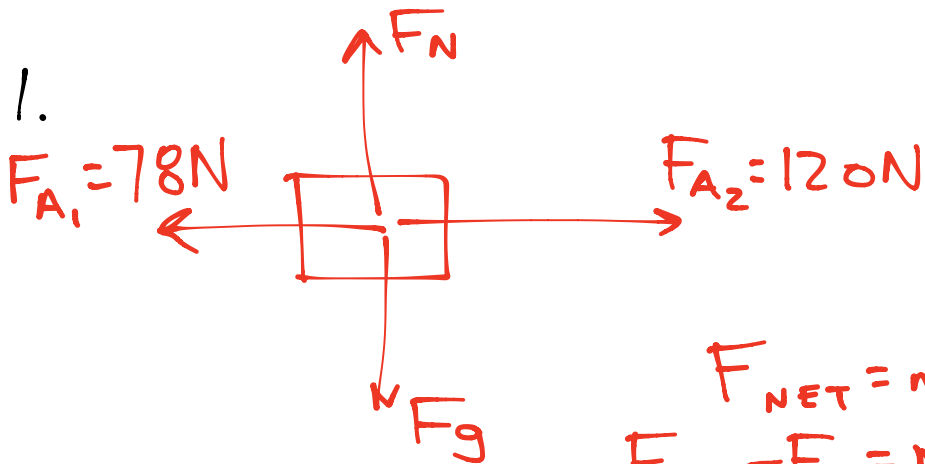


DYNAMICS REVIEW- SOLUTIONS



$$\begin{aligned}F_{\text{NET}} &= ma \\F_{A_2} - F_{A_1} &= ma \\a &= \frac{F_{A_2} - F_{A_1}}{m} \\&= \frac{120 - 78}{940} \\&= 0.047 \frac{\text{m}}{\text{s}^2} \\&\text{RIGHT}\end{aligned}$$

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).

\therefore AS THE BUS SLOWS DOWN, THE PASSENGER DOES NOT

3. KINEMATICS:

$$v_i = 0$$

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

$$t = 5.0 s$$

$$a = ?$$

$$v_f = v_i + at$$

$$v_f = at$$

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

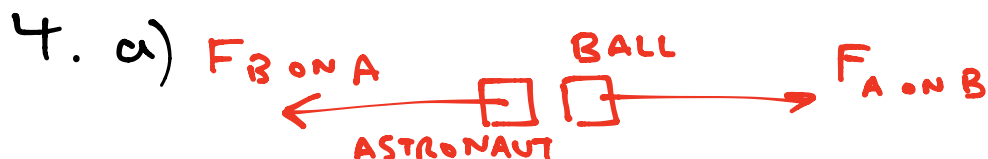
$$= \frac{16}{5}$$

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

$$F_{NET} = ma$$

$$= (1200)(3.2)$$

$$= 3840 N \text{ IN THE DIRECTION OF THE FINAL VELOCITY}$$



NEWTON'S THIRD LAW

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

$$= -m_B a_B$$

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

$$= -7.92 N$$

$$7.9 N \text{ LEFT}$$

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

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 OR B)

5 a)



$$F_{NET} = ma \quad a = 0 \text{ CONSTANT SPEED}$$

$$F_N - F_g = 0$$

$$F_N = F_g$$

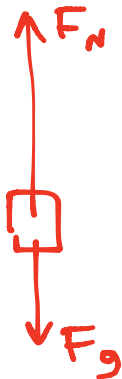
$$= mg$$

$$= (62)(9.8)$$

$$= 608 \text{ N}$$

610N

b)



$$F_{NET} = ma$$

$$F_N - F_g = ma$$

$$F_N - mg = ma$$

$$F_N = ma + mg$$

$$= m(a + g)$$

$$= 62(1.8 + 9.8)$$

$$= 719 \text{ N}$$

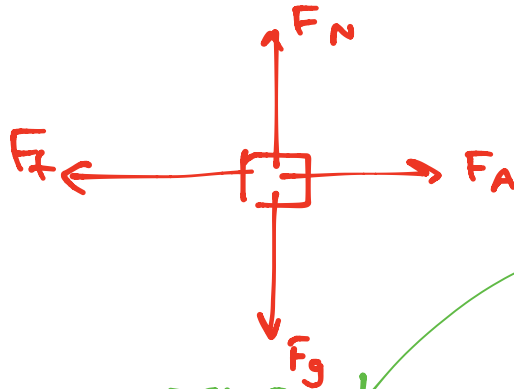
720N

c)



$$\begin{aligned}
 F_{NET} &= ma \\
 F_N - F_g &= ma \\
 F_N - mg &= ma \\
 F_N &= ma + mg \\
 &= m(a + g) \\
 &= 62(-2.5 + 9.8) \\
 &= 453 \text{ N} \\
 &= \mathbf{450 \text{ N}}
 \end{aligned}$$

6. a)



$$\begin{aligned}
 F_N &= F_g \\
 &= mg
 \end{aligned}$$

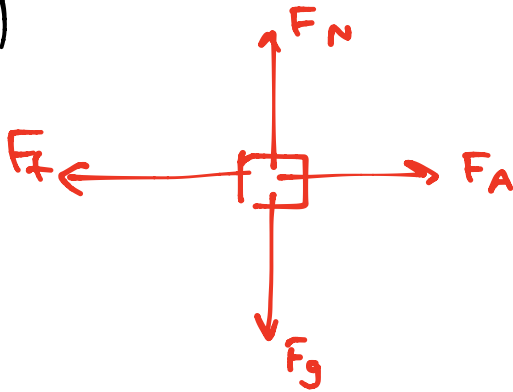
UP/DOWN
BALANCED

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

$$\begin{aligned}
 F_{NET} &= ma \\
 F_A - F_f &= 0 \\
 F_A &= F_f \\
 &= \mu_s F_N \\
 &= \mu_s mg \\
 \mu_s &= \frac{F_A}{mg} \\
 &= \frac{170}{(38)(9.8)} \\
 &= \mathbf{0.46}
 \end{aligned}$$

SEE NOTE

b)



$$F_N = F_g = mg \quad \text{UP/DOWN BALANCED}$$

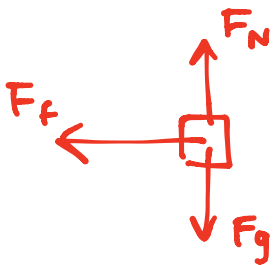
$$F_{NET} = ma \quad a = 0 \quad \text{CONSTANT VELOCITY}$$

$$F_A - F_f = 0$$

$$F_A = F_f = \mu_k F_N = \mu_k mg$$

$$\mu_k = \frac{F_A}{mg} = \frac{120}{(38)(9.8)} = 0.32$$

7.



$$F_N = F_g = mg \quad \text{UP/DOWN BALANCED}$$

$$F_{NET} = ma$$

$$-F_f = ma$$

$$-\mu F_N = ma$$

$$-\cancel{\mu} \cancel{mg} = \cancel{m} a$$

$$-\mu g = a$$

$$a = -(0.62)(9.8) = -6.076 \frac{m}{s^2}$$

KINEMATICS:

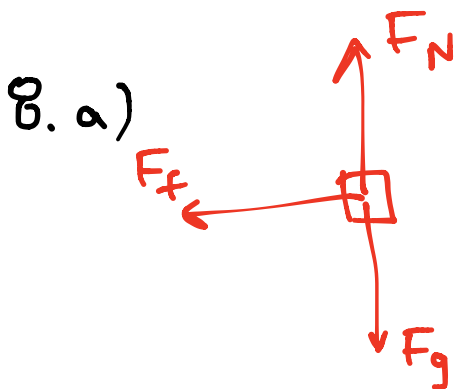
$$a = -6.076 \frac{m}{s^2}$$

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

$$v_f = 0$$

$$d = ?$$

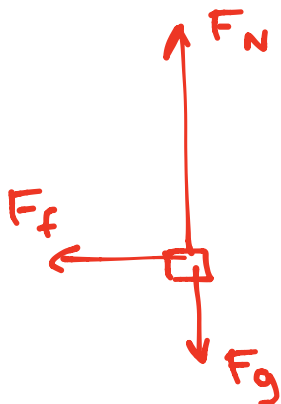
$$\begin{aligned} v_f^2 &= v_i^2 + 2ad \\ 0 &= v_i^2 + 2ad \\ d &= \frac{-v_i^2}{2a} \\ &= \frac{-18^2}{2(-6.076)} \\ &= 27 \text{ m} \end{aligned}$$



$$\begin{aligned} F_N &= F_g \\ &= mg \end{aligned} \quad \begin{array}{l} \text{UP/DOWN} \\ \text{BALANCED} \end{array}$$

$$\begin{aligned} F_f &= \mu F_N \\ &= \mu mg \\ &= (0.28)(4.8)(9.8) \\ &= 13 \text{ N LEFT} \\ &\quad \text{(DIRECTION OPPOSITE} \\ &\quad \text{OF ITS VELOCITY)} \end{aligned}$$

b)



CONSIDER ONLY
UP/DOWN MOTION TO
FIND F_N :

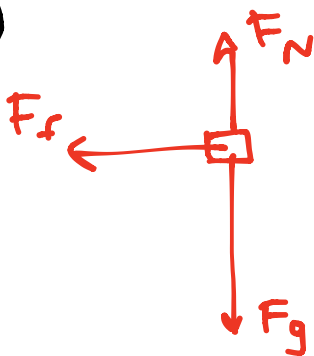
$$\begin{aligned} F_{NET} &= ma \\ F_N - F_g &= ma \\ F_N - mg &= ma \end{aligned}$$

$$\begin{aligned}
 F_N &= ma + mg \\
 &= m(a + g) \\
 &= 4.8(1.6 + 9.8) \\
 &= 54.72 \text{ N}
 \end{aligned}$$

$$\begin{aligned}
 F_f &= \mu F_N \\
 &= (0.28)(54.72) \\
 &= 15 \text{ N LEFT (DIRECTION} \\
 &\quad \text{OPPOSITE OF ITS VELOCITY)}
 \end{aligned}$$

FRICION INCREASES AS F_N INCREASES

c)



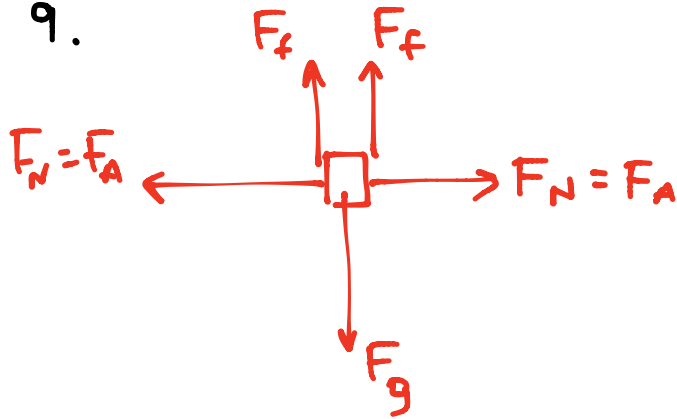
CONSIDER ONLY UP/DOWN MOTION TO FIND F_N :

$$\begin{aligned}
 F_{NET} &= ma \\
 F_N - F_g &= ma \\
 F_N - mg &= ma \\
 F_N &= ma + mg \\
 &= m(a + g) \\
 &= 4.8(-1.6 + 9.8) \\
 &= 39.36 \text{ N}
 \end{aligned}$$

$$\begin{aligned}
 F_f &= \mu F_N \\
 &= (0.28)(39.36) \\
 &= 11 \text{ N LEFT (DIRECTION} \\
 &\quad \text{OPPOSITE OF ITS VELOCITY)}
 \end{aligned}$$

FRICION DECREASES AS F_N DECREASES

9.



$$F_{NET} = ma$$

$a = 0$
NOT
FALLING

$$F_f + F_f - F_g = 0$$

$$2F_f - F_g = 0$$

$$2\mu F_N - mg = 0$$

$$2\mu F_A - mg = 0$$

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

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

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