Name: **Date:** **Class:**

Day 5: Redesign Using Engineering Design Process, IMA/AMA, Hypotheses, and Calculations

Materials Needed:

- 1 3-lb weight (flat plate weight or bagged sand)
- 12-24" of string or thin rope
- 1 Newton scale/spring scale
- scissors
- glue or tape
- access to commonly discarded items such as the following:
  - empty plastic jug or bottle (large enough to hold the weight)
  - dog or cat food bag
  - empty flour or rice bag
  - other recyclable materials

Instructions:

1. Join your team and gather the same commonly discarded materials used in Day 4.
2. Review your previous design and discuss how to improve it to create more mechanical advantage (i.e., a way to make moving the hand weight easier).
3. Sketch your redesigned prototype below.
4. Rebuild your material-moving system using the materials provided.
5. Test your new design by measuring how many Newtons of force it takes to pull the hand weight across a control surface (baseline surface).
6. Predict (hypothesize) how many Newtons of force it will take to move the weight across each of the five other surfaces using your new design. (Hint: Remember to consider the smoothness, texture, and material of each surface.*)*
7. Drag the weight across each surface using your redesigned system.
8. Record the actual force (in Newtons) needed for each one.
9. Calculate the difference between your predicted values and the actual measurements.
10. Summarize your findings by discussing:
    - What changes you made to the design, and why.
    - The values you measured.
    - How you tested your design.
    - Whether your predictions were accurate.
11. Fill out Table B.

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Redesign Sketches

Table A: Hypotheses and All Measurements in Newtons			
	Hypothesis	**Actual Measurement**	**Difference**
Control Surface	N/A		
Turf			
Carpet			
Bubble Wrap			
Vinyl Flooring			
Felt			

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Findings Summary - Were You Right/Wrong? Why? Justify.

Table B: Actual Mechanical Advantage Calculations (all measurements in Newtons)

	Resistance (Fr)	Effort (Fe)	AMA (Fr / Fe)
Control Surface			
Turf			
Carpet			
Bubble Wrap			
Vinyl Flooring			
Felt			