EXPERIMENT

2 The Use of Volumetric Glassware

Objective

Familiarity with the various instruments used for making physical measurements in the laboratory is essential to the study of experimental chemistry. In this experiment, you will investigate the uses and limits of the various types of volumetric glassware.

Introduction

Most of the glassware in your laboratory locker has been marked by the manufacturer to indicate the volume contained by the glassware when filled to a certain level. The graduations etched or painted onto the glassware by the manufacturer differ greatly in the precision they indicate, depending on the *type* of glassware and its intended *use*. For example, beakers and Erlenmeyer flasks are marked with very approximate volumes, which serve merely as a rough guide to the volume of liquid in the container. Other pieces of glassware, notably burets, pipets, and graduated cylinders, are marked much more precisely by the manufacturer to indicate volumes. It is important to distinguish when a *precise* volume determination is necessary and appropriate for an experiment and when only a *rough* determination of volume is needed. This manual attempts to be *nonspecific* when describing situations when the volume is not critical (for example, "add a few milliliters of water"), and explicit when the volume is important (for example, "pipet exactly 1.0 mL of the mixture).

Glassware that is intended to contain or to deliver specific precise volumes is generally marked by the manufacturer with the letters "*TC*" (to contain) or "*TD*" (to deliver). For example, a flask that has been calibrated by the manufacturer to contain exactly 500 mL of liquid at 20°C would have the legend "*TC 20 500 mL*" stamped on the flask. A pipet that is intended to deliver a precise 10.00-mL sample of liquid at 20°C would be stamped with "*TD 20 10 mL*." It is important not to confuse "TC" and "TD" glassware: such glassware may not be used interchangeably. The temperature (usually 20°C) is specified with volumetric glassware since the volume of a liquid changes with temperature, which causes the density of the liquid to change. Although a given pipet will contain or deliver the same *volume* at any temperature, the *mass* (amount of substance present in that volume) will vary with temperature.

A. Graduated Cylinders

The most common apparatus for routine determination of liquid volumes is the graduated cylinder. Although a graduated cylinder does not permit as precise a determination of volume as do other volumetric devices, for many applications the precision of the graduated cylinder is sufficient. Figures 2-1 and 2-2 show typical graduated cylinders. In Figure 2-1, notice the plastic safety ring, which helps to keep the graduated cylinder from breaking if it is tipped over. In Figure 2-2, compare the difference in graduations shown for the 10-mL and 100-mL cylinders. Examine the graduated cylinders in your lab locker, and determine the smallest graduation of volume that can be determined with each cylinder.