Return To Middle School Lesson Plans

Title: **Fossil Fuels-Importance and Formation**
Level: **Middle School**
Day/Time:

Acdemic Expectations
Core Content for Assessment:

(Graphics for Fossil Fuels - Importance and Formation)

Objectives:

To introduce the student to the concept of energy as a common factor among all things. Students should be able to:

1. List at least three things that people and animals do that uses energy.
2. Name three fossil fuels.
3. Describe how fossil fuels were formed.
4. Tell how much plant debris it took to form one foot of coal.
5. List at least three things (more will be covered later) that run on energy products produced from fossil energy sources.

Time Allotment: 30-45 minutes

Background Information:

Why is fossil energy important in our lives? What are fossil fuels? How were fossil fuels formed?

"Fossil energy" is a term for the group of energy resources formed from prehistoric plants and animals.
"Fossil fuels" refer to the members of this group-coal, natural gas, and petroleum.

Key Question: Why do you and every person, plant, and animal ever living on earth need energy?

Answer: [All living things, including dinosaurs, roses, butterflies, and you, have needed energy to move, eat, sleep, play, or even unfold a petal.

The Human Body: That Marvelous Machine Your body is like a machine. You must have a fuel to run your engine because it is your engine (heart) that enables your levers (arms), wheels (feet), computer (brain), etc. to operate. Energy is the fuel you use to power your engine. People get energy from consuming many kinds of food. After we eat the food, our bodies digest and then burn it to produce energy.]

Key Question: Why are fossil fuels important?

[Machines, such as the televisions, cars, and computers we take for granted in our daily lives, also need energy to run. Many times the energy used to power these things comes from "fossil fuels."

We burn natural gas, a fossil fuel, to heat our homes. We use gasoline, a product made from a liquid fossil fuel named "petroleum," to power our cars.

We get energy for our bodies when we eat food or for our cars when we burn fossil fuels.]

Key Question: What has a dinosaur got to do with the lights in your home?

[Energy again! The dinosaur ate and used food as fuel to produce the energy it needed to move, play, and even sleep. Our bodies need energy for the same reasons. however, we need energy also to power many things that we use in our everyday life, such as the lights that help us see at night. The energy that makes you lights possible is called electricity. This electricity is produced mostly from fossil fuels that were formed from plants and animals that lived and died millions of years ago.

Much of our electricity is produced by turning a fossil fuel rock called "coal." Coal is a very, very old type of fossil. It was formed from plants that flourished in the great swamp forests over 300 million years ago. The Earth's climate, soil, and atmosphere were favorable for thick plant growth. Many large areas of flat swampy land of perpetual summer existed where plants grew profusely, died, and fell into the shallow waters. These plants could be enormous. Plants, that today occasionally grow to three feet in tropical forests, grew to heights of 30-125 feet (impressively tall oak trees today are 100 feet tall). Some of these plants had branches that grew directly out of their trunks making them look like 100 foot tall bottle brushes. over millions of years these dead plants became coal. Anthracite coal can be over 100 million years older than a dinosaur fossil. Even the youngest member of the coal family, lignite, had been formed before the last dinosaur died.]

Key Question: What are fossil fuels?

[The word "fossil" is defined as hardened remains of plant or animal life from some previous geological period that are preserved in the Earth's crust. Therefore, "fossil fuels" are materials that can be used today to produce energy (heat or power) that were created from plants and animals that lived millions of years ago. Like many fossil, these fossil fuel may be found deep in the layers of the Earth.]

Key Question: Name three fossil fuels.
[coal, natural gas, & petroleum]

Key Question: Do you know which of the three states of matter (solid, liquid, or gas) each fossil fuel is?

[Coal is a solid, petroleum is a liquid (although some may be very thick), and natural gas is a gas.]

To prevent confusion, while we are studying fossil fuels we will use the word "gas" to refer to a substance that is readily dispersed throughout the atmosphere (i.e., the gaseous state of matter). The term "natural gas" will be used to refer to the fossil fuel. When we are discussing the petroleum product that powers most cars we will use the word "gasoline."

Key Question: When and how were fossil fuels formed?

a. When did fossil fuels begin forming?

[Some began forming from plants over 100 million years before the dinosaurs appeared.]

b. What were the original things that became fossil fuels?

[Coal was commonly formed from plant debris and natural gas and petroleum were formed from tiny organisms found in the prehistoric seas.]

c. How were fossil fuels formed?

[When the plants died, they fell into the shallow swampy water and were buried over millions of years by increasing amounts of plants, mud, sand, water, and rock. Bacteria attacked the cellulose in the plant cell walls breaking up the large pieces of plant tissue. One of the products of this bacterial activity is methane gas, which sometimes can be seen bubbling up through the water and is called "swamp gas."

The pressure of the weight of the upper layers compacted the plant materials on the bottom into a dense substance called "peat." Peat forms relatively quickly in geological time, but slowly in human perception. A 2-3 inch layer of peat can form in about 100 years. Some of our modern swamps have peat layers over 30 feet in depth that represent relatively steady growth for 15,000 years. For instance, the Great Dismal Swamp in Virginia and North Carolina contains about 3/4 billion tons of peat today. It may take only a few thousand years to form peat, but it takes millions of years to form coal from this peat. As the peat is compacted by the weight of the increasing layers above, it is also buried deeper and exposed to heat deep in the Earth. During this final stage, temperature is the primary agent responsible of the change to coal. However, pressure can still play a big part also. For example, much of the anthracite coal in theu.S. was formed during the ancient formation of the Appalachian Mountains when Ancestral Africa collided with North America as the Earth concentrated its land masses into one continent called "Pangaea." The special combination of time, pressure, and heat changed these ancient plants and animals into the fossil fuels we use today.]

d. How much buried plant matter did it take to form a foot of coal?

[It took 10 feet of plant matter to make 1 foot of coal.]

e. Were there equal amounts of coal,, natural gas, and petroleum formed?

[No, coal is much more common than natural gas or petroleum. The composition of the original materials, the amount and duration of pressure and heat, and the length of the formation period varied for each fossil fuel. The timing and the composition had to be just right for each one. These complex conditions evidently happened much more commonly in the case of coal than they did for natural gas or petroleum.]

Key Question: What keeps petroleum (a liquid) and natural gas (a gas) from escaping to the surface of the Earth?

[Petroleum and natural gas are often found under rock formations called "caprock" that are dense enough to trap the petroleum and natural gas and keep it from seeping to the surface. Some petroleum and natural gas have been found at the surface of the Earth and recorded by man. Marco Polo, an Italian explorer, wrote of seepages of oil in Caspian Sea region. The "eternal fires" reported byPlutarch, a Greek historian, in the area of present day Iraq probably were natural gas seepages that had been ignited by lightening.

Materials:

Dinosaurs and Power Plants Teacher's Guide Supplement
Drawing- "Using Energy: Dinosaur Jumping Rope"
Drawing- "The Human Body: That Marvelous Machine"
Drawing- "Gasoline...Is Used...to Power Cars"
Drawing- "The Energy Needed to Power Our Lights..."
Drawing- "How was Coal Formed?"
Drawing- "Underground Geological Layers of the Earth"
Word List
Graphic- "Energy Equivalents"
Copy of "Energy Uses" sheet for each student
(need pencil or pen to answer questions)
Yardstick or Tape Measure (not included)

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Activity:

Ask, "What do a dinosaur and you have in common?"

1. Give a short time for answers then show the picture of the "Using Energy: Dinosaur Jumping Rope: (Teacher's Guide Supplement) and ask "What does your body need to allow you to jump rope, run, or hit a ball?"

Answer: "Energy"

2. Hand out to each student a copy of Dinosaurs and Power Plants and of the "Energy Uses Quiz" (Supplement). Have the class complete the "Energy Uses Quiz." Follow these activities with a class discussion utilizing the Key Questions found in this Teacher's Guide.

3. To begin finding out more about energy and how it is used, the class will read of Dinosaurs and Power Plants, complete the "Energy Uses" quiz, and participate in a class discussion.

Activities:

4. On the "Energy Uses Quiz" (Teachers Guide Supplement) provided by the teacher, quickly LIST:
a) the ways a dinosaur used energy, [finding food, running, swimming, etc.]
b) the ways your body uses energy, and [playing baseball, holding a pencil, watching TV, playing video games, etc. Even sitting or sleeping require energy.]
c) three machines that use energy (electricity, coal, natural gas, or petroleum). [television, clock, furnace, bus, car, lights, computer, typewriter, intercom, air conditioner, fire or attendance bell, fan, cafeteria ovens & refrigerators, etc.].
5. Discuss the "Energy Equivalents"

Follow-up Activities:

1. Cut out pictures at home for a collage (to be finished at the end of the lesson series) of prehistoric animals and plants or pictures about coal, gas, or petroleum.

2. Practice spelling words from the word list for this lesson or write a definition for each word or word group.

3. Designate a small square of a space on a table top that can be left undusted for at least two weeks. Check the space after 24 hours to see what has collected. Check again each day for two weeks. Discuss: 1) what has happened on your space and 2) now this small example can relate to soil layers outside. In two weeks, note how much material collected in your space. Then think how much could collect in a month, a year, 10 years, 50 years, 100 years, 1000 years, one million years or in five billion years (the time that has passes since Earth formed).

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