

Mechanical Advantage

Introduction:

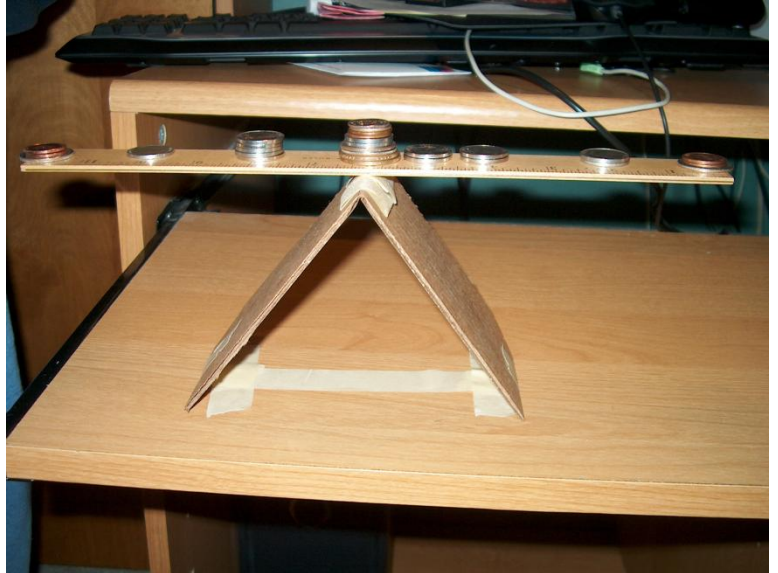
By making a simple balance, or lever, we can explore the basics of mechanics.

Materials:

- Cardboard
- Coins
- Tape
- Ruler

Procedure:

1. Cut cardboard into rectangles.
2. Fold the short way.
3. Make a triangle (the fulcrum) with the two sides of the cardboard and the table
4. Tape the fulcrum to the table.
5. Make a circle of tape with the sticky side on the outside.
6. Place the circle of tape on the top of the fulcrum.
7. Balance a flat ruler on the tip of the fulcrum and make sure the ruler is on top of the circle of tape. This is a lever. The left half of the ruler is called the load arm. The right half of the ruler is called the effort arm.
8. Hold the ruler so it does not fall down. Put one coin three inches to the left of the center. Using only *one* coin, try to balance the ruler. Fill in the 'Coins to right' for trial 1 on the back of this sheet.
9. Hold the ruler so it does not fall down. Put two coins (the same kind) two inches to the left from the center. Using only *one* coin, try to balance the ruler. Fill in the 'Coins to right' for trial 2 on the back of this sheet.
10. Experiment on your own by putting different numbers of coins at the same spot on the load arm. Next, try to balance the ruler by placing coins on the effort arm. Record your data in the table on the back.



		Positions			
		Inches to left	Coins on left	Inches to right	Coins on right
Trials	1	3	1		1
	2	2	2		1
	3				
	4				
	5				
	6				
	7				

Did you notice a pattern? Multiply the inches to left by the coins on left. Then multiply the inches to right by the coins on right. Are they the same? When you place a coin on the ruler, a force pushes downward. The work that the coin exerts is equal to the distance from the center multiplied by the weight of the coin. When the work is the same for the load arm and the effort arm, the lever is in balance.

Why does this happen? When a force pushes down on one side of the lever, the other side is pushed up (try it!). The work coins do on one side of the lever push the other side up. Similarly, the work the other coins do on the other side pushes the first side up. Because the work is the same, the forces balance out, and so does the lever!