
1/1	For a 180-lb person :
-----	-----------------------

$$W = mg : 180 \text{ lb} = m (32.2 \text{ ft/sec}^2)$$
$$m = \frac{5.59 \text{ slugs}}{}$$
$$180 \text{ lb} \left(\frac{4.4482 \text{ N}}{\text{lb}} \right) = \underline{801 \text{ N}}$$
$$W = mg : 801 \text{ N} = m (9.81 \text{ m/s}^2)$$
$$m = \underline{81.6 \text{ kg}}$$

Contact me in order to access the whole complete document. Email: solution9159@gmail.com
WhatsApp: <https://wa.me/message/2H3BV2L5TTSUF1> Telegram: <https://t.me/solutionmanual>

WILEY

$$\frac{1}{2} \quad W = mg = (1500 \text{ kg}) \left(9.81 \frac{\text{m}}{\text{s}^2} \right) = \underline{14\,720 \text{ N}}$$

$$m = (1500 \text{ kg}) \left(\frac{1 \text{ slug}}{14.594 \text{ kg}} \right) = \underline{102.8 \text{ slugs}}$$

$$W = mg = (102.8 \text{ slugs}) \left(32.2 \frac{\text{ft}}{\text{sec}^2} \right) \\ = \underline{3310 \text{ lb}}$$

WILEY

$$\begin{aligned} \frac{1}{3} \quad \underline{V}_1 &= 12 (\cos 30^\circ \underline{i} + \sin 30^\circ \underline{j}) \\ &= 10.39 \underline{i} + 6 \underline{j} \\ \underline{V}_2 &= 15 \left(-\frac{3}{5} \underline{i} + \frac{4}{5} \underline{j} \right) = -9 \underline{i} + 12 \underline{j} \\ \underline{V}_1 + \underline{V}_2 &= 12 + 15 = \underline{27} \\ \underline{V}_1 + \underline{V}_2 &= (10.39 - 9) \underline{i} + (6 + 12) \underline{j} = \underline{1.39 \underline{i} + 18 \underline{j}} \\ \underline{V}_1 - \underline{V}_2 &= (10.39 - (-9)) \underline{i} + (6 - 12) \underline{j} = \underline{19.39 \underline{i} - 6 \underline{j}} \\ \underline{V}_1 \times \underline{V}_2 &= (10.39 \underline{i} + 6 \underline{j}) \times (-9 \underline{i} + 12 \underline{j}) \\ &= [10.39(12) - 6(-9)] \underline{k} = \underline{178.7 \underline{k}} \\ \underline{V}_2 \times \underline{V}_1 &= \underline{-178.7 \underline{k}} \\ \underline{V}_1 \cdot \underline{V}_2 &= 10.39(-9) + 6(12) = \underline{-21.5} \end{aligned}$$



1/A The mass of an average apple is

$$m = \frac{2 \text{ kg}}{12} = 0.1667 \text{ kg}$$

Weight in newtons is $W = mg = 0.1667(9.81) = \underline{1.635 \text{ N}}$

Weight in pounds is $W = 1.635 \text{ N} \left(\frac{1}{4.4482} \frac{\text{lb}}{\text{N}} \right)$

$$= \underline{0.368 \text{ lb}}$$

These apples weigh closer to 2 N each than to the rule of 1 N each!

WILEY

1/5

$$F = \frac{G m_{Ti} m_{Cu}}{d^2} = \frac{G \left[\frac{4}{3} \pi R^3 \rho_{Ti} \right] \left[\frac{4}{3} \pi (2R)^3 \rho_{Cu} \right]}{(6R)^2}$$

$$= \frac{32}{81} \pi^2 G \rho_{Ti} \rho_{Cu} R^4$$

$$= \frac{32}{81} \pi^2 (6.673 \cdot 10^{-11}) (4510) (8910) (0.040)^4$$

$$= 2.68 (10^{-8}) \text{ N}$$

Force is a vector quantity, so

$$\underline{F} = F \underline{n} = 2.68 (10^{-8}) [-\cos 35^\circ \underline{i} - \sin 35^\circ \underline{j}]$$

$$= \underline{(-2.19 \underline{i} - 1.535 \underline{j})} 10^{-8} \text{ N}$$

1/6	$mg = \frac{1}{2} mg_{h=0}$
-----	-----------------------------

$$\frac{R^2}{(R+h)^2} g_0 = \frac{1}{2} g_0$$

Solve for h to obtain $\underline{h = (\sqrt{2} - 1)R}$

or $\underline{h = 0.414R}$

WILEY

1/7

$$g_{\text{rel}} = 9.780\,327 (1 + 0.005\,279 \sin^2 \gamma + 0.000\,023 \sin^4 \gamma \dots)$$

$$\text{At } \gamma = 35^\circ, \quad g_{\text{rel}} = 9.797\,337 \text{ m/s}^2$$

$$g_{\text{abs}} = g_{\text{rel}} + 0.03382 \cos^2 \gamma$$

$$= 9.797\,337 + 0.03382 \cos^2 35^\circ$$

$$= 9.820\,031 \text{ m/s}^2$$

$$W_{\text{abs}} = mg_{\text{abs}} = 60 (9.820\,031) = \underline{589 \text{ N}}$$

$$W_{\text{rel}} = mg_{\text{rel}} = 60 (9.797\,337) = \underline{588 \text{ N}}$$

(More precise values : $W_{\text{abs}} = 589.2 \text{ N}$

$W_{\text{rel}} = 587.8 \text{ N}$)

WILEY

1/8

$$g_h = \frac{G m_e}{(R+h)^2}$$

$$g_h = \frac{(6.673 \times 10^{-11})(5.976 \times 10^{24})}{[(6371 + 300)(1000)]^2} = \underline{8.96 \text{ m/s}^2}$$

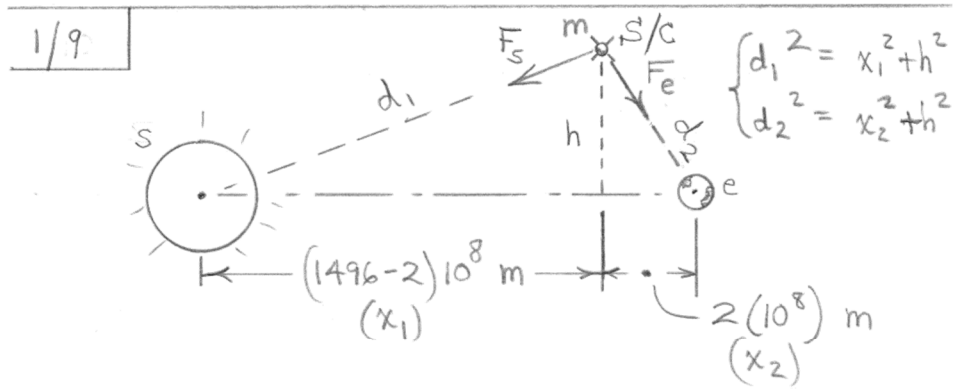
$$\text{Mass of person: } m = \frac{W}{g} = \frac{880}{9.80665} = 89.7 \text{ kg}$$

Absolute weight at $h = 300 \text{ km}$:

$$W_h = m g_h = 89.7 (8.96) = \underline{804 \text{ N}}$$

The terms "zero-g" and "weightless" are definitely misnomers in this case.

WILEY



$$F_s = \frac{Gmm_s}{d_1^2}, \quad F_e = \frac{Gmme}{d_2^2}$$

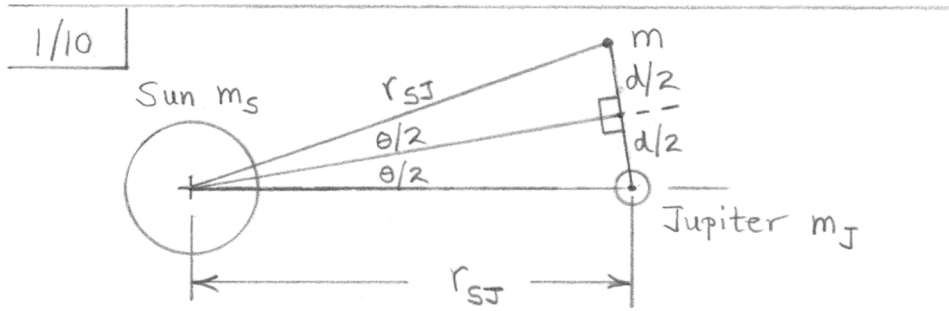
For equal force magnitudes, $F_s = F_e$

$$\Rightarrow \frac{m_s}{d_1^2} = \frac{m_e}{d_2^2} \quad \text{or} \quad \frac{m_s}{x_1^2 + h^2} = \frac{m_e}{x_2^2 + h^2}$$

$$h = \left[\frac{m_e x_1^2 - m_s x_2^2}{m_s - m_e} \right]^{1/2}$$

With $m_e = 5.976(10^{24}) \text{ kg}$, $m_s = 333000 m_e$,
and x_1 and x_2 as above:

$$h = 1.644(10^8) \text{ m} \quad \text{or} \quad \underline{\underline{1.644(10^5) \text{ km}}}$$



Newton's Law of Universal Gravitation :

$$\frac{Gm m_s}{r_{SJ}^2} = \frac{Gm m_J}{d^2}$$

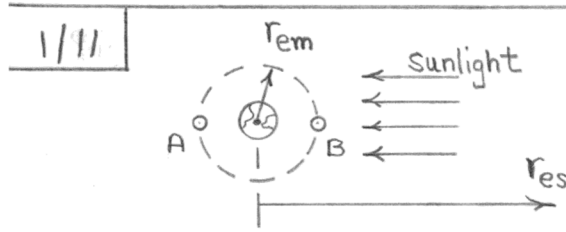
$$d = r_{SJ} \sqrt{\frac{m_J}{m_s}} = 778 (10^6) \sqrt{\frac{317.8}{333000}}$$

$$= 24.0 (10^6) \text{ km}$$

$$\text{Then } \sin \frac{\theta}{2} = \frac{d/2}{r_{SJ}} = \frac{24.0 (10^6) / 2}{778 (10^6)}$$

$$\theta = 1.770^\circ$$

(We could have used the small-angle approach $d = r_{SJ} \theta$!)



Force exerted by earth on moon :

$$F_e = \frac{Gm_e m_m}{r_{em}^2} = \frac{(6.673 \times 10^{-11})(5.976 \times 10^{24})^2(1)(0.0123)}{(3.84398 \times 10^8)^2}$$

$$= 1.984 \times 10^{20} \text{ N}$$

Forces exerted by sun on moon :

$$F_{sA} = \frac{Gm_s m_m}{(r_{es} + r_{em})^2} = \frac{(6.673 \times 10^{-11})(5.976 \times 10^{24})^2(333,000)(0.0123)}{(1.496 \times 10^{11} + 3.84398 \times 10^8)^2}$$

$$= 4.34 \times 10^{20} \text{ N}$$

$$F_{sB} = \frac{Gm_s m_m}{(r_{es} - r_{em})^2} = 4.38 \times 10^{20} \text{ N}$$

Ratios :	
R_A	$= 2.19$
R_B	$= 2.21$

WILEY

$$\frac{1}{12} \quad E = \int_{t_1}^{t_2} mgr \, dt$$

$$[E] = (M)(L/T^2)(L)(T) = ML^2/T$$

$$\text{SI: } [E] = \text{kg} \cdot \text{m}^2/\text{s} \quad (\text{base } \checkmark)$$

$$\text{U.S.: } [E] = \text{slugs} \cdot \text{ft}^2/\text{sec} \quad (\text{not base})$$

$$= \frac{\text{lb} \cdot \text{sec}^2}{\text{ft}} \cdot \text{ft}^2/\text{sec} = \underline{\text{lb} \cdot \text{ft} \cdot \text{sec}}$$

WILEY

$$\frac{1}{13} \quad Q = \frac{1}{2} \rho v^2$$
$$[Q] = \frac{M}{L^3} \left(\frac{L}{T}\right)^2 = \underline{ML^{-1}T^{-2}}$$

WILEY