Sun, to Moo, to You!

Standards of Learning
Science: 4.5

Objective
Students will:
- Investigate the transfer of energy in the process of making milk.
- Understand that there are different forms of energy and that living things need energy to survive.

Materials
- Jump rope, 1 per group
- Relay cards, 1 set per group

Background Knowledge
Humans and animals get their energy from nutrients produced by plants. Humans and dairy cows can both receive energy from plants in the form of fruits, vegetables, or grains. All energy webs originate with the sun.

Plants absorb the sun's radiant energy and transform it into chemical energy through the process of photosynthesis. The plants use much of this energy to grow and store the remaining energy in their cells. When cows eat feed, they are able to use the chemical energy stored in the plants they consume. Cows use this energy to do everything from eating and digesting their food to breathing and producing milk. The milk produced by dairy cows and beef produced by beef cattle also contains part of this energy. When we drink milk, or eat beef products, we receive the energy that originally came from the sun. Our bodies rely on kinetic (physical) energy to do work, have fun, and accomplish tasks.

Cows are ruminants, which is an animal whose stomach has four compartments. Ruminants can digest grass and other forages, which would be inedible to humans and other animals. At least 90 percent of grazing land, nationally, is land that cannot otherwise be used for farming because it is too high, rough, dry, or wet. However, cattle are able to eat the grasses on these lands and convert the energy to beef and dairy products that humans are able to eat.

Procedure
1. Have students brainstorm different types of energy. Ask them to list ways they use energy throughout the day. Discuss how energy is transferred, rather than created. Now brainstorm how animals use energy. How can an animal's energy be transferred to humans?
2. Divide the students into teams of seven students. Teams without seven students will need to select one or more members to complete the relay twice.
3. Assign each team a color. Outside, the students line up with their teams in single file lines. Five yards in front of each team's starting line, place a jump rope. Several feet beyond the jump rope, spread out the team's relay cards face down. Five yards further, place a finish line.
4. Explain to the students that they are about to participate in a relay race team competition. Build up the importance of supporting each other and contributing to the goals of the team. Demonstrate how each student will individually leave his or her team's starting line. They will run to the jump rope and jump rope five times. Next, they will pick up one of the seven relay cards and run to the finish line. Once they are at the finish line, they will yell, "Moo!" to signal the next teammate in line to begin the relay.
5. Once the entire team has crossed the finish line, the team members will work together to put

each of the relay cards in the correct order. The cards will create a sequence showing how energy moves within the process of making milk. When the team has completed the entire relay, team members must all sit quietly in a line. The first team sitting quietly on the grass wins! The winning group reviews the correct order with the class.

6. Discuss how the correct sequence of cards showed that plants produce energy through photosynthesis and cattle eat plants such as grass, hay, and grain. Cattle convert the plant energy into producing milk which provides healthy foods for our diet.
    a. Sun, seeds, plants, cow, milk, drinking milk, exercising

Adaptations

You may omit the relay race part of the lesson and instead challenge students to organize the cards in the correct order showing the flow of energy through the web.

Credits

Original lesson adapted from California Agriculture in the Classroom

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