الكيمياء (1)

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إعداد الطالبة: دانه حجيلة

1st → 6/11 2nd → 2/12 final → 26/12

Scientific measurements:

mass → الكتلة

weight → الوزن

Atom → الذرة

one phase → حالة واحدة [مثل ماء وملح]

Matter (مادة)

- Substance (نقية)
  - element: Zn
  - compound: NH_3
- Mixture (خليط)
  - Homogeneous (متجانس)
  - heterogeneous (غير متجانس)

Ex:
- $S + L \rightarrow NaCl + H_2O$
- $L + L \rightarrow alkohol + H_2O$
- $g + L \rightarrow O_2 + H_2O$
- (المحاليل) solution

properties (خواص):
- physical
- chemical

Properties

- Intensive: لا تتعلق بالكميات — can't be added (temperature)
- Extensive: Can be added (mass)

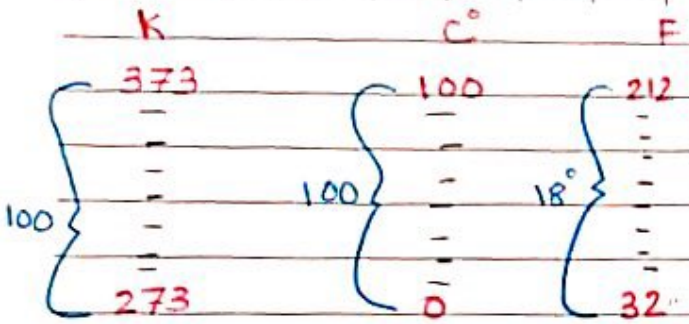
Measurements (SI → International system)

- Number
- unit
  - Basic: (K) Temperature; Time (s); mass (kg); length (m); (mol) amount material
  - Derived: volume (m^3); Density $\frac{kg}{m^3}$

Volume → حجم

Density → كثافة

Five Apple



25C° ⟶ K

25c° + 273 = 298 K

5 C° = 9 F

$\frac{5C°}{9F}$ / $\frac{9F}{5C°}$

25C° ⟶ F

$^{5}25\,C° \times \frac{9F}{5C°} + 32 =$

45 F + 32 =

77 F

50 F ⟶ C°

(50F - 32F) $\times \frac{5C°}{9F}$ =

$^{2}18F \times \frac{5C°}{9F}$ =

10 C°

1 m = 100 cm

$\frac{1m}{100cm}$ / $\frac{100cm}{1m}$

0.75 m ⟶ cm

$0.75\,m \times \frac{100\,cm}{1\,m}$

75 cm

Uncertinity in measurements:

26.5 / 26.4 / 26.6 ⟶ 27	26.26 / 26.24 / 26.27 ⟶ 26.3
26 ⟶ certin number	26.2 ⟶ certin
0.5 / 0.4 ⟶ uncertin number 26	0.06 / 0.04 / 0.07 ⟶ uncertin 26.2

precise ⟶ دقيق (more digits)

Accuracy ⟶ الصحة (How much is closer to the truth)

Significant Numbers: (أرقام معنوية)

How many significant figures is there?

2.1 ⟶ 2 20203 ⟶ 5

222 ⟶ 3 0.0025 ⟶ 2

101 ⟶ 3 0.00203 ⟶ 3

1000 ← حسب آلة الحاسبة

* إذا كان تدريج الأداة 0 - 1 - 2 - ... 1000 فيحسب فقط صفر واحد (2)
* // // // // // 0 - 10 - 20 - ... 1000 // صفرين (3)
* // // // // // 0 - 100 - 200 - ... 1000 // ثلاثة أصفار (4)

$1000 = 1 \times 10^3 = 10 \times 10^3 = 1.00 \times 10^3 = 1.000 \times 10^3$

(1) (1) (2) (3) (4)

حسب الكتاب الجديد

How many significant figures? ← أول سؤال بالامتحان

Ex (1.36):

a) 46.5 → 3
b) 94.820 → 5
c) 105.86 → 5
d) 0.00254 → 3
e) 0.05860 → 4
f) 150 → 2 بسبب عدم وجود فاصلة عشرية

السؤال الثاني بالامتحان ؟

$3.14 \times 2.751 = 13.49709375$

0.64

الجواب حسب أصغر No.sig.f

(a) 13 b) 13.4 c) 13.49

في الضرب و القسمة نتبع قاعدة أصغر No.sig.f

$3.247 + 41.36 + 125.2 = 169.807$

$= 169.8$

في الجمع و الطرح نعتمد على المنازل العشرية حسب الأقل

Ex (1.9):

a) $21.0233 + 21.0 = 42.0233$ → 42.0
b) $16.0324 \div 11.7 = 0.85740084$ → 0.857

Dimensional analysis: (كتابة الرقم مع الوحدة)

0.57 m ≟ cm

$0.57\,m \times \frac{100\,cm}{1\,m} = 57\,cm$

Exact numbers ← (No. sig) لها عدد لا نهائي من الأرقام المعنوية

53 cm ≟ m

$53\,cm \times \frac{1\,m}{100\,cm} = 0.53\,m$

Ex (1.5): 2.5×10^3 m ≟ ft if 1 ft = 12 inch, 1 inch = 2.54 cm, 1 m = 100 cm

$2.5 \times 10^3\,m \stackrel{?}{=} ft$

$2.5 \times 10^3\,m \times \frac{100\,cm}{1\,m} = 2.5 \times 10^5\,cm \times \frac{1\,inch}{2.54\,cm}$

$= \frac{2.5 \times 10^5}{2.54}\,inch \times \frac{1\,ft}{12\,inch} = \frac{2.5 \times 10^5}{2.54 \times 12}\,ft = 8.2 \times 10^3\,ft$

Q (1.19): 0.27 miles ≟ yd if 1 yd = 3 ft, 1 mi = 5280 ft

0.27 miles ≟ yd

$0.27\,mi \times \frac{5280\,ft}{1\,mi} = 0.27 \times 5280\,ft \times \frac{1\,yd}{3\,ft} = \frac{0.27 \times 5280}{3}\,yd$

$= 47520$

$= 4.7520 \times 10^4$

$= 4.7 \times 10^4\,yd$

$0.0035 \times \frac{10^3}{10^3} = \frac{3.5}{10^3} = 3.5 \times 10^{-3}$

The molar mass of Na = 23 g/mol find .5 mol Na ≟ g ؟

$0.5\ \text{mol Na} \times \frac{23\ \text{g}}{\text{mol}} = 11.5\ \text{g}$

Ex (3.2): 0.254 mol of $FeCl_3$ ≟ g if the molar mass of $FeCl_3$ = 162.204 g/mol ؟

$162.204\ \frac{\text{g}}{\text{mol}} \times 0.254\ \text{mol} = 41.2\ \text{g}$

1 mol atom = 6.022×10^{23} atoms

$\frac{1\ \text{mol}}{6.022 \times 10^{23}\ \text{atom}}$ or $\frac{6.022 \times 10^{23}\ \text{atom}}{1\ \text{mol}}$

1 mol = 12 g

$\frac{1\ \text{mol}}{12\ \text{g}}$ or $\frac{12\ \text{g}}{1\ \text{mol}}$

$\frac{12\ \text{g}}{\text{mol}} \times \frac{1\ \text{mol}}{6.022 \times 10^{23}\ \text{atom}} = \frac{12}{6.022 \times 10^{23}}$ g (the mass of 1 atom)

3g C ≟ atom

$3\ \text{g} \times \frac{1\ \text{mol}}{12\ \text{g}} = \frac{1}{4}\ \text{mol} \times \frac{6.022 \times 10^{23}\ \text{atom}}{1\ \text{mol}}$

$= \frac{6.022 \times 10^{23}}{4}$ atoms

- Atomic mass = 12.01 u
- Molar mass = 12.01 g/mol
- 1 mol atom = 6.022×10^{23} atoms

H.W: 29.5 $\frac{dm}{s}$ = ? $\frac{Km}{h}$

1 Km = 1000 m
1 m = 10 dm
1 h = 60 d
1 d = 60 s

$29.5 \frac{dm}{s} \times \frac{60 s}{1 d} \times \frac{1 m}{10 dm}$

$29.5 \times 6 \frac{m}{d} \times \frac{1 Km}{1000 m} \times \frac{60 d}{1 h}$

$29.5 \times 36 \times 10^{-2} \frac{Km}{h} = 29.5 \times .36 \frac{Km}{h} = 10.62 \frac{Km}{h}$

Chapter 2 X

CHAPTER 3 :- (The mole and stoichiometry)

molecule : جزيء (more than one atom) Like H_2O and O_2

Atomic mass : الكتلة الذرية

What is the atomic mass for carbon?

12 u ← وحدة ذرية مختارة بالنسبة لـ C

u وحدة

1 mol = عدد أفوكادرو = 6.022×10^{23}

1 mol of atoms = 6.022×10^{23} atom

Molar mass : الكتلة المولية (g/mol)

Molecular mass : الكتلة الجزيئية

How much is the molecule mass for H_2O?

$2 \times 1 + 16 = 18$ u

molar mass = 18 g / mol

How much is the molecular mass for CH_4?

Atomic mass → 12.01 (C), 1 (H)

Molecular mass = (12.01) x 1 + (1) x 4

= 12.01 + 4

≈ 16 u

Molar mass = 16 g/mol

1 mol (CH_4) = 6.022×10^{23} molecular

Ex (3.5): If we have 0.864 mol (P) How many mol of $Ca_3(PO_4)_2$?

$Ca_3(PO_4)_2$

3, 2, 8

$\frac{3 \text{ mol Ca}}{1 \text{ mol } Ca_3(PO_4)_2}$ or $\frac{1 \text{ mol } Ca_3(PO_4)_2}{3 \text{ mol Ca}}$; $\frac{8 \text{ mol O}}{1 \text{ mol } Ca_3(PO_4)_2}$ or $\frac{1 \text{ mol } Ca_3(PO_4)_2}{8 \text{ mol O}}$

$\frac{2 \text{ mol P}}{1 \text{ mol } Ca_3(PO_4)_2}$ or $\frac{1 \text{ mol } Ca_3(PO_4)_2}{2 \text{ mol P}}$

0.432

$0.864 \text{ mol (P)} \times \frac{1 \text{ mol } Ca_3(PO_4)_2}{2 \text{ mol (P)}} = 0.432 \text{ mol } Ca_3(PO_4)_2$

Ex (3.7):

1) How much mol of Al equal 0.0774 mol of $Al_2(SO_4)_3$?

$\frac{1 \text{ mol } Al_2(SO_4)_3}{2 \text{ mol Al}}$ or $\frac{2 \text{ mol Al}}{1 \text{ mol } Al_2(SO_4)_3}$

Al: $0.0774 \text{ mol } Al_2(SO_4)_3 \times \frac{2 \text{ mol Al}}{1 \text{ mol } Al_2(SO_4)_3} = 0.1116 \text{ mol Al}$

2) How much mol of O equal 0.0774 mol of $Al_2(SO_4)_3$?

$\frac{12 \text{ mol O}}{1 \text{ mol } Al_2(SO_4)_3}$ or $\frac{1 \text{ mol } Al_2(SO_4)_3}{12 \text{ mol O}}$

$0.0774 \text{ mol } Al_2(SO_4)_3 \times \frac{12 \text{ mol O}}{1 \text{ mol } Al_2(SO_4)_3} = 5.59 \times 10^{23} \text{ mol}$

Ex: How much gram of Zn there is in 8.85×10^{24} atom of Zn?

1 mol = 6.022×10^{23} atom

1 mol = 65.41 g/mol (molar mass)

$$8.85 \times 10^{24} \text{ atom Zn} \times \frac{1 \text{ mol}}{6.022 \times 10^{23} \text{ atom}} = \frac{8.85 \times 10^{24}}{6.022 \times 10^{23}} \text{ mol}$$

$$\frac{8.85 \times 10^{24} \text{ mol}}{6.022 \times 10^{23}} \times \frac{65.41 \text{ g}}{\text{mol}} = 961 \text{ g of Zn}$$

Ex (3.10): How much gram of Fe there is in Fe_2O_3 if the O is 25.6 g?

1 Molecular of Fe_2O_3 has → 2 atoms of Fe, 3 atoms of O

1 mol of Fe_2O_3 has → 2 mols of Fe, 3 mols of O

Molar mass → O = 16 g/mol Fe = 26.9 g/mol → ∴ Libre

$$25.6 \text{ g O} \times \frac{1 \text{ mol (O)}}{16 \text{ g (O)}} = \frac{25.6}{16} \text{ mol (O)} \times \frac{2 \text{ mol Fe}}{3 \text{ mol (O)}}$$

$$= \frac{25.6 \times 2}{16 \times 3} \text{ mol Fe} \times \frac{26.9 \text{ g Fe}}{1 \text{ mol Fe}}$$

$$= \boxed{\frac{25.6 \times 2}{16 \times 3} \times 26.9 \text{ g of Fe}}$$

g(A) → g(B)

$$\text{g(A)} \times \frac{\text{mol A}}{\text{g A}} \text{ (molar mass)} = \text{mol A} \times \frac{\text{mol B}}{\text{mol A}} = \text{mol B} \times \frac{\text{g B}}{\text{mol B}} \text{ (molar mass)}$$

* (g ① mol) ~ (mol ② g) = g (B)

Mass % :- (النسبة المئوية الكتلية)

A + B + C $\overset{?}{=}$ A%

$\frac{\text{mass of A}}{\text{Total mass (A+B+C)}} \times 100\%$

Ex (3.12):

0.546 g of compound

0.2012 g of N (مثلا) 0.3450 g of O

How much is N% and O%?

$\frac{0.2012\ g\ N}{(0.2012)+(0.3450)} \times 100\% =$

$\frac{0.2012\ g\ (N)}{0.546} \times 100\% = 36.84\%\ (N)$

$100 - 36.84 = 63.16\%\ (O)$

Ex (3.14): How much is %N and %O in N_2O if the Molar mass for O = 16 g/mol and for N = 14 g/mol?

The total molar mass = $2 \times 14 + 16 = 44$ g/mol

$\%N = \frac{14 \times 2}{44} \times 100\% = 64\%$

$\%O = 100\% - 64\% = 36\%$

Ex (3.8): Is the mass% of N% = 25.9% and in O% = 74.06% in N_2O_5 if the molar mas for N = 14 and O = 16 ?

Total mass of $N_2O_5 = 2 \times 14 + 5 \times 16 = 108$

$\%N = \frac{2 \times 14}{108} \times 100\% = 25.9\%$ so it's true

Five Apple

Empirical Formula: (الصيغة الأولية)

Ex (3.16): 1.525 g → [N, H] N → 1.333 g what is the empirical formula?

mass of H = 1.525 − 1.333 = 0.192 g H

Molar mass: N = 14.0 g/mol
H = 1.008 g/mol

$1.333\ g\ N \times \frac{1\ mol\ N}{14\ g\ N} = \frac{1.333}{14}\ mol\ N = 0.0952\ mol\ N$

$0.192\ g\ H \times \frac{1\ mol\ H}{1.008\ g\ H} = \frac{0.192}{1.008}\ mol\ H = 0.190\ mol\ H$

N	H
$\frac{0.0952}{0.0952}$	$\frac{.190}{0.0952}$
1	2

NH_2

Ex (3.21): 81.79 % C and 6.10 % H and O find the Empirical formula:

100 − (81.79 + 6.10) = 12.11 % O

Molar mass: C = 12.01 g/mol H = 1.008 g/mol O = 16 g/mol

بس يعطيني بالسؤال نسبة مئوية بفرض أن الكتلة الكلية = 100 وكل نسبة هي كتلة

$81.79\ g\ C \times \frac{1\ mol\ C}{12.01\ g\ C}$

$= \frac{81.79}{12.01}\ mol\ C = 6.810\ mol\ C$

$\frac{2 \times 3.027}{18.015}$ mol H $\times \frac{1.008 \text{ g H}}{1 \text{ mol H}} = 0.3874 \text{ g H}$

$5.048 - (2.021 + 0.3874) = 2.640 \text{ g O}$

g → mol

$2.021 \text{ g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} = 0.168 \text{ mol C}$

$0.3879 \text{ g H} \times \frac{1 \text{ mol H}}{1.008 \text{ g H}} = 0.384 \text{ mol H}$

$2.640 \text{ g O} \times \frac{1 \text{ mol O}}{16 \text{ g O}} = 0.165 \text{ mol O}$

C	H	O
$\frac{0.168}{0.165}$	$\frac{0.384}{0.165}$	$\frac{0.165}{0.165}$
1.02	2.33	1
(1 تقريب)	(2.33 لا تقريب)	1) x 2
2	4.66 (لا تقريب)	2
(1	2.33	1) x 3
3	6.99 (تقريب)	3
3	7	3

$C_3 H_7 O_3$

$6.10\ g\ H \times \frac{1\ mol\ H}{1.008\ g\ H} = \frac{6.10}{1.008}\ mol\ H = 6.052\ mol\ H$

$12.11\ g\ O \times \frac{1\ mol\ O}{16\ g\ O} = \frac{12.11}{16}\ mol\ O = 2.7569\ mol\ O$

C	H	O
$\frac{6.816}{0.7569}$	$\frac{6.052}{0.7569}$	$\frac{0.7569}{0.7569}$
9	8	1

C_9H_8O

Compound (C, H, O) + O_2 ⟶ CO_2 + H_2O (نواتج)

Ex (3.23):

Compound + O_2 ⟶ CO_2 + H_2O

5.048 g — 7.406 g — 3.027 g

molar mass: $CO_2 = 44.01$ $H_2O = 18.015$ $C = 12.01$ $H = 1.008$ $O = 16$

find the empirical formula of the compound:

$7.406\ g\ CO_2 \times \frac{1\ mol\ CO_2}{44.01\ g\ CO_2} = \frac{7.406}{44.01}\ mol\ CO_2$

$\frac{7.406}{44.01}\ mol\ CO_2 \times \frac{1\ mol\ C}{1\ mol\ CO_2} = \frac{7.406}{44.01}\ mol\ C = 2.021\ g\ C$

$3.027\ g\ H_2O \times \frac{1\ mol\ H_2O}{18.015\ g\ H_2O} = \frac{3.027}{18.015}\ mol\ H_2O$

$\frac{3.027}{18.015}\ mol\ H_2O \times \frac{2\ mol\ H}{1\ mol\ H_2O} = \frac{2 \times 3.027}{18.015}\ mol\ H$

If the molar mass of $C_3H_7O_3 = 182$ is $C_3H_7O_3$ molecular formula?

$C_3H_7O_3$ molar mass $= 3\times12 + 7\times1 + 16\times3 = 91$

$91 \neq 182$ so it's not a molecular formula

$\frac{182}{91} = 2 \longrightarrow 2(C_3H_7O_3)$

Molecular mass $\longrightarrow C_6H_{14}O_6$

Ex: Fe_2O_3 if the molar mass of it is 272g/mol and the molecular formula is Fe_2O_3?

molar mass $= 2\times55.8 + 3\times16 = 136 \rightsquigarrow \frac{272}{136} = 2(Fe_2O_3)$

Empirical formula of a compound C_2H_5 and the molar mass is 145 what is the molecular formula?

$2\times12 + 5\times1 = 29 \rightsquigarrow \frac{145}{29} = 5$

$5\times(C_2H_5) \longrightarrow C_{10}H_{25}$

Stoichiometry and Chemical equations:-

$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$ (موزونة Balanced equation)

reactants ↓ products

$Zn + 2HCl \longrightarrow ZnCl_2 + H_2$

Ex (3.25):

$3\,Ba(NO_3)_2 + 2\,(NH_4)_3PO_4 \longrightarrow Ba_3(PO_4)_2 + 6\,NH_4NO_3$

$\left(C_8H_{18} + \frac{25}{2}O_2 \longrightarrow 8CO_2 + 9H_2O\right) \times 2$

$2\,C_8H_{18} + 25\,O_2 \longrightarrow 16\,CO_2 + 18\,H_2O$

$C_3H_8 + 5\,O_2 \longrightarrow 3\,CO_2 + 4\,H_2O$

$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

$3NaOH + H_3PO_4 \longrightarrow Na_3PO_4 + 3H_2O$

$Mg(OH)_2 + 2HCl \longrightarrow MgCl_2 + 2H_2O$

Ex (3.28): $2\,SO_{2(g)} + O_{2(g)} \longrightarrow 2\,SO_{3(g)}$ How many mol of O_2 if there is 6.67 mol SO_3 ?

$6.67 \text{ mol } SO_3 \times \frac{1 \text{ mol } O_2}{2 \text{ mol } SO_3} = \frac{6.67}{2} \text{ mol } O_2 =$

$\frac{6.67}{2}$ mol O_2 =

Ex (3.31): $CaCO_{3(s)} \longrightarrow CaO + CO_{2(g)}$

56.08 g/mol, 44.01 g/mol

1.50×10^2 g, ?? g

$1.50 \times 10^2 \text{ g CaO} \times \frac{1 \text{ mol CaO}}{56.08 \text{ g CaO}} = \frac{1.50 \times 10^2}{56.08} \text{ mol CaO}$

$\frac{1.50 \times 10^2}{56.08} \text{ mol CaO} \times \frac{1 \text{ mol } CO_2}{1 \text{ mol CaO}} = \frac{1.50 \times 10^2}{56.08} \text{ mol } CO_2$

$\frac{1.50 \times 10^2}{56.08} \text{ mol } CO_2 \times \frac{44.01 \text{ g } CO_2}{1 \text{ mol } CO_2} = 118 \text{ g } CO_2$

Five Apple

Limiting Reactant :-

excess (زيادة) — Limiting reactant

$2H_2 + O_2 \longrightarrow 2H_2O$

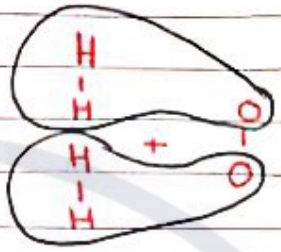
2 mol + 1 mol → 2 mol

4 mol + 2 mol → 4 mol

8 mol + 4 mol → 8 mol

4 mol + 1 mol → 1 mol

8 mol + 1 mol → 1 mol



$= 2H_2O$

Ex: (3.32)

100.0872 g/mol — 36.4614 g/mol — 44.01 g/mol

$CaCO_{3(s)} + 2HCl_{(aq)} \longrightarrow CO_{2(aq)} + CaCl_2$

125 g — 125 g — g = ??

$125\ g\ CaCO_3 \times \frac{1\ mol\ CaCO_3}{100.0872\ g\ CaCO_3} = \frac{125}{100.0872}\ mol\ CaCO_3$

$\frac{125}{100.0872}\ mol\ CaCO_3 \times \frac{1\ mol\ CO_2}{1\ mol\ CaCO_3} = \frac{125}{100.0872}\ mol\ CO_2$

$\frac{125}{100.0872}\ mol\ CO_2 \times \frac{44.01\ g\ CO_2}{1\ mol\ CO_2} = \boxed{55\ g\ CO_2}$

$125\ g\ HCl \times \frac{1\ mol\ HCl}{36.4614\ g\ HCl} = \frac{125}{36.4614}\ mol\ HCl$

$\frac{125}{36.4614}\ mol\ HCl \times \frac{1\ mol\ CO_2}{2\ mol\ HCl} = \frac{125}{36.4614 \times 2}\ mol\ CO_2$

$\frac{125}{36.4614 \times 2}\ mol\ CO_2 \times \frac{44.01\ g\ CO_2}{1\ mol\ CO_2} = \boxed{75.4\ g\ CO_2}$

The Limiting Reactant : $CO_2 = 55\ g$

Percentage yield = $\frac{\text{Actual}}{\text{Theoretical}} \times 100\%$

(Actual: ناتج التجربة — Theoretical: ناتج العمل)

If the Actual = 32

$\frac{32}{55} \times 100\% = 63\%$

Five Apple

$1.6 \text{ mol } MgCl_2 \times \frac{95.21 \text{ g } MgCl_2}{1 \text{ mol } MgCl_2} = \boxed{8.3 \text{ g } MgCl_2}$

$155 \text{ g } FeCl_3 \times \frac{3 \text{ mol } MgCl_2}{2 \text{ mol } FeCl_3} \times \frac{1 \text{ mol } FeCl_3}{162.2 \text{ g } FeCl_3} =$

$1.43 \text{ mol } MgCl_2 \times \frac{95.21 \text{ g } MgCl_2}{1 \text{ mol } MgCl_2} = \boxed{136 \text{ g } MgCl_2}$

(A)

Questions:-

1) 0.05630170 How many significant figures? 7

2) (3.862 x 1.5630) - 5.98 =

A) .056 B) 0.05646 C) .06 D) .0565 e) 0.056462

3) 25 cm → mm

1 cm = 10 mm

$25\,cm \times \frac{10\,mm}{1\,cm} = 250\,mm$

4) 19.5 g $K_2Cr_2O_7$ How many g K?

Molar mass: K = 39.09 $K_2Cr_2O_7$ = 294.09

$19.5\,g\,K_2Cr_2O_7 \times \frac{1\,mol\,K_2Cr_2O_7}{294.09\,g\,K_2Cr_2O_7} \times \frac{2\,mol\,K}{1\,mol\,K_2Cr_2O_7} =$

$\frac{19.5 \times 2}{294.09}\,mol\,K \times \frac{39.09\,g\,K}{1\,mol\,K} =$ **5.18 g K**

5) $Ca_3(PO_4)_2 \cdot 3H_2O$ is 10 g How many atoms of O If the molar mass of $Ca_3(PO_4)_2 \cdot 3H_2O$ is 364.3 g/mol?

$10\,g\,Ca_3(PO_4)_2 \cdot 3H_2O \times \frac{1\,mol\,Ca_3(PO_4)_2 \cdot 3H_2O}{364.3\,g\,Ca_3(PO_4)_2 \cdot 3H_2O} =$

$\frac{10}{364.3}\,mol\,Ca_3(PO_4)_2 \cdot 3H_2O \times \frac{11\,mol\,O}{1\,mol\,Ca_3(PO_4)_2 \cdot 3H_2O} =$

$\frac{10 \times 11}{364.3}\,mol\,O \times \frac{6.022 \times 10^{23}\,atom\,O}{1\,mol\,O} =$

1.82×10^{23} atoms of O

6) Compound of Br and F Contains 58.37% Br what is the Empirical formula?

نفرض أن كتلة المركب = 100 g

نفرض أن كتلة Br = 58.37 g

100 - 58.37 = 41.63 g F

Molar mass : Br = 79.9 g/mol F = 19.9 g/mol

$58.37\ g\ Br \times \frac{1\ mol\ Br}{79.9\ g\ Br} = \frac{58.37}{79.9}\ mol\ Br = 0.7305\ mol\ Br$

$41.63\ g\ F \times \frac{1\ mol\ F}{19.9\ g\ F} = 2.09\ mol\ F$

Br	F
$\frac{0.7305}{0.7305}$	$\frac{2.09}{0.7305}$
1	3

BrF_3

H.W: $3Mg + 2FeCl_3 \longrightarrow 3MgCl_2 + 2Fe$

41.0 g, 155 g, g = ?

Molar mass : Mg = 24.31 g/mol $FeCl_2$ = 162.2 g/mol

MgCl = 95.21 g/mol

A) 136 b) 146 c) 128 d) 154 e) 161

$41\ g\ Mg \times \frac{1\ mol\ Mg}{24.31\ g\ Mg} \times \frac{3\ Mol\ MgCl_2}{3\ mol\ Mg} = 1.6\ mol\ MgCl_2$

Five Apple

CHAPTER 4: (aqueous solutions)

Solution

Solute — مذاب — Solid / Liquid / gas — NaCl C_2H_5OH CO_2

Solvent — مذيب

$NaCl_{(s)} \xrightarrow{H_2O} Na^+_{(aq)} + Cl^-_{(aq)}$ (electrolyte) كهرلي

ذائب متأين ولا

$C_{12}H_{22}O_{11(s)} \xrightarrow{H_2O} C_{12}H_{22}O_{11(aq)}$ (non-electrolyte)

ذائب غير متأين ولا

$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$ (weak-electrolyte)

تأين ضعيف ولا

$CaCl_{2(s)} \xrightarrow{H_2O} Ca^{+2}_{(aq)} + 2Cl^-_{(aq)}$

$Na_2SO_{4(s)} \xrightarrow{H_2O} 2Na^+_{(aq)} + SO_4^{-2}{}_{(aq)}$

$K_3PO_4(s) \xrightarrow{H_2O} 3K^+(aq) + PO_4^{-3}(aq)$

Equations For Ionic Reactions:-

$Pb(NO_3)_2(aq) + 2KI(aq) \longrightarrow PbI_2(s) + 2KNO_3(aq)$

↳ precipitate (مترسب)

↳ metathesis reaction (إحلال مزدوج)

↳ molecular equation (معادلة جزيئية)

$Pb^{+2}(aq) + 2NO_3^-(aq) + 2K^+(aq) + 2I^-(aq) \longrightarrow PbI_2(s) + 2K^+(aq) + 2NO_3^-(aq)$

↳ Ionic equation (معادلة أيونية)

$Pb^{+2}(aq) + 2I^-(aq) \longrightarrow PbI_2(s)$

Spectator Ions (أيونات متفرجة)

↳ Net Ionic equation (NIE)

Ex (4.3):

$(NH_4)_2SO_4(aq) + Ba(NO_3)_2(aq) \longrightarrow 2NH_4NO_3(aq) + BaSO_4(s)$

↳ molecular equation

$2NH_4^+(aq) + SO_4^{-2}(aq) + Ba^{+2}(aq) + 2NO_3^-(aq) \longrightarrow 2NH_4^+(aq) + 2NO_3^-(aq) + BaSO_4(s)$

↳ Ionic equation

$SO_4^{-2}(aq) + Ba^{+2}(aq) \longrightarrow BaSO_4(s)$

↳ Net Ionic equation

Ex (4.4):

$CdCl_2(aq) + Na_2S(aq) \longrightarrow NaCl(aq) + CdS(s)$

$Cd^{+2}_{(aq)} + 2Cl^{-}_{(aq)} + 2Na^{+}_{(aq)} + S^{-2}_{(aq)} \longrightarrow CdS_{(s)} + 2Na^{+}_{(aq)} + 2Cl^{-}_{(aq)}$

$Cd^{+2}_{(aq)} + S^{-2}_{(aq)} \longrightarrow CdS_{(s)}$

قوانين الإذابة:

1. عناصر المجموعة الأولى إن وجدت في مركب فهو دائمًا ذائب.
2. NH_4^+ / CH_3COO^- / ClO_3^- / ClO_4^- / NO_3^- إن وجدت في المركب فهو ذائب.
3. عناصر المجموعة السابعة (I^- / Br^- / Cl^-) إن وجدت في المركب فهو ذائب إلا إذا ارتبطت مع (Hg_2^{+2} / Pb^{+2} / Ag^+).
4. SO_4^{-2} دائمًا ذائبة إلا إذا ارتبطت مع (Hg_2^{+2} / Pb^{+2} / Ag^+) وإذا ارتبطت مع عناصر المجموعة الثانية باستثناء (Be / Mg)

II

Be, Mg } + SO_4 (ذائب)

Ca, : , Ba } + SO_4 (غير ذائب)

5. المركبات التي تحتوي على (OH^-) غير ذائبة إلا إذا ارتبطت مع عناصر المجموعة الأولى وعناصر المجموعة الثانية باستثناء (Mg / Be) تصبح ذائبة.

($Mg(OH)_2$ / $Be(OH)_2$) ← غير ذائب

NH_4OH ← ذائب

6. S^{-2} / CO_3^{-2} / SO_3^{-2} / PO_4^{-3} دائمًا غير ذائبة إلا إذا ارتبطت مع عناصر المجموعة الأولى و الأيونيا NH_4 تصبح ذائبة

7. NH_4 دائما ذائبة

Ex:

$AgNO_3$ ← ذائب	$Fe_2(SO_4)_3$ ← ذائب
$(NH_4)_2CO_3$ ← ذائب	$Pb(NO_3)_2$ ← ذائب
$NiSO_4$ ← ذائب	$Ni(OH)_2$ ← غير ذائب
$Al(OH)_3$ ← غير ذائب	$MgCl_2$ ← ذائب
	$Al_2(SO_4)_3$ ← ذائب

Five Apple

$NaCl_{(aq)} + KNO_{3(aq)} \longrightarrow NaNO_{3(aq)} + KCl_{(aq)}$ ← No reaction

Because:

$Na^+ + Cl^- + K^+ + NO_3^- \longrightarrow Na^+ + NO_3^- + K^+ + Cl^-$

So No reaction

Acid - Basic Reactions:-

Strong acids: HCl / HI / $HClO_4$ / H_2SO_4 / HNO_3 / HBr / $HClO_3$

$$HCl \xrightarrow{H_2O} H^+ + Cl^-$$

weak acid ← (HF) $\rightleftharpoons H^+ + F^-$

Strong Basic: NaOH / KOH / $Ba(OH)_2$ / $Ca(OH)_2$

$$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$$

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

Strong acid: $HX \longrightarrow H^+ + X^-$

↳ mono protic (أحادي البروتون)

weak acid: $HA \rightleftharpoons H^+ + A^-$

Strong Basic: $M(OH)_n \longrightarrow M^{+n} + n(OH^-)$

weak Basic: $B + H_2O \rightleftharpoons BH^+ + OH^-$

Ex (4.7): $(C_2H_5)_3N + H_2O \rightleftharpoons (C_2H_5)_3NH^+ + OH^-$

$H_2SO_4 \longrightarrow HSO_4^- + H^+$ (Poly protic ثنائي البروتون)

$HSO_4^- \longrightarrow SO_4^{-2} + H^+$

$NaHSO_4$ ← acid Salt

الأكاسيد:

$Na_2O + H_2O \longrightarrow 2NaOH$

$CO_2 + H_2O \longrightarrow H_2CO_3$

$NO_2 + H_2O \longrightarrow HNO_3$

$SO_2 + H_2O \longrightarrow H_2SO_3$

أكسيد الفلز + H_2O ← Basic Reaction

أكسيد اللافلز + H_2O ← acid reaction

تفاعلة متزنة حمض قوي

$HCl_{(aq)} + NaOH_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$

$H^+_{(aq)} + Cl^-_{(aq)} + Na^+_{(aq)} + OH^-_{(aq)} \longrightarrow Na^+_{(aq)} + Cl^-_{(aq)} + H_2O_{(l)}$

$H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$

$Ca(OH)_{2(aq)} + 2HCl_{(aq)} \longrightarrow 2H_2O_{(l)} + CaCl_{2(aq)}$

$Ca^{+2}_{(aq)} + 2OH^-_{(aq)} + 2H^+_{(aq)} + 2Cl^-_{(aq)} \longrightarrow 2H_2O_{(l)} + Ca^{+2}_{(aq)} + 2Cl^-_{(aq)}$

$\frac{2}{2}OH^-_{(aq)} + \frac{2}{2}H^+_{(aq)} \longrightarrow \frac{2}{2}H_2O_{(l)}$

$OH^- + H^+ \longrightarrow H_2O$

حمض ضعيف وقاعدة قوية

$CH_3COOH_{(aq)} + NaOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$

$CH_3COOH_{(aq)} + Na^+_{(aq)} + OH^-_{(aq)} \longrightarrow CH_3COO^-_{(aq)} + Na^+_{(aq)} + H_2O_{(l)}$

$CH_3COOH_{(aq)} + OH^-_{(aq)} \longrightarrow CH_3COO^-_{(aq)} + H_2O_{(l)}$

$HCl_{(aq)} + NH_{3(g)} \longrightarrow NH_4Cl_{(aq)}$

$H^+_{(aq)} + Cl^-_{(aq)} + NH_{3(aq)} \longrightarrow NH_4^+_{(aq)} + Cl^-_{(aq)}$

$NH_3 + H^+ \longrightarrow NH_4^+$

$HCl + NaHCO_3 \longrightarrow NaCl + H_2CO_3$

$H_2CO_3 \longrightarrow H_2O_{(l)} + CO_{2(g)}$ (غاز ← غازات + ماء)

$SO_2 + H_2O \longrightarrow H_2SO_3$ (Acid rains)

$$\text{Molarity (M)} = \frac{\text{N. mol. Solute}}{\text{Volume of solvent}} \left(\frac{mol}{L}\right)$$

0.1 mol (NaCl) $\Longrightarrow$ $\frac{0.1 \text{ mol NaCl}}{1 \text{ L}}$

0.1 mol NaCl and 100 mL

$$M = \frac{0.1 \text{ mol NaCl}}{100 \text{ mL} \times \frac{10^{-3} \text{ L}}{\text{mL}}} = 1 M$$

Ex: 1.461 g NaCl in 250.0 mL ?? Molarity of NaCl if the molar mass of NaCl = 58.5 g/mol

$$1.461 \text{ g NaCl} \times \frac{1 \text{ mol NaCl}}{58.5 \text{ g NaCl}}$$

$$\frac{1.461}{58.5} \text{ mol NaCl} \times \frac{1}{250 \text{ mL} \times 10^{-3} \frac{\text{L}}{\text{mL}}} = 0.1000 \frac{M}{L}$$

Ex: 0.20 mol NaCl in 0.50 L sol (M=??):

$M = \frac{2}{5} = .4\ M$

Ex (4.25): M=?? 2.75 g KI in 125 mL the molar mass is 165.9 g/mol:

$2.75\ g\ KI \times \frac{1\ mol\ KI}{165.9\ g\ KI} \times \frac{L}{125 \times 10^{-3}\ mL \times \frac{L}{mL}} = 0.133\ M$

Ex (4.29): g($AgNO_3$) = ?? 250.0 mL of 0.0125 M ($AgNO_3$)

$0.0125\ \frac{M}{L} = \frac{mol\ AgNO_3}{250 \times 10^{-3}\ mL \times \frac{L}{mL}} = 0.0125 \times 250 \times 10^{-3}\ mol\ AgNO_3$

The molar mass is 169.87 g/mol

$0.0125 \times 250 \times 10^{-3}\ mol\ AgNO_3 \times \frac{169.87\ g\ AgNO_3}{mol\ AgNO_3} = 0.531\ g\ of\ AgNO_3$

Dilution of Solutes:-

Number of moles after dilution = Number of mol (Solute) before dilution

$M_{d.l} \times V_{dil} = M_{con} \times V_{con}$

$M_{d.l}$: molarity, V_{dil}: Volume

$M_{con} \times V_{con}$: بعد التركيز

Ex: (4.31) $V_F^{Final} = ??$ 100 mL of 0.125 M H_2SO_4 → 0.0500 M H_2SO_4

$M_{d.l} \times V_{d.l} = M_{con} \times V_{con}$

$0.0500 \times V_F = 0.125 \times 100$ $V_F = 250\ mL$

Five Apple

Ex (4.32): mL = ?? to 150 mL of .5 M HCl to reduce con to be 0.10 M:

$M_{dil} \times V_{dil} = M_{con} \times V_{con}$

$0.10 \times V_{dil} = 0.5 \times 150$

$V_{dil} = 750$ mL

$750 - 150 = 600$ mL → of H_2O to reduce

Solution Stoichiometry:-

Ex (4.33): mL = ?? of 0.0475 M H_3PO_4 + 45 mL of 0.1 M KOH:

$M = \frac{mol}{L}$

$H_3PO_4 + 3KOH \longrightarrow K_3PO_4 + 3H_2O$

0.0475 M — 0.1 M

?? mL — 45 mL

$0.1 \frac{mol\ KOH}{L} \times 45\ mL \times 10^{-3} \times \frac{L}{mL} = 45 \times 10^{-4}$ mol KOH

$45 \times 10^{-4}\ mol\ KOH \times \frac{mol\ H_3PO_4}{3\ mol\ KOH} = 15 \times 10^{-4}$ mol H_3PO_4

$M = \frac{mol\ KOH}{L\ KOH}$

$0.0475\ M = \frac{15 \times 10^{-4}\ mol\ H_3PO_4}{L \times 10^3 \times \frac{mL}{L}} = \frac{15 \times 10^{-4}}{0.0475 \times 10^3}$ mL

Concentration of electrolytic solutions:-

$NaCl \longrightarrow Na^+ + Cl^-$

1 mol — 1 mol — 1 mol

1 M — ? — ?

Ex: 0.20 M $Al_2(SO_4)_3$ Al^{+3} = ? SO_4^{-2} = ?

$Al_2(SO_4)_3 \longrightarrow 2Al^{+3} + 3SO_4^{-2}$

0.20 M | 2 × 0.20 | 3 × 0.20

0.2 M | 0.4 M | 0.6 M

Q (4.36): PO_4^{-3} = 0.250 M Na^+ ? ? in Na_3PO_4

$Na_3PO_4 \longrightarrow 3Na^+ + PO_4^{-3}$

0.25 M | 3(0.25) M | 0.25 M

0.25 M | 0.75 M | 0.25 M

Ex (4.37): 18.4 mL of 0.100 M $AgNO_3$ + $CaCl_2$ (20.5) mL

M = ??

$2AgNO_3 + CaCl_2 \longrightarrow 2AgCl + Ca(NO_3)_2$

0.100 M | ? ? M

18.4 mL | 20.5 mL

$\frac{0.1 \text{ mol } AgNO_3}{1 \text{ L sol}} \times 18.4 \times 10^{-3} \text{ mL} \times \frac{1 \text{ L}}{\text{mL}} \times \frac{1 \text{ mol } CaCl_2}{2 \text{ mol } AgNO_3}$

$\frac{0.1 \times 18.4 \times 10^{-3}}{2}$ mol $CaCl_2$

$M = \frac{\text{Mol } CaCl_2}{\text{L } CaCl_2}$

$= \frac{9.2 \times 10^{-4}}{20.5 \times 10^{3} \text{ mL} \times \frac{\text{L}}{\text{mL}}}$

$= 0.0449$ M

CHAPTER 5: (Oxidation - Reduction Reactions)

تفاعلات الأكسدة و الاختزال

$\overset{0}{2Na} + \overset{0}{Cl_2} \longrightarrow 2NaCl$

Cl_2 ← oxidizing agent (عامل مؤكسد)

Na ← reducing agent (عامل مختزل)

$2Na \longrightarrow 2Na^+ + 2\cancel{e}$ oxidation نصف تفاعل

$Cl_2 + 2\cancel{e} \longrightarrow 2Cl^-$ Reduction نصف تفاعل

$2Na + Cl_2 \longrightarrow 2Na^+ + 2Cl^-$

Oxidation numbers:

F ← أعلى كهروسلبية دائماً شحنتها (-1)

H ← دائماً شحنتها (+1) إلا إذا ارتبط بالفلزات

$\overset{+1}{2K}\overset{-1}{Cl} + \overset{+4}{Mn}\overset{-2}{O_2} + \overset{+1}{2H_2}\overset{+6}{S}\overset{-2}{O_4} \longrightarrow \overset{+1}{K_2}\overset{+6}{S}\overset{-2}{O_4} + \overset{+2}{Mn}\overset{+6}{S}\overset{-2}{O_4} + \overset{0}{Cl_2} + 2\overset{+1}{H_2}\overset{-2}{O}$

$Mn^{+4} + 2\cancel{e} \longrightarrow Mn^{+2}$ Reduction MnO_2 ← oxidizing agent

$2Cl^{-1} \longrightarrow Cl_2 + 2\cancel{e}$ oxidation $2KCl$ ← Reducing agent

$SO_4 \longrightarrow S^{+6} / O^{-2}$ always

$S_4O_6^{2-} \longrightarrow 4x + 6(-2) = -2$

$4x - 12 = -2$

$4x = 10$

$x = \frac{10}{4}$

$\boxed{x = 2.5}$

Ex (5.3):

1) $\overset{+4}{S}\overset{-2}{O_3}^{-2}$ to $\overset{+6}{S}\overset{-2}{O_4}^{2-}$ $S^{+4} \longrightarrow S^{+6}$ (oxidation)

$x - 6 = -2$

$x = +4$

2) $\overset{0}{Cl_2}$ to $\overset{+5}{Cl}O_3^-$ $\overset{0}{Cl_2} \longrightarrow Cl^{+5}$ (oxidation)

$x - 6 = -1$

$x = +5$

5.1 + (4.9/4.1/4.5) باقي الشابتر ماعدا 4.2 + All 3 + 1.6 + 1.5 + 1.4 : مادة الفيرست

(Chapter 2 x)

3) N_2O_4 to $\overset{-3}{N}\overset{+1}{H_3}$ $N^{+4} \rightarrow N^{-3}$ (Reduction)

$2x - 8 = 0$

$x = +4$

4) $\overset{+2}{Pb}\overset{-2}{O}$ to $\overset{+2}{Pb}\overset{-2}{ClO_4}$ Neither oxidation nor reduction

5) $\overset{0}{Ag}$ to $\overset{+1}{Ag_2}\overset{-2}{S}$

$Ag^{\circ} \rightarrow Ag^{+1}$ (oxidation)

انتهت مادة الفيرست

CHAPTER 6: (Energy And Chemical Change) <- الأسهل

Kinetic Energy = $\frac{1}{2}$ mass v^2 $(K \cdot g (\frac{m}{s})^2) \rightarrow J$ جول

لـ الطاقة الحركية

J = 4.184 Calori

KJ = 4.184 K Cal

Calori = 1000 caleri = 1 Kcalori

Potential Energy → طاقة الوضع

Law of Conservation of Energy: لـ قانون حفظ الطاقة

- Energy can't be created
- Energy can't be destroyed
- Energy can be change from one form to another

الطاقة لا تفنى ولا تستحدث ولكن تتغير من شكل لآخر.

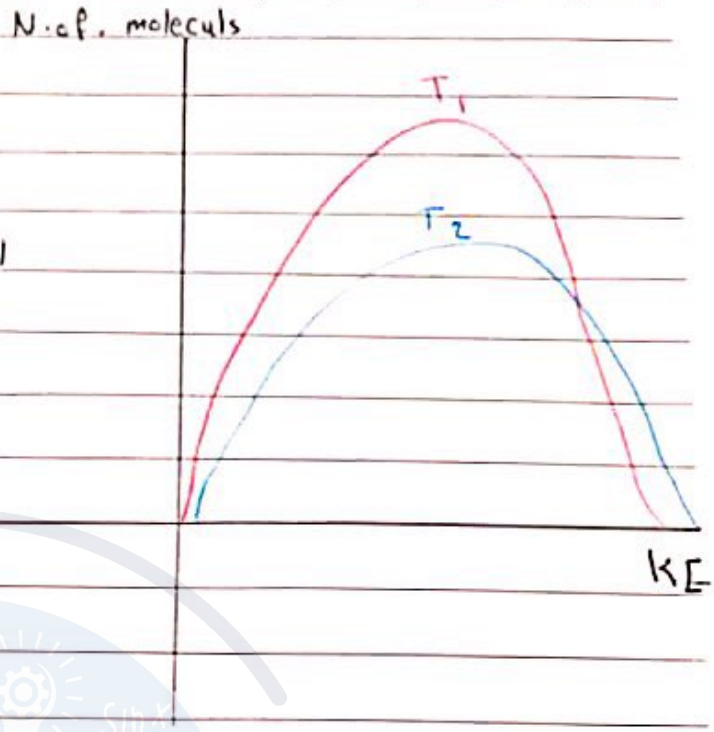
Heat (J)

Temp. (C°/K)

10	95

متغير ثابت
$\frac{1}{2}mv^2$

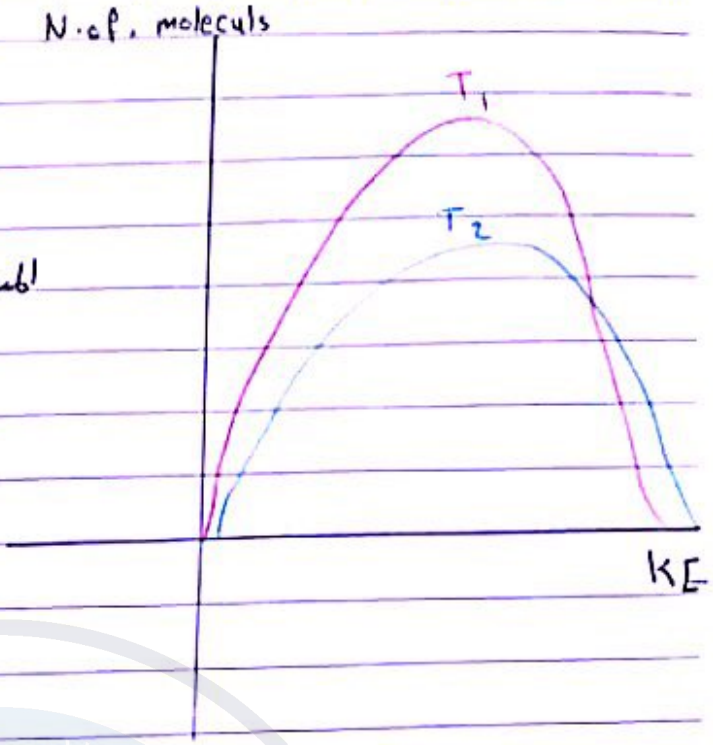
KE $\propto$ Temp.
average average



المساحة تحت منحنى T_1 = المساحة تحت منحنى T_2
(بسبب ثبات عدد الجزيئات)

$\frac{1}{2}mv^2$

KE α Temp.
average average



المساحة تحت منحنى T_1 = المساحة تحت منحنى T_2
(بسبب ثبات عدد الجزيئات)

State functions

الاقتران الذي لا يعتمد على المسار بل على حالتي النتيجة الابتدائية و النهائية وتكتسب صورة (Δf)

مثلاً:

Temp(Δt)
Energy (ΔE)

$\Delta t = t_2 - t_1$
$\Delta E = E_2 - E_1$

(6.3) Measuring Heat

System + Surrounding = universe

open	close	isolated
exchange mass and heat	exchange only heat and the mass constant	No exchange in mass and heat both are constant

Specific heat (حرارة نوعية) (S):
heat needed to raise tem. 1°C to 1g of object $\frac{J}{g \cdot deg}$

Heat Capacity (C):
heat needed to rais tem. 1°C of the all object

$C = mass \times S$

$C = g \times \frac{J}{g \cdot deg} = \frac{J}{deg}$

Heat (q) = mass x s x Δt
= C x Δt (J)

Ex: (6.4) ball → tem = 220°C
water → m = 250 g
tem = 20 °C
S = 4.184 $\frac{J}{g \cdot deg}$
t_f = 30 °C
C = ?

The heat lost from ball = heat gained by water

C x Δt = mass x S x Δt
C (220 - 30) = 250 x 4.184 x (30 - 20)
190 C = 250 x 4.184 x 10
C = 55.3 J/deg

q_{ball} = (-) because it lost heat
q_{H_2O} = (+) // // gained //
$-q_{ball} = +q_{H_2O}$
$-(C \times \Delta t) = +10460$
$C \times \Delta t = -10460$

(6.4) Energy of Chemical Reactions:
exothermic (طارد) → $-\Delta H$ (A + B → P + heat)
Endothermic (ماص) → $+\Delta H$ (C + D + heat → P)

$Zn_{(s)} + 2HCl_{(aq)} \longrightarrow ZnCl_{2(aq)} + H_{2(g)}$ تمدد (-)

لـ وجود الغاز يعني وجود شغل سالب ووجود طاقة

Compression (ضغط) ⟶ + work

Expansion (تمدد) ⟶ - work

$A_{(l)} + B_{(g)} \longrightarrow C_{(aq)}$ تتقلص (+)

Chemical Reactions

constant Volume — constant pressure

$\Delta E = q + w$

⟶ at constant Volume ∴

$V_f = V_i$ ∴ $\Delta V = 0$

$\Delta E = q - p\Delta V$

$\Delta E = q_v$ ⟶ تدل على الحجم

$C_4H_{10} + O_2 \longrightarrow CO_2 + H_2O + heat$ (تتفاعل الثوابت)

bomb Calorimeter : أداة تقيس الحرارة عند تغير الضغط

صورتو بالكتاب ص

⟶ at constant pressure ∴

Enthalpy $\downarrow$ py ⟶ $H = E + PV$

طاقة الروابط اللي بتتكو وبتتكسر

$\Delta H = \Delta E + \Delta(PV)$

$\Delta PV = V \cdot dp + p \cdot dv$

$\Delta pV = V \cdot dp + p \cdot \Delta v$

∴ $\Delta H = \Delta E + P\Delta V + V\Delta p$

$= q - p\Delta V + p\Delta V + V\Delta p$

$= q + V\Delta p$ ⟶ at constant pressure $\Delta p = 0$

$P_f = P_i$

$\Delta H = q_p$

$\Delta E = q_{(V)}$
$\Delta H = q_{(P)}$ $\rightarrow q = m s \Delta t = C \Delta t$

Coffecup calorimeter : constant pressure

$HCl + NaOH \longrightarrow NaCl + H_2O + Heat$

Ex (6.12): 1.5 g $C_{12}H_{22}O_{11}$ molar mass = 342.3 g/mol احترق

bomb calorimeter $T_i = 24\ ^\circ C$

$C = 8.930\ KJ/deg$ $T_f = 26.77\ ^\circ C$

$\Delta E = ??\ KJ/mol$

$T_f > T_i \rightarrow$ طارد $\rightarrow -q$

$q = C \Delta t$

$= 8.930 \frac{KJ}{deg} (26.77 - 24\ ^\circ C)\ deg$

$= -24.7\ KJ$ ← دائماً في الـ bomb calorimeter لأنه احتراق

$1.5\ g \times \frac{1\ mol}{342.3\ g} = 4.26 \times 10^{-3}\ mol$

$\rightarrow \Delta E = \frac{-24.7\ KJ}{4.26 \times 10^{-3}\ mol} = \boxed{-5.08 \times 10^3 \frac{KJ}{mol}}$

→ Heat absorbed ($q+$) ماص للطاقة

Heat evolved ($q-$) طارد للطاقة

→ work done on the system (+)

work done by the System (−)

شغل خارجي

$w = -P_{ex} \Delta V \rightsquigarrow (V_f - V_i)$

$\Delta E = q + w$

في حالة التمدد ← $V_f > V_i$ ← $-w$

" " التقلص ← $V_f < V_i$ ← $+w$

Ex (6.20): gives of heat = 204 J → q = − 204 J

compress 68 J → w = + 68 J

$\Delta E = q + w$

$= -204 + 68$

$= -136$ J

Ex (6.21): 2.5 L to 26 L against press. = 4 atmos and gas press. = 26 atmos w = ??

$w = -P_{ex} \Delta V$

$= -20 \text{ atom} \times (10 - 2.5)\ L$

$= -15\ L \cdot \text{atmes}$

1 L.atom = 101.3 J

1st Law of Thermodynamics:

$\Delta E = q + w$

$\Delta E = q_v$ $q = ms\Delta t$

$= c \Delta t$

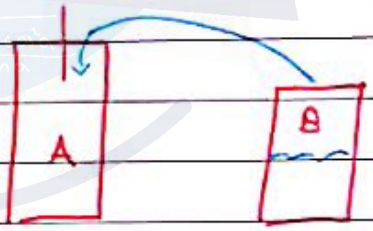
$T_i > T_f$ → endothermic

$T_f > T_i$ → exothermic

$\Delta E = q_v$

$\Delta H = q_p$

A + B = P



endothermic q = +

exothermic q = −

Ex (6.32): what is the heat in KJ/mol (HBr)?

$KOH_{(aq)} + HBr_{(aq)} \longrightarrow KBr_{(aq)} + H_2O_{(L)}$

45 mL, 1 M | 45 mL, 1 M | d = 1.0 J/mL

s = 4.18 J/deg

$T_i = 23.5\ ^\circ C$ $T_f = 30.2\ ^\circ C$

$T_i < T_f$ so it is exothermic

$q = m s \Delta t$

$= 90 \times 4.18 \times 6.7$

$= 2.5 \times 10^3$ J

$= -2.5$ KJ

No. mol of HBr $= 45\ mL \times \frac{100\ mol}{} \times 10^{-3} \frac{L}{mL}$

$= 4.5 \times 10^{-2}$ mol HBr

$\frac{-2.5\ KJ}{4.5 \times 10^{-2}\ mol} = -56$ KJ/mol HBr

Total (v) = 45+45 = 90 mL

$m = d \times v$

$= 1 \times 90 = 90$

Always for strong Basic and acid $\Delta H = -56$

يجب الانتباه لازم تعدل عشان ممكن يتغير بالأرقام الناتج يختلف

(6.7) Thermochemical Equations:

$KOH + HBr \longrightarrow KBr + H_2O \quad \Delta H^\circ = 56$ KJ

$N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)} \quad \Delta H^\circ = -92.38$ kJ

$2N_{2(g)} + 6H_{2(g)} \longrightarrow 4NH_{3(g)} \quad \Delta H^\circ = 2 \times -92.38$ KJ

ΔH° : Heat is standard conditions

(T = 25°C p = 1 atmos 1.00 M)

Ex (6.15): $CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(l)}$

$\Delta H^\circ = -890.5$ kJ

Calculate :-

1) when 3 moles CO_2 are formed :

$3CH_4 + 6O_2 \longrightarrow 3CO_2 + 6H_2O \quad \Delta H^\circ = -2672$ KJ

2) H_2O when 10 g CO_2 produced:

$10\ g\ CO_2 \times \frac{1\ mol\ CO_2}{44\ g\ CO_2} = 0.227$ mol CO_2

$\Delta H^\circ = -890.5 \frac{kJ}{mol\ CO_2} \times 0.277\ mol\ CO_2$

$= -202\ kJ$

3) $10\ g\ O_2$??

$10\ g\ O_2 \times \frac{1\ mol\ O_2}{32\ g\ O_2} = 0.313\ mol$

$-890.5 \frac{kJ}{2\ mol\ O_2} \times 0.313\ mol\ O_2 = 139\ kJ$

Hess's Law:

$A + B \longrightarrow C \quad \Delta H_1$

$C + D \longrightarrow E \quad \Delta H_2$

$A + B + D \longrightarrow E$

Ex (6.17):

$2\ C_4(s) + O_2(g) \longrightarrow 2\ C_4O_2(s) \quad \Delta H^\circ = -310\ kJ$

$2\ C_4(s) + \frac{1}{2}\ O_2(g) \longrightarrow C_4{}_2O(s) \quad \Delta H^\circ = -169\ kJ$

$C_4{}_2O(s) + \frac{1}{2}\ O_2(g) \longrightarrow 2\ C_4O(s) \quad \Delta H^\circ = ??$

$C_4{}_2O(s) \longrightarrow 2\ C_4(s) + \frac{1}{2}\ O_2(g) \quad \Delta H^\circ = +169\ kJ$

$2\ C_4(s) + \frac{1}{2} O_2(g) \longrightarrow 2\ C_4O(s) \quad \Delta H^\circ = -310\ kJ$

$C_4O(s) + \frac{1}{2}\ O_2(g) \longrightarrow 2\ C_4O(s) \quad \Delta H^\circ = -141\ kJ$

Ex: $Fe_2O_3(s) + 3\ CO(g) \longrightarrow 2\ Fe(s) + 3\ CO_2(g) \quad \Delta H^\circ = -26.7\ kJ$

$CO(g) + \frac{1}{2}\ O_2(g) \longrightarrow CO_2(g) \quad \Delta H^\circ = -283\ kJ$

$2\ Fe(s) + \frac{3}{2}\ O_2(g) \longrightarrow Fe_2O_3(s) \quad \Delta H^\circ = ??$

$2\ Fe(s) + 3\ CO_2(g) \longrightarrow Fe_2O_3(s) + 3\ CO(g) \quad \Delta H^\circ = 26.7\ kJ$

$3\ CO(g) + \frac{3}{2}\ O_2(g) \longrightarrow 3\ CO_2(g) \quad \Delta H^\circ = 3 \times -283\ kJ$

$2\ Fe(s) + \frac{3}{2}\ O_2(g) \longrightarrow Fe_2O_3(s) \quad \Delta H^\circ = 26.7 - (3 \times 283)$

$2C_{(s)} + O_{2(g)} + 2H_{2(g)} \longrightarrow CH_3COOH \quad \Delta H^\circ_f$

↳ graphite

غرافيت إذا تشكل في الظروف الطبيعية

When 1 mol of a compound is formed from it's elements in standard forms ⇝ ΔH°_f ⟶ formation heat

Ex: is ΔH° is formation ?

$2Al_{(l)} + \frac{3}{2} O_{2(g)} \longrightarrow Al_2O_{3(s)} \quad \Delta H^\circ_f X$

↳ in standard it is (s)

$H_2O_{2(l)} \longrightarrow H_2O_{(l)} + \frac{1}{2} O_{2(g)} \quad \Delta H^\circ_f X$

$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)} \quad \Delta H^\circ_f X$

↳ because it must be 1 mol

$aA + bB \longrightarrow cC + dD \quad \Delta H^\circ$

$\Delta H^\circ = \Sigma n \Delta H^\circ_f - \Sigma n \Delta H^\circ_f$

↳ of products

$c\Delta H^\circ_f C + d\Delta H^\circ_f D - (a\Delta H^\circ_f A + b\Delta H^\circ_f B)$

Ex: $2CH_3OH_{(aq)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 2H_2O_{(l)}$

ΔH°_f = −238.6 kJ/mol ; O_2 = 0 ; CO_2 = −393.5 ; H_2O = −285.7

$\Delta H^\circ = (2 \times -393.5 + 2 \times -285.7) - (2 \times -238.6 + 0 \times 3)$

ΔH°_f for pure elements at standard = 0

Chapter (7): The Quantum Mechanical Atom

(7.1) - (7.4) X

(7.5) Quantum No. of e in Atoms:

orbital : مدار

1] principal Q.N (n)

$n = 1, 2, 3, \dots \infty$

2] Secondary Q.N (L) يحدد شكل المدار الفرعي

$L = n - 1$ up to 0

shell ← Energy level

↓

sub sell

↓

الفرعي وهو مكان وجود الـ e

Ex:

$n = 1 \longrightarrow L = 0 \longrightarrow s$

$n = 2 \longrightarrow L = 1, 0 \longrightarrow s/p$

$n = 3 \longrightarrow L = 2, 1, 0 \longrightarrow s/p/d$

L شكل المدار الفرعي

0 → s ○

1 → p ∞

2 → d

3 → f

3] Magnatic Q.N (ML) يحدد اتجاه الحركة بالفضاء

$ML = -L, 0, +L$

Ex:

$L = 2 \longrightarrow ml = -2, -1, 0, +1, +2$

4] Spin Q.N (ms)

$ms = +\frac{1}{2}, -\frac{1}{2}$

عكس متاوي في الساعة مع متاوي الساعة

paoly Law: in one atom 2 e can't be same in the four Q.N it should be different in one Q.N at least.

Ex: n=1 find L/mL/ms:

n=1 → L=0(s) → mL=0 → ms = $+\frac{1}{2}, -\frac{1}{2}$

↳ in s orbital there are 2é

paramagnatic:
half filled → one é

↑é ↓é

1,0,0,$+\frac{1}{2}$ ↳ 1,0,0,$-\frac{1}{2}$

diamagnatic:
filled orbital

if n=2 → L=1,0 (s,p) → mL=+1,0,-1 → ms=$+\frac{1}{2}, -\frac{1}{2}$

↳ in p orbital there are 3é

on P_x, P_y, P_z

No. n	No. orbital	No. é
n=1	1	1
n=2	4	8
n=3	9	18
n=4	16	32
(n) →	(n^2) →	($2n^2$)

Ex (7.9): n, L ? for the following:

1) 4d — n=4 — L=2
2) 5f — n=5 — L=3
3) 7s — n=7 — L=0

Ex (7.10): what sub shells will be found in:

1) n=2 (s, p)

2) n=4 (s, p, d, f)

Ex (7.11): 1) é ?? in (d) ?

10 é

2) é ?? n = 5

$2n^2 = 2 \times 25 = 50$

important

Ex (7.12): what of the following is Acceptable ?

1) n = 2 - L = 1 - mL = 0 Acceptable

Solution:

n = 2 L = 1, 0 mL = -1, 0, +1

$m_{L_0} = 0$

2) n = 2 - L = 2 - mL = 1 un acceptable

n ≠

3) n = 2 - L = 1 - mL = -2 X

4) n = 3 L = 2 mL = -2

5) n = 0 L = 0 mL = 0 X

L = n = 1, 2, ... ∞

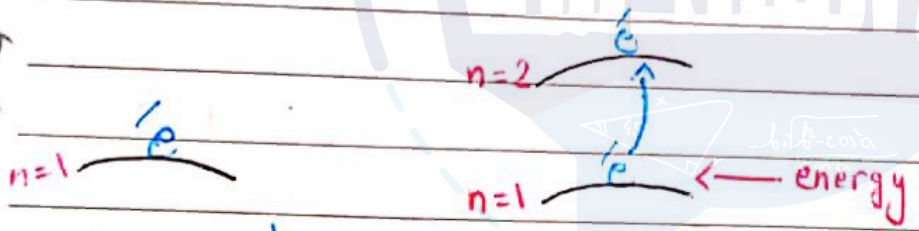
3) $n = 2 \quad L = 1 \quad m_L = -2$ ✗

4) $n = 3 \quad L = 2 \quad m_L = -2$ ✓

5) $n = 0 \quad L = 0 \quad m_L = 0$ ✗

6) $n = 1, 2, \ldots \infty$

(7.7) Energy levels and Ground State é Configuration



State ground
مستقر
Lowest energy

excited state
مستثار

^{1}H : $1s^1$ ↑ ($1s^1$)

^{2}He : $1s^1$ ⇅ ($1s^2$)

Valence é : الإلكترونات التكافؤ في المدار الأخير الأكثر طاقة . (Highest n)

^{3}Li : $1s^2\ 2s^1$ ↑ ($2s^1$)

[He] $2s^1$ → ① valence é ; ② Core é

Core é : الإلكترونات في باقي المدارات

^{4}Be : [He] $2s^2$ ⇅ ($2s^2$) dyamegnatic (paird)

^{5}B : [He] $2s^2\ 2p^1$ ⇅ ($2s^2$) ↑ _ _ ($2p^1$)

^{6}C : [He] $2s^2\ 2p^2$ ⇅ ($2s^2$) ↑ ↑ _ ($2p^2$) → Hunds Rule in p orbital

↑ ↑ ↑ ①

⇅ ⇅ ⇅ ②

^{7}N : [He] $2s^2\ 2p^3$ ⇅ ($2s^2$) ↑ ↑ ↑ ($2p^3$)

^{8}O : [He] $2s^2\ 2p^4$ ⇅ ($2s^2$) ⇅ ↑ ↑ ($2p^4$)

^{9}F : [He] $2s^2\ 2p^5$ ⇅ ($2s^2$) ⇅ ⇅ ↑ ($2p^5$) → valence é : 7 é

يساوي رقم المجموعة

^{10}Ne : [He] $2s^2\ 2p^6$ ⇅ ($2s^2$) ⇅ ⇅ ⇅ ($2p^6$) → valence é : 8 é

→ special stability استقرار خاص

→ Nobel gas غاز خامل

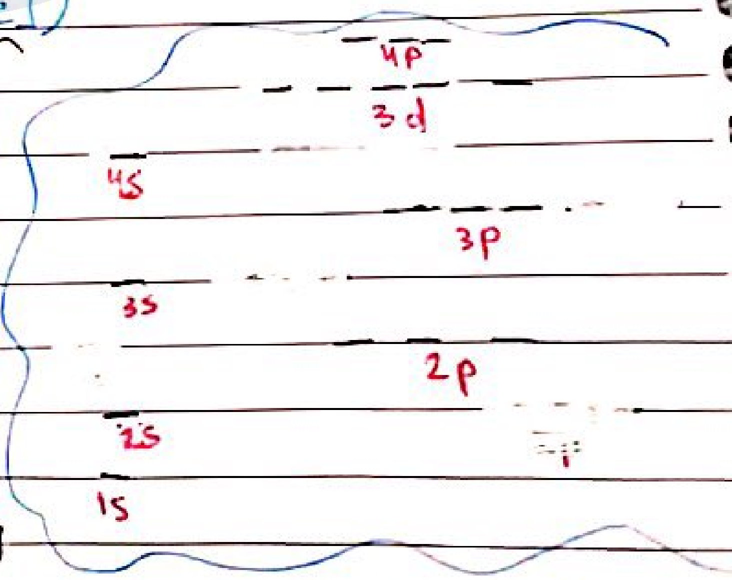
^{11}Na : [Ne] $3s^1$ ($2s^2\ 2p^6\ 3s^1$ [He]) — [Ne]

^{12}Mg : [Ne] $3s^2$

^{13}Al : [Ne] $3s^2\ 3p^1$

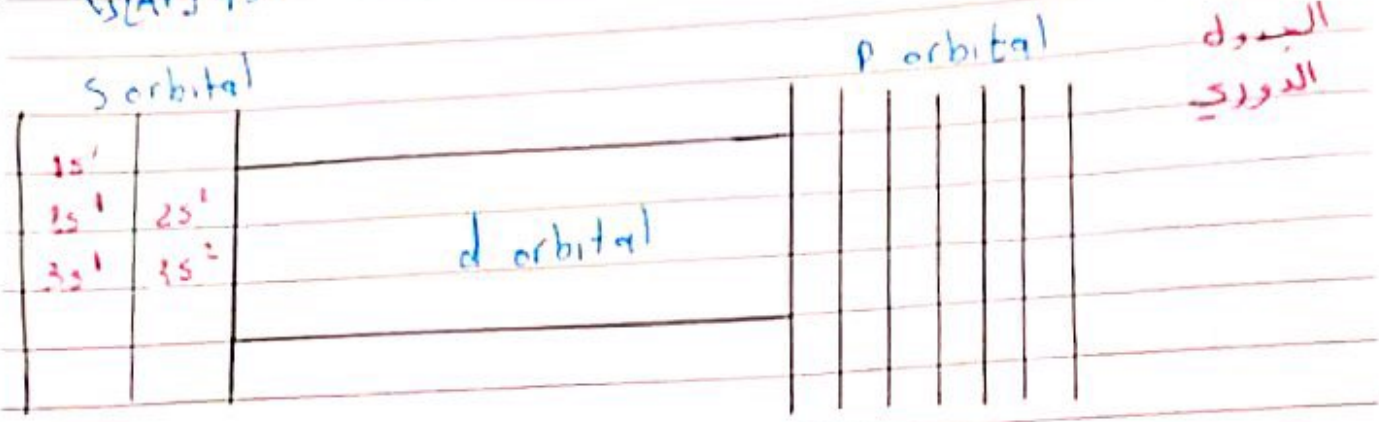
^{14}Si : [Ne] $3s^2\ 3p^2$

^{18}Ar : [Ne] $3s^2\ 3p^6$ specail stability



^{19}K : [Ne] $3s^2\ 3p^6\ 4s^1$

(ج) [Ar] $4s^1$



الجدول الدوري

^{20}Ca : [Ar] $4s^2$

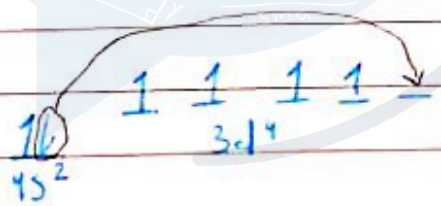
^{21}Sc : [Ar] $4s^2\ 3d^1$

^{22}Ti : [Ar] $4s^2\ 3d^2$

^{23}V : [Ar] $4s^2\ 3d^3$

^{24}Cr : [Ar] $4s^2\ 3d^4$ ✗

[Ar] $4s^1\ 3d^5$ ✓



^{25}Mn : [Ar] $4s^2\ 3d^5$

^{26}Fe : . . . . .

^{27}Co : . . . . . .

^{28}Ni : . . . . . .

^{29}Cu : [Ar] $4s^2\ 3d^9$

[Ar] $4s^1\ 3d^{10}$

^{30}Zn : [Ar] $4s^2\ 3d^{10}$

^{31}Ga : [Ar] $4s^2\ 3d^{10}\ 4p^1$

11 Na ← مجموعة أولى ← ns^1 إذًا

11 Na: [Ne] $3s^1$

10 Na^+: [Ne] ← وصل لتركيب غاز خامل إذًا وصل للاستقرار

10 Na^{2+}: [He] $2s^2\ 2p^5$ X

O: $1s^2\ 2s^2\ 2p^4$ ← مجموعة 6 وعدد الـ Valence 6

O^{-2}: $1s^2\ 2s^2\ 2p^6$ ← وصل للاستقرار
↳ قانون الـ 8

non-metals gain é

metals lose é المجموعة 1/2

H
Li Be
Na Mg

يفقد ē إلى أن يصل إلى الغاز النبيل الذي بسبقه بدورة

يكسب ē إلى أن يصل إلى الغاز النبيل الذي بتبعه بنفس الدورة

B C N O F Ne
Ar

CHAPTER 8: Basics of Chemical Bonding: ترابط

Ionic Bond: Metal + Non-Metal

رابطة أيونية

NaCl ← Ionic

Na (metal) Cl (non-metal)

Na^+Cl^-

الإلكترون الأبعد عن النواة هو الأسهل للفقد

Na : $[Ne]\ 3s^1$

Na^+ : $[Ne]$ ← شحنة موجبة (Cation)

وصل لتركيب الغاز النبيل القبله بالسطر في الجدول

Cl : $[Ne]\ 3s^2\ 3p^5$

Cl^- : $[Ar]$ ← شحنة سالبة (anion)

وصل لتركيب الغاز الخامل بنفس السطر حسب الجدول الدوري

$E = \frac{q_1 q_2}{v}$ قانون كولوم

$E < 0$

كلما زادت قوة التجاذب بين الجزيئات تحول من غاز إلى سائل إلى صلب

ooo ooo ooo

Solid Liquid gas

$NaCl$ ← بلورة

Latice energy : طاقة البلورة

$Na^+_{(g)} + Cl^-_{(g)} \longrightarrow NaCl_{(s)}\ \Delta H^\circ_{Latice}$

ΔH°_{Latice}: when two elements in gas state come with other to form one mole of solid compound form Latice energy.

$Na_{(s)} \longrightarrow Na_{(g)}\ \Delta H^\circ_1 = 107.8$

$\frac{1}{2} Cl_{2(g)} \longrightarrow Cl_{(g)}\ \Delta H^\circ_2 = 121.3$

$Na_{(g)} \longrightarrow Na^+_{(g)} + e^-\ \Delta H^\circ_3 = 495.4$

$Cl_{(g)} + e^- \longrightarrow Cl^-_{(g)}\ \Delta H^\circ_4 = -348.8$

$Na^+_{(g)} + Cl^-_{(g)} \longrightarrow NaCl_{(s)}\ \Delta H^\circ_{L.L} = ??$

$Na_{(s)} + \frac{1}{2} Cl_{2(g)} \longrightarrow NaCl_{(s)}\ \Delta H^\circ_f = -411$

$Na_{(s)} + \frac{1}{2} Cl_{2(g)} \longrightarrow NaCl_{(s)}$

$\Delta H^\circ_f = \Sigma \Delta H^\circ$

$-411 = 107.3 + 121.3 + 495.4 - 348.4 + \Delta H^\circ_{L.L}$

$\Delta H^\circ_{L.L} = -787\ kJ$

Five Apple

Ex (8.5): S^{-2}, Cl^{-}, K^{+} :-

they all have the electronic configuration which is [Ar]

Na· ·C· :O· ·Ca· :Ne: ·K· ·N: :F·

حسب لويس عدد النقاط حول رمز العنصر يساوي رقم المجموعة ويساوي الـ valence é

Na· —(−é)→ Na^{+}

:Cl· —(+é)→ $:Cl:^{-}$

Li_2O ⇝ Li· ·O· ·Li

Li^{+} :O: Li^{+}

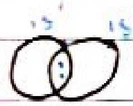
Covalent bond (رابطة تساهمية) :-

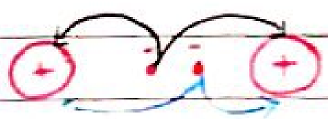
الهدف منها الوصول إلى الـ octa ⇝

تشارك

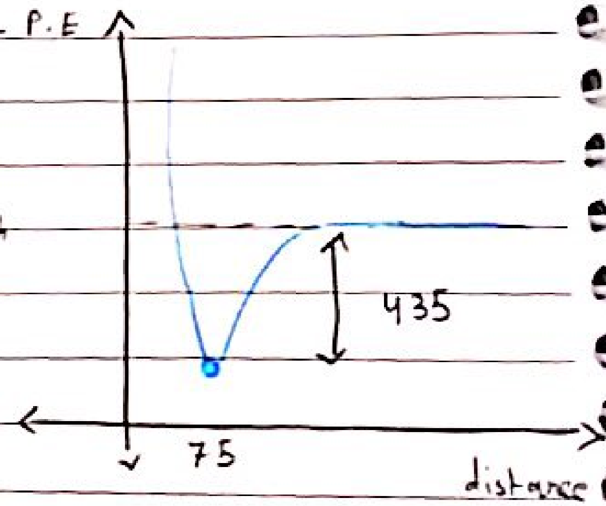
H_2 H· ·H X   H(:)H ✓ ⇝ تقل الطاقة

1s¹ 1s¹





كل é ينجذب لنواتين مما يؤدي إلى خفض الطاقة.

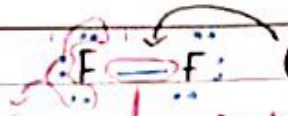


* دائماً تكوين الروابط exothermic ←

* // تكسير // endothermic

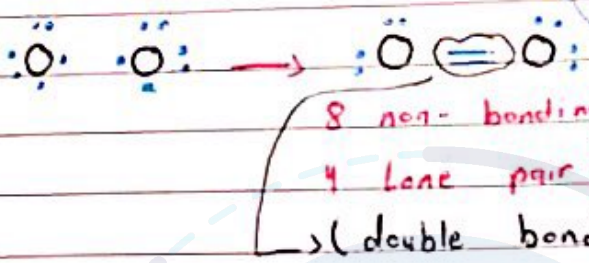
لوصف ال Covalent bond :

- Bond length المسافة المثالية
- Bond energy طاقة الربط أو طاقة تكسير الروابط

F_2  (single bond)

non-bonding or lone pair é

- How many non-bonding é? 12é
- // // lone pair é? 6é
- // // bonding pair? 1

O_2 

8 non-bonding é
4 lone pair é
(double bond)

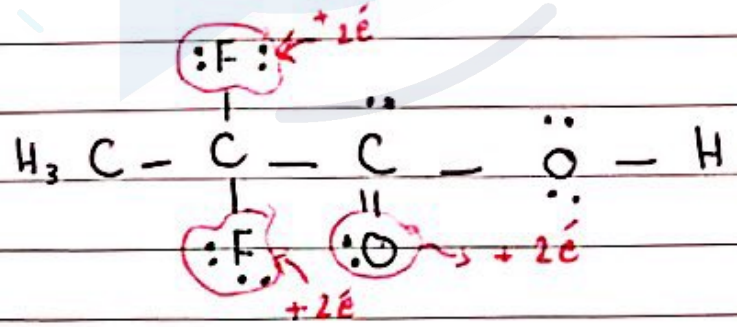
N_2 

(triple bond)

Ex (8.9):

S 2 bonds
P 3 //
Si 4 //

Ex (8.10):

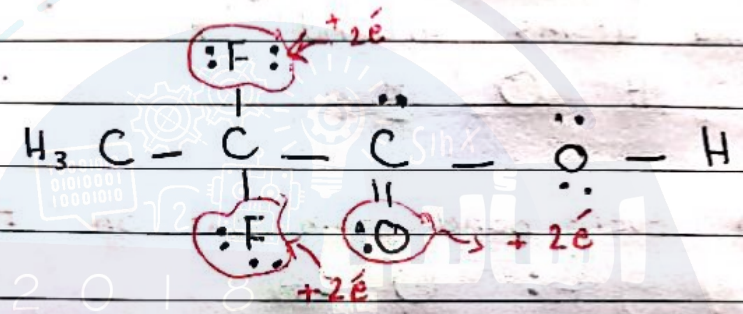


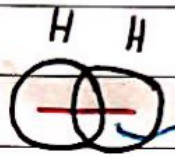
S 2 bonds

P 3 //

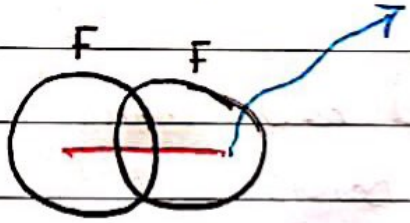
Si 4 //

Ex (8.10):

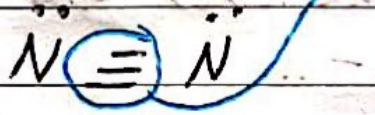




→ Bond length ↑ Bond Energy ↓



→ Bond order ↑ Bond Energy ↑



Electronegativity: الكهروسلبية

الصف → ↑ يتناقص (بالجدول الدوري)

↳ En increase

C	N	O	(F)
			the most En ←
Si	P	S	Cl
		Se	Br

$\overset{\delta+}{H} - \overset{\delta-}{F}$ polar bond

← الرابطة القطبية تحدث بين الالكترونات غير متشابهين

C-H / Si-H
↳ more polar (أعلى من Si C)

C-O / C-S
↳ more polar

S-H / C-H
↳ more polar

Lwes Construction:

H_2O: 2×1 + 6 = 8 ⇝ valence é

1] Calculate total valence é

2] draw Lwes construction by putting the center atom and the bond atoms around it

H O H

3] Put 8é on every bond atom but on H put only 2é

H: O :H

4] Count how many v.é are there and Put them on the center atom.

H: Ö :H

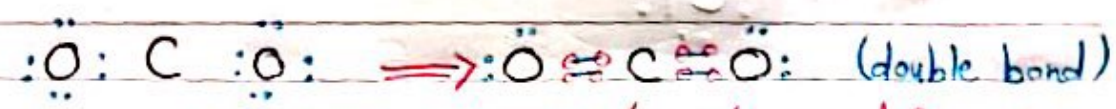
5] Cont how many v.é around center atom and how many does it need to reach octet rule (8é) and make bonds.

H—Ö—H

↳ 8.é around O

NH_3: $3\times1 + 5 = 8$

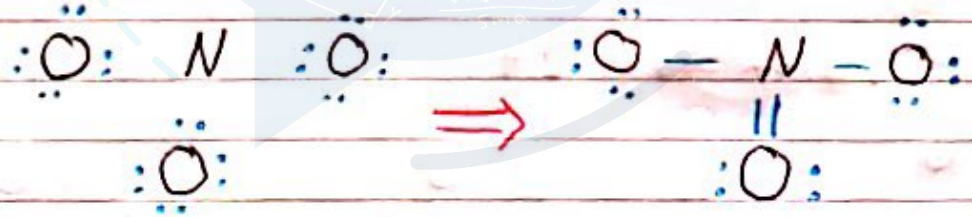
CO_2: $2\times6 + 4 = 16$



↳ 8 ē around C

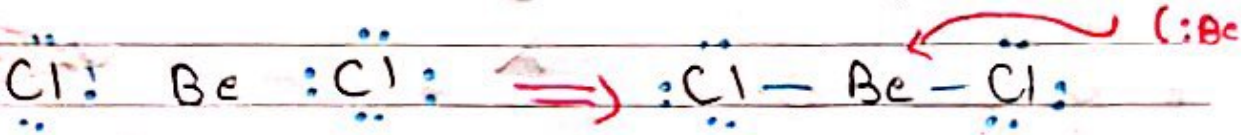
NH_4^+ : $5 + 4 - 1 = 8$

NO_3^- : $5 + 3\times6 - 1 = 24$



II VII

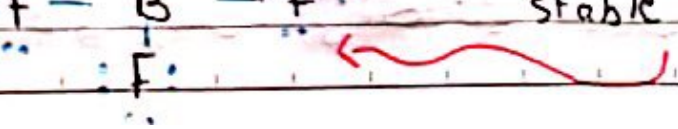
$BeCl_2$: $2 + 2\times7 = 16$ (Be) is from exceptions it is stable at (:Be:)



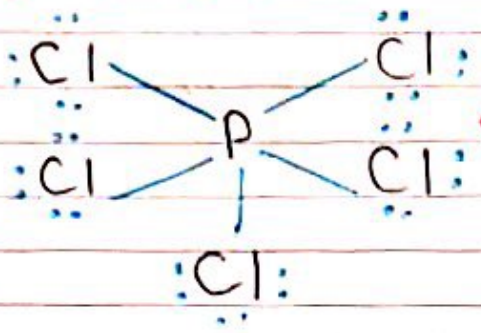
III VII

BF_3: $3 + 3\times7 = 24$

(B) is from exceptions it is stable at :B:



PCl_5: 5 + 5×7 = 40



P is from exceptions it is stable at

n=1 H

n=2 Li Be B C N O F

n=3 Na Mg Al Si P S

n = 2 → $2n^2 = 8$ NCl_5 X

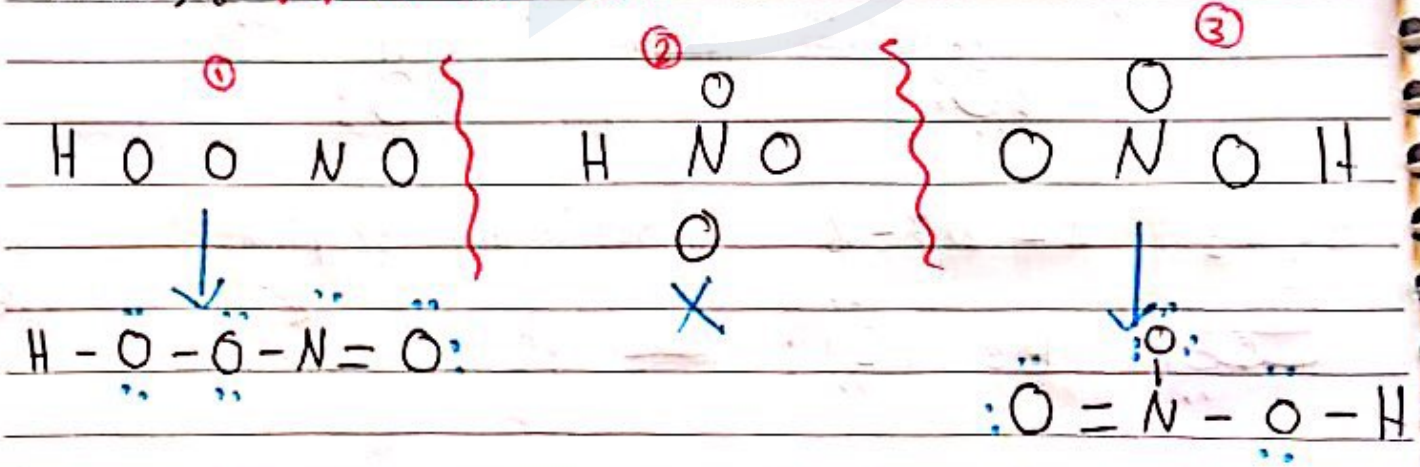
n = 3 → $2n^2 = 18$

SF_6

OF_6 X

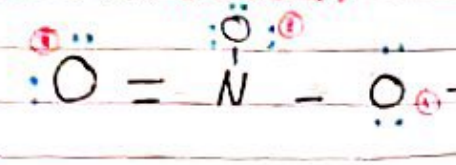
HNO_3: 1 + 5 + 3×6 = 24

① ② ③



(FC): Formal Charge يستخدم لمعرفة الهيكل الصحيح و للمركب الذي يحمل أكثر من خيار للهيكل

FC = V.é (atom alone) − V.é (in the compound)

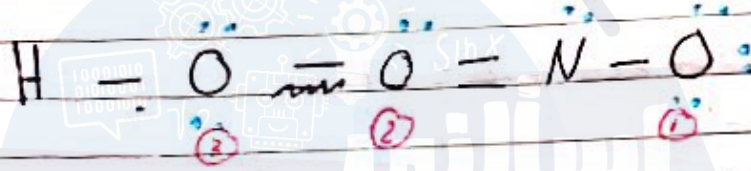


$FC_{(H)} = 1 - 1 = 0$
$FC_{(O_1)} = 6 - 6 = 0$
$FC_{(O_2)} = 6 - 7 = -1$
$FC_{(O_3)} = 6 - 6 = 0$
$FC_{(N)} = 5 - 4 = (+1)$

→ $0 + 0 + 0 - 1 + 1 = 0$

↳ +1 on the most (En)

So it is correct

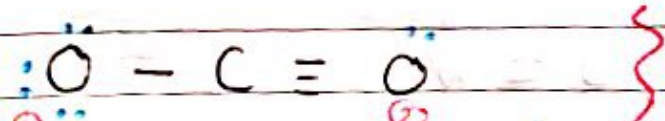


X

$FC_{(H)} = 1 - 1 = 0$
$FC_{(O_1)} = 6 - 7 = -1$
$FC_{(O_2)} = 6 - 5 = (+1)$ → +1 must be with the most (En)
$FC_{(O_3)} = 6 - 6 = 0$
$FC_{(N)} = 5 - 5 = 0$

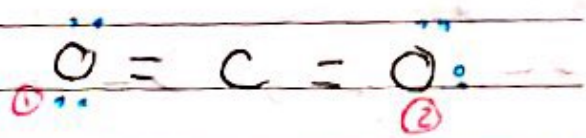
- كل ما كان FC أقرب للصفر إذًا هو الصحيح
- إذا كان في +1 / -1 الأعلى كهرو سلبية تكون مع الـ (+1)

CO_2 : $4 + 2 \times 6 = 16$



X

$FC_{(O_1)} = 6 - 7 = -1$
$FC_{(O_2)} = 6 - 5 = +1$
$FC_{(C)} = 4 - 4 = 0$

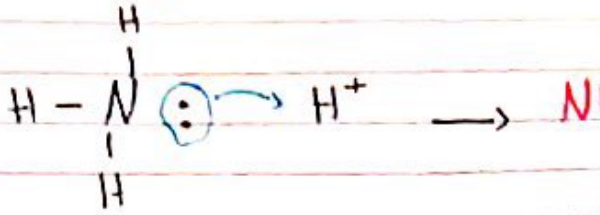


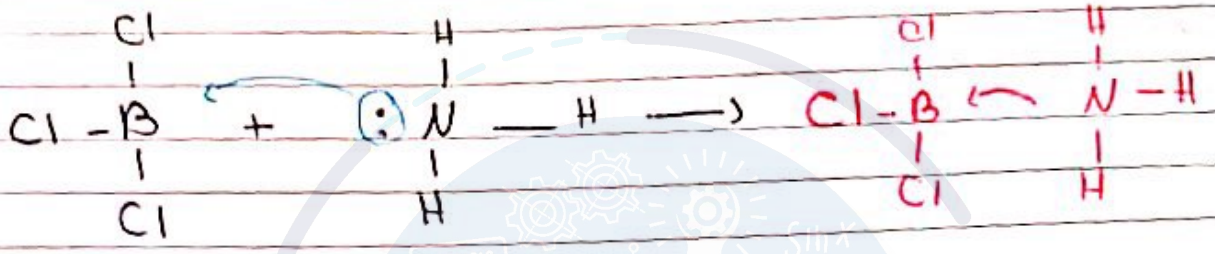
✓

$FC_{(O_1)} = 6 - 6 = 0$
$FC_{(O_2)} = 6 - 6 = 0$
$FC_{(C)} = 4 - 4 = 0$

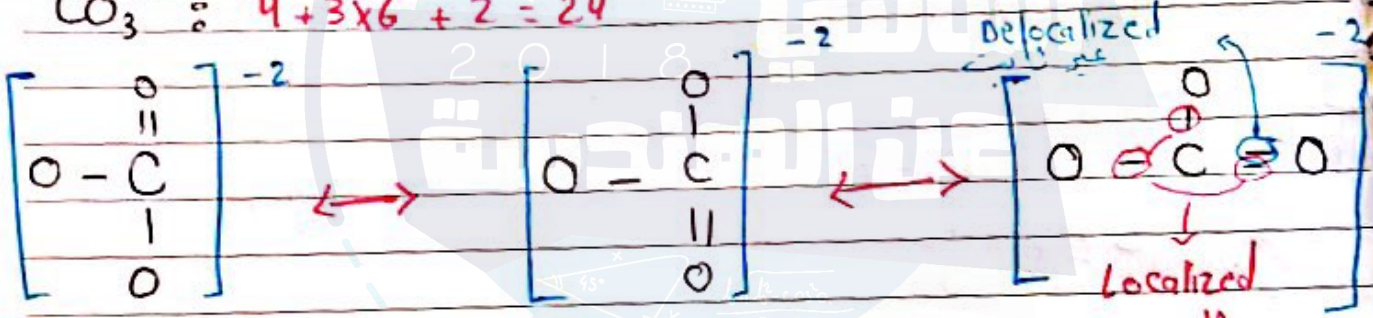
Coordinate Covalent Bond: الرابطة التناسقية

one atom gives pair of é not only one'e



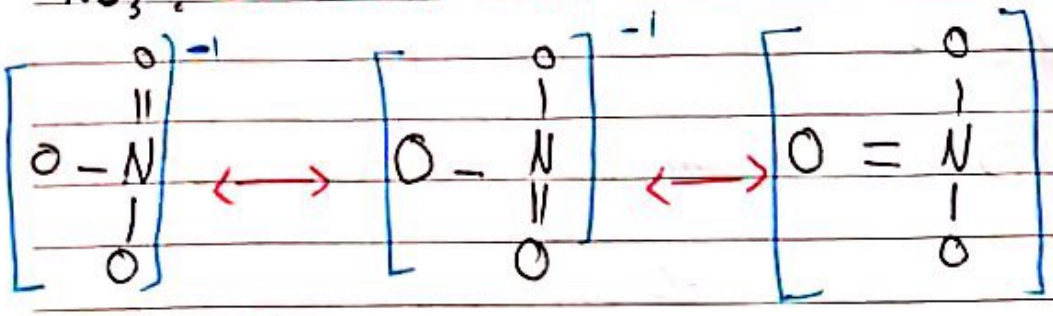


CO_3^{-2} : 4 + 3x6 + 2 = 24



Resonance: التردد

NO_3^- : 5 + 18 + 1 = 24

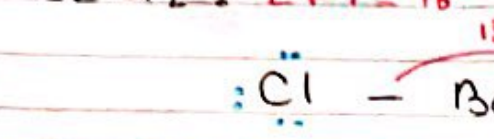


O_3 : 18

CHAPTER(9): (Theories of Bonding and Structure)

{الشكل الكيميائي للمركب هو الذي يحدد صفاته الفيزيائيه}

$BeCl_2$: 2 + 14 = 16



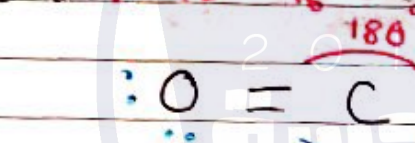
خطي (Linear) (AB_2)

A: Central Atom
B: Bonding //

Valence Shell Electron Pair Repulsion (VSEPR)

النظرية الأولى لـ

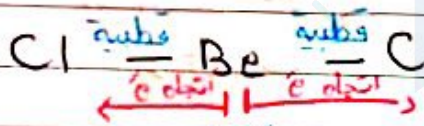
CO_2 : 4 + 12 = 16



(Linear) (AB_2)

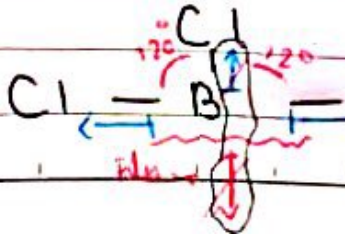
تعامل الـ Double معاملة الـ single

[الرابطة التساهمية تنشأ بين عنصرين مختلفين بالكهروسلبية]



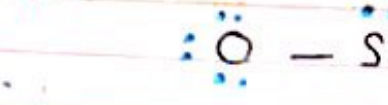
بالرغم بعض
الروابط قطبي
فالمركب غير قطبي

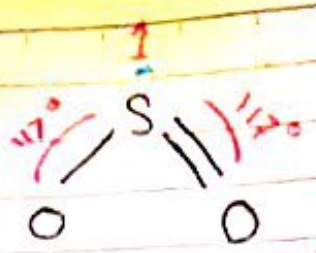
BCl_3: 3 + 21 = 24



(trigonal planer) مثلث مستوي (AB_3) غير قطبي

SO_2 : 18



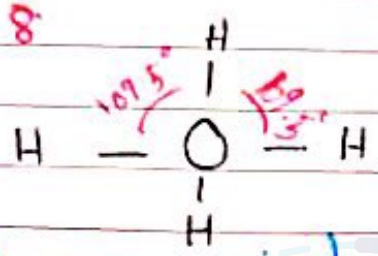


Polar (قطبي)

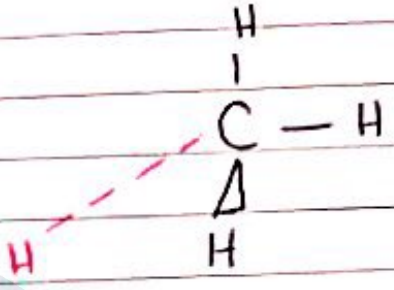
ما يكون حولين الـ Center رابطتين و 2e إذاً هو (AB_2E).

(V- Shape or bent)

CH_4 : 4+4 = 8

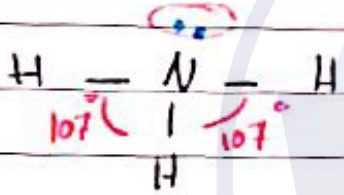


(non-polar)



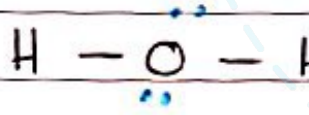
(AB_4) (tetra hedral)

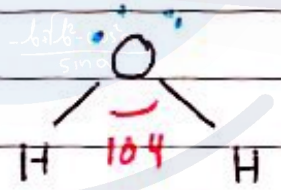
NH_3 : 5+3 = 8



(AB_3E) (trigonal pyramidal)

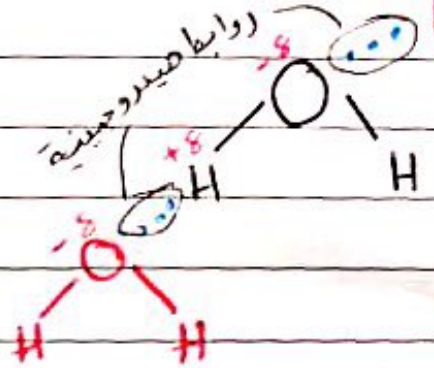
H_2O : 2 + 6 = 8





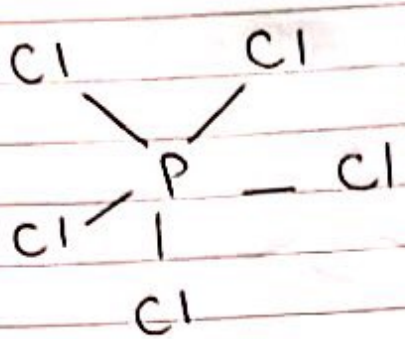
(AB_2E_2) (V- Shell or bent)

(Very polar)



لذلك الماء سائل #

PCl_5 : 40

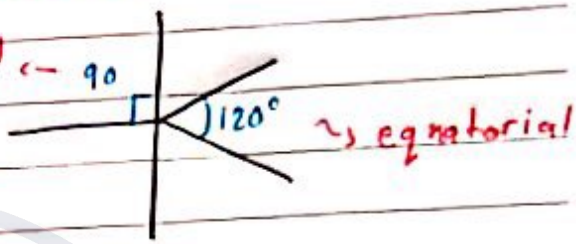


(AB5)

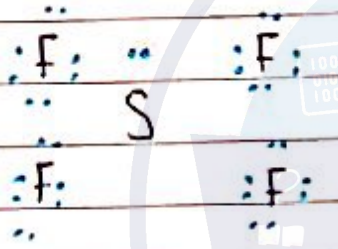
(Trigonal bipyramida)

هرميت فوق بعض مشتركين

بنفس القاعدة للمثلثة

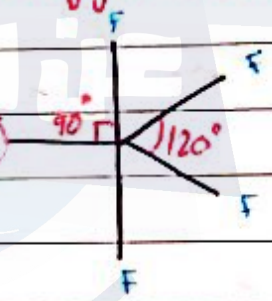


SF_4 : 6 + 28 = 34

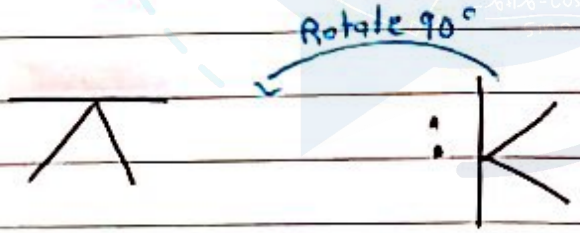


(AB4E)

(trigonal bipyramidal)

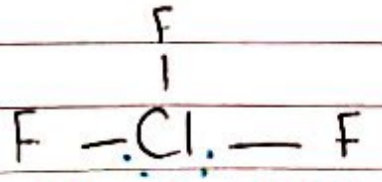


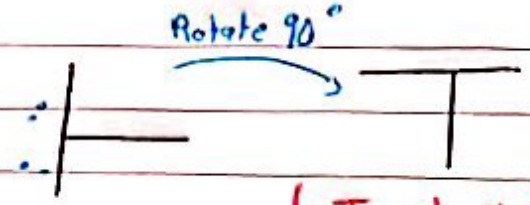
يحتاج للمساحة الأكبر



(distorted tetrahedra or See Saw Shell)

ClF_3 : 7 + 21 = 28





(trigonal bypyramidal)

(AB_3E_2)

(T-Shell)