Name:

Saving our Earth one Insulation at a Time!

The process of heating and cooling accounts for\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_ % of the energy used in the average American home.

It is predicted that the average temperature will rise another \_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_degrees F in the next 100 years.

What is an insulator?

**Experiment**:

You are all highly educated engineers working on a significant problem present in the world today – global warming. Because of green house gasses and the expenditure of energy due to the use of equipment such as heating and air conditioning, our population is at a severe risk for facing many worldwide problems due to temperature increases. One significant way to reduce unwanted energy use is to insulate households. By adding insulation, houses can retain heat in the winter and cool air in the summer.

You and your engineer partner are in charge of finding out the best insulation material to be used in many households around the area. Because of cost, the engineer laboratory has supplied your science teams with materials similar to what will be used on the houses but not exact resources. Also, keep in mind that what is being tested is only a single layer of what will be used for the actual insulation. The Earth’s future is in your hands… GOOD LUCK!

**Each group will need:**

Thermometer

Hot plate

10 Styrofoam cups

5 rounds of newspaper, saran wrap, tinfoil, paper towel

Tongs/ hot mitt

Graph paper

Marker

**Safety:**

* EVERYONE in the classroom will be required to wear safety goggles to avoid hot water being splashed into eyes. Because we are dealing with hot water, all persons need to be extremely careful when pouring and taking temperatures. If there is a spill or burn, tell the instructor immediately.
* Do not let the probe wire touch the hot plate, it will burn through and ruin the thermometer device.
* Be careful with edges of tin foil, they can be sharp. If someone cuts themselves, tell the teacher immediately.

**Procedure**:

1. Place an 800 ml beaker of tap water on the hot plate and turn temperature dial all the way up.
2. Heat the water with the thermometer probe placed in the water until it reaches about 70˚C.
3. Double the Styrofoam cups to where you have 5 sets of 2 cups put together and label them 1-5.
4. In the table below, record what number cup matches each insulation. Leave number 1 open for the control.
5. Using hot mitt, pour heated water into each doubled cup about half way. ( make sure all cups are filled to about the same point for accuracy) BE CAUTIOUS WHEN POURING HOT WATER.
6. Take initial temperature of each cup and record in table below.
7. Quickly place 5 rounds of each insulation on top of the doubled cups. (while you are waiting, make your prediction on what insulation will be the most effective below)
8. Take the temperature of each cup by slipping the probe under the insulation without removing it. Do this every 5 minutes for 15 minutes and record.
9. After 15 minutes, dump the water and discard insulators in garbage.

Create a hypothesis on what type of insulation will work the best in the blank space below. (Newspaper, saran wrap, tinfoil, paper towel) My hypothesis is………. Because……..

**Data:**

(Be sure to label in degrees Celsius!)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Cup number | Insulation type | Initial temperature (t=0 minutes) | t= 5 min temperature | t= 10 min temperature | Final Temperature (t= 15 min) |
| 1 | Control | 50˚C |  |  |  |
| 2 |  | 50˚C |  |  |  |
| 3 |  | 50˚C |  |  |  |
| 4 |  | 50˚C |  |  |  |
| 5 |  | 50˚C |  |  |  |

On the sheet of graph paper provided, graph Time vs. Temperature for each insulation type. Be sure to label each line drawn to indicate insulation types (hint: there should be 5 lines on graph)

**Follow up**:

What is the best insulator, how do you know?

Was your prediction correct or incorrect? What do you conclude from your results?

What general trend do you notice from ALL of the cups’ temperatures?

Were your results consistent with the rest of the class? If not, what could you have done differently to make your results more accurate? (ex: were the tops of your cups covered completely?)

**The Greenhouse Effect**

A garden greenhouse keeps plants warmer than they would be outside, even though it often does not have an extra source of heat. Greenhouses work because the glass traps some of the sun’s radiation energy (similar to sun light entering a house window). The atmosphere keeps the Earth warm in a similar way. Without any greenhouse effect the average temperature of the Earth would be about -18˚C, similar to a domestic freezer. Instead it averages around 15˚C. Many gases in the atmosphere act as so-called ‘greenhouse gases’ and help to warm our planet. These include: carbon dioxide; water vapor; methane; chlorofluorocarbons (CFCs) and their replacements, hydrochlorofluorocarbons (HCFCs) and oxides of nitrogen.

1. If the greenhouse effect did not exist would the normal temperature of the Earth be higher or lower? By how much?
2. Why might an increase in the concentration of greenhouse gases be a concern? What might be the effect of an increase?

**Thinking Beyond:**

Because there are many effects of global warming due to human behavior, think of something you can do at home that will help reduce resource waste and contribute to the efforts of reducing greenhouse gasses.

|  |  |  |
| --- | --- | --- |
| What will you change? | What efforts will you make to change it? | How will this help reduce Greenhouse gasses? |
|  |  |  |

