

The Art of Weighing Objects

To weigh out a portion of a reagent—typically a solid, but, on occasion, a liquid—we use an analytical balance. Although there are several types of balances, the most common is the electronic pan balance. The sample is placed on a pan, which displaces 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. If the balance is calibrated, then an accurate measurement of mass is possible.

Electronic pan balances are available with a variety of precisions, which we define here as the number of decimal points to which we can weight the sample. 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 four-digit balances, which is why the balance pan is enclosed within a housing with sliding glass doors that remain closed when recording the mass.

For a reagent that is not hygroscopic—that is, a reagent that does not absorb water—the sample is weighed directly into a suitable container. Because many items of glassware have small openings that make it hard to directly add a solid reagent or have a mass greater than the balance's capacity, solids often are dispensed onto weighing paper or a weighing boat. In either case, the weighing paper or weighing 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. The solid reagent is transferred to another container using a small stream of solvent.

If a reagent is hygroscopic or it cannot be transferred using a solvent, then samples are obtained in a different manner. First, we place a portion of the reagent greater than we 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.