LAMC Physical Science 1 Homework #3 Solution

Ch 3

Matching

a.3

g.15

h.6

j.10

l.12

r.5

m.7

Multiple Choice

1.d

2.d

4.b

5.a

8.b

10.a

14.d

Fill in the blank

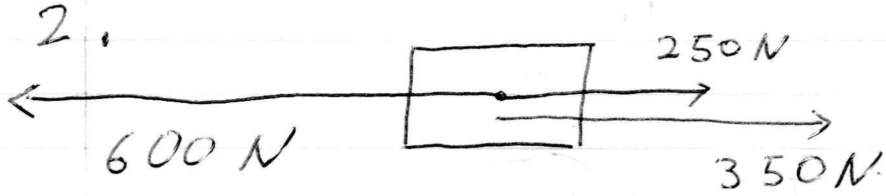
7.Kg m/s^2

13.net or unbalanced

Exercises

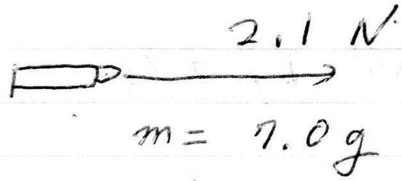
Ch 3

2.



In order to balance the force, $\boxed{350N}$ is needed in the direction of 250 N force.

4.



$F = 2.1 N$

$m = 7.0 g \times \frac{1 kg}{1000 g}$

$= 7.0 \times 10^{-3} kg$

$a = ??$

$F = ma$

$a = \frac{F}{m}$

$= 2.1 N \times \frac{1}{7.0 \times 10^{-3} kg}$

$\boxed{= 300 \, m/s^2}$

6.

$F = 1500 N$

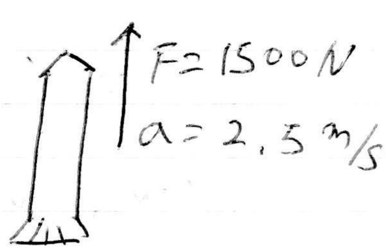
$a = 2.5 m/s^2$

$m = ??$

$m = \frac{F}{a}$

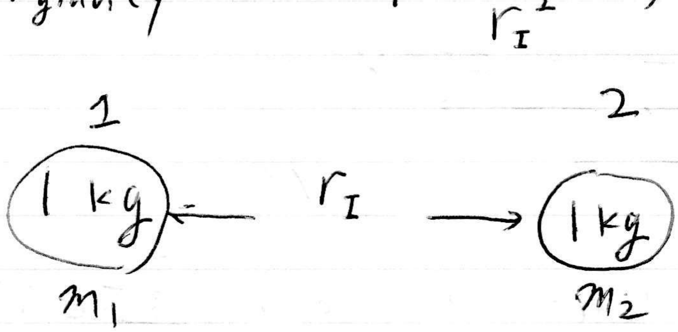
$= \frac{1500 N}{2.5 m/s^2}$

$= 600 kg$



14.

$$F_{gravity} = G\frac{m_1 m_2}{r_I^2}, \text{ where } G = 6.67\times10^{-11}\,N\cdot m^2/kg^2$$



We can set $r_I = 1\,m$ without destroying generality because we only care about ratio between two cases,

(a) r_I is decreased by 2/3

$\Rightarrow r_{II} = 1/3\ m$.

$$F_I = G\frac{m_1 m_2}{r_I^2}$$

$$= G\frac{1\,kg \times 1\,kg}{1\,m^2}$$

$$= 6.67\times10^{-11}\,N\cdot\frac{\cancel{m^2}}{\cancel{kg^2}}\cdot\frac{1\,\cancel{kg^2}}{1\,\cancel{m^2}}$$

$$= 6.67\times10^{-11}\,N$$

Now, we will calculate F_{II} with $r_{II} = \frac{1}{3}m$

$$F_{II} = G \times \frac{1\,kg \times 1\,kg}{\underbrace{(\frac{1}{3} m)^2}_{r_{II}}}$$

$$= 6.67 \times 10^{-11} N \frac{\cancel{m^2}}{\cancel{kg^2}} \times \frac{1\,\cancel{kg^2}}{\frac{1}{9}\cancel{m^2}}$$

$$= 9 \times \underbrace{6.67 \times 10^{-11} N}_{F_I}$$

Thus $\boxed{F_{II} = 9\ F_I}$ F is increased by a factor of 9/4

(b) r is increased by a factor of 3.

$$r_{III} = 3 m$$

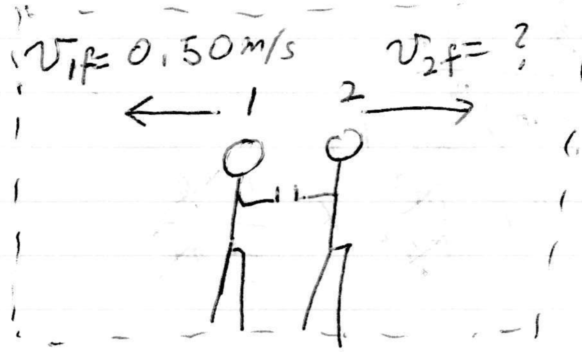
$$F_{III} = G \times \frac{1\,kg \times 1\,kg}{\underbrace{(3 m)^2}_{r_{III}}}$$

$$= 6.67 \times 10^{-11} N \frac{\cancel{m^2}}{\cancel{kg^2}} \times \frac{1\,\cancel{kg^2}}{9\,\cancel{m^2}}$$

$$= \frac{1}{9} \times \underbrace{6.67 \times 10^{-11} N}_{F_I}$$

$$\boxed{F_{III} = \frac{1}{9} F_I}$$ F is decreased by 1/9

21.



There are force between two people, but No external force is exerted. Thus, momentum is conserved.

$W_1 = 735\,N$ $\quad W_2 = 490\,N$

$v_{1f} = 0.50\,m/s$

$w_1 = 735\,N = m_1 g$

$w_2 = 490\,N = m_2 g$

$v_{2f} = ??$

$v_{1o} = 0\,m/s$

$v_{2o} = 0\,m/s$

First, we need to find the masses of the two people.

$$W = mg$$

$$m = \frac{w}{g}$$

$$m_1 = \frac{w_1}{g} = \frac{735\,N}{10\,m/s^2} = 73.5\,kg$$

$$m_2 = \frac{w_2}{g} = \frac{490\,N}{10\,m/s^2} = 49\,kg$$

Since both of them are at rest initially, initial momentum is zero.

$$P_i = m_1 \underbrace{v_{1o}}_{0} + m_2 \underbrace{v_{1o}}_{0}$$

Final momentum is

$$P_f = m_1 v_{1f} + m_2 v_{2f}$$

$$= 73.5\,kg \times 0.50\,m/s + 49\,kg \times v_{2f}$$

Since $P_i = P_f$,

$$73.5\,kg \times 0.50\,m/s + 49\,kg \times v_{2f} = 0$$

$$49\,kg \times v_{2f} = -36.75\,kg\,m/s$$

$$\frac{\cancel{49kg}\,v_{2f}}{\cancel{49kg}} = -\frac{36.75\,\cancel{kg}\,m/s}{49\,\cancel{kg}}$$

$$\boxed{v_{2f} = -0.75\,m/s}$$

Negative number means that she is moving in the opposite direction.