## Chapter 5: Newton's laws of Motion

1. A block is given an initial velocity of 5.00 m/s up a frictionless incline of angle $\theta = 20°$. How far up the incline does the block slide before coming to rest?

2. A box of mass $m_2 = 1$ kg on a frictionless plane inclined at angle $\theta = 30°$. It is connected by a cord of negligible mass to a box of mass $m_1 = 3$ kg on a horizontal frictionless surface. (a) If the force F = 2.3 N, what is the tension in the connecting cord? (b) What is the largest magnitude of F may have without the cord becoming slack?

3. A small object of mass m is suspended from a string attached to a fixed point on the ceiling of a car. When the car moves with acceleration **a** along an inclined plane of angle $\beta$, the object will deflect and the string will make an angle $\theta$ with the vertical. Find angle $\theta$ (in terms of $\beta$ and a).

4. A 65-kg student weighs himself by standing on a scale mounted on a skateboard that is rolling down an incline. Assume there is no friction so that the force exerted by the incline on the skateboard is normal to the incline. What is the reading on the scale if $\theta = 30°$?

5.An object of mass $m_1$ hangs from a string that passes over a very light fixed pulley $P_1$. The string connects to a second very light pulley $P_2$. A second string passes around this pulley with one end attached to a wall and the other to an object of mass $m_2$ on a frictionless horizontal table. (a) If $a_1$ and $a_2$ are the accelerations of $m_1$ and $m_2$, respectively, what is the relation between these accelerations? Find expressions for (b) the tensions in the strings and (c) the accelerations $a_1$ and $a_2$ in terms of the masses $m_1$ and $m_2$, and g.

6. Suppose three blocks are in contact with one another on a frictionless, horizontal surface. A horizontal force F is applied to $m_1$. Take $m_1 = 2$ kg, $m_2 = 3$ kg, $m_3 = 4$ kg, and F = 18 N. (a) Drew a separate free body diagram for each block. (b) Determine the acceleration of the blocks.

7. A 2-kg block rests on a frictionless wedge that has an inclination of $\theta = 60°$ and an acceleration to the right such that the mass remains stationary relative to the wedge. (a) Find a. (b) What would happen if the wedge were given a greater acceleration?

8. Consider the arrangement of masses as shown in the diagram. Find the value of the hanging mass, $m_1$, such that the mass $m_3$ does not slip over the wedge of mass $m_2$. (The acceleration of the mass $m_3$, relative to the wedge is zero). There is no friction in this problem.