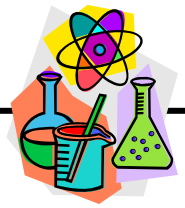
Science 10-4 Unit B: Understanding Energy Transfer Technologies

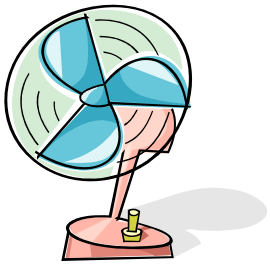


Cooling and Heating Systems

We use cooling and heating systems to improve our daily lives and make us comfortable.

Examples:

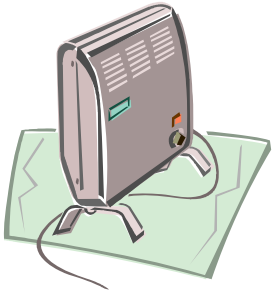
- fans cool us on hot days
- radiators cool the engines in our cars
- stoves heat our food
- furnaces heat our homes.



1. Make a list of the equipment and systems used to cool or heat areas in homes, schools and workplaces.

   Examples:

   - air conditioners
   - solar panels
   - electric heaters.



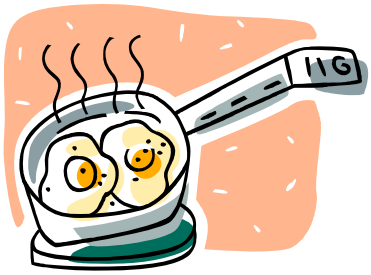
Thermal energy transfer: The movement of thermal energy from a hotter object to a cooler object.

2. Choose a system or piece of equipment that uses a cooling system. Research, draw and label a diagram of how the cooling system works. Include in your diagram a description of the principle that heat transfers from warmer to cooler objects (thermal energy transfer).

   Review Processing and Displaying Data for tips on drawing a scientific diagram. Explain your diagram to the class.

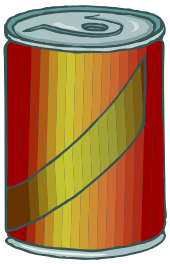
Examples of thermal energy transfer:

- Thermal energy (heat) from a burner on a stove is transferred to the contents of a frying pan.
- Placing a cold can of pop on your forehead on a hot day makes you feel cooler because heat from your head is transferred to the pop.

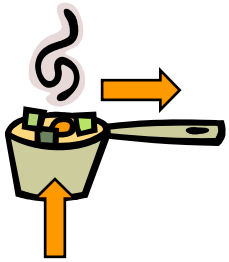


Thermal energy is transferred in three ways:

- conduction
- convection
- radiation.



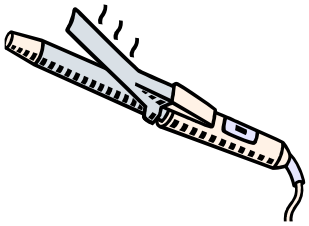
Did You Know? Have you ever touched the handle of a pan on a stove and found it to be warm? The handle becomes warm because it conducts heat energy from the contents of the pan.



Conduction: transfer of thermal energy when particles heat up and vibrate, causing neighbouring particles to heat up and vibrate. The process of heating and vibrating continues along the object.

3. In a group or by yourself, describe an example of heat being transferred by conduction at home or in the workplace.

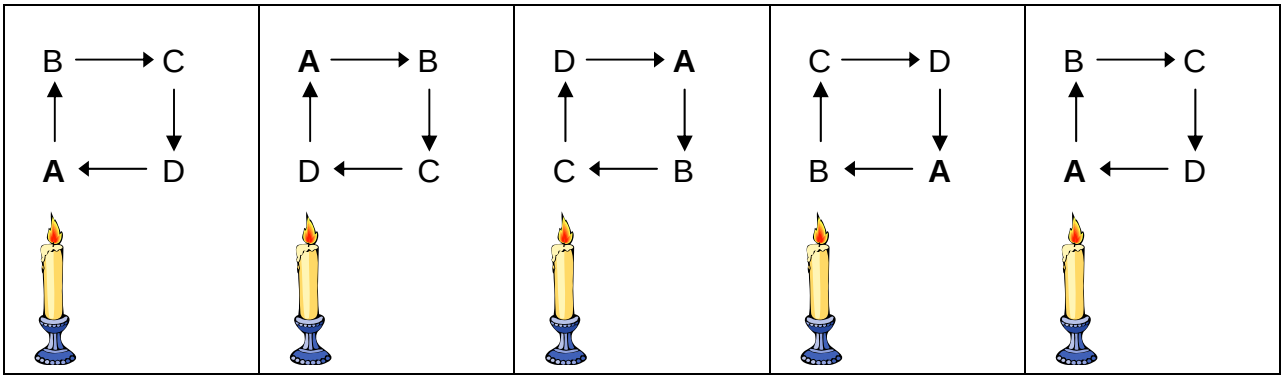
   Examples:
   - curling iron
   - branding iron
   - elements of an electric stove.



   Make sketches, and name and label your examples.
   Review Processing and Displaying Data for tips on drawing a scientific diagram.
   Explain how heat energy is conducted in each example.

Did You Know? Weather conditions are often caused by convection of air and water masses. For example, convection currents in our oceans cause climate change.

Convection: transfer of thermal energy when a mass of air or water heats and rises then cools and falls. The following diagram shows the convection of air in a closed space.



The mass of air at **A** heats up.

A rises and **D** rushes in to take **A**'s place.

D rises and pushes **A** aside.

As a result, **A** cools and falls, which pushes **B** aside.

D cools and falls, which pushes **A** aside, back to the heat source.

4. Identify heating sources that heat rooms in homes, school or workplaces. Sketch the convection currents from the heat source throughout the room.

5. Sketch the convection currents in a convection oven and explain the difference between this method of food preparation and conventional heating ovens.

6. Investigate and present information to classmates about the effects of convection and conduction in distributing heat in natural systems.

   Examples:

   - geothermal heat that produces geysers, hot springs and volcanic activity
   - large bodies of water that cool in the summer and warm in the winter.

   See the research section of English Language Arts for help.

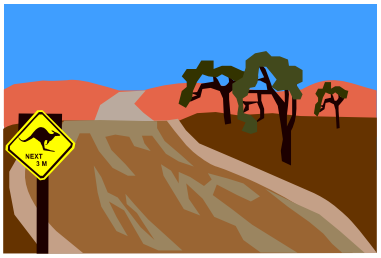
Did You Know? Radiant energy released by concrete on a hot day can make the air above highways or sidewalks ripple.

Radiation: transfer of thermal energy through waves or rays.

Examples:

- A flame radiates heat waves and so does the Sun.
- The Sun gives off (emits) large amounts of radiation, which can warm skin and even burn it.
- Heat energy from the Sun can be used to meet energy needs, such as heating homes, cooking food and producing electrical energy from solar cells.

7. In a group or by yourself, describe ways in which thermal energy is radiated, e.g., sidewalks or sand on a hot summer day.



8. Work with a partner to design and create a solar cooker. Before you begin, review Scientific Inquiry and Safety in Science.

   Consider the following when designing your solar cooker:

   - dark-coloured surfaces absorb heat better than light-coloured surfaces
   - reflection of solar rays increases heat transfer
   - reduction of air leaks prevents heat loss
   - protecting your solar cooker from wind and other cooling variables.

Objective/question/problem/issue

To design and construct a model to heat a liquid using solar energy.

Hypothesis/prediction

Materials

small cardboard box
oven cooking bags
aluminium foil
twist ties
black, nontoxic paint
paintbrush
scissors or utility knife
duct tape
thermometer
oven mitts
sunglasses
lightweight, shallow cooking pot
(or empty 500 ml soup can)
white glue

Procedure	**Diagram/sketch**
1. With a partner, complete a detailed sketch of the solar cooker you plan to construct. 2. Obtain your teacher's approval of the design before constructing your solar cooker. 3. Construct your cooker (prototype). 4. Obtain a container and information about the amount of liquid to use from your teacher. 5. Set up your solar cooker and liquid container in an appropriate location. 6. Record temperatures and times every five minutes.	

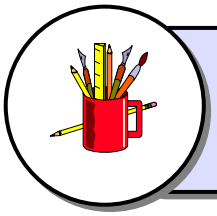
Results: List below or on a separate page. Use a chart and/or graph to show your results.

Analysis: Compare findings with prediction and classmates' results. Write a conclusion and/or inference statement.

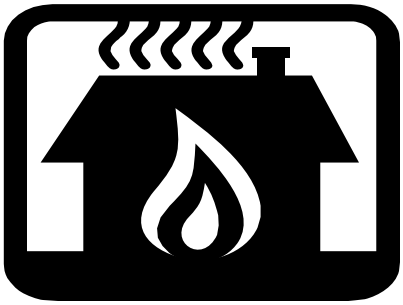
Generalize: Pose further questions, or suggest how this information relates to other situations.

9. Describe or show ways to prevent the loss of heat from your home, school or workplace. Consider factors such as insulation, convection, conduction, air flow through windows and doors.

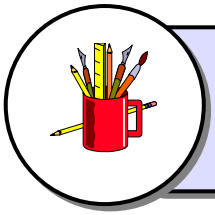
   Develop an action plan to reduce loss of thermal energy, and share it with others.



Use Tools Action Plan Template and Preparing to Share Ideas.



10. Examine how a traditional Aboriginal structure such as a tipi retains heat. Explain how thermal energy convection is used to maintain a warm environment. Consider factors such as air flow and insulation. Compare traditional Aboriginal structures with modern buildings using a Venn diagram.



Use Tool Venn Diagram.

11. In a group, discuss how the particles of matter react to temperature (e.g., When do they speed up? When do they slow down?).

12. Investigate employment opportunities related to heating and cooling systems or other energy transfer technologies. Consider jobs in a variety of fields. Using the ALIS Web site (www.alis.gov.ab.ca) to guide your inquiry, search OCCinfo (Occupational Profiles).

    Examples:

    - manufacturing, e.g., building materials
    - installation or repair, e.g., stoves, refrigerators, furnaces, fireplaces
    - construction of homes and offices.

    Find out the education and skills required, location of jobs and other important information. Share your findings with classmates.