Popcorn Relay Race

**Purpose**: The purpose is to help students visualize the intangible concept of energy (the first and second law of thermodynamics) using a concrete process, a relay race using popcorn.

**First Law of Thermodynamics:** The first law of thermodynamics is often called the *Law of Conservation of Energy.* This law states energy can’t be created or destroyed, it just changes forms. Thus, the total amount of energy available in the universe is constant.

**Second Law of Thermodynamics:** Energy transfers from useful to less useful forms. Energy flows in one irreversible direction. It cannot be recycled or reused. As energy transfers, heat is lost. This law also predicts entropy, the measure of disorder in a system. Because heat is lost when energy is transferred, entropy always increases with time. Eventually, because of the second law of thermodynamics, energy in the universe is becoming less useful over time.

**Directions**: 1. In this activity, you are to run a relay race using 4-5 people per group. The tallest person with the biggest hands (holds the most “energy”) is first while the shortest person with the smallest hands is last.

2. Fill the hands of the tallest person with popcorn representing energy. Drop the popcorn into a tray and count the kernels. Have them run across the room with open hands and then return.

3. Drop the popcorn in the tray and count the kernels before the next person picks them up to run.

4. Repeat the process, transferring the remaining kernels to the next person, counting them when they return.

5. We will be running 2 races to demonstrate different forms of energy transfer.

Copy and fill out the following data tables in your field notebook.

Table 1: The first race demonstrates energy transfer in a food web (think back to our ecosystem unit).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Student | Sun (tallest) | Producer | Herbivore | 1st Carnivore | 2nd Carnivore (shortest) |
| # of popcorn kernels |  |  |  |  |  |

Table 2: The second race demonstrates energy transfer when using fossil fuels.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Student | Sun (tallest) | Producer | Fossil | Refined extracted fuel | Gas in car (shortest) |
| # of popcorn kernels |  |  |  |  |  |

**Questions:** Answer the following in your field notebook

1. What does the popcorn represent?

2. What does handing off the popcorn represent?

3. What does running represent?

4. What law is simulated when the popcorn is handed off to the next member of the food web?

5. In the food web example, if the popcorn was not handed off, what would happen to the organism?

6. What law is simulated when popcorn falls either as you run or as you hand off the popcorn to the next trophic level (person)?

7. What does the popcorn on the ground represent?

8. Based on these 2 laws of thermodynamics, why is it so important to protect producers (plants?)

9. Ultimately, what is the source of the gasoline going in the tank?

10. Why do you think gasoline is referred to as a nonrenewable resource?

11. Using the first law, explain why we have limited supply of oil or coal?

12. Explain why conventional cars are only 25-30% efficient, using only ¼ of each gallon to actually run the car. Where does the other energy go?