FORCES EXERCISE 1

Solutions

NAME: _____ DATE: _____

$$F_{grav} = \frac{G * m_1 * m_2}{d^2}$$

where G represents the universal gravitation constant

($G = 6.67 \times 10^{-11}\ N \cdot m^2 / kg^2$)

(1) Determine the force of gravitational attraction between the earth ($m = 5.98 \times 10^{24}$ kg) and a 70-kg physics student if the student is standing at sea level, a distance of 6.37×10^6 m from earth's center.

$$F = \frac{(6.67\times10^{-11})(70)(5.98\times10^{24})}{(6.37\times10^{6})^2}$$

$F = 688\ N$

(2) Suppose that two objects attract each other with a force of 16 units. If the mass of both objects was doubled, and if the distance between the objects remained the same, then what would be the new force of attraction between the two objects?

$F \propto m$ F

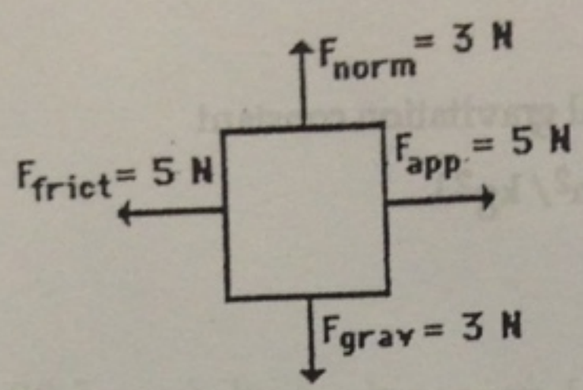
$m_1, m_2 \rightarrow 2m \cdot 2m$

$\therefore F \times 4 = 16 \times 4$

$F = 64\ N$

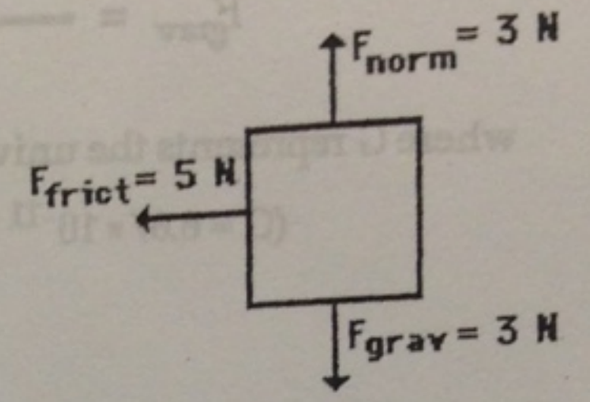
(3) Free-body diagrams for four situations are shown below. For each situation, determine the net force acting upon the object.

Situation A

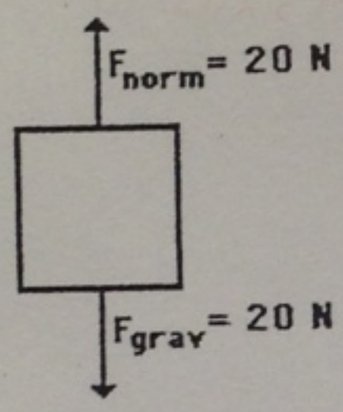


$F_{net} = 0\ N$

Situation B

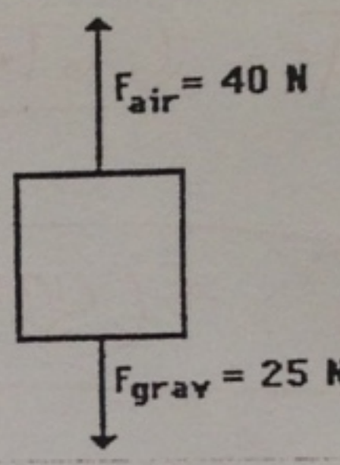


Situation C



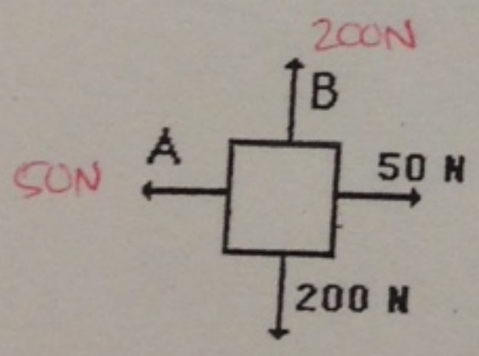
$F_{net} = 0\ N$

Situation D

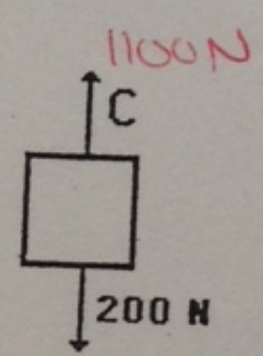


$F_{net} = 15\ N$

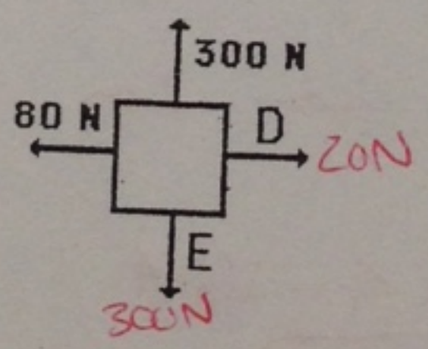
(4) Free-body diagrams for four situations are shown below. The net force is known for each situation. However, the magnitudes of a few of the individual forces are not known. Analyze each situation individually and determine the magnitude of the unknown forces.



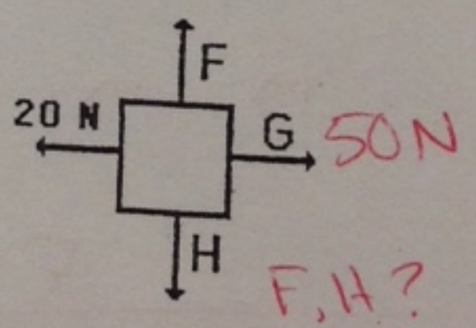
F_{net} = 0 N



F_{net} = 900 N, up



F_{net} = 60 N, left

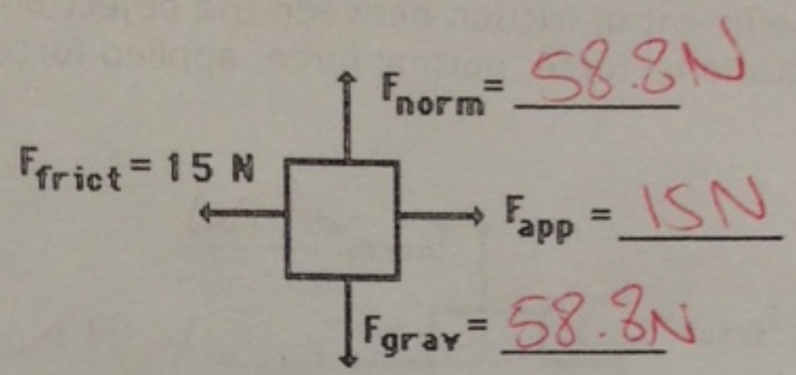


F_{net} = 30 N, right

Force Resolution Problems

Practice #1

A rightward force is applied to a 6-kg object to move it across a rough surface at constant velocity. The object encounters 15 N of frictional force. Use the diagram to determine the gravitational force, normal force, net force, and applied force. (Neglect air resistance.)



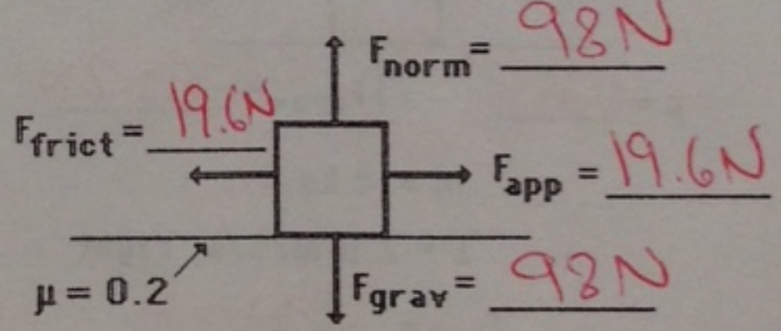
m = 6 kg

a = 0 m/s/s

F_{net} = 0N

Practice #2

A rightward force is applied to a 10-kg object to move it across a rough surface at constant velocity. The coefficient of friction between the object and the surface is 0.2. Use the diagram to determine the gravitational force, normal force, applied force, frictional force, and net force. (Neglect air resistance.)



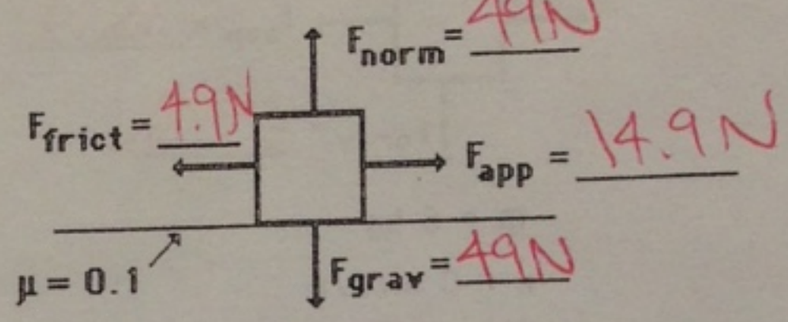
m = 10 kg

a = 0 m/s/s

F_{net} = 0N

Practice #3

A rightward force is applied to a 5-kg object to move it across a rough surface with a rightward acceleration of 2 m/s/s. The coefficient of friction between the object and the surface is 0.1. Use the diagram to determine the gravitational force, normal force, applied force, frictional force, and net force. (Neglect air resistance.)



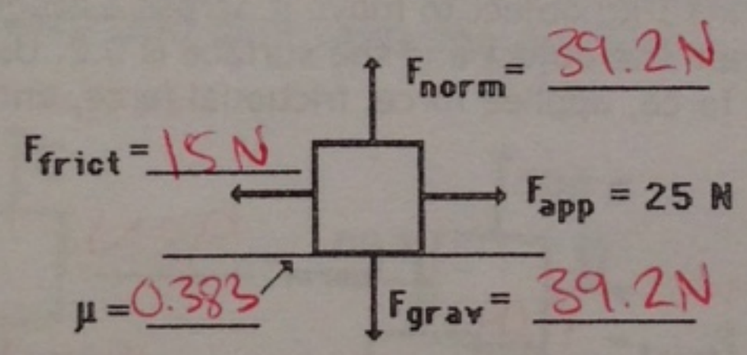
m = 5 kg

a = 2 m/s/s, right

F_{net} = 10N right

Practice #4

A rightward force of 25 N is applied to a 4-kg object to move it across a rough surface with a rightward acceleration of 2.5 m/s/s. Use the diagram to determine the gravitational force, normal force, frictional force, net force, and the coefficient of friction between the object and the surface. (Neglect air resistance.)



m = 4 kg

a = 2.5 m/s/s, right

F_{net} = 10N righ

1. Lee Mealone is sledding with his friends when he becomes disgruntled by one of his friends comments. He exerts a rightward force of 9.13 N on his 4.68-kg sled to accelerate it across the snow. If the acceleration of the sled is 0.815 m/s/s, then what is the coefficient of friction between the sled and the snow.

$F_n = 45.86N$

$a = 0.815 m/s^2$

$F_{net} = (4.68)(0.815)$

$F_{net} = 3.81N$

$F_{Fr} = 9.13 - 3.81$

$F_{Fr} = 5.32N$

$F_{app} = 9.13N$

$m = 4.68kg$

$F_g = (4.68)(9.8)$

$F_g = 45.86N$

$\mu = \frac{5.32}{45.86}$

$\mu = 0.116$

2. In a Physics lab, Ernesto and Amanda apply a 34.5 N rightward force to a 4.52-kg cart to accelerate it across a horizontal surface at a rate of 1.28 m/s/s. Determine the friction force acting upon the cart.

$F_n = 44.3N$

$a = 1.28 m/s^2$

$F_{Fr} = 34.5 - 5.79$

$F_{net} = 4.52(1.28)$

$F_{Fr} = 28.71N$

$F_{net} = 5.79N$

$F_{app} = 34.5N$

4.52kg

$F_g = (4.52)(9.8)$

$F_g = 44.3N$