

## Engineering Challenge: Energy Efficient Home

**Problem:** Your task is to design, construct and test an energy efficient home for your Otter Pops. In order to decrease the rate of heat transfer you will need to recall all you have learned about conduction, convection, radiation, insulators and conductors. You will be given a budget for your home. You may buy any supplies of your choosing as long as they are available and fit in your budget. You will work with a partner (2 people). Your home will need to be big enough to hold two otter pops.

**Research:** Using the internet and the research tools you have been taught, you will research the following materials that may be used to insulate your home. For each item listed, write two pros and two cons to using that material as an insulator. You will also need to cite the sources that you used to find those pros and cons.

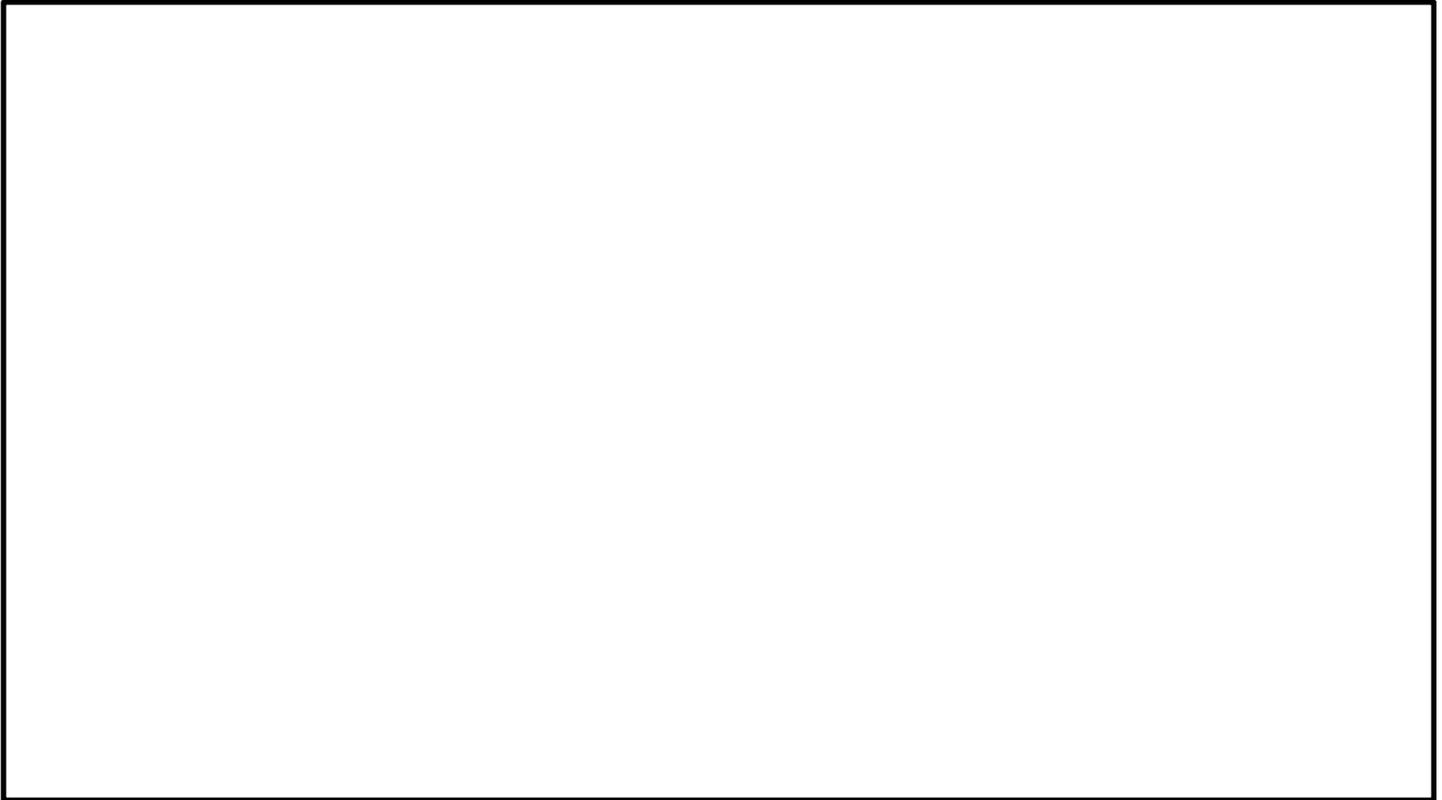
Insulation Material	Pro	Pro	Con	Con	Sources
Cotton Balls					
Styrofoam					
Cotton Batting (Fiber Fill)					
Fiberglass Insulation					
Shredded Paper					
Tissue Paper					
Popcorn					
Fleece					

Your budget is \$ \_\_\_\_\_

Design and Construct:

1. Design your home using the supplies that you purchased. You MUST use some type of paper for the frame for your home. Your **tape** may NOT touch any of the insulation materials. It may only touch the frame of the home.

Sketch a cross-section (side view) of your design below. Include where you will use each of the materials you have chosen. **LABEL** the materials in your diagram.



Budget: Check the price sheet at your table for prices.

Materials	Quantity	Cost	Total
Grand Total			

2. Build your home based on your design and fill your home with the materials you have chosen.

3. Obtain the initial mass (including the wrapper) of the 2 otter pops and place them in the center of your home. Record the initial mass in the data table on the next page.

Test:

4. Place your home in a radiated area. You will return to class and watch a video. While you are watching the video, your otter pop will be protected in your insulated home.
5. After the video, take your home back to your lab table and measure the final mass by cutting a slit into your otter pop and draining the liquid that has melted in the sink or into a cup if you'd like to drink it. Obtain the mass of the remaining otter pop. (wrapper and what is still frozen)
6. Eat the frozen part and complete the data below.
7. Clean your station and return your materials to the front of the lab.

Data Table:

Beginning Mass = \_\_\_\_\_g

Final Mass = \_\_\_\_\_g

Change in Mass = \_\_\_\_\_g

Analysis:

8. How well did your insulated home reduce the amount of heat that entered?
9. If you were to redesign your home, what would you change?
10. Define Conduction:
11. How can the amount of conduction be reduced?
12. Define Convection:
13. How can the amount of convection be reduced?
14. Define Radiation:
15. How can the amount of radiation be reduced?
16. Explain the relationship between heat transfer and energy efficiency.

# Bill Nye- HEAT

1. Heat is \_\_\_\_\_.
2. Heat moves in what 3 ways?
  - 
  - 
  -
3. Define and give an example of radiation:
4. Define and give an example of conduction:
5. Define and give an example of convection:
6. Anything with molecules has \_\_\_\_\_. The molecules in cold things are moving more \_\_\_\_\_ than the molecules of warm things.
7. Which has more heat energy: an ice sculpture or a burning match? Why?
8. \_\_\_\_\_ cameras are sensitive to heat radiation.
9. How does heat conduction work in the metal brownie pan?
10. How does heat radiation work in the glass brownie pan?
11. You can measure how hot something is in \_\_\_\_\_ or \_\_\_\_\_. The \_\_\_\_\_ something is, the \_\_\_\_\_ its molecules.
12. Do freezers have heat?
13. \_\_\_\_\_ has heat.