# EXPERIMENT 2: THE USE OF CHEMICAL BALANCES

## Instructor Tips

1. Remind students that they can begin with either of the balances. They don't have to do parts A and B in that order. This will help reduce waiting lines at the balances.

2. Remind students to record their unknown identification numbers on their experiment sheets.

3. Remind students to keep their unknowns for use in both parts A and B of the experiment.

4. Emphasize to students that they should not use any balances until they have been properly instructed.

5. Point out to students that example 2.1 in Part A, and example 2.2 in Part D are examples only, and should not be treated as experimental procedures.

## Pre-Lab Review Answers

1. No specific safety alerts are given.

2. Part D, sodium chloride in sink.

3. Centigram: 2.62 g. Electronic (intermediate sens.): 2.621 g. Electronic (high sens.): 2.6211 g.

4. Average mass should be reported as 2.5368 g, using five significant figures to match the five in 10.147 g.

5. According to instructions given in the calculations and report section, the x value would be 4, and the y value (rounded to the nearest 0.1) would be 10.1.

6. In direct weighings, object is placed directly on balance and weighed. When weighing is done by difference, the object is weighed in a container. The container is weighed alone, and the mass of the object is obtained by subtracting the container mass from the mass of container-plus-object.

7. Weighing by difference is used when accurate masses are wanted, because the procedure eliminates errors in the balance such as an incorrect zero setting.

8. Accurate masses are usually recorded as data.

9. An approximate sample mass is determined by placing a container on the balance, and adjusting the weights to achieve balance. The weights are then adjusted to increase the mass

by the amount of sample wanted. Sample is then added until the balance just trips. Accurate masses are determined by the difference method described in question 4.

**Answers to Experiment Questions**

1. b: A centigram balance detects mass differences no smaller than 0.01 g, so accurate masses should be recorded to reflect that. No estimates should be made between the.01 marks.

2. c: Since direct weighings were done, either or both values could have balance errors included.

3. b: Since a balance reading represents ± .001 g, the two results of 28.774 g (direct) and 28.775 g (by difference) may be considered to be identical.

4. a: Weigh a group that is large enough to make the value to the left of the decimal 10 or greater. This increases the number of sig. figs in the total mass to five. When this is divided by a counting number to get the average, five sig. figs would be justified in the average mass.

5. This response will vary depending on the individual student results. The explanation will simply be a reference to the collected data.

6. b: After weighing the container, the mass reading is increased by an amount equal to the desired sample size. 0.71 g + 0.50 g = 1.21 g.

**Student Results**

1. The time required for our students to collect their data ranges from 1 hr, 30 minutes to 2 hr, 10 minutes. This time is influenced by the number of students in the lab and the number of balances made available. We often use surplus lab time to discuss the calculations.

2. Unknown masses: If the stockroom has done a good job of weighing the masses, the students usually get values done by difference that are correct to within ± 0.02 g(centigram balance) and ± 0.002 g (or 0.0002 g) for electronic balances.