Physics 122 - Inclines and Pulleys

1. A box weighing 500 N is being pulled across a level floor at a constant speed by a force of 50.0 N that acts upward at an angle of 30° to the floor.

   a. What is the force that actually pulls the box along the floor? (43.3 N)
   b. What is the force of friction that opposes the motion? (43.3 N)
   c. What is the normal force in this case? (475 N)
   d. What is the coefficient of friction? (0.0912)

2. A truck weiging 3000 N is being pushed across a level floor with a constant speed by a force of 500 N that acts downward at 20° to the floor.

   a. What is the force of friction acting on the bottom of the truck? (470 N)
   b. What is the normal force? $(3.17 \times 10^3$ N)
   c. What is the coefficient of friction? (0.148)

3. A car weighing 1.5×10^4 N is parked on a hill that is 10.0 m long and 5.0 m high. The angle of elevation of the inclined plane, therefore is 30°.

   a. What is the component of the car's weight that acts down on the hill? $(7.5 \times 10^3$ N)
   b. What is the component of the car's weight that acts perpendicular to the hill? $(1.3 \times 10^4$ N)
   c. What is the normal force? $(1.3 \times 10^4$ N)
   d. What is the force of friction that holds the car from rolling down the hill? $(7.5 \times 10^3$ N)

4. A 250 N sled is pulled up an inclined plane at a constant speed. If the inclined plane is 12.0 m long and 5.00 m high and has a coeffient of friction of 0.200, what force parallel to the plane will be needed to pull the sled? (149 N)

5. An inclined plane 14.0 m long and 4.00 m high is used to load suitcases into an airplane. It takes a force of 35.0 N parallel to the plane to move a 100 N suitcase up the plane at a constant speed. What is the coefficient of friction? (0.067)

6. An inclined plane is 4.00 m long and 1.50 m high. An object that just slides down the plane at constant speed without being pushed weighs 75.0 N. Calculate the coefficient of friction. (0.404)

7. An inclined plane has an angle of elevation of 20°. A carton weighing 150.0 N is to be moved up the plane. If the coefficient of friction is 0.300, what force is needed to move the carton up the plane at uniform speed? (93.6 N)

8. A safe weighing 2500 N is to be lowered down an inclined plane 5.00 m long and 2.00 m high. The coefficient of friction is 0.500. Will the safe have to be held back or pushed to make it move at a constant speed? What force must be exerted parallel to the plane to accomplish this? (Pushed 149 N)

1. Two blocks are joined as in the diagram below left. The mass of block A is 8.0 kg and the mass of block B is 2.0 kg. If block A is on a frictionless surface, calculate its acceleration. (2.0 m/s^2)
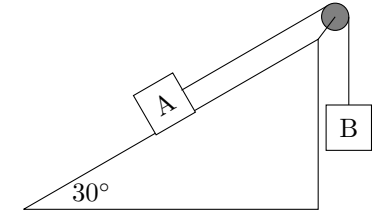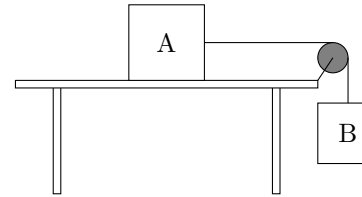

2. Two blocks are joined as in the diagram above right. Block A has a mass of 0.40 kg and block B has a mass of 0.10 kg. If the inclined plane is frictionless, find the acceleration of block A. $(1.96 \text{ } m/s^2$ down the plane)

3. A body of mass 200 kg is placed at the top of an inclined plane that makes an angle of 30° with the horizontal. The coefficient of friction is 0.200. Find

   a. the net force on the body; (640 N)
   b. the body's acceleration; and (3.20 m/s^2)
   c. the speed of the body at the bottom of the plane if the plane is 5.00 m long. (5.66 m/s)

4. Two blocks A and B have masses of 7.0 kg and 4.0 kg respectively. They are connected by a rope over a single fixed pulley. Assuming the pulley is frictionless, calculate the acceleration of the two blocks and find the tension in the rope. $(2.7 \text{ m/s}^2, 50 \text{ N})$

5. Two blocks are joined as in the diagram below. The mass of A is 30 kg, and the mass of block B is 12 kg. Calculate the acceleration of block A if the coefficient of friction is 0.20. (5.1 m/s^2)
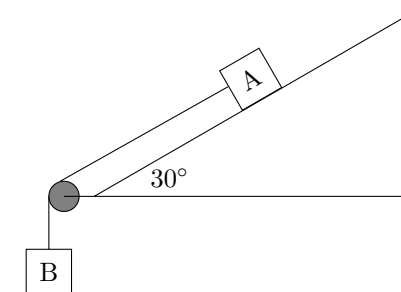
6. Blocks A and B in the diagram above have masses of 4.0 kg and 1.0 kg respectively. If the inclined plane has a coefficient of friction of 0.30, find A's acceleration. (4.0 m/s^2)