$F - mg = 0$

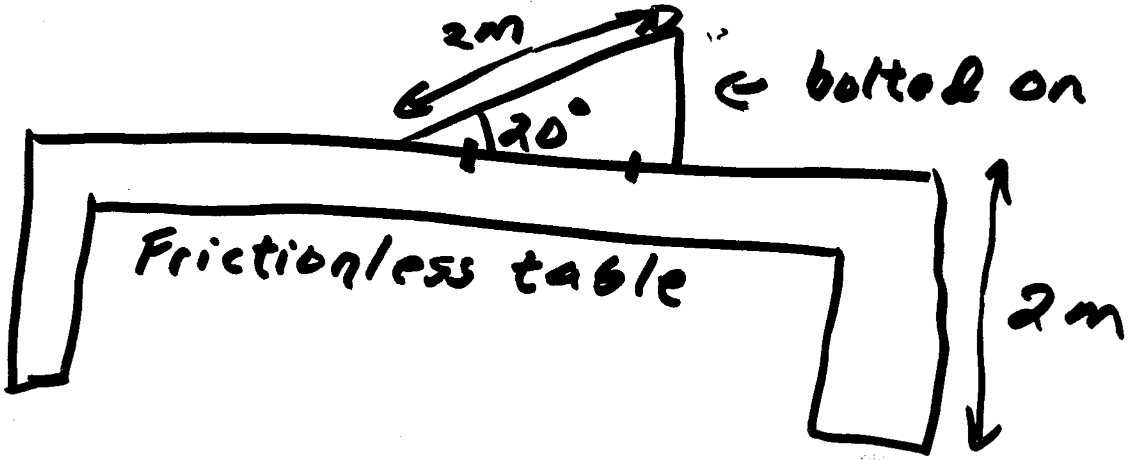
$F = mg$

$d = 5m$



$P = \frac{W}{t} = \frac{(50kg)(9.8 m/s^2)(5m)}{5s} = 500W$

(C)



A box of 20 kg slides down a ramp where a frictional force of 50N opposes its motion

a) what is velocity of box at bottom of ramp

b) what is velocity of box at bottom of table

c) How far from table does box fall

d) It hits a spring with k = 5000 N/m how far does it compress?

a) Conservation of Energy

$U_i = mgh$ $\qquad h = l\sin\theta = 2m \cdot \sin 20^\circ$

$= .68m$

$U_i = (20kg)(9.8m/s^2)(.68m) = \boxed{133J}$

$W_{net} = \Delta K = Fl\cos\theta = (50N)(2m)\cos 180^\circ$

$= \underline{-100J}$

$133J - 100J = \underline{33J = \frac{1}{2}mv^2} \Rightarrow \boxed{V = 1.82m/s}$

$E_i = E_f$

b) $E_i = \frac{1}{2}mv_i^2 + U_i^{\nearrow 0}$

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

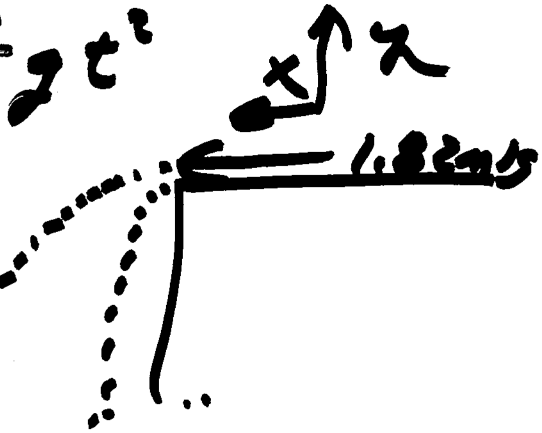
$\underline{\frac{1}{2}mv_i^2} = \frac{1}{2}mv_f^2 + mgh$

$v_f^2 = v_i^2 - 2gh$

$v_f^2 = (1.82\,m/s)^2 - 2\cdot(9.8\,m/s^2)(-2m)$

$= \boxed{6.52\,m/s}$

c) $y = y_0 + v_{oy}t - \frac{1}{2}gt^2$



[redacted]

$-2m = 0 + 0 - \frac{1}{2}gt^2$

$t = \sqrt{\frac{2 \cdot 2m}{g}}$ $\quad$ $t = .64s$

$d = v_x t = (1.82\ m/s)(.64s) = \boxed{1.16\ m}$

d) $E_i = \frac{1}{2}mv^2 - mgh$

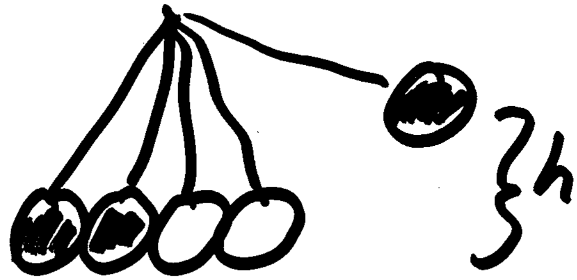
$E_f = \frac{1}{2}kx^2 - mgh$

$E_i = E_f$

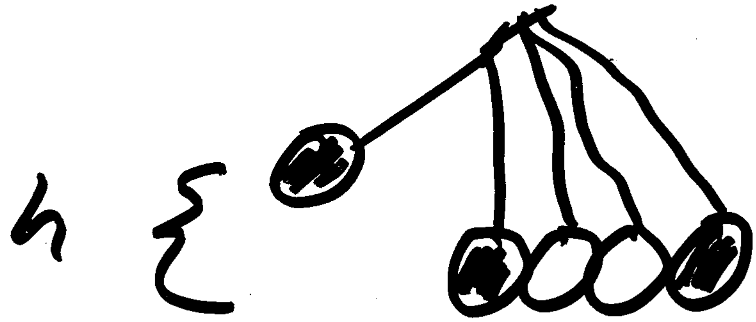
$\frac{1}{2}mv^2 - \cancel{mgh} = \frac{1}{2}kx^2 - \cancel{mgh}$

$\Rightarrow \frac{1}{2}(20kg)(6.52\ m/s)^2 = \frac{1}{2}(5000\ N/m)x^2$

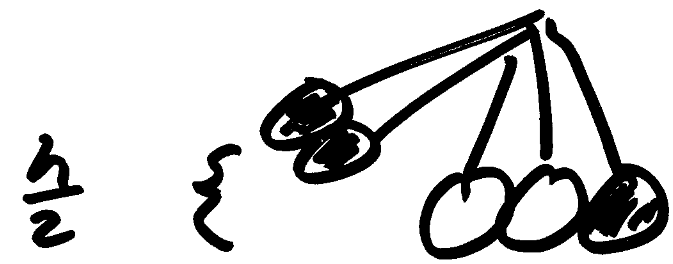
$\boxed{x = .41m}$



$E_i = mgh$



$E_f = mgh$



$E_f = 2mg\frac{h}{2}$

$= mgh$

Conservation of Energy allows 2 balls to rise $\frac{h}{2}$, but this does not happen.

Another conservation

<u>LAW</u>