

## Volume Expansion

41. A 400-mL glass beaker at room temperature is filled to the brim with cold water at  $4.4^{\circ}\text{C}$ . When the water warms up to  $30.0^{\circ}\text{C}$ , how much water will spill from the beaker?
42. A tank truck takes on a load of 45,725 L of gasoline in Houston, where the temperature is  $28.0^{\circ}\text{C}$ . The truck delivers its load in Minneapolis, where the temperature is  $-12.0^{\circ}\text{C}$ .
- How many liters of gasoline does the truck deliver? *43 967L*
  - What happened to the gasoline? *shrank*

72. Equal volumes of water are heated in two narrow tubes that are identical, except that tube A is made of soft glass and tube B is made of ovenproof glass. As the temperature increases, the water level rises higher in tube B than in tube A. Give a possible explanation.

73. A platinum wire easily can be sealed in a glass tube, but a copper wire does not form a tight seal with the glass. Explain.

94. What is the change in length of a 2.00-m copper pipe if its temperature is raised from  $23^{\circ}\text{C}$  to  $978^{\circ}\text{C}$ ?

95. What is the change in volume of a  $1.0\text{-m}^3$  concrete block if its temperature is raised  $45^{\circ}\text{C}$ ?

96. **Bridges** Bridge builders often use rivets that are larger than the rivet hole to make the joint tighter. The rivet is cooled before it is put into the hole. Suppose that a builder drills a hole 1.2230 cm in diameter for a steel rivet 1.2250 cm in diameter. To what temperature must the rivet be cooled if it is to fit into the rivet hole, which is at  $20.0^{\circ}\text{C}$ ?

97. A steel tank filled with methanol is 2.000 m in diameter and 5.000 m in height. It is completely filled at  $10.0^{\circ}\text{C}$ . If the temperature rises to  $40.0^{\circ}\text{C}$ , how much methanol (in liters) will flow out of the tank, given that both the tank and the methanol will expand?

98. An aluminum sphere is heated from  $11^{\circ}\text{C}$  to  $580^{\circ}\text{C}$ . If the volume of the sphere is  $1.78\text{ cm}^3$  at  $11^{\circ}\text{C}$ , what is the increase in volume of the sphere at  $580^{\circ}\text{C}$ ?