p131 29 – 37 odd, 38, 39, 41

(29) (a) mass is the same on Earth and the planet

(b) Weight = mg

Earth $W = (21\,kg)(9.81\,ms^{-2}) = \underline{206\,N}$

Planet $W = (21\,kg)(12.0\,ms^{-2}) = \underline{252\,N}$

(31) $g = \frac{GM}{r^2}$

$= \frac{(6.67\times10^{-11}\,N\,m^2\,kg^{-2})(5.98\times10^{24}\,kg)}{[(1.5)(6.38\times10^{6}\,m)]^2}$

$= \underline{4.4\,ms^{-2}}$

(33) $F = \frac{G m_1 m_2}{r^2}$ $\qquad m_1 + m_2 = 4\,kg$, $\quad m_2 = 4 - m_1$

$= \frac{G m_1 (4-m_1)}{r^2}$

$m_1(4-m_1) = \frac{Fr^2}{G}$

$4m_1 - m_1^2 = \frac{Fr^2}{G}$

$0 = m_1^2 - 4m_1 + \frac{Fr^2}{G}$

$= m_1^2 - 4m_1 + \frac{(2.5\times10^{-10}\,N)(0.25\,m)^2}{6.67\times10^{-11}\,N\,m^2\,kg^{-2}}$

$0 = m_1^2 - 4m_1 + 0.234$

$m_1 = \frac{4 \pm \sqrt{(-4)^2 - 4(1)(.234)}}{2(1)} = 3.94,\ 0.06$

so the masses are $\underline{3.94\,kg}$ and $\underline{0.06\,kg}$

(35) $g = \frac{Gm}{r^2}$

$$r = \sqrt{\frac{Gm}{g}} = \sqrt{\frac{(6.67\times10^{-11}\ Nm^2kg^{-2})(5.98\times10^{24}\ kg)}{(\frac{9.81\ ms^{-2}}{10})}}$$

$$r = \underline{2.02\times10^{7}\ m}$$

(37) $m = 1.99\times10^{30}\ kg$
$r = 1.74\times10^{6}\ m$

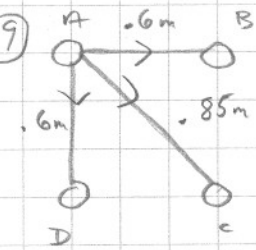
$$g = \frac{Gm}{r^2} = \frac{(6.67\times10^{-11}\ Nm^2kg^{-2})(1.99\times10^{30}\ kg)}{(1.74\times10^{6}\ m)^2}$$

$$g = \underline{4.38\times10^{7}\ ms^{-2}}$$

(38) $$g = \frac{Gm}{r^2} = \frac{(6.67\times10^{-11}\ Nm^2kg^{-2})(5.98\times10^{24}\ kg)}{(6.38\times10^{6}m + 250\times10^{3}m)^2}$$

$$g = 9.07\ Nkg^{-1}$$

(39)

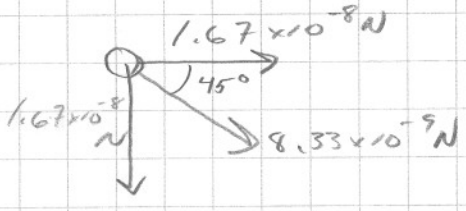


$$F = \frac{Gm_1m_2}{r^2}$$

$$F_{AB} = \frac{(6.67\times10^{-11}\ Nm^2kg^{-2})(9.5kg)(9.5kg)}{(.6m)^2} = 1.67\times10^{-8}N$$

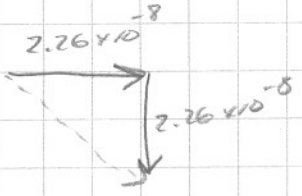
$F_{AD} = 1.67\times10^{-8}N$ (same distance)

$$F_{AC} = \frac{(6.67\times10^{-11}\ Nm^2kg^{-2})(9.5kg)(9.5kg)}{(.85m)^2} = 8.33\times10^{-9}N$$



X: $1.67\times10^{-8}N + 8.33\times10^{-9}N \cos 45$
$= 2.26\times10^{-8}N$

y: $1.67\times10^{-8}N + 8.33\times10^{-9}N \sin 45$
$= 2.26\times10^{-8}N$



$$F = \sqrt{(2.26\times10^{-8}N)^2 + (2.26\times10^{-8}N)^2}$$

$F = 3.2\times10^{-8}N$ towards the center

(41) $F = \frac{G m_1 m_2}{r^2} = m g$

$m = \frac{g r^2}{G}$ $\qquad g = 0.38(9.81\ m s^{-2})$

$= \frac{0.38(9.81\ m s^{-2})(3400 \times 10^3\ m)^2}{6.67 \times 10^{-11}\ N m^2 kg^{-2}}$

$m_{mars} = 6.5 \times 10^{23}\ kg$