

Measuring Mass

The mass of a reagent is determined using a balance. Although there are several types of balances, the most common in the modern chemistry laboratory is the electronic pan balance. The sample being weighed is placed on a pan, displacing the pan downward due to the force of gravity. The balance's circuitry detects this downward motion and supplies an opposing electromagnetic force to counterbalance that from the sample. The magnitude of this force is proportional to the sample's mass. Provided the balance has been calibrated, an accurate measurement of mass is possible.

Electronic pan balances are available with a variety of precisions (defined here as the number of decimal points to which a sample can be weighed). For most samples a three-digit balance (an uncertainty of ± 0.001 g) is sufficient, although a four-digit balance (± 0.0001 g) is needed in some cases.

Balances are susceptible to air currents that produce small deflections in the balance's pan and, as a result, produce fluctuations in the recorded mass. This is particularly true for three-digit and four-digit balances. A wind shield minimizes this problem. For a three-digit balance the wind shield is a square, plastic wall that fits around the balance's pan with a closable top flap. The shield is left in place and the top closed if necessary. The balance pan for a four-digit balance is enclosed within a housing with sliding glass doors.

For a solid reagent that is not hygroscopic (that is, a reagent that does not absorb water), samples are weighed directly into a suitable container. Because many items of glassware have either small openings that make it hard to directly add solids or have a mass greater than the balance's capacity, samples often are weighed on weighing paper or a weighing boat. In either case, the paper or boat is placed on the balance pan and the balance is tared so that it registers a mass of 0.000 g. A spatula or scoopula is used to transfer the desired amount of reagent to the paper or boat. This is done carefully to avoid spilling reagent on the balance pan as this results in an inaccurate reading.¹ The solid reagent is transferred to another container using a small stream of solvent.

For a solid reagent that is hygroscopic or that cannot be transferred using a solvent, samples are obtained in a different manner. First, place a portion of the reagent greater than what you need into a small, closed weighing bottle. Weigh the bottle and then transfer a portion of the sample to the appropriate container. Reweigh the bottle and determine the sample's mass by difference.

Liquid reagents can be weighed on a balance, although they are more commonly measured using glassware.

¹ Be sure to clean up any spilled reagents as they may corrode the balance's mechanism and prevent it from working properly. Chemicals spilled on the bench top should, of course, be cleaned up as they pose a hazard to others working in the lab.