

1. Two men pull on a 940 kg refrigerator initially at rest. One pulls with a force of 78 N to the left. The other pulls with a force of 120 N to the right. What is the acceleration of the refrigerator? Assume there is no friction.
2. When the driver of a bus hits the brakes suddenly, a passenger sitting in the rear of the bus moves towards the front of the bus. Using principles of physics, explain the reason for this.
3. A car has a mass of 1200 kg. Find the net force needed to accelerate the car from rest to 16 m/s in 5.0 s.
4. An 86 kg astronaut pushes on a 2.4 kg ball initially at rest in outer space. As a result, the ball moves with an acceleration of  $3.3 \text{ m/s}^2$ .
  - a. Compare the force experienced by the astronaut with the force experienced by the ball.
  - b. Find the astronaut's acceleration.
5. **Elevator Problem.** A 62 kg man stands in an elevator. Determine the man's apparent weight for the following scenarios. (Apparent weight is the normal force)
  - a. The elevator is moving upward at a constant speed of 2.2 m/s.
  - b. The elevator is accelerating upwards at  $1.8 \text{ m/s}^2$ .
  - c. The elevator is accelerating downwards at  $2.5 \text{ m/s}^2$ .
6. A 38 kg crate rests on a horizontal floor. A horizontal pulling force of 170 N is needed to start the crate moving. After it is in motion, a horizontal pulling force of 120 N is needed to slide the crate across the floor at a constant speed.
  - a. Find the coefficient of static friction between the crate and the floor.
  - b. Find the coefficient of kinetic friction between the crate and the floor.
7. A car is travelling at 18 m/s on a horizontal road. The driver of the car locks the wheels by slamming on the brakes. The coefficient of kinetic friction between the tires and the road is 0.62. Find the stopping distance of the car.
8. **Another elevator problem.** A 4.8 kg suitcase is sliding across a horizontal floor of an elevator. The coefficient of kinetic friction between the suitcase and the floor is 0.28.
  - a. If the elevator is moving upward at a constant speed of 1.6 m/s, find the kinetic frictional force acting on the suitcase.
  - b. If the elevator is accelerating upwards at  $1.6 \text{ m/s}^2$ , find the kinetic frictional force acting on the suitcase.
  - c. If the elevator is accelerating downwards at  $1.6 \text{ m/s}^2$ , find the kinetic frictional force acting on the suitcase.
9. A 3.2 kg chunk of wood is pressed between two hands. The forces, equal in magnitude, act on opposite sides of the block and are perpendicular to the chunk of wood. The coefficient of static friction between the hands and the wood is 0.53. Find the magnitude of the minimum pressing force exerted by each hand to keep the chunk of wood from falling. (Remember that the normal force is not always upwards.)