

the pharmacist must make the patient or the guardian aware of this and indicate that this feature enhances the ability to shake it up before administration. Furthermore, some patients do not make the connection that the medicine should be administered by mouth. Oral antibiotic suspensions intended to treat a middle ear infection have been mistakenly administered directly into the ear by some patients or guardians. Thus, the pharmacist should review with the patient the proper route of administration. Lastly, because these are reconstituted with purified water, stability problems with the drug usually dictate that it be stored in the refrigerator until it is consumed. The patient has to be informed of this. The consumer may overlook a tiny label directing refrigerator storage. Alternatively, not all suspensions need to be stored in the refrigerator, but because of prior experience with other liquid suspensions that necessitated refrigeration, a patient or guardian may assume that this is necessary.

Certain suspensions, such as aluminum hydroxide gel, cholestyramine, and kaolin, by virtue of their active ingredients interfere with absorption of other drugs. For example, cholestyramine has been shown to interfere with and decrease the bioavailability of warfarin, digoxin, and thyroid hormones. The pharmacist should be aware of this and make recommendations to help avoid this drug interaction whenever possible. The typical suggestion is to stagger the administration of the liquid cholestyramine away from other

drug administration by several hours, and giving warfarin at least 6 hours after the cholestyramine reportedly avoids the impaired warfarin bioavailability (9). However, warfarin undergoes enterohepatic recycling in the body, and if cholestyramine is present in the intestine because of earlier administration, it can bind it and decrease warfarin's reabsorption. In this instance, use of one of the two drugs should be discontinued by the physician. However, if concurrent use is necessary, the pharmacist should monitor the patient more frequently for the possibility of an altered anticoagulant response. This is important because if adjustments in warfarin dosage are made on the basis of cholestyramine interference and then the cholestyramine is discontinued, the warfarin dosage also must be decreased according to the patient's prothrombin time.

AEROSOLS

Pharmaceutical aerosols are pressurized dosage forms that, upon actuation, emit a fine dispersion of liquid and/or solid materials containing one or more active ingredients in a gaseous medium (Physical Pharmacy Capsule 14.7). Pharmaceutical aerosols are similar to other dosage forms because they require the same types of considerations with respect to formulation, product stability, and therapeutic efficacy. However, they differ from most other dosage forms in their dependence upon the function of the container, its



PHYSICAL PHARMACY CAPSULE 14.7

Partial Pressure and Aerosol Formulation

Aerosols generally contain an active drug in a liquid gas propellant, in a mixture of solvents with a propellant, or in a mixture with other additives and a propellant. The gas propellants can be formulated to provide desired vapor pressures for enhancing the delivery of the medication through the valve and actuator in accordance with the purpose of the medication. Aerosols are used as space sprays, surface sprays, aerated foams, and for oral inhalation.

Various propellants have properties that may be important including molecular weight, boiling point, vapor pressure, liquid density, and flash point. An example of a calculation to determine the vapor pressure of a certain mixture of hydrocarbon propellants follows.