General Chemistry Laboratory

Experiment 1 :

♦ **Tools ...**

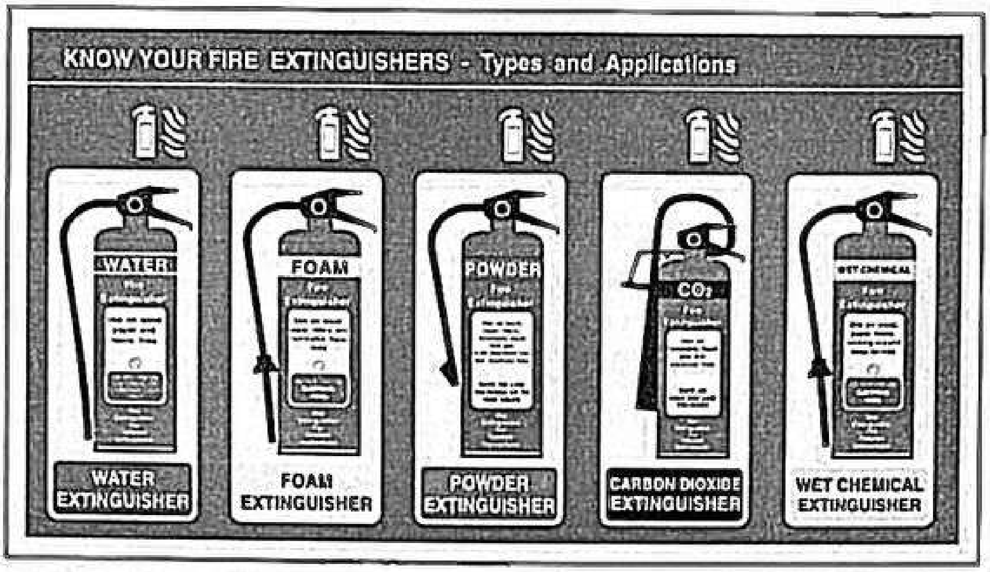
*** Splitting of Chemicals ... Wash with plenty of Water? Acid, Base.

*** Clothes Burning ... Use Safety Shower Not Extinguisher.

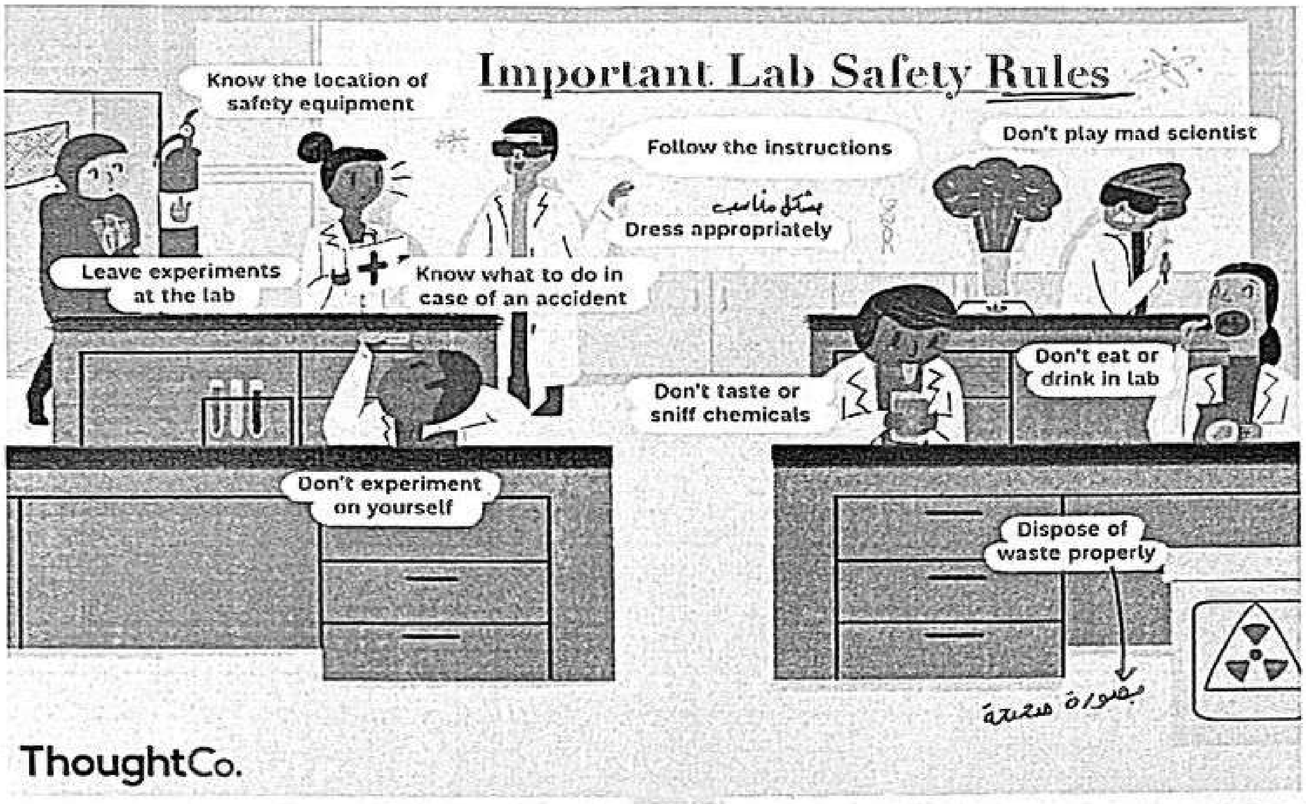
*** When heating flammable Liquids ... Indirect Heating Up.

*** Every chemical substance is dangerous until proven otherwise.

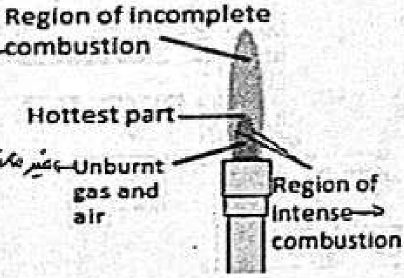
*** Fire Extinguisher:



♦ Safety Rules & Chemical Hazard Signs ...



♦ Bunsen burner …



** Founder: Robert Bunsen (1811 – 1899).

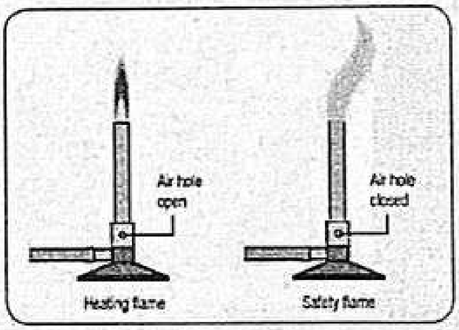
** Main purpose: Combustible gas- air mixture

' Natural gas ' yields a hot, efficient flame.

** Natural gas: Methane (CH_4) – Hydrocarbons.

Sufficient O_2
Blue, nonluminous flame
Water + CO_2
$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$

Insufficient O_2
Yellow, Luminous flame
small C particles until incandescent heating
Water + CO + CO_2
$3CH_{4(g)} + 9/2\ O_{2(g)} \rightarrow CO_{2(g)} + 6H_2O_{(g)} + C_{(s)} + CO_{(g)}$

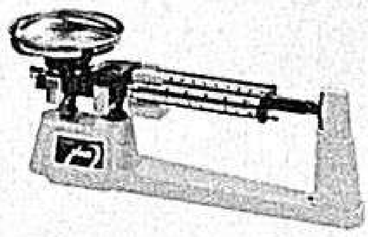


♦ Laboratory Balance ... (ميزان)

** Most common used piece, with different models & sensitivities.
** How to choose? Depending on the degree of precision (دقة) required.
** Common types:

1. Top-loading balance.

2. Triple-beam balance.



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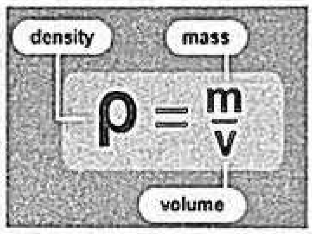
Experiment 2

♦ Physical Properties of substances ..

** Identification like: color, odor (رائحة), density, solubility, M.P, B.P, state of matter.
——► Qualitative " Intensive properties "
** Addition tests are required for more info. ; Purity, differentiation, etc.

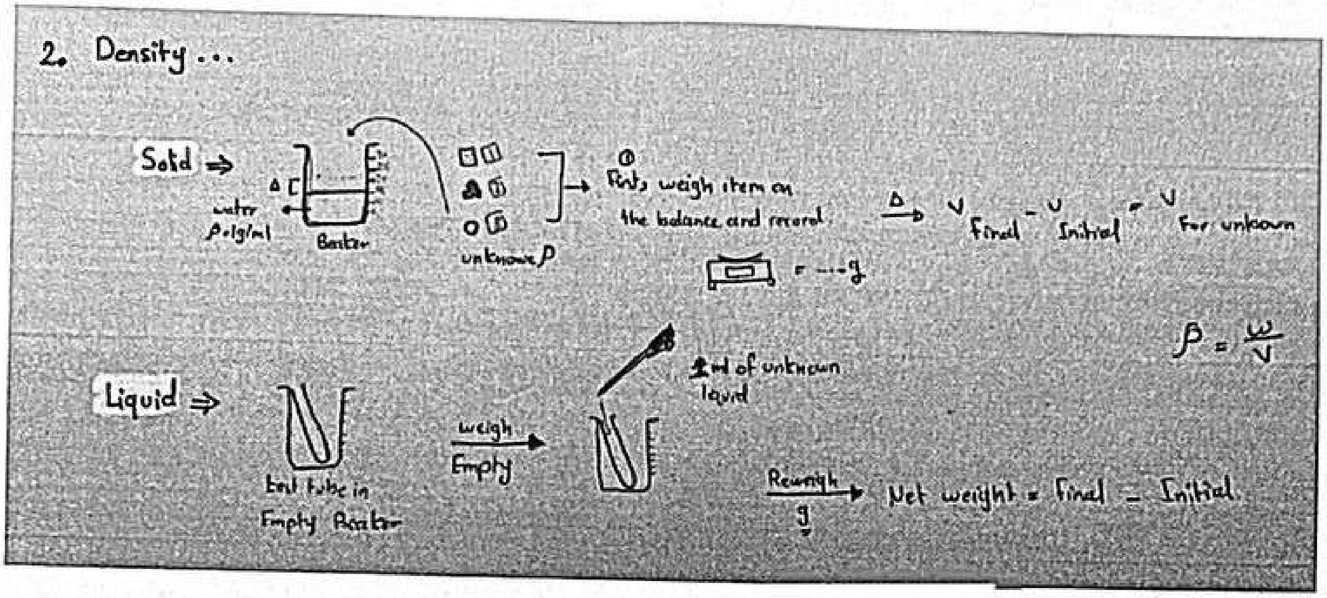
1... Density.

** Def.: mass of substance (g) per Unit of volume (ml / cm^3 / L ... liquid / solid / gas). SI
** Water density as a reference equal:



1 g/ml

- ──► Light Metal if $\rho < 1$ g/ml
  large volume with small mass
- ──► Heavy Metal if $\rho > 1$ g/ml
  large mass with small Volume



2…Solubility. (Solute + Solvent)

** Def.: maximum mass (g) of substance ' solute ' that dissolves in a fixed mass (100 g) of solvent at given <u>temperature</u>. Reaching Saturation

** Difference solubility? Because of molecular composition either solute or solvent. تغير

** Generally … Like dissolve like!

** Solid in Liquid:

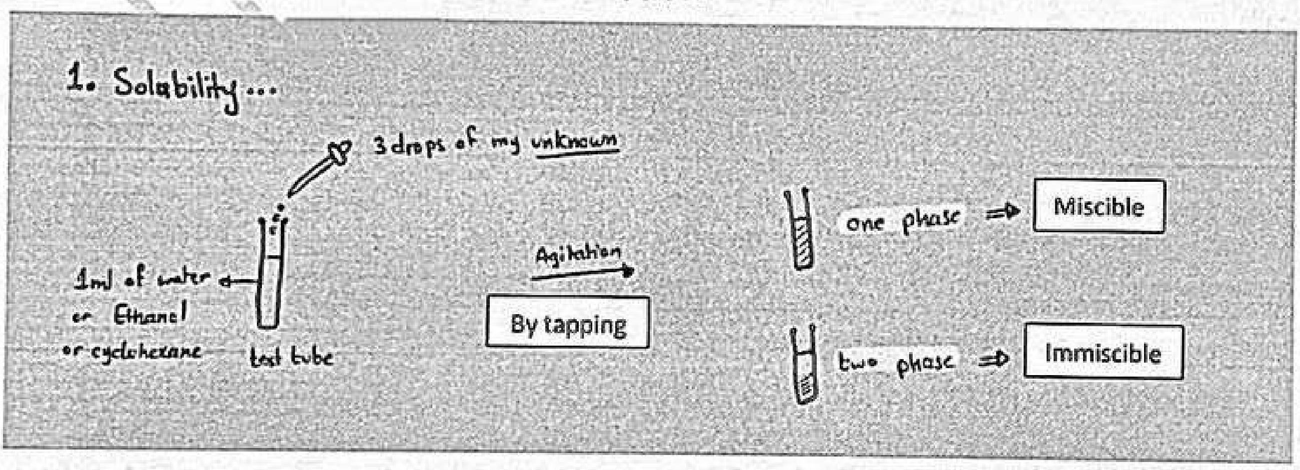
1. Soluble.
2. Insoluble.
3. Partial soluble.

** Liquid in Liquid:

1. Miscible قابل للمزج
2. Immiscible.

Descriptive term	Part of the solvent required per part of solute
Very soluble	Less than 1
Freely soluble	From 1 to 10
Soluble	From 10 to 30
Sparingly soluble (شحيح الذوبان)	From 30 to 100
Slightly soluble (قليل الذوبان)	From 100 to 1000
Very slightly soluble	From 1000 to 10,000
Practically insoluble	10,000 and over

VFSSSVP



3.. Melting Point & Boiling Point.

ذوبان

** Melting P.: the temperature at which solid and liquid form of a pure substance coexist.

بطريقة عفوية

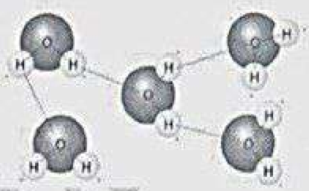
غليان ** Boiling P.: the temperature at which bubbles form spontaneously until the whole liquid convert to gas at atmospheric pressure. $P_{gas} = P_{atmosphere}$

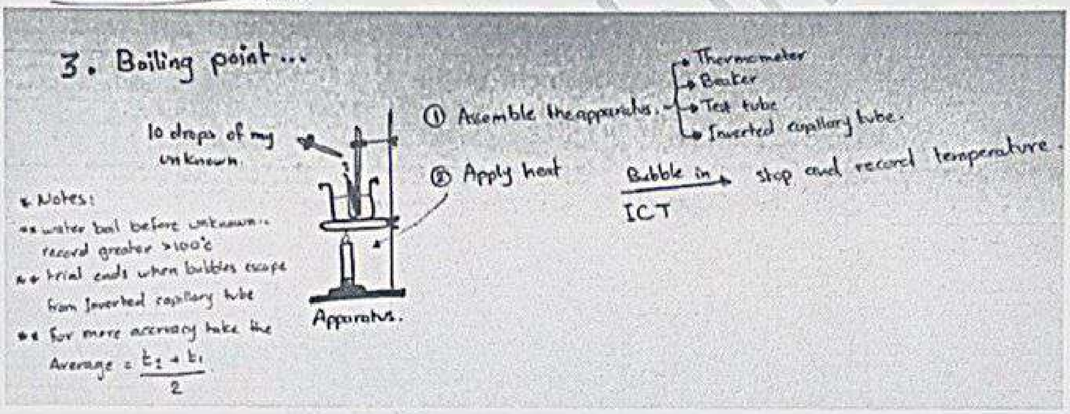
** Characteristic of each substance!

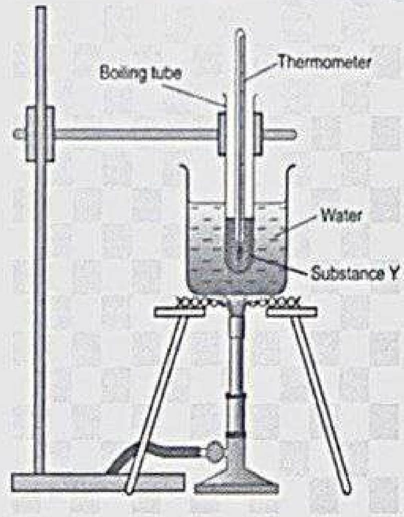
** Dependency on the Intermolecular forces of substance… greater the magnitude = higher M.P or B.P? Highly arranged and vice versa.

** Wide range of M.P indicates an impure lattice? بنية

Because impurities disturbs the rhythm and weaken intermolecular forces.







Melting Point

Experiment 3 :

♦ Chemical properties of substances ...

Def...

** Chemical properties: characteristic of substance that depends on its chemical environment.

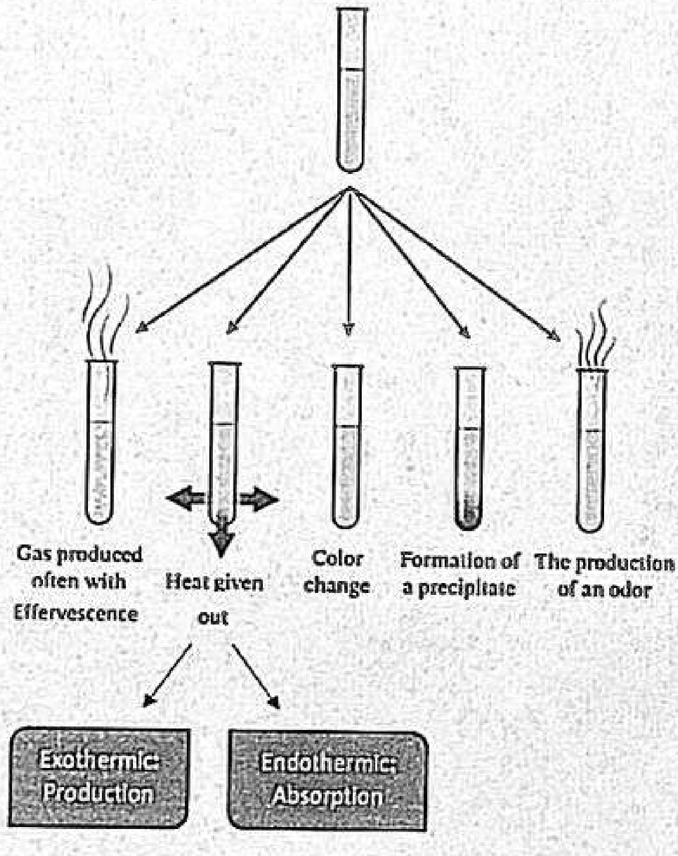
** Substance: pure element or compound have a unique set of chemical & physical properties.

** Trial and error study: method used to seek a pattern in accumulated data.

** Reagent: solid chemical or solution have a known concentration of solute.

- Chemical property indicate chemical rxn. (Break & Form)
- Use?
  1. To identify the presence or absence of substance.
  2. Determine or measure parameter.
  3. Separation and Identification through TAES or Systemic studies.

*** Noticing Chemical Changes / Observations :

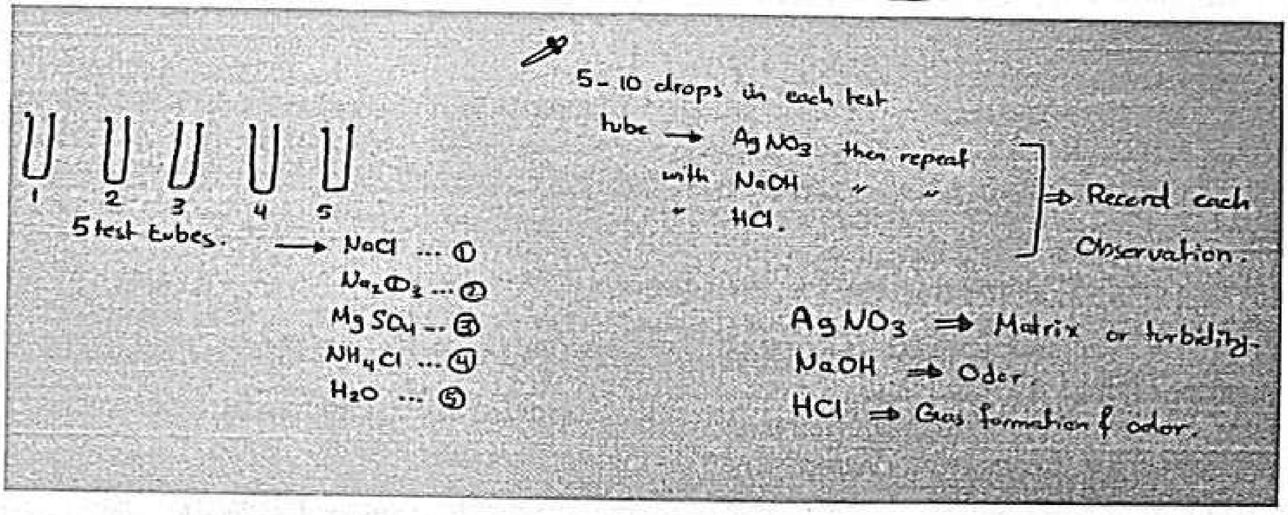


A + B → Product

p – precipitate
c – cloudy
nr – no reaction
go – gas & odor
g – gas

** $AgNO_3$ stains skin black, not harm.

** Precipitation example: 2 AgNO3(aq) + K2CrO4(aq) —> Ag2CrO4(s) + 2 KNO3(aq).



Reactant	NaCl	$NaCO_3$	$MgSO_4$	NH4Cl	H_2O	Unknown
$AgNO_3$	Cloudy, White bottom	Pale yellow to brown thick	Faint Cloudy ppt.	White cloud, ppt	---	**
NaOH	---	---	Cloudy, White bottom	---	---	-
HCl	---	Bubble CO2	---	---	---	**

- Balanced Equations:

1. $AgNO_3\,(aq) + NaCl\,(aq) \longrightarrow AgCl\,(s) + NaNO_3\,(aq)$

2. $Na_2CO_3\,(aq) + 2\,AgNO_3\,(aq) \longrightarrow Ag_2CO_3\,(s) + 2\,NaNO3\,(aq)$

3. $MgSO_4 + 2AgNO_3 \rightarrow Mg(NO_3)_2 + Ag_2SO_{4(s)}$

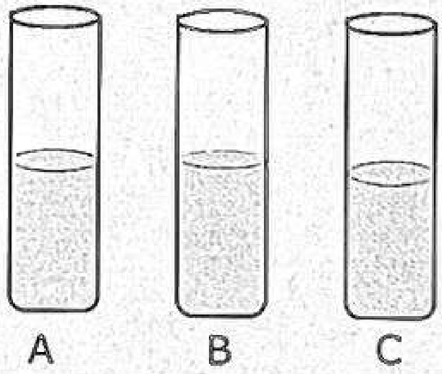
4. $NH_4Cl\,(aq) + AgNO_3\,(aq) \longrightarrow AgCl\,(s) + NH_4NO_3\,(aq)$

5. $MgSO_4\,(aq) + 2\,NaOH\,(aq) \longrightarrow Mg(OH)_2\,(s) + Na_2SO_4\,(aq)$

6. $Na_2CO_3\,(aq) + 2\,HCl\,(aq) \longrightarrow 2\,NaCl\,(aq) + CO_2\,(g) + H_2O\,(l)$

≈ 3 unknown test tubes are in a test tube rack on the laboratory bench. Lying beside the test tubes are three labels: potassium iodide, silver nitrate, and sodium sulfide. You are to place the labels on the test tubes using only the three solutions present. Identify the test tubes, using the following test results.

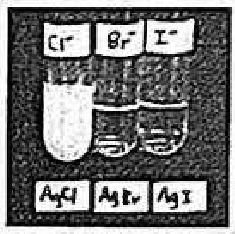
1. A portion of Test Tube 1 added to a portion of Test Tube 3 produces a yellow, silver iodide precipitate.
2. A portion of Test Tube 2 added to a portion of Test Tube 3 produces a black, silver sulfide precipitate.



** **Observation and its equation examples:**

× $NaHCO_{3\,(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2CO_{3\,(g)}$ .... $H_2CO_{3\,(g)} \rightarrow H_2O_{(g)} + CO_{2\,(g)} \uparrow$ (gas)

× $AgNO_{3\,(aq)} + HCl_{(aq)} \rightarrow AgCl_{(s)} \downarrow + HNO_{3\,(aq)}$ (Precipitation)

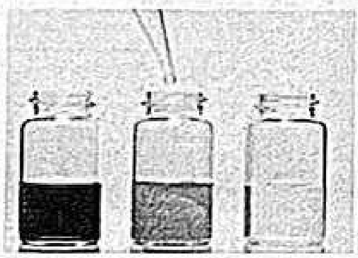


× $NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(aq)} + Heat\ (T\uparrow)$ (Hot, exothermic)

× $2B_{(s)} + H2\,O_{(g)} + Heat \rightarrow B_2H_{6\,(g)} + 3/2\ O_{2\,(g)}\ (T\downarrow)$ (cold, endothermic)

× $I_{2\,(aq)} + KI_{(aq)} \rightarrow KI_{3\,(aq)}$ (brownish – colorless) .... Color change

× $NH_4Cl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + NH_4OH_{(g)}$ .... $NH_4OH_{(aq)} \rightarrow NH_{3(g)} \uparrow + H_2O_{(aq)}$ (gas + odor)



Experiment 4 :

♦ **Limiting Reagent...**

** Chemical rxns affected by :

$\%Yield = \frac{Actual\ Yield}{Theoretical\ Yield} \times 100\%$

1. Reactant (starting material)
2. Percentage yield (affected by exper. Conditions)

** *If I need L.R in my chemical reaction, it should be mixed non-stoichiometric.* **Not 1:1**

** stoichiometric: chemical reaction with balanced equation.

** Limiting reagent: reactant that determine amount of product generated in chemical reaction. Complete consumption

** Theoretical yield depends on limiting reactant.

** % composition: mass ratio of component of mixture or compound to the total of the sample.

** The concept of limiting reactant:

% A = A⁺ / AB * 100 %

1. Write chemical equation ***BALANCED***.
2. Calculate reactants mole
3. Choose the limiting reagent 'without molecular coefficient'.
4. Limiting reactant coefficient moles = Product coefficient moles.
5. After calculating product's mole number, calculate mass. (Theoretical yield)
6. After proceeding ur experience, calculate % yield.

Spectator Ions: cations or anions that don't participate in chemical reaction 'observable or detectable'

♦ Manual example...

Molecular equation.

$3BaCl_2 \cdot 2H_2O_{(aq)} + 2Na_3(PO_4)_2 \cdot 12H_2O_{(aq)} \rightarrow Ba_3(PO_4)_{2\ (s)} \downarrow + 6NaCl_{(aq)} + 30H_2O_{(l)}$

Ionic equation...

$6Na^+_{(aq)} + 2PO_4^{3-} + 30H_2O_{(l)} + 3Ba^{2+}_{(aq)} + 6Cl^-_{(aq)} \rightarrow Ba_3(PO_4)_{2(s)} + 6Na^+_{(aq)} + 6Cl^-_{(aq)} + 30\ H_2O_{(l)}$

Net Ionic equation...

$$3Ba^{2+}_{(aq)} + 2PO_4^{3-} \rightarrow Ba_3(PO_4)_{2(s)}$$

Net Ionic equation: equation with ions that participate in observed chemical reaction.

Forming Heterogenous mixture that collect solid and filtrate it then measure.

Calculations:

1... M.W of $\underline{BaCl_2 \cdot 2H_2O}$ = 244.27 g/mole × 3 = 732.81 g/mole (L.R)

M.W of $Na_3(PO_4)_2 \cdot 12H_2O$ = 380.12 g/ mole × 2 = 760.24 g/mole

M.W of $Ba_3(PO_4)_2$ = 601.93 g/ mole

2... Masses of reactants or products are given...

** $Ba_3(PO_4)_2$ mass is 0.188 g

** Salt mixture (reactants) mass is 0.942 g

** Limiting reagent is $BaCl_2 \cdot 2H_2O$

** Mole $_{Ba3(PO4)2}$ = Mass / M . Weight

Mole $_{Ba3(PO4)2}$ = 0.188 g ÷ 601.93 g/ mole = 3.123×10^{-4} moles.

** 1 mole of $Ba_3(PO_4)_2$ requires 3 mole of limiting reagent ($\underline{BaCl_2 \cdot 2H_2O}$)

3.123×10^{-4} moles × 3 = 9.369×10^{-4} mole of Ba^{+}

** Mass $_{BaCl2 \cdot 2H2O}$ = Mole × M.W

Mass $_{BaCl2 \cdot 2H2O}$ = 9.369×10^{-4} mole × 244.27 g/mole = 0.2288 g.

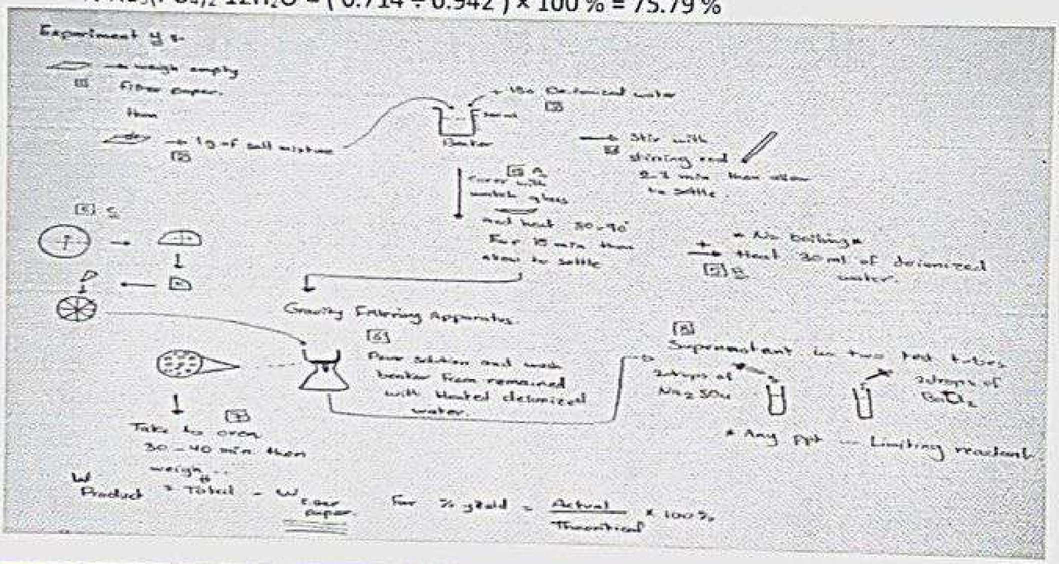
** Mass $_{Na3(PO4)2 \cdot 12H2O}$ = Total salt mixture - Mass $_{BaCl2 \cdot 2H2O}$

Mass $_{Na3(PO4)2 \cdot 12H2O}$ = 0.942 g – 0.228 g = 0.714 g

** Percent composition:

% $BaCl_2 \cdot 2H_2O$ = (0.2288 ÷ 0.942) × 100 % = 24.28 %

% $Na_3(PO_4)_2 \cdot 12H_2O$ = (0.714 ÷ 0.942) × 100 % = 75.79 %



Example :

** $NH_3 + O_2 \rightarrow NO + H_2O$, 3.25 g of NH_3 are allowed to react with 3.50 g of O_2.
a. Which reactant is the limiting reagent?
b. How many grams of NO are formed?

Solution:

1... balance & calculate: $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

$Mole_{NH_3}$ = Mass / M.W = 3.25 g ÷ 17 g/mole = 0.1912 mole ÷ 4 = 4.8×10^{-2}

$Mole_{O_2}$ = Mass / M.W = 3.5 g ÷ 32 g/mole = 0.1094 mole ÷ 5 = 2.2×10^{-2}

2... $5O_2 \rightarrow 4NO$

0.1094 → ??? = 0.1094 * 4 / 5 = 0.08752 mole

Mass NO = mole × M.W = 0.08752 × 30.01 = 2.6264 g.

Exp 4 Acid and base ..

Zn + HCl / + H_3PO_4 → gas ↑

Types of rxn:-

① Acid.base rxn
② Redox. rxn
③ ppt. rxn

litmus

Chemical compounds → Acid Blue → red
→ Base Red → blue
→ Salt.

Balanced equation — stoichiometry / Sum stoich

S + O_2 → SO_2 ... Choking "خانق"
yellow solid — Blue flame — Irritant

pH < 7 Acid → tart taste ...(H^+) produce H_3O^+ in aqueous solution HCl, H_3PO_4, HNO_3

↓ Pricking when touch skin (وخز)

Sulfuric acid → Diprotic "produce two protons".

$H_2SO_4 + H_2O \longrightarrow H_3O^+ + HSO_4^-$ ... ①

$HSO_4^- + H_2O \longrightarrow H_3O^+ + SO_4^{-2}$ ... ②

* Hydrated cation⁺ → ions have bonded H_2O : produce acid solution.

Vinegar → acetic acid
Citrus Fruits → citric acid
Vit C → Ascorbic acid

ex: Ammonium ⇒ $NH_4^+ + H_2O \longrightarrow NH_3 + H_3O^+$

Ferric ions ⇒ $Fe(OH)^{3+} + H_2O \longrightarrow Fe(OH)^{+2} + H_3O^+$

pH > 7 Base ⇒ bitter taste ... (OH^-) in aqueous solution like NH_3, Soaps, antacids, detergents

↓ Slippery touch

washing soda / Soda ash → Na_2CO_3
Drain cleaner/oven → Caustic soda / Lye
جير مطفأ Slaked Lime → $Ca(OH)_2$
Caustic potash → KOH
Magnesia milk → $Mg(OH)_2$
↓
antacid + purgative

* Anions⁻ → produce basic solution

ex: carbonate ⇒ $CO_3^{2-} + H_2O \longrightarrow HCO_3^- + OH^-$

phosphate ions.

* * * * * * * *

Acidity → ↓ concentration of H_3O^+

* pH : convenient mathematical expression that express Low concentration of hydronium ion

$pH = -\log [H_3O^+]$ ⇒ Def: negative logarithm of molar concentration of $\{H_3O^+\}$

→ m.concentration

$25°$, neutral condition → $[H_3O^+] = 1 \times 10^{-7}$ mole/L

$pH = -\log[1 \times 10^{-7}] = 7$

ex.. $[H_3O^+] = 1 \times 10^{-3}$ mole/L → pH ?? = 3 Acidic

$[H_3O^+] = 1 \times 10^{-12}$ mole/L → pH ?? = 12 Basic

* To measure acidity or basic solution ⇒ Litmus paper "use more than one"

↳ mixed Indicator : universal indicators

pH test papers

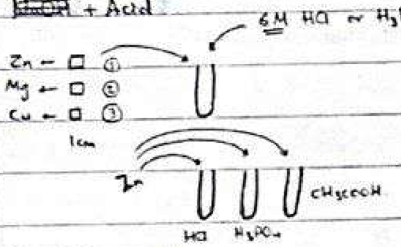
Procedure

Acid

* Dilute or concentrated acids / bases ⇒ skin burns, irritation of mucus membrance.

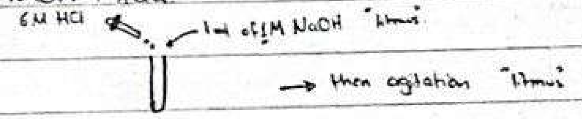
wash with water + Adding Baking Soda $NaHCO_3$.

Metal + Acid

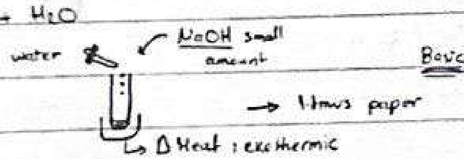


Base

NaOH + Acid



NaOH + H_2O



* $NaOH + H_2O \rightarrow Na^+ + OH^-$ ↑
* $Na_2CO_3 + H_2O \rightarrow NaHCO_3 + OH^- + Na^+$

Titration ⇒ Determine Molar concentration of strong acid / base.

$pH + pOH = 14$ → For H_2O at neutral.

$K_w = [OH^-][H^+] = 1 \times 10^{-14}$

Example :-

NaOH is strong base , find pH by adding 1g of base to enough water to make 1L of solution.

$M = \frac{mole}{V \text{ in } L}$

$K_w = 1 \times 10^{-14}$

$M.W_{NaOH} = 40 \text{ g/mole}$

$V_{solution} = 1L$

$M_{NaOH} = 1g.$

$NaOH + H_2O \longrightarrow Na^+ + OH^-$

$pH = -\log [H^+]$?!

① NaOH moles $\longrightarrow$ $mole = \frac{mass}{M.W} = \frac{1g}{40 g/mole} = 0.025 \text{ mole}$

$M_{NaOH} = \frac{Moles}{V_{in L}} = \frac{0.025 \text{ mole}}{1 L} = 0.025 \text{ mole/L of } [OH^-]$

$K_w = [OH^-][H^+]$

$\frac{1 \times 10^{-14}}{0.025} = \frac{(0.025) \cdot [H^+]}{0.025} = 4 \times 10^{-13}$

$pH = -\log [4 \times 10^{-13}]$

$-(\log 4 + \log 10^{-13}) = 13 - \log 4$

$= 12.40$

$PH = ? = -\log [H_3O^+]$

$m = 1g \;/\; M.W = 40 \;/\; V = 1L$

(3)

$[NaOH] = \frac{Moles}{V} = \frac{\frac{1}{40}}{1} = \boxed{\frac{1}{40}} = [OH^-]$

$pH_{stomach} = 1-2$

Experiment 6:

① → ↓ stomach acidity ? weak bases.

Antacid analysis.

② → relieve acid indigestion.

* Acid Indigestion ... pH low.

How ⇒ neutralization of $(H^+)_{excess}$

Antacids → Milk of magnesia $Mg(OH)_2$

Sodium bicarbonate $NaHCO_3$

$CaCO_3$ تَيْن

$$Mg(OH)_2 + 2H^+ \longrightarrow Mg^{+2} + 2H_2O$$

or انستاتا

$$NaHCO_3 + H^+ \longrightarrow Na^+ + \underline{CO_2} + H_2O \Rightarrow \text{Belching}$$

$NaHCO_3$

Buffering ⇒ resist large change of acidity.

Rolaids → antacid contain $Mg(OH)_2$ + $CaCO_3$ (1:5)

Back titration ⇒ procedure where analyte is swamped with excess neutralizing agent the remainded neutralizing agent is neutralized to final stoichiometric point.

Procedure

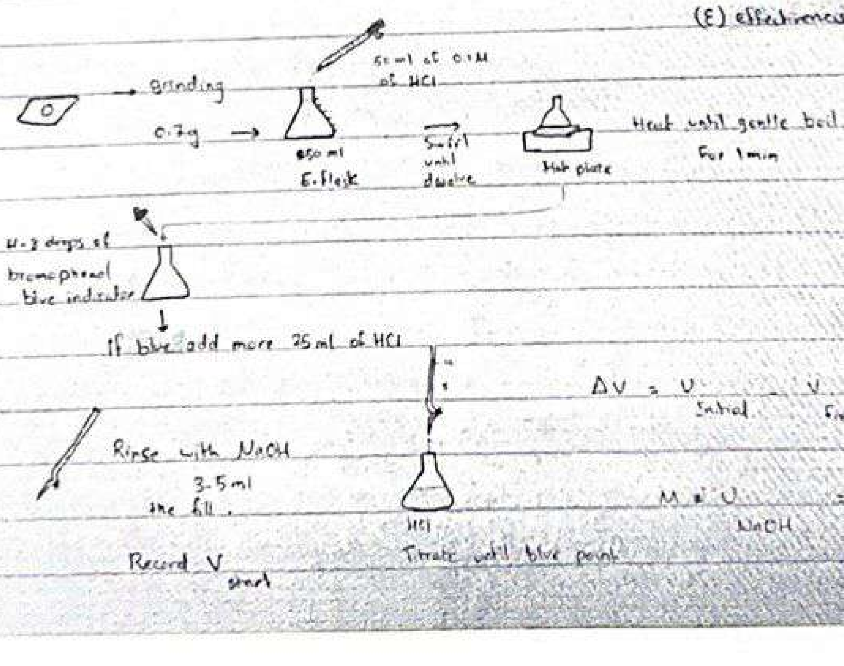
Antacid + strong acid → Titration ? to avoid buffer system formation.
in excess [HCl]

Bromophenol Blue
yellow → blue

NaOH + Back titration) Heating ? Driving off excess CO_2

* Moles of HCl = Mole of antacid + Moles of NaOH

$$(E) \text{ effectiveness} = \frac{\text{Mole antacid}}{\text{Mass Antacid}}$$



$$\Delta V = V_{initial} - V_{final} = V_{NaOH}$$

$$M \cdot V_{NaOH} = M \cdot V_{HCl}$$

*** 25 ml of 0.5 NaOH titrated with 50 ml of HCl. What is the concentration of HCl

Solution $M_{NaOH} = [0.5]$, $V_{NaOH} = 25\,ml \xrightarrow{\times 10^{-3}} 0.025\,L$

$V_{HCl} = 50\,ml \xrightarrow{\times 10^{-3}} 0.05\,L$, M ?!

moles of NaOH = moles of HCl

$M \times V_{NaOH} = M \times V_{HCl}$

$\Rightarrow (0.5) \times (0.025) = (0.05) \times M_{HCl}$

$M_{HCl} = 0.25$

*** When adding 50 ml of 0.1 HCl to 25 ml of ammonia. It takes 21.5 ml of 0.1 M NaOH to neutralize the excess HCl ... what is the Molar concentration of ammonia?

$HCl + NH_3 \longrightarrow NH_4Cl$ ... ①

$HCl + NaOH \longrightarrow NaCl + H_2O$ ... ②

Solution

equation ②

[1] V HCl $\rightarrow M \times V_{HCl} = M \times V_{NaOH}$ .... $V_{HCl} \times 0.1 = 0.1 \times (21.5 \times 10^{-3})$

$V_{HCl} = V_{NaOH} = 0.0215\,L$

[2] Total HCl Volume = $Volume_{excess}$ + $Volume_{reacted\ with\ NH_3}$

$(50 \times 10^{-3})\,L = 0.0215\,L + ??$

$V_{HCl\ reacted} = 0.05 - 0.0215 = 0.0285\,L$

[3] M_{NH_3} → 1 mole HCl ⟶ 1 mole NH_3

0.0285 mole ⟶ ?!

mole = 0.0285

$M_{HCl} = \frac{Mole}{V}$

Mole = $M \times V$

$= 0.1 \times 0.0285$

$= 0.00285$ mole

$M_{NH_3} = \frac{mole}{V_L} = \frac{0.0285}{25 \times 10^{-3}} = \frac{0.0285}{0.025} = 1.14\ M$

Experiment 7 : Molar mass of a volatile liquid

Atm. pressure → mercury Barometer

For Determination ⇒ Synthesis of new compound ? measure of molar mass of it
↓
Fundamental property

* Dumas method ⇒ determine molar mass of low boiling point liquid

How ? Vaporized liquid within fixed volume + measured temperature & barometer pressure

Ideal Gas Law ⇒ $n_{vapor} = \frac{PV}{RT}$ R = universal gas constant = 0.08206 $\frac{L \cdot atm}{mol \cdot K}$

$mass_{vapor} = mass_{vapor + vessel} - mass_{vessel}$

$M.M_{vapor} = \frac{mass}{n}$

modify

* Not all Gas / Liquid can calculate using equation ? large molecular volume ... ①

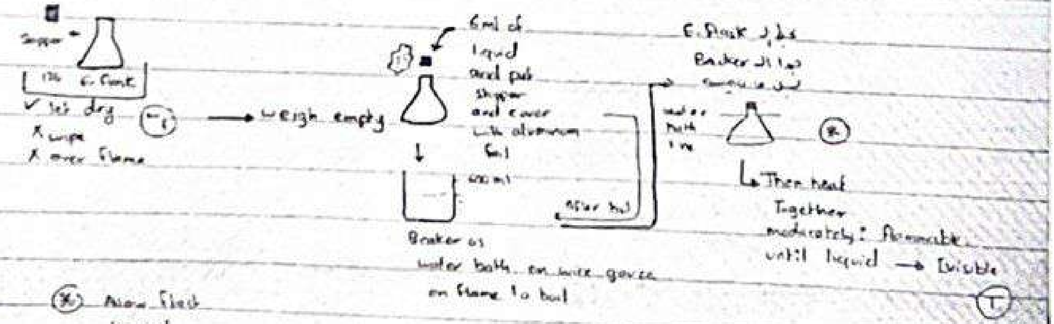
large intermolecular force ✓ IGL

Deviate from ideal gas behavior ... ②
↓
T > of boiling point of the liquid

• So, how to calculate ?!

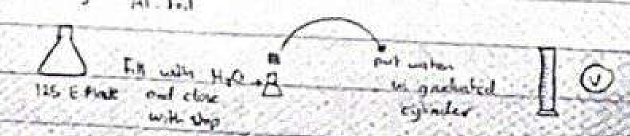
Van der Waal equation ⇒ $\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$ a = intermolecular force, b = volume of the molecule

Procedure



(※) Allow flask to cool "Condensation" — Dry → weigh without rubber Al. foil

Flask Volume ⇒



Pressure ⇒ Barometer (P)

Experiment 8

Recrystallization.

Perfect result ? suitable solvent.

* Crystallization : process that solid compound precipitates from saturated solution in

  Crystal Form → Evaporation / → Cooling

?? Recrystallization ⇒ separation of solid mixture.

→ Purification ... How ?! [1] Different solids have different solubilities in solvent

[2] Most solids in hot > cold solvent

according to solubility.

Impure Solid → Suitable Hot Solvent ⇒ Cooling (تدريجي) ... Saturation ✓

Crystallization ✓ → Pure

Impurity → Soluble / → Insoluble

→ Insoluble impurity ... gravity filtration of hot solution

Soluble impurity ... remain Dissolved in cold saturated solution

Suction filtration [illegible] → "After precipitation of desired compound" mother liquor

↳ Dry ... purity ?! → M. point

* Crystal formation : selective process of only molecules of same substance that fit into crystal lattice without impurities

* Determination of solubility of solid solute in solvents.

1. Polarity of solute & solvent

   * Polar group in polar solvent {OH, NH_2, COOH} → [Methanol, ethanol, H_2O]

     5 > C [illegible]

   * Non polar in non polar → Chloroform, CCl_4, hexane, petroleum ether

2. lattice energy of crystalline solute.

   Solid → [illegible] —break by→ Dissolution How?

   ⇒ using energy from solvent

* High lattice energy ∝ melting point ⇒ more stable

* melting point ∝ $\frac{1}{\text{Solubility}}$

Solubility / M.p [illegible] Isomers (cis, trans) [illegible]

* Suitable solvent properties for recrystallization:

1. High T .. Dissolve large amout of solid "purification", Low T .. small or little amount
2. Low T .. Dissolve impurities or never even at B.P
3. No reaction with solute "purification" تغير كيميائي
4. Evaporate from crystals

* Cheap, non toxic, non flammable.

* Recrystallization steps ... (A) Suitable solvent
  - (B) preparation of Hot solution ... Decolorization ?
  - (C) Filtration while Hot ? Insoluble impurity
  - (D) Cool to recrystallization crystallization Induction
  - (E) collect, washing and dry Suction filtration

(A) 0.1g of powder in 2ml solvent → Dissolved while cold ? Reject ∴ unsuitable

→ Heat to BP + stirring without dissolving ... Reject.

حتى الحل recrystallization نستعمل الحل المناسب → two solvent: one dissolve X and the other not ... mix

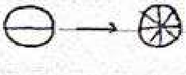
ذوبان المادة تحت درجة الغليان (BP) نضيف المحلول الثاني ! miscible solvent of mixture

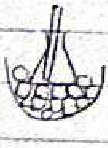
تدريجياً → عكورة turbidity . نتركه حتى تصير المادة بلورة

Slow Recrystallization لا نضع فوراً في الثلج

(B) Free powder →  ← Solvent small portion; Stir / Heat to boil → Dissolved "one phase"
  - → Add solvent (اذا ما ذاب كله)
  - → Charcol "Decolorizing" لون

(Bombing)

(C)  "Fluted filter paper" + Short term funnel] → Avoid premature crystallization

(D) Scratching  ? help in crystal formation.

(E) Buchner funnel ⇒ Rapid

⇒ Complete removal of solvent

(a) Washing ⇒ cold in ice solvent ⇒ Dry in oven, if m.p low ... spread on filter