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# VOLUMETRIC SOLUTIONS

## Change to read:

### ▲1. INTRODUCTION▲ (USP 1-Aug-2020)

#### 1.1 DEFINITIONS

**1.1.1 Normal solutions:** Normal solutions are solutions that contain one gram-equivalent weight of the compound in 1 L of solution.

$$N = \text{equivalent/L}$$

$$N = \text{weight (g)}/[\text{equivalent weight (g)} \times L]$$

▲ (USP 1-Aug-2020)

**1.1.2 Molar solutions:** Molar solutions are solutions that contain one gram-molecule ▲weight▲ (USP 1-Aug-2020) of the compound in 1 L of solution.

$$M = \text{mol/L}$$

$$M = \text{weight (g)}/(\text{mol weight} \times L)$$

▲ (USP 1-Aug-2020)

**1.1.3 Correction factor:** It is frequently difficult to prepare standard solutions of a desired theoretical normality or molarity, and this is not essential. A solution of approximately the desired normality or molarity is prepared and standardized by titration against a standard, ▲preferably a primary standard, if available.▲ (USP 1-Aug-2020) The correction factor so obtained is used in all calculations where such solutions are used. If necessary, the concentration of the solution may be adjusted to a given normality or molarity, by dilution or by addition of the appropriate reagent.

The concentration of the volumetric solution does not differ from the prescribed one by more than 10%. The correction factor is determined by an appropriate number of replicates. The correction factor should be redetermined frequently.

**1.1.4 Blank determinations:** Where it is directed that "any necessary correction" be made by a blank determination, the determination is to be conducted with the use of the same quantities of the same reagents treated in the same manner as the solution or mixture containing the portion of the substance under assay or test, but with the substance itself omitted.

## Change to read:

### 2. PREPARATION AND STANDARDIZATION

#### 2.1 SCOPE

When solutions of a reagent are used in different concentrations, the details of the preparation and standardization are usually given for the concentration most frequently required. Stronger or weaker solutions are prepared and standardized in the same general manner as described, using proportionate amounts of the reagent.

#### 2.2 PREPARATION BY DILUTION

It is possible in many instances to prepare lower concentrations accurately by making an exact dilution of a stronger solution.

Volumetric solutions prepared by dilution should be restandardized as directed for the stronger solution, using proportionate amounts of reagents.

Dilute solutions that are not stable, as, for instance, potassium permanganate 0.01 N, are preferably prepared by exactly diluting the higher normality with thoroughly boiled and ▲subsequently▲ (USP 1-Aug-2020) cooled water on the same day they are required for use.

▲Commercially available volumetric solutions may be used provided their titre is determined or verified prior to first use.▲ (USP 1-Aug-2020)

#### 2.3 STANDARDIZATION

The following directions give ▲some methods▲ (USP 1-Aug-2020) for standardization, but other methods of standardization, capable of yielding at least the same degree of accuracy ▲and precision (see [Validation of Compendial Procedures \(1225\)](#)),▲ (USP 1-Aug-2020) may be used.

The values obtained in the standardization of volumetric solutions are valid for all Pharmacopeial uses of these solutions, regardless of the instrumental or chemical indicators used in the individual monographs.

Where the apparent normality or molarity of a titrant depends upon the special conditions of its use, the individual monograph sets forth the directions for standardizing the reagent in the specified context.

Primary standards are reagents that are extremely pure <sup>▲</sup>and <sup>▲</sup>(USP 1-Aug-2020) stable. <sup>▲</sup><sup>▲</sup>(USP 1-Aug-2020) They are established by organizations such as the National Institute of Standards and Technology (NIST, [www.nist.gov](http://www.nist.gov)) in the United States, National Physical Laboratory (NPL, [www.npl.co.uk](http://www.npl.co.uk)) in the United Kingdom, etc. Some examples of primary standards are sodium carbonate, tris-(hydroxymethyl)aminomethane (TRIS or THAM), sodium chloride, potassium dichromate, and sodium tartrate <sup>▲</sup>dihydrate. <sup>▲</sup>(USP 1-Aug-2020) Primary standards that are used for the standardization of volumetric solutions are also known as volumetric standards. It is acceptable to use volumetric standards provided by other organizations as far as they are traceable to the appropriate primary standard.

For those salts that usually are available as certified primary standards or that are available as highly purified salts of primary standard quality, it is permissible to prepare solutions by accurately weighing a suitable quantity of the salt and dissolving it to produce a specific volume of solution of known concentration. <sup>▲</sup>Acetic, hydrochloric, and sulfuric acids may be standardized against a sodium hydroxide solution that recently has been standardized against a certified primary standard. <sup>▲</sup>(USP 1-Aug-2020)

#### 2.4 TEMPERATURE

All volumetric solutions, if practicable, are to be prepared, standardized, and used at the standard temperature of 25°.

If a titration is carried out with the volumetric solution at a markedly different temperature, standardize the volumetric solution used as the titrant at that different temperature, or make a suitable temperature correction.

**Auxiliary Information** - Please [check for your question in the FAQs](#) before contacting USP.

Topic/Question	Contact	Expert Committee
VOLUMETRIC SOLUTIONS INTRODUCTION	<a href="#">Margareth R.C. Marques</a> Principal Scientific Liaison	HDQ USP Headquarters

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