Name _____ Date _____ Class _____

Enrich

Temperature, Thermal Energy, and Heat

Read the passage and study the table.

Converting Temperatures

In this section, you learned that most of the world uses the Celsius temperature scale, but that in the United States, the most common temperature scale is Fahrenheit. You are probably more familiar with one of these scales than the other. One way to become more comfortable with the unfamiliar temperature scale is to compare the numerical values of everyday temperatures in °C and °F.

To convert °F to °C	To convert °C to °F
1. Subtract 32.	**1.** Multiply by 9.
2. Multiply by 5.	**2.** Divide by 5.
3. Divide by 9.	**3.** Add 32.

Convert the following temperatures using the methods described above.

1. Normal body temperature is 98.6°F. _____°C
2. Room temperature is about 72°F. _____°C
3. The lowest temperature ever recorded on Earth was –89.4°C at Vostok, Antarctica. _____°F
4. The highest temperature ever recorded on Earth was 57.8°C at El Azizia, Libya. _____°F
5. –40°C = _____°F
6. The common temperature for baking a cake is 350°F. _____°C
7. Iron melts at 1535°C. _____°F

Answer the following questions on a separate sheet of paper.

8. Which is warmer –30°C or –30°F? Show your work.
9. You are riding to school on a bus in a snowstorm. Through the window, you see a lighted sign that gives the temperature as 26°, but you cannot make out whether the temperature scale is Celsius or Fahrenheit. Which is it, and how do you know?

Name _____ Date _____ Class _____

Enrich

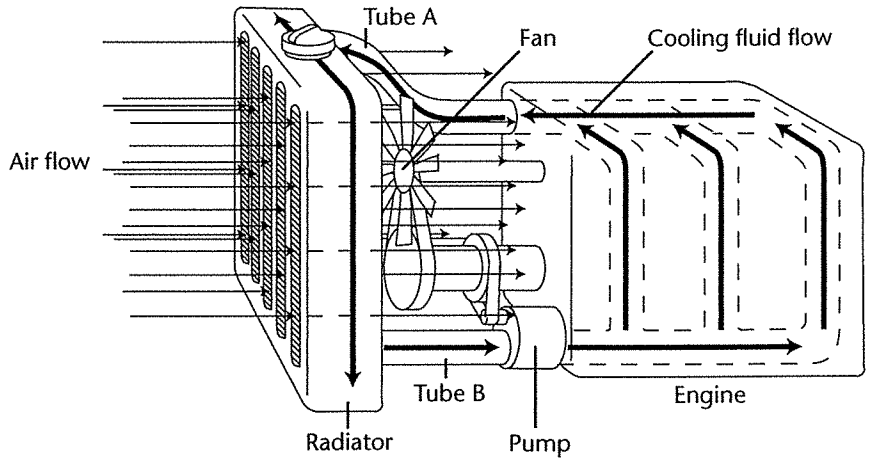
The Transfer of Heat

An automobile engine would not be able to run for very long if it did not have a cooling system. Read the passage and examine the diagram. Then use a separate sheet of paper to answer the questions that follow.

Radiating Heat

Internal combustion engines transform thermal energy to mechanical energy. Unfortunately, not all of the thermal energy produced by the burning of the mixture of fuel and air can be used to move the pistons. Some of the heat produced just heats the engine, and that can create problems. If an engine gets too hot, the oil that lubricates the moving parts will burn. Also, engines have some parts that will be destroyed if they get too hot.

A solution is to build a cooling system to carry heat away from the engine. The simplified diagram below shows a cooling system for an automobile engine. Arrows indicate the direction of movement of cooling fluid. Internally, the radiator is a series of flattened pipes that the cooling fluid moves through. The flattened pipes provide a very large surface area over which outside air flows.



1. Where is the cooling fluid hotter, in tube A or in tube B? Why?
2. Heat moves from material having more thermal energy to material having less thermal energy. Into what material does heat from the hot cooling fluid go?
3. What is the function of the radiator?
4. The pump moves fluid from the radiator into the engine. What might happen to the engine if the pump stopped working?

Name _____ Date _____ Class _____

Enrich

Thermal Properties

Read the passage. Then use a separate sheet of paper to answer the questions that follow.

Thermostats

A thermostat is a switch that is sensitive to changes in temperature. Thermostats are used to control the temperature of heating systems and cooling systems in homes, businesses, and vehicles. Thermostats also control the temperature of ovens, and turn on the fan of a computer when it becomes too warm.

A thermostat works on the principle of thermal expansion. When metals are heated, they expand, or become larger. Different metals expand at different rates. The amount of expansion depends on the length of the piece of metal and the temperature increase. For example, a one-meter length of steel expands 0.012 mm for every kelvin degree of temperature increase. A one-meter length of brass expands 0.019 mm for every kelvin degree of temperature increase.

A thermostat contains a bimetallic strip, a strip made of two metals, brass and steel, joined together. When the temperature increases, both metals expand. However, brass expands more than steel. Because the two pieces of metal are joined, the unequal expansion causes the strip to bend. The shorter steel is on the inside of the curve and the longer brass is on the outside of the curve.

In a heating system, when the room is cool, the bimetallic strip cools and contracts. As the strip straightens, it touches a contact in an electrical switch. This turns on the heating system. As the room warms, the bimetallic strip becomes warmer and expands. The strip curves and moves away from the contact. This turns off the heating system. Eventually, the room cools, and the strip straightens, starting the heating system again.

1. How could a bimetallic strip be used to make a thermometer?
2. Some thermostats have the bimetallic strip formed into a spiral. What is the advantage of this shape?
3. A one-meter length of nickel expands 0.012 mm for every kelvin degree of temperature increase. Why would a bimetallic strip made of nickel and steel not be a good choice for a thermostat?