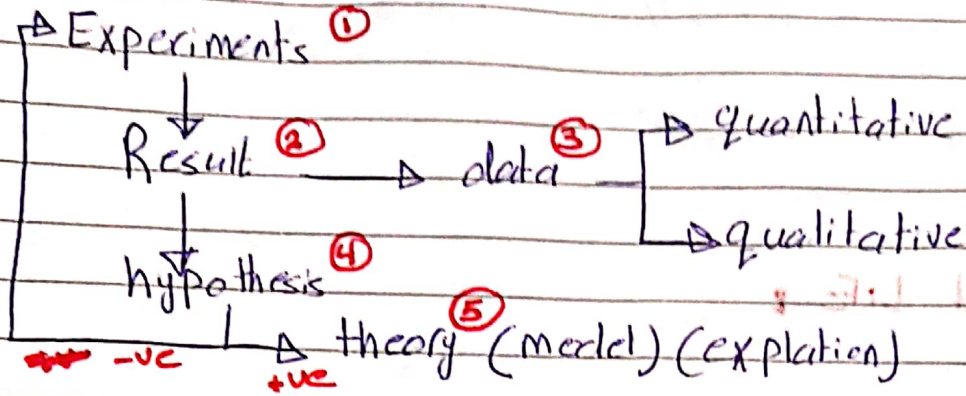


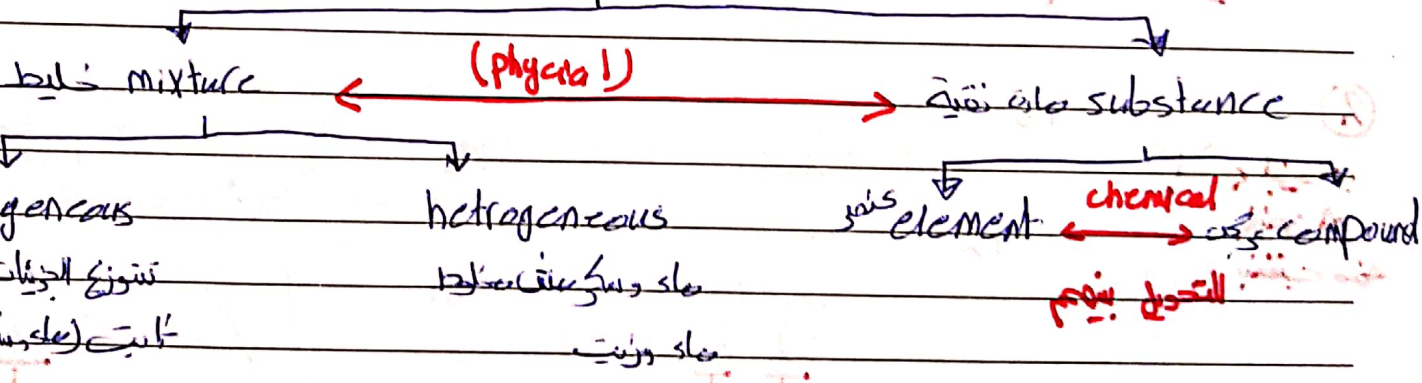
* Scientific method: (1.2), LOL, chapter 1



من التجربة
 * بينا قوة بين law و theory
 law ← Fact (حقيقه ثابتة متعلم تتغير) مثال: شروق الشمس من الشرق وتغربا
 theory ← هي نفس لاي احاطت اليه (law) ويمكن تتغير حسب درجات فوق العطاء
 مثال: الشمس ثابتة بين الارض بتغير دوله الشمس، الشمس بتتوكل وللارض بتتوكل ويؤثر بتغير دوله الشمس

1.3 g

Matter (الامور)



* كيف ما ايقينا compound او mixture
 انه compound انما الجايز الى فيه يكون دائما ثابتة و بوجه الك (H₂O) فيه دائما
 (1 او 2) اما في mixture ممكن تتغير مثلا (1:1) او (3:1) و هو

1.02

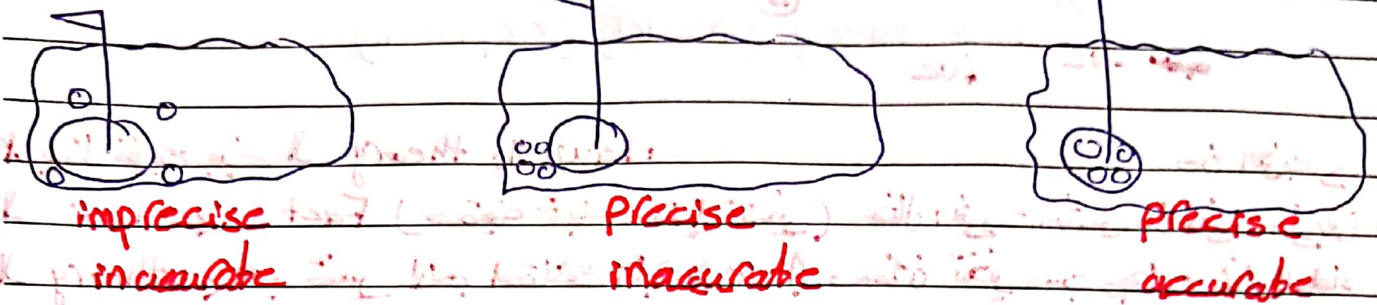
* 1.5 : measurements and significant figures

(No + Unit) *القياسات*

* precision : *الدقة*

* accuracy : *الدقة*

- In Real Life :



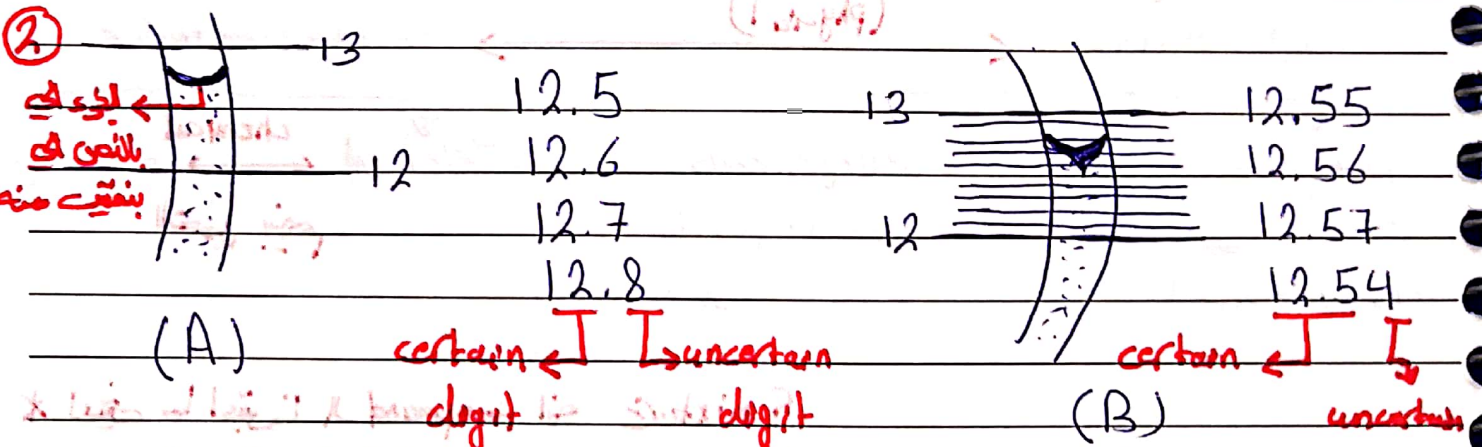
- In Data :

* True value = 1.800

① St. A : 1.786 , 1.770 \Rightarrow avg = 1.778

St. B : 1.800 , 1.802 \Rightarrow avg = 1.801

\rightarrow more precise + more accurate than (St. A).



← مكان الرقم *الرقم* ← المكان الذي *الرقم*
 (الرقم) *الرقم*

more precise \leftarrow (كل ما كان فيه ارقام اكثر "اكثر ارقام")

* certain + uncertain \Rightarrow significant figures *الارقام الهامة*

* نكتب صلا ان unct. (no + unct.) ← نعامل مع الأرقام (no):

* Counting sig. Fig. uncertain و certain
 1. All digits are significant except zero.

1351

(4)

532.167

(6)

(-) ما بين صلا انه certain الا ان

digit يكون 1, 2, 3, ...

موجودة او لا بتفويت صلا

2. Zero's.

a) Leading (من اليسار), To the left of non-zero digit

0123

(3)

ما الى اليمين و ما قبله => not sig

00.0251

(3)

ما بين صلا و ما بعد صلا

b) In between => sig

101

(3)

303101

(6)

0.0301

(3)

c) To the right of non-zero digit

1. IF there is decimal point => sig

0.030100 (5)

2. No decimal point => ? (Not)!

501000

(3)

ما الى اليمين موجودة صلا و ما قبله

ما الى اليمين

* اللى المكتوب ما الى اليمين اكتب الامتار شكل 10^n

5.01×10^5

5.010×10^5

5.0100×10^5

* نفس الصلا لكن اللى

انك لا اللى uncertain

انك (اللى خايف)

* L03: Calculations

1) \times, \div

Least number of sig. Fig. 4

$100.0 + 0.0634 = 25.31$

$= 0.250493875 \Rightarrow 0.250$

* Round off < 5 omit, > 5 add 1.

2) $+, -$

Least number of decimal places

لا يترك sig. Fig. ← بقدر أقل منزلة
(بما أن digits به الأرقام العشرية)

$184.2 + 2.324 = 186.524 \Rightarrow 186.5$

3) Exact no's (constant)

→ definition (كل، عدد صحيح)

→ count (العدد الكلي)

Contain ∞ number of sig. Fig.

$\Rightarrow 3.0 \text{ g} \times 9 \text{ coins} = 27 \text{ g}$

↳ measured value → exact value (∞)

$\Rightarrow 3.000 \text{ g} \times 12 \text{ coins} = 36.000 \text{ g}$

رجاءاً وضبطوا الكلي

* ex (1.62) p 30'd

a) $8.7 \times 0.57 = 0.8456 \Rightarrow 0.85$

8.871

b) $8.937 - 8.930 = 0.007$

0.00819

d) $(0.00615 \times 54.6) + 1.002 = 1.0101 \Rightarrow 1.010$

ال sig. Fig. ← ال rounding بتبني به

(At the Final step.)

(1.6)

* SI-Units

Table 1.1 - P.19

m
Sec
Kg
K
mol

length
time
mass, weight (N)

(الوحدات الرئيسية)

A

cd

Table 1.2 - P.19

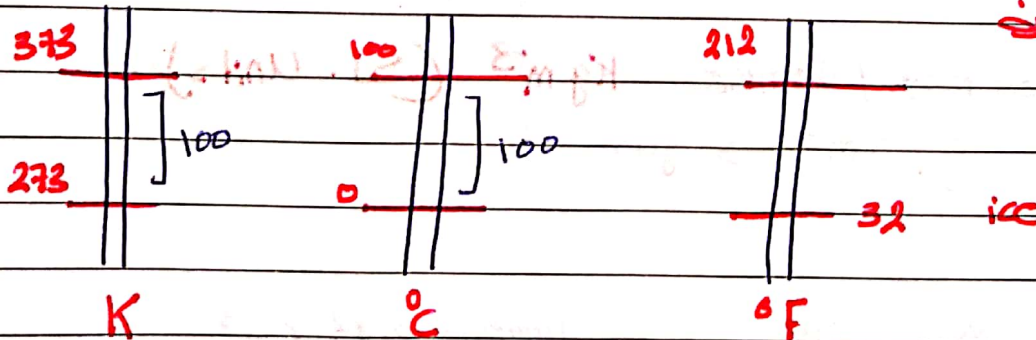
(preFixes)

10^6	M
10^3	K
10^{-1}	d
10^{-2}	c
10^{-3}	m
10^{-6}	μ
10^{-9}	n
10^{-12}	p

ex: 1.66 - P.30 e:

a) $5.89 \times 10^{-12} \text{ s} \Rightarrow 5.89 \text{ ps}$

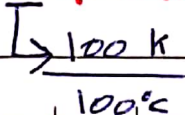
* Temperature:



التجربة انه عند صفر كلفين في نفس الوقت عند اكن condition

$T(K) = 0^\circ C + 273 K \Rightarrow 273$

$T(K) = 100^\circ C + 273 K \Rightarrow 373$



$$\frac{180^{\circ}\text{F}}{100^{\circ}\text{C}}$$

$$* T(^{\circ}\text{F}) = T(^{\circ}\text{C}) \times \frac{9^{\circ}\text{F}}{5^{\circ}\text{C}} + 32^{\circ}\text{F}$$

$$* T(\text{K}) = T(^{\circ}\text{C}) + 273.15\text{K}$$

* ex 1.70 - p 30 c :

a) $51^{\circ}\text{F} \rightarrow ^{\circ}\text{C} ?$

$$\Rightarrow 51^{\circ}\text{F} = T \times \frac{9^{\circ}\text{F}}{5^{\circ}\text{C}} + 32^{\circ}\text{F} \Rightarrow T = 10.566 \Rightarrow 11^{\circ}\text{C}$$

(exact)

b) $-11^{\circ}\text{F} \rightarrow ^{\circ}\text{C} ? \Rightarrow -24^{\circ}\text{C}$

كل ما انخفضت الحرارة الاربعة بين
 $^{\circ}\text{C}$ و $^{\circ}\text{F}$ ربع تقريبا من اربعين

c) $-41^{\circ}\text{C} \rightarrow ^{\circ}\text{F} ?$

$$\Rightarrow -41^{\circ}\text{C} \times \frac{9}{5} + 32 \Rightarrow -42^{\circ}\text{F}$$

* 1.7 derived units

(المشتق من وحدات الـ SI)

area = length \times length m^2

volume = (length)³ $\text{m}^3 \Rightarrow$ (derived SI-units)

* $1 \text{ dm}^3 \equiv 1 \text{ Liter (L)}$ بالترتيب

$$(1 \text{ m} = 10 \text{ dm})^3 \Rightarrow 1 \text{ m}^3 = 10^3 \text{ dm}^3$$

$$\Rightarrow 1 \text{ m}^3 = 10^3 \text{ L} \Rightarrow 10^{-3} \text{ m}^3 = 1 \text{ L}$$

$$1 \text{ cm}^3 = 1 \text{ mL}$$

$$1 \text{ m}^3 = 10^6 \text{ cm}^3 = 10^6 \text{ mL}$$

* Density (d) = mass / volume Kg m^{-3} (SI-units)

$\text{g/cm}^3 \rightarrow \text{S}$
 $\text{g/dm}^3 \rightarrow \text{gas}$

* 1.76 - p 30 c

$$m = 5.44 \text{ g}, \text{ volume} = 0.73 \text{ cm}^3$$

$$d = 5.44 / 0.73 \Rightarrow 8.1 \text{ g/cm}^3$$

* L04

ex 1.78 (p.30.e) $\rightarrow m = ?$, $v = 43.8 \text{ ml}$, $d = 0.70 \text{ g/ml}$
 $d = \frac{m}{v} \Rightarrow m = dv \Rightarrow 0.70 \times 43.8 = 30.66 \text{ g}$
 $= 31 \text{ g}$

ex 1.80 (p.30.e) $\rightarrow v = ?$, $d = 3.10 \text{ g/ml}$, $m = 88.5 \text{ g}$
 $= 28.5 \text{ ml}$

$\rho = \text{Unit}$

* 1.8 Dimensional analysis

given Unit * $\left[\frac{\text{desired Unit}}{\text{given Unit}} \right] = \text{desired Unit}$

\rightarrow conversion factor

ex 1.82 (p.30.e) $\rightarrow 61 \text{ mg} \rightarrow ? \text{ Mg}$

$61 \text{ mg} \times \frac{10^{-3} \text{ g}}{1 \text{ mg}} \times \frac{1 \text{ Mg}}{10^6 \text{ g}} = 61 \times 10^{-3} \text{ Mg}$

$1 \text{ mg} = 10^{-3} \text{ g}$
 $1 \text{ Mg} = 10^6 \text{ g}$

$\frac{10^{-3} \text{ g}}{1 \text{ mg}} = 1$

* ex 1.18, 1.10 (p.28)

* ex 1.88 (p.30.e) \rightarrow

$3.15 \text{ Btu} \rightarrow ? \text{ J}$, $1 \text{ Btu} \rightarrow 252.0 \text{ cal}$
 $1 \text{ cal} \rightarrow 4.184 \text{ J}$

$3.15 \text{ Btu} \times \frac{252.0 \text{ cal}}{1 \text{ Btu}} \times \frac{4.184 \text{ J}}{1 \text{ cal}} \Rightarrow 3321 \text{ J}$

$= 3.32 \times 10^3$

* ex (1.90. p30e)

$$1.30 \times 10^{10} \text{ barrels} \rightarrow ? \text{ m}^3$$
$$= 2.1 \times 10^9 \text{ m}^3$$

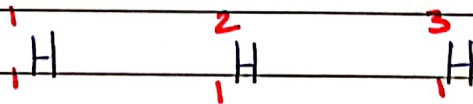
* note 8 m/s \rightarrow km/h

* Chapter 2 (😊) :

* 2.3 - Atomic no (Z) \rightarrow no of protons in the nucleus.
- Mass no (A) \rightarrow no of protons and neutrons.
عدد البروتونات \rightarrow عدد النيوترونات

- Nuclide \rightarrow $\begin{matrix} A \\ Z \end{matrix} X$ (atom)

- Isotopes \rightarrow same Z, diff A



* ex 8 $^{23}_{11}\text{N}$

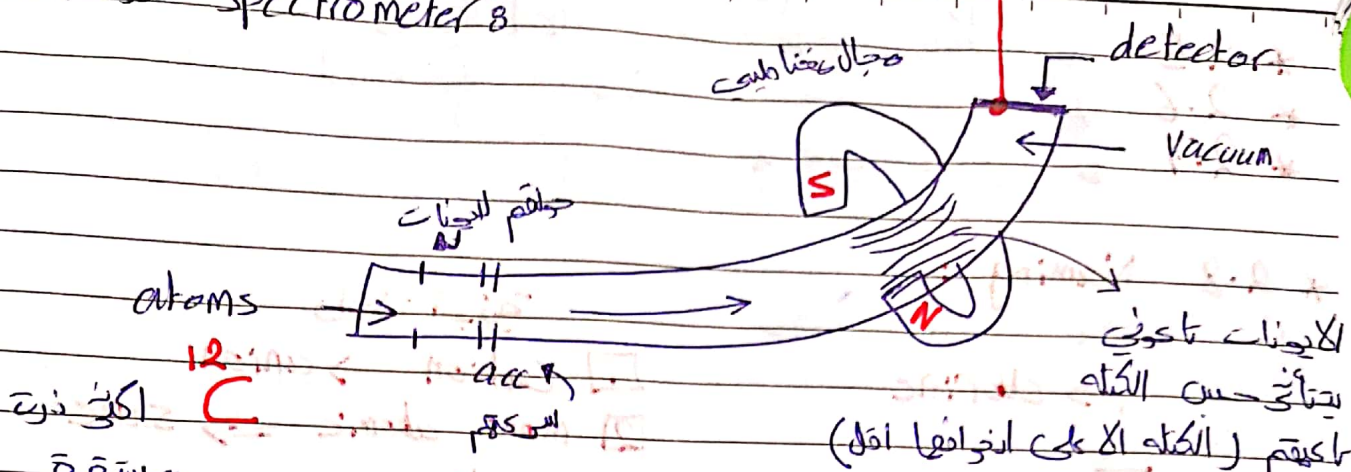
no of neutrons = 12

no of protons = 11

* 2.4 Atomic weight (mass ~~and~~ atoms)

\equiv average relative atomic mass.

* Mass spectrometer



وصيراك اوجدنا باقي الكتلة من خلال ال ^{12}C (بالنسبة اليه) يعني لو جينا بكار ^{13}C ورج تحبنا بمكان معين ونحسب المسافة وكل انقي بالقياس لل ^{12}C
 $^{13}C = 13.005$



لو كانت وحيدة مثلا كنا نظار واحد فقط

* هذا كيف اوقف النسب؟

بجيب النسب من الامارات اى بيمزب سلبه

* ex 8 2.54 (p. 64d)

amu	Frac. ab
27.977	0.9221
28.976	0.0470
29.974	0.0309

مجموع ال Frac

atomic weight = ? amu $\Rightarrow 28.086 / 1$
 $= 28.09$ amu
 (atomic mass unit)

* 2.5 → metals, non-metals, metalloids

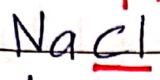
* 2.6 →

* 2.7 → organic com X

* 2.8 Naming:

□ Ionic compounds

→ chlorine



Sodium chloride

1st → 2nd

same → root + ide

القاعدة الأيونية

□ Cation → anion

□ mono atomic ⇒ same cation

□ mono atomic → root + ide anion

* L05.

+2 <u>Mn</u> O ⁻²	Manganese (II) oxide
+3 <u>Mn</u> ₂ O ₃ ⁻²	" (III) "
+4 <u>Mn</u> O ₂ ⁻²	" (IV) "

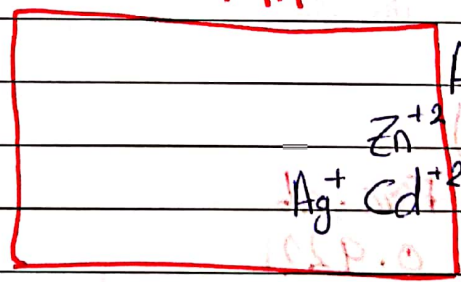
"cation"

□ 2 more than one charge → use stock system

→ Stock system

G ₁	G ₂
Li	Mg
Na	Ca
K	Sr
Rb	Ba
Cs	(+2)

T.M

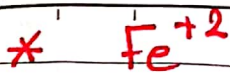


Stock system → position ← position still as system.

NiCl₂ → Nickel (II) chloride

ZnCl₂ → Zinc (II) chloride

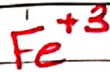
العدد ← ٢



Iron (II)

Ferrous

↳ السخايل



Iron (III)

Ferric

↳ احمر

بعض انا بنعتنا على السخايل ←



Copper (II)

Cupric

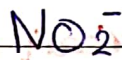


Copper (I)

Cuprous

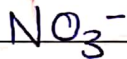
←

* Poly atomic Ions: Table 2.6 / P.58



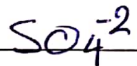
~~nitrite~~

nitrite



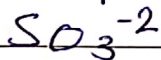
nitrate

← احمر

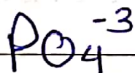


sulfate

←

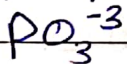


sulfite

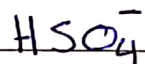


phosphate

←



phosphite

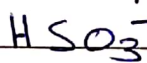


hydrogen

sulfate

OR

bisulfate

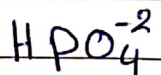


hydrogen

sulfite

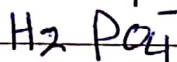
OR

bisulfite



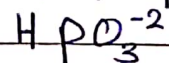
mono hydrogen

phosphate



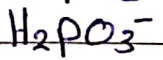
di "

"



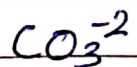
mono "

phosphite

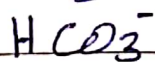


di "

"



carbonate



bicarbonate

OR

hydrogen carbonate

OH^- hydroxide

O_2^{2-} peroxide

CN^- cyanide

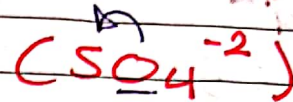
$\text{S}_2\text{O}_3^{2-}$ thio sulfate

CrO_4^{2-} chromate

$\text{Cr}_2\text{O}_7^{2-}$ dichromate

MnO_4^- permanganate

"بنيو الوبو ووبو س2"



الاسم في الوبو

NH_4^+ ammonium

Hg_2^{+2} mercury (I)

* ex: 2.78 - P. 69 F

1 CaO calcium oxide

2 $\text{NH}_4\text{HCO}_3 \equiv \text{NH}_5\text{CO}_3$ ammonium bicarbonate

3 $\text{Cu}(\text{NO}_3)_2$ copper (II) nitrate

* ex: 2.80 - P. 69 F.

1 sodium thio sulfate $\text{Na}_2\text{S}_2\text{O}_3$

2 chromium (III) phosphide CrP

3 mercury (I) nitride $(\text{Hg}_2)_3\text{N}_2$

2 Binary molecular compounds

رابطات ثنائية

CO carbon monoxide

1 1st → 2nd

CO₂ carbon dioxide

2 1st → same

3 2nd → root + ide

NO nitrogen monoxide

4 add prefixes

NO₂ nitrogen dioxide

(Table 2.7 / p.58)

N₂O dinitrogen monoxide

5 if mono at begin

N₂O₃ dinitrogen trioxide

→ omit.

N₂O₅ dinitrogen pentoxide

* Common names

H₂O water

NH₃ ammonia

* EXB 2.84 / P. 69-F

1 N₂F₄ dinitrogen tetrafluoride

2 As₄O₆ tetraarsenic hexoxide

3 Acids and Bases

H⁺ ← OH⁻ → (Cation) OH⁻

القواعد
التي تتكون

Fe(OH)₃
Iron(III) hydroxide

Oxoacids

Binary

H_nXO_m

HX

HNO₃

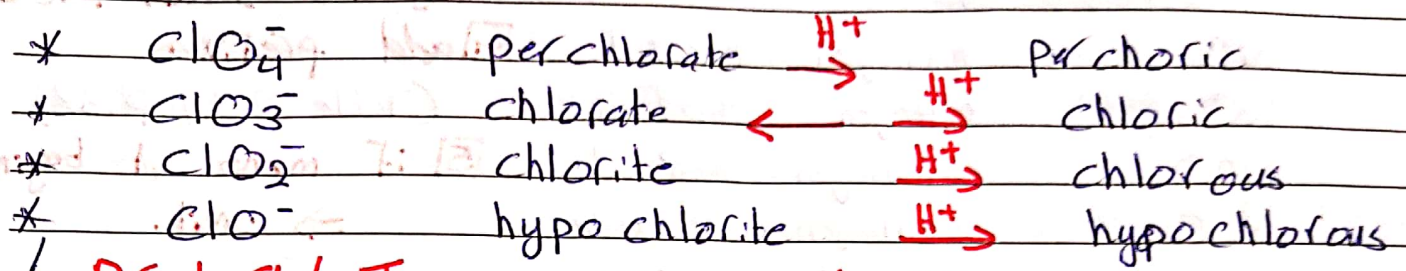
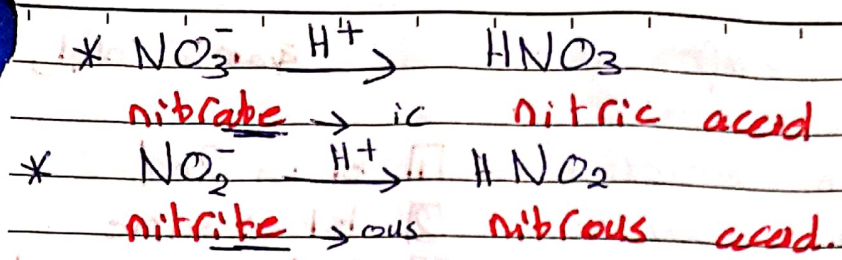
HCl

H₂SO₄

HF

HBr

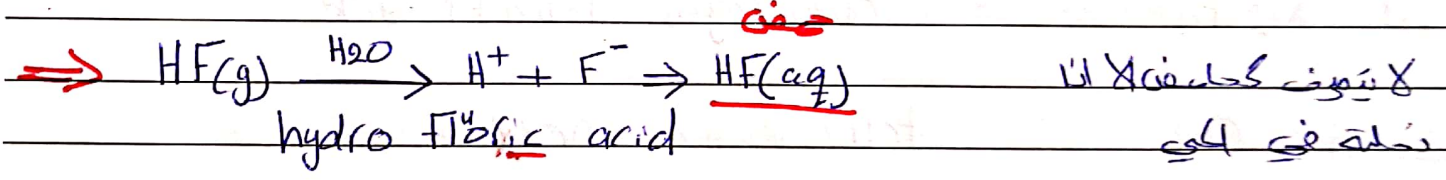
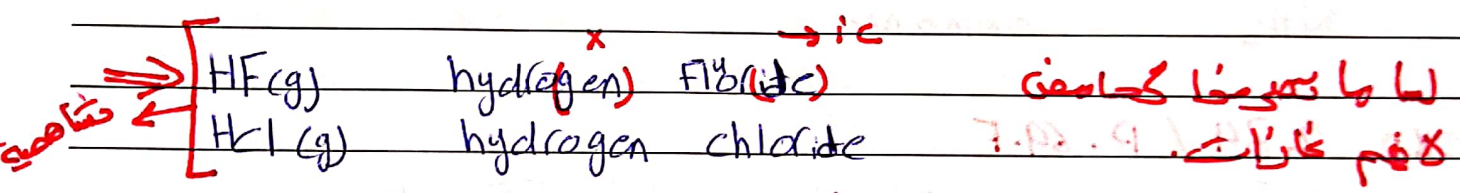
X: nonmetal



$\rightarrow \text{Br} / \text{Cl} / \text{I} \rightarrow$ البروم ، الكلور

* LO6.

* Binary molecular Acids (HX); X = F, Cl, Br, I



HCl(aq) hydro chloric acid

$\Rightarrow \text{H}_2\text{S(g)}$ hydrogen sulfide

لا يتصرف كحمض في الماء

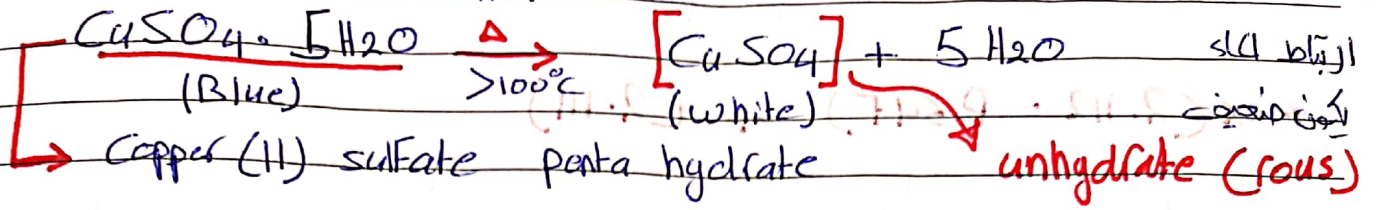
$\Rightarrow \text{H}_2\text{S(aq)}$ hydro sulfuric acid

$\Rightarrow \text{H}_2\text{SO}_4$ sulfuric acid

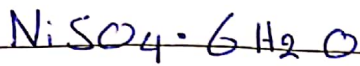
\Rightarrow sulfurous acid H_2SO_3

Hydrates

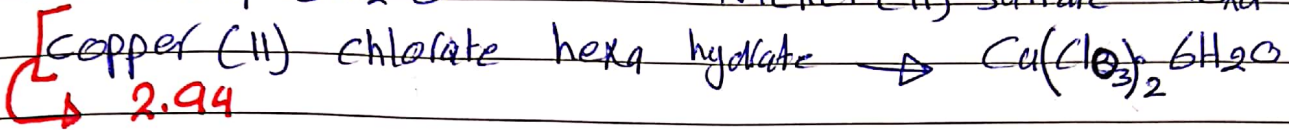
التي تتكون من مادة صلبة - جزء من الماء
heat



* ex (2.92 - P.69F)



Nickel (II) sulfate hexa hydrate



* 2.90 (ex)

- 1 HIO hypiodous acid (IO^- hypoiodite)
 - 2 HClO₂ chlorous acid (ClO_2^- chlorite)
 - 3 H₂SeO₃ selenous acid (SeO_3^{2-} selenite)
- SO_3^{2-} (sulfite)

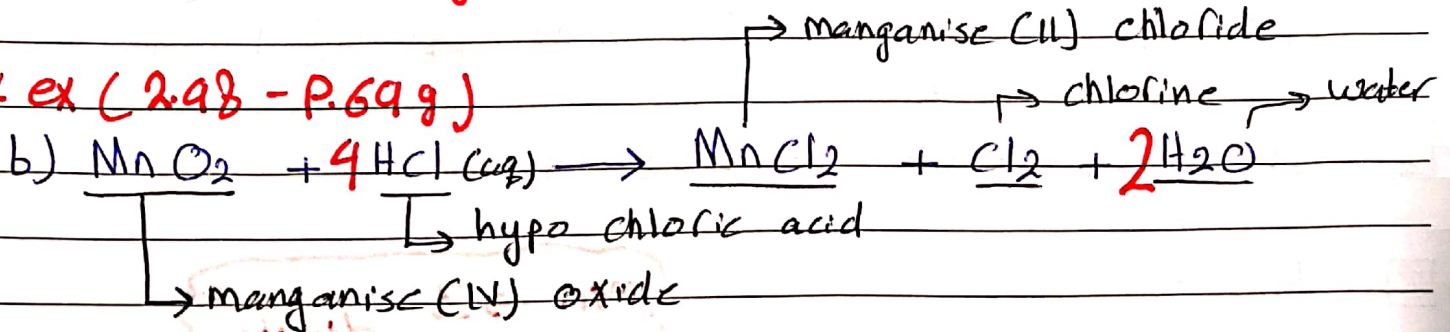
* 2.9 chemical equation.

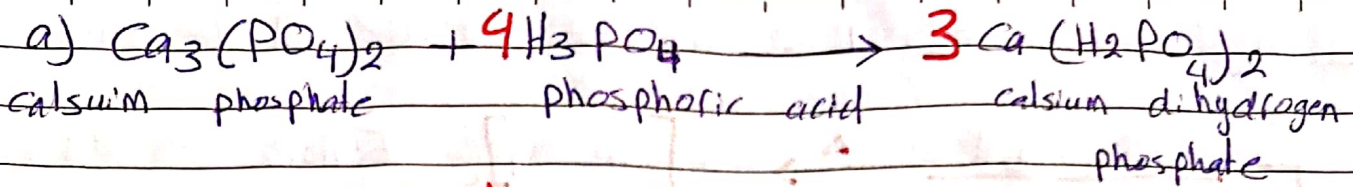
Reactant(s) → product(s)

↳ condition (ظروف التفاعل)

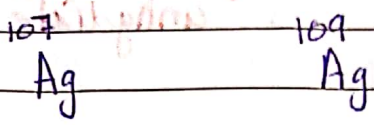
* 2.10 Balancing

* ex (2.98 - P.69g)





* ex (2.112 - P.69F) + (2.111)



معدن فضة
 متوسط الوزن الذري = $(70.9 \cdot (avg)) \cdot x =$

* Chapter 3 ☺:

* 3.1 Molecular weight (Mw) → الوزن الجزيئي
 Formula weight (Fw) → الوزن الصيغي
 = \sum At.wt.'s

* ex (3.28 - P.101c)

- 1) H_2SO_4 2) PCl_5 3) NH_4Cl 4) $\text{Ca}(\text{OH})_2$
 sulfuric acid phosphorus pentachloride ammonium chloride calcium hydroxide

1) $2 \times 1.008 + 32.07 + 4 \times 16.00 \Rightarrow 98.1 \text{ amu}$

2) $31 + 5 \times 35.45 \Rightarrow 208 \text{ amu}$

3) 53.5 amu

4) 74.1 amu

min → 3
 max → 4 digits

* 3.2 The mole concept.

كل الوحدة الكافية لعدد الجزيئات في 1 ذرة كربون

- mole

- Avogadro's no (N_A) = 6.022×10^{23} $\frac{\text{Units}}{\text{mol}}$

طلبنا موجب لانه عدد واحد ووقت اومض

Molar mass \rightarrow mass of 1 mole (g/mol)

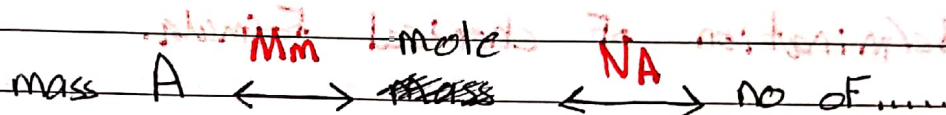
* ex (3.34 - P101C)

The mass of 1 atom Br (mg)

$M_m(\text{Br}) = 79.9 \text{ g/mol} \equiv \text{Atomic weight (amu / atom)}$

$$\frac{79.9 \text{ g}}{\text{mol}} * \frac{1 \text{ mol}}{6.022 * 10^{23} \text{ atom}} * 1 \text{ atom} \Rightarrow 1.32 * 10^{-22} \text{ g}$$

* LOT.



* ex (3.38 - P101C)

a) 0.331 mol (Fe)

$\Rightarrow ? \text{ g}$

$$0.331 \text{ mol} * \left(\frac{55.85 \text{ g}}{\text{mol}} \right) \Rightarrow 18.49 \Rightarrow 18.5 \text{ g Fe}$$

"exact" يعني انهم
انه كل واحد بيان كيف تكتبه

* ex (3.42 - P101C)

b) 2.57 g As

$\Rightarrow ? \text{ mol}$

$$2.57 \text{ g} * \frac{1 \text{ mol}}{74.92 \text{ g}} \Rightarrow 0.03430 \Rightarrow 0.0343 \text{ mol}$$

* ex (3.46 - P101 d)

→ (exact → jis a'is)

a) ? atom Al

25.7 g Al

$$25.7 \text{ g} \times \frac{1 \text{ mol}}{26.98 \text{ g}} \times (6.022 \times 10^{23}) \text{ atom} \Rightarrow 5.736 \times 10^{23}$$

$$\Rightarrow 5.74 \times 10^{23} \text{ atom}$$

c) ? Ca^{+2} ions

4.71 g $\text{Ca}_3(\text{PO}_4)_2$

$$\text{Mm } \text{Ca}_3(\text{PO}_4)_2 = 310.18 \text{ g/mol}$$

$$\Rightarrow 3 \times 4.71 \text{ g} \times \frac{1 \text{ mol}}{310.18 \text{ g}} \times 3 \text{ mol } \text{Ca}^{+2} \times 6.022 \times 10^{23} \text{ ions}$$

$$= 2.74 \times 10^{23} \text{ ions } (\text{Ca}^{+2})$$

II) Determination of chemical formula.

3.3) Percent composition

$$\text{mass \% of A} = \frac{\text{mass of A in whole} \times 100\%}{\text{mass of whole}}$$

* ex (3.58 - P101 d) % by mass = ?

a) $\text{NO}_2 \rightarrow$ % N, % O = ??

For 1 mol

$$\text{NO}_2 \begin{cases} \xrightarrow{2} 14.01 \text{ g N} \\ \xrightarrow{4} 32.00 \text{ g O} \end{cases}$$

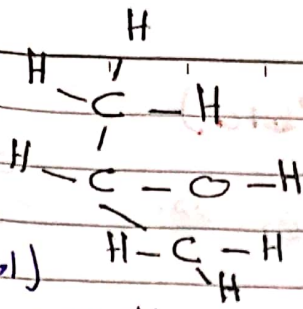
$$\boxed{1} \text{ \% N} = \frac{14.01}{46.01} \times 100\% = 30.4\%$$

$$\boxed{2} \text{ \% O} = \frac{32.00}{46.01} \times 100\% = 69.6\%$$

$$\Rightarrow 30.4\% + 69.6\% = 100\% \checkmark$$

Molar mass of the compound is the sum of atomic weights of the atoms in the molecule.

* ex (3.60 - P101d)



% mass
% C ?
% O ?
% H ?

$\equiv C_3H_8O$ (Mm = 60.1 g/mol)
% C = 60.0% , % O = 26.6% , % H = 13.4%

* ex (3.62 - P101d)

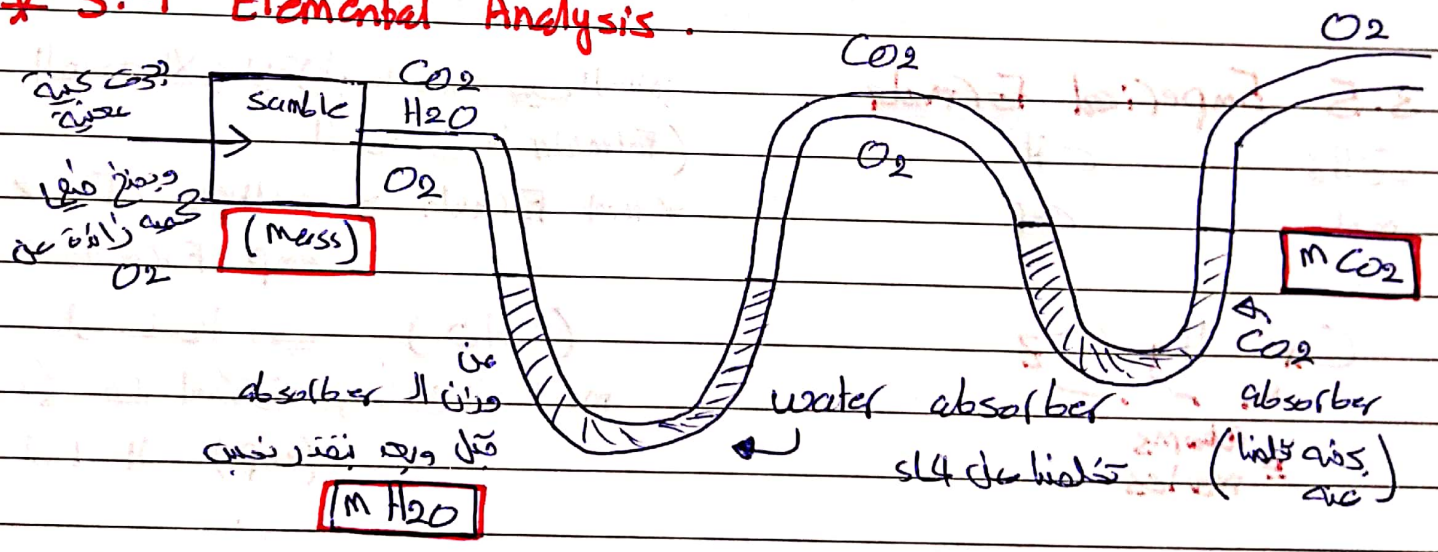
more s??

40.8 g $CaSO_4$ or 38.8 g Na_2SO_4 ?

1 $40.8 g \times \frac{32.06 g}{136.14 g} = 46.8 g$ $\frac{1 mol}{136.14 g} \times \frac{1 mol}{1} \times \frac{32.06 g}{1 mol}$

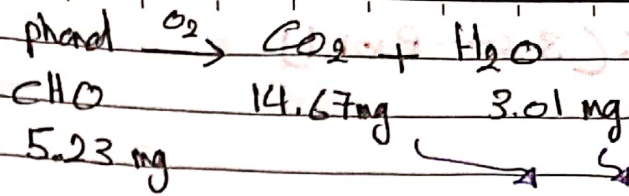
2 $38.8 g \times \frac{32.06 g}{126.04 g} \Rightarrow 9.87 g$ (Na₂SO₄)

* 3.4 Elemental Analysis



% H in H₂O → % O in CO₂

* ex (3.64 - Poid)



% C, % H, % O = ??

(بالنسبة إلى الأجزاء)

1) $14.67 \text{ mg } CO_2 \times \frac{12.01 \text{ mg}}{44.01 \text{ mg}} \Rightarrow 4.0033 \text{ mg } C$

2) $3.01 \text{ mg } H_2O \times \frac{2 \times 1.008 \text{ mg}}{18.02 \text{ mg}} \Rightarrow 0.3368 \text{ mg } H$

3) $5.23 = m_1 + m_2 + m_3 \Rightarrow 5.23 = 4.0033 + 0.3368 + m_O$
 $m_O = 0.8899 \text{ mg } O$

% C = $\frac{4.0033}{5.23} \times 100\% \Rightarrow 76.5\%$

% H = $\frac{0.3368}{5.23} \times 100\% \Rightarrow 6.44\%$, % O = 17%

* 3.5 Empirical Formula

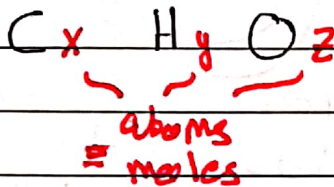
C_6H_6
mol

CH
emp

الصيغة الأولية (الصيغة الجزيئية)

(Formula) الجزيئية

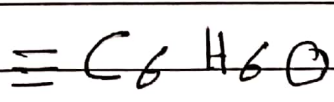
* mol Formula \rightarrow multiple of *
emp. Formula



(CHO) أو صيغة زينة
 صيغة صمد الكيمياء من الأجزاء (emp)
 الجزيئية (emp)

1) $\frac{C_4}{12} \quad \frac{H_{0.3}}{1} \quad \frac{O_{0.8}}{16} \rightarrow$ "جوانابم كولات"

$\frac{C_{0.3}}{0.25} \quad \frac{H_3}{0.25} \quad \frac{O_{0.25}}{0.25} \rightarrow$ "بنفسه كولات"
 "مول"





100% من الكمية = المبدأ = 100g =

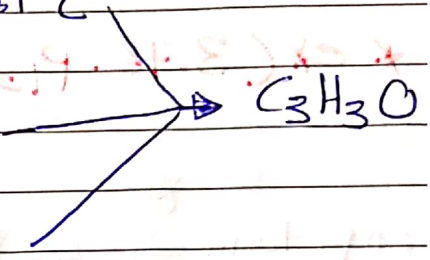
"المركب الجزيئي" C_6H_6O ← المركب الجزيئي هو الذي

* ex (3.68 - P101e) 65.4% C, 5.5% H, 29.1% O
emp formula?

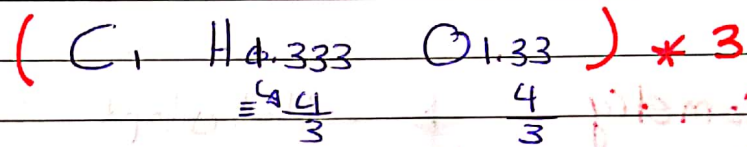
100g
1 65.4g $\times \frac{1 \text{ mol C}}{12.01 \text{ g}} \Rightarrow 5.445 \text{ mol C}$

2 5.5g H $\times \frac{1 \text{ mol H}}{1.008 \text{ g}} \Rightarrow 5.45 \text{ mol H}$

3 29.1g O $\times \frac{1 \text{ mol O}}{16.00 \text{ g}} \Rightarrow 1.819 \text{ mol O}$



* ex (3.70 - P101e) 34.6% C, 3.9% H, 61.5% O



$\Rightarrow C_3H_4O_4$

0.333 ...] $\times 3$
0.666 ...] $\times 3$
0.25] $\times 4$
0.75] $\times 4$
0.5 $\rightarrow \times 2$

* LOB.

Mol. Formula = n * emp. Formula

$\frac{\text{Mol. Formula}}{\text{emp. Formula}} = n$
 $\hookrightarrow \text{mol. mass}$

ex (3.74 - P. 101e) BH_3 , $M_m = 28$ amu
 Borane $M_m = ??$

B \Rightarrow mol. mass = 13.83 amu \equiv Mol. mass

$$\frac{28}{13.83} = n \Rightarrow n \approx 2 \Rightarrow (BH_3)_2 \Rightarrow B_2H_6$$

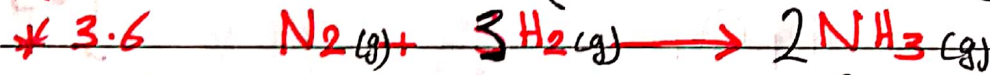
* ex (3.76 - P. 101e) 44.3% C, 6.9% H, 43.8% O
 \Rightarrow emp formula

emp. form $\Rightarrow C_3H_3O_2$ (73) amu
 Mol wt = 146 amu / mol form??

$$\frac{146}{73} = n \Rightarrow n = 2 \Rightarrow (C_6H_6O_4)$$

III Stoichiometry

المقادير الكيميائية
 (الكميات النسبية المتساوية)



molecules: 1 3 2 \rightarrow molecules (الجزيئات)
 moles: 1 3 2 \rightarrow moles (مولات)

X masses: 28g + 6.0g \rightarrow 34g (masses) (الكتل)

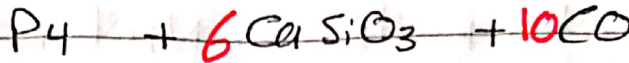
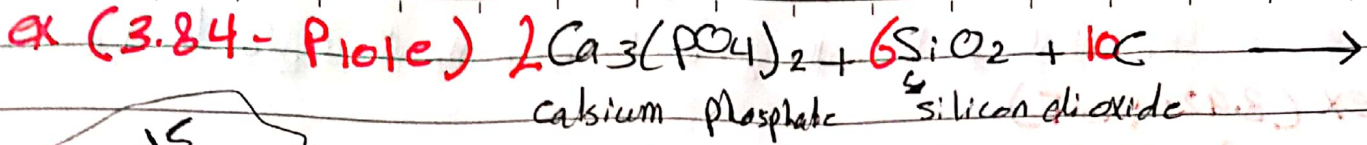
* mass A $\xrightarrow{M_m A}$ mole A \xrightarrow{eq} mole B $\xrightarrow{M_m B}$ mass B

A, B could be reactant or product (المتفاعلات والنواتج)
 (pr-pr) (pr-re) \leftarrow (re-re) (re-pr)

310.18 g/mol

calcium

? g



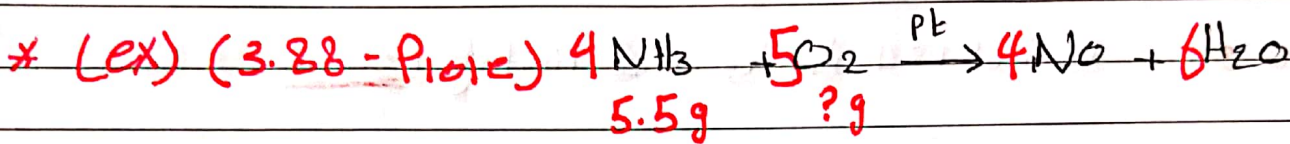
30.0g

123.88 g/mol

quant number
(30.0) mass

$$30.0 \text{ g P}_4 \times \frac{1 \text{ mol P}_4}{123.88 \text{ g P}_4} \times \frac{2 \text{ mol Ca}_3(\text{PO}_4)_2}{1 \text{ mol P}_4} \times \frac{310.18 \text{ g Ca}_3(\text{PO}_4)_2}{1 \text{ mol Ca}_3(\text{PO}_4)_2}$$

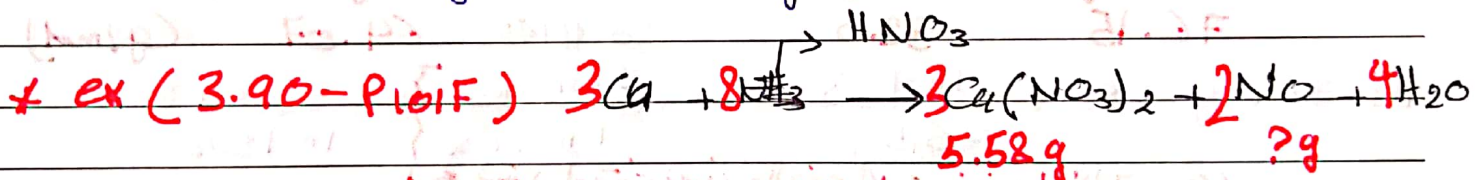
$$\Rightarrow 150.2 \text{ g} \Rightarrow 150. \text{ or } 1.50 \times 10^2 \text{ g}$$



17.03 g/mol 32.0 g/mol

$$5.5 \text{ g NH}_3 \times \frac{1 \text{ mol NH}_3}{17.03 \text{ g NH}_3} \times \frac{5 \text{ mol O}_2}{4 \text{ mol NH}_3} \times \frac{32.0 \text{ g O}_2}{1 \text{ mol O}_2}$$

$$\Rightarrow 12.92 \text{ g} \Rightarrow 13 \text{ g O}_2$$



187.56 g/mol 30.01 g/mol

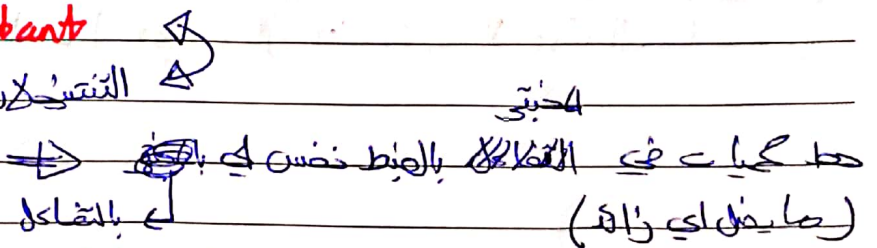
$$5.58 \text{ g} \times \frac{1 \text{ mol}}{187.56 \text{ g}} \times \frac{2 \text{ mol NO}}{3 \text{ mol Cu}(\text{NO}_3)_2} \times \frac{30.01 \text{ g NO}}{1 \text{ mol NO}}$$

$$\Rightarrow 0.595 \text{ g NO}$$

* 3.8 Limiting Reactants

EXCESS

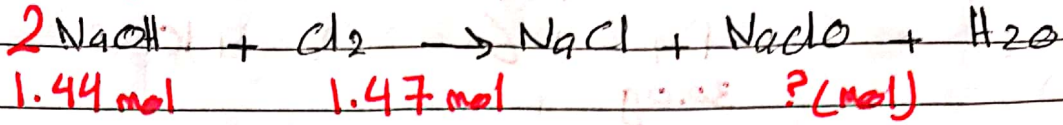
Stoichiometric quantities



* enough, excess \Rightarrow (Limiting reactant)

* ازا ما بين في السؤال من الكاشف في نواتج التفاعل

* ex (3.92 - P101F)



في حساب كل ناتج كم يتطابق مع الكاشف (NaClO)

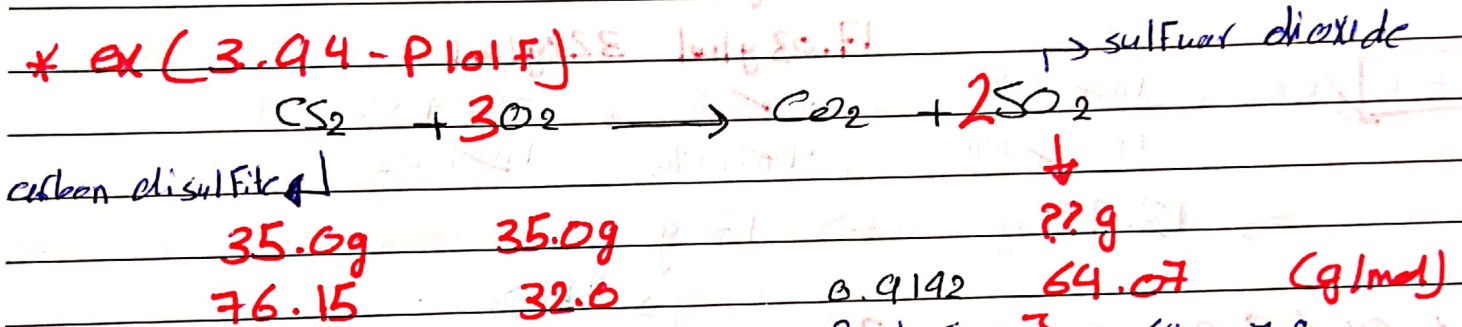
$$\boxed{1} \quad 1.44 \text{ mol NaOH} \times \frac{1 \text{ mol NaClO}}{2 \text{ mol NaOH}} \Rightarrow 0.720 \text{ mol NaClO}$$

← L.R. هو NaOH

$$\boxed{2} \quad 1.47 \text{ mol Cl}_2 \times \frac{1 \text{ mol NaClO}}{1 \text{ mol Cl}_2} \Rightarrow 1.47 \text{ mol NaClO}$$

* note 8 : Limiting reactant هو الكاشف الذي ينفذ أولاً في التفاعل

* ex (3.94 - P101F)



$$\boxed{1} \quad 35.0 \text{ g CS}_2 \times \frac{1 \text{ mol CS}_2}{76.15 \text{ g}} \times \frac{2 \text{ mol SO}_2}{1 \text{ mol CS}_2} = 0.9142 \text{ mol SO}_2$$

64.07 g / mol SO₂

← بقدر اقل من والقيمة الاقل تقريبا (64.07)

$$\boxed{2} \quad 35.0 \text{ g O}_2 \times \frac{1 \text{ mol O}_2}{32.0 \text{ g}} \times \frac{2 \text{ mol SO}_2}{3 \text{ mol O}_2} = 0.7292 \text{ mol SO}_2$$

64.07 g / mol SO₂

$$\Rightarrow 46.72 \text{ g SO}_2$$

* الفرق بين 0.9 و 0.7 هو القيمة الاقل في الكمية كانت في تنبع (الزيادة) الناتج يحصل بالنسبة الى CS₂ كاشف (بعض بيانات اقل كمية الى CS₂ الى ما نتجت)

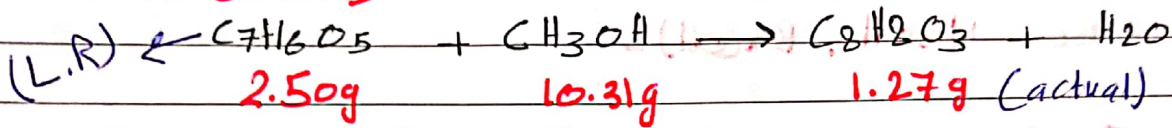
$$\Rightarrow 7.24 \text{ g CS}_2$$

*** على المثال السابق**

لو فرضنا انه الكمية الحقيقية (actual) $40.0g \leftarrow SO_2$ (actual) expt value
 والقيمة الحقيقية حسابها $46.72g \leftarrow$ Theoretical yield (مربطها اجمالي)

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

*** 3.98 (P. 101 F)**



(لانه النواتج بنوع 1:1) **Excess**

$\Rightarrow \% = 46.1\%$

*** LO9.**

{ نهاية مادة الفيزيوس }

*** chapter 4 ☺**

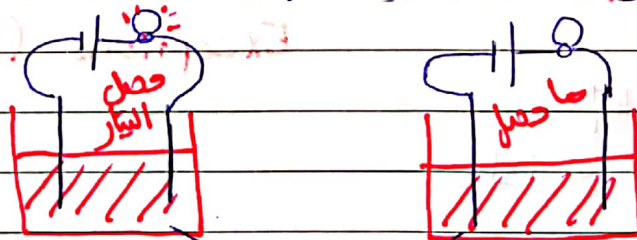
- Chemical reactions

mixture

solution \rightarrow solvent (higher substance) homogenous (solution II)
 \rightarrow solute (s) (lower substance in the solution)

H_2O aqueous solution (الماء في المحلول)

I) * 4.1.



aqueous solution

Electrolyte

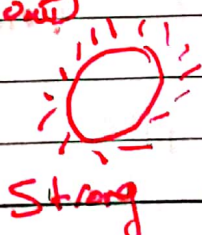
nonelectrolyte \rightarrow (sugar)

(methanol)

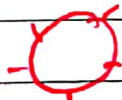
(Ethanol)

(Urea)

(قوة التوصيل)

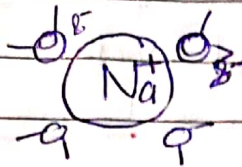
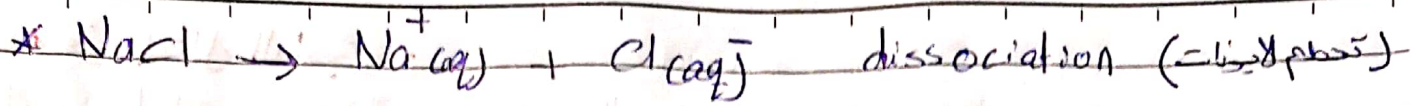


Strong

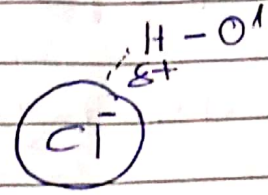


Weak

- * soluble ionic compound
- * strong acids



hydration
(إسالة المذابة)



* **Strong Electrolyte eq. solution:** (تفكك جيد جداً في محلول مائي)

soluble ionic compounds

strong acids HCl, HNO_3

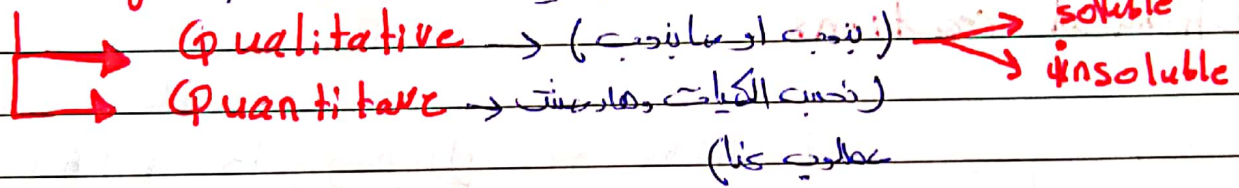
strong bases $\text{NaOH}, \text{Ba}(\text{OH})_2$

* **Weak Electrolyte eq. solution:** (تفكك ضعيف "معتدل")

weak acids HF

weak bases NH_3

* **solubility:** (القدرة على إذابة مادة ما في كمية معينة من المذيب)



* **Solubility Rules:**

Table (4.1) / P. 107

Rule ("soluble")

1. $\text{Li}^+, \text{Na}^+, \text{K}^+, \text{NH}_4^+$

Rb^+, Cs^+ (مذابة جداً)

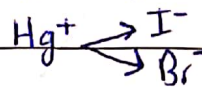
Exceptions ("insoluble")

2. $\text{CH}_3\text{CO}_2^-, \text{NO}_3^-, \text{ClO}_4^-, \text{ClO}_3^-$

3. $\text{Cl}^-, \text{Br}^-, \text{I}^-$

$\text{Ag}^+, \text{Hg}_2^{+2}, \text{Pb}^{+2}$

eg. AgCl



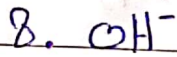
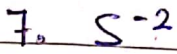
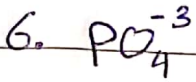
(insoluble)

4. SO_4^{-2}

$\text{Ag}^+, \text{Hg}_2^{+2}, \text{Pb}^{+2}$

$\text{Ca}^{+2}, \text{Sr}^{+2}, \text{Ba}^{+2}$

Rule ("insoluble")



Exceptions ("soluble")

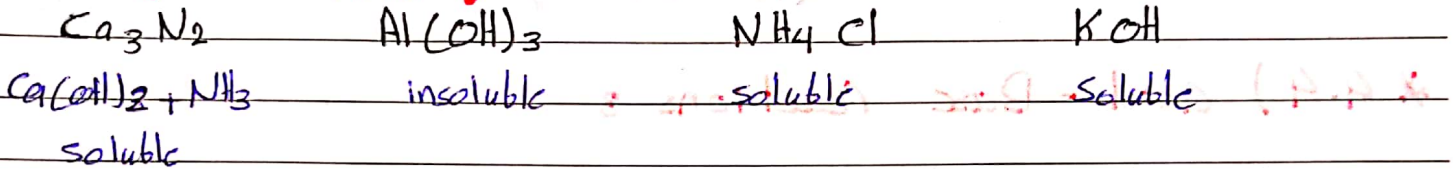
Rule 1

Rule 1

Rule 1

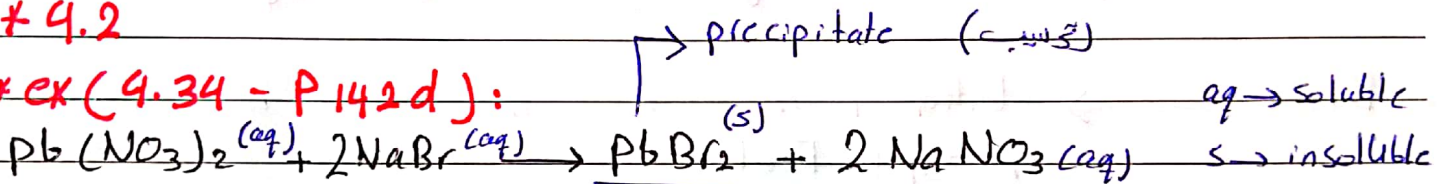
Rule 1, Ca^{+2} , Sr^{+2} , Ba^{+2}

*** ex (4.30 - P142c):**



*** 4.2**

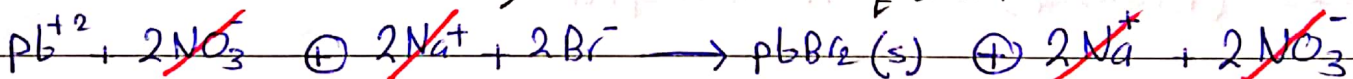
*** ex (4.34 - P142d):**



*** Metathesis (تبدل) (double displacement)**

⇒ precipitation reactions (4.3)

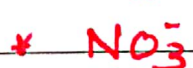
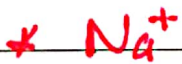
⇒ molecular equation



⇒ ionic equation



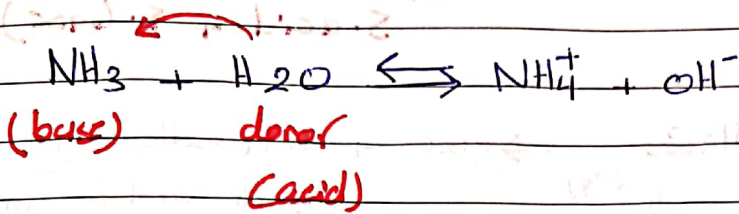
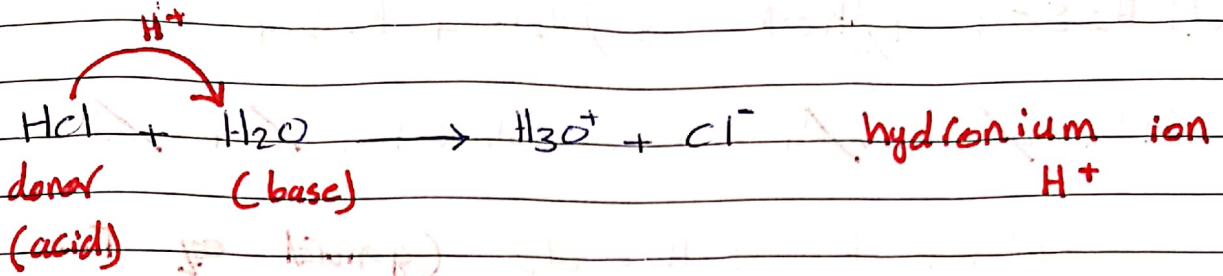
⇒ net ionic equation



] → spectator ions (الأيونات المتفرجة)
 "المتفرجة"

molecular equation الـ net ionic equation الـ spectator ions الـ

* L10.



* ex (4.42 - P142 d): → Strong (acid / base) / weak (acid / base)?

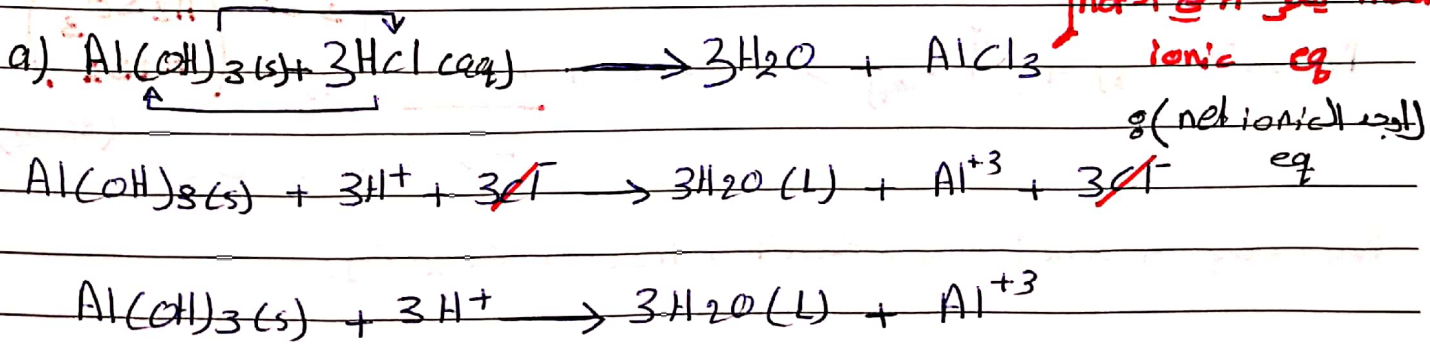
HCNO + H ₂ O weak acid = (H ₃ O ⁺ + CN ⁻)	Mg(OH) ₂ ↓ ↑ Mg ²⁺ + 2OH ⁻ Strong base	HClO ₃ strong acid	NH ₃ weak base
---	--	----------------------------------	------------------------------

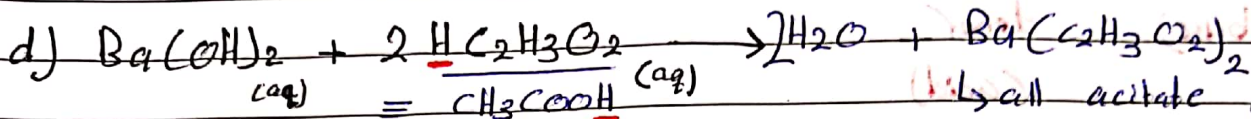
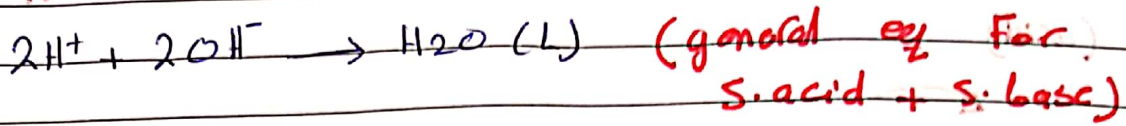
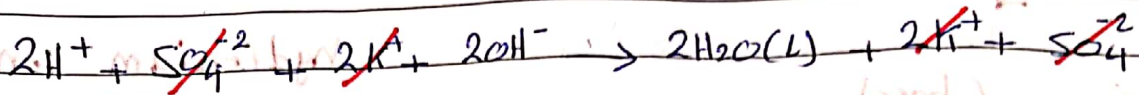
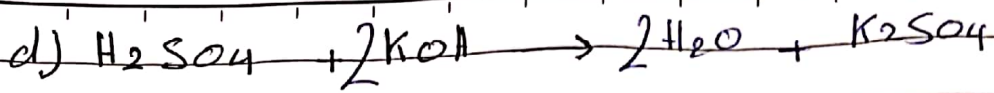
... insoluble ...
... (strong) ...

* Neutralization reactions:

→ (acid + base → water + salt)

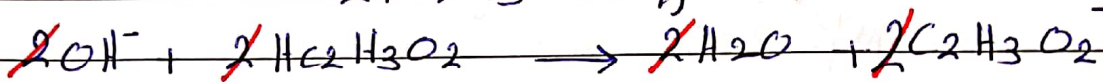
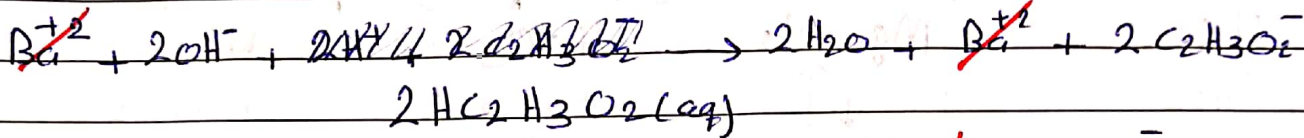
* ex (4.44 - P.142 d): ... (insoluble) ... base ... insoluble ...





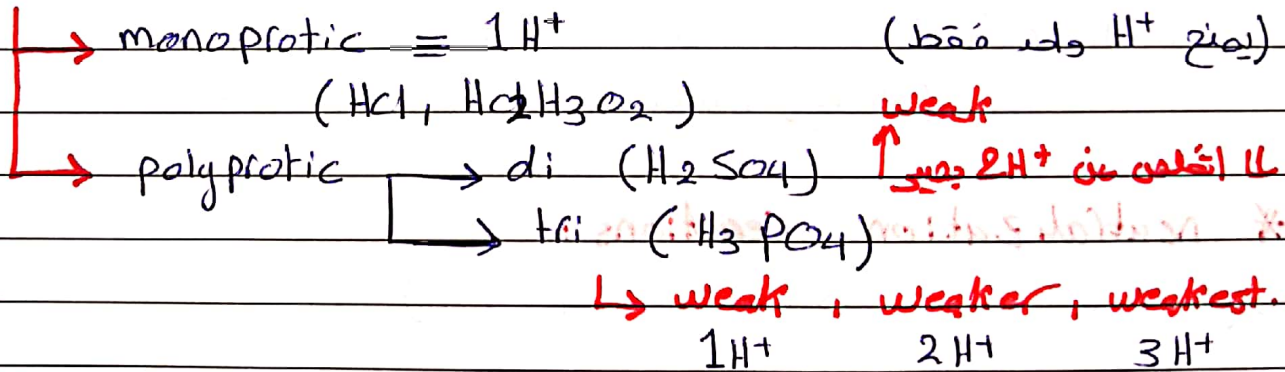
all acetate are soluble

weak acid

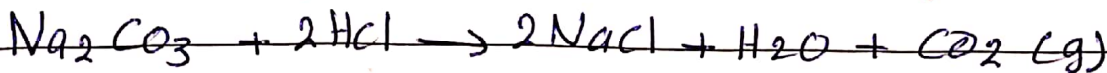
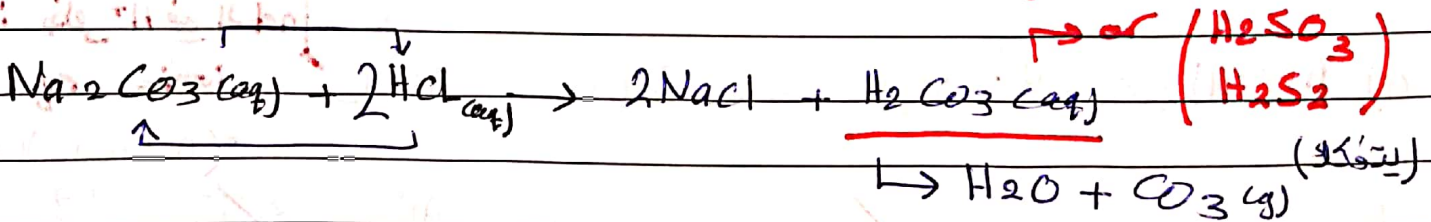


net ionic eq: $OH^- + HC_2H_3O_2 \rightarrow H_2O + C_2H_3O_2^-$ soluble acid

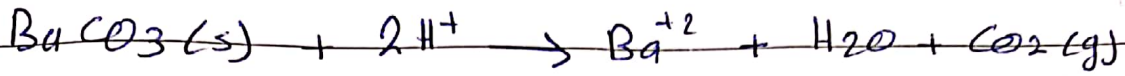
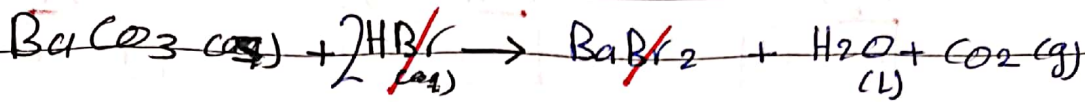
* Acids



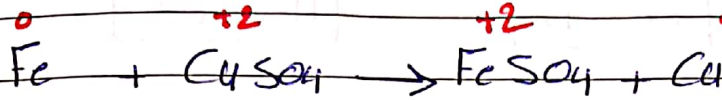
* neutralization reactions that gives gases:



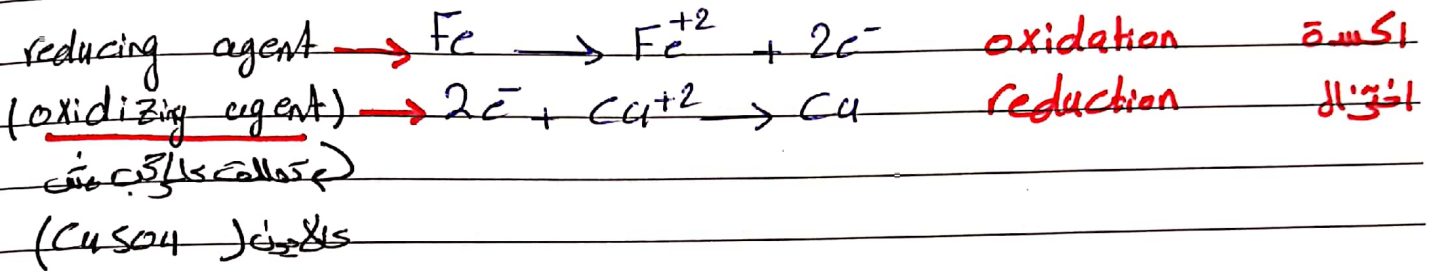
* ex (4.54 - P 142 c):



* 4.5 Oxidation - Reduction Reactions:



الأيون الموجب يتحرك من ذرة
لثمة هي الأيون البرونزي
عقد داخل التواة



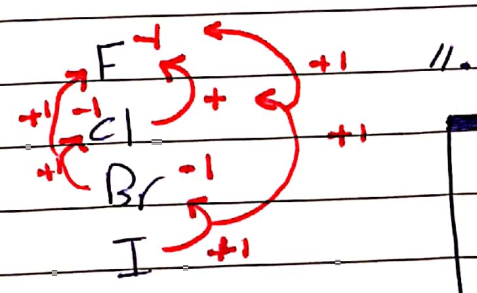
* Oxidation State (number):

قد تكون حقيقتا او لا
حقيقتا $\text{Fe}, \text{Cu}^{+2}$
ليس حقيقتا S

Table 4.5 - P 124

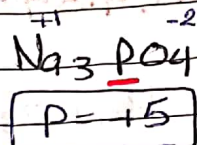
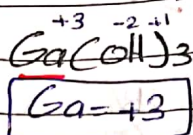
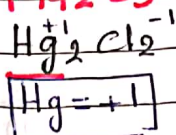
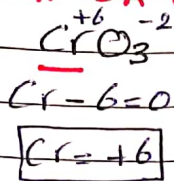
Rules

- Free elements \equiv Zero ($\text{N}_2, \text{O}_2, \text{P}_4, \text{S}_8 = 0$)
- monatomic ion \equiv charge ($\text{Na}^+ = 1, \text{Ca}^{+2} = 2, \text{O}^{-2} = -2$)
- Oxygen = -2 " Except $\text{O}_2^{-2} = -1$ "
- H = +1 " except $\text{MH}_n \Rightarrow -1$: M = metal
- Halogens = -1 " Except

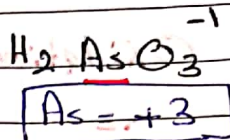
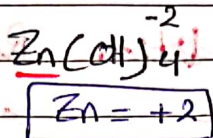
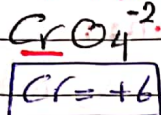
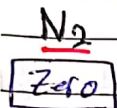


6. \sum oxid. st's = charge.

* ex (4.56 - P 142 e):

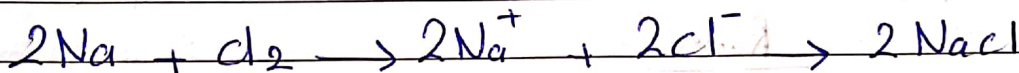
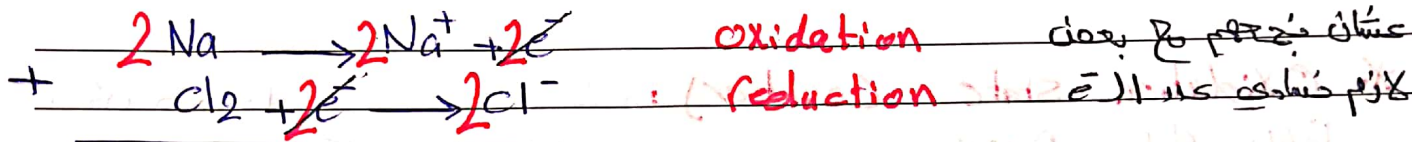
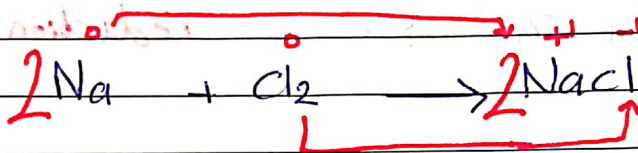
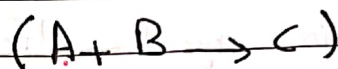


* ex (4.58 - P 142 e):



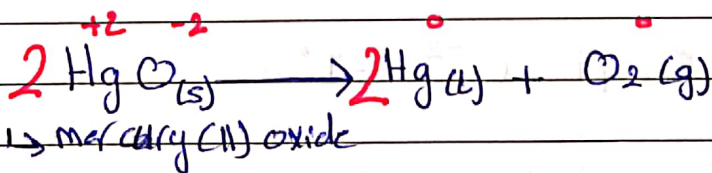
* L11. common redox Reactions:

1. Combination Reactions.

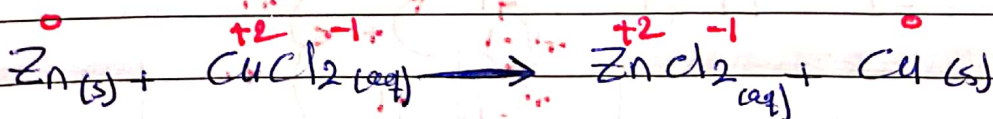


* دقیر اورین لالهه جی کوهه القاسم (الکسواله جیلا)

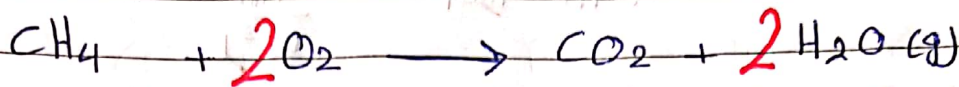
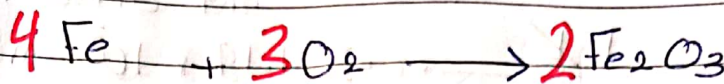
2. Decomposition. (C → A + B)



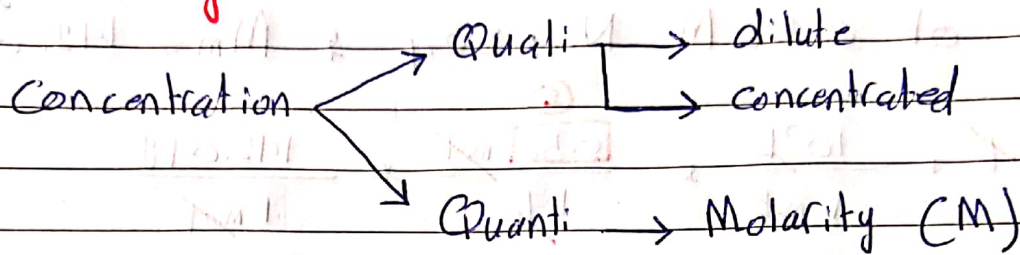
3. Displacement Reactions.



4. Combustion Reactions. (تفاعلات الاحتراق)



* III) working with solutions.



مادتي بوج
نفسه

* 4.7) Molarity (M): (mol / L)

$$\text{Molarity} = \frac{\text{moles of solute}}{1 \text{ Liter of solution}}$$

$$\Rightarrow M = \frac{n}{V} \leftarrow \text{mL} \rightarrow$$

مثلا 0.10 مول في 1 لتر
0.10 مول / لتر

0.10 M
= 0.10 molar
= 0.1 mole of solute
1 L of solution

* ex (4.70 - P142F)

1.200 g (OxH) in 100.0 mL soln; M = ??

Mm = 90.04 g/mol

$$1.200 \text{ g OxH} \times \frac{1 \text{ mol}}{90.04 \text{ g}} = 0.013327 \text{ mol}$$

$$M = \frac{n}{V} \Rightarrow M = \frac{0.013327 \text{ mol}}{100.0 \times \left(\frac{10^{-3}}{m}\right) \text{ L}} \Rightarrow 0.1333 \text{ M}$$

* ex (4.72 - P142 F): P mL of 0.126 M HClO₄ and 0.150 mol

$$0.150 \text{ mol HClO}_4 \times \frac{1 \text{ L}}{0.126 \text{ mol}} \rightarrow 1.19 \times 10^3 \text{ mL}$$

* ex (4.78 - P142 F): How to prepare? (كيف نحضره؟) (mass)

250.0 mL of 0.50 M Na₂SO₄ & M_m = 142.04 g/mol

$$250.0 \text{ mL} \times \frac{10^{-3} \text{ L}}{1 \text{ mL}} \times \frac{0.50 \text{ mol}}{1 \text{ L}} \times \frac{142.04 \text{ g}}{1 \text{ mol}} = 17.8 \text{ g Na}_2\text{SO}_4 \Rightarrow 18 \text{ g}$$

* Fig 4.18 - P132

* 4.8) Dilution (التخفيف)

$$n_{\text{Before}} = n_{\text{After}} \rightarrow M_1 V_1 = M_2 V_2$$

العدد المول في البداية = العدد المول في النهاية
 التركيز في البداية × الحجم في البداية = التركيز في النهاية × الحجم في النهاية

* ex (4.80 - P142 F):

0.75 M HCl, 1.50 L stock

stock 12.4 M HCl, V = ?? (التركيز في المحلول المركز)

$$V_1 = \frac{M_2 V_2}{M_1} \Rightarrow \frac{0.75 \text{ M} \times 1.50 \text{ L}}{12.4 \text{ M}} \times \frac{1 \text{ mL}}{10^{-3} \text{ L}}$$

$$= 91 \text{ mL}$$