Glossary

Active ingredient—A substance in a pharmaceutical product that has a therapeutic effect, as opposed to an inert (inactive) ingredient that has no physiologic effect. The substance may have a toxic effect if it is present in too great an amount.

Addition—The mathematical process of summing numbers. This word also refers to the process of incorporating ingredients into pharmaceutical products.

Admixture—A sterile parenteral product that has various ingredients incorporated (admixed) into it.

Aliquot—A fractional part of a whole liquid or solid mixture of active and inert ingredients, which is used to obtain an amount of drug that is less than the sensitivity of a measuring instrument would allow to be measured directly (see also, *Stock Liquid* or *Solid*).

Alligation—A mathematical method for mixing substances having two different concentrations of the same drug to obtain an amount of substance with a third concentration of drug.

Apothecaries' system—A centuries-old system of weights and measures based on a pound having 12 ounces, an ounce having 8 drams, a dram having 3 scruples, and a scruple having 20 grains. For safety reasons, this system has been replaced in healthcare practice by the metric system of weights and measures.

Arabic numeral—The ten digits, 0 through 9, used in mathematics to indicate quantity.

Atomic weight—Also known as atomic mass, the weight of an atom, subatomic particle or molecule stated in atomic mass units.

Body surface area (BSA)—The surface area of the human body calculated using a mathematical formula to determine drug dosage.

Cockcroft-Gault equation—A mathematical formula that estimates a patient's creatinine clearance.

Common fraction—A ratio expressing a whole number (the numerator) divided by a whole number (the denominator) that is also defined as a proper fraction if the value of the ratio is less than 1.

Concentration—The amount of a chemical ingredient divided by the total weight or volume of a mixture of chemicals.

Conversions—The processes of expressing quantities in one system of weights and measures as quantities in another system of weights and measures.

Creatinine clearance—An estimate of the body's ability to remove creatinine (a normal product of metabolism) that reflects glomerular filtration rate in the kidney and that also reflects the body's ability to remove many drugs. This calculation is used to estimate the size of a drug dose that replaces the amount of drug removed.

Cubic centimeter (cc)—The volume of a cube 1 cm on each edge that is very close to the volume of 1 mL and that, for pure water, is very close to a weight of 1 g at room temperature and atmospheric pressure. This unit of measure has largely been replaced by the milliliter with the adoption of the metric system by healthcare practitioners.

DEA number—An alphabet letter/number combination registered to a healthcare practitioner by the U.S. Drug Enforcement Administration that authorizes the prescribing and dispensing of controlled substances for patients.

Decimal fraction—See *Common Fraction*. The result of dividing the numerator by the denominator of a common fraction and expressing the result in decimal form. For example, $\frac{63}{84} = 0.75$.

Denominate number—Also known as a *concrete number*, a number expressing the things counted. A number having both a quantity and the units being counted. For example, 5 g of one drug and 8 g of another drug are in a mixture of drug product.

Density—The ratio of the mass of a substance per unit volume of the substance. Density has units of mass/volume (for example, g/mL). It is very similar to the specific gravity of a liquid or solid substance at room temperature and atmospheric pressure; however, there can be a large difference between density and specific gravity of gases under standard conditions (see also, *Specific gravity*).

Diluent—Also known as a *vehicle*, an inactive substance added to a drug to either reduce the concentration of the drug in a liquid formulation or to assist in formulating the drug as a solid dosage form such as a tablet or capsule.

Directions for use—Regarding a prescription issued for a patient's drug therapy, the instructions provided by the prescriber for how the prescribed drug should be used by the patient.

Dimensional analysis—The mathematical process for solving problems where the denominate numbers given in a problem are arranged in an equation so that the units of these numbers cancel leaving only the unknown denominate number needed to answer the problem's question. This process recognizes that, by definition, an equation must have the same value expressed on both the left and right sides of the equal sign.

Dissociation constant—An equilibrium constant showing the ability of a molecule to separate reversibly into its component parts. For example, sodium chloride dissolved in water dissociates into sodium and chloride ions.

Division—The mathematical process where a number is divided by another number. For example, a common fraction is written as a decimal fraction by dividing the numerator by the denominator. For pharmaceutical products, division can mean creating equal quantities of drug mixture from a large quantity of the mixture. For example, by the process of aliquots, equal portions of a drug mixture are weighed from a large amount of the mixture, and each portion will contain the same amount of active drug.

Dry powder for reconstitution—The dry, powdered material in a drug container that—after adding back the diluent removed when the powder was created—becomes a solution or suspension of drug with a known concentration. Often, further dilution of the solution or suspension may be needed before the drug can be administered to a patient.

Electrolyte—A chemical that is dissolved and thoroughly mixed in water that allows an electric current to flow through the solution because the chemical dissociates into ions.

Enlargement—The process of proportionally increasing a drug formulation both in total size and amounts of each ingredient to make a larger quantity of the product.

Exponential notation—Also known as *scientific notation*, this is a method of expressing numbers as a coefficient multiplied by 10 raised to an exponent. For example, 672 may be written as 0.672×10^3.

Flow rate—Refers to the volume of drug solution per unit of time (typically, milliliters per minute or per hour) administered to patients. This term should be distinguished from *dosing rate*, which is the amount of drug itself given per unit of time (typically, milligrams per minute or hour; or, milligrams per kilogram of body weight per minute or hour).

Fluid ounce—A unit of volume measurement that, in U.S. measurement standards, equals approximately 29.6 mL. This definition is distinct from that of a *dry* ounce (or, simply, ounce), which is a measure of weight equal to approximately 28.4 g.

Formula—A brief way of showing mathematical or chemical relationships using symbols to represent the principles or elements involved. Also, this word describes the ingredients and amounts of each contained in a pharmaceutical product.

Freezing point depression—The effect of reducing the freezing temperature of a pure solvent (often water) when a solute (for example, sodium chloride) is dissolved in the solvent.

Gram—The metric system unit of mass (weight) defined as 1/1,000th of a kilogram.

Household system—Sometimes referred to as customary U.S. *system of measurements*, these are the units of volume, weight, and length commonly used in commerce in the United States.

Hypertonic—An aqueous solution of drugs/chemicals with a concentration higher than that required to cause no net movement of water between cells in tissue such as eye or blood and the solution itself. For example, a 1.2% w/v solution of sodium chloride is called hypertonic compared to 0.9% w/v sodium chloride solution, which is considered isotonic (or, normal) with respect to physiologic fluids.

Hypotonic—An aqueous solution of drugs/chemicals with a concentration lower than that required to cause no net movement of water between cells in tissue such as eye or blood and the solution itself. For example, a 0.5% w/v solution of sodium chloride is called hypotonic compared to 0.9% w/v sodium chloride solution, which is considered isotonic (or, normal) with respect to physiologic fluids.

Ideal body weight (IBW)—A representation of a patient's body weight calculated from a formula that explains drug distribution in the body and/or metabolism of certain drugs better than the patient's actual body weight.

Inch—A unit of measure for length in the customary U.S. system of measurements equal to 25.4 mm.

Inert substance—A substance that is not chemically or physiologically reactive. An inert substance may be used as a filler to produce drug capsules or other drug dosage forms.

Intravenous parenteral product—A pharmaceutical product formulated to be suitable for injection into a vein. Distinguished from an enteral product, a parenteral product is intended for administration by a route other than oral or rectal.

Isotonic—An aqueous solution of drugs/chemicals with a concentration equal to that required to cause no net movement of water between cells in tissue such as eye or blood and the solution itself. For example, a 0.9% w/v sodium chloride solution is considered isotonic (or, normal) with respect to physiologic fluids.

Least weighable quantity—Also known as the *minimum measurable quantity*, the smallest amount of substance that can be weighed with no more than a chance of 5% error on a balance having a known sensitivity. For example, using a balance with a sensitivity requirement of 6 mg, no less than 120 mg may be weighed with assurance that the error in that weight will be no more than 5% (6 mg, or 5% of 120 mg).

Liter—A unit of volume in the metric system containing 1,000 mL.

Mass—The amount of matter in an object that, when acted on by gravitational force, is reflected by the weight of an object. The kilogram is the basic unit of mass in the metric system.

Measurement equivalents—A quantity of substance expressed in one system of measurement that is equal to that same quantity in a second system of measurement. For example, in the customary U.S. system of measurement (the household system) 1 fl. oz equals approximately 29.6 mL in the metric system.

Medical errors—A preventable event due to faulty diagnosis, treatment, or care of disease resulting in harm to a patient.

Medication order—Often referred to as a *drug prescription*, an order issued by a person licensed to do so for a drug to be taken by or administered to a patient.

Meter—The basic unit of length in the metric system.

Metric prefixes—A word element preceding a basic unit of measurement in the metric system that indicates a multiple or a fraction of that basic unit. For example, a kilogram is 1,000 g, while a milligram is 1/1,000th of a gram.

Metric system—Also known as the *international system of units*, the system of measurement based on the meter, kilogram, and liter.

Milliequivalent (mEq)—A unit of chemical combining power defined as the amount of a substance that acts like 1 mM of hydrogen ions (H^+) in a reaction; often, describing the concentration of electrolyte in solution (potassium chloride 20 mEq/L, for example). The mass of 1 mEq of a substance (the milliequivalent weight of that substance) is 1/1,000th of the gram-atomic or gram-molecular weight of the substance. This is the same as the numeric value of atomic or molecular weight of a substance expressed as milligrams. For example, the molecular weight of sodium chloride is 58.5 (Na^+ 23 and Cl^- 35.5), so 1 mEq of sodium ion weighs 23 mg. Note that *equivalents* of a substance is much too large a unit of measure for mammalian physiology.

Milligram percent—Usually written mg%, a unit of measure for concentration stating the number of milligrams of a substance in each 100-mL portion of solution. This has the same meaning as expressing a concentration as milligrams per deciliter (mg/dL).

Millimole—The weight of a chemical equal to 1/1,000th of a mole of that substance. The International System of Units reference standard for the mole is carbon-12; 12 g of this element equals 1 mole (1 gram-atomic weight) and contains 6.02×10^{23} atoms of carbon-12. Using sodium chloride as an example, 1 mole (in this case, 1 gram-molecular weight) is 58.5 g. 1 mM of sodium chloride weighs 58.5 mg.

Mixed number—A number shown as the sum of an integer (other than zero) and a proper fraction. For example, $1\frac{4}{5}$ is a mixed number.

Mixture—A single system of material made by combining two or more different substances that do not necessarily chemically interact, which allows thorough dispersion of the substances so a uniform concentration of substances exists throughout the system. Examples include solutions, suspensions, and mixtures of powdered substances.

Molar fraction—The amount of a component (stated in moles or as weight) divided by the total amount of all the components (stated in moles or as weight) in a chemical molecule or chemical mixture. For example, using NaCl, Na^+ is 39.3% (23/58.5) of the molecule.

Molecular weight—Also known as *molecular mass*, this is the mass of a molecule determined as the sum of the masses of the individual atoms making up the molecule.

The Dalton (also known as the *atomic mass unit*), based on the mass of carbon-12, describes the mass of a molecule. For calculations, molecular mass is taken to mean molar mass (weight), which is the numeric value of molecular mass for a substance expressed as grams. For example, 1 mole of carbon-12 weighs approximately 12 g and 1 mole of sodium chloride weighs approximately 58.5 g.

Multiplication—One of the basic operations of arithmetic (sometimes known as *multiple additions*) where a number is enlarged by a second number. For example, 4.5 multiplied by 3 is equal to 4.5 + 4.5 + 4.5, which is equal to 13.5. This operation is most often represented as $4.5 \times 3 = 13.5$.

Nonelectrolyte—A substance that when dissolved in a polar solvent such as water does not dissociate into ions.

Osmolality—The osmotic pressure of a solution where the concentration of solute is defined as the amount of dissolved substance(s) per weight of solution. For example, 154 mOsmol per 1 kg of solution.

Osmolarity—The osmotic pressure of a solution where the concentration of solute is defined as the amount of dissolved substance(s) per volume of solution. For example, 154 mOsmol per liter of solution.

Osmotic pressure—The pressure (typically, hydrostatic pressure) that must be applied to a solution to prevent the movement of water molecules across a semipermeable membrane separating pure water from the solution. The semipermeable membrane allows water molecules, but not solute molecules, to pass through it.

Parts—A fraction, portion or component of a whole. For example, the number 24 can be thought of as having 4 parts of 6 units each; or, 25 is 1/4 of 100.

Parts per billion—An expression of concentration stating the amount (parts) of a substance in 1 billion parts of a mixture. For example, 1 g per 1,000,000,000 g of a mixture.

Parts per million—An expression of concentration stating the amount (parts) of a substance in 1 million parts of a mixture. For example, 1 g per 1,000,000 g of a mixture.

Percentage—An expression of concentration stating the amount (parts) of a substance in 100 parts of a mixture. For example, 1 g per 100 g of a mixture is 1 percent.

Percentage of error—The difference between the true value for some aspect of a system or object and the actual calculated or measured value stated as the percentage difference between the true or desired value and the actual value. For example, 200 mg of a substance is weighed, and the true value of that amount is shown to be only 180 mg using a more sensitive weighing device. The percentage of error is $[(180\text{ mg} - 200\text{ mg})/180\text{ mg}] \times 100\% = -11\%$, where the negative sign means the true value is less than the actual value.

Percent strength—An expression of concentration stated as a percent. For example, 70 mL of alcohol added to enough water to make 100 mL of total alcohol solution is 70% strength. See definition of *Volume in Volume* (*v/v*).

Pounds—Units of mass equal to 16 ounces in the U.S. customary system of weights and measures.

Precision—Describes a process or instrument for measurement where repeated applications of the process or instrument yields the same value. Precision should be distinguished from *accuracy* (the value obtained by applying the process or instrument) which is indeed the true value of whatever is being measured.

Prescription balance—A precision device, either mechanical or electronic, for weighing substances used in the preparation of drug products.

Prescription label—Although this may refer to the FDA-approved product information from the manufacturer accompanying prescription drug products, this term usually refers to the information printed on or accompanying drugs dispensed to a patient in response to an authorized prescriber's order.

Prescription order—An order issued by an authorized healthcare provider for a drug, device, procedure, or test to be administered or dispensed to a patient.

Proportion—A math expression showing equality between two ratios, which can be used to reduce or enlarge a drug product formula or calculate an aliquot containing a stated amount of drug. For example, a formula contains 120 mg of drug in a total mixture of 3,200 mg.

$\frac{120\text{ mg}}{3{,}200\text{ mg}} = \frac{8\text{ mg}}{X\text{ mg}}$ ▶ X = 213 mg, which is the amount of mixture containing 8 mg of drug.

Ratio—A fractional relationship showing or explaining the parts of a whole. For example, "5 of the 8 students in a class are women" may be expressed as "5/8 of the class are women."

Ratio strength—A statement of concentration used, typically, for low concentrations displayed in the ratio form (e.g., 1:1,000, 1:725, etc.), where the first number is usually shown as 1. Ratio strength indicates parts in a total number of parts and does not have units of measure associated with it. Units are implied from the nature of the substances involved. For example, 1 g of substance dissolved in a total of 1,000 mL of water (a w/v statement of concentration) is described as 1:1,000. Also, for example, note that 1:100 is a ratio strength known as 1%, which is 1 part out of a total of 100 parts.

Reconstitution—The process of rehydrating or resuspending a freeze-dried (lyophilized) powder by adding a suitable vehicle, such as water, to the powder.

Reduction—The process of proportionally decreasing a drug formulation both in total size and amounts of each ingredient to make a smaller quantity of the product.

Roman numerals—A numbering system having origins in ancient Rome based on the symbols I (1), V (5), X (10), L (50), C (100), and M (1,000).

Sensitivity requirement—The smallest weight a balance (scale) can distinguish. A Class A torsion prescription balance has a sensitivity requirement (SR) of 6 mg. The SR of a balance is used to determine the smallest amount (minimum measurable quantity) that can be weighed with the assurance that amount contains no more than a 5% error in measurement.

Sodium chloride equivalent—The amount of sodium chloride equivalent to 1 g of a dissolved substance with respect to the tonicity (osmotic pressure) contributed to the solution by that substance. For example, the sodium chloride equivalent of mannitol is 0.18, which means 1 g of dissolved mannitol produces the same tonicity as 0.18 g of dissolved sodium chloride.

Solute—A substance that is dissolved in another substance, generally referring to either a solid or liquid substance dissolved in a liquid substance.

Solution—A homogeneous mixture of substances (solute[s] and a solvent). This term generally refers to the mixture being a liquid, although it has been used to describe mixtures of solid materials. The term *concentration* describes the amount of solute contained in a volume of solvent.

Solvent—The vehicle in which a solute is dissolved. The solvent, generally, provides the characteristics of the resulting solution and is the largest part of a solution. That is, a liquid solvent yields a liquid after adding a solute.

Specific gravity—As *apparent* specific gravity, the ratio of the weight of a volume of substance to the weight of an equal volume of water (the usual reference standard for medical calculations) at specified conditions of temperature and pressure. The specific gravity of water is 1. Specific gravity is dimensionless because the units of weight (grams) cancel during its calculation (see also, *Density*).

Specific volume—Mathematically, the reciprocal value of density. Its value is expressed in several forms including mL/g. Intuitively and using 1 mL of water as a frame of reference, substances less dense than water would occupy a volume greater than 1 mL, while substances more dense than water would occupy a volume less than 1 mL. For example, room air's density is approximately 1.29 g/mL and its specific volume is 0.78 mL/g.

Stock liquid or solid—A solution or mixture of substances in relatively high concentrations from which a portion can be diluted to a lower concentration for the purpose of preparing a drug product or dose of drug (see also*, Aliquot*).

Strength—A general reference to the relative concentration of a substance thoroughly dispersed in another substance.

Subtraction—The mathematical process of removing objects from a group.

Suspension—A mixture (a disperse system) containing solid particles (referred to as the *internal phase*) that are dispersed throughout a liquid (referred to as the *external phase*) that may contain additional substances to help suspend the particles.

Thermometry—Measurement of temperature.

Valence—A measure of the combining power of atoms of an element with atoms of other elements to form molecules.

Volume in volume (v/v)—Often referred to as *volume/volume percent* (v/v%), describes the strength of the solution formed from the mixing of liquids. The amount of one liquid divided by the entire volume formed when an amount of a second liquid is added to it is expressed as a percent concentration. For example, 70 mL of alcohol plus sufficient water to make a total of 100 mL is a 70% v/v solution (70 mL/100 mL) × 100 = 70% v/v).

Weight—Generally, defined as the mass of an object acted on by the force of gravity. An operational definition is more useful. The force against an object (an amount of drug being weighed, for example) exerted by a supporting structure (the pan on a prescription balance, for example) can be measured directly in grams or kilograms.

Weight in volume (w/v)—Often referred to as *weight/volume percent* (w/v%), describes the strength of the solution formed from dissolving a solid (solute) in a liquid (solvent), which is water in the case of mammalian physiology. A solution containing 2 g of solute in a total volume of 100 mL is described as 2% w/v. Although mathematically incorrect in the form of grams per milliliters, the percent notation is taken to be correct since, for dilute solutions, the weight of the final solution is assumed to be 100 g. $(2\text{ g}/100\text{ mL}) \times 100 \approx (2\text{ g}/100\text{ g}) \times 100 = 2\%$ w/v.

Weight in weight (w/w)—Often referred to as *weight/weight percent* (w/w%), describes the strength of the mixture formed from the mixing of solids, which are usually finely powdered in form. The amount of one substance divided by the entire weight resulting when an amount of a second substance is added to it is expressed as a percent concentration. For example, 30 g of powdered drug plus sufficient lactose to make a total of 100 g is a 30% w/w mixture.

$$(30\text{ g}/100\text{ g}) \times 100 = 30\%$$

Whole number—Also known as *natural numbers* (numbers used for counting), integers not containing fractional or decimal parts. For example, 0, 1, 2, 3, 4, etc.