CH5 Exercises:

1. (5.5) A picture frame hung against a wall is suspended by two wires attached to its upper corners. If the two wires make the same angle with the vertical, what must this angle be if the tension in each wire is equal to 0.75 of the weight of the frame?

2. (5.9) A man pushes on a piano with mass 180 kg; it slides at constant velocity down a ramp that is inclined 19^o above the horizontal floor. Neglect any friction on the piano. Calculate the magnitude of the force applies by the man if he pushes (a) parallel to the incline, and (b) parallel to the floor.

3. (5.13) On September 8^{th}, 2004, the Genesis spacecraft crashed into the Utah desert because its parachute did not open. The 210 kg capsule hit the ground at 311 km/hr and penetrated the soil to a depth of 81 cm. (a) what was its acceleration (m/s2 and g's), assumed to be constant, during the crash? (b) What force did the ground exert on the capsule during crash? (c) How long did this force last?

4. (5.17) A light rope is attached to a block with mass 4 kg that passes over a frictionless, massless pulley, and a block of mass m is suspended from the other end. When the blocks are released, the tension in the rope is 15 N. (a) Draw 2 FBDs, one for each block. (b) what is the acceleration of each block? (c) Find m. (d) How does the tension compare to the weight of the hanging block?

5. (5.27) A stockroom worker pushes a box with mass 16.8 kg on a horizontal surface with a constant speed of 3.5 m/s. The coefficient of kinetic friction between the box and surface is 0.2. (a) What horizontal force must the worker apply to maintain the motion? (b) if the force calculated in part (a) is removed, how far does the box slide before coming to rest?

6. (5.35) Given the coefficient of kinetic friction between tires and dry pavement is 0.80. (a) What is the shortest distance you can stop a car by locking up the brakes when traveling at 28.7 m/s (65 mph)? (b) On wet pavement the coefficient of kinetic friction is 0.25, how fast should you drive to be able to stop in the same distance as in part (a)?

7. (5.40) You throw a baseball straight upward. The drag force is proportional to v2. In terms of g, what is the y-component of the ball's acceleration when the ball's speed is half its terminal speed and (a) is moving up? (b) It is moving back down?

8. (5.43) A stone with mass 0.8 kg is attached to one end of a string 0.9 m long. The string will break is the tension exceeds 60 N. The stone is whirled around a horizontal circle on a frictionless tabletop; the other end of the string remains fixed. What is the maximum velocity the stone can attain without breaking the string?

9. (5.45) A small remote-controlled car with mass 1.6 kg moves at a constant speed v = 12 m/s in a track formed by a vertical circle inside a hollow metal cylinder that has a radius of 5 m. What is the magnitude of the normal force exerted on the car by the walls of the cylinder at (a) the bottom of the track, and (b) the top of the track?

10. (5.49) A 1125 kg car and a 2250 pickup approach a curve on a highway that has a radius of 225 m. (a) At what angle should the highway engineer bank this curve so that vehicles traveling at 65 mph can safely round it regardless of the condition of their tires? Should the heavier truck go slower than the lighter car? (b) As the car and truck round the curve at 65 mph, find the normal force on each one due to the highway surface?

11. (5.53) You designed a space station that is 800 m in diameter to create artificial gravity at the outside rim of the station. (a) How many revolutions per minute are needed to simulated earth's gravity of 9.8 m/s^2? (b) Suppose you wanted to simulate Martian gravity of 3.7 m/s^2, what would be the revolutions per minute?

12. (5.100) Consider a banked wet roadway as described in Example 5.22 (Section 5.4), where the coefficient of static friction is 0.30 and the coefficient of kinetic friction is is 0.25 between the road and the tires. The radius of the curve is R = 50 m. (a) If the bank angle is $\beta = 25o$, what is the maximum speed the automobile can have before sliding UP the banking? (b) What is the minimum speed the auto can have before sliding DOWN the banking?