Lab Review

Nov 28, 2022

Chemistry Department, Cypress College

Class Announcements

Lab

- Lab Practicuum Week; Mon - Lab Review
- Submit **All** Lab Assignments...

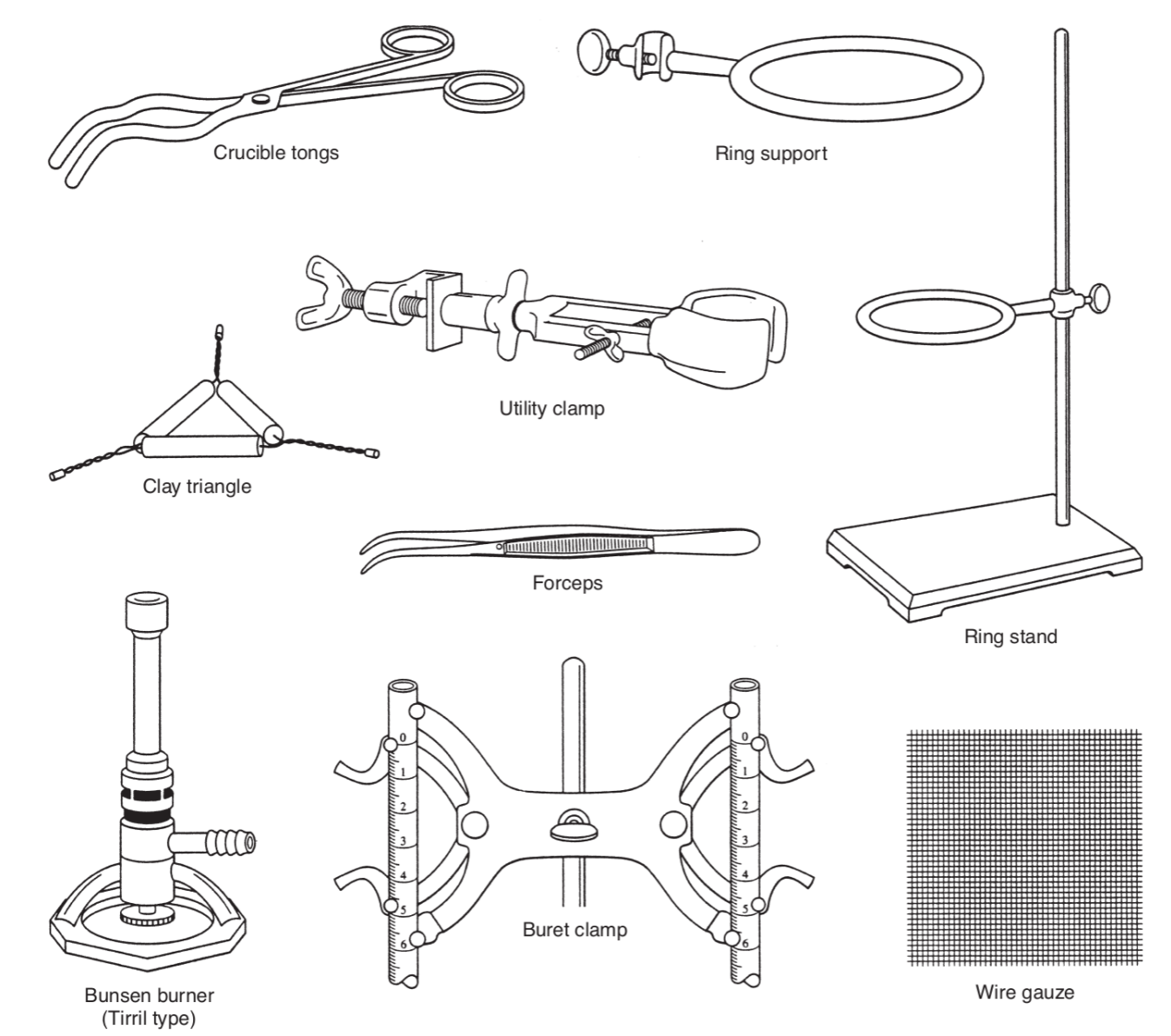
Lecture

- Finish up Ch 9; Begin Ch 10 and 11
- Final Exam Dec 10th in Lecture
- Quiz and Homework posted this Fri, Dec 2nd

Outline

Lab Review

Laboratory Equipment/Check-in



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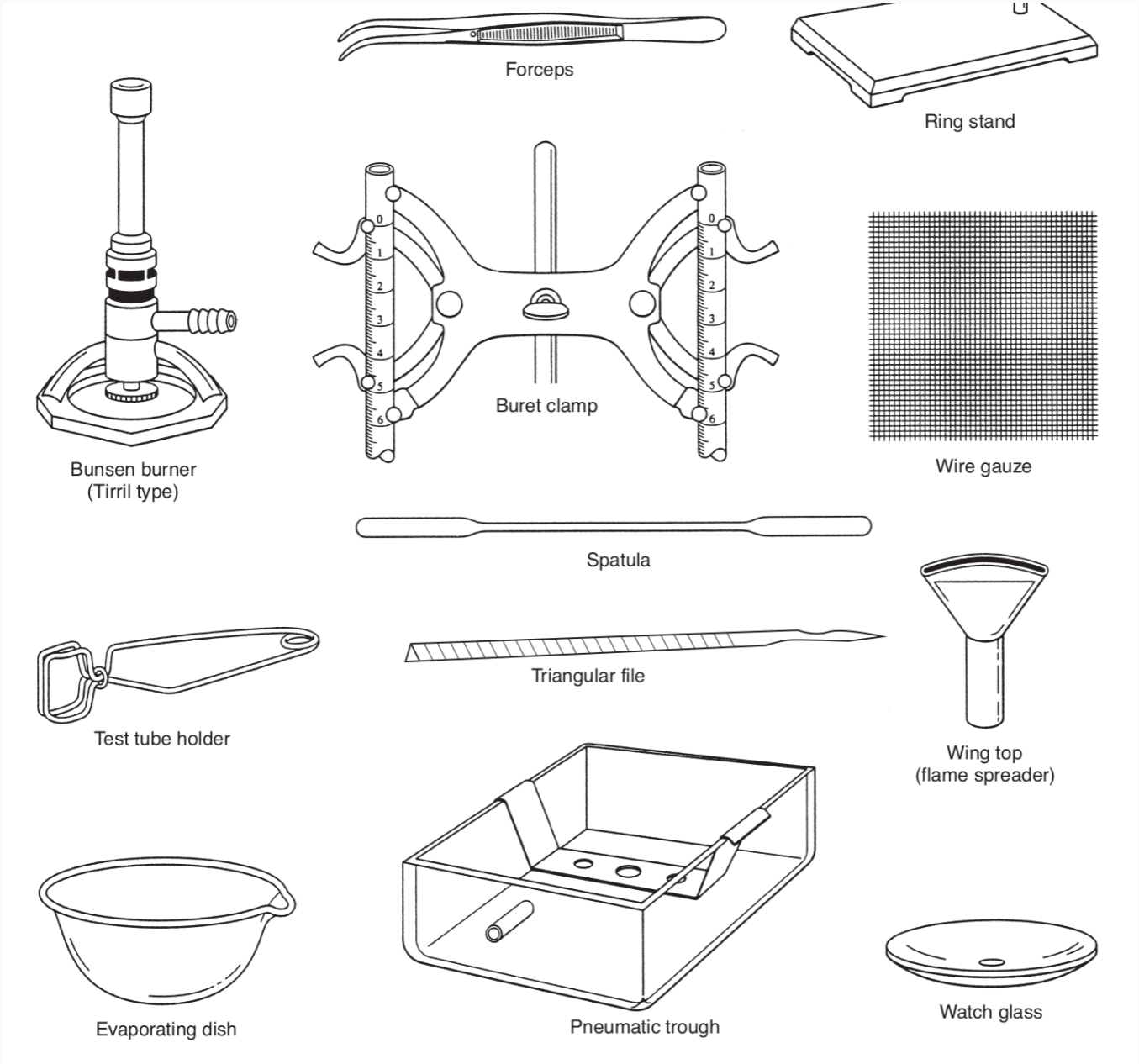

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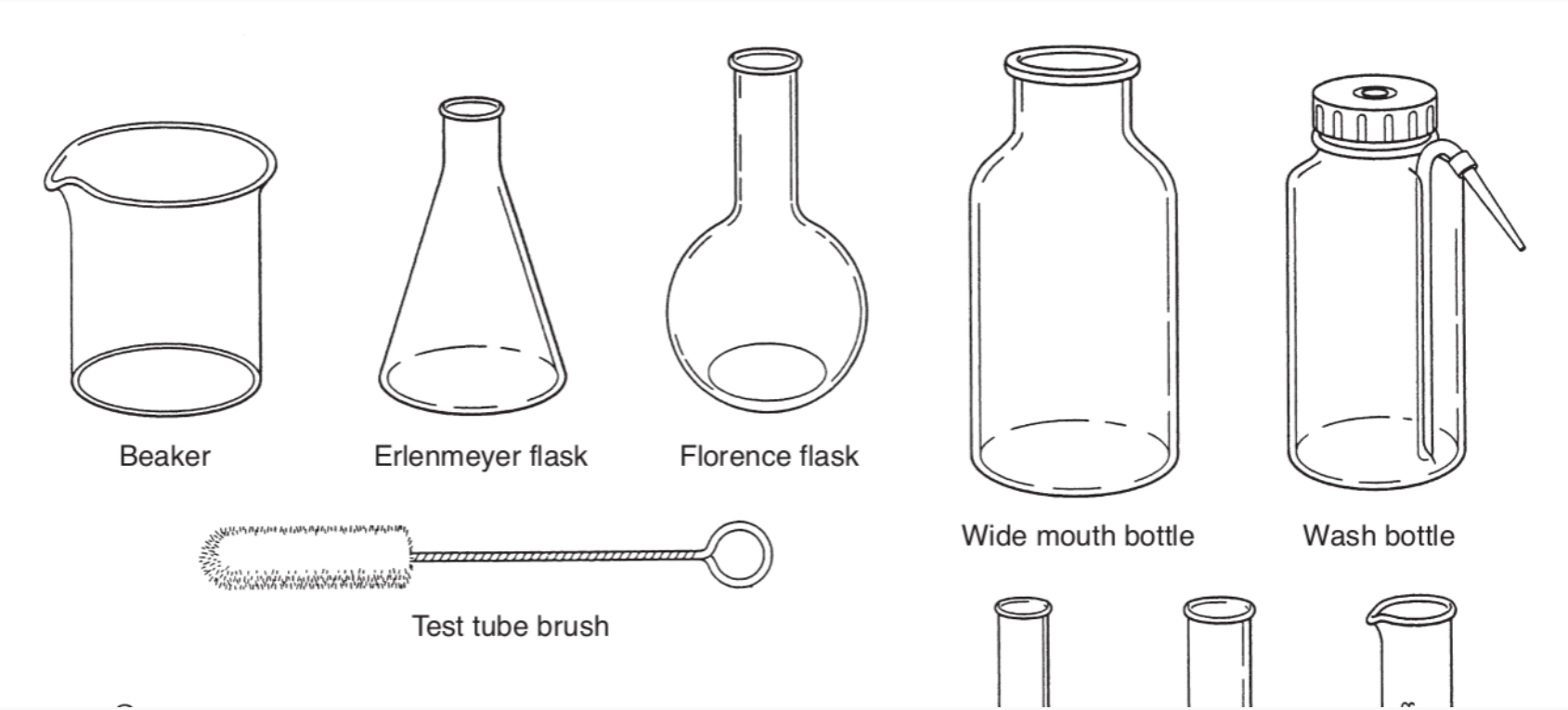

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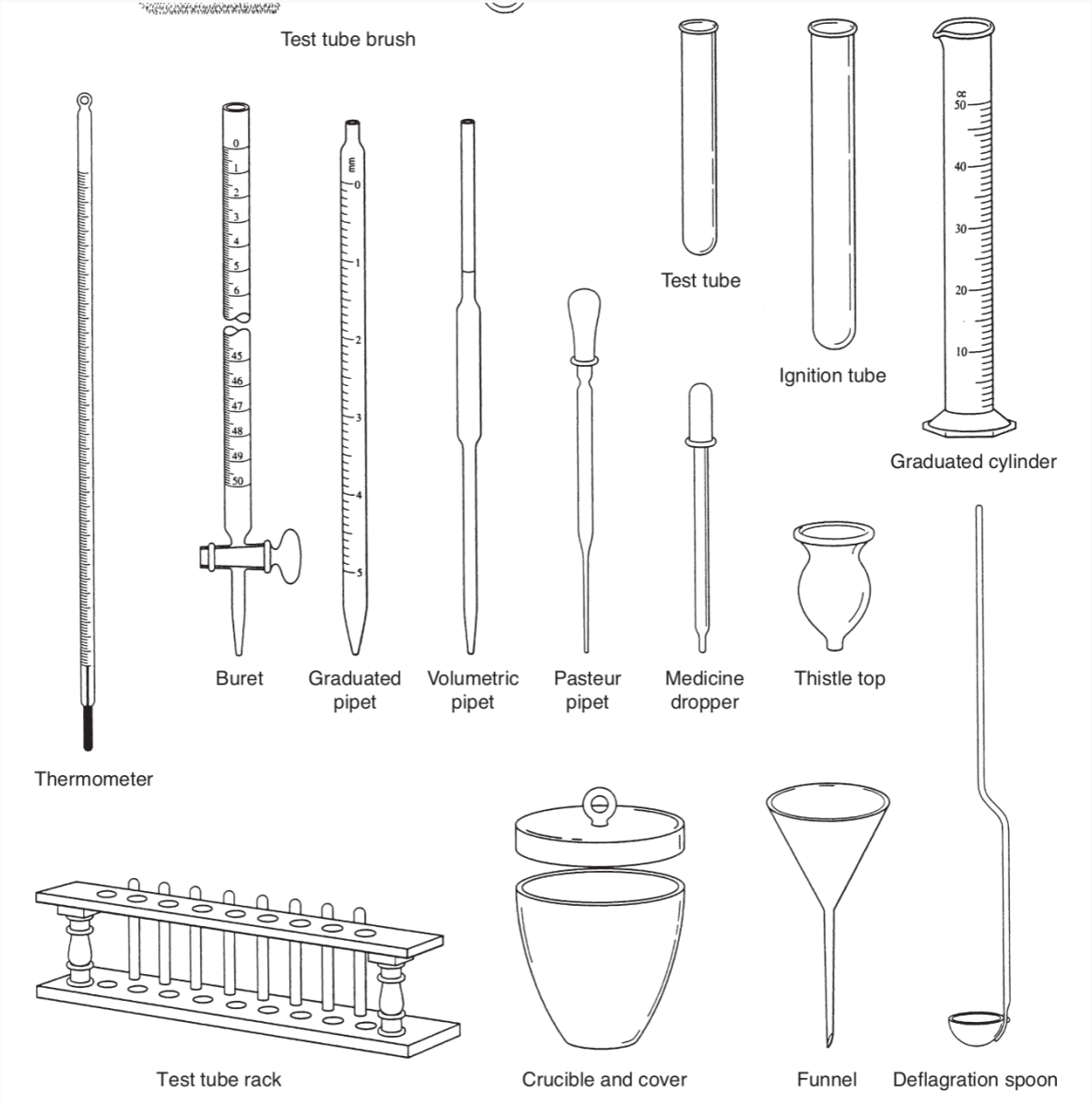


Lab Safety

- Common sense - lab safety clothing (goggles, long pants), no eating/drinking in lab
- Familiarize material safety data sheets (MSDS)
- Label the reagent bottles and never return reagent back into the bottle
- Know the locations of the fire extinguisher
- Dispose chemicals into waste containers

Math Toolbox

- Scientific Notation
- Significant figures
- Unit Conversion

Scientific Notation

The scientific notation is expressed

$$N = C \times 10^m \tag{1}$$

where N is a large number, C is the coefficient (a number between $1 - 9$) and m is the exponent (a positive or negative integer)

Example: $0.00363246 = 3.63246 \times 10^{-3}$

Significant Figures

- The meaningful digits in a measured or calculated quantity
- Example: $0.00363246 \simeq 3.63 \times 10^{-3}$ to three sig figures
- Implies relative accuracy of 10^{-m}, e.g. 0.1% for $m = 3$

Leading, Sandwiched and Trailing Zeroes

Leading zeroes: Precede non-zero digits in a decimal number are **not** significant e.g. 0.00001

Sandwiched zeroes: Occur between nonzero numbers are significant e.g. 10,024

Trailing zeroes: Following non-zero numbers are significant in numbers with a decimal point e.g. 1,000.

Calculation: Rules for Rounding

Rule 1: In carrying out a multiplication or division, the answer cannot have more significant figures than either of the original numbers.

Example:

$$\frac{278\text{mi}}{11.70\text{gal}} = 23.8\text{mi/gal} \tag{2}$$

Calculation: Rules for Rounding

Rule 2: In carrying out an addition or subtraction, the answer cannot have more digits after the decimal point than either of the original numbers or more digits after the leftmost uncertain digit than either of the original numbers.

Example:

$$3.18\text{L} + 0.01315\text{L} = 3.19\text{L} \tag{3}$$

Unit Conversion

Giga (G)	Mega (M)	kilo (k)	hecto (h)	deca (da)
$\left(\frac{1\ \text{Gm}}{1 \times 10^{9}\ \text{m}}\right)$	$\left(\frac{1\ \text{Mm}}{1 \times 10^{6}\ \text{m}}\right)$	$\left(\frac{1\ \text{km}}{1000\ \text{m}}\right)$	$\left(\frac{1\ \text{hm}}{100\ \text{m}}\right)$	$\left(\frac{1\ \text{dam}}{10\ \text{m}}\right)$
$\left(\frac{1 \times 10^{9}\ \text{m}}{1\ \text{Gm}}\right)$	$\left(\frac{1 \times 10^{6}\ \text{m}}{1\ \text{Mm}}\right)$	$\left(\frac{1000\ \text{m}}{1\ \text{km}}\right)$	$\left(\frac{100\ \text{m}}{1\ \text{hm}}\right)$	$\left(\frac{10\ \text{m}}{1\ \text{dam}}\right)$

Basic Units

meter (m)
gram (g)
Liter (L)
second (s)
mole (mol)
calorie (cal)
Joule (J)

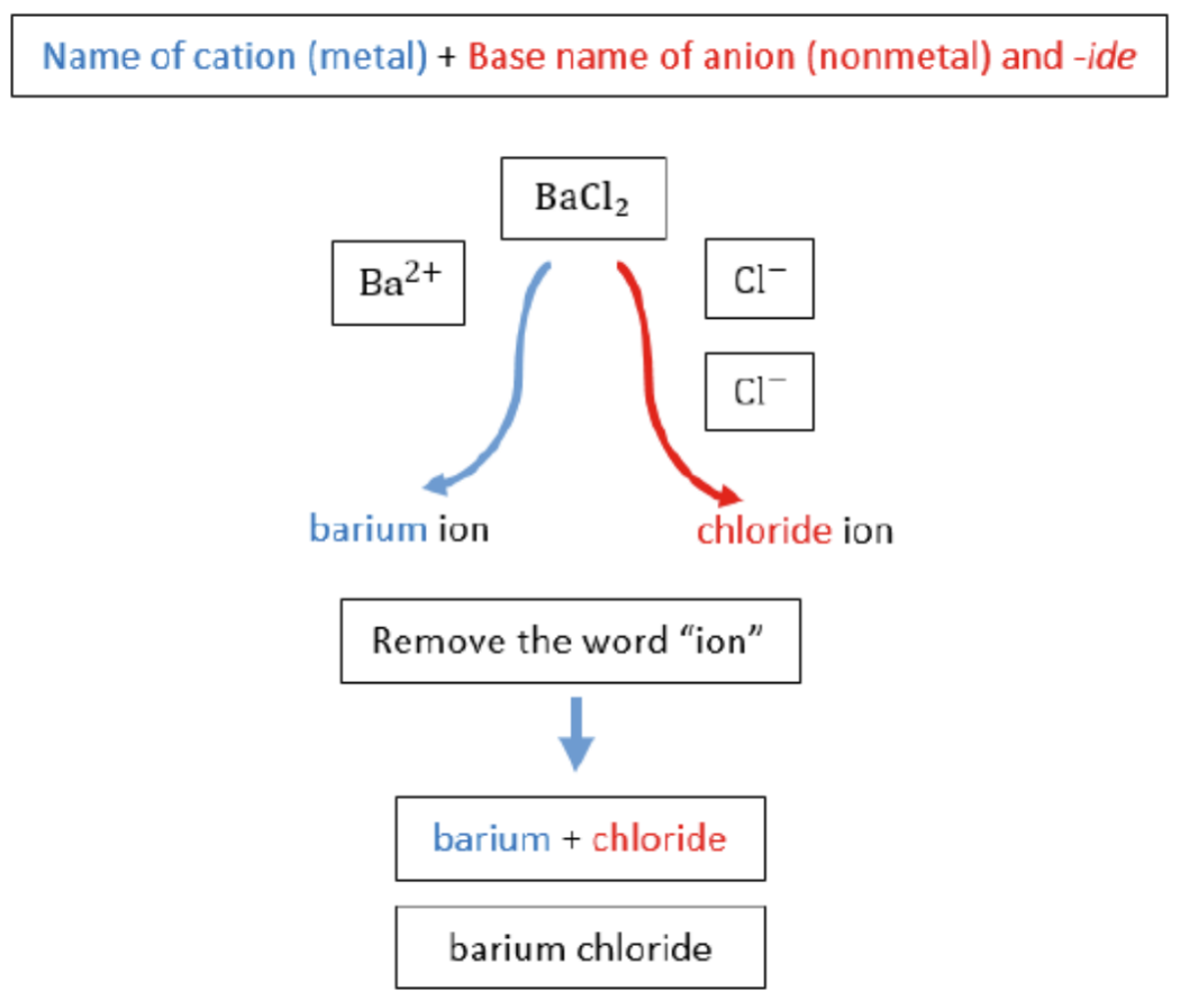
deci (d)	centi (c)	milli (m)	micro (μ)	nano (n)
$\left(\frac{10\ \text{dm}}{1\ \text{m}}\right)$	$\left(\frac{100\ \text{cm}}{1\ \text{m}}\right)$	$\left(\frac{1000\ \text{mm}}{1\ \text{m}}\right)$	$\left(\frac{1 \times 10^{6}\ \mu\text{m}}{1\ \text{m}}\right)$	$\left(\frac{1 \times 10^{9}\ \text{nm}}{1\ \text{m}}\right)$
$\left(\frac{1\ \text{m}}{10\ \text{dm}}\right)$	$\left(\frac{1\ \text{m}}{100\ \text{cm}}\right)$	$\left(\frac{1\ \text{m}}{1000\ \text{mm}}\right)$	$\left(\frac{1\ \text{m}}{1 \times 10^{6}\ \mu\text{m}}\right)$	$\left(\frac{1\ \text{m}}{1 \times 10^{9}\ \text{nm}}\right)$

Nomenclature

- Common mistakes: mixing between ionic and molecular compounds e.g. $Ca_3(PO_4)_2$
- Naming ionic compounds, memorize the polyatomic ions
- Naming molecular compounds, memorize the prefixes

Naming Binary Ionic Compounds

The metal cation is named first, followed by the nonmetal anion. The word ion is dropped from both parts.



Naming Molecular Compounds

Prefix	Number	Prefix	Number	Prefix	Number
mono-	1	penta-	5	octa-	8
di-	2	hexa-	6	nona-	9
tri-	3	hepta-	7	deca-	10
tetra-	4				

1. Use numerical prefix for the element (usually ignore the first when using "mono")
2. Add "-ide" to the second element

Laboratory Techniques

- Bunsen burner
- Evaporation
- Gravity Filtration

Bunsen Burner

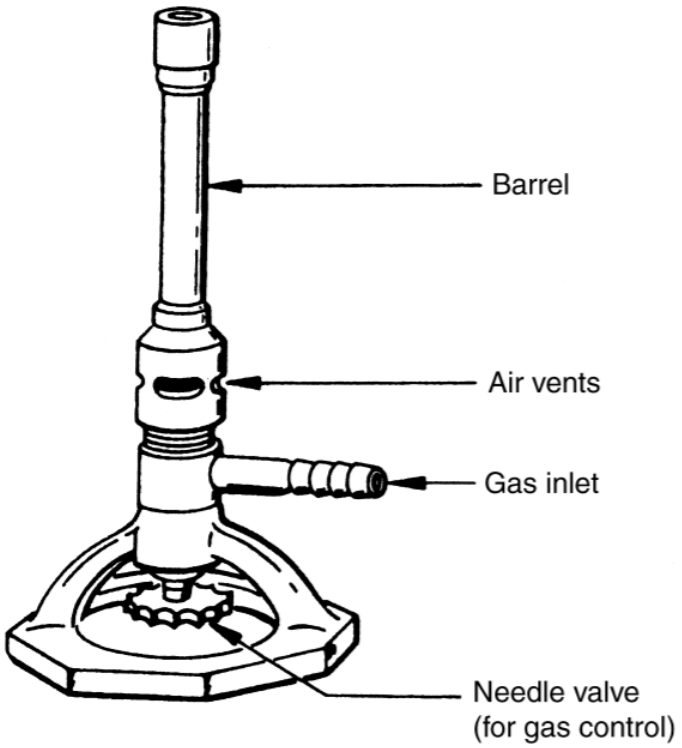


Figure 1.1 Bunsen burner (Tirrill type)

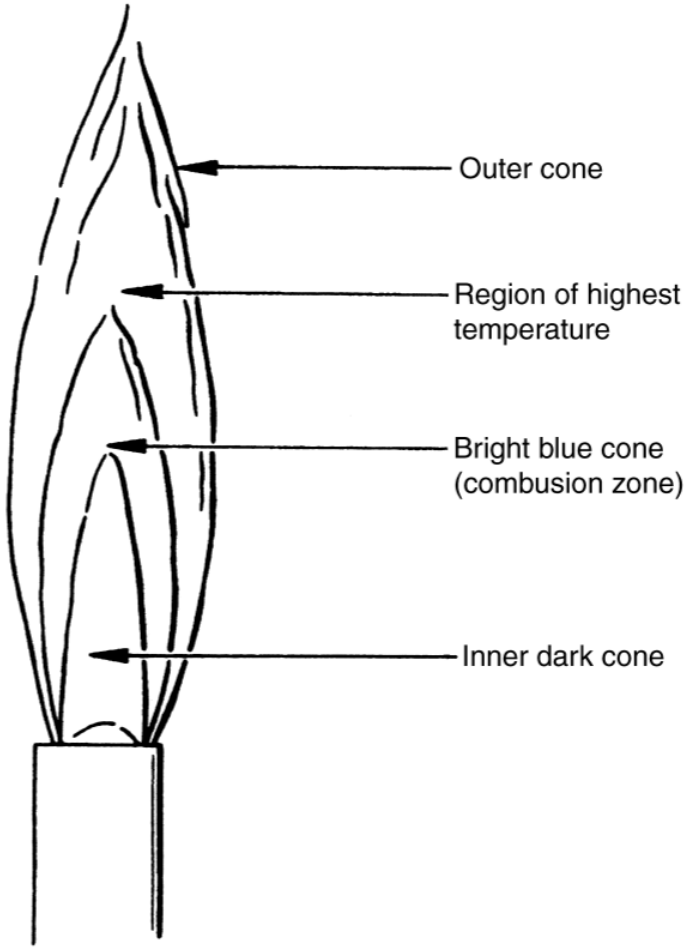


Figure 1.2 Bunsen burner flame

Evaporation

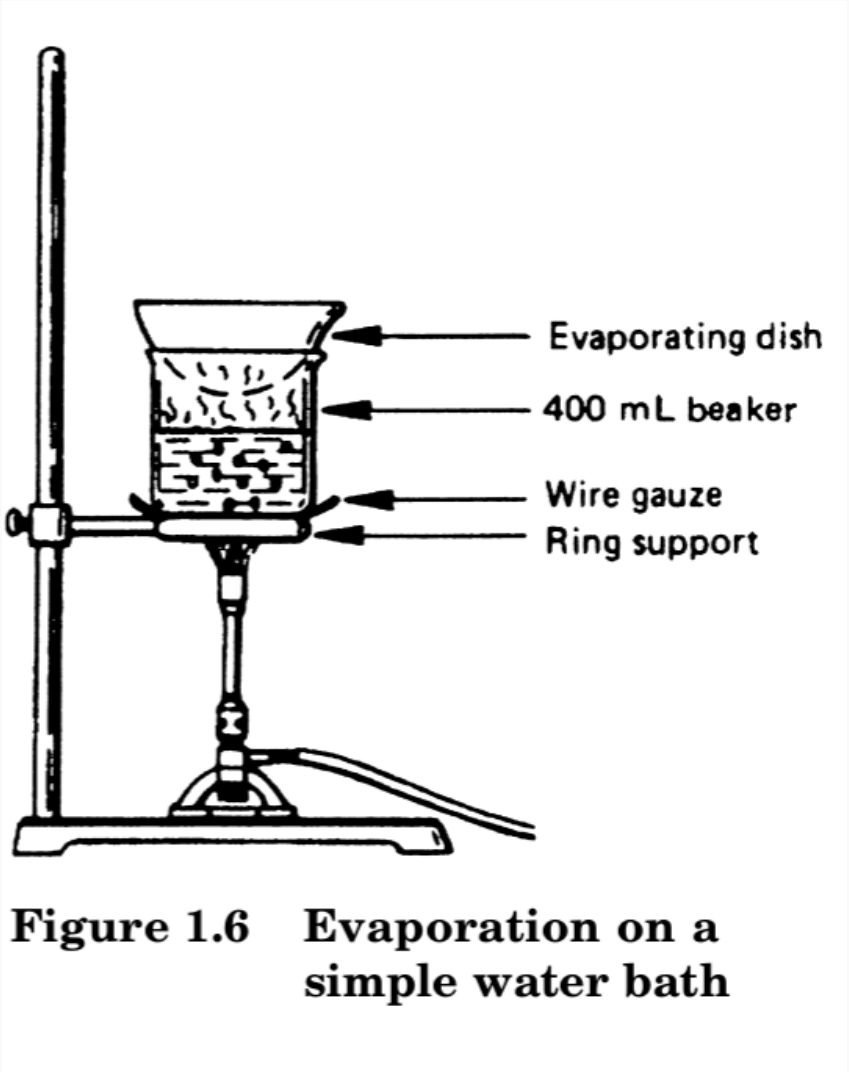


Figure 1.6 Evaporation on a simple water bath

Gravity Filtration

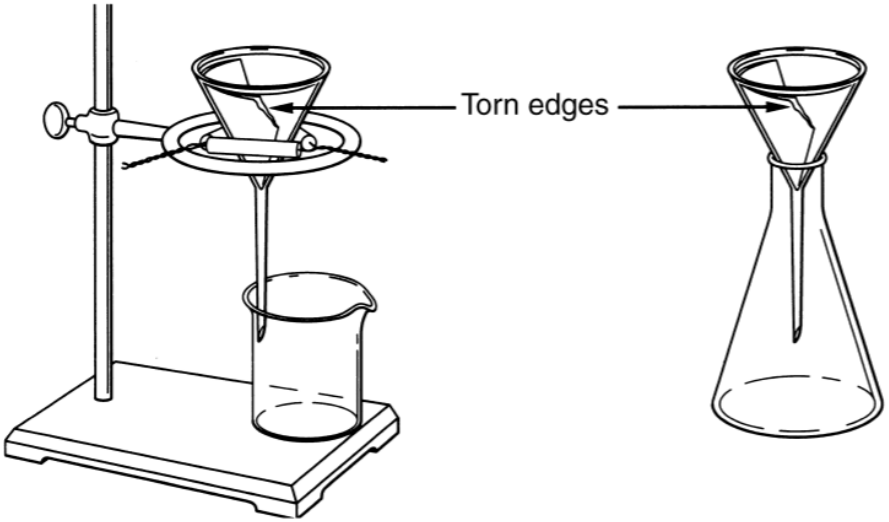


Figure 1.8 Support the filter with a ring stand or an Erlenmeyer flask

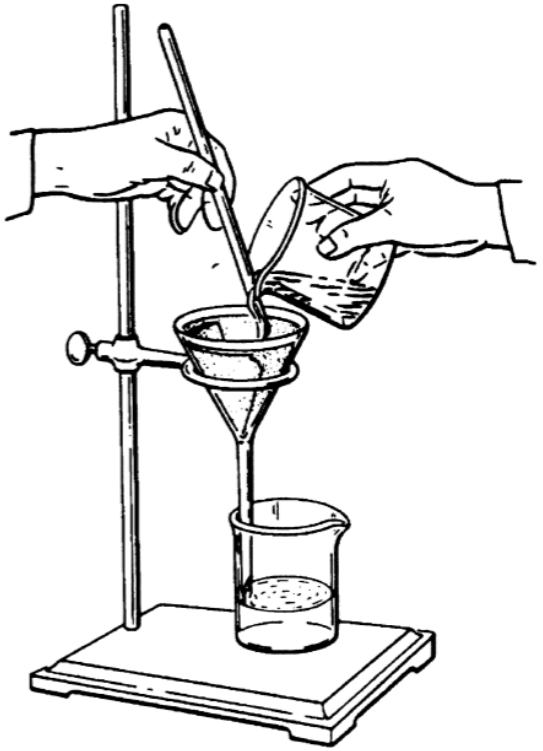
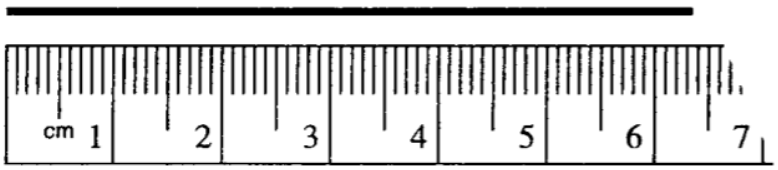
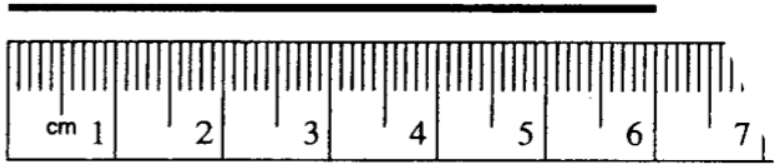


Figure 1.9 Pouring a solution down a stirring rod

Measurements

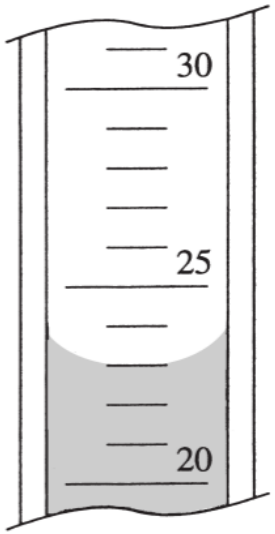


(a)



(b)

Figure 2.1



Calculations for density (mass/volume)

Water in Hydrates

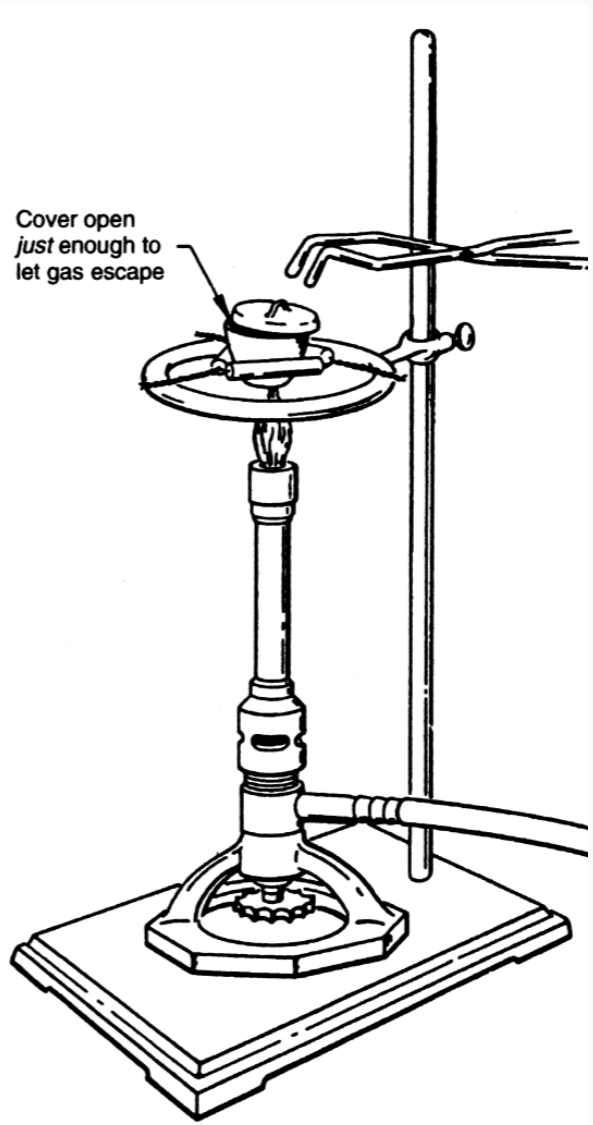


Figure 7.2 Method of heating a crucible

Single+Double Displacement Reactions

Signs for Chemical Reaction

- Color change
- Gas formation
- Exothermic and endothermic (heat changes)
- Precipitation (solid formation) - Solubility rules

Electrolytes

- Take home message: The formation of ions
- Strong electrolytes are solids that dissolve into ions
- Weak electrolytes are solids that doesn't dissolve into ions

KCl Reaction

$KHCO_3(aq) + HCl(aq) \rightarrow KCl(aq) + H_2O(l) + CO_2(g)$

- Understanding the chemical equation e.g. cookbook recipe
- Limiting reagent type problem
- Determining amount moles HCl from molarity needed to react with all your $KHCO_3(s)$

Lewis Structures

1. Count the total number of valence electrons
2. Draw the atomic skeleton by determining the central atoms (generally the one capable of making many bonds)
3. Add single bonds (each counts as 2 electrons) to atoms and add lone pairs if needed to satisfy the octet rule
4. Check that if the amount of valence electrons counted match the Lewis structure
5. Check formal charges on the atoms

Computing Formal Charges

$$\text{Formal Charge} = \text{VE - } \frac{1}{2} \text{ BE - NBE}$$

where VE is the number of valence electrons, BE is the bonding electron, and NBE is the nonbonding electron aka lone pairs

Resonance Structures

As seen in the previous slide, O_3 and CO_3^{-2} have multiple structures that are valid

Resonance structures - the movement of electrons satisfying a valid Lewis Structure