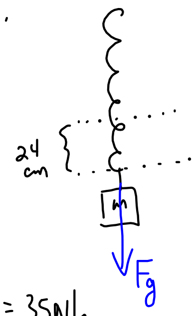
PP|261

38.



$k = 35 N/m$

$$E_e = \frac{1}{2}kx^2$$

$$E_e = \frac{1}{2}(35\frac{N}{m})(0.24\,m)^2$$

$$\boxed{E_e = 1.0\,J}$$

What is the mass attached to the end of the spring?

$$F_a = kx$$

$$F_g = kx$$

$$mg = kx$$

$$m = \frac{kx}{g}$$

$$m = \frac{(35\frac{N}{m})(0.24m)}{9.81m/s^2}$$

$$\boxed{m = 0.86kg}$$

40.

compressed

$F_a = -18N$

$x = -15cm$

$\Delta E_e = ?$

Use Hooke's Law first to find k:

$$F_a = kx$$

$$-18N = k(-0.15m)$$

$$k = \frac{-18N}{-0.15m}$$

$$\boxed{k = 1.2 \times 10^2 \frac{N}{m}}$$

$$\Delta E_e = E_{e_2} - \overset{0}{\cancel{E_{e_1}}}$$

$$\Delta E_e = \frac{1}{2}kx^2$$

$$\Delta E_e = \frac{1}{2}(1.2 \times 10^2 \frac{N}{m})(-0.15m)^2$$

$$\boxed{\Delta E_e \doteq 1.4\,J}$$

§6-4 Power + Efficiency

Power

The rate at which work is done

$$P = \frac{W}{\Delta t}$$

where P is the power ($\frac{J}{s}$ or Watt)
W is the work (J)
Δt is the time to do the work (s)

MP|263

$W = 1.50 \times 10^5 J$
$\Delta t = 10.0 s$
$P = ??$

$$P = \frac{W}{\Delta t}$$

← symbol for Work

$$P = \frac{1.50 \times 10^5 J}{10.0 s}$$

the unit Watt.

$$\boxed{P = 1.50 \times 10^4 W}$$

MP|264

$m = 60.0 kg$
$\Delta d = 4.00 \times 10^2 m$
$\Delta t = 1.00 m$
a) $W = ?$
b) $P = ?$

a) $W = F_{\parallel} \Delta d$ or $W = \Delta E_g$

$W = F_g \Delta d$

$W = mg\Delta d$

$W = (60.0 kg)(9.81 m/s^2)(4.00 \times 10^2 m)$

$$\boxed{W = 2.35 \times 10^5 J}$$

b) $P = \frac{W}{\Delta t}$

$P = \frac{2.35 \times 10^5 J}{60.0 s}$

$$\boxed{P = 3.92 \times 10^3 W}$$

NS Power

$P \cdot \Delta t = \text{Work}$

Billed for kW · h

$1 kW \cdot h = 1000 \frac{J}{\cancel{s}} \cdot 3600 \cancel{s}$

$1 kW \cdot h = 3.6 \times 10^6 J$

So you are really billed for the amount of energy you have used NOT power.

Efficiency

The ratio of useful energy to the input energy:

$$\text{Efficiency} = \frac{E_O}{E_I} \times 100\%$$

Where E_O is the output energy
E_I is the input energy

MP|269

$E_I = 3.50 \times 10^3\,J$

$$\left.\begin{array}{l} m = 0.500\,kg \\ h = 1.00 \times 10^2\,m \end{array}\right\} E_g \text{ (useful/output)}$$

$E_g = mgh$

$E_g = (0.500\,kg)(9.81\,m/s^2)(1.00 \times 10^2\,m)$

$\boxed{E_g = 4.90 \times 10^2\,J}$

Efficiency = ?

$$\text{Efficiency} = \frac{E_O}{E_I} \times 100\%$$

$$\text{Efficiency} = \frac{4.90 \times 10^2\,J}{3.50 \times 10^3\,J} \times 100\%$$

$$\boxed{\text{Efficiency} = 14.0\%}$$

Only 14.0% of the Chemical potential energy was useful. The rest of the energy → thermal
light
sound
air resistance

<u>TO DO</u> PP|266 (Power)

PP|270-271 (Efficiency)