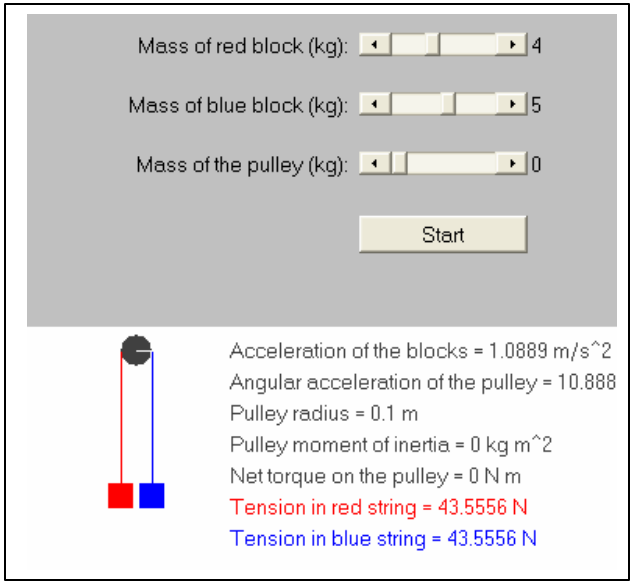
Newton's 2nd Law: Acceleration of a Pulley System

A "Virtual" Exercise

According to Newton's 2nd Law, the acceleration of an object is inversely proportional to its total mass and directly proportional to the net force acting on it.

Go to the web site http://physics.bu.edu/~duffy/java/Rotation2.html. You will see a drawing identical to the one to the right. Run the simulation while adjusting the masses of the red and blue blocks in order to examine Newton's Second Law.

For the first trials, you will keep a constant total mass of 10 kg. By "moving" mass from one side to the other, you will vary the net force.



1. Run the simulation using the masses shown in **Data Table I**, using a mass of zero for the pulley.
2. Record the acceleration shown in the simulation.
3. Calculate the weights of the blocks. (Use g = 9.8 m/s/s when calculating the weights.)
4. The net force will be the difference in the weights (Blue weight – Red weight).
5. Make a graph of **Acceleration vs Net Force when Total Mass is Constant**.
6. Does the shape of your graph confirm the relationship between acceleration and net force that Newton's Law predicts?

Data Table I - Experimental Results: Constant Mass

Block Mass, kg		Total Mass, kg	Block Weight, N		Net Force, N	Acceleration, m/s/s
Red	Blue		Red	Blue		
1	9					
2	8					
3	7					
4	6					
5	5					
6	4					
7	3					
8	2					
9	1					

For these next trials, you will keep a constant net force of 9.8 N. By "adding" mass to each side of the pulley, you can maintain the same net force while varying the

1. Run the simulation using the masses shown in **Data Table II**, using a mass of zero for the pulley.
2. Record the acceleration shown in the simulation.
3. Calculate the weights of the blocks. (Use g = 9.8 m/s/s when calculating the weights.)
4. The net force will be the difference in the weights (Blue weight – Red weight).
5. Use MS Excel to make a graph of **Acceleration vs Total Mass when the Net Force is Constant**.
6. Does the shape of your graph confirm the relationship between acceleration and total mass that Newton's Law predicts?

Data Table II - Experimental Results: Constant Net Force

Block Mass, kg		Total Mass, kg	Block Weight, N		Net Force, N	Acceleration, m/s/s
Red	Blue		Red	Blue		
1	0					
2	1					
3	2					
4	3					
5	4					
6	5					
7	6					
8	7					
9	8					