

The Rube Goldberg Challenge

Supporting and Background
Information



Background Information:

- **STEM education** is an approach to learning that integrates the content and skills of science, technology, engineering and mathematics.



- **The Rube Goldberg design challenge** is an engineering exercise that requires the use of a series of simple machines interconnected in “as complex a manner as possible”, often comically, in order to accomplish a simple, everyday task.

Engineering

Engineering means “any engagement in a systematic practice of design to achieve...(a)...solution to...(a)... particular... problem (sic)”. (A Framework for K-12 Science Education: Practices,

- Crosscutting Concepts, and Core Ideas)

The **Engineering Design Process** is a cycle that allows participants to move through several phases:

- Ask
- Imagine
- Plan
- Create
- Improve



Engineering

As you work on your project, think about how your TEAM works through each of these phases. At the end of each team meeting, you may want to write a journal entry or record a video log of how your team is progressing through these phases. You may also want to consider how your team is using the **Scientific and Engineering Practices**, which are:

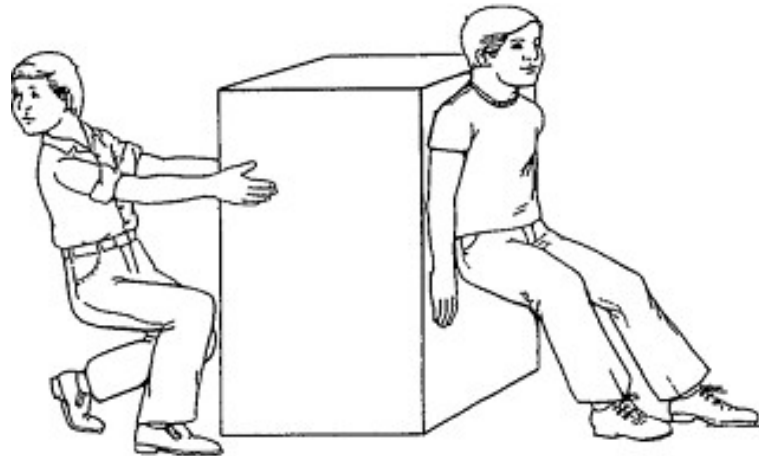
- Asking Questions and Defining Problems
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Developing and Using Models
- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence
- Using Mathematics and Computations Thinking
- Obtaining, Evaluating, and Communicating Information



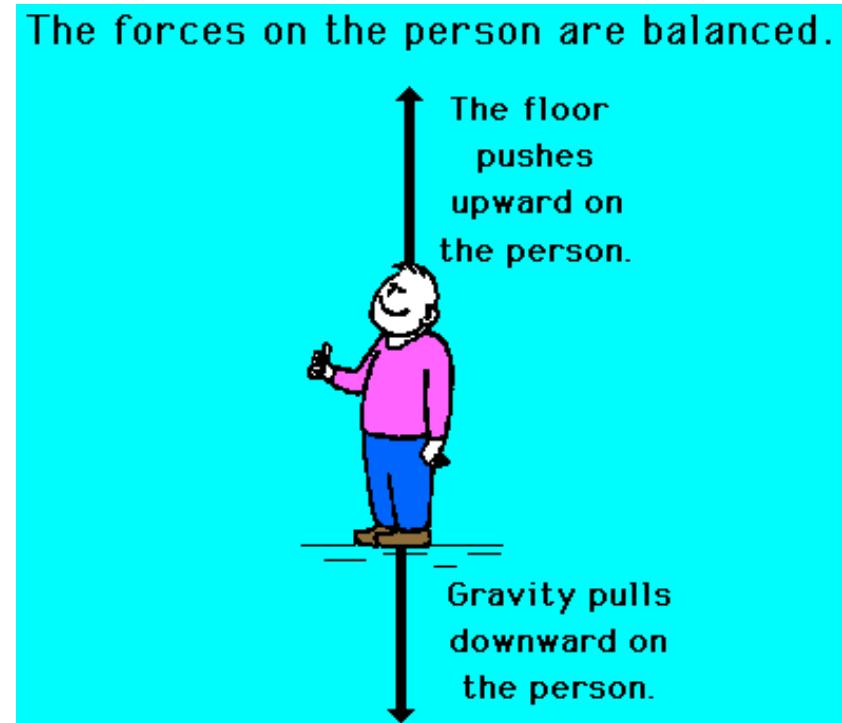
- **Science**: In the K-12 context, science is generally taken to mean the traditional natural sciences: physics, chemistry, biology, and (more recently) earth, space, and environmental sciences. (A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas)

Science

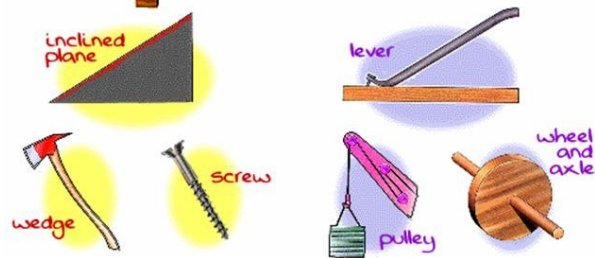
- Current Kindergarteners learn about forces and motion through Push and Pull.
- They are expected to develop an understanding of the effects of different strengths or different directions of pushes and pulls on the motion of an object.



- Current 3rd Graders are expected to determine the effects of balanced and unbalanced forces on the motion of an object and the cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
- Think about how these and other scientific concepts (friction, gravity, etc.) apply while you are working on your Rube Goldberg design.



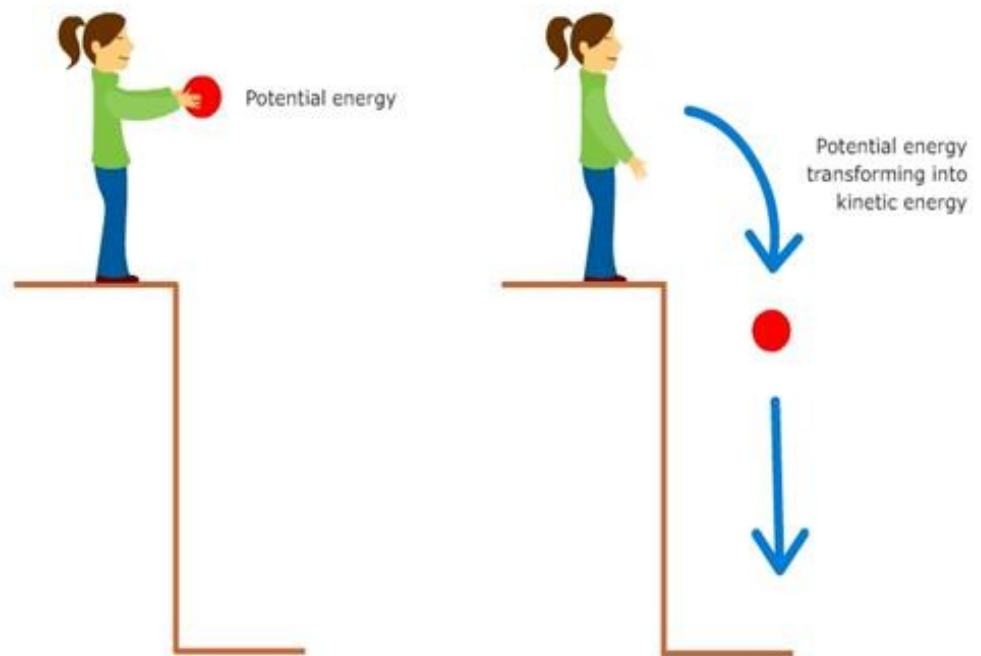
Simple Machines



- The simple machines themselves are an aspect of science. They can be considered as follows (definitions taken from Macmillan/McGraw-Hill Grade 3):
 - Inclined plane: a simple machine with a flat slanted surface that is raised at one end
 - Wedge: A simple machine that uses force to split objects apart
 - Screw: A simple machine made up of an inclined plane wrapped into a spiral
 - Wheel and Axle: A simple machine that consists of a wheel that moves around a post, or axle
 - Lever (Grade 4): A simple machine made of a solid bar or plank and a fixed point, called a fulcrum
 - Pulley

Other elements of science & science vocabulary **that may be considered** include, but are not limited to, the following:

- Compound machine
- Mass
- Speed
- Acceleration
- Momentum
- Force
- Friction
- Balanced Forces
- Unbalanced Forces
- Action Force
- Reaction Force
- Energy
- Work
- Potential Energy
- Kinetic Energy
- Effort
- Load
- Simple Machine
- Fulcrum

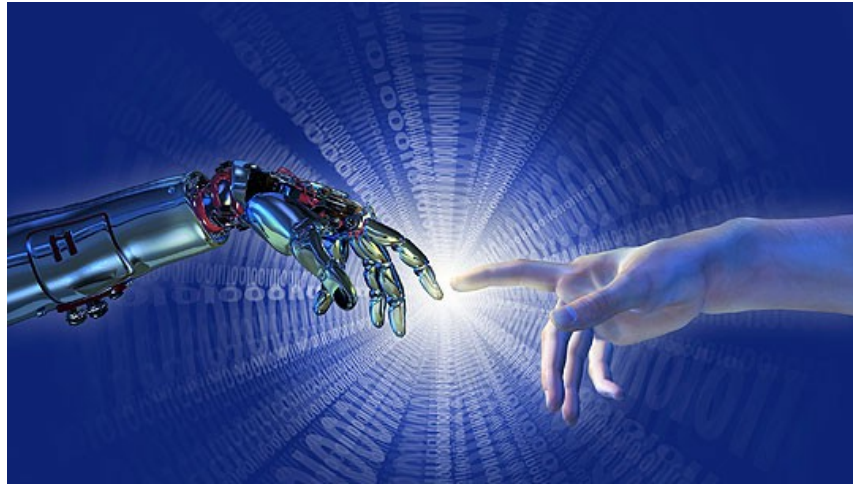


You may also want to consider how your team is using the **Scientific and Engineering Practices**, which are:

- Asking Questions and Defining Problems
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Developing and Using Models
- Constructing Explanations and Designing Solutions
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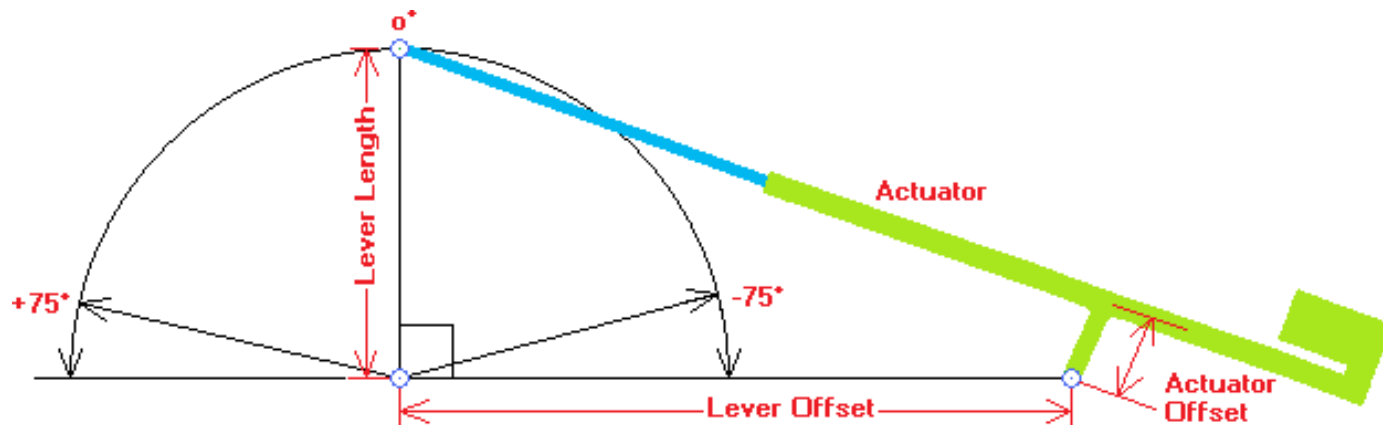
Technology



- **Technology** can include all types of human-made systems and processes. Technologies result when engineers apply their understanding of the natural world and of human behavior to design ways to satisfy human needs and wants. (A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas)

Mathematics






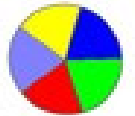


- **Mathematics**: Think about the ways in which you used specific mathematical **concepts**, such as:
 - Measurement
 - Geometry
 - Computation
 - Fractions
 - Decimals
 - Time
 - Weight



Mathematical Practices

And specific **mathematical practices** such as:

- Patterns
- Number Sense
- Precision
- Use of mathematical tools
- Effective use of strategies
- Persistence

Mathematical Practices	
I can ...	
1. Make sense of problems and persevere in solving them 	3. Use appropriate tools strategically 
2. Reason abstractly and quantitatively 	6. Attend to precision 
3. Construct viable arguments & critique the reasoning of others 	7. Look for and make sense of structures 
4. Model with mathematics 	8. Look for & express regularity in repeated reasoning 

Advisor's Role



- Help students understand the definitions and terms as they apply to the challenge.
- Aid in “team reflection” at the conclusion of each meeting, in order help the team organize their thoughts as they apply to the essay.

Possible/Suggested Timeline

- August-October
 - Introduce Challenge
 - Form Teams
 - Provide Background Knowledge Needed
 - Plan & Design
- November-January
 - Build, Test, Revise designs
 - Work on Essay Components & Reflection
- February-March
 - Film Projects, Edit and complete Video Entry
 - Complete Essay Prompt
 - Submission of Entry
- April
 - Display Board work
- May
 - Awards Ceremony



Additional Background Knowledge

- Search youtube by “simple machines” or “rube goldberg” for a wealth of supporting video clips and songs, as needed. These links are a few that may be helpful:
 - <https://www.youtube.com/watch?v=R011TmGlSX4>
 - <https://www.youtube.com/watch?v=OdM2jWg2uEE>
 - <https://www.youtube.com/watch?v=aMx7nIIH9ik>
 - https://www.youtube.com/watch?v=E_ErIoQjNos
 - <https://www.youtube.com/watch?v=xgDC>

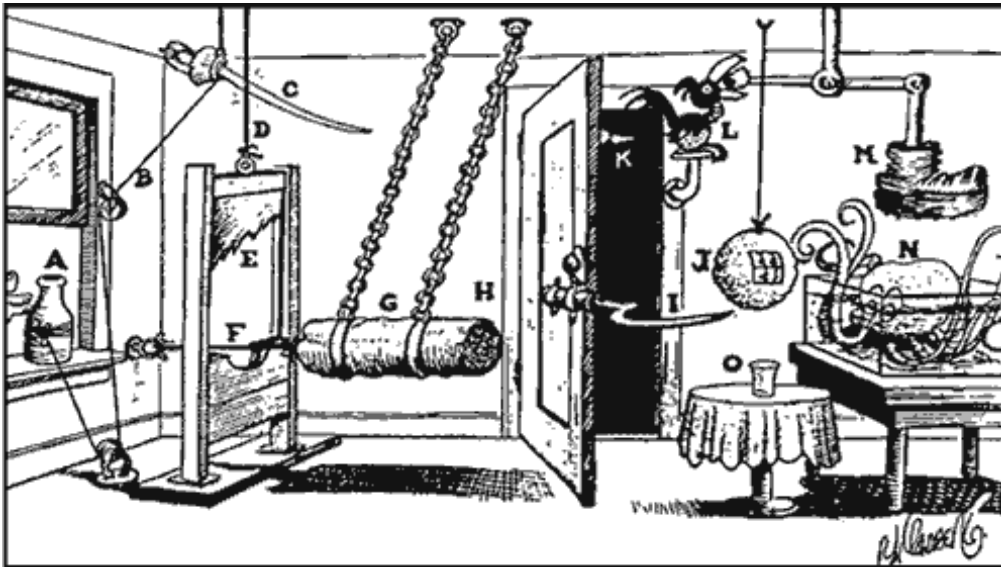
Writing Task:



- Your team will explain how the Rube Goldberg Challenge supports this statement: “Engineering and technology provide a context in which students can test their own developing scientific knowledge and apply it to practical problems; doing so enhances their understanding of science—and, for many, their interest in science—as they recognize the interplay among science, engineering, mathematics and technology.”

Essay Prompt:

- How is your Rube Goldberg design a strong example of a STEM project? How do the **components** of STEM (science, technology, engineering and math) *work together* to make your machine's design successful?



STEM



Science • Technology • Engineering • Math