

Name _____

Section _____

Partner(s) _____ NONE _____

Date _____

USE OF THE ANALYTICAL BALANCE

PRE-LAB QUERIES

1. What is mass? How is it determined?
2. How are mass and volume of a substance related?

OBJECT

This activity introduces you to the use of the analytical balance, an instrument that allows you to determine the mass of objects to 0.0001g or 0.1 mg.

PROCEDURE

A. Determination of the mass of two objects (crucible and cover) individually and together

1. Mass each object individually three separate times on one analytical balance. Record the masses in the data table.
2. Mass both objects together three separate times on the same balance. Record the masses in the data table.
3. Calculate the sum of the masses of the two objects and record the result in the results table

Compare the results of the sum of the two objects to the mass of them together; they should agree to within 0.3 mg. The replicate mass determinations of any object should also agree within this limit. One means to check this replication is by calculating the **range**, which is the difference between the high and low values. The range should be no larger than 0.3 mg. Repeat the massings two more times if needed to replicate the mass within the prescribed limit.

B. Determination of the volume of a drop.

1. Mass a 10 mL beaker.
2. Place water in a clean buret making sure there is no air in the tip. Record the initial volume of the water in the data table. Deliver exactly 50 drops of water from the buret into the pre-massed beaker. Record the final volume of the water in the buret.
3. Mass the beaker with the water.
4. Measure the temperature of the water.
5. Calculate the mass and volume of one drop of water and record the values in the results table.
6. You can calculate the volume of a drop in another way using the **specific volume** (V_s) (the volume occupied by one gram of water corrected for buoyancy of air) Using the mass of a drop of water and table below, calculate the volume of a drop of water using the following formula:

$$V_{\text{drop}} (\text{mL}) = M_{\text{drop}} (\text{g}) \times V_s (\text{mL/g})$$

Temperature (°C)	Specific Volume (mL/g)
20	1.0028
21	1.0030
22	1.0032
23	1.0034
24	1.0036
25	1.0038
26	1.0041
27	1.0043
28	1.0046
29	1.0048
30	1.0051

C. Mass of a fingerprint

1. Clean a watch glass with a kimwipe or microwipe.
2. Using a piece of paper or tongs, mass the watch glass.
3. Now touch the watch glass with your finger ten to twenty times, each time touching a clean part of the watch glass. Be sure to record the number of times you touch the glass.
4. Remass the watch glass after fingerprinting.
5. Calculate the mass of your fingerprint.

D. Determining balance accuracy using a standard mass

1. Obtain an object of standard mass from your instructor. **DO NOT TOUCH** the mass with your fingers because substances in your finger oils may react with the object and modify its mass! Mass it three times on the analytical balance and record the masses in the appropriate data table.
2. Calculate the percentage error in your average mass using the formula below.

$$\% \text{ error} = \frac{\text{experimental mass (average)} - \text{theoretical mass}}{\text{theoretical mass}} \times 100$$

The theoretical mass is the mass of the standard. For this lab, if the object is marked with a “10”, the mass is 10.0000 g.

DATA AND RESULTS

A. Determination of the mass of two objects (crucible and cover) individually and together

DATA				RESULTS	
Trial	Object 1 _____	Object 2 _____	Objects 1 and 2 Massed Together	Sum of Object 1 and Object 2	Difference (mass sum - mass together)
1					
2					
3					
4					
5					
RESULTS					
Average					
Range					

B. Determination of the volume of a drop.

DATA	
Mass of 10 mL beaker	
Mass of 10 mL beaker and water	
Volume reading on buret before dispensing water	
Volume reading on buret after dispensing water	
Number of drops	
Temperature of water	
RESULTS	
Mass of water	
Volume of water	
Mass of 1 drop	
Volume of 1 drop (from buret readings)	
Volume of drop (from V_s calculation)	

How do the results for the volume of a drop compare for the two methods used?

C. Mass of a fingerprint

DATA	
Mass of watch glass	
Mass of watch glass and fingerprints	
Number of fingerprints	
RESULTS	
Mass of fingerprints	
Mass of 1 fingerprint	

Do your fingerprints contribute mass when determining the mass of an object to the nearest 0.1 mg? Explain.

D. Determining balance accuracy using a standard mass

DATA	
Mass of standard - trial 1	
Mass of standard - trial 2	
Mass of standard - trial 3	
RESULTS	
Average mass	
% error	

CONCLUSIONS

How do your results from the volume of a drop and single fingerprint mass (parts B and C) compare to three other students in the laboratory? Make sure you can support your statements!

The percentage error allows you to assess the **accuracy** or closeness to true value. It assumes we have a standard with a known mass. How does your balance error compare to three other students?

POST-LABORATORY QUESTIONS

1. Explain the difference between data and results.
2. The percent error can be positive or negative. Explain what the sign of the error tells you about the error.
3. Why is it important not to touch the standard mass?