

---

---

# Balances

---

---

## INTRODUCTION

Balances are given two main designations: the maximum mass they can handle, and the degree of accuracy with which they measure. Two types of balances are described here.

One type can measure with an accuracy of 0.001 gram. Because of the accuracy, this type of balance is called a *milligram* balance. You should use this type of balance when directions in a lab tell you to weigh an object "to the nearest 0.001g". Balances of this type usually have draft covers to keep disturbances caused by drafts to a minimum. Use the covers, but make sure that the object to be weighed does not touch any portion of the cover. There are three different versions of milligram balances in the lab, all made by Mettler. The maximum masses vary from 160 g to 340 g, depending on the model.

The other type of balance has a capacity of 400 g and an accuracy of 0.1g. Because of the accuracy, this type of balance is called a *decigram* balance. You should use this type of balance when directions in a lab tell you to weigh an object "to the nearest 0.1g". Our lab uses the Scout balance, made by Ohaus.

When using any balance, clean, hard objects may be weighed directly on the pan. Otherwise, an appropriate container for the substance to be weighed must be used. In either case, the balance must be zeroed before measuring a mass. When a container is used and its weight is zeroed, the process is called "taring".

All of the balances are digital electronic machines that use transducers to convert pressure into voltage, which is converted and displayed as mass by the balance.

## USING THE METTLER BALANCES PM460, BB224, AND PB303

Follow the instructions for using a container when weighing as given above, as well as the instructions for using the draft cover. Gently and briefly press ON or TARE (lower front of balance). Place the object to be weighed on the pan. The display gives the mass. The Mettler can "tare out" up to 150 grams. With an empty container on the pan, press ON or TARE to zero the display. As material is added to the container, the net weight is displayed. See the discussion in the right column for more on taring. For objects with masses less than 59 g (40 g for the BB model), the display reads to

the 0.001g place. For objects above 59 g (40 g for the BB model), the display reads to the 0.01g place. This must be kept in mind when weighing small quantities of a substance in a heavy container if the mass of the substance is to be recorded to the nearest 0.001g. Be aware that if the "TARE" bar is pressed for two seconds, the mass-unit measurement changes. Pressing the bar for two seconds again will return the balance to the original unit. Changing the units on the balance can cause confusion. Be careful.

## AFTER WEIGHING

Follow the instructions on the next page about keeping the balance area clean. *Do not turn the balance off*. The PB303 model automatically turns off after 3 minutes of inactivity.

## WEIGHING SMALL QUANTITIES IN HEAVY CONTAINERS ON METTLER BALANCES

"Heavy" is 59 grams or more for the PM460 and PB303, and 40 grams or more for the BB224. Remember to use the draft shield for all weighings. If the containers are too large for the draft shield, try to protect the weighing area from drafts with your body or a notebook. Don't breathe on the balance during the weighing if the draft shield is not in place.

- 1) One weight only:** If you need to weigh a sample in a flask or other heavy container, place the empty container on the pan, press the tare bar to zero out the weight of the container, and then add the sample and record the mass.
- 2) Consecutive weights:** If you need to weigh a sample, treat it with heat or react it, and weigh it again, all with the sample in a heavy container, you must adjust the zero reading on the balance if you wish to obtain 0.001 g reading for the mass. To do this, take along a piece of glassware with a mass close to but less than the container's mass. Place the glassware on the pan, tare the weight out, then set the container on the pan. Its weight should now show less than 59 grams on the PM460, or less than 40 grams on the BB224. Record the weight. Add the sample, and record the weight again. After treating the sample as called for in the experiment, use the same piece of glassware to zero the balance. Then set the container on the pan, and record the weight. The weights you are recording will all be offset from the actual values, but the difference in weights will be true. For some experiments, a special zeroing weight will be placed by the balances for your use. It will be clearly marked for that purpose.

### **USING THE SCOUT BALANCE**

Turn the balance on by gently and briefly pressing **Rezero On**. If you are weighing something in a container or on weighing paper, place the container or paper on the pan and press **Rezero On**. As material is added to the container or paper, the net weight is displayed.

The balance will automatically turn off after 3 minutes of inactivity.

### **KEEP BALANCE AREAS CLEAN**

Wipe up spills. Ask the instructor for advice on what to do with spilled chemicals and how to deal with messy spills.

#### **Be a good citizen and pick up after yourself.**

Instructors will deduct points from your laboratory grade if you do not follow this admonition.