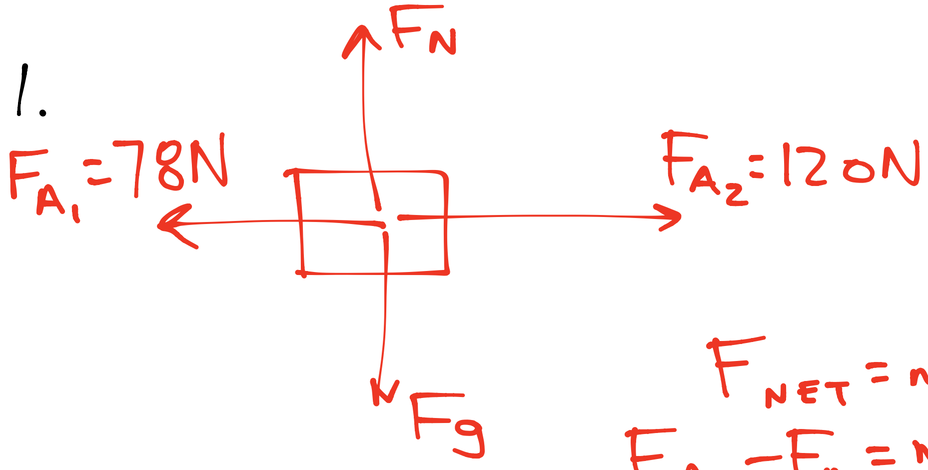
DYNAMICS REVIEW- SOLUTIONS

1.



$$F_{NET} = ma$$

$$F_{A_2} - F_{A_1} = ma$$

$$a = \frac{F_{A_2} - F_{A_1}}{m}$$

$$= \frac{120 - 78}{940}$$

$$= 0.045 \frac{m}{s^2}$$

RIGHT

2. NEWTON'S FIRST LAW
THE PASSENGER HAS INERTIA. UNTIL A FORCE (FROM THE BUS) ACTS ON THE PASSENGER, HE/SHE CONTINUES TO MOVE AT A CONSTANT VELOCITY (FORWARD).

∴ AS THE BUS SLOWS DOWN, THE PASSENGER DOES NOT

3. KINEMATICS:

$v_i = 0$

$v_f = 16\ \frac{m}{s}$

$t = 5.0\ s$

$a = ?$

$$v_f = \cancelto{0}{v_i} + at$$

$$v_f = at$$

$$a = \frac{v_f}{t}$$

$$= \frac{16}{5}$$

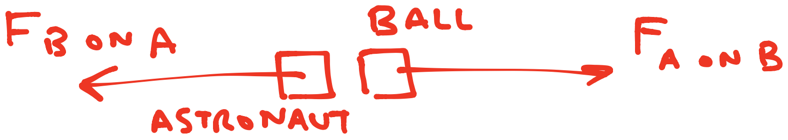
$$= 3.2\ \frac{m}{s^2}$$

$$F_{NET} = ma$$

$$= (1200)(3.2)$$

$= 3840N$ IN THE DIRECTION OF THE FINAL VELOCITY

4. a)



NEWTON'S THIRD LAW

$$F_{B\ on\ A} = -F_{A\ on\ B}$$

$$= -m_B a_B$$

$$= -(2.4)(3.3)$$

$$= -7.92\ N$$

7.9 N LEFT (DIRECTION OPPOSITE OF $F_{A\ on\ B}$)

b)

$$F_{NET} = ma$$

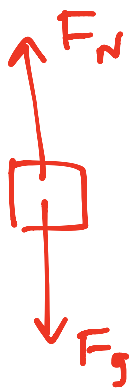
$$a = \frac{F_{NET}}{m}$$

$$= \frac{-7.92}{86}$$

$$= 0.092 \ \frac{m}{s^2} \text{ LEFT}$$

(DIRECTION OPPOSITE OF $F_{A \text{ on } B}$)

5 a)



$$F_{net} = ma$$

$$F_N - F_g = 0$$

$$F_N = F_g$$

$$= mg$$

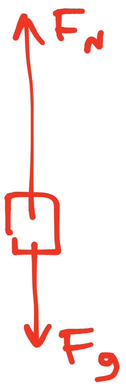
$$= (62)(9.8)$$

$$= 608 \text{ N}$$

610N

$a = 0$
constant
speed

b)



$$F_{NET} = ma$$

$$F_N - F_g = ma$$

$$F_N - mg = ma$$

$$F_N = ma + mg$$

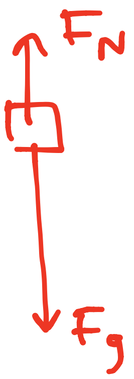
$$= m(a+g)$$

$$= 62(1.8+9.8)$$

$$= 719 \text{ N}$$

720N

c)



$F_{NET} = ma$

$F_N - F_g = ma$

$F_N - mg = ma$

$F_N = ma + mg$

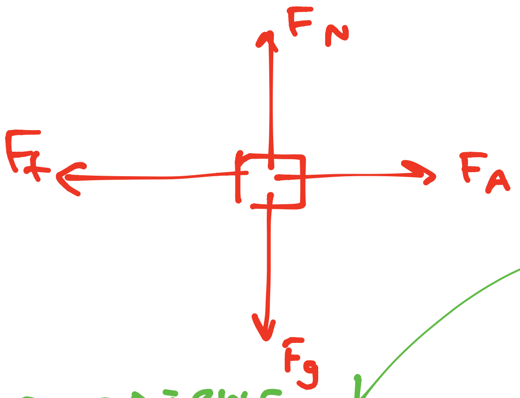
$= m(a+g)$

$= 62(-2.5+9.8)$

$= 453\,N$

$450N$

6. a)



$F_N = F_g$

$= mg$

UP/DOWN
BALANCED

$F_{NET} = ma$

SEE NOTE

$F_A - F_f = 0$

$F_A = F_f$

$= \mu_s F_N$

$= \mu_s mg$

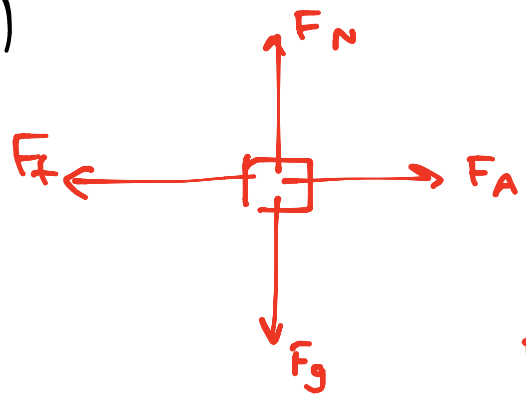
$\mu_s = \frac{F_A}{mg}$

$= \frac{170}{(38)(9.8)}$

$= 0.46$

WHEN CONSIDERING
THE SCENARIO WHERE
AN OBJECT JUST
STARTS TO MOVE,
USE μ_s AND $a=0$

b)



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

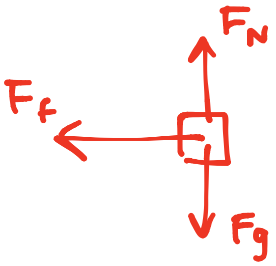
UP/DOWN
BALANCED

$$F_{NET} = ma$$

a = 0
CONSTANT
VELOCITY

$$F_A - F_f = 0$$
$$F_A = F_f$$
$$= \mu_k F_N$$
$$= \mu_k m g$$
$$\mu_k = \frac{F_A}{mg}$$
$$= \frac{120}{(38)(9.8)}$$
$$= 0.32$$

7.



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

UP/DOWN
BALANCED

$$F_{NET} = ma$$
$$-F_f = ma$$
$$-\mu F_N = ma$$
$$-\mu \cancel{m} g = \cancel{m} a$$
$$-\mu g = a$$
$$a = -(0.62)(9.8)$$
$$= -6.076 \ \frac{m}{s^2}$$

KINEMATICS:

$a = -6.076\ \frac{m}{s^2}$

$v_i = 18\ \frac{m}{s}$

$v_f = 0$

$d = ?$

$$\cancelto{0}{v_f^2} = v_i^2 + 2ad$$

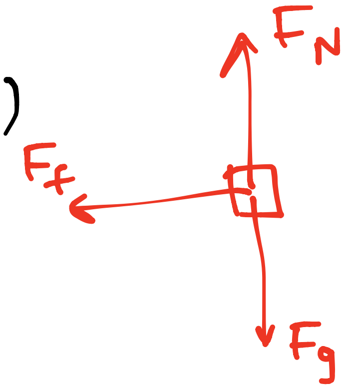
$$0 = v_i^2 + 2ad$$

$$d = -\frac{v_i^2}{2a}$$

$$= \frac{-18^2}{2(-6.076)}$$

$$= 27\ m$$

8. a)



$F_N = F_g$ UP/DOWN BALANCED

$= mg$

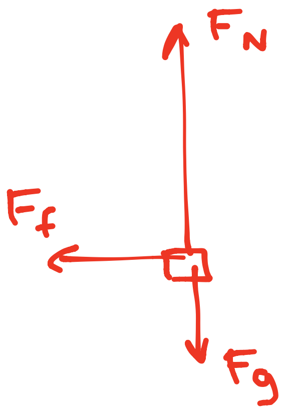
$F_f = \mu F_N$

$= \mu mg$

$= (0.28)(4.8)(9.8)$

$= 13\ N$ LEFT (DIRECTION OPPOSITE OF ITS VELOCITY)

b)



CONSIDER ONLY UP/DOWN MOTION to FIND F_N:

$$F_{NET} = ma$$

$$F_N - F_g = ma$$

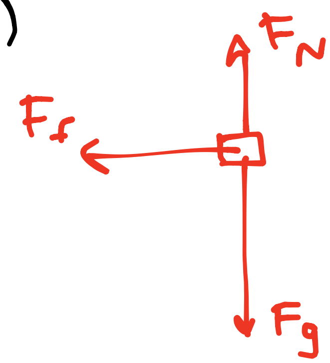
$$F_N - mg = ma$$

$$F_N = ma + mg$$
$$= m(a+g)$$
$$= 4.8(1.6+9.8)$$
$$= 54.72\ N$$

$$F_f = \mu F_N$$
$$= (0.28)(54.72)$$
$$= 15N$$ LEFT (DIRECTION OPPOSITE OF ITS VELOCITY)

FRICTION INCREASES AS F_N INCREASES

c)



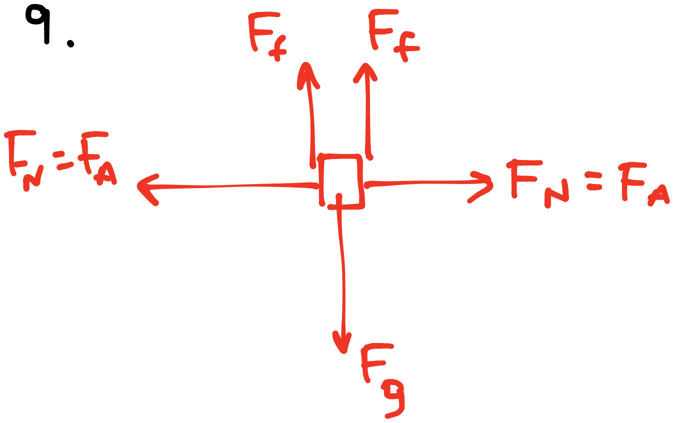
CONSIDER ONLY UP/DOWN MOTION TO FIND F_N:

$$F_{NET} = ma$$
$$F_N - F_g = ma$$
$$F_N - mg = ma$$
$$F_N = ma + mg$$
$$= m(a+g)$$
$$= 4.8(-1.6+9.8)$$
$$= 39.36N$$

$$F_f = \mu F_N$$
$$= (0.28)(39.36)$$
$$= 11N$$ LEFT (DIRECTION OPPOSITE OF ITS VELOCITY)

FRICTION DECREASES AS F_N DECREASES

9.



$F_{NET} = ma$

a = 0
NOT
FALLING

$F_f + F_f - F_g = 0$

$2F_f - F_g = 0$

$2\mu F_N - mg = 0$

$2\mu F_A - mg = 0$

$$F_A = \frac{mg}{2\mu}$$

$$= \frac{(3.2)(9.8)}{2(0.53)}$$

$$= 30.\text{ N}$$