Physics 2100 Review of Chapters 4, and 5

1. A large heavy box sits on the bed of a pickup truck. Suddenly the pickup truck accelerates forward and the box begins to slide towards the back of the truck. The bed of the truck is not frictionless.

Draw free body diagrams with labeled forces for both the box and the truck. Mark any action/reaction force pairs with 'X's on their stems.

2. A 5.6 kg bucket of water is accelerated upwards by a cord with a breaking strength of 75 N. What is the minimum time in which the bucket can be raised 12 meters while it is accelerating?

3. Two blocks connected by a light horizontal rope sit at rest on a horizontal, frictionless surface. Block A has mass 15.0 kg, and block B has mass m. A constant horizontal force $F = 60.0$ N is applied to block A (**Fig. P4.40**). In the first 5.00 s after the force is applied, block A moves 18.0 m to the right. (a) While the blocks are moving, what is the tension T in the rope that connects the two blocks? (b) What is the mass of block B?

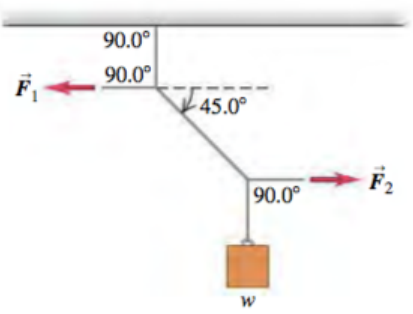
Figure **P4.40**

4. You have a weight, near the surface of the earth, of 683 N. If you are in an elevator standing on a scale that reads 725 N, what is the magnitude and direction of the elevator's acceleration?

What are they if the scale reads 595 N?

5. In **Fig. E5.10** the weight *w* is 60.0 N. (a) What is the tension in the diagonal string? (b) Find the magnitudes of the horizontal forces ***F1*** and ***F2*** that must be applied to hold the system in the position shown.

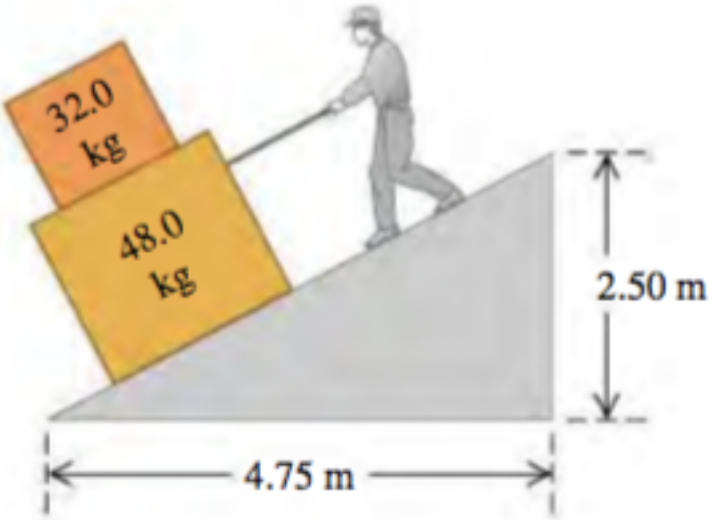
Figure **E5.10**



6. An 8.00-kg block of ice, released from rest at the top of a 1.50-m-long frictionless ramp, slides downhill, reaching a speed of 2.50 m/s at the bottom. (a) What is the angle between the ramp and the horizontal? (b) What would be the speed of the ice at the bottom if the motion were opposed by a constant friction force of 10.0 N parallel to the surface of the ramp?

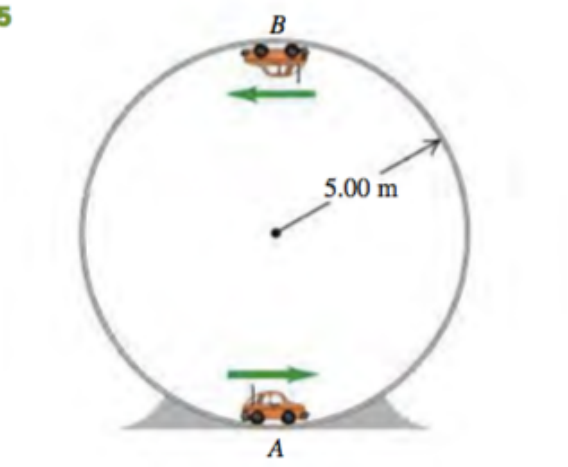
7. You are lowering two boxes, one on top of the other, down a ramp by pulling on a rope parallel to the surface of the ramp (**Fig. E5.33**). Both boxes move together at a constant speed of 15.0 cm/s. The coefficient of kinetic friction between the ramp and the lower box is 0.444, and the coefficient of static friction between the two boxes is 0.800. (a) What force do you need to exert to accomplish this? (b) What are the magnitude and direction of the friction force on the upper box?

Figure **E5.33**



8. A small car with mass 0.800 kg travels at constant speed on the inside of a track that is a vertical circle with radius 5.00 m (Fig. E5.45). If the normal force exerted by the track on the car when it is at the top of the track (point *B*) is 6.00 N, what is the normal force on the car when it is at the bottom of the track (point *A*)?

Figure **E5.45**



9. A 1125-kg car and a 2250-kg pickup truck approach a curve on a highway that has a radius of 225 m. (a) At what angle should the highway engineer bank this curve so that vehicles traveling at 65.0 mi/h can safely round it regardless of the condition of their tires? Should the heavy truck go slower than the lighter car?