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**Unit 1 Activity 2: Telling a “Story of Energy”**

**A “Story of Energy” from a famous physicist, Richard Feynman.**

The passage that follows is from a book which chronicles a set of lectures presented by Nobel Prize winning physicist Richard Feynman during the 1961-1962 academic school year. This passage was chosen as an introduction to the concept of energy because it gives a clear view of the concept through a simple and effective analogy.

**From The Feynman Lectures on Physics: *What is Energy?***

In this chapter, we begin our more detailed study of the different aspects of physics, having finished our description of things in general. To illustrate the ideas and the kind of reasoning that might be used in theoretical physics, we shall now examine one of the most basic laws of physics, the conservation of energy.

There is a fact, or if you wish, a law, governing all natural phenomena that are known to date. There is no known exception to this law--it is exact so far as we know. The law is called the conservation of energy. It states that there is a certain quantity, which we call energy, which does not change in the manifold changes which nature undergoes. That is a most abstract idea, because it is a mathematical principle; it says that there is a numerical quantity which does not change when something happens. It is not a description of a mechanism, or anything concrete; it is just a strange fact that we can calculate some number and when we finish matching nature go through her tricks and calculate the number again, it is the same. (Something like the bishop on a red square, and after a number of moves--details unknown--it is still on some red square. It is a law of this nature). Since it is an abstract idea, we shall illustrate the meaning of it by an analogy. Imagine a child, perhaps "Dennis the Menace," who has blocks, which are absolutely indestructible, and cannot be divided into pieces. Each is the same as the other. Let us suppose that he has 28 blocks. His mother puts him with his 28 blocks into a room at the beginning of the day. At the end of the day, being curious, she counts the blocks very carefully, and discovers a phenomenal law--no matter what he does with the blocks, there are always 28 remaining! This continues for a number of days, until one day there are only 27 blocks, but a little investigating shows that there is one under the rug--she must look everywhere to be sure that the number of blocks has not changed. One day, however, the number appears to change--there are only 26 blocks. Careful investigation indicates that the window was open, and upon looking outside, the other two blocks are found. Another day, careful count indicates that there are 30 blocks! The causes considerable consternation, until it is realized the Bruce came to visit, bringing his blocks with him, and he left a few at Dennis' house. After she has disposed of the extra blocks, she closes the window, does not let Bruce in, and then everything is going along all right, until one time she counts and finds only 25 blocks. However, there is a box in the room, a toy box, and the mother goes to open the toy box, but the boy says "No, do not open my toy box," and screams. Mother is not allowed to open the toy box. Being extremely curious, and somewhat ingenious, she invents a scheme! She knows that a block weighs three ounces, so she weighs the box at a time when she sees 28 blocks, and it weighs 16 ounces. The next time she wishes to check, she weighs the box again, subtracts sixteen ounces and divides by three. She discovers the following:



There then appear to be some new deviations, but careful study indicates that the dirty water in the bathtub is changing its level. The child is throwing blocks into the water, and she cannot see them because it is so dirty, but she can find out how many blocks are in the water by adding another term to her formula. Since the original height of the water was 6 inches and each block raises the water a quarter of an inch, this new formula would be:



In the gradual increase in the complexity of her world, she finds a whole series of terms representing ways of calculating how many blocks are in places where she is not allowed to look. As a result, she finds a complex formula, a quantity which has to be computed, which always stays the same in her situation.

What is the analogy of this to the conservation of energy? The most remarkable aspect that must be abstracted from this picture is that there are no blocks. Take away the first term (in the equation shown above) and we find ourselves calculating more or less abstract things. The analogy has the following points. First, when we are calculating the energy, sometimes some of it leaves the system and goes away, or sometimes comes in. In order to verify the conservation of energy, we must be careful that we have not put any in or taken any out. Second, the energy has a large number of different forms, and there is a formula for each one. These are: gravitational energy, kinetic energy, heat energy, elastic energy, electrical energy, chemical energy, radiant energy, nuclear energy, mass energy. If we total up the formulas for each of these contributions, it will not change except for energy going in and out. It is important to realize that in physics today, we have no knowledge of what energy is. We do not have a picture that energy comes in little blobs of a definite amount. It is not that way. However, there are formulas for calculating some numerical quantity, and when we add it all together it gives "28"--always the same number. It is an abstract thing in that it does not tell us the mechanism or the reasons for the various formulas.

Excerpt from "Conservation of Energy"; The Feynman Lectures on Physics; Feynman, Leighton and Sands; Addison-Wesley Publishing Company, 1963.

***And now it’s time for your Story of Energy!***

In your groups, brainstorm and discuss analogies you can use to tell your own “Story of Energy.” Your “Story of Energy” should relate to how energy is stored, transferred, and conserved. After discussing your story, represent your story on a whiteboard. The summary of your story should fit on a single whiteboard and be large enough to be seen from across the room. Be creative, have fun, and ask questions when needed!