


Name: _____ Date: _____ Group: _____

Heat Transfer and Your Electric Bill

(Lexile 740L)

- 1 Summer is hot in most parts of Texas. Temperatures outside can go over 100° F (38° C). After being outside in this heat, it is so nice to enter a cool, air conditioned building. Sometimes, however, the air conditioner runs non-stop. An air conditioner runs on electrical power. High summer temperatures can also bring high electric bills. Advertisements from home improvement companies are everywhere. They say they can save you money on cooling. Let us take a look at the science behind keeping your home cool. Then we can better evaluate some of those products and services.

- 2 When we say that it is hot outside, we are talking about temperature. Temperature is a measure of the average kinetic energy of the particles in a system. Temperature is one component of thermal energy. Thermal energy is the total internal energy of a system. The other is heat. Heat is simply moving thermal energy. Heat transfer is thermal energy moving from one physical system to another. As the heat enters the system, the particles within the system move faster. The kinetic energy of the system increases. When the particles move faster, the temperature of the system goes up.
- 3 There are three processes involved in heat transfer. They are convection, conduction, and radiation. The kinetic energy of the particles of the substance will increase if the substance absorbs thermal energy. The kinetic energy of the particles will decrease if the substance releases thermal energy. Conduction is the transfer of thermal energy that occurs when two objects of different temperatures are in direct contact. Convection is the transfer of thermal energy that occurs in currents of gas or liquid of different temperatures. Radiation is the transfer of thermal energy through empty space. Thermal energy will continue to move from one object to another until all objects are the same temperature. Heat transfer must be blocked in order to keep a home cool and comfortable.



- 4 There are a lot of choices to help make your home more energy efficient. Most block heat transfer. Many companies offer services and products to help. A service is a task that a company performs for you. A product is an actual item that you will purchase and keep. Different products are designed to stop different heat transfer processes.
- 5 Insulation is the first thing that most people think about to keep their home a comfortable temperature. There are many kinds of insulation. Most block conduction. The outside surfaces of walls get hot. The thermal energy moves through the wall to the inside by conduction. Insulation is placed inside the walls to block this heat transfer. The same is done on attic floors. It will block heat transfer to the interior ceiling. Insulation is made of materials that resist conduction. This includes foam or fiberglass mesh. Both have many pockets of trapped air. Gas molecules are not close together. This makes conduction through air very slow. Some companies sell double-paned windows. These have two plates of glass. A layer of air between the plates reduces conduction through windows.
- 6 The Earth is heated by radiation from the Sun. Solar radiation heats the air. Surfaces that absorb sunlight get hot too. Solar radiation can also pass through a plain glass window. It will heat the inside of a building. You can use light-colored blinds to block the sunlight. You can also use a special transparent coating on the window glass. This can stop heat transfer by reflecting the radiation back outside.
- 7 Solar radiation also heats the roof. In the summertime, rooftops can get to between 150° F and 180° F (65 - 82° C). At these temperatures, the roof itself will begin to radiate heat. This raises the temperature in the attic. This can heat the home directly, through the ceiling. A hotter attic can also make your air conditioner work harder. Air ducts carry the cooled air from the air conditioner. Most of the air ducts run through the attic. A hotter attic warms the air coming out of your ducts. A radiant barrier can block the heat transfer. It is made of reflective material. It is placed about an inch away from the inside surface of the roof.
- 8 Gaps around doors or windows can allow hot, outside air to enter the house. The mixture of gases of two different temperatures is convection. The hot air from outside of the house makes it hotter inside. The air conditioner has to work harder. Leaks must be found. Weather stripping or foam can be used to block them. Usually air leaks in around the edges of old doors and windows.

- 9 How do you know which of these products your home needs? The best place to start is a service called a home energy audit. Home energy audits are done by inspectors called auditors. They will examine the home's structure and appliances. They also study the habits of the family. Auditors will evaluate how energy efficient the home is. They make recommendations on how to make things better. One test they should perform is a thermographic scan. You can see one at the beginning of this passage. The scanning device displays an infrared image of the house. Scans are made inside as well as outside. This can help the auditor find areas that need more insulation. The scan also shows where energy is lost. A blower door test can be used to find leaks.
- 10 A home energy audit is a good service. It is recommended by the US Department of Energy. However, it is important to choose the right person to audit your home. The auditor you choose should be certified. You should read reviews and check for complaints about the company. Watch out if a company that sells insulating products offers a free inspection. They may exaggerate their findings to get you to purchase their product. It is best to hire an auditor who is not trying to sell you something.
- 11 As we have seen, heat moves into a building by the processes of conduction, convection, and radiation. We want to keep a comfortable temperature inside our home. However, this can be difficult when summer temperatures soar. We need to block heat transfer into the home. Then the air conditioner can keep us cool inside without working so hard. We will save money on our summertime electric bill.



1 You purchase several rolls of fiberglass insulation and pay extra for installation. Have you purchased a product or a service?

- A** A product
 - B** A service
 - C** Both a product and a service
 - D** Neither
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2 Replacing old windows with high-tech new windows can block which types of heat transfer?

- A** Radiation
- B** Conduction
- C** Conduction and radiation
- D** Conduction, convection, and radiation



- 3** What has happened when the air temperature in a room has gone up?
- A** Thermal energy has transferred into the room, and the kinetic energy of the air molecules has increased.
 - B** Thermal energy has transferred into the room, and the kinetic energy of the air molecules has decreased.
 - C** Thermal energy has transferred out of the room, and the kinetic energy of the air molecules has increased.
 - D** Thermal energy has transferred out of the room, and the kinetic energy of the air molecules has decreased.
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- 4** In the winter, hot air from the heater rises, making the air near the ceiling warmer than the air near the floor. Many ceiling fans have a setting said to reduce heating energy costs. How could that work?
- A** The ceiling fan is in contact with the ceiling and heats the room by conduction.
 - B** The spinning blades radiate heat through the air and heat the room by radiation.
 - C** The spinning blades cause the hot air on the ceiling to mix through the rest of the room and heat the room by convection.
 - D** It cannot work. Ceiling fans can only cool rooms.



- 5** A home owner pastes a radiant barrier directly onto the inside attic wall but finds no reduction of summertime attic temperatures. What is the most likely reason?
- A** In contact with the wall, heat can come through the radiant barrier by conduction.
 - B** A radiant barrier works like a blanket to keep the attic warmer in the winter.
 - C** A radiant barrier cannot stop air leaks when touching the walls.
 - D** The paste helps the thermal radiation penetrate the radiant barrier.
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- 6** The products described in this passage keep your home cooler in the summer. How will they affect your heating costs in the winter?
- A** They limit heat coming in and make the house cooler. Heating costs will go up.
 - B** They limit heat going out and make the house warmer. Heating costs will go down.
 - C** They only work in the summer. Heating costs will stay the same.
 - D** It is impossible to predict the change in heating costs.