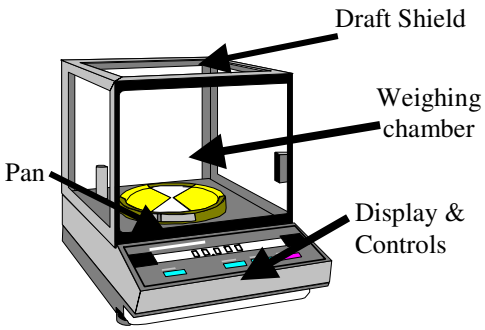
Analytical Balances



Analytical balances are used for very accurate, quantitative measurements of mass to the nearest 0.001 g. (Some read to 0.0001 g.) They are delicate instruments, subject to errors caused by vibration and drafts. These problems can be minimized with care and a certain amount of common sense.

Analytical balances all have glass-sided boxes around the weighing chamber. These function as a draft shields. The doors open from the top, and maybe the sides. Close these doors while using the balance. It will be very difficult to obtain a stable value if you do not. The top may have to remain open to obtain masses of large objects; try to minimize drafts in the area while making such measurements.

For optimum accuracy, the balance should be level. If it is not, inform the laboratory instructor, who will make the necessary adjustments. Do not lean on the bench while operating the balance. This may cause vibrations which are transmitted to the balance.

To begin any measurement on the analytical balance, close the draft shield doors and press the button or control bar that turns on the balance. The display should indicate zero (0.000) g. If it does not, inform your laboratory instructor.

To weigh a solid object that is *not* a reagent:

Open the draft shield door and gently place the object on the center of the pan. Close the door; the mass will be displayed. Record the mass. Never weigh solid or liquid reagents directly on the pan. Weighing paper or a container should be used for this purpose as described in the next paragraph.

To tare a container and weigh a reagent:

1. Open the draft shield door and gently place the container (or weighing paper) on the center of the pan. Close the door; the container mass will appear on the display. This is the tare mass.* Record it in your data table.

2. Calculate a target mass (mass of desired chemical and tare mass).

---

* The word "tare" may derive from the Arabic *taraha*, to reject. The mass of the container, the tare, is subtracted (rejected) from the combined mass of the container and contents to obtain the mass of the contents.

3. Open the draft shield door and remove the tared container. With the container on the bench top, dispense the chemical.

4. Place the container back on the balance pan and check the mass. If you need to add more chemical, remove the container from the balance and add it, then check the mass again. Repeat this process until the target mass is reached.

5. Close the door and record the mass from the display. Carefully remove the container from the pan. Close the door when finished.

One can also tare the container, then push the control bar to zero the balance, and measure the mass of the compound directly, rather than obtaining its mass by difference. Directions for individual experiments will indicate which method is preferred. Generally, if the compound will undergo some chemical conversion in the container, then be reweighed, the method given in steps is preferred.

A few other tips on use of the analytical balance:

1. **Do not dispense chemicals into a container while it is on the balance pan.** This prevents spills in the balance chamber, which is difficult to clean. If you spill something near the balance, clean it up.

2. The target mass is just that, a target. It's very difficult to dispense an exact mass of chemical. Therefore, experiments are set up to require an approximate mass, but the experimenter records the exact mass of the chemical he/she dispensed. For example:

   The experiment states "obtain about 0.5 g of the unknown." The student finds the tare mass of the container to be 34.568 g. The target mass for container and chemical is 35.068. The student dispenses chemical according to Step 4 above. On his last addition, he overshoots the target mass by a bit. He closes the draft shield and records a mass of 35.142 g. He calculates the exact mass of unknown to be 0.578 g and uses this value in his calculations.

3. If you've overshot your target mass, do not put the excess chemical back into the reagent bottle. Retain it in the experiment, as in the example above, or put it in the waste container.

4. If you are doing a series of weighings of the same object over a period of time, perform all measurements on the same balance.

5. Do not bump or place heavy objects on the bench after zeroing the balance.

6. Let hot objects cool before obtaining the mass.

7. Obtain the mass of hygroscopic (water absorbing) materials quickly.