LESSON: SC9.03.3

B. Bowers

Heat Transfer

Scheduled Posting: Dec. 1
A.D. Dec. 7

Transfer this, science guy!!!

It's a good thing that this lesson is about CONTROLLING the transfer of heat...or else this science guy would be in deep trouble!

Controlling heat transfer is another way of saying insulation. And on a day like today with new snow fall, insulation is a good thing! In this lesson, we will be looking at how we can control the transfer of heat by means of conservation and insulation. Let's take a look at our objectives for this lesson:

OBJECTIVES

To identify applications in which heat transfer is controlled

To interpret the effect of clothing materials and design on the retention or transfer of heat.

To describe and demonstrate a technique for comparing the effectiveness of different kinds of insulating materials.

RESOURCES

1. Pages 141-146 of your text
2. Grolier's Multimedia CD-ROM

VOCABULARY

1. conservation
2. fossil fuels
3. heat insulator
4. RSI value
5. greenhouse effect

Lesson

Heat Transfer

Objective One: To identify applications in which heat transfer is controlled

Let's take a look at the illustration on page 141. Can you identify the "spots" where heat is being transferred efficiently or wastefully? We don't even need to look at the book to find examples of applications where heat is being transferred. Just look around you right where you are sitting. Can you find any things that are transferring heat or insulating against the transfer of heat? As I sit at my desk, I can see my triple-pane window trying to keep all of the heat inside of the house, my space heater knocking out heat to keep this room warm, my basement walls which are insulated to keep the heat from warming my yard, and my overhead light which is transferring a small amount of heat as a result of the electrical activity going on inside that bulb. What about you? Go ahead, take a look around.

Objective Two : To interpret the effect of clothing materials and design on the retention or transfer of heat.

Start daydreaming of a beautiful hot day at the beach. You are watching a great volleyball tournament but it is getting really hot and you start tugging at the front of your t-shirt trying to get some air-flow going down your chest. Do you know why this helps? It is because your t-shirt has formed an insulating layer between you and the outside air and has also trapped “dead-air” between your skin and the t-shirt. As you’ve read on page 145, dead-air is a great insulator of heat, just what you DON’T want for a day at the beach. This is why summer active wear is made from materials that “breathe” and that are made from a mesh-like material. These “breathe-able” materials allow the heat to escape through the clothing and into the air, thus eliminating any possibility of dead-air space.

It is no surprise to you that your ski jacket or parka is your best friend when it is -20^{0}C outside. But why is that? The obvious answer is that the jacket keeps your warm. But how does the jacket do this?

For starters, the jacket acts as an insulator that keeps the heat generated by your body from escaping into the air. The jacket also traps air between you and the jacket lining. This air is somewhat like the “dead-air” described on page 145, but it is not real dead-air space because your movement and the fact that there is no seal around you and the jacket both allow the air to circulate. For this reason, one-piece snow suits are a great insulator because they can keep a large area of your body covered with dead-air for insulation.

These jackets are able to keep your body heat from escaping because of the type of lining in the jacket. As the text states on page 145, both down and man-made fibres may contain as much as 70,000 fluffy filaments that overlap and interlock to form a protective layer of dead-air space.

Objective Three: To describe and demonstrate a technique for comparing the effectiveness of different kinds of insulating materials.

The principle of using dead-air space for insulation also applies to the building construction industry. A common problem area for insulation is the WINDOW. You've probably heard someone say, "I feel a draft," and after exploring the issue, found that a window is either partially open or has been poorly insulated and sealed. Builders have a system to determine a window's effectiveness at insulating against the transfer of heat. This system is based on the material's RSI value (see page 144 and 145). Let's take a closer look at how a builder would use the RSI values to determine if a certain window will make a good insulator.

We first need to know the steps we need to take to determine a window's complete RSI value.

Step One.

We need to list out (itemize) the separate components that make up the total window. These items are

1. one glass window pane
2. (that's it!)

Step Two.

We then need to know the formula for determining the RSI value for all of the window's components. This formula is as follows:

RSI value/cmX the thickness of this material as measured in cm = the RSI value for that piece of material

So we have the following values to insert into our formula:

RSI 0.017/cm (the RSI value for glass window pane) X 0.3cm (the thickness of the glass window pane) = an RSI value of 0.0051.

Step Three.

We now may add the RSI values that we calculated in Step Two. Since we only listed one item in Step one, then we have only one figure to deal with:

RSI of a 0.3 cm glass window pane is RSI 0.0051

As you can see, the steps to determine the RSI value of a certain insulator are not too difficult. Let's look at how we would determine the RSI value for a double-glazed window.

Step One

Itemize the components of the window:

1. glass window pane
2. air space
3. glass window pane

Step Two

Calculate the RSI values for each of the items listed in step one.

1. glass window pane (3cm): 0.0051
2. air (1 cm) : 0.15 X 1cm = 0.15
3. glass window pane (3cm): 0.0051

Step Three

Now we add up the values that we calculate in step two:
0.0051+0.15+0.0051=0.1602

So the double-glazed window has an RSI value of 0.1602

Let’s Wrap This Up

Main points to remember:

- The control of heat transfer is an integral part of the material “things” that surround us. Because the source of much of our usable heat comes from non-recycleable sources, we need to be very careful not to waste these resources.

- Even our clothes, at least the athletic wear, are designed to either transfer heat or insulate heat.

- A particular item can be measured as to its ability to insulate against the transfer of heat. This measurement is called the RSI value.

Assignments

- To complete the SC9.03.3.Exam

CAFE

CREATION CAFÉ

Body temperature reflects the level of heat energy in an animal's body. It is the consequence of the balance between heat produced from metabolism and the exchange of heat with the surrounding environment. The continuance and activity of life processes are profoundly influenced by temperature . Usually animal life is feasible only within a relatively narrow range of temperatures. The lower limit is just about the freezing point of water, 0 degrees C (32 degrees F), whereas the upper limit is about 45 degrees C (113 degrees F), the temperature at which cell structures begin to degenerate.

The above sentences are from the GME on the subject of body temperature. Please notice the bolded items. These facts teach me that life is a delicate thing and that it exists in a world that has been uniquely fitted for it, and so uniquely fitted that to suggest that it came about by mere chance seems ludicrous. But as one strong evolutionist said, “I will continue to believe in the theory of evolution because to believe in a creator God is not acceptable to me.” Too often, people reject creation theory not on the basis of fact, but on the basis of faith. You see, to evolutionists, the theory of evolution is their faith and chance and random occurrence are their gods.