Physics 1P Traeger

Problems 44-48, 55-61, 72-78

Elastic Potential Energy: 44-48

(44) Energy in spring = $\frac{1}{2} K X^2$

N/m ↓ ; ↑ spring constant ; ↑ amount of spring compression

$E = \frac{1}{2} \cdot 150 \frac{Kg}{s^2} \cdot (0.02\ m)^2 = 0.03\ J$

(45) Find X in this problem.

$E = \frac{1}{2} K X^2 \quad \therefore \quad X = \sqrt{\frac{2E}{K}} = \sqrt{\frac{2 \cdot 20\ J}{175 \frac{N}{m}}} =$

$X = 0.48\ m$

(46) Find K in $E = \frac{1}{2} K X^2 \quad \therefore \quad K = \frac{2E}{X^2} =$

$\frac{2 \cdot 96 \frac{Kg\,m^2}{s^2}}{(0.05\ m)^2} = 76800 \frac{N}{m}$

(47) $Force_{spring} = KX$ $\quad Force = m \cdot g = 0.20\ Kg \cdot 9.8 \frac{m}{s^2} = 1.96\ N$

$K = \frac{Force}{X} = \frac{1.96\ N}{0.03\ m} = 65.3 \frac{N}{m}$

$PE_{spring} = \frac{1}{2} K X^2 = \frac{1}{2} \cdot 65.3 \frac{N}{m} \cdot (0.03\ m)^2 = 0.03\ J$

(48) $Force = KX$ $\quad Force = m \cdot g = 5\ Kg \cdot 9.8 \frac{m}{s^2} = 49\ N$

$K = \frac{Force}{X} = \frac{49\ N}{0.07\ m} = 700 \frac{N}{m}$ $\quad PE = \frac{1}{2} K X^2 = \frac{1}{2} \cdot 700 \frac{N}{m} (0.07\ m)^2$

$= 1.72\ J$

D

Mixed Problems 55-61

(55) $PE = \frac{1}{2}Kx^2$ find x. so, $x = \sqrt{\frac{2PE}{K}} =$

~~$\sqrt{2}$~~ $\sqrt{\frac{2 \cdot 5J}{270 \frac{N}{m}}}$ = ~~0.0 m~~ **0.192 m** sorry calculator error.

(56) $KE = \frac{1}{2}mv^2$ ∴ $V = \sqrt{\frac{2KE}{m}} = \sqrt{\frac{2 \cdot 0.36J}{0.02Kg}}$

$= 6 \frac{m}{s}$

(57) Use $KE = \frac{1}{2}mv^2$, so $m = \frac{2KE}{v^2} = \frac{2 \cdot 3600J}{(12 \frac{m}{s})^2} =$

50 Kg

(58) $PE = mgh$, solve for g. so, $g = \frac{PE}{m \cdot h} =$

$g = \frac{20J}{(0.5Kg \cdot 2.5m)} = 16 \frac{m}{s^2}$

(59) $PE = mgh$ ∴ solve for h, so $h = \frac{PE}{mg} =$

$h = \frac{2400000J}{(50Kg \cdot 9.8 \frac{m}{s^2})} = 4898 m$

(60) Use $PE = \frac{1}{2}Kx^2$, solve for K. so, $K = \frac{2PE}{x^2} =$

$\frac{(2 \cdot 0.003J)}{(0.01m)^2} = 60 \frac{N}{m}$

(61) ~~Energy~~ Power = Force × velocity ∗ Final Force

~~$F = \frac{E}{v} = \frac{37000J}{14 \frac{m}{s}} = 2643N$ $F = ma$, so $m = \frac{F}{a} =$~~

Disregard. see next page. ~~$\frac{2643N}{9.8 \frac{m}{s^2}} = 270 Kg$~~

(61) $KE = \frac{1}{2} m v^2$, so $m = \frac{2KE}{v^2} = \frac{2 \cdot 37000\,J}{(14\frac{m}{s})^2} =$

$378\ Kg$ Answer in Key of 0.38 Kg is wrong.

Conservation of Energy Problems 72-78

(72) ~~$\frac{1}{2} m v_i^2 = \frac{1}{2} m v_f^2$~~

zero, so $0 = \frac{1}{2} m v_f^2$

$WORK = \Delta E = \frac{1}{2} m v^2 = \frac{1}{2} \cdot 2000\,Kg \cdot (30\frac{m}{s})^2 =$

$900{,}000\ J$

(73) $\frac{1}{2} m v_i^2 + mgh_i = \frac{1}{2} m v_f^2 + mgh_f$

$mgh_i = \frac{1}{2} m v_f^2 \therefore V_f = \sqrt{2gh_i} = \sqrt{2 \cdot 9.8\frac{m}{s^2} \cdot 2.7m}$

$V_f = 7.3\frac{m}{s}$

(74) $\frac{1}{2} m V_i^2 + mgh_i = \frac{1}{2} m V_f^2 + mgh_f$

$mgh_i = \frac{1}{2} m V_f^2 \therefore V_f = \sqrt{2gh} = \sqrt{2 \cdot 9.8\frac{m}{s^2} \cdot 125m}$

$V_f = 49.5\frac{m}{s}$

(75) $W = \Delta E = -\frac{1}{2} m v^2 = \frac{1}{2} \cdot 1500\,Kg \cdot (20\frac{m}{s})^2 =$

$-300{,}000\ J$

(76) $\frac{1}{2} m v_1^2 + mgh_1 = \frac{1}{2} m v_f^2 + mgh_2$

$h_2 = \frac{1}{2}\left(\frac{v_1^2}{g}\right) = \frac{1}{2}\left(\frac{(190\frac{m}{s})^2}{9.8\frac{m}{s^2}}\right) = 1842\ m$

(77) $\frac{1}{2}Kx^2 = \frac{1}{2}mv^2$, so

$$v = \sqrt{\frac{Kx^2}{m}} = \sqrt{\frac{395\frac{N}{m}\cdot(0.005m)^2}{0.5Kg}}$$

$$v = 0.14\ \frac{m}{s}$$

(78) a) $\frac{1}{2}Kx^2 = mgh$

$$h = \frac{\frac{1}{2}Kx^2}{mg} = \frac{1}{2}\left(\frac{220\frac{N}{m}\cdot(0.02m)^2}{(0.003Kg\cdot 9.8\frac{m}{s^2})}\right)$$

$$h = 1.5m$$

b) $\frac{1}{2}Kx^2 = mgh$

$$h = \frac{1}{2}\frac{Kx^2}{mg} = \frac{1}{2}\left(\frac{220\frac{N}{m}\cdot(0.04m)^2}{(0.003Kg\cdot 9.8\frac{m}{s^2})}\right)$$

$$h = 6.0m$$