Basic Skills for Chemistry
CHEM-1020
Experiment No. 2
Use of Laboratory Equipment

Introduction

In the chemistry laboratory, several kinds of equipment are used to measure mass and volume. In this experiment you will use two mechanical balances and one electronic balance to measure the mass of an "unknown" metal slug. You will use graduated cylinders for measuring liquid volumes. In a previous experiment, you examined similar analog instruments and learned how to read them. This experiment is designed to reinforce and test that knowledge.

Measurement of Mass:

Single, clean objects may be weighed on a laboratory balance by placing them directly on the balance pan. Prior to weighing an object without a container, the balance must be zeroed with a screw adjustment to make the balance read zero grams when there is no mass in the pan.

Chemicals, liquids and granular substances are never weighed directly on a balance. To prevent contamination and damage to balances, chemicals are always weighed in a container such as a lightweight plastic weigh boat, small beaker or weighing bottle. On a mechanical balance the mass of the empty container is determined in a preliminary "tare" step and subtracted from the total mass to get the mass of the chemical alone. When weighing an object or chemical in a container, the balance need not be zeroed in because any error in the zero point will be the same for both weighings and will cancel out in subtraction.

Electronic balances allow you to bypass the subtraction step. Simply place a container on the electronic balance pan and press the tare button. This causes the balance to register the mass of the container as zero. The mass of the chemical added is then read directly from the display. A container that is too heavy may cause the displayed mass to lose one decimal place. If taring a heavy container causes the digital mass reading to change from 0.01g to 0.1g, replace the container with a lighter one and push the tare button again.

Measurement of Liquid Volume:

For the best measuring precision, choose the smallest graduated cylinder that will contain all the liquid to be measured. After you determine how the appropriate graduated cylinder is to be read, pour in the liquid you wish to measure, place the cylinder on a level surface at eye level and read the volume from the bottom of the liquid meniscus.

Report:

You will be graded on the proper use of each instrument and on the accuracy of your measurements. Examine each instrument before you use it to determine the precision to which is properly read. Record all your measurements on the data sheet in black ink. Always express the units of each measurement and each result.

Experimental

Measurement of Mass:
Obtain a metal unknown mass slug from your instructor and remove it from its plastic container. Record the mass number on your data sheet. Use this same slug for all subsequent weighing procedures a) through e).

a) Place a plastic weigh boat on a platform balance pan and record its mass. Place the metal slug in the weigh boat and determine the mass of the two objects together.

b) Zero in the platform balance and measure the mass of the slug alone on the balance pan.

c) Zero in the hanging pan balance and measure the mass of the unknown metal slug alone.

d) Determine the metal slug mass on an electronic balance by two different methods. Place a 250 mL beaker on the balance pan and press the tare button so the balance reads zero. Carefully place the slug in the beaker and record the mass displayed which is the mass of slug alone.

e) Place the same 250 mL beaker on the electronic balance and record its mass. Without taring the balance, place the slug inside the beaker. Weigh the two objects together and record their combined mass.

Measurement of Liquid Volume:
a) Locate three pre-filled graduated cylinders in the laboratory, labeled A, B, and C. Each cylinder contains a different amount of water. Examine the cylinder markings, determine how to read the cylinder and record the volume of water contained in the A, the B and C cylinder.

b) Obtain a numbered bottle representing an unknown volume. Record the bottle number. Fill the bottle to the very top with water and measure that volume of the water using a graduated cylinder of the appropriate size.

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Data Page

Measurement of Mass: Unknown mass slug number _____

a) Mass of plastic weight boat on the platform balance: _____

Mass of plastic weight boat and metal slug: _____

b) Mass of metal slug weighed alone on the platform balance: _____

c) Mass of unknown metal slug alone on hanging pan balance: _____

d) Mass of metal slug in tared beaker on electronic balance: _____

e) Mass of 250 mL beaker on the electronic balance: _____

Mass of beaker and metal slug on the electronic balance: _____

Measurement Liquid Volume:

a) Water volumes read from pre-filled graduated cylinders:

Graduated Cylinder A: Cylinder Size: _____ Water Volume:_____

Graduated Cylinder B: Cylinder Size: _____ Water Volume:_____

Graduated Cylinder C: Cylinder Size: _____ Water Volume:_____

b) Volume of water contained in a bottle of unknown volume: _____

Bottle number: _____ Size of graduated cylinder used: _____

Volume of water contained by unknown bottle: _____

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Report Page

Measurement of Mass: Unknown slug mass number: _____

a) Mass of metal slug (platform balance): _____ (2 points)

b) Mass of metal slug (platform balance): _____ (2 points)

c) Mass of unknown metal slug (hanging pan balance): _____ (2 points)

d) Mass of unknown metal slug (electronic balance) _____ (2 points)

e) Mass of unknown metal slug (electronic balance): _____ (2 points)

Measurement of Liquid Volume:

a) Water volumes in three pre-filled graduated cylinders (6 points)

Graduated Cylinder A: Water Volume:_____

Graduated Cylinder B: Water Volume:_____

Graduated Cylinder C: Water Volume:_____

b) Volume of water contained in a bottle of unknown volume.

Bottle number: _____ Volume of unknown bottle: _____ (2 points)

Question: Describe the process used to examine an analog instrument in order to determine how it is to be read. (2 points)