

Heat: Where Does It Go?

From the Good Housekeeping Research Institute where thousands of products are tested by engineers and scientists each year.

Background:

Heat can be produced from a variety of sources. It's often the byproduct of inefficient electronics and appliances, but it's also an intentional energy source that keeps your house warm in the winter.

Most of us use natural gas, heating oil, or

electricity to heat our homes. But each time a door or window is left open or leaking, or wall insulation is poor, your home's heating system has to work extra hard to make up for this, which wastes energy, and costs a lot of money.

Making sure that your home is well insulated makes a lot sense.



Basic Experiment:

Purpose:

Find leaks, which are common sources of heating expenses in a home.

Materials:

1. An infrared thermometer (or thermal leak detector):
 - Black and Decker Thermal Leak Detector (\$36)
 - Craftsman IR Thermometer (\$80)
 - Ryobi IR Thermometer (\$30)
 - General Tools IR thermometer (\$50)

Instructions:

1. Use the infrared gun around the room to try and isolate leaks or places where outside air may be leaking in. This usually occurs around windows or near cracks in a door.
2. Any location with that reads significantly below room temperature is likely a source of heat loss.

Discussion Points:

- Why is leaking air bad?
- What can be done to minimize the air being lost?

Advanced Experiment:

Purpose:

Compare the insulative capacity of different walls and windows. Insulation is commonly rated using what's called an R-value. The higher a wall or window's R-value, the better it will insulate.

Materials:

1. An infrared thermometer (or thermal leak detector):
 - Black and Decker Thermal Leak Detector (\$36)
 - Craftsman IR Thermometer (\$80)
 - Ryobi IR Thermometer (\$30)
 - General Tools IR thermometer (\$50)

Instructions:

1. If possible, find the layout dimensions and materials contained in a wall (i.e. brick 3", gypsum 3/4", etc.), or window. If this is not available, you can make an example wall with assumed thicknesses and materials.
2. Use the following calculation to find the R-value of two different walls, or windows. Common R-values can be found here:

<http://www.coloradoenergy.org/procorner/stuff/r-values.htm>

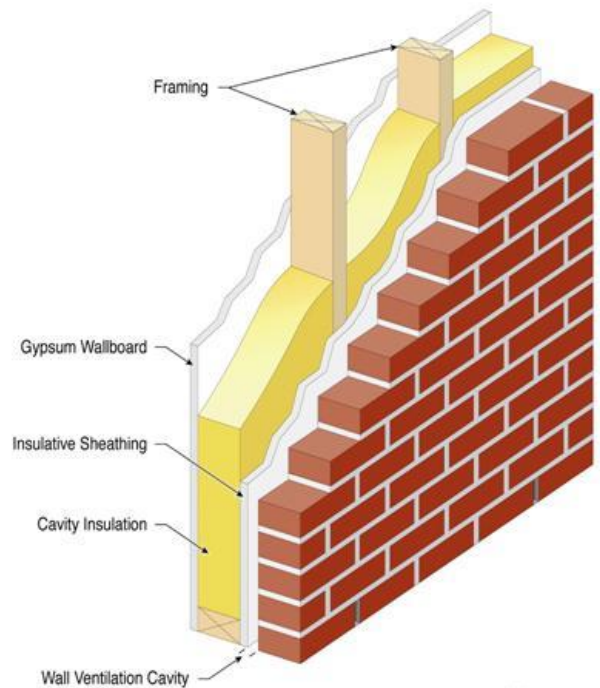
3.
 - a. In series (such as below) the total R-value can be calculated as follows:

$$R_{total} = R_1 + R_2 + R_3 \dots$$

- b. In parallel, the average R-value can be calculated using the following, and by multiplying each term by its subsequent surface area.

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \dots$$

4. Now, compare your results by checking the temperature of a wall with an infrared gun. If it's a cold day outside, you'd expect the window, or whichever wall has a lower R-value, to insulate less and thus be colder. If it's a hot day and the air conditioning is on, you'd expect the window, or wall with lower insulating value, to be warmer.



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Discussion Points:

- What will make up for the lost warm or cold air?
- What materials make up a good insulator?

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