

Grade Six: Energy
Lesson 6.3: Energy Transfer & Transformation

Lesson Concept	Energy can be transferred and transformed between different forms.
Link	In the previous lesson students learned that energy is classified as potential or kinetic. Lesson 6.3 introduces the difference between transferring energy in the same form or transforming energy to another form. In the next lesson, students learn that energy from the sun is transformed by radiation to thermal energy and is transferred by conduction and convection in different materials.
Time	120 minutes (Divide at points between Explain 2 and Explore 3)
Materials	Video segment “Students Build a Rube Goldberg Machine” R1 Rube Goldberg Introduction R2 Fox Trot Comic Strip <u>Per Group (groups of 4)</u> NOTE THIS IS A SUGGESTED LIST ONLY Set of dominoes Hot Wheels type of car Wind-up toy String (approximately 12 inches) Strip of masking tape 2 Coffee stirrer sticks Balloon 2 Rubber bands Plastic cup with water Alka-Seltzer tablet <u>Individual</u> H1 Energy Transfer and Transformation Video Notes H2 Rube Goldberg Design H3a,b Energy Transfer and Transformation Lab
Advance preparation	1. Download “Students Build a Rube Goldberg Machine” Titled: The Most Outrageous Way to Share a Coke

<http://ryanseacrest.com/2012/06/06/students-build-rube-goldberg-machine-that-highlights-viral-videos-video/>

2. Duplicate handouts, **H1 (Energy Transfer and Transformation Video Notes)**, **H2 (Rube Goldberg Design)** and **H3 a,b (Energy Transfer and Transformation Lab)**
3. Collect and set up materials for Energy Transfer and Transformation Lab.
4. Note: Explore 3 is optional.

Procedure:

Engage (10 minutes) Energy can be changed to do work.

1. Explain that different forms of energy have been the topic of our science class for the last two lessons. Today we are going to watch a video that has a demonstration of how energy can be used to do work in interesting ways.
2. Ask students to watch the video “Students Build a Rube Goldberg Machine” and think about how the energy changes while the students solve the problem of how to share a coke.
3. Ask students to discuss what they saw in the video. What forms of energy did you observe in the video? How did forms of energy change while using the machine? Chart ideas.

Explore/Explain 1 (15 minutes) Energy is changed by either transformation to another form of energy or transfer to the same form in a different way.

4. Place **R1 (Rube Goldberg Introduction)** under the document camera and read about Rube Goldberg and the processes of transfer and transformation of energy. Discuss examples of both transfer and transformation seen in the video. Chart examples.
5. Distribute video recording sheet **H1 (Energy Transfer and Transformation Video Notes)**. Ask students to complete the handout as they watch the video “Students Build a Rube Goldberg Machine” with stops at critical points of transfer and transformation.
6. Place **R2 (Fox Trot comic)** under the document camera and as a class follow the path from each point to another point. Briefly discuss what is happening between each point (A to B etc through H).
7. Ask students to discuss film-notes with a partner. How can the form of energy be identified at any point in the sequence? How can transfer or transformation of energy be identified? Explain how you know it is a transfer or a transformation of energy. Share ideas with the whole class.

Explore #2 (25 minutes) Machines can transfer or transform energy. Drawings can be used to record the transfer or transformation of energy. .

8. Distribute **H2 (Rube Goldberg Design)** to students. As a class, work through the Lab Prep questions #1 – 4.
9. Using the diagram, fill in the chart for each step. As a class, work together for A to B, B to C, and I to J (such as...)
 - a. A to B Spoon to String; Mechanical; Transfer
 - b. B to C String pulling 2nd spoon; Mechanical; Transfer
 - c. I to J String pulls and lighter is lit; Mechanical to Chemical; Transformation
10. Working in pairs, students complete the table listing the actions, energy forms and whether it is an energy transfer or transformation. Ask students to complete as homework if not completed in class.

Explain #2 **(10 minutes) Machines that transfer and transform energy can use diagrams and words as a blueprint for developing the machine.**

11. Ask students to share and explain their chart to a different student who was not their partner.
12. Discuss and edit any differences between charts building consensus for one type of energy change: transfer or transform for each.

Explore #3 **(25 minutes) Machines that transfer and transform energy can be designed using blueprints.**

Teacher Note: Explore #3 is optional

13. As a class, review the transfer and transformations that occur in **R2 (Fox Trot comic)**.
14. Distribute **H3a, b (Energy Transfer and Transformation Lab)** and discuss procedures.
15. Divide students into groups of 3 or 4 and review with the class the supplies available to build their machine. Distribute the materials to each group.
16. Give students a few minutes to brainstorm and play with the materials. Decide on a “task” for the groups’ machine to complete.
17. Ask students to work with table groups and design a blueprint for the groups’ machine on **H3 a,b (Energy Transfer and Transformation Lab)**. Remember to label all energy transfers and transformations beginning with the sun.
18. Once the students’ blueprints are completed, students will build and test their machine.
19. Ask students to complete questions #4 – 6 while they are working.

Teacher Note: Do not distribute water until machine is set up.

Explain #3 **(20 minutes) Machines that transfer and transform energy can be build using blueprints.**

20. Ask all groups to set up their machine and be ready to explain their machine to the class.
21. Pour water in each group's cup.
22. As a class, go to each group's machine and ask the group to explain the transfers and transformations for their individual machine. Then, trigger the machine to start.

Extend **(5 minutes) Machines that transfer and transform can be used to do work at home.**

23. Review **R2 (Fox Trot comic)** and prepare the students to create their own blueprint for a job at home.
24. Assign the homework of completing their own blueprint of their new Rube Goldberg machine. Remind students to remember to label all transfers and transformations.

Evaluate **(10 minutes) Transferring energy does not change form, transforming energy changes form.**

25. Ask students to complete the following prompt on the back of their blueprint homework. How do you know when a change is a transfer? How do you know when a change in transformation?

ENERGY TRANSFER AND TRANSFORMATION

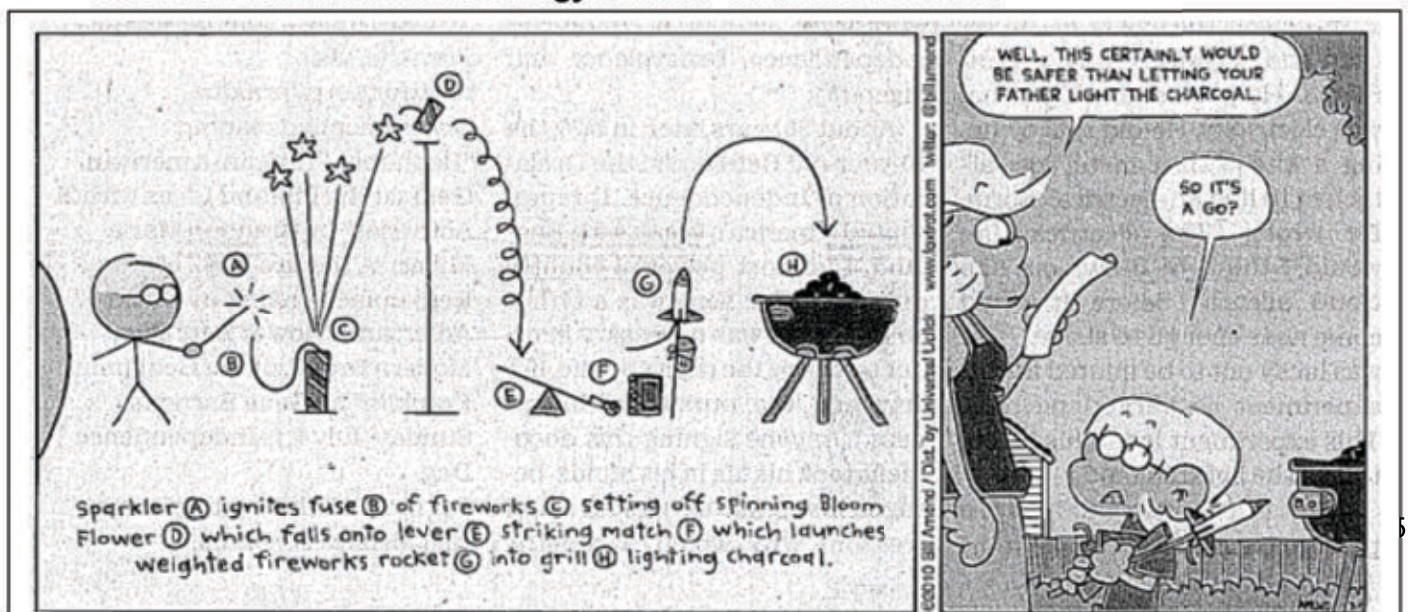
Watch the video: "The Most Outrageous Way to Share a Coke"

Brainstorm ways you saw energy being transferred and transformed.

TRANSFER

TRANSFORMATION

Discuss the cartoon below. Label each step with the type of energy being used and whether it is an energy transfer or transformation.



Name _____

Rube Goldberg Design

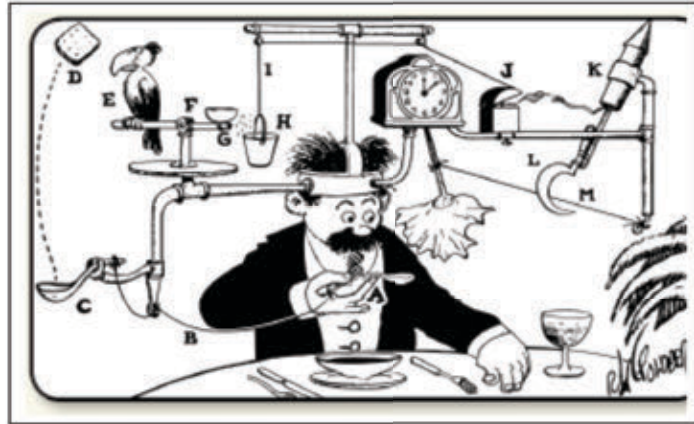
LAB PREP:

1. Analyze the cartoon to the right. What task is eventually completed?

2. What is the initial action that begins the sequence?

3. How many distinct steps can you identify in the machine's mechanics?

4. What is the difference between energy transfer and energy transformation?



ENERGY TRANSFER is _____

ENERGY TRANSFORMATION is _____

5. Use the following data table to describe the energy transfers and transformations shown above.

STEP	Description of Action	Energy Form Present	Energy Transfer or Transformation
A TO B			
B TO C			
C TO D			
D TO E			
E TO F			
F TO G			
G TO H			
H TO I			
I TO J			
J TO K			
K TO L			
L TO M			

Name _____

ENERGY TRANSFER & TRANSFORMATION

Procedures:

1. Examine the materials supplied. Brainstorm in your group a sequence of energy transfers and transformations that could be assembled with these items to perform a task. Include at least 2 energy transformations.
2. Draw a blueprint of your proposed Rube Goldberg machine that includes a description of energy transfers and transformations.
3. Label all energy transfers and transformations beginning with the sun!

4. Build and Test your design. Does it work? _____

5. What adjustments will you make? _____

6. Retest your design and be ready to share and explain your energy transfers and transformations with the class

HOMEWORK:

Without any material constraints (that means you can use anything you think of), design a more complicated machine that can complete a different task using as many energy transfers and transformations as possible. Think along the lines of the model you studied in class on eating soup and a napkin to wipe the person's mouth. This would be a job you would like completed at home using very little of your energy. . .xs

What task will your machine complete? _____

How will the sequence begin? _____

How will it end? _____

Create a blueprint of your new Rube Goldberg machine below. Identify and describe all the energy transfers and transformations beginning with the sun.



Rube Goldberg!

Reuben Goldberg was a very creative man. After all, he was a cartoonist, an engineer, an inventor, a sculptor, and a writer. He was born July 4, 1883 in San Francisco and attended UC Berkeley. Having a knack for taking a simple task and creating a very complex path, his designs became known as "Rube Goldbergs". The path to job completion always contained many transfers and transformations of energy forms. For many years he drew his designs as cartoons, and it has been a challenge for many to build his designs or create their own.

Energy Transfer: Energy remains in the same form and is transferred from one component to another (ie: mechanical to another form of mechanical).

Energy Transformation: Energy changes form from one component to another (ie: mechanical to sound).

