Name: _____ Date: _____

Levers

Abstract:
Simple machines do not let you get away with doing less work. According to the law of conservation of energy, you must do exactly as much work, plus a little more to overcome friction, than performing the task without the simple machine would have required. The advantage of the simple machine is that the task is easier to accomplish as the machine reduces the force required or changes the direction in which the force must be applied. A simple machine may make a task easier, but they always require more work in than you can get back out. All machines are made up of one or more simple machines. Levers are simple machines that change the amount of force needed to lift objects and can change the direction in which the lifting force is applied.

Levers can be divided into three groups or "classes" depending upon the relative position of three points on the lever.

The Fulcrum – is the fixed point of the lever, the point at which it is anchored and around which the entire lever rotates. The Effort – is the place on the lever where you are actually applying your force - pushing or pulling on the lever. It is the place where you are putting your work in to the lever. It is the force which we must apply to accomplish the task using the simple machine. The Resistance – is the place on the lever where the object which we wanted to move is located. It is the place where the work that comes out of the machine is accomplished. It is the force which must be overcome in order to accomplish the task without using the simple machine.

Procedure:
Part A: The operation of a first class lever

1. Using a meter stick, clamp, fulcrum, hangers and pivot point, assemble a first class lever. The fulcrum should be located at the 50 cm mark.
2. Hang a 500 gram resistance mass at the 90 cm mark.
3. Hang a spring scale upside down at the 10 cm mark.
4. Record the following data into the data table provided below and use the data recorded in the first four columns of the data table to calculate the expected effort force required to operate the lever. Show all of your work.
5. Using the spring scale measure and record the actual effort force (+/- 0.1 N) in the data table.
6. Repeat steps 2 - 5 with the 500 gram mass moved to the 80, 70, and 60 cm marks.

Part B: The operation of a second class lever

1. Assemble a second class lever with the fulcrum at the 90 cm mark.
2. Hang a 500 gram resistance mass at the 30 cm mark, the spring scale at the 10 cm mark.
3. Use the data recorded in the first four columns of the data table to calculate the expected effort force required to operate the lever. Show all of your work.
4. After making an estimate, measure the actual effort force (+/- 0.1 N) required to make this lift.
5. Repeat steps 2 - 4 with the 500 gram mass moved to the 45, 60, and 75 cm marks.

Part C: The operation of a third class lever

1. Assemble a third class lever with the fulcrum at the 50 cm mark.
2. Hang a 500 gram resistance mass at the 5 cm mark, the spring scale at the 30 cm mark.
3. Use the data recorded in the first four columns of the data table to calculate the expected effort force required to operate the lever. Show all of your work.
4. After making an estimate, measure the actual effort force (+/- 0.1 N) required to make this lift.
5. Repeat steps 2 - 4 with the 500 gram mass moved to the 12, 19, and 26 cm marks.

Data:

Part A Table: First Class Levers

Resistance Arm (m)	Resistance Force (N)	Effort Arm (m)	Predicted Effort Force (N)	Actual Effort Force (N)	Force of Friction (N)	Ideal Mechanical Advantage (IMA)	Actual Mechanical Advantage (AMA)

Part B Table: Second Class Levers

Resistance Arm (m)	Resistance Force (N)	Effort Arm (m)	Predicted Effort Force (N)	Actual Effort Force (N)	Force of Friction (N)	Ideal Mechanical Advantage (IMA)	Actual Mechanical Advantage (AMA)

Part C Table: Third Class Levers

Resistance Arm (m)	Resistance Force (N)	Effort Arm (m)	Predicted Effort Force (N)	Actual Effort Force (N)	Force of Friction (N)	Ideal Mechanical Advantage (IMA)	Actual Mechanical Advantage (AMA)