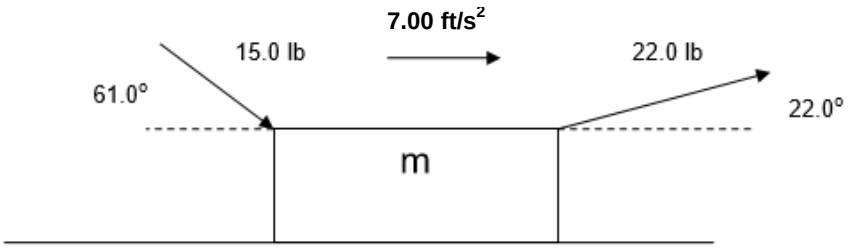
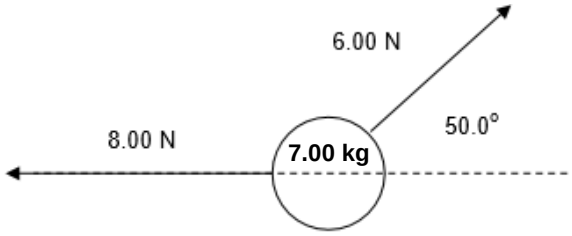
Dynamics with Friction Worksheet

Problems 3-10 taken from the school's old textbook: Giancoli, D. (1980). Physics, 2nd Ed. Englewood Cliffs, NJ: Prentice Hall.

1. Find the mass of the object shown below. Assume a <u>frictionless surface</u>.



2. For this particle in space (there is no gravity), find the accelerations and directions (an angle) of the mass shown.



3. (p. 67 #23) If the coefficient of kinetic friction between a 25-kg crate and the floor is 0.45, how much force is required to move the crate at a steady speed across the floor? How much force is required if μ_k is zero?

4. (p. 67 #28) A roller coaster reaches the top of the steepest hill with a speed of 5.0 km/h. It then descends the hill which is at an average angle of 45° and is 50-m long. What will its speed be when it reaches the bottom? <u>Neglect friction.</u> (Hint: what did you just learn about the component of gravity's acceleration down an incline?)

5. (p. 67 #30) A wet bar of soap slides freely down a ramp 2.0 m long inclined at 6.8°. How long does it take to reach the bottom? <u>Neglect friction.</u> (Hint: look at the hint for the previous problem.)

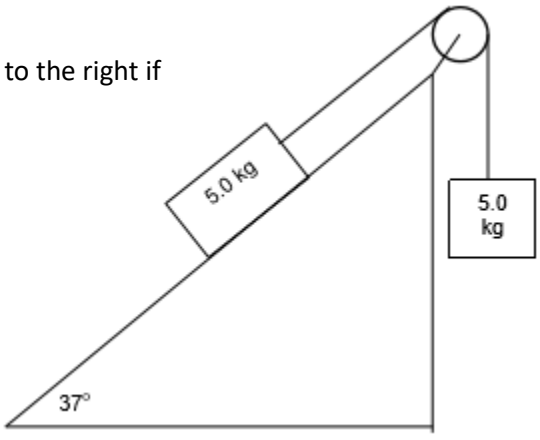
6. (p. 67 #31) A box is given a push so that it slides across the floor. How far will it go, given that the coefficient of kinetic friction is 0.30 and the push imparts an initial speed of 3.0 m/s?

7. (p. 68 #36) A 5000-kg helicopter accelerates upward at 0.550 m/s^2 while lifting a 1500-kg car.
   a) What is the lift force exerted by the air on the blades of the helicopter?
   b) What is the tension in the cable (ignore its mass) that connects car to helicopter?

8. (p. 68 #37) An 18.0-kg box is released on a 33.0° incline and accelerates down the incline at 0.300 m/s^2. Find the friction force impeding its motion. How large is the coefficient of friction?

9. (p. 68 #46) A flatbed truck is carrying a 2800-kg crate of bananas. If the coefficient of static friction between the crate and the bed of the truck is 0.55, what is the maximum rate the driver can decelerate when coming to a stop in order to avoid burying himself in squished bananas if the crate were to hit the cab?

10. (p. 68 #49) What is the acceleration of the system shown in the diagram to the right if the kinetic coefficient of friction is 0.15?



ANSWERS:

1. 3.95 slugs
2. a = .884 m/sec^2; θ = 48.0° above the direction of the 8N force
3. 110.25 N; if μ is zero and the crate is already moving, no force is required
4. 26.4 m/s
5. 1.86 sec
6. 1.53 m
7. a) 6.73x10^4 N; b) 1.55x10^4 N
8. 90.7 N; .613
9. 5.39 m/s^2
10. 1.37 m/s^2