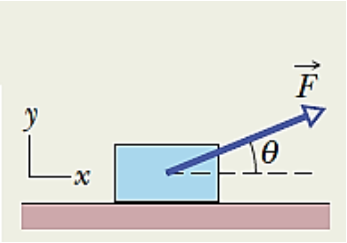
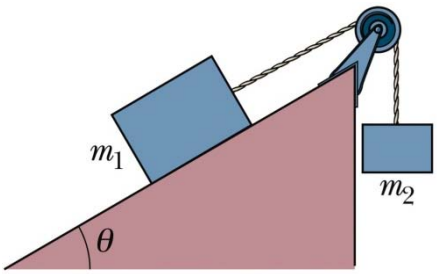
Chapter 5
Example Problems

1. In the figure a block of mass m = 3.0 kg slides along a floor while a force of 12.0 N is applied to it at an upward angle of θ = 30°. The coefficient of kinetic friction between the block and the floor is μ_k = 0.40. What is the normal force acting on the block and the magnitude of the acceleration?



2. A block of mass m_1 = 3.70 kg on a plane inclined at an angle of θ = 30° is connected by a cord over a massless, frictionless pulley to a second block of mass m_2 = 2.30 kg.
   a. Draw the free-body diagram for the two block system.
   b. Write down the equations of motion for each block.
   c. What are the magnitude of the acceleration of each block and the tension in the cord if the coefficient of kinetic friction for the surface is μ_k = 0.25?



3. A raindrop with radius R = 1.5 mm falls from a cloud that at height h = 1200 m above the ground. The drag coefficient C for the drop is 0.60. Assume that the drop is spherical throughout its fall. The density of water is 1000 kg/m^3, and the density of air is 1.2 kg/m^3. What is the terminal speed of the raindrop? What would be the raindrop's speed just before impact if there was no drag force?

4. One end of a steel rod of radius R = 9.5 mm and length L = 81 cm is held in a vise. A force of magnitude F_{app} = 62 kN is then applied perpendicularly to the end face at the other end, pulling directly away from the vise. The Young's modulus and shear modulus for steel are 200.0×10^9 N/m^2 and 79.3×10^9 N/m^2, respectively.
   a. What are the stress on the rod, the elongation ΔL, and strain of the rod?
   b. If the force is now applied horizontal to the end face of the rod, what is the shear and the shear deformation Δx of the rod*?*