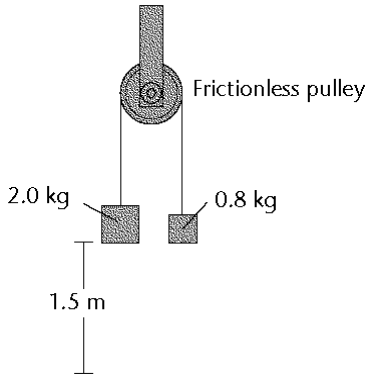
Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Forces Problems, for extra practice!

Problem

1. You and your bike have a combined mass of 80 kg. How much braking force has to be applied to slow you from a velocity of 5 m/s to a complete stop in 2 s?
2. Before opening his parachute, a sky diver with a mass of 90.0 kg experiences an upward force from air resistance of 150 N.
   a. What net force is acting on the sky diver?
   b. What is the sky diver's acceleration?
3. A large helicopter is used to lift a heat pump to the roof of a new building. The mass of the helicopter is 5.0×10^3 kg and the mass of the heat pump is 1500 kg.
   a. How much force must the air exert on the helicopter to lift the heat pump with an acceleration of 1.5 m/s^2?
   b. Two chains connected to the load each can withstand a tension of 15,000 N. Can the load be safely lifted at 1.5 m/s^2?
4. In a lab experiment, you attach a 2.0-kg weight to a spring scale. You lift the scale and weight with a constant reading of 22.5 N.
   a. What is the value and direction of the acceleration on the weight?
   b. How far do you lift the weight in the first 2.0-s interval?
5. As a large jet flies at a constant altitude, its engines produce a forward thrust of 8.4×10^5 N. The mass of the plane is 2.6×10^5 kg.
   a. What is the forward acceleration of the plane, ignoring air resistance?
   b. How much upward force must the air exert on the plane when it is flying horizontally?
6. Two masses are tied to a rope on a pulley, as shown below.



   a. When the system is released from this position, what is the acceleration of the 2.0-kg mass?
   b. How long does it take for the 2.0-kg mass to fall to the floor?
7. A man is standing on a scale inside an airplane. When the airplane is traveling horizontally (in other words, the vertical acceleration of the plane is zero) the scale reads 705.6 N. What is the vertical acceleration of the plane in each of the following situations?
   a. When the scale reads 950.0 N
   b. When the scale reads 500.0 N

8. An airboat glides across the surface of the water on a cushion of air. Perform the following calculations for a boat in which the mass of the boat and passengers is 450 kg.
   a. If there is no friction, how much force must the propeller fan exert on the air to accelerate the boat at 5.0 m/s^2?
   b. If the actual acceleration with the fan generating the force calculated in part a is only 4.95 m/s^2, how much friction does the air cushion exert on the boat?
   c. What is the upward force exerted by the air cushion on the boat?
9. A golf ball with a mass of 45 g is struck by a club, leaving the tee with a speed of 1.8×10^2 km/h. The period of acceleration was 0.50 m/s.
   a. What is the average acceleration on the ball as it was struck (in m/s^2)?
   b. What is the force exerted on the club?
   c. What is the force exerted on the club by the ball?
10. A package of instruments is attached to a helium-filled weather balloon that exerts an upward force of 45 N.
   a. If the instrument package weighs 10.0 kg, will the balloon be able to lift it?
   b. What is the upward acceleration if the instruments weigh 2.0 kg?
11. A 12-kg block sits on a table. A 10.0-kg block sits on top of the 12-kg block. If there is nothing on top of the 10.0-kg block, what is the force that the table exerts on the 12-kg block?
12. A box experiences a net force of 41 N while it is being lifted. What is the acceleration of the box?
13. A rope can withstand 1.000×10^3 N of tension. If the rope is being used to pull a 10.0-kg package across a frictionless surface, what is the greatest acceleration that will not break the rope?
14. A 0.100-kg weight is attached to a spring scale. Find the reading on the scale for each of the following situations.
   a. When the scale is not moving
   b. When the scale accelerates at 2.4 m/s^2 in the horizontal direction
15. A penny is dropped from the top of a 30.0-m-tall tower. The tower, however, is not located on Earth. The penny has a mass of 2.5 g and experiences a gravitational force of 0.028 N.
   a. What is acceleration due to gravity on this planet?
   b. After 1.00 s, the penny has a velocity of 10.1 m/s. Assuming the force exerted on the penny by air resistance is uniform and independent of speed, what is the magnitude of the force of air resistance on the penny?
16. The combined mass of a sled and its rider is 46.4 kg. The sled is pulled across a frozen lake so that the force of friction between the sled and the ice is very small.
   a. Assuming that friction between the sled and the ice is negligible, what force is required to accelerate the sled at 3.45 m/s^2?
   b. A force of 150.0 N is applied to the sled and produces an acceleration of 3.00 m/s^2. What is the magnitude of the force of friction that resists the acceleration?