Physics 20

# Chapter 3 Worksheet

1. **Determine** the force required to accelerate a 20kg cart from rest to 0.50m/s in 2.0s. (*5.0N*)

2. ***Film Fhysics!*** In the 1978 movie "Superman," there is a scene where Lois Lane falls from a helicopter crash at the top of a building. She falls from rest for 9.0 s before Superman catches her.
   a) Ignoring air resistance, **determine** her velocity (in km/h) at the moment Superman catches her. (*3.2e2 km/h is the answer, but as a note, because of air resistance she would probably have reached an actual terminal velocity of about 200 km/h*)
   b) In 2.0 s Superman has brought her 47 kg body to a complete stop. **Determine** the average force he must have exerted on her body to accomplish this, and **explain** how you think this would affect her. (*2.1e3 N. Although this amount of force would not be lethal, it would likely cause her some injuries.*)

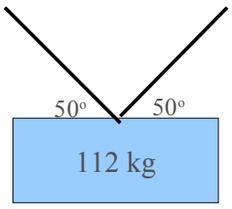
3. A 15.0kg box is sitting on the floor. The coefficient of static friction is 0.40 and the coefficient of kinetic friction is 0.30.
   a) **Sketch** the free body diagram of this box (assume for only this question that it ***is*** moving).
   b) **Determine** if the box will move if I push with a force of 20N. If it does move, **determine** its acceleration. (*Since static friction can be as high as 59N, no it will not move.*)
   c) **Determine** if the box will move if I push with a force of 70N. If it does move, **determine** its acceleration. (*Accelerates at 1.7m/s$^2$.*)

4. I have decided to try to learn how to swim again (I know, this must be some sort of delusion!). As soon as I get into the water I start to sink! I have a mass of 57.5kg. When I am in the water my body has a buoyancy of 412 N. I know that if my entire body is moving through the water, it feels a force due to friction of 34 N.
   a) **Determine** the net force acting on my body when I am in the water (a free body diagram might help). Be sure to give the direction! ($F_{NET}$ *= 118 N [down]* )
   b) **Determine** my acceleration in the water. Be sure to give the direction! (*a = 2.05 m/s$^2$ [down]*)

5. **Sketch** and **explain** one of Galileo's gedankens involving forces.

6. **Explain** (in your own words) each of Newton's three laws of motion.

7. You are hanging a sign from two wires as shown. **Determine** the tension in each wire. (*7.2e2N [50$^o$ up from horizontal]*)




8. The International Olympic Committee has hired you to evaluate some changes they are planning for downhill skiing. One of the concerns that they have is how fast the skiers will go down a new hill that has a greater slope than before. The statistics they give you are:
   - New slope = 60° from horizontal
   - Average Skier's Mass = 83 kg
   - Coefficient of Kinetic Friction between snow and waxed skis = 0.15

   a) **Sketch** a free body diagram of a skier on the ski slope.
   b) **Determine** the normal force acting on the skier. ($F_N$ *= 407.115 = 4.1e2 N* )
   c) **Determine** the force due friction as she goes down the slope. ($F_f$ *= 61.0167 N = 61 N*)
   d) **Determine** the force parallel to the slope that causes her to move down the slope. ($F_{//}$ *= 705.144 N = 7.1e2 N*)
   e) **Determine** the net force acting on the skier. ($F_{NET}$ *= 644.127 N = 6.4e2 N*)
   f) **Determine** the acceleration of the skier down the slope. (*a = 7.8 m/s$^2$*)