with certainty. If the readings given by your thermometer differ by more than one degree from the true temperatures of the systems measured, you should exchange your thermometer and then calibrate the new thermometer. A mixture of ice and water has an equilibrium temperature of 0°C and will be used as the first calibration system. A boiling-water bath, whose exact temperature can be determined from the day's barometric pressure, will be used as the second calibration system in this experiment.

Once your thermometer has been calibrated, you will use the thermometer to determine the *boiling point* of an unknown liquid as a means of identifying the liquid. The boiling point of a pure substance is important because it is *characteristic* for a given substance (at a particular barometric pressure). That is, under the same laboratory conditions, a given pure substance will always have the *same* boiling point. Characteristic physical properties (such as the boiling point of a pure substance) are of immense help in the *identification of unknown substances*. Such properties are routinely reported in scientific papers when new substances are isolated or synthesized, and they are compiled in tables in the various handbooks of chemical data that are available in science libraries. When an unknown liquid substance is isolated from a chemical system, its boiling point may be measured (along with certain other characteristic properties) and then compared with previously tabulated data. If the experimentally determined physical properties of the unknown match those found in the literature, you can typically assume that you have identified the unknown substance.

The **boiling point** of a liquid is defined as the temperature at which the vapor escaping from the surface of the liquid has a pressure equal to the pressure existing above the liquid. In the most common situation of a liquid boiling in a container open to the atmosphere, the pressure above the liquid will be the day's barometric pressure. In other situations, the pressure above a liquid may be reduced by means of a vacuum pump or aspirator, which enables the liquid to be boiled at a much lower temperature in an open container (this is especially useful in chemistry when a liquid is unstable, and might decompose if it were heated to its normal boiling point under atmospheric pressure). When boiling points are tabulated in the chemical literature, the pressure at which the boiling-point determinations were made are also listed. The method to be used for the determination of boiling point is a semimicro method that requires only a few drops of liquid. Since boiling-point determinations are so common, they will be used as an aid in identification of substances in several later experiments in this manual.

The apparatus used for heating samples in this experiment is called a **Thiele tube**. The Thiele tube contains oil (typically mineral oil) as a fluid, which permits the determination of temperatures up to about 200°C. The Thiele tube is constructed in such a way that when the side arm is heated, the warm oil will rise and enter the main chamber of the tube, which provides for circulation of the oil and for a more uniform temperature. Samples to be placed in the Thiele tube are ordinarily positioned so that the sample is aligned with the top branch of the side arm. When using a Thiele tube, ***remember that it contains hot oil,*** which can be **dangerous** if caution is not exercised.

Copyright © Houghton Mifflin Company. All rights reserved.