

Name: _____

Forces in Equations

3.7

A For each stated *action force*, identify the *reaction force*.



Bat hits ball.



Man pushes car.

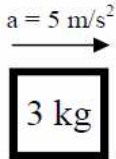


Bus hits bug.

A force is a push or pull resulting from an interaction between two objects. Whenever there is a force, there are two objects involved - with both objects pushing (or pulling) on each other in opposite directions. While the direction of the pushes (or pulls) are opposite, the strength or magnitudes are equal. This is sometimes stated as Newton's Third Law of motion: *for every action, there is an equal and opposite reaction*. A force is a push or a pull and it always results from an interaction between two objects. These forces always come in pairs.

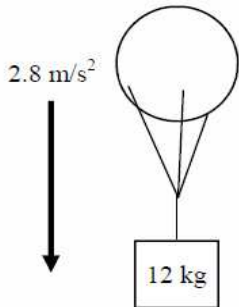
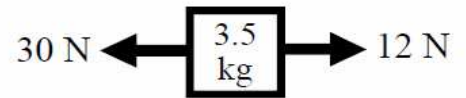


Identify by words the action-reaction force pairs in each of the following diagrams.



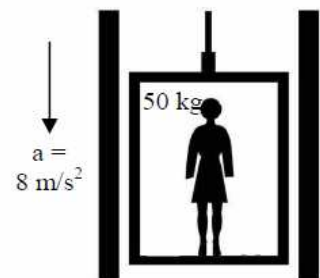
1. A 3 kg object is accelerating 5 m/s^2 to the right. Calculate the net force acting on the object.

2. Calculate the acceleration of the object at the right.



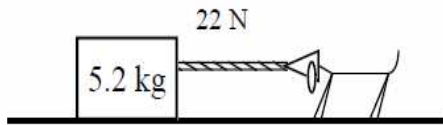
3. A. Draw a force diagram for the object at the left next to the object.
- B. Is the acceleration positive or negative?
- C. Calculate the tension in the rope.

4. A. Draw the force diagram for the lady in the elevator.
- B. Is the acceleration positive or negative?
- C. Figure out the normal force acting on the lady.



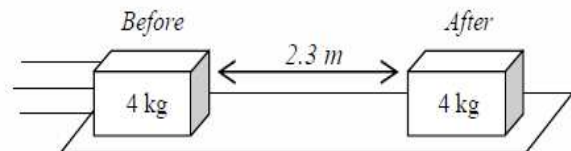
D. Does she feel lighter or heavier than normal?

$\mu_s = .35$
 $\mu_k = .2$



5. Bim is pulling a 5.2 kg object with 22 N. The floor has friction.
 - A. Which way does friction act?
 - B. Draw a force diagram for the object.
 - C. Write the equation for friction:
 - D. Calculate both types of friction acting on the object.
 - E. If the object started at rest, does it start to slide?
 - F. Why?
 - G. If the object is already moving, calculate its acceleration.

6. What is the Newton's Third Law force pair for each of the following forces found in the diagram above.
 - A. The force of gravity pulling down on Bim.
 - B. The force of tension pulling on the mass.
 - C. The normal force of the floor on Bim's feet.
 - D. The force of friction of the floor on a block.
7. The normal force acting on the object above is equal to the force of its weight. Why is this not a Third Law Action-Reaction pair?
8. A 4 kg object slides to a stop due to friction in 4.8 seconds.
 - A. Draw a force diagram of the object while it is moving.
 - B. Use a kinematic equation to find the acceleration of the object.



- C. Find the force that slowed down the object.
- D. Use the friction equation to find the coefficient of friction (μ) of the surface.

9. Slim Jim's spaceship the "Galactic Cruiser" is 1.8×10^8 m from the center of the earth. Calculate the force of gravity on the ship.

