Physics 1P

Traeger

Work + Energy Problem HW
Solutions: #8-11, 20-24, 31-36.

8) $D = 150\ m$ $F = 13500\ N$, Find work.

$W = F \cdot d = 13500\ N \cdot 150\ m = 2{,}025000\ J$

$= 2.03 \times 10^6\ J$

9) $W = F \cdot d$

$d = \frac{W}{F} = \frac{49000\ J}{450\ N} = \frac{49000\ \frac{Kg m^2}{s^2}}{450\ \frac{Kg m}{s^2}} = 198\ m$

$*N \cdot m = J$

10) First, Find Distance. using $d = r \cdot t$

$d = 45 \frac{m}{\cancel{s}} \left(2 \cancel{hr}\right)\left(\frac{60\ \cancel{min}}{1\ \cancel{hr}}\right)\left(\frac{60 \cancel{s}}{1\ \cancel{min}}\right) = 324{,}000\ m$

$W = F \cdot d = 25000\ N \cdot 324{,}000\ m = 8.1 \times 10^9\ J$

$*N \cdot m = J$

11) Find weight of bird using $F = mg$

$= 3.6\ Kg \cdot 9.8 \frac{m}{s^2} = 35.28\ N$

$W = F \cdot d = 35.28\ N \cdot 50\ m = 1764\ J$

$*N \cdot m = J$

20) $GPE = mgh = 450 Kg \cdot 9.8 \frac{m}{s^2} \cdot 25\ m = 110250\ J$

$\frac{Kg m^2}{s^2} = J$

21) Earth

$\triangle GPE_{Earth} = 45\ Kg \cdot 9.8 \frac{m}{s^2} \cdot (18m - 2m) = 7056\ J$ on Earth

$\frac{Kg m^2}{s^2} = J$

Moon

$\triangle GPE_{Moon} = 45\ Kg \cdot 1.6 \frac{m}{s^2} \cdot (18m - 2m) = 1152\ J$ on Moon

$\frac{Kg m^2}{s^2} = J$

27) $\Delta GPE = 0.25\ Kg \cdot 9.8 \frac{m}{s^2} \cdot (0.5m - 2m) =$

$-3.7\ J$

$\frac{Kg\,m^2}{s^2} = J$

23) $PE = mgh \therefore h = \frac{PE}{mg} = \frac{10000\ J}{(60\ Kg \cdot 9.8 \frac{m}{s^2})} =$

$17\ m$

$\frac{\frac{Kg\,m^2}{s^2}}{\frac{Kg\,m}{s^2}} = m$ (units)

24) $PE = mgh \therefore g = \frac{PE}{m \cdot h} = \frac{45\ J}{(0.5\ Kg \cdot 12m)} =$

$7.5 \frac{m}{s^2}$

$\frac{\frac{Kg\,m^2}{s^2}}{Kg \cdot m} = \frac{m}{s^2}$ (units)

31) $KE = \frac{1}{2} mv^2$

$KE = \frac{1}{2} \cdot 4Kg \left(9 \frac{m}{s}\right)^2 = 162\ J$ $\frac{Kg\,m^2}{s^2}$

32) $KE = \frac{1}{2} mv^2 \therefore m = \frac{2 \cdot KE}{v^2} = \frac{(2 \cdot 2000\ J)}{\left(4 \frac{m}{s}\right)^2} = \frac{\frac{Kg\,m^2}{s^2}}{\frac{m^2}{s^2}} = Kg$ (units)

~~2000 Kg~~ oops

$250\ Kg$

33) $KE = \frac{1}{2} mv^2 \therefore \sqrt{\frac{2KE}{m}} = v = \sqrt{\frac{2 \cdot 1.6 \times 10^5\ J}{400\ Kg}}$

$v = 30 \frac{m}{s}$

$\sqrt{\frac{\frac{Kg\,m^2}{s^2}}{Kg}} = \sqrt{\frac{m^2}{s^2}} = \frac{m}{s}$ (units)

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34) $KE = \frac{1}{2}mv^2$ so $v = \sqrt{\frac{2 \cdot KE}{m}} =$

$\sqrt{\frac{2 \cdot 20\,J}{3\,Kg}} = 3.7\ \frac{m}{s}$

Units $\sqrt{\frac{\frac{Kg\,m^2}{s^2}}{Kg}} = \sqrt{\frac{m^2}{s^2}} = \frac{m}{s}$

35) $KE = \frac{1}{2}mv^2 \therefore m = \frac{2 \cdot KE}{v^2} = \frac{(2.450\,J)}{(6\ \frac{m}{s})^2} =$

$48.9\ Kg$ Units $\frac{\frac{Kg\,m^2}{s^2}}{\frac{m^2}{s^2}} = Kg$

36) $KE = \frac{1}{2}mv^2 \therefore v = \sqrt{\frac{2 \cdot KE}{m}} =$

$v = \sqrt{\frac{2 \cdot 15000\,J}{1200\,Kg}} = 5\ \frac{m}{s}$

Units $\sqrt{\frac{\frac{Kg\,m^2}{s^2}}{Kg}} = \sqrt{\frac{m^2}{s^2}} = \frac{m}{s}$