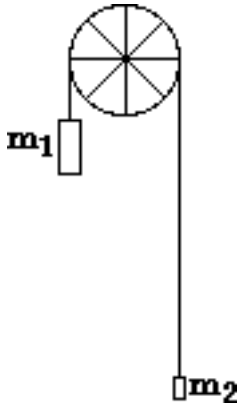
Two Body Problems Involving Pulleys

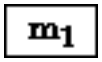
Two-body systems in which both objects are connected by strings often include a pulley. Pulleys have the unique feature of being capable of altering the direction of the forces acting upon objects within a system of objects. As an example of how this works, consider the two masses attached by a string and hanging over opposite sides of a pulley as shown at the right. The force of gravity acts downwards upon each mass, and tension acts upwards on each mass. Since the masses are connected by the same string, the tension force on m_1 is identical to the tension force on m_2. A system analysis can be used to determine the acceleration of the system. F_{grav1} pulls the system counter-clockwise and F_{grav2} pulls the system clockwise; thus, the two forces can be thought of as opposing each other. Once the acceleration is determined, an individual-body analysis for either object can be used to determine the tension force.



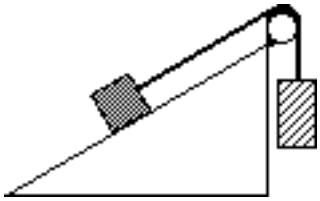
1. A 200-gram and 50-gram mass are connected by a string stretched over a pulley. Determine the acceleration of the masses and the tension in the string.

Analysis of Forces on m_1	**Analysis of Forces on m_2**
 **∑F Equations:**	 **∑F Equations:**

2. Consider the two-body situation at the right. A 20.0-gram hanging mass is attached to a 250.-gram glider. The coefficient of friction between the 250.-gram glider and the surface is 0.050. Determine the acceleration of the system and the tension in the string.

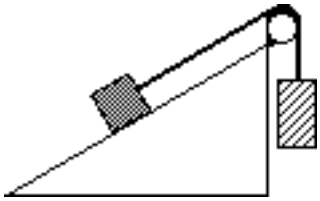
Analysis of Forces on m_1	**Analysis of Forces on m_2**
 **∑F Equations:**	 **∑F Equations:**

3. Consider the two-body situation at the right. A 2000.-kg crate rests on an incline and is connected by a cable to a 3000.-kg mass suspended over a pulley. The incline angle is 30.0° and the surface can be assumed to be frictionless. Determine the acceleration of the system and the tension in the cable.



Analysis of Forces on m_1	**Analysis of Forces on m_2**
	
∑F Equations:	**∑F Equations:**

4. Consider the two-body situation at the right. A 2000.-kg crate rests on an incline and is connected by a cable to a 3000.-kg mass suspended over a pulley. The incline angle is 30.0° and the coefficient of friction is 0.150. Determine the acceleration of the system and the tension in the cable.



Analysis of Forces on m_1	**Analysis of Forces on m_2**
	
∑F Equations:	**∑F Equations:**