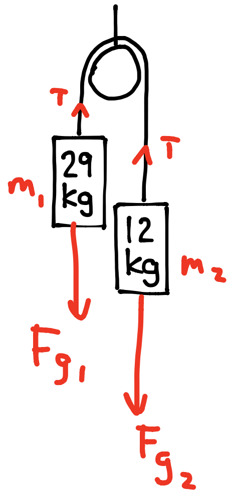
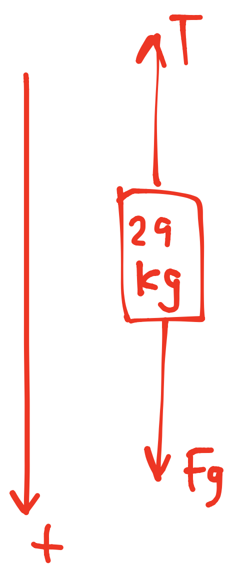
DYNAMICS 11 REVIEW - SOLUTIONS

1. a)

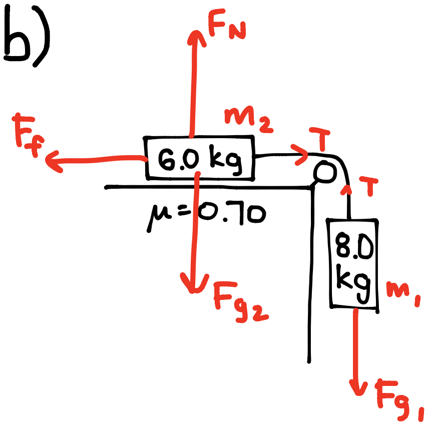


$$F_{NET} = Ma$$
$$F_{g_1} - T + T - F_{g_2} = Ma$$
$$F_{g_1} - F_{g_2} = Ma$$
$$m_1 g - m_2 g = Ma$$
$$a = \frac{m_1 g - m_2 g}{M}$$
$$= \frac{(m_1 - m_2)}{M} g$$
$$= \frac{(29 - 12)}{41} (9.8)$$
$$= 4.1 \ \frac{m}{s^2} \text{ LEFT}$$



$$F_{NET} = ma$$
$$F_g - T = ma$$
$$mg - T = ma$$
$$T = mg - ma$$
$$= m(g - a)$$
$$= 29(9.8 - 4.1)$$
$$= 170 \text{ N}$$

b)



$$F_{NET} = Ma$$

$$F_{g_1} - \cancel{T} + \cancel{T} - F_f = Ma$$

$$F_{g_1} - F_f = Ma$$

$$m_1 g - \mu F_N = Ma$$

$$m_1 g - \mu m_2 g = Ma$$

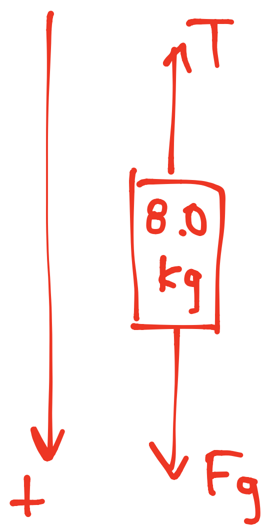
$$a = \frac{m_1 g - \mu m_2 g}{M}$$

$$= \frac{(8.0)(9.8) - (0.70)(6.0)(9.8)}{14.0}$$

$$= 2.7 \frac{m}{s^2} \text{ RIGHT}$$

$$F_N = F_{g_2}$$

$$= m_2 g$$



$$F_{NET} = ma$$

$$F_g - T = ma$$

$$mg - T = ma$$

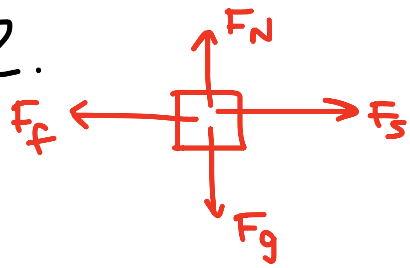
$$T = mg - ma$$

$$= m(g - a)$$

$$= 8.0(9.8 - 2.7)$$

$$= 57 \text{ N}$$

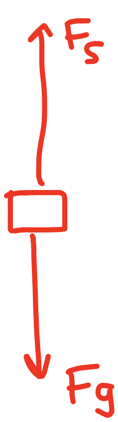
2.



$$F_N = F_g$$
$$= mg$$

$$F_{NET} = ma$$
$$F_s - F_f = ma$$
$$kx - \mu F_N = ma$$
$$kx - \mu mg = ma$$
$$a = \frac{kx - \mu mg}{m}$$
$$= \frac{(333)(0.33) - (0.33)(3.3)(9.8)}{3.3}$$
$$= 30.\ \frac{m}{s^2}$$

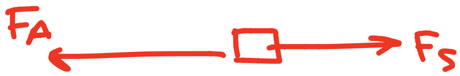
3.



$a = 0$

$$F_{NET} = ma$$
$$F_s - F_g = 0$$
$$F_s = F_g$$
$$kx = mg$$
$$x = \frac{mg}{k}$$
$$= \frac{(4.0)(9.8)}{350}$$
$$= 0.11\ m$$
$$= 11\ cm$$

4.



$F_{NET} = ma$ ($a = 0$)

$F_s - F_A = 0$

$F_s = F_A$

$kx = F_A$

$k = \frac{F_A}{x}$

$= \frac{240}{0.60}$

$= 4.0 \times 10^2 \ \frac{N}{m}$

5. a) $F_g \propto \frac{1}{r^2}$ (PROPORTIONAL TO)

F_g IS INVERSELY PROPORTIONAL TO THE SQUARE OF THE RADIUS

IF r IS INCREASED BY A FACTOR OF 2, THEN F_g IS DECREASED BY A FACTOR OF $\frac{1}{2^2} = \frac{1}{4}$

$420 \times \frac{1}{4} = 105 \ N$

b) IF r IS DECREASED BY A FACTOR OF $\frac{1}{50}$, THEN F_g IS DECREASED BY A FACTOR OF $\frac{1}{\left(\frac{1}{50}\right)^2} = 2500$

$420 \times 2500 = 1050000 \ N$

6. GIVEN:

$F_g = 5.4$ N

$r = 1.5 \times 10^{13}$ m

$m_1 = M_E = 5.97 \times 10^{24}$ kg

$m_2 = ?$

$$F_g = G\frac{m_1 m_2}{r^2}$$

$$m_2 = \frac{F_g r^2}{G m_1}$$

$$= \frac{(5.4)(1.5\times10^{13})^2}{(6.67\times10^{-11})(5.97\times10^{24})}$$

$$= 3.1\times10^{12} \text{ kg}$$

VERY HEAVY SLUG!

7. a) $F_g = mg$

$$= (1.0\times10^{4})(9.8)$$

$$= 9.8\times10^{4} \text{ N}$$

b) GIVEN:

$m_1 = m_E = 5.97\times10^{24}$ kg

$m_2 = 1.0\times10^{4}$ kg

$r = 42000$ km $= 4.2\times10^{7}$ m

$F_g = ?$

$$F_g = G\frac{m_1 m_2}{r^2}$$

$$= (6.67\times10^{-11})\frac{(5.97\times10^{24})(1.0\times10^{4})}{(4.2\times10^{7})^2}$$

$$= 2300 \text{ N}$$

c) GIVEN:

$M = m_E = 5.97\times10^{24}$ kg

$r = 42000$ km $= 4.2\times10^{7}$ m

$F_g = ?$

$$g = G\frac{M}{r}$$

$$= (6.67\times10^{-11})\frac{(5.97\times10^{24})}{(4.2\times10^{7})^2}$$

$$= 0.23 \frac{\text{N}}{\text{kg}}$$

8. $m_Y = 3m_x$
$r_Y = 2r_x$

WEIGHT ON PLANET X → $F_{g_x} = G\frac{m_x m_o}{r_x^2}$ ← MASS OF OBJECT

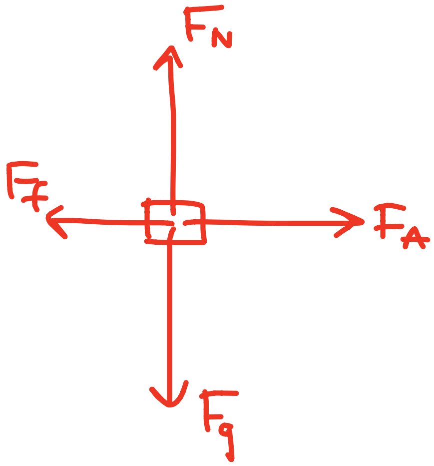
WEIGHT ON PLANET Y →
$$F_{g_Y} = G\frac{m_Y m_o}{r_Y^2}$$
$$= G\frac{(3m_x)m_o}{(2r_x)^2}$$
$$= G\frac{3m_x m_o}{4r_x^2}$$
$$= \frac{3}{4}\left(G\frac{m_x m_o}{r_x^2}\right) \quad (= F_{g_x})$$
$$= \frac{3}{4}F_{g_x}$$
$$F_{g_x} = \frac{4}{3}F_{g_Y}$$

WEIGHT ON PLANET X IS GREATER BY A FACTOR OF $\frac{4}{3}$.

9. a) GIVEN:
$m = 1.31 \times 10^{22}$ kg
$r = 1.18 \times 10^{6}$ m

$$g = G\frac{m}{r^2}$$
$$= (6.67\times10^{-11})\frac{(1.31\times10^{22})}{(1.18\times10^{6})^2}$$
$$= 0.63 \ \frac{N}{kg}$$

b)



$$F_N = F_g$$
$$= m g_{PLUTO}$$

$$F_{NET} = ma$$
$$F_A - F_f = ma$$
$$F_A - \mu F_N = ma$$
$$F_A - \mu m g_{PLUTO} = ma$$

$$a = \frac{F_A - \mu m g_{PLUTO}}{m}$$

$$= \frac{90. - (0.70)(60.0)(0.63)}{60.0}$$

$= 1.1 \frac{m}{s^2}$ RIGHT (in the DIRECTION OF THE PUSH)