Physical Science Lab Investigation #2: Energy Transfer and Transformation
How can you make an action figure jump higher?

Introduction: The **Law of Conservation of Energy** states that within a given system *the total amount of energy always stays the same – it is neither created nor destroyed*; instead, energy is transformed from one form to another. When energy is stored in one form or another it is called **potential energy**. Potential energy can be stored in the chemical bonds between atoms and in the nuclei of atoms. Energy can also be stored based on the position of an object. When potential energy is transformed into motion it becomes **kinetic energy**. Kinetic energy can be detected when objects move. In this investigation you will explore the relationship between potential energy and kinetic energy as you try to make an action figure jump using a teeterboard (See Figure 1).

Your Task: Determine a rule that explains how an army man can be made to jump lower or higher on a teeter board.

The guiding question of this investigation is: ***How can you make an army man jump higher?***

Figure 1: A teeter board
Image Source: http://www.circusjuventas.org

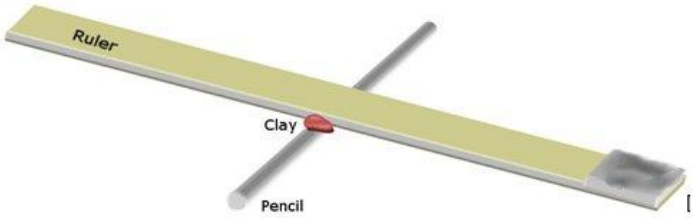
Materials: You may use any of the following materials during your investigation.

- Ruler
- Meter stick
- Triple-beam balance (or digital balance)
- Clay (100 g)
- Army man

Safety Precautions:

- Wear safety glasses
- Do not allow the army man to jump too far from your work area.

Getting Started:



1. Construct the teeterboard: Place a small piece of clay under the middle of the ruler and stick it to a pencil.
2. Use some of the additional clay to make a mass that can be dropped on the raised end of the teeterboard.
3. Carefully balance your army man on the lowered end of the ruler.
4. During each drop and jump be sure to create a clear area around the teeterboard.

As you work through this investigation think about the role of theories and laws in science. Also, think about how experimentation is used in science.

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Argumentation Session: Once your group has completed your work, prepare a whiteboard that you can use to share and justify your ideas. Your whiteboard should include all the information shown Figure 1.

To share your work with others, we will be using a **Round-Robin** format. This means that one member of your group will stay at your work station to share your groups' ideas while the other group members will go to the other group one at a time in order to listen to and critique the arguments developed by your classmates. When the session is over, you will have a chance to meet with your group and revise your original argument.

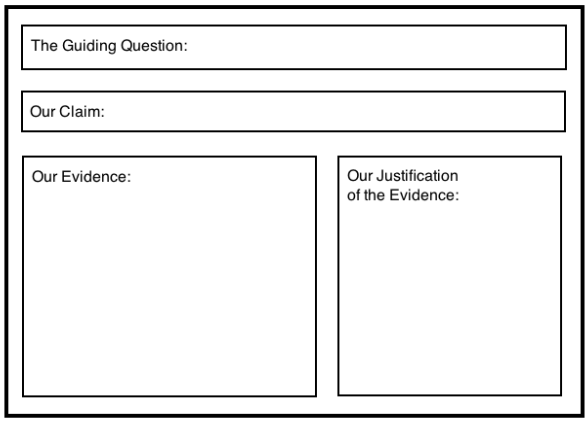

Figure 1. A whiteboard

Report: Once you have completed your research, you will need to prepare an ***investigation report*** that consists of three sections. Each section should provide an answer for the following questions:

1. What were you trying to do and why?
2. What did you do during your investigation and why did you conduct your investigation in this way?
3. What is your argument?

Your report should answer these questions in 2 pages or less. This report must be typed and any diagrams, figures, or tables should be embedded into the document. Be sure to write in a persuasive style; you are trying to convince others that your claim is acceptable or valid!

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Name _____ Student ID # _____

Teacher _____ Period _____ Date _____

Checkout Questions
Physical Science Lab #2: Energy Transfer and Transformation

1. **Describe** at least one way to gain more potential energy if you are going to drop an object.

While preparing for their new teeterboard circus act, the Flying Wazowski's wanted to launch someone higher to complete the trick. Frances, the oldest brother, suggested that their smallest brother should jump onto the board to get a bigger reaction from the crowd.

2. **Use** the concept of potential energy to suggest a way that the smallest brother could launch one of his brothers higher than ever for the circus act.

Figure 1: A teeter board
Image Source: http://www.circusjuventas.org

Please read EACH statement carefully and then indicate the degree to which you agree or disagree with EACH statement by circling the appropriate letters to the right of each statement (SD = Strongly Disagree; D = Disagree More Than Agree; U = Uncertain or Not Sure; A = Agree More Than Disagree; SA = Strongly Agree).

Scientific Laws and Theories

3.	Unlike theories, scientific laws are not subject to change.	SD	D	U	A	SA
4.	Scientific laws are theories that have been proven true.	SD	D	U	A	SA
5.	A scientific law is a description of a relationship or a pattern in nature (i.e., laws describe *how* things happen).	SD	D	U	A	SA
6.	A scientific theory provides an explanation for a relationship or pattern in nature (i.e., theories explain *why* things happen).	SD	D	U	A	SA
7.	Scientists create laws.	SD	D	U	A	SA
8.	Scientific theories exist in the natural world and are uncovered through scientific investigations (i.e., scientists discover theories).	SD	D	U	A	SA

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Experimentation in Science

Use the following information to answer question 9 – 11. An individual interested in birds looked at many different types of birds who eat different types of food. After recording the beak shape and the type of food eaten by hundreds of different birds, s/he noticed that birds, who eat similar types of food, tend to have similar shaped beaks. For example, birds that eat hard-shelled nuts have short, strong beaks and birds that eat insects have long, slim beaks. The individual concluded that there is a relationship between beak shape and the type of food birds eat.

9. This investigation was scientific in nature.	SD	D	U	A	SA
10. This investigation is an example of an experiment.	SD	D	U	A	SA
11. This investigation proves that the shape of a bird's beak depends on the type of food the bird eats.	SD	D	U	A	SA

Use the following information to answer question 12 – 15. An individual heats a beaker of ice water while continually stirring it. After five minutes of heating and stirring, s/he observes that the temperature of the ice water mixture does not change. The individual then stops stirring and a few minutes later the temperature of the water starts to rise. The individual concludes that heat does not raise the temperature of liquid water so long as it is constantly stirred.

12. This investigation was scientific in nature.	SD	D	U	A	SA
13. This investigation was well designed.	SD	D	U	A	SA
14. This investigation is an example of an experiment	SD	D	U	A	SA
15. This investigation proves that liquids do not change temperature when stirred.	SD	D	U	A	SA

Directions: The last two questions are about your views about what was important to learn during the lab. Please answer the following questions truthfully - they will not influence your grade at all.

16. **In your opinion**, what was the most important idea for you to learn during the lab? (Circle the <u>one</u> option that best represents your view)

    a. The difference between kinetic and potential energy
    b. Using the concept of potential energy to solve a problem
    c. The difference between scientific theories and laws
    d. The role of experimentation in scientific investigations
    e. All of the above
    f. None of the above

17. **In your opinion**, what **did your teacher think** was the most important idea for you to learn during the lab? (Circle the one option that best represents your view)

    a. The difference between kinetic and potential energy
    b. Using the concept of potential energy to solve a problem
    c. The difference between scientific theories and laws
    d. The role of experimentation in scientific investigations
    e. All of the above
    f. None of the above

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