FIRE

LESSON PLAN

Meets the following 5th Grade Science Standards:

Earth Science:

4a: Students know uneven heating of Earth causes air movements (convection currents)

Investigation and Experimentation:

6b: Develop a testable question (Can we make a fire doing …?)

6c: Plan and conduct a simple investigation (Make a fire)

6d: Identify the dependent and controlled variables in the investigation (what resources are available versus what resources do we have with us)

6e: Identify a specific variable and explain how it helps us collect information (the amount of heat)

6h: Draw conclusions and determine if more information is needed (did the fire start? Why or why not?

Meets the following 6th Grade Science Standards:

Heat/Thermal Energy:

3: Heat moves in a predicable flow from warmer objects to cooler objects until all the objects are the same temperature

3a: Students know energy can be carried from one place to another by heat flow or by waves, including water, light and sound waves, or by moving objects.

3b: Students know when that when fuel is consumed, most of the energy released becomes heat energy

3c: Students know heat flows in solids by conduction (which involves no flow of matter) and in fluids by conductions and by convection (which involves flow of matter)

3d: Students know heat energy is also transferred between objects by radiation (radiation can travel through space)

Energy in the Earth System:

4a: Students know the sun is the major source of energy for phenomena on Earth's surface; it powers winds, ocean currents, and the water cycle.

4b: Students know solar energy reaches Earth through radiation, mostly in the form of visible light.

OBJECTIVES:

1. Briefly introduce the positive and negative effects of fire.
2. Define fire and describe the chemical reaction.
3. Memorize the three elements necessary to produce and sustain a fire.
4. Discuss the three ways in which heat moves.
5. Discuss the three types of fuel and how they can be used to build an effective fire.
6. Discuss the importance of oxygen and what structures can be used to ensure there is enough
7. airspace around the fuel.
8. Have students make a successful fire and roast a marshmallow.
9. Know when it is safe to light a fire.

BACKGROUND INFORMATION:

Fire is a chemical reaction known as rapid oxidization. There are three main elements necessary to create fire: heat (energy), fuel, and oxygen (oxidizer). The right amount of these elements will create the chemical reaction resulting in fire. There are several atmospheric, land, fuel and weather conditions that can seriously affect the danger level of lighting a fire. Sometimes fire is necessary for survival. Sometimes a fire is just for enjoyment, but it should never be carelessly lit because it can destroy lives, and even kill. In this lesson, we will study the chemical reaction, the elements necessary for fire, the things that affect fire, and how to make a fire using different materials.

PROCEDURES:

1. Briefly ask students about the reasons for building a fire and the negative effects a fire can have.
2. Examine the chemical reaction know as fire using the icons to help students visualize this complicated process.
3. Teach the three elements needed to create a fire (Fire Triangle).
4. Discuss the three ways heat travels using ice for conduction, the windmill for convection, and magnets for radiation.
5. Discuss the three fuel types using the chart and actual samples of each fuel type.
6. Discuss the importance of oxygen and show structures to build that will ensure there is enough airspace for oxygen.
7. Divide them into groups of 2-3 students and have them build and light their own fires. Roast a marshmallow.
8. Review the Fire Checklists: Fire Safety and Extinguish the Fire.
9. Read James 3:3-6 and discuss the power (good and bad) of words.
10. Extinguish the fires. Have students to this if possible.

FIRE

TEACHER'S NOTES

Scripture References:

James 3:3-6: "*If we put bits into the mouths of horses so that they obey us, we guide their whole bodies as well. Look at the ships also: though they are so large and are driven by strong winds, they are guided by a very small rudder wherever the will of the pilot directs. So also, the tongue is a small member, yet it boasts of great things. How great a forest is set ablaze by such a small fire! And the tongue is a fire, a world of unrighteousness. The tongue is set among our members, staining the whole body, setting on fire the entire course of life, and set on fire by hell."*

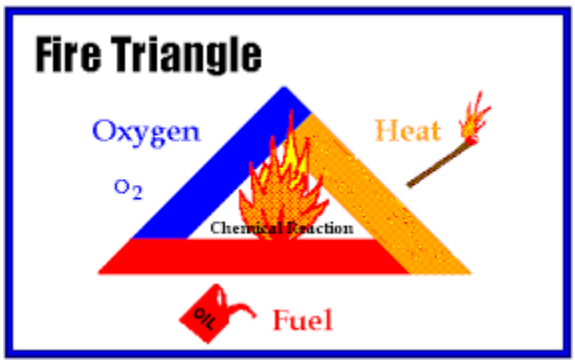
I. Fire is a Chemical Reaction

A. Reasons to build a fire and the negatives effects it can have:
   1. Reasons to build a fire include: heat, light, cooking, campfire times, and protection from animals.
   2. Negative effects of a fire include physical harm, destruction, and death.

B. Fire is a chemical reaction known as rapid oxidization. Heat causes volatile gases to be released from fuel. As the heat increases and oxygen is added, oxygen rapidly takes electrons from the gases and adds them to the oxygen molecules. This rapid process causes the heat and light of fire.

C. Three elements are needed to create fire: Heat (energy), Fuel, and Oxygen (oxidizer). The right amount of these three elements leads to an uninhibited chemical reaction. Fire cannot exist if one of those elements is missing.

II. Fire Triangle



A. Heat is a form of energy associated with the motion of atoms or molecules and are capable of being transferred through solids, fluids, gasses, and empty space.
   1. Energy is most often produced by heat. Heat can be produced by many ways, such as friction, radiation (from the sun for example), or transference (as in a lit match).

B. Heat always moves from hotter to colder objects until they are the same temperature. This transfer of energy is important to understanding weather patterns, wind directions, and the water cycle on Earth.

C. **Heat** moves in three ways: **conduction**, **convection**, and **radiation**. This affects the way a fire can ignite and travel.
   1. **CONDUCTION**:

a. Material to Teach: **Conduction** is when heat is transferred through a **solid object**. When you hold an ice cube in your hand, the heat transfers from your hand, to the ice cube. This can be seen by the ice cube melting and your hand becomes colder because heat is taken away from your hand.
    i. Pass out ice cubes to each student to experience.
b. Further Knowledge: Molecules move heat through a solid object. That is why coffee in a pot over a fire gets hot. Or if you put a fork on a heat source your fingers get hot from the handle of the fork. "Conduction occurs when a group of atoms or molecules whose average kinetic energy is greater than that of another group transfer some of that excess energy by means of collisions. Because hot objects have atoms with grater average kinetic energy than do cold ones, there is a transfer of this kinetic energy from hot to cold. In a solid the atoms vibrate in place, but energy may still be transferred from atom to atom as happens when a pan is placed on a stove and its handle becomes hot." (CA State Standards 6th grade 3c). Conduction can also apply to liquids and gasses if there is no cumulative flow (aka convection currents) in the materials.

2. **CONVECTION**:
    a. Material to Teach: **Convection** is when heat is transferred through **air, liquids or gases** where the warmer particles rise up and colder particles are pushed down. This is why heated air rises, forming air currents, and why fire will move UP a slope or a tree by convection**.**
    b. Further Knowledge: Webster's online dictionary says "movement in a gas or liquid in which the warmer parts move up and the colder parts move down." "Convection occurs because most fluids become less dense when heated; the hot fluid will rise through cold fluid because of the hot fluid's great buoyancy. As hot fluid away from a heat source, it may cool, become denser, and sink back to the source to be warmed again. The resulting circulation is called a *convection current*. Convection currents account for the water in a kettle reaching a uniform temperature although the kettle is warmed at the bottom." (CA State Standards 6th grade 3c). This also accounts for why heated air rises. Fire will move up a tree or up a slope by convection.
3. **RADIATION**:
    a. Material to Teach: **Radiation** is when heat is transferred through **electric and magnetic waves**. The sun is the main source of heat and energy for Earth.
    b. Further Knowledge Webster's online dictionary says "energy that comes [moves] from a source in the form of waves or rays you cannot see." "Another form of energy transfer between objects is radiation: the emission and absorption of electromagnetic waves. Radiation is fundamentally different from conduction and convection in that the objects do not have to be in contact with each other or be joined by a solid or fluid material. Heating by sunlight is an obvious example of radiant energy transfer. Both the heat and the light that can be seen are forms of electromagnetic radiation. Calling attention to this fact may help dispel the common misconception that all radiation is harmful." (CA State Standards 6th grade 3d). Heat radiates from a heat source. The air is not heated, but objects near the source will warm up. The Earth is heated by the sun. Curtains can catch fire through a closed window from radiated heat.

D. There are three types of **fuel**: Tinder, Kindling, and Coal Producers.
   1. **Tinder** is needed to start your fire. It is small, easily flammable substance less than the size of a match. Dryer lint, cotton balls, dry grass, cattails, cedar shavings, and pine needles are examples of tinder.
   2. **Kindling** is used to take your small amount of heat from your tinder and slowly build a healthy fire. It is between the size of a match and a pencil. Splinters of soft wood, small twigs, and fuzz sticks are examples of kindling.
   3. **Coal Producers** are fuel greater than 1 inch which will burn to make hot coals and sustain a fire. Softer wood will light quicker, while harder wood will burn longer. Wood that comes from trees with needles are softer wood, while wood that comes from trees with broad leaves are harder wood.

E. **OXYGEN** is necessary for fire. The number one reason fires are difficult to start is because not enough airspace is left around the fuel. Make sure you leave enough space between the fuels by building a log cabin or a teepee.

III. Build a Fire

A. Divide students into groups of 2-3 students. Give them their set of firewood and a safe location to build their fire.
B. Ask students to take turns constructing their own log cabin.
C. Give them matches to set the last log cabin on fire.
D. Have students slowly add fuel till the fire is sustaining itself. Have them roast marshmallows.

IV. Review the Fire Checklists

A. Have students sit down.
B. Review the Fire Safety Checklist.
   1. Is this fire necessary?
      a. Fire should never be used carelessly.
   2. Is it in a safe area?
      a. Bare soil, away from burnable objects.
   3. Is the weather safe?
      a. Dry and windy conditions make fires dangerous.
   4. How can I extinguish the fire?
      a. Do not build a fire unless you can easily extinguish it.
   5. Can I watch the fire until it is put out?
      a. Never leave a fire unattended.

C. Review Extinguish the Fire Checklist
   1. Remove heat with water
   2. Remove fuel by separating the fuel with a stick
   3. Remove oxygen by covering it with dirt