Experiment Laboratory Weighing

INTRODUCTION

A thorough knowledge and care of the balances used in the laboratory is essential. Many weighings are rough and require the **top-loading** balance. However, semimicro quantities must be weighed using an **analytical balance**.

IMPORTANT RULES FOR WEIGHING:

1) Do not handle objects to be weighed with bare hands. Use tongs, paper towels, or gloves. There are no gloves available, so you will use paper towels for handling objects.

2) Never weigh chemicals directly in contact with the balance pan; use vessels, weighing paper or filter paper.

3) Do not weigh hot or cold objects on the balance. Hot objects will give erroneously lower readings due to air buoyancy, while cold objects will give higher readings due to the condensation of water vapor.

4) Never spill chemicals inside the analytical balance enclosure. If you spill chemicals on the top loading balance, clean it immediately. Keep weighing chamber and weighing pan clean.

5) Do not overload the balance. The usual maximum capacity for the analytical balance is 110 g.

6) Always CARE for the balance.

7) Before using the balance, ensure that the pan is clean. If it is dirty report it to your instructor. Then brush the pan down with a special brush.

8) Ensure that the bubble in the Level Indicator is centralized while the balance is "OFF". Your instructor may need to adjust the Leveling Feet.

WHICH BALANCE TO USE?
IT DEPENDS ON THE ACCURACY YOU NEED IN THE EXPERIMENT.

1) Most experiments tell you how much accuracy you will need. Never use the analytical balance if the top-loading will do.

2) If you need to weigh to the nearest **milligram (± 0.001 g)** or to the **tenth of a milligram (± 0.0001 g),** then use the analytical balance, otherwise, use the top-loader.

3) If the instructions say weigh **accurately** about 2 grams of sample" use the analytical balance. The clue is the word "accurately".

WEIGHING BY DIFFERENCE TO OVERCOME THE PROBLEM OF LACK OF CALIBRATION OF THE BALANCE

Balances should be calibrated regularly especially if they are moved from their location, or after a large variation in temperature, humidity, or atmospheric pressure.

How accurate are your balance readings? There is no way for you to know. In order to overcome the problem of inaccurate readings due to lack of calibration or miscalibration, chemists designed a method called **WEIGHING BY DIFFERENCE.** It takes into account the high probability that a balance may be "off " by several grams or a fraction of a gram. It does not matter how far off your balance is if you weigh by difference.

Suppose a beaker containing a sample of NaCl was weighed on a calibrated balance **(Balance # 1)** and a reading of 26.7587 g was recorded. A portion of the sample was then poured out into an Erlenmeyer flask, so the new reading is 24.7423 g. Calculate the mass of the sample that was poured into the flask.

Initial reading	= 26.7587	g
Final reading	= 24.7423	g
Mass of sample transferred (calculated by difference)	= 2.0164	g

Suppose, however, that **Balance # 2** which is off by 0.5000 g because it had not been calibrated, was used. The initial reading would have been 0.5000 g lower at 26.2587 g. The final reading would also have been lowered by the same amount. Thus, the final reading would have been 24.2423 g. Calculate the mass of the sample poured into the flask.

Initial reading	= 26.2587	g
Final reading	= 24.2423	g
Mass of sample transferred (calculated by difference)	= 2.0164	g

Does the choice of balance matter? _____

Why ? _____

_____

Notice that a **reading** on a balance Display is not considered a mass, but only an item of data. **Mass** is calculated.

EXPERIMENT

A) WEIGH A METAL BLOCK ON THE TOP - LOADING BALANCE

(Throughout the weighing process you should protect the object to be weighed from your hands with a paper towel.)

1) Obtain a numbered metallic object from your instructor. Record its number on the report sheet.

2) The top-loading balance is located on the counter next to the window in your lab.

3) First check it for any dust or chemicals, brushing any that you see.

4) The balance must be perfectly leveled. Look for the bubble at the back of the balance that indicates the level. The bubble should be within the circle. If it is not, report it to your instructor. The instructor will rotate the round green feet until the bubble is within the circle. (Students should not handle these leveling knobs.)

5) Now turn -**ON** the balance. Wail until it displays "0.00 g", then place on your metallic object. Record the reading on the report sheet in **INK**. If you copy the data incorrectly on your report sheet, just cross it out with a **single line** and copy the correct data next to it or above it. The uncertainty of the reading on the top-loading balance is $\pm$ 0.05 g.

6) Turn -off the balance. Please always remember to turn-off the top-loading balance when finished.

7) Repeat steps 2-6 given above on two other **different** Top-loading balances, using the **same** metallic block.

B) WEIGH THE SAME METAL BLOCK ON THE ANALYTICAL BALANCE

(Throughout the weighing process you should protect the object to be weighed from your hands with a paper towel)

1) Find the small weighing room next to the laboratory. Locate the analytical balances.

2) The uncertainty of a reading made on the analytical balance is $\pm$ 0.0001 g. Look down through the glass top to the floor of the balance. The leveling bubble is visible in a hole in the floor. The bubble must be centered perfectly in the space. If not, report it to your instructor. Your instructor will adjust the leveling and bring the bubble to the center of the circle. Students should not adjust the leveling themselves. The **instructor** will slowly and carefully adjust the thumb screws on the legs of the balance until the bubble is exactly in the center of the space.

The glass case is designed to protect the balance from temperature fluctuations and air currents that cause drifting, where the reading on the balance does not stop, but continues to change. Remember that your body is warmer than the air in the room and in the balance; do not warm up the inside of the balance with your body heat. Keep your hands out of the case as much as possible and keep the balance windows closed while working.

3) Push the **ON** button. Allow the balance to calibrate. After about 5 seconds, it will display "0.0000 g". The balance is now ready to be used. If the balance does not read zero, push the T (TARE) button. The balance should read 0.0000 g.

4) Open the door and carefully place the metallic object on the middle of the pan to avoid corner load errors. The maximum capacity of the balance is 110 g. Do not overload the balance by placing objects that weigh more than its maximum capacity. Overloading will damage the balance.

5) Close the balance window and after about 5 seconds record the reading in **INK** on the report sheet.

6) Carefully remove the object and close the doors of the glass case.

7) Push the “OFF” button.

8) Repeat steps 2 to 7 on two other **different** analytical balances using the **same** metallic block.

9) Show your data to your instructor and get his /her signature on the report sheet.

C) WEIGH BY DIFFERENCE THREE SAMPLES OF NaCl USING THE ANALYTICAL BALANCE.

Clean three 125 ml Erlenmeyer flasks. **Make sure the external walls of the Erlenmeyer flasks are completely dry.** Number them 1, 2, and 3 using pencil on the white spot on the flask.

A reminder: Throughout the weighing process you should protect the Erlenmeyer flasks from your hands with a paper towel.

1) Use the plastic spoon provided to transfer about two spoonful of NaCl(s) into a clean dry 50 ml beaker.

2) Take the items listed below with you to the weighing room:

- 50 ml beaker containing NaCl(s) that you obtained earlier.
- A clean 125 ml Erlenmeyer flask labeled #1**. Make sure the external wall of the Erlenmeyer flask is completely dry.**
- Your report sheet.
- A pen (not pencil).

3) You need to weigh accurately about 0.3 g of NaCl as follows:

a) Turn the analytical balance **ON**.

b) After you see a display of 0.0000 g, place the Erlenmeyer flask **labeled #1** on the pan of the analytical balance.

c) Close the balance windows and touch the **TARE** button. “ 0.0000 g ” will be displayed regardless of the mass of the Erlenmeyer flask. Record this as the initial reading on the report sheet.

d) Add NaCl(s) to Erlenmeyer flask #1 by holding the beaker in a tilted position and tap it gently with your forefinger to allow little specs of NaCl crystals to enter the Erlenmeyer flask which is placed on the pan inside the balance. Keep adding little specs of NaCl until you obtain about 0.3g. Close the balance glass case windows. Record this reading to the one-tenth of a milligram on the report sheet .

e) When you are finished, remove the Erlenmeyer flask, close the balance windows, touch the **TARE** bar, and press the **OFF** button.

4) To dispense a **second** sample into another Erlenmeyer flask **labeled #2**, repeat steps 2 and 3 given above.

5) To dispense a **third** sample into another Erlenmeyer flask **labeled #3**, repeat steps 2 and 3 given above.

6) **Show** the three samples of NaCl and your data to your instructor and get his/her signature on the report sheet.

7) Wash and dry your Erlenmeyer flasks and store them for your next lab period.

REPORT SHEET NAME _____

EXPERIMENT - Laboratory Weighing Instructor's initial_____

DATA:

I used object # _____

A) TOP-LOADING BALANCE:

Reading including units

1. _____
2. _____
3. _____

_____
(instructor's initial)

B) ANALYTICAL BALANCE:

Reading including units

1. _____
2. _____
3. _____

_____
(instructor's initial)

C) WEIGHING BY DIFFERENCE THREE SAMPLES OF NaCl:
NaCl SAMPLES:

	Sample #1	Sample #2	Sample #3
Initial reading	**g**	**g**	**g**
Final reading	**g**	**g**	**g**
Calculated mass of NaCl	**g**	**g**	**g**

_____
(instructor's initial)

Questions:

1) If you have a 13 gram object, how many significant figures are in a reading obtained from a top-loading balance?

_____

2) A top-loading weighs to $\pm$ 0.5 g. How many mg is that?

_____

3) If a procedure tells you "Weigh the sample to the nearest milligram", which balance would you use? (The analytical or the top-loading?

_____

4) An analytical balance usually weighs to $\pm$ 0.1 milligram. How many grams is that?

_____

5) If a procedure tells you to "Add about 3 g of ammonium sulfate" which kind of balance should be used? (The analytical or the top-loading ?)

_____

6) If a procedure tells you to "Weigh to the nearest tenth of a gram about 3 grams...", which balance would you use, the analytical or the top-loading

_____

7) If a procedure says "Weigh about 0.8 g to the nearest 0.1 milligram", which balance would you use, the analytical or the top-loading?

_____

8) The vessel to be weighed should be placed _____of the pan.
(off to the side, or in the center)

9) After heating a sample in a dish it will save time to weigh it immediately or cool it completely?

_____

10) To avoid the errors in mass due to the use of balances that are not calibrated, one should weigh by a method called _____.

11) If you weigh a hot object on the balance, the reading will be higher, the same, or lower than if it had been weighed after it cools to room temperature? _____
(higher, the same, or lower)

12) If you weigh a cold object on the balance, the reading will be higher, the same, or lower than if it had been weighed after it warms up to room temperature? _____
(higher, the same, or lower)