



**Electricals For You**

اللجنة الأكاديمية لقسم الهندسة الكهربائية - HU

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تلخيص

# Chemistry lab

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[Fb.com/groups/Electricals4You](https://www.facebook.com/groups/Electricals4You)

لجنة كلية الهندسة الكهربائية - الجامعة الهاشمية

Exp 1 Safety and Equipment. There is a quiz for the exp.

المطلوب: شرح الأدوات صفحة 4-7 + حفظ قواعد السلامة من 1-13 من  
 + حفظ أدوات السلامة ص 8+9  
 الترتيب حسب الرتبة  
فقط volumetric pipette > pipette > graduated cylinder > Beaker & Er. flask  
 volumetric flask > Burette

Exp 2 Empirical Formula of a compound. There is a quiz for the exp.

\* هذه التجربة تحتوي جانب نظري وجانب حسابي  
 \* النظري يتعلم بالعلاقات والحسابي يتعلم بالتحويلات بناء على الجدول الدوري  
 كما في المادة الأصلية (أساسيات الكيمياء)

Calculation Part:-

Ex) How many grams of Magnesium combine with 1.5g of chloride ions in  $MgCl_2$ ?

Sol → اطلب كاسي كمافي المادة النظرية

$$1.5g Cl \times \frac{1 \text{ mol Cl}}{35.4g Cl} \times \frac{1 \text{ mol MgCl}}{2 \text{ mol Cl}} \times \frac{24.31 g Mg}{1 \text{ mol Mg}} = 0.514 g Mg$$

Ex) If 11.8 g of iron reacts with 5.06 g of Oxygen. Determine the empirical formula of the resulting oxide?

Sol → الخطوات

Fe	:	O	
11.8g	:	5.06g	① تحويل لفرامات
$\frac{11.8}{55.8} = 0.211 \text{ mol}$	:	$\frac{5.06}{16} = 0.316 \text{ mol}$	② تحويل لمولات
$\frac{0.211}{0.211} = 1$	:	$\frac{0.316}{0.211} = 1.5$	③ العتق على اصغر عدد
$1 \times 2 = 2$	:	$1.5 \times 2 = 3$	④ جبر الرقم
∴ $Fe_2O_3$ #			



Ex) Nicotine is a compound containing C, H and N  
 A 2.5 g sample of the compound is burned and produces  
 6.78 g of CO<sub>2</sub>, 1.94 g of H<sub>2</sub>O, and 0.43 g of N<sub>2</sub>.  
 What is the empirical formula of nicotine?

Sol →

$6.78 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{44 \text{ g CO}_2} \times \frac{1 \text{ mol C}}{1 \text{ mol CO}_2}$ $= 0.154 \text{ mol}$	$1.94 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18 \text{ g H}_2\text{O}} \times \frac{2 \text{ mol H}}{1 \text{ mol H}_2\text{O}}$ $= 0.216 \text{ mol}$	$0.43 \text{ g N}_2 \times \frac{1 \text{ mol N}_2}{28 \text{ g N}_2} \times \frac{2 \text{ mol N}}{1 \text{ mol N}_2}$ $= 0.031 \text{ mol}$
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① إيجاد مولات كل عنصر

0.154 / 0.031 = 5 : 0.216 / 0.031 = 7 ; 0.031 / 0.031 = 1

② النسبة كل الصغرى



Ex) When 0.288 g of P is burned, 0.66 g of white Phosphorus oxide is obtained, determine the empirical formula of this oxide?

Sol → we have 0.288 g P & 0.66 g of Oxide

∴ mass of O = mass of Oxide - mass of P = 0.66 - 0.288 = 0.372 g

P : O

① 0.288 g : 0.372 g

②  $\frac{0.288}{31} = 0.0093$  ;  $\frac{0.372}{16} = 0.0233$  mole

③  $\frac{0.0093}{0.0093} = 1$  ;  $\frac{0.0233}{0.0093} = 2.5$

④ 1 × 2 = 2 ; 2.5 × 2 = 5



Ex) A 2.00-g sample of a bromide oxide is converted to 2.936 g of AgBr, Calculate the empirical formula of the oxide, (M.wt for AgBr = 187.78 g/mol, Br = 80 g/mol and O = 16 g/mol)

Sol → نفس فكرة السؤال السابق لكن يجب أولاً إيجاد كتلة Br

$$2.936 \text{ g AgBr} \times \frac{1 \text{ mol AgBr}}{187.78 \text{ g AgBr}} \times \frac{1 \text{ mol Br}}{1 \text{ mol AgBr}} \times \frac{80 \text{ g Br}}{1 \text{ mol Br}} = 1.25 \text{ g Br}$$

mass O = mass oxide - mass Br = 2 g - 1.25 g = 0.75 g O

Br : O  
 $\frac{1.25}{80} = 0.0156 \text{ mol} ; \frac{0.75}{16} = 0.0468$

$\frac{0.0156}{0.0156} = 1 ; \frac{0.0468}{0.0156} = 3 \quad \# \text{ BrO}_3$

\* أسئلة الحسابات في هذه التجربة لا تنعدي الأفكار السابقة

The Other Part :-

① أسئلة تتعلق بالتجربة :-

Why?

- ① Heating before starting? To remove the moisture الرطوبة
- ② Don't weight the crucible when it's hot? It gives wrong accurate
- ③ Don't cover the crucible widely? It burns Mg brightly
- ④ Adding a few water drops? To decompose  $\text{Mg}_3\text{N}_2$



Postlab questions ⑤

What is the effect of Mg:O mole ratio on it:

- ①  $Mg_3N_2$  Not decomposed completely  $\rightarrow$  increased  
OR The formation of side product.
- ②  $Mg_3N_2$  decomposed completely  $\rightarrow$  no effect.
- ③ Carbon deposited on the crucible surface  $\rightarrow$  decrease
- ④ Carbon not deposited on the crucible surface  $\rightarrow$  no effect
- ⑤ Magnesium oxide ash is not dried completely  $\rightarrow$  decrease
- ⑥ Magnesium oxide ash is dried completely  $\rightarrow$  no effect
- ⑦ Rapid Oxidation of magnesium  $\rightarrow$  increase
- ⑧ Air is not sufficient to ~~react~~<sup>react</sup> with all the Mg  $\rightarrow$  increase
- ⑨ Air is sufficient to react with all the Mg  $\rightarrow$  no effect
- ⑩ Nonvolatile and unreactive impurities in the crucible during oxidation  $\rightarrow$  decrease
- ⑪ Nonvolatile and unreactive impurities in the crucible

from the beginning  $\rightarrow$  no effect

⑫ If the balance reads 10.02g for any reading  $\rightarrow$  no effect

× بالنسبة ل 10 + 11 باختصار  $\rightarrow$  ⑤ وجود مواد متطايرة قبل التأكسد لا يؤثر وأثناء التأكسد يؤثر.

⑤ وجود مواد متطايرة قبل أو أثناء التأكسد لا يؤثر.

\* لو طلب O:Mg نكتب العلاقات أعلناه

Eq  $\rightarrow$  معادلات

- ① The formation of  $Mg_3N_2$  (side reaction)  $\rightarrow 3Mg + N_2 \rightarrow Mg_3N_2$
- ② The reaction between magnesium Nitride and water  $\rightarrow Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3$
- ③ Heating Mg to ash  $\rightarrow Mg(OH)_2 \xrightarrow{\Delta} MgO + H_2O$

Exp 3 → Limiting Reactant.  
 \* No quiz for the exp.

\* الهدف من هذه التجربة هو معرفة كيفية تحديد ال L.R

⊗ Calculation Part →

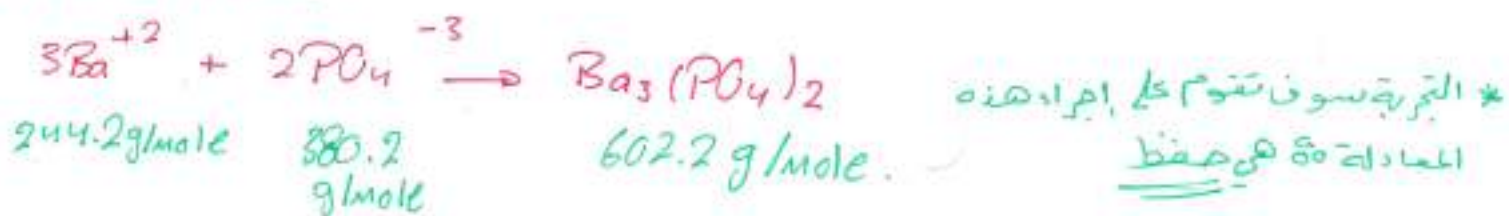
$$\text{Percent yield} = \frac{\text{Actual yield} \xrightarrow{\text{given}}}{\text{Theoretical yield} \xrightarrow{\text{calculated}}} \times 100\%$$

= How to determine the theoretical yield?

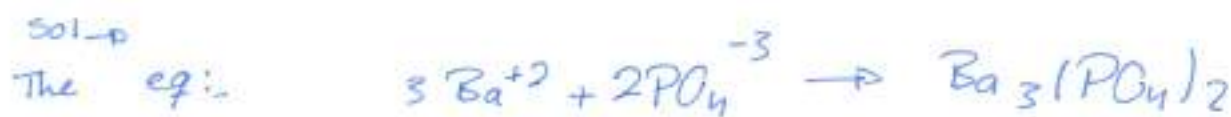
- ① we find the L.R by →
- [1] convert each element to moles
  - [2] Divide each element on it's coefficient
  - [3] The smallest number is the L.R

② we use only the L.R in our normal calculation.

\* Before we start -



Ex) A 25 g sample of  $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$  react with excess  $\text{BaCl}_2 \cdot \text{H}_2\text{O}$ . If the mass of  $\text{Ba}_3(\text{PO}_4)_2$  obtained is 17.56g. Calculate the % yield of  $\text{Ba}_3(\text{PO}_4)_2$ ?



[1] Determine the L.R → given  $\text{Ba}^{+2}$  excess so  $\text{PO}_4^{-3}$  is L.R

[2] Use grams of  $\text{PO}_4^{-3}$  in our normal calculations:

$$\text{Theoretical yield} = 25 \text{ g } \text{PO}_4^{-3} \times \frac{1 \text{ mol } \text{PO}_4^{-3}}{380.2 \text{ g } \text{PO}_4^{-3}} \times \frac{1 \text{ mol } \text{Ba}_3(\text{PO}_4)_2}{2 \text{ mol } \text{PO}_4^{-3}} \times \frac{602.2 \text{ g } \text{Ba}_3(\text{PO}_4)_2}{1 \text{ mol } \text{Ba}_3(\text{PO}_4)_2}$$

Actual yield = 17.56g → % yield =  $\frac{17.56}{19.8} = 88.68\%$

\* from the eq



Ex) A mixture containing 40 g of  $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$  and 30 g of  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  is dissolved in water. A precipitate of  $\text{Ba}_3(\text{PO}_4)_2$  weighing 22.65 g is produced. Calculate the % yield of  $\text{Ba}_3(\text{PO}_4)_2$ .

Sol →

1] Determine the L.R

$$\frac{40 \text{ g } \text{PO}_4^{-3}}{380.2} = 0.105 \text{ mole} \rightarrow \frac{0.105 \text{ mole}}{\text{coefficient } \leftarrow 2} : 0.0525$$

$$\frac{30 \text{ g } \text{Ba}^{+2}}{244.2} = 0.123 \text{ mole} \rightarrow \frac{0.123 \text{ mole}}{3} = 0.041 \rightarrow \text{The Smallest}$$

∴  $\text{Ba}^{+2}$  is L.R

2]

$$0.123 \text{ mol } \text{Ba}^{+2} \times \frac{1 \text{ mol } \text{Ba}_3(\text{PO}_4)_2}{3 \text{ mol } \text{Ba}^{+2}} \times \frac{602.7 \text{ g } \text{Ba}_3(\text{PO}_4)_2}{1 \text{ mol } \text{Ba}_3(\text{PO}_4)_2}$$

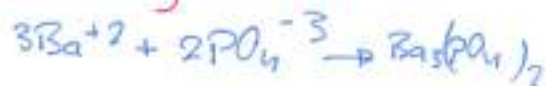
Theoretical

~~Actual~~ yield = 24.69 g

% yield =  $\frac{22.65}{24.69} \times 100\% = 91.7\%$

Ex) 10 g of a unknown mixture containing  $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$  and  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  is dissolved in distilled water. The mass of  $\text{Ba}_3(\text{PO}_4)_2$  precipitated is 3.5 g. calculate the % of each salt present in the mixture. if the  $\text{BaCl}_2$  is the limiting reactant?

1]  $\text{Ba}^{+2}$  is L.R



we have given 3.5 g  $\text{Ba}_3(\text{PO}_4)_2$  ∴

$$3.5 \text{ g } \text{Ba}_3(\text{PO}_4)_2 \times \frac{1 \text{ mol } \text{Ba}_3(\text{PO}_4)_2}{602.7 \text{ g } \text{Ba}_3(\text{PO}_4)_2} \times \frac{3 \text{ mol } \text{Ba}^{+2}}{1 \text{ mole } \text{Ba}_3(\text{PO}_4)_2} \times \frac{244.2 \text{ g } \text{Ba}^{+2}}{1 \text{ mol } \text{Ba}^{+2}}$$

Mass  $\text{Ba}^{+2} = 4.25 \text{ g}$

%  $\text{Ba}^{+2} = \frac{4.25 \text{ g}}{10 \text{ g}} \times 100\% = 42.5\%$

%  $\text{PO}_4^{-3} = (100 - 42.5)\% = 57.5\%$

## \* Procedures Part →

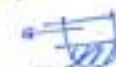
why?

1] Don't boil the solution → To minimize the lost of the mass

2] Using distilled water → To provide the reactions of the ~~unknowns~~ <sup>unknowns</sup>

\* What is the supernatant liquid?

It is the clear liquid above a precipitate.

\* يعني في حبيبتين طينة الحليب  
طينة السائل  
Liq.   
Prec.

## \* Determination of the L.R. →

1] Test for excess  $\text{PO}_4^{3-}$  OR Limiting  $\text{Ba}^{+2}$  →Add 2 drops of 0.5M  $\text{BaCl}_2$  to the solution. If a precipitate is formed then  $\text{PO}_4^{3-}$  is the excess and  $\text{Ba}^{+2}$  is the L.R.If a precipitate is not formed the  $\text{PO}_4^{3-}$  is the ~~excess~~ <sup>L.R</sup> and  $\text{Ba}^{+2}$  is the excess.2] Test for excess  $\text{Ba}^{+2}$  OR Limiting  $\text{PO}_4^{3-}$  →Add 2 drops of 0.5M  $\text{Na}_3\text{PO}_4$  to the solution. If a ppt. is formed then  $\text{Ba}^{+2}$  is the excess and  $\text{PO}_4^{3-}$  is the L.R.If a ppt. is not formed then  $\text{Ba}^{+2}$  is the L.R. and  $\text{PO}_4^{3-}$  is the excess.

## Post Lab Part

= what is the effect of heating the solution on the particle size of  $\text{Ba}_3(\text{PO}_4)_2$  ppt.? It makes a conglutination= what is the effect on the actual yield of the  $\text{Ba}_3(\text{PO}_4)_2$  of:

1] Using a coarse paper → decrease

2] Insufficient washing of the ppt. → increase.

3] Using Acidic to wash the solution → decrease.

4] The ppt. wasn't dried completely → increase.



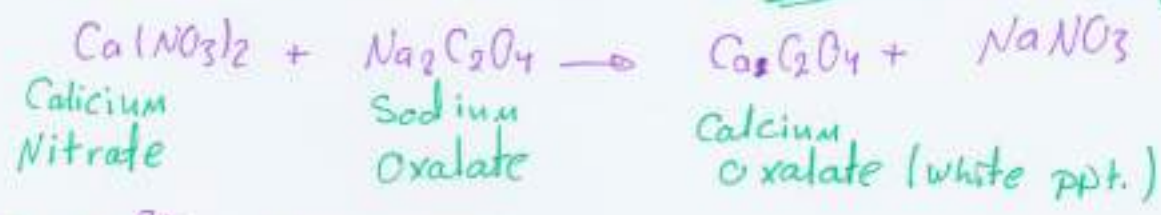
There is no quiz for the exp.

Exp 4 Tests For Cations and Anions

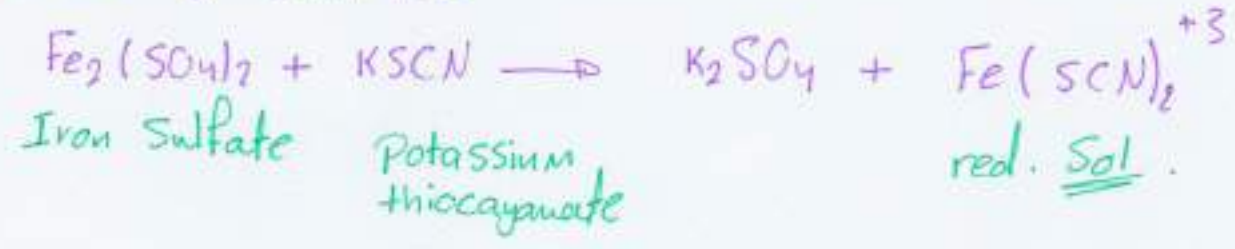
\* المطلوب من هذه التجربة هو فقط المكتوب أدناه.  
\* المعادلات ليست مهمة لكن المطلوب أسماء المركبات وكتيبتها الكسفية والكواستي ولون الناتج والوسط الموضح فيها فقط.

Cations →

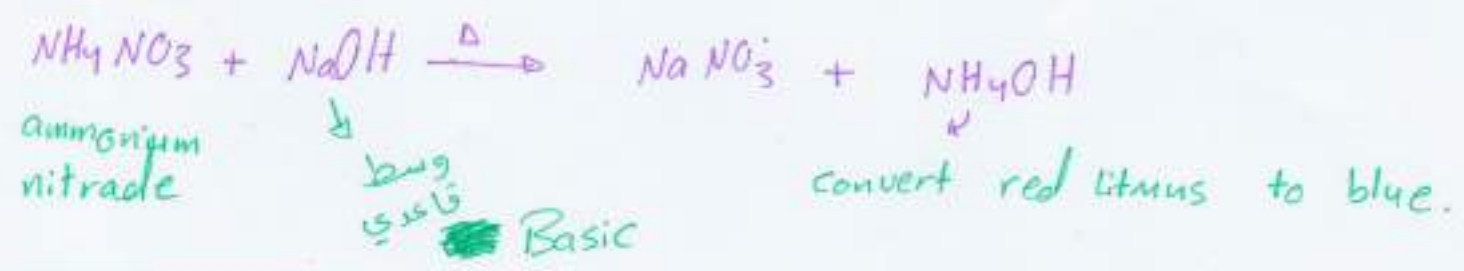
[1]  $Ca^{+2}$ , Calcium test



[2]  $Fe^{3+}$ , Ferric test

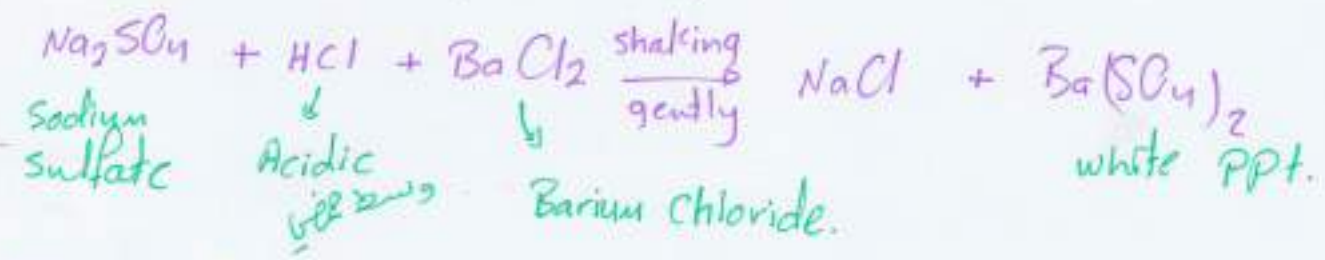


[3]  $NH_4^+$  ammonium test

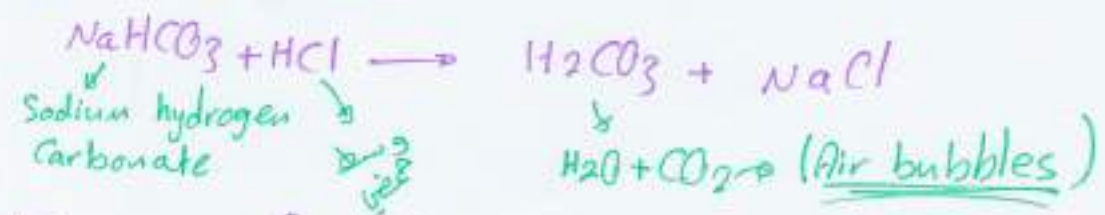


Anions →

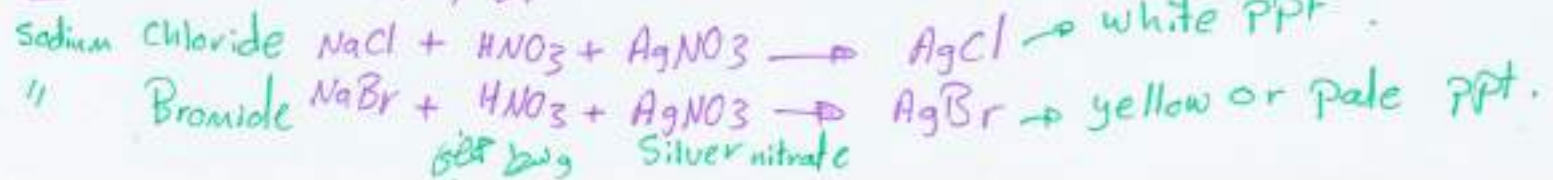
[1]  $SO_4^{-2}$  (sulfate test)



[2]  $HCO_3^-$  - test



[3] Test of  $Cl^-$ ,  $Br^-$



# Exps Identification of A compound:

Page 9

Physical Properties.

There is no quiz for the exp.

\* Prelab →

1] Define

A. Solubility → الذائبة The maximum mass of solute that can be dissolved in a fixed mass of solvent at a given temperature.

B. Boiling Point → 1] The temperature at which the liquid starts to boil

2] The temperature at which bubble form spontaneously and continue to form until the entire volume of the liquid has been converted to a gas.

3] The temperature where the vapor pressure is equal to the atmospheric pressure.

9] A student's liquid unknown boils at approximately  $69^{\circ}\text{C}$ , is insoluble in water but soluble in cyclohexane. Its density is  $0.65 \text{ g/ml}$ , which chemical in table (page 41) is the unknown?

\* هذا السؤال إذا أجبت عليه فاعلم أنك، الاتقارن بين المعطيات والجداول وقتاً،

The unknown is → n-hexane.

3] What physical property, measurable in this experiment, distinguishes cyclohexane from cyclohexene?

Boiling point.

4] Using apparatus described in this experiment, when should the boiling point of a liquid be recorded?

When the bubbles cease to escape and before the liquid re-enters the capillary tube.



\* The exp.

1 Solubility → Solution = Solute + Solvent  
الذائبة                      محلول                      مذاب                      مذيب

\* Likes dissolves in Like

- 1 Polar - Polar → Soluble (miscible)                      يذوب
- 2 nonpolar - nonpolar → Soluble (miscible)                      يذوب
- 3 Polar - Salt → Soluble (miscible)                      يذوب
- 4 nonpolar - Salt → insoluble (immiscible)                      لا يذوب
- 5 Polar - nonpolar → insoluble (immiscible)                      لا يذوب

\* Levels of solubility →

- 1 complete dissolving                      ذوبان كامل
- 2 partial dissolving                      ذوبان جزئي
- 3 insoluble.                      غير ذائب (عديم).

2 Density =  $\frac{\text{mass}}{\text{Volume}}$  ,  $\rho = \frac{m}{V}$                       1 L = 1000 mL

3 Boiling point , B.P

\* it called normal B.P if the vapor pressure =  $P_{atm} = 1$

\* B.P solution > B.P ~~solute~~ <sup>why?</sup> ~~solvent~~ → Because it has stronger intermolecular forces.

\* we are dealing with 3 solvents in this experiment.

- 1 Water (H<sub>2</sub>O) → Polar
- 2 Cyclohexane → C<sub>6</sub>H<sub>12</sub> → non-polar
- 3 Ethanol (C<sub>2</sub>H<sub>5</sub>OH) → Polar.

\* Postlab →

1 How does atmospheric pressure affect the boiling point of a liquid?  
directly →  $\rightarrow$

\* Also →  
How does intermolecular forces affect the boiling point of a liquid?  
directly

2] If several drops of liquid unknown <sup>المتن</sup> cling to the pipette wall after delivery will the density of the unknown be reported too high or too low?

too low because mass will decrease then due to the relation  $\rho = \frac{m}{V}$ , the density will decrease.

3] A. If the Boiling pt. is recorded when bubbles are rapidly escaping the capillary tube, will it be recorded too high or too low? Explain.

\* إذا قرأنا بعد ماطلع الماء من الأنبوب ← القراءة < الأصلية

temp > true B.P, because  $v.p > P_{atm}$

B. If the Boiling pt. is recorded after the liquids enters the capillary tube (after the heat is removed), will it be recorded too high or too low? Explain.

\* إذا قرأنا بعد ما دخل الماء إلى الأنبوب ← القراءة > الأصلية.

temp < true B.P, because  $v.p < P_{atm}$ .

C. If the Boiling pt. is recorded when the liquids cease to escape and before the liquids re-enters the capillary tube?

\* إذا قرأنا أثناء المروج وقبل الدخول إلى الأنبوب ← القراءة = الأصلية.

temp = true B.P, because  $v.p = P_{atm}$ .

\* إذا أجا أي سوال بيكليت في المواد الاتية تصحح للتجربة إختار، التي درجة غليانها أقل من 100 (أقل من درجة غليان الماء).

\* إذا أجا أي سوال بيكليت في المواد الاتية لا تصحح للتجربة إختار، التي درجة غليانها أكبر من 100 (أكبر من درجة غليان الماء).

# Can you predict when the  $v.p = P_{atm}$ , theoretically? No



Exp 1

Q<sub>1</sub>) The correct statement concerning handling of chemicals in lab is:-

1. Direct contact with chemicals is allowed.
2. No need to read the label on the reagent bottles.
3. Smelling and tasting chemicals are not allowed.
4. Toxic chemicals can be used outside the fume hood.
5. All of the above.

Ans: 3

Q<sub>2</sub>) Which of the following is not a safety tool?

1. First aid Equipment.
2. Fire extinguisher
3. Graduated cylinder
4. Fume hood
5. Fire blanket.

Ans: 3

Q<sub>3</sub>) Which of the following is not a safety equipment?

1. Beaker
2. Goggle
3. First aid equipments
4. Fire blanket

Ans: 1

Q<sub>4</sub>) Write down T or F:-

T - Do not point your test tube at your face when heating anything to watch what happening exactly.

F - Open sandals, short skirts and shorts are allowed in the lab.

Q5) When a metal (M) with atomic mass 56 g/mol was oxidized to a metal oxide that contains 36.4% by mass O (Atomic weight O = 16 g/mol), the empirical formula of the metal oxide is: -

1.  $MO_2$                       2.  $MO_3$                       3.  $M_2O_3$   
 4.  $M_3O_4$                       5.  $M_2O_5$

Sol → 36.4 % O → 36.4 g O

%M = (100 - 36.4)% = 63.6% → 63.3 g M

تحويل النسب

$$\begin{array}{r} M: \\ 63.3 \text{ g} \\ \hline 56 \end{array}$$

$$\begin{array}{r} O \\ 36.4 \text{ g} \\ \hline 16 \end{array}$$

$$\frac{1.13 \text{ mol}}{1.13} : \frac{2.275 \text{ mol}}{1.13}$$

تحويل النسب

النسبة إلى الصغرى

$$1 : 2$$



Ans: 1

Q6) In the empirical formula experiment which statement below is incorrect: -

- (Mg to O) mole ratio will not affect, if the balance is always read 0.05 g higher than the actual value.
- The side product that formed is  $Mg_3N_2$ .
- If the magnesium oxide is not dried completely the reported value of (Mg to O) mole ratio will decrease.
- (Mg to O) mole ratio will increase if air is not sufficient to react with all the magnesium.
- (Mg to O) mole ratio will decrease if a rapid oxidation is occur and some of the magnesium is lost.

Ans: 5



Q7) A compound of iridium, Ir (M.wt = 192.2 g/mol), and oxygen, O (M.wt = 16 g/mol), was produced in a lab by heating iridium in a crucible, the data was collected:

Mass of crucible 38.26 g

Mass of crucible and iridium 39.63 g

Mass of crucible and iridium oxide 39.74 g

What is the empirical formula of this compound?

1.  $\text{IrO}_2$                       2.  $\text{IrO}$                       3.  $\text{Ir}_2\text{O}_3$                       4.  $\text{Ir}_3\text{O}_4$

Sol →

$$\text{Mass Ir} = 39.63 \text{ g} - 38.26 \text{ g} = 1.37 \text{ g}$$

$$\text{Mass iridium oxide} = 39.74 \text{ g} - 38.26 = 1.48 \text{ g}$$

$$\text{Mass O} = 1.48 - 1.37 = 0.11 \text{ g}$$

$$\begin{array}{l} \text{Ir} \\ \frac{1.37 \text{ g}}{192.2} \\ 7.12 \times 10^{-3} \\ \frac{7.12 \times 10^{-3}}{6.87 \times 10^{-3}} \end{array} : \begin{array}{l} \text{O} \\ \frac{0.11 \text{ g}}{16} \\ 6.87 \times 10^{-3} \\ \frac{6.87 \times 10^{-3}}{6.87 \times 10^{-3}} \end{array}$$

Ans: 2



Q8) A 0.1000 g sample containing C (FM=12), H (FM=1) and O (FM=16) only, and produced 0.1910 g of  $\text{CO}_2$  and 0.1172 g of  $\text{H}_2\text{O}$ , what is the empirical formula of the compound?

1.  $\text{C}_3\text{H}_8\text{O}$
2.  $\text{C}_5\text{H}_{12}\text{O}$
3.  $\text{C}_4\text{H}_{10}\text{O}$
4.  $\text{C}_2\text{H}_6\text{O}$
5.  $\text{C}_2\text{H}_4\text{O}$

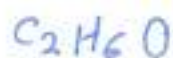
Sol →  
 mass  
 mass C →  $0.1910 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{44 \text{ g CO}_2} \times \frac{1 \text{ mol C}}{1 \text{ mol CO}_2} \times \frac{12 \text{ g C}}{1 \text{ mol C}}$   
 $= 4.34 \times 10^{-3} \text{ mol C} = 0.052 \text{ g C}$

Mass H →  $0.1172 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18 \text{ g H}_2\text{O}} \times \frac{2 \text{ mol H}}{1 \text{ mol H}_2\text{O}} \times \frac{1 \text{ g H}}{1 \text{ mol H}}$   
 $= 0.013 \text{ mol H} = 0.013 \text{ g H}$

Mass O →  $0.100 - (0.052 + 0.013) = 0.035 \text{ g O} = 2.1875 \times 10^{-3} \text{ mol O}$

C	H	O
$\frac{4.34 \times 10^{-3}}{2.1875 \times 10^{-3}}$	$\frac{0.013}{2.1875 \times 10^{-3}}$	$\frac{2.1875 \times 10^{-3}}{2.1875 \times 10^{-3}}$

2 : 6 : 1



Ans: 4

For expt

Q9) Which of the following statement is not correct?

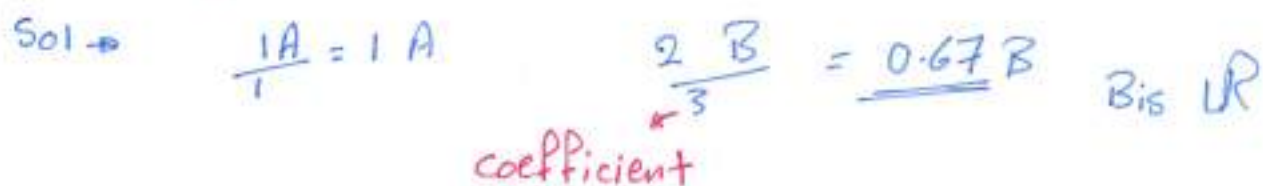
1. Open sandals, short skirts and shorts are not allowed in the lab.
2. When dealing with flammable material, don't heat with direct flame.
3. You should return excess chemicals to their reagent bottles
4. Never taste or smell chemicals or solutions in the lab.
5. Laboratory work can't be started as soon as you enter the lab, unless the teacher is present.

Ans: 3



Q10) Given the equation  $A + 3B \rightarrow C + D$  by reacting 1 mole of A with 2 moles of B, which of the following is true?

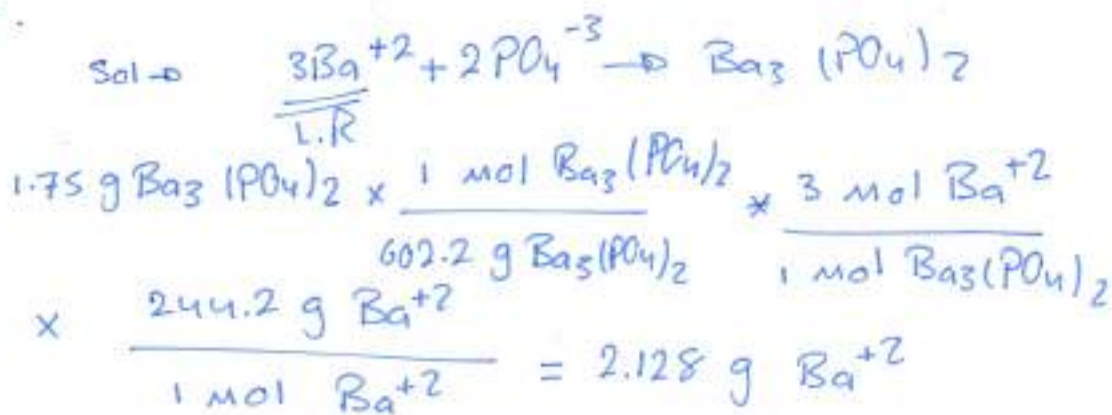
1. A is limiting reactant because of its higher molar mass.
2. B is limiting reactant because of its higher molar mass.
3. A is limiting reactant because you have fewer moles of A than B.
4. B is limiting reactant because you have fewer moles of A than B.
5. B is limiting reactant because you need 3 moles of B and you have 2.



Ans: 5

Q11) If 3.28 g unknown mixture containing  $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$  (M.Wt = 380.2 g/mol) and  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  (M.Wt = 244.2 g/mol) is dissolved in distilled water, the mass of  $\text{Ba}_3(\text{PO}_4)_2$  (M.Wt = 602.2 g/mol) precipitate is 1.75 g. Calculate the % of  $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$  in the mixture if the  $\text{BaCl}_2$  is the limiting reactant.

1. 44.19%
2. 35.09%
3. 65.58%
4. 57.42%
5. 75.00%



$$\text{Mass PO}_4^{-3} = 3.28 - 2.128 = 1.15 \text{ g}$$

$$\% \text{ Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O} = \frac{1.15}{3.28} \times 100 \% = 35.09\%$$

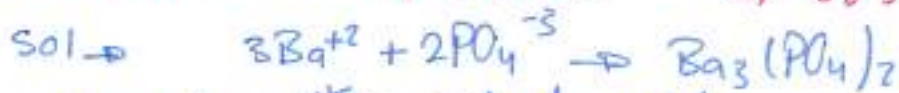
Ans: 2

Q12) A mixture containing equal masses (x)

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of  $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$  (M.Wt = 380.2 g/mole) and  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  (M.Wt = 244.2 g/mole) is dissolved in water, A ppt. of  $\text{Ba}_3(\text{PO}_4)_2$  (M.Wt) = 602.2 g/mole was produced with a mass 0.2x of the starting materials. Then the Percentage yield of  $\text{Ba}_3(\text{PO}_4)_2$  is:-

- 1) 37.9%      2) 63.1%      3) 88.3%      4) 25.3%



$$\% \text{ yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100\%$$

$$\text{mass Ba}^{+2} = \text{mass PO}_4^{-3} = x \text{ g}$$

Find the L.R

$$\text{Ba}^{+2} \rightarrow \frac{x \text{ g}}{244.2 \text{ g/mole}} = \frac{x}{244.2} \text{ mole} / 3 = \frac{x}{732.6}$$

coefficient

$$\text{PO}_4^{-3} \rightarrow \frac{x \text{ g}}{380.2 \text{ g/mole}} = \frac{x}{380.2} \text{ mole} / 2 = \frac{x}{760.4} \text{ // smaller than}$$

$\text{PO}_4^{-3}$  is L.R

$$\frac{x}{380.2} \text{ mole PO}_4^{-3} \times \frac{1 \text{ mole Ba}_3(\text{PO}_4)_2}{2 \text{ mole PO}_4^{-3}} \times \frac{602.2 \text{ g Ba}_3(\text{PO}_4)_2}{1 \text{ mol Ba}_3(\text{PO}_4)_2}$$

$$= 0.791 x \text{ g} \equiv \text{Theoretical yield}$$

Actual yield = 0.2x g

$$\% \text{ yield} = \frac{0.2x}{0.791x} \times 100\% = 25.3\%$$

Ans: 4

Q13) In the limiting reactant of salt mixture exp. to test for Limiting  $\text{Ba}^{+2}$  ion:-

Ans: 1

1. Add few drops of Barium ion (0.5M) to the supernatant and ppt. will appear.
2. Heat the mixture solution in the water bath for 30 minutes.
3. Add few drops of phosphate ion (0.5M) to the supernatant and ppt. will appear.
4. Add few drops of Barium ion (0.5M) to the supernatant and ppt. will not appear.
5. none of the above.



The Sulfate ion can be detected by:-

1. Adding  $BaCl_2$  solution in acidic media and a white ppt. will appear.
2. Adding  $BaCl_2$  solution in basic media and a white ppt. will appear.
3. Adding  $HCl$  solution, a gas will change the wet red litmus to blue.
4. Adding  $NaOH$  solution, a gas will change the wet blue litmus to red.
5. Adding  $NaOH$  solution, ammonia smell can be detected.

Ans: 1

Q15) The  $Cl^-$  can be detected by:-

1. Sodium oxalate
2. potassium thiocyanate
3. Silver nitrate + acid
4. Barium chloride + acid
5. Hydrochloric acid.

Ans: 3

Q16) When an unknown react with sodium hydroxide solution, it evolved a gas which convert the wet red litmus paper to blue. The resulted aqueous layer from the previous reaction was ~~the~~ treated with hydrochloric acid solution and carbon dioxide evolved immediately as a result of reaction, The unknown is:-

1.  $CaCl_2$
2.  $Ca(HCO_3)_2$
3.  $NH_4Cl$
4.  $NH_4HCO_3$

Ans: 4

Q17) An unknown salt give a gas that convert the litmus paper from red to blue when detected with sodium hydroxide and a pale yellow precipitate when reacted with silver nitrate in acidic media. The formula of the salt is:-

1.  $CaBr_2$
2.  $Fe_2(SO_4)_3$
3.  $NH_4HCO_3$
4.  $FeBr_3$
5.  $NH_4Br$

Ans: 5

Q18) The iron (III) ion can be detected by:-

Ans: 2

1. Adding  $BaCl_2$  solution, in acidic media and a white ppt. will appear.
2. Adding  $KSCN$  solution, and a red color will appear.
3. Adding  $HCl$  solution, a gas will change the wet red litmus paper to blue.
4. Adding  $NaOH$  solution, a gas will change the wet blue litmus paper to red.
5. Adding  $KSCN$  solution, and a white color will appear.



Q19) which of the following pair of liquids are miscible?

1. Polar + Salt
2. non-polar + non-polar
3. a and b will be miscible
4. Non-polar + Polar
5. Non-polar + Salt.

Ans: 3

Q20) which of the following statement is correct?

1. The boiling point is the temperature at which the vapor pressure of the liquid is higher than the atmospheric pressure
2. If the boiling point is recorded while the bubble escaping from the capillary tube (and the heat is removed), the recorded boiling point will be too low
3. The boiling point of the substance increase as the intermolecular forces between molecules decrease.
4. If the boiling point is recorded after the liquid enters the capillary tube (after the heat is removed), the recorded boiling point will be too high.
5. As the temperature increases the vapor pressure of the liquid increases.

\* Relations →

Ans: 5

- ① Intermolecular forces ↑      vapor pressure ↓
- ② Temperature ↑      vapor pressure ↑
- ③ Boiling point ↑      vapor pressure ↓

And so on ...

Q21) If you need 10 ml pipette to weight 10 ml of three unknowns liquid substances A, B and C. you find that the weight of the 10 ml of each substance is the following  
 $A = 9.2 \text{ g}$  ,  $B = 9.0 \text{ g}$  ,  $C = 8.9 \text{ g}$ . The order of density decreasing of these liquids is:-

1.  $C > A > B$
2.  $B > C > A$
3.  $A > B > C$
4.  $A > C > B$

Ans: 3



Q22) A student's liquid unknown boils at approximately 79°C, is insoluble in water but soluble in cyclohexane and ethanol. The mass of 2ml of the unknown = 1.75 g, From the table below the unknown is:

Compound	Density g/ml	Boiling Point (°C)	Solubility		
			S: Soluble, i: insoluble		
			H <sub>2</sub> O	C <sub>6</sub> H <sub>12</sub>	C <sub>2</sub> H <sub>5</sub> OH
X	0.79	68	S	S	i
Y	0.90	60	S	S	S
Z	0.59	78	i	S	S
R	0.89	80	i	S	S
Q	0.89	79	i	S	i
P	0.79	59	S	S	S

1. X                      2. Z                      3. Q                      4. R

~~Density~~ Density =  $\frac{m}{V} = \frac{1.75}{2} = 0.88 \text{ g/ml}$

Ans: 4

exp 4

Q23) The following results were obtained for an unknown containing a cation and an anion.

			(with litmus paper test)
Cation test	Sodium oxalate -ve	Potassium thiocyanate +ve	Sodium hydroxide -ve
Anion test	Barium chloride (in acidic medium) +ve	Silver nitrate (in acidic medium) -ve	Hydrochloric acid (immediate reaction) -ve

1. FeCl<sub>3</sub>                      2. (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>                      3. Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>                      4. NH<sub>4</sub>Cl

Ans: 3