Chapter 5 Applying Newton's Laws

Example 1:
Two 10 kg masses are suspended at opposite ends of a rope that passes over a pulley that is attached to the ceiling by a chain. (a) What is the tension in the chain? (b) What is the tension in the rope?

Example 2:
When a bird sits on a wire that connects two telephone poles which are 40 ft apart, the wire is depressed 3 in from the horizontal. What is the weight of the bird if the tension in the wire is 150 lb?

Example 3:
A rope is attached to the top of a smooth 37° incline and to a 30 kg block that rests on the incline. Assuming that the rope is parallel to the incline, what is the tension in the rope?

Example 4:
A 900 N box is being pulled by a rope at a constant speed up a smooth 30° incline. Calculate the tension in the rope. (Assume the rope is parallel to the incline.)

Example 5:
A horizontal 180 N force is applied to a 20 kg box that is initially at rest on a rough horizontal surface. What is the acceleration of the box? ($\mu_s = 0.8$ and $\mu_k = 0.6$)

Example 6:
What is the acceleration of a 2 kg block that is sliding down a rough 37° incline? ($\mu_k = 0.25$)

Example 7:
A 160 lb box is being pulled by a rope across a rough horizontal surface at a constant speed. The rope is inclined 25° above the horizontal. Calculate the coefficient of friction if the tension in the rope is 100 lb.

Example 8:
A 100 kg mass rests on a rough table top and is connected to a 75 kg mass by means of a rope and a pulley. The 60 kg mass hangs from the pulley. If ($\mu_s = 0.6$ and $\mu_k = 0.4$) what is the acceleration of the blocks?

Example 9:
A rope connects a 40 kg block to a 30 kg block. The rope passes over a pulley at the top of a 37° incline. The 40 kg block rests on the incline and the 30 kg block hangs from the pulley. The blocks start from rest. Calculate the tension in the rope connecting the two blocks. ($\mu_s = 0.5$ and $\mu_k = 0.2$)

Example 10:
A 20 kg block sits on top of a 50 kg block which is being pulled horizontally by a 420 N force. What is the minimum coefficient of friction if the top block does not slide across the bottom block? There is no friction between the floor and the 50 kg block.

Example 11:

A 0.72 kg toy car completes a circular path in 6 seconds. What is the magnitude of the radial force acting on the car? The radius of the circle is 1.5 m.

Example 12:
A highway curve is un-banked; find the minimum coefficient of friction if a car is able to negotiate the turn without slipping. The radius of the turn is 90 ft and the car's speed is 30 mph.

Example 13:
Find the angle, θ, at which a frictionless highway curve must be banked if a car is able to negotiate the turn. The radius of the turn is 640 ft and the car's speed is 75 mph.

Example 14:
A car passes over the top of a small hill. Find the car's minimum speed if the normal force between the seat and the passenger is zero. The radius of curvature of the hill is 150 ft.