Physics 112

Springs / elastics

efficiency.

Green Text

p 258 (35, 36, 37)

p 261 (38, 39, 40)

$F = kx$

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

$\text{eff} = \frac{\text{out}}{\text{in}} \times 100\%$

p 276-277

(30-37)

35.

$$F = kx$$

$$k = \frac{F}{x} = \frac{50\ N}{0.095\ m} = 530\ N/m$$

36. $k = 1.10 \times 10^3 \ N/m$

$F = 455 \ N$

a)

$F = kx$

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

$\frac{455 \ N}{1.10 \times 10^3 \ N/m} = x$

$0.414 \ m = x$

b) $F = -455 \ N$

37. $k = 1.50\ N/m$

$X_{max} = 10\ cm = 0.10\ m$

$F = kx$

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

$F = 0.15\ N$

$W = mg$

$m = W/g$

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

$m = 0.0153\ g$

P 261

38. $x = 24\ cm$ $k = 35\ N/m$

$= 0.24\ m$ $E_e = ?$

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

$$= \frac{1}{2}(35)(0.24)^2$$

$$= 1.008\ J$$

$E_e = 1.0\ J$

39. $k = 48$ N/m $\quad x = ?$

$$\Delta E_e = E_{e_2} - E_{e_1} = 2.2 \text{ J}$$

$E_{e_1} = 0$ J (elastic is not pulled yet)

$\Delta E_e = E_{e_2} - E_{e_1}$

$2.2 = E_{e_2} - 0$

$E_{e_2} = 2.2$ J

$$E_{e_2} = \frac{1}{2}kx^2$$

$$2.2 = \frac{1}{2}(48)x^2$$

$0.30_m = x$

40. $F = 18\ N$

$x = 15\ cm = 0.15\ cm$

$\Delta E_g = ?$

$E_{e_1} = 0\ J$ (Not compressed yet)

$F = kx$

$k = \frac{F}{x} = \frac{18}{0.15}$

$= 120\ N/m$

$\Delta E_e = E_{e_2} - E_{e_1}$

$\Delta E_e = E_{e_2} - 0$

$\Delta E_e = E_{e_2}$

$\Delta E_e = \frac{1}{2}(120)(0.15)^2$

$\Delta E_e = 1.4\ J$

p 276

30. $F = 25\ N$

$x = 5.5\ cm = 0.055\ m$

$F = kx$

$k = \frac{F}{x} = \frac{25\ N}{0.055\ m} = 450\ N/m$

$k = 450\ N/m$

31. $\Delta E_e = ?$

$k = 120 \text{ N/m}$

$x = 8.0 \text{ cm}$

$x = 0.08 \text{ m}$

a) $\Delta E_e = E_{e_2} - E_{e_1}$

$= E_{e_2}$

$= \frac{1}{2} k x^2$

$= \frac{1}{2}(120)(0.08)^2$

$\Delta E_e = 0.38 \text{ J}$

b) $F = kx$

$= 120 \text{ N/m}\,(0.08)$

$F = 9.6 \text{ N}$

32. $k = 74 \text{ N/m}$

$m = 18 \text{ g} = 0.018 \text{ kg}$

$x = 10.0 - 3.5$ eff: 75%

$x = 6.5 \text{ cm}$

$x = 0.065 \text{ m}$

75%

$(0.75) E_e = KE$

$0.75\left(\frac{1}{2}\right)(74)(0.065)^2 = \frac{1}{2}(0.018)v^2$

$13 = v^2$

$3.6 \text{ m/s} = v$

33. $k = 555 \text{ N/m}$

$m = 1.50 \text{ kg}$

$x = 12 \text{ cm} = 0.12 \text{ m}$

TE = TE

$E_e = KE$

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

$\frac{1}{2}(555)(0.12)^2 = \frac{1}{2}(1.50)v^2$

$2.3 \text{ m/s} = v$

34. $m = 35\ kg$

$k = 4945\ N/m$

$x = 25\ cm = 0.25\ m$

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

$= \frac{1}{2}(4945)(0.25)^2$

$= 154.5\ J$

$E_e = PE$

$154.5 = mgh$

$154.5 = 35(9.81)h$

$0.45_m = h$

35. $k = 450 \ N/m$

$m = 2.2 \ kg$

$F = w = mg = 2.2(9.81)$

$= 21.6 \ N$

$F = kx$

$21.6 = 450(x)$

$\frac{21.6}{450} \quad x = 0.048 m$

36.

$$P = \frac{W}{t} = \frac{7.0 \times 10^2 \text{ J}}{2.0 \text{ sec}}$$

$$= 350 \text{ W}$$

$$\boxed{P = 3.5 \times 10^2 \text{ W}}$$

37. 30 min = 1800 sec

a) $150\ J/s \times 1800\ sec = 2.7 \times 10^5\ J$

b) $900\ \frac{J}{s} \times 1800\ sec = 2 \times 10^6\ J$

c) $2000\ \frac{J}{s} \times 1800\ sec = 4 \times 10^6\ J$

d) $2.5 \times 10^6\ \frac{J}{s} \times 1800\ sec = 4.5 \times 10^9\ J$