Force Stations
Student Worksheet 1

Name: _____

Date: _____ Period: _____

Exploring Forces

Instructions
Conduct the simple experiment at each of the ten stations. Rotate to the next station when directed by your teacher.

Station A—Elastic Forces Due to Tension

1. Examine the washers hanging from the rubber band.

   Describe the forces acting on the washer. _____

   _____

2. Examine the washers hanging from the string.

   Describe the forces acting on the washer. _____

   _____

   How are the forces acting on the washer hanging from the rubber band and the washer hanging from the string different? How are they the same? _____

   _____

   _____

3. Draw a diagram in the space below of the washers hanging from the rubber band and from the string. Identify, using arrows (vectors), the direction of each of the forces acting on the object(s).

Station B—Gravity

1. Suspend the washer on the string at a height of 1 m. Let go of the string.

   Describe the forces acting on the washer. _____

   _____

2. Lift the end of the meter stick that has the pinewood racer up 0.5 m while letting the other end of the meter stick rest on the table.

   Describe the forces acting on the pinewood racer. _____

   _____

3. Draw a diagram in the space below of the pinewood racer on the meter stick. Identify, using arrows (vectors), the direction of each of the forces acting on the object(s).

Station C—Friction

1. Place a textbook at one end of ramp. Raise the ramp until the book begins to slide.

   Record the distance the ramp was raised in centimeters. _____

2. Cover the ramp with the towel and place the textbook on the ramp again. Raise the ramp until the textbook begins to slide.

   Record the distance the ramp was raised in centimeters. _____

3. Draw a diagram in the space below of the textbook on the ramps with and without the towel. Identify, using arrows (vectors), the direction of each of the forces acting on the object(s).

Station D—Friction

1. Observe the textbook on the table.

   In its resting state, describe the forces acting on the textbook. _____

   _____

2. With your finger, lightly press on the side of the textbook, but not hard enough to move it.

   Describe the forces acting on the textbook now. _____

   _____

3. Draw a diagram in the space below of the textbook with your finger pressed against the side. Identify, using arrows (vectors), the direction of each of the forces acting on the object(s).

4. Use the spring scale to determine how much force is needed to make the textbook slide.

   How large is the force, in newtons (N), needed to move the textbook? _____

   Describe the opposing force. _____

   _____

Station E—Elastic Forces Due to Compression

1. Observe the textbook balanced on the meter stick.

   Is the meter stick straight? _____

2. Now gently lift the textbook.

   What happens to the meter stick? _____

   _____

3. Replace the textbook and draw a diagram in the space below of the textbook balanced on the meter stick. Identify, using arrows (vectors), the direction of each of the forces acting on the object(s).

Station F—Elastic Forces Due to Compression

1. Observe the sponge on the table.

   Describe the forces acting on the sponge. _____

   _____

2. Now place the textbook on top of the sponge, covering 1 cm of the sponge's edge.

   What happens to the sponge? _____

   _____

3. Remove the textbook and observe the sponge.

   What happens to the sponge? _____

   _____

4. Replace the textbook on the edge of the sponge and draw a diagram in the space below of the textbook on top of the sponge. Identify, using arrows (vectors), the direction of each of the forces acting on the object(s).

Station G—Gravity

1. Hold your arm out straight to the side of your body with your palm up. Place a textbook on your palm. Hold the textbook as motionless as possible for 1 minute.

   Do you feel a force acting on the textbook? _____

   Describe this force. _____

   _____

   What keeps the textbook from falling to the floor? _____

   _____

2. Draw a diagram in the space below of your arm and the textbook. Identify, using arrows (vectors), the direction of each of the forces acting on the object(s).

3. Now place the textbook on a table.

   Describe the force that keeps the textbook from falling. _____

   _____

4. Draw a diagram in the space below of the table and the textbook. Identify, using arrows (vectors), the direction of each of the forces acting on the object(s).

Station H—Magnetism

1. Place two horseshoe magnets together with their opposite poles connected. Slowly pull on the attached spring scales, pulling the magnets in opposite directions.

   How much force, in newtons (N), is needed to separate the two magnets? _____

2. Join the magnets again and apply a force just short of the magnets separating. Draw a diagram in the space below of the magnets in this position. Identify, using arrows (vectors), the direction of each of the forces acting on the object(s).

Station I—Buoyancy

1. Fill the small beaker with water. Immerse it into the large beaker. Keeping the small beaker underwater, lift it until its rim is level with the surface of the water.

   Does the small beaker filled with water exert a downward force? _____

   _____

2. Now lift the small beaker until the bottom is almost out of the water.

   Does it exert a downward force? _____

   _____

3. Draw a diagram in the space below of the small beaker with its bottom almost out of the water as previously described. Identify, using arrows (vectors), the direction of each of the forces acting on the object(s).

4. Now empty the small beaker. Turn it upside down and push it to the bottom of the larger beaker. The small beaker should be filled with air.

   Is the small beaker of air exerting a force? _____

5. Draw a diagram in the space below of the small beaker of air in this position. Identify, using arrows (vectors), the direction of each of the forces acting on the object(s).

Station J—Elastic Forces Due to Compression

1. Pick up a flexible drinking straw from the table and observe it carefully. Notice that it resembles a spring. Slowly bend the it to form an arch.

   What happened to the ridges on the top and bottom? _____

   _____

2. Now bend the straw so that it forms a valley.

   What happened to the ridges on the top and bottom? _____

   _____

3. Draw a diagram in the space below of the straw as an arch and also as a valley. Identify, using arrows (vectors), the direction of each of the forces acting on the ridges at the top and bottom.

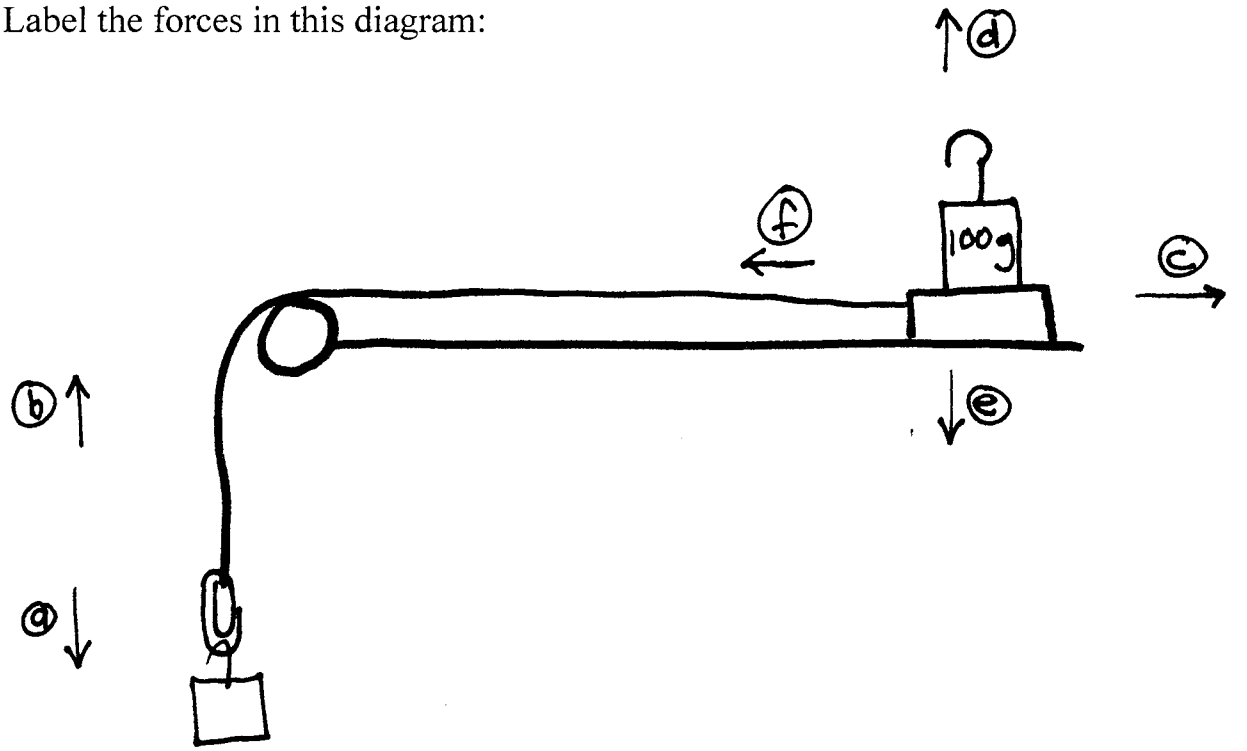
Station K – Force required to overcome Static Friction with different surfaces

1. Place the wood block on the apparatus with a 100g weight on it. Attach the string to the wood block. At the end of the string, attach weights, 20 g at a time, until the block starts to slide. Record the amount of weight that caused the block to slide. Repeat the process for the wood block with a mirror on the bottom and with the wood block with sandpaper on the bottom.

Data:

Type of surface	Weight to overcome Static Friction
wood	
mirror	
sandpaper	

Label the forces in this diagram:



Station L – Rotational Inertia

Study how the distribution of mass affects motion.

Part A: Symmetrical distribution of mass

1. Load the two discs with 4 balls in the pattern shown:

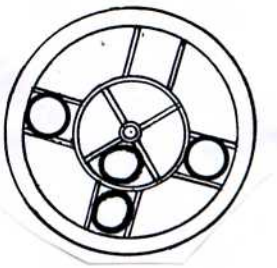
Disc 1  Disc 2 

2. Place the discs at the starting line, release them (without pushing them), and measure the time it takes for each disc to get to the finish line (d = 1 m)
3. Calculate the speed of each disc

	Distance	Time (s)	Speed (m/s)
Disc 1	1 m		
Disc 2	1 m		

Part B: Asymmetrical Distribution of mass

1. Load the two discs with 4 balls in the pattern shown:

Disc 1  Disc 2 

2. Push the discs to get them rolling.
3. Describe the motion of each disk:

Disc 1: _____

Disc 2: _____