Important Concepts . . .

Preview Review

Science *Grade 7* *TEACHER KEY*

W1 - Lesson 5: Understanding Heat and Temperature in Nature and Technology

V5-07

Important Concepts of Grade 7 Science

Materials Required.
Textbook:
Science in Action 7

Science Grade 7
Version 5
Preview/Review W1 - Lesson 5 TEACHER KEY

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Preview/Review Concepts
for
Grade Seven Science

TEACHER KEY

W1 - Lesson 5:
Understanding Heat and Temperature in Nature and Technology

OBJECTIVES

By the end of this lesson, you should be able to

- identify natural and artificial sources of heat
- explain why heating and cooling systems are used
- explain how some common heating and cooling technology works
- describe solar heating
- describe technology used to control heat movement into and out of buildings

GLOSSARY

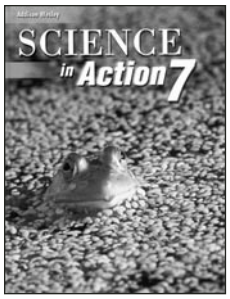
air conditioning - cooling a building using forced-air refrigeration

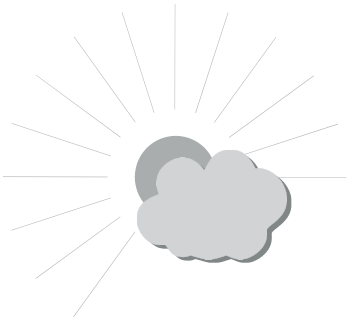
geothermal - the Earth's internal heat

R or RSI values - indicate the insulating capacity of a material. The higher the number, the greater the insulating ability.

solar heating - heating with the sun's radiant energy

W1 - Lesson 5: Understanding Heat and Temperature in Nature and Technology





Heat energy is produced by both nature and human activities. Read page 223 of *Science in Action 7*. On the Earth's surface, fire and decay produce heat. From within the earth comes **geothermal** energy.

The major source of natural heat, of course, is the sun. Human activities involving combustion (or burning) and electrical use produce heat.

1. What are some uses of electricity that produce heat?

   lights, heaters, appliances, etc.

2. Describe the locations on Earth where people could easily make use of geothermal energy.

   in geologically active areas where there are volcanoes, hot springs, etc. E.g., Iceland, New Zealand

3. What type of energy is converted into heat energy by fire?

   chemical - thermal

Heating and Cooling Systems

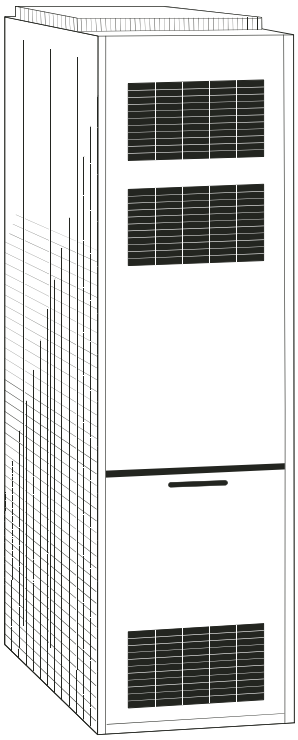
Humans like to be able to control the temperature of their homes and workplaces. As a result, technologies have been developed to heat and cool such spaces. Read pages 229 to 332 of *Science in Action 7*.

How do you heat your home? Likely, you use a furnace and forced air or a boiler and in-floor-heating. Some may use wood stoves. The least technological of the three methods is the wood stove. People decide when more fuel is needed and add it as desired. With furnaces and boilers, a thermostat controls the temperature reached by turning the heater on or off.

During the hotter part of the year, you may want to cool your home. The simplest way to do this is to open windows at cool times of day and close the windows, doors, and curtains when the day becomes warm. If you want to use technology, you could use a form of refrigeration – **air conditioning**.

4. What form of heat transfer is used when heating a home with a furnace?

   convection



5. What form of heat transfer is used when heating a home with a boiler?

   radiant

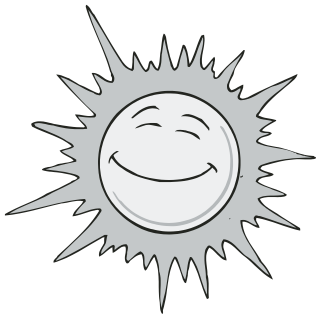
6. How does a thermostat work?

   It has a bimetallic strip that coils and uncoils in response to the air temperature. It will open/close an electric circuit controlling the heating unit.

7. How does a typical refrigerator work?

Liquid refrigerant absorbs heat from the fridge/freezer. This cools the fridge/freezer and vapourizes the refrigerant. The vapor is cooled in the condenser coils, causing it to become a liquid again as it is compressed.

Solar Energy and Heating



Read pages 225 to 228 of *Science in Action 7*. The sun is a pollution-free and renewable source of energy. People have made use of the sun's heat for as long as we have been on Earth. Over time, we have developed more technology to help us use it.

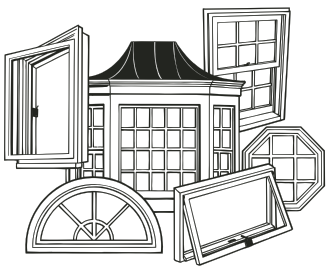
Until relatively recently, the sun was used passively to heat things. In other words, the idea was to let lots of solar energy in and then try to keep the heat there. No machines are used in this method of heating. On the other hand, active **solar heating**, uses machines to improve heating efficiency.

8. What are some design features to include when building a solar energy heated building?

Put most windows on the south side with an overhang to keep out excess heat in the summer. Insulate well, seal vapour barrier, etc.

9. What are the parts needed to build an active solar energy system?

a collector, heat storage unit, heat distribution unit



10. What types of landscaping should be used around a building to make it more energy efficient?

soil berms, conifers around the north side of the building, deciduous trees on the south side for shade in the summer and to allow sun through in the winter

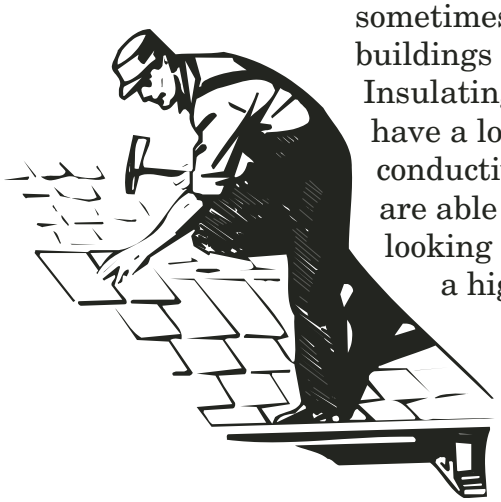
11. When would a back-up system be needed for a solar heating system?

When it's really cold and when the sun isn't shining.

Controlling Heat Movement to and from Buildings

Controlling the temperature of a space partly involves the addition or removal of heat. An equally important part of it involves keeping an area at the achieved temperature. For example, in the winter we want to keep our homes warm. In the summer, we want them to stay cool.

Insulation, which prevents heat transfer, is placed in the walls and ceilings and sometimes under floors of buildings in cold climates. Insulating materials have a low thermal conductivity. Consumers are able to compare materials they might use as insulation by looking at their **R** or **RSI-values**. This rating system gives a higher number to better insulators and a lower number to poorer insulators. Read pages 233 and 234 of the textbook.



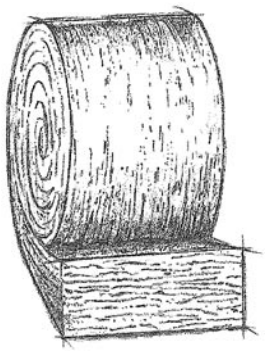
12. White polystyrene has an R-value of 0.29 / cm; blue polystyrene's R-value is 0.35 / cm. Which would you choose as an insulator if they cost the same amount?

Blue has a higher R-value so it would insulate better.

13. Using the R-values given in question 12, what would be the total R values provided by 3 cm of white polystyrene? 3 cm of blue polystyrene?

White 3 ~~cm~~ x $\frac{0.29}{cm}$ = 0.87

Blue 3 ~~cm~~ x $\frac{0.35}{cm}$ = 1.05



14. Why are people in Canada more concerned with heat loss than they have been in years past?

Energy costs have risen substantially and people want to help preserve the environment.

15. In addition to using effective insulation, what are some ways that we can control heat loss from our homes in the winter?

Weather-stripping, energy efficient windows, sealing vapour barriers, etc.

16. Why would you bother to insulate a home in a hot climate?

to keep heat out of the house

17. Think about your home and decide on at least 4 ways you could make it more thermally efficient. In other words, how could you make it lose less heat in the winter and gain less heat in the summer?

Answers will vary. E.g., weather-stripping, seal leaks, better windows, etc.

18. What is a thermogram?

It is an infrared photograph that shows areas of heat loss.

19. How can a thermogram be used to help improve the energy efficiency of buildings?

It can show where insulation needs to be improved, cracks plugged, etc.

You should now have a basic understanding of heat sources and some of the technology people have developed to control heat.

Take a few minutes to review the material you learned this week. You will be having a quiz on it.