Physics 1P Traeger

Dynamics Chapter Problems 13-19 and 26-31

(10) Use $\vec{F} = m\cdot\vec{a}$

$\vec{F} = 50\,kg \cdot 1.5\,\frac{m}{s^2} = 75\,kg\frac{m}{s^2} = \boxed{75\,N}$

(11) $\vec{F} = m\vec{a}$, so $m = \frac{\vec{F}}{\vec{a}} = \frac{10000\,\cancel{N}\,\frac{kg\,m}{s^2}}{5.5\,\frac{m}{s^2}} = \boxed{1818\,kg}$

(12) $\vec{F} = m\cdot\vec{a}$, so $\vec{a} = \frac{\vec{F}}{m} = \frac{235\,\cancel{kg}\,\frac{m}{s^2}}{40\,\cancel{kg}} = \boxed{5.9\,\frac{m}{s^2}}$

(13) $\vec{F} = m\cdot\vec{a}$

Knowns are $m = 45\,kg$ $v_f = 12\,\frac{m}{s}$ $v_i = 0\,\frac{m}{s}$ $x_i = 0\,m$ $x_f = 20\,m$

~~Use $x_f = x_0 + v_0 t + \ldots$~~

Need to find a, so use ~~$v_f^2 = v_0^2$~~

$v_f^2 = v_0^2 + 2a(x - x_0)$ to find a

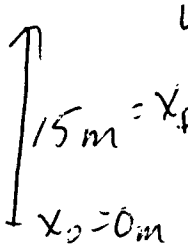
$v_f^2 - v_0^2 = 2a(x - x_0)$

$a = \frac{1}{2}\left(\frac{v_f^2 - v_0^2}{x - x_0}\right) = \frac{1}{2}\left(\frac{(12\frac{m}{s})^2 - (0\frac{m}{s})^2}{20\,m - 0\,m}\right) = \frac{1}{2}\left(\frac{144\frac{m^2}{s^2}}{20\,m}\right)$

$a = 3.6\,\frac{m}{s^2}$

Now, Use $\vec{F} = m\vec{a}$ $\vec{F} = 45\,kg \cdot 3.6\,\frac{m}{s^2} = \boxed{162\,N}$

(14) Knowns: $\vec{F} = 3000\,N$ $m = 1200\,kg$
wants to know time



First, use $\vec{F} = m\vec{a}$ to solve for $\vec{a}$.

$$\vec{a} = \frac{\vec{F}}{m} = \frac{3000\ \cancel{kg}\frac{m}{s^2}}{1200\,kg} = 2.5\frac{m}{s^2}$$

Now use $x_f = x_0 + v_0 t + \frac{1}{2}at^2$ to find t

$v_i = 0$ and $x_0 = 0$, so

$x_f = \frac{1}{2}at^2$ solve for t

$$\sqrt{\frac{2x_f}{a}} = t = \sqrt{\frac{2 \cdot 15\,m}{2.5\frac{m}{s^2}}} = 3.55$$

(15) Knowns $57\,kg = m$ and $a = 9.8\frac{m}{s^2}$
Wants Force
Use $\vec{F} = m \cdot \vec{a}$ to find force

$$\vec{F} = 57\,kg \cdot 9.8\frac{m}{s^2} = 558.6\,N$$

(16) Knowns $\vec{F} = 34\,N$ $\vec{a} = 2.5\frac{m}{s^2}$
Find mass. Use $\vec{F} = m \cdot \vec{a}$, so

$$m = \frac{\vec{F}}{\vec{a}} = \frac{34\,kg\frac{m}{s^2}}{2.5\frac{m}{s^2}} = 13.6\,kg$$

(17) Knowns $\vec{F} = 725\,N$ $\vec{a} = 3.0\,\frac{m}{s^2}$

Unknown is mass

Use $\vec{F} = m \cdot \vec{a}$, so $m = \frac{\vec{F}}{\vec{a}} = \frac{725\,N}{3.0\,\frac{m}{s^2}} =$

75 Kg

(18) Given $m = 4\,Kg$ $t = 0.5\,s$ $V_{f_1} = 10\,\frac{m}{s}$

Find $\vec{F}_{net}$, need to find $\vec{a}$, so use

$V_f = V_0 + at$ $\therefore$ $V_f - V_0 = at$

$a = \frac{V_f - V_0}{t} = \frac{(0\,\frac{m}{s} - 10\,\frac{m}{s})}{0.5\,s} = -20\,\frac{m}{s^2}$

Now, use $\vec{F} = m \cdot \vec{a}$

$\vec{F} = 4\,Kg \cdot -20\,\frac{m}{s^2} =$ **$-80\,N$**

(19) Knowing $m = 0.18\,Kg$ $\vec{F} = 0.5\,N$

First, find $\vec{a}$ $\vec{F} = m\vec{a}$, so $\vec{a} = \frac{\vec{F}}{m} =$

$\vec{a} = \frac{0.5\,N}{0.18\,Kg} = 2.8\,\frac{m}{s^2}$

$\vec{V} = V_0 + at = 0\,\frac{m}{s} + (2.8\,\frac{m}{s^2} \cdot 5\,s) =$ **$14\,\frac{m}{s}$**

$X_f = X_0 + V_0 t + \frac{1}{2}at^2 = \frac{1}{2}at^2 = \frac{1}{2} \cdot 2.8\,\frac{m}{s^2}\,(5\,s)^2$

$= 35\,m$

(26) $\vec{F} = m \cdot \vec{a}$ $\quad m = \dfrac{\vec{F}}{\vec{a}} = \dfrac{270 \text{ Kg}\frac{m}{s^2}}{9.8 \frac{m}{s^2}} =$

Knowns: $\vec{F} = 270 N$

$\vec{a} = 9.8 \frac{m}{s^2}$

27.6 Kg

(27) Weight $= \vec{F} = m\vec{g}$

Knowns: $m = 60 Kg$, $\vec{a} = 9.8 \frac{m}{s^2}$

Find $\vec{F}$

$\vec{F} = 60 Kg \cdot 9.8 \frac{m}{s^2} = 588 N$

(28) $\vec{F}_{mars} = 17 N$ $\quad \vec{g}_{Mars} = 3.8 \frac{m}{s^2}$

Find mass using $\vec{F} = m\vec{g}$

$$m = \frac{\vec{F}}{\vec{g}} = \frac{17 \text{ Kg}\frac{m}{s^2}}{3.8 \frac{m}{s^2}} = 4.5 \text{ Kg}$$

Weight on Earth $= 4.5 Kg \cdot 9.8 \frac{m}{s^2} = 44.1 N$

Weight on Moon $= 4.5 Kg \cdot 1.6 \frac{m}{s^2} = 7.7 N$

Mass does not change. Only weight does!

(29) weight $= \vec{F}_g = m \cdot \vec{a} =$

$2\text{kg} \cdot 9.8 \frac{m}{s^2} =$

$0.002\text{kg} \cdot 9.8 \frac{m}{s^2} = 0.02\text{ N}$

(30) Knowns: $\vec{F}_g = 330\text{ N}$ $\vec{a} = 9.8 \frac{m}{s^2}$

Use $\vec{F} = m\vec{a}$, solve for m

$$m = \frac{\vec{F}}{\vec{a}} = \frac{330\text{ kg}\frac{m}{s^2}}{9.8 \frac{m}{s^2}} = 33.7\text{ kg}$$

(31) Knowns $m = 836\text{ kg}$ $g_{mars} = 3.8 \frac{m}{s^2}$

weight on Mars:

$\vec{F}_{Mars} = 836\text{kg} \cdot 3.8 \frac{m}{s^2} = 3177\text{ N}$

weight on Earth:

$\vec{F}_{Earth} = 836\text{ kg} \cdot 9.8 \frac{m}{s^2} = 8193\text{ N}$