

PHYSICAL PHARMACY CAPSULE 15.1 CONT.

not semipermeable to all drugs. It allows ammonium chloride, alcohol, boric acid, glycerin, propylene glycol, and urea to diffuse freely. In the eye, the cell membrane is semipermeable to boric acid, and a 1.9% solution of boric acid is an isotonic ophthalmic solution. But even though a 1.9% solution of boric acid is isotonic with the eye and is iso-osmotic, it is not isotonic with blood—since boric acid can freely diffuse through the red blood cells—and it may cause hemolysis.

Pharmacists are often called upon to calculate the quantity of solute that must be added to adjust a hypotonic solution of a drug to isotonic. This can be done using several methods, including L-value, sodium chloride equivalent, and cryoscopy.

One of the most frequently used methods for calculating the quantity of sodium chloride necessary to prepare an isotonic solution is the *sodium chloride equivalent method*. A sodium chloride equivalent is the amount of sodium chloride that is osmotically equivalent to 1 g of the drug. For example, the sodium chloride equivalent of ephedrine sulfate is 0.23, that is, 1 g of ephedrine sulfate is equivalent to 0.23 g of sodium chloride.

EXAMPLE 9

How much sodium chloride is required to make the following prescription isotonic?

Rx Ephedrine sulfate 2%
Sterile water, qs 30 mL
M. isoton with sodium chloride

- (30 mL) (0.009) = 0.270 g sodium chloride is required if only sodium chloride is present in the 30 mL of solution.
- (30 mL) (0.02) = 0.6 g ephedrine sulfate is to be present.
- (0.6 g) (0.23) = 0.138 g is the quantity of sodium chloride represented by the ephedrine sulfate.
- Since 0.270 g sodium chloride is required if only sodium chloride is used and the quantity of sodium chloride that is equivalent to 0.6 g of ephedrine sulfate is 0.138 g, then $0.270\text{ g} - 0.138\text{ g} = 0.132\text{ g}$ of sodium chloride required to render the solution isotonic.
- Therefore, the solution requires ephedrine sulfate 0.6 g, sodium chloride 0.132 g, and sufficient sterile water to make 30 mL.

By selective employment of solvent or vehicle, a pharmacist can prepare injectable preparations as solutions or suspensions in either an aqueous or nonaqueous vehicle. For the most part, oleaginous injections are administered intramuscularly. They must not be administered intravenously, as the oil will occlude the pulmonary microcirculation. Some examples of official injections with oil as the vehicle are presented in Table 15.1.

Added Substances

The USP permits addition of suitable substances to official preparations intended for injection to increase stability or usefulness

as long as the substances are not interdicted in the individual monographs, are harmless in the amounts administered, and do not interfere with the therapeutic efficacy of the preparation or with specified assays and tests. Many of these added substances are antibacterial preservatives, buffers, solubilizers, antioxidants, and other adjuncts. Agents employed solely for their coloring effect are strictly prohibited in parenteral products.

The USP requires that one or more suitable substances be added to parenteral products that are packaged in multiple-dose containers to prevent the growth of microorganisms regardless of the method of sterilization