Elastic Potential Energy

restoring force → $(F = -kx)$

Hooke's Law: $F_a = kx$

Elastic Potential Energy: $E_e = \frac{1}{2}kx^2$

Work Energy Theorem: $W = \Delta E_e$

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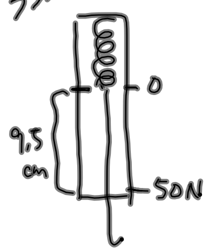
35.



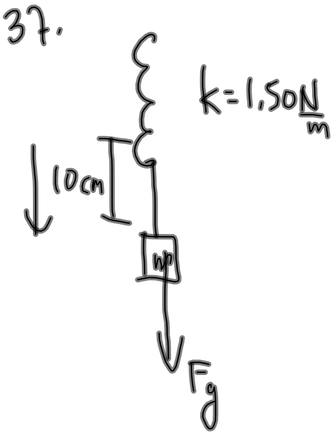
$F_a = kx$

$k = \frac{F_a}{x}$

$k = \frac{50N}{0.095m}$

$k \doteq 5.2 \times 10^2 N/m$

37.



$F_a = kx$

$F_a = (1.50\frac{N}{m})(0.10m)$

$F_a = 0.15N$

$F_g = mg$

$0.15N = m(9.81m/s^2)$

$m = \frac{0.15N}{9.81m/s^2}$

$m = 0.015kg$

Quiz (§6-1, 6-2, 6-3)

- Work: $W = F_{\parallel}\Delta d$

  $W = F\Delta d\cos\theta$

  W = area under a F-d graph

  $W = \Delta E$ (Work Energy Theorem)

- Kinetic Energy: $E_K = \frac{1}{2}mv^2$
- Gravitational Potential Energy: $E_g = mgh$
- Elastic Potential Energy: $E_e = \frac{1}{2}kx^2$

  (Hooke's Law: $F_a = kx$

§6-4 Power + Efficiency

K: $F_g = 585N$

$\Delta d = 8(18cm) = 144cm$

$\Delta t = 1.88s$

$W = F_{\parallel}\Delta d$

$W = (585N)(1.44m)$

$W = 842.4J$

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

1 Watt = 1 J/s

$P = \frac{842.4J}{1.88s}$

$P \doteq 448$ Watts

J: $F_g = 580N$

$\Delta d = 144cm$

$\Delta t = 1.75s$

$W = F_{\parallel}\Delta d$

$W = (580N)(1.44m)$

$W = 835.2J$

$P = \frac{835.2J}{1.75s}$

$P \doteq 477W$

Power is the rate at which work is done:

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

where P is the power (W - Watts)
W is the work done (J)
Δt is the time (s)

Consider the unit kW·h ($P\Delta t = W$)

On your "Power" Bill → kW·h ← an energy unit NOT power

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$W = 1.50 \times 10^5 J$

$\Delta t = 10.0 s$

$P = ?$

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

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

$P = 1.50 \times 10^4 W$

units: $\frac{J}{s} = W$

Efficiency

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

where E_O is the output energy (useful energy)
E_I is the input energy

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$E_I = 3.50 \times 10^3\ J$ (input energy)

$h = 1.00 \times 10^2\ m$
$m = 0.500\ kg$
} $E_g = mgh$ (output / useful energy)

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

$E_g = 490.5\ J$

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

$$\text{Efficiency} = \frac{490.5\ J}{3.50 \times 10^3\ J} \times 100\%$$

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

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