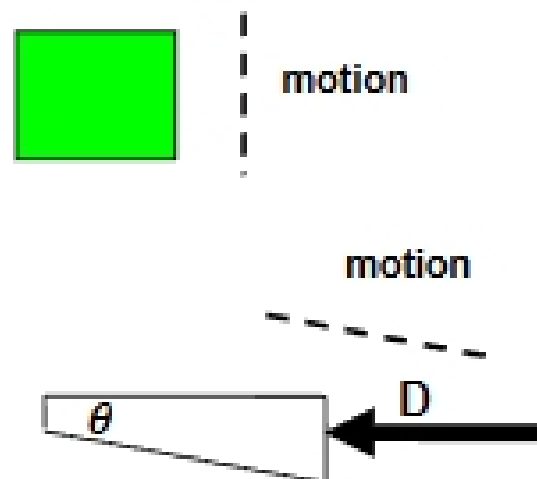
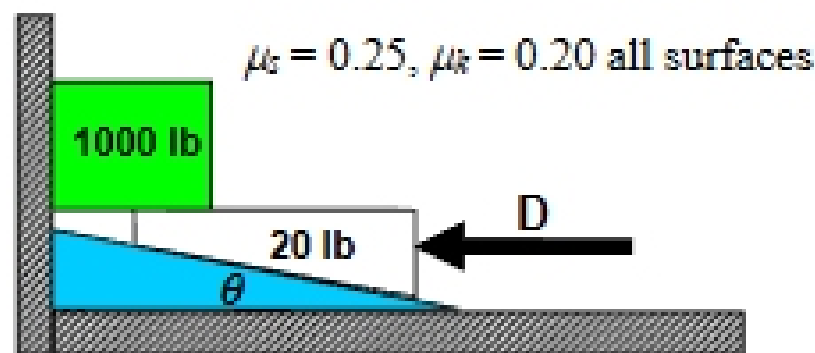


## Learning Exercise 5g: Frames and Static Machines

**Objective:** To be able to properly model friction in simple mechanical assemblies in static equilibrium and in motion.

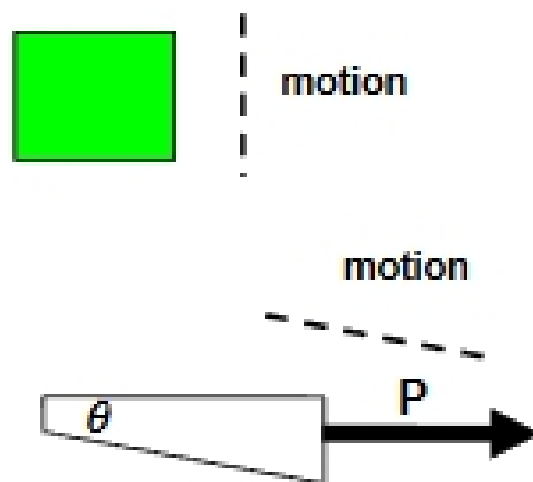
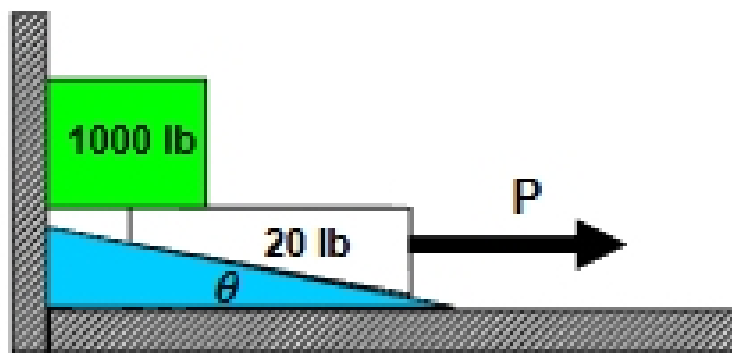
- EXAMPLE 5.8 - Wedges with Friction:** A pair of wedges is used to lift a heavy block vertically. Only the wedge on which the force is applied can move along the slope. The heavy block is constrained on a track so it can only move vertically. Given the materials and coefficients of friction, the idea is to select the angle of this wedge that will allow the block to be lifted without excessive applied horizontal driving force to the left. In addition, we want the wedge to remain stationary and hold the weight in position after lifting and the applied force is removed. Finally, we want to be able to remove the wedge and lower the weight without having to apply excessive horizontal pulling force to the right. *Show the directions of potential motion then complete the FBD of the block and the wedge that moves. Write the equations of equilibrium assuming that motion is on*



the verge of happening. Write these as a function of the wedge angle  $\theta$ . Use the equations to evaluate the force  $D$  needed to drive the wedge as a function of the wedge angle  $\theta$ . Compute values for increasing values of  $\theta$  in the table.

$\theta$	5	10	20	30
<b>D</b>				

2. Repeat the above for the case when the wedge is being pulled out to the right so as to lower the heavy block.



$\theta$	5	10	20	30
<b>P</b>				

3. *Select an angle that satisfies the objectives stated above. For the selected angle and 101% of the minimum driving force, find the accelerations of the wedge during the lifting operation. Then recognizing the movement of the block is kinematically related to the movement of the wedge, find the acceleration of the block from kinematics.*