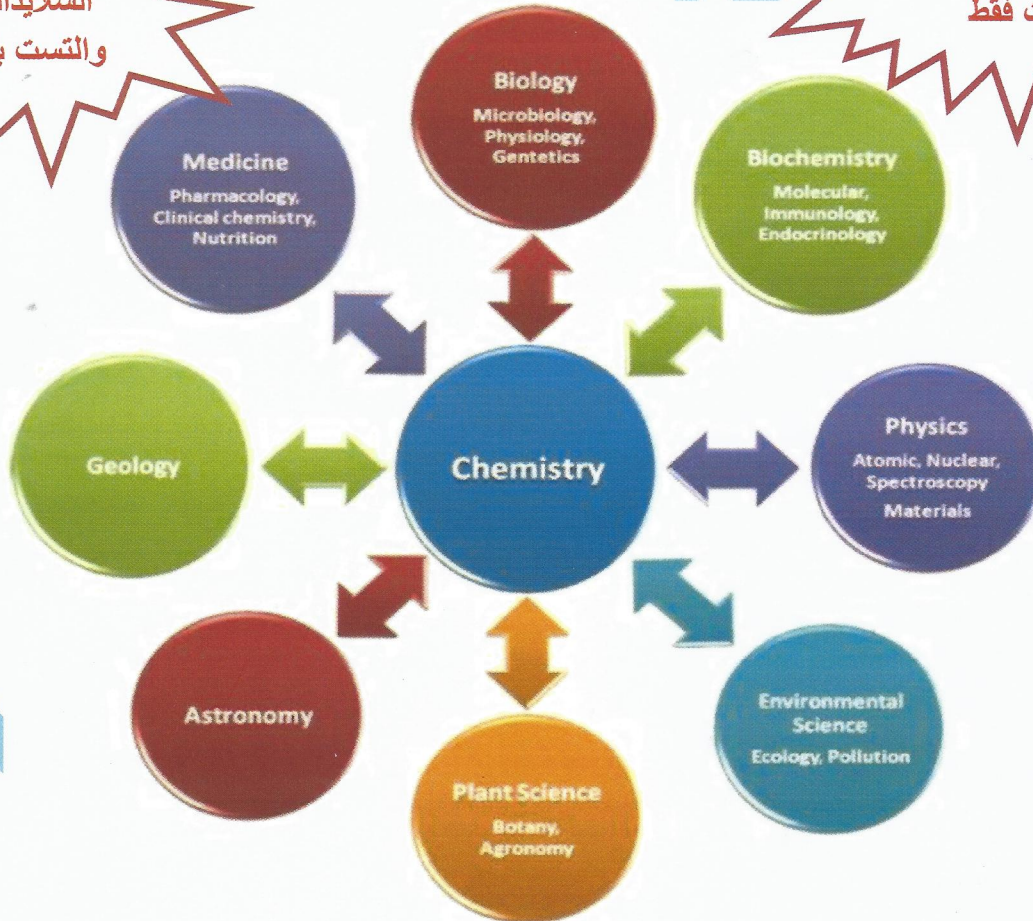# Chemistry

نسخه محدثه 1440/2019

110

الدوري الأول

شامل
السلايدات
والتست بنك

هذا الملخص
خاص بمنهج
البنات فقط

The study of change

Video (1)

Chemistry :Is the study of matter and the changes it undergoes.

⇐ **علم الكيمياء** : هو العلم الذي يهتم بدراسة المادة وتحولاتها .

Matter(المادة) : Anything with Mass كتله and volume حجم .

☞ **المادة** : هي أي شيء له كتله وحجم .

Atom :The smallest unit of matter that maintains its chemical identity .

☞ **الذرة** : هي أي أصغر وحدة في تركيب المادة .

States of matter	حالات المادة	

✾ **solid** الجوامد : ice , wood , gold (الذهب) .

✾ **Liquids** السوائل : water , oil (الزيت) .

✾ **Gases** الغازات : water vapor , Air .

(للإطلاع)

Some Elements and their symbols

Video (2)

Name	الاسم	Symbol	Name	الاسم	Symbol
Oxygen	أكسجين	O	Barium	باريوم	Ba
Hydrogen	هيدروجين	H	Bromine	بروم	Br
Fluorine	فلور	F	Tungsten	تنجستين	W
Sulfur	كبريت	S	Iodine	يود	I
Silicon	سيليكون	Si	Potassium	بوتاسيوم	K
Carbon	كربون	C	Arsenic	زرنيخ	As
Calcium	كالسيوم	Ca	Iron	حديد	Fe
Copper	نحاس	Cu	Mercury	زئبق	Hg
Cobalt	كوبلت	Co	Magnesium	ماغنسيوم	Mg
Chlorine	كلور	Cl	Silver	فضه	Ag
Aluminum	الومنيوم	Al	Gold	ذهب	Au
Lead	رصاص	Pb	Phosphorus	فسفور	P
Platinum	بلاتين	Pt	Nitrogen	نيتروجين	N
Manganese	منجنيز	Mn	Nickel	نيكل	Ni
Tin	قصدير	Sn	Sodium	صوديوم	Na
Zinc	خارصين	Zn	Chromium	كروم	Cr

Measurement and Units

Measurements of Macroscopic Properties .

Macroscopic Properties: e.g.: length, weight, temperature, volume .

SI Units : International System of Units .

▶ used for commerce and science around the world .

TABLE 1.2	SI Base Units	
Base Quantity	**Name of Unit**	**Symbol**
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electrical current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

حفظ

▶ **Candela** : is not commonly used in chemistry .

▶   **Mass** : is the measure of the amount of matter in an object.

▶ **Weight** : is the measurement of the pull of gravity on an object.

$$weight = c \times mass$$

لا تبحث عن النجاح ابحث عن التفوق

Video (4)

1. The SI Unit of mass is   :

   a- pound   b - kilogram   c-gram   d- mole

2. The kg is the SI Unit of :

   a- length   b- mass   c-temperature   d-current

3. The energy unit in the SI unit system is

   a- Pa   b- J   c- N   d- W

4. Which of the following is not an SI base unit?

   a-kilometer   b- kilogram   c-second   d- Kelvin

SI derived units

& Are defined in terms of the seven base quantities via a system of quantity equations.

Area= width x length   المساحة = الطول × العرض

Unit of width = m
Unit of length = m

Unit of Area = $m \times m = m^2$

Volume = width × length × height   الحجم = الطول x العرض x الارتفاع

Volume = $m \times m \times m = m^3$

حفظ

Force	القوة	Newton	N	$Kg\, m / S^2 \equiv Kg\, m.\, S^{-2}$
Pressure	الضغط	Pascal	Pa	$(N/m^2) \equiv Kg.m^{-1}s^{-2}$
Energy	الطاقة	Joule	J	$Kg.m^2/s^2 \equiv N.m$
Electric charge	الشحنة الكهربية	coulomb	C	A.S
Electrical Potential	الجهد الكهربي	Volt	V	J/C
Frequency	التردد	Hertz	s^{-1} (HZ)	S^{-1} (1/ s)
Power	القوة	Watt	W	$J/S \equiv Kg.m^2/s^3$
Area	المساحة			m^2
Volume	الحجم			m^3
Density	الكثافة			Kg/m^3

1. The derived unit of force unit is :

a- $Kgm^{-1}s^{-2}$ b- Kgm^2s^{-2} c- $Kg.m.\, s^{-2}$ d- $Kg\, m^3s^{-1}$

2. Newton (N) which is a derived SI unit for measuring the force is :

a- $Kg\, m^2\, s^{-2}$ b- $Kg\, m^{-1}\, s^{-2}$ c- $Kg.m.s^{-2}$ d- $Kg\, m\, s^{-3}$

Prefixes with SI Units

Video (6)

1 Tera	T	10^{12}
1 Giga	G	10^{9}
1 Mega	M	10^{6}
1 Kilo	K	10^{3}
1 deci	d	10^{-1}
1 centi	C	10^{-2}
1 milli	m	10^{-3}
1 micro	μ	10^{-6}
1 nano	n	10^{-9}
1 Angstrom	A^{0}	10^{-10}
1 Pico	P	10^{-12}
1 Fimto	f	10^{-15}

1. The SI prefixes giga- and micro represent, respectively:

   a- 10^{-9} and 10^{-6} b- 10^{6} and 10^{-1} c - 10^{3} and 10^{-3} d- 10^{9} and 10^{-6}

2. A nano meter correspond to :

   a- 10^{-9} b- 10^{6} c - 10^{3} d- 10^{9}

3. A micro liter correspond to :

   a- 10^{-6} b- 10^{6} c - 10^{3} d- 10^{9}

لا تبحث عن النجاح أبحث عن التفوق

Prefix ⟷ Unit

Video (7)

◄ المسائل نوعين : ☝ prefix to unit والعكس ✌ prefix to prefix.

Prefix ⟷ Unit

◄ لو أتذكر في المسألة مقطع واحد فقط من مقاطع الجدول السابق تكون دي النوع الأول (مباشرة) .

Video (8)

1. The number of nano – seconds (ns) which is equivalent to 120 second is :

a- <u>1.2×10^{11}</u>   b- 1.2 ×10^{-11} c-1.2 × 10^{14} d- 1.2×10^8

◄ في المسألة مقطع واحد وهو nano دي مسألة one prefix . كيف نحل ؟؟ !!

☝ تكتبي ال انتي حفظها من الجدول حق المقطع nano كالآتي :

➤ 1 nano second ⟶ 10^{-9} second من الجدول

✌ بعد كده نزلي المعطيات من المسألة تحت second 120: وتحت المطلوب X: nano second

➤ 1 nano second ⟶ 10^{-9} second من الجدول

   X nano second ⟶ 120 second

◄ طريفين في وسطين تجيبي المجهول .

➤ x = $\frac{120}{10^{-9}}$ = 1.2 × 10^{11} nano-second

2. How many meters are in 6 Km ?

a- 6×10^{3} b- 4×10^{-6} c- 3×10^{-6} d- 3×10^{6}

- 1 Kilo meter $\longrightarrow$ 10^{3} meter   من الجدول

  6 Kilo meter $\longrightarrow$ x meter

طريقين في وسطين تجيبي المجهول .

➤ x = 6×10^{3} meter

---

3. What is 22.6 m when converted to decimeters?

    a- 0.226 dm   b- 2.26 dm   c-226 dm   d-2.26 $\times 10^{-3}$

---

1 d.s $\longrightarrow$ 10^{-1} m   (من الجدول)

x d.m $\longrightarrow$ 22.6 m

☛ $x = \dfrac{22.6}{10^{-1}}$ = 226 dm

4.the number of nano –seconds (ns) which is equivalent to 2 minutes is :

    a- 1.2×10^{11} b- 1.2×10^{-11} c-1.2×10^{14} d- 1.2×10^{8}

---

1 n.s $\longrightarrow$ 10^{-9} s (من الجدول)

X n.s $\longrightarrow$ 120 s   (2 minutes)

☛ $x = \dfrac{120}{10^{-9}}$ = 1.2×10^{11}

Prefix ⟷ prefix

1. Express 500 centimeters in gagameters :

    a-5.0×10^{9} b-5.0×10^{-11} c-5.0×10^{-9} d-5.0×10^{-10}

في المسألة مقطعين وهو giga و centi يبقا دي مسألة prefix to prefix . كيف نحل ؟؟ !!

500   centimeters   ?? gaga meter

$500 \times 10^{-2} \times 10^{-9}$ (نعكس اشارة prefix حق المجهول)

$= 5.0 \times 10^{-9}$ gaga meter

2. 6.0 kg is how many microgram?

    a- 6.0×10^{6} μm   b- 1.7×10^{-7} μm   c- 6.0×10^{9} μm   d-1.7×10^{-4} μm

في المسألة مقطعين وهو Kilo و micro دي مسألة prefix 2. كيف نحل ؟؟ !!

6   Kilo gram   ?? microgram

$6 \times 10^{3} \times 10^{6}$ ⟵ (نعكس اشارة prefix حق المجهول)

⟵ (نضرب كله)

$= 6 \times 10^{9}$ micro gram

3. The diameter of an atom(قطر ذره) is approximately 1×10^{-7} mm. | Video (12) |

What is this diameter when expressed in nanometers ?

(a) 1×10^{-18} nm   (b) 1×10^{-15} nm   (c) 1×10^{-9} nm   (d) 1×10^{-1} nm

في المسألة مقطعين وهو nano و milli يبقا دي مسألة prefix to prefix . كيف نحل ؟؟ !!

1×10^{-7} mille meter   ?? nanometers

$1 \times 10^{-7} \times 10^{-3} \times$ 10^{9} ⟵ (نعكس اشارة prefix حق المجهول)

(نضرب كله)

$= 1 \times 10^{-1}$ nm

نفس فكره الفديو السابق

4. What is 25.4 mg when converted to kilograms ? (prefix - prefix)

a-2540 kg   b-2.54 x10^{-5} kg   c-2.54 kg   d-2.54 x 10^{4} kg

في المسألة مقطعين وهو kilo و milli يبقا دي مسألة prefix to prefix . كيف نحل ؟؟ !!

25.4   mille gram   ?? Kilogram

25.4 $\times$ $10^{-3} \times$ 10^{-3} (نعكس اشارة prefix حق المجهول)

$= 2.54 \times 10^{-5}$ Kilogram

_ Converting 300 nm to μm equals :

a-3.0×10^{-1} μm   b-3.0×10^{-2} μm   c-3.0×10^{3} μm   d-3.0×10^{-3} μm

---

← في المسألة مقطعين وهو micro و nano يبقا دي مسألة prefix to prefix . كيف نحل ؟؟ !!

300   nanometer   **?? micro meter**

$300 \times 10^{-9} \times$ 10^{6} (نعكس اشارة prefix حق المجهول)

$= 3.0 \times 10^{-1}$ micro meter

---

9. The largest value القيمة الأكبر among the following is :

a- 0.02 mm   b- 2 μm   c- 200 nm   d-2000 pm

← في السؤال ده بتحولي كل المعطيات (الاختيارات) إلي وحدة واحدة وهي المتر .. وبعدها تقدري تحكمي مين أكبر قيمة .

← لما نفس الفكرة تيجلكم تضربوا الرقم المعطي في الوحدة حقه في كل اختياري.

A-   0.02 mm = 0.02×10^{-3} = 2×10^{-5} m

B-   2 μ m   = 2×10^{-6} = 2×10^{-6} m

C-   200 nm = 200×10^{-9} = 2×10^{-7} m

D-   2000 pm = 2000×10^{-12} = 2×10^{-9} m

---

10. Which of these quantities represent the largest mass?   نفس فكره الفديو السابق

a- 2.0×10^2 mg   b- 0.10010 Kg   c- $1.0 \times 10^5 \mu$ g   d- 2.0×10^2 cg

A- 2×10^2 mg   = $2 \times 10^2 \times 10^{-3}$ = 0.2

B-   0.10010 Kg   = 0.10010×10^3 = 100.1

C- 1.0×10^5 μ g   = $1.0 \times 10^5 \times 10^{-6}$ = 0.1

D- 2.0×10^2 c g   = $2.0 \times 10^2 \times 10^{-2}$ = 2

11. 500 pm is equal to   Video (15)

a- 5 nm   b- 50 μm   c- 0.05 mm

نلاحظ أن الاختيارات مختلفة الوحدة لابد أن نحل بالتجريب

50 pm ⟶ ?? nm

⟶ ?? µm

⟶ ?? mm
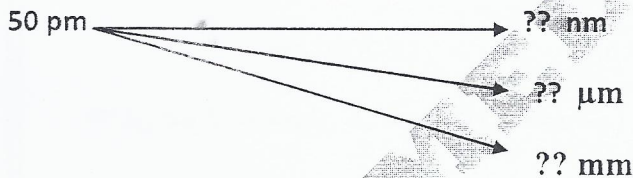
نحول 50 pm مره ل mm , nm , µm ونطابق الاجابه بالخيارات .

Density Calculations

❋ **Density:** Is the amount of matter in a given amount of space.

☛ الكثافة (d): هي كتلة وحدة الحجوم من المادة . (الكثافة $= \frac{m \text{ الكتلة}}{v \text{ الحجم}}$)

$$density = \frac{mass}{volume}$$

❋ SI derived unit for density is $kg/m^3 \equiv g/cm^3$ (g/ml) .

☛ Density decrease with temperature .**(density of gases are very low)** .

☛ g/ml & g/cm^3 for liquid and solids . (حفظ)

☛ $g/L = 0.001\ g/ml$ for gases (Because density of gases are very low) . (حفظ)

☛ $g/ml \longrightarrow kg/m^3$ (نضرب في 1000)

☛ $g/Cm^3 \Longrightarrow kg/m^3$ (نضرب في 1000)

1. mass of apiece of iron is 50 gram and its volume 10 cm^3 find density in (Kg/m^3)

Mass = 50 g   ,   volume = 10   Cm^3

☛ Density $= \frac{mass}{Volume}$

☛ density $= \frac{50}{10}$ = 5 g/cm^3 × 1000 = 5000 Kg/m^3

2.the density of apiece of agold with amass of 301 g And volume of 15.6 cm^3 is

    a-19.3 x 10 6 Kg/ m^3 b- 19.3 g/ m^3

    c-19.3 Kg/ m^3 d-19.3 x 10^3 Kg/ m^3

3.Bromine is liquid at 25^0 C .Its density is 3.12g/Cm^3 .what the volume of 28.1 g liquid

$$D = 3.12 \text{ g/Cm}^3 \quad , \quad m = 28.1 \text{ g}$$

- Density $= \dfrac{\text{mass}}{\text{Volume}}$

- volume $= \dfrac{m}{d}$ - $V = \dfrac{28.1}{3.12} = 9.01 \text{ cm}^3$ (ml)

4.The density of mercury is 13.6 g /Cm^3 . How many Liters dose 251 g of Hg occupy ?

    a- 18.5 L   b- 54.9 L   c-18.5 x 10^{-3}L   d-5.42 L

- Density $= \dfrac{m}{V}$ - $V = \dfrac{m}{d}$

- $V = \dfrac{251}{13.6} = 18.5 \text{ cm}^3 = 1.85 \div 1000 = 18.5 \times 10^{-3} \text{L}$

في المسالة تبغها باللتر واحنا مطلعنها (ml) cm^3 نقسم علي 1000 للتحويل

Liter $\underset{1000 \div}{\overset{\times 1000}{\rightleftharpoons}}$ mL (cm^3)

5.The density of copper (Cu) is 9.0 g/ mL . according to SI units   (Kg /m^3) it equal to :

    a-9000 Kg/m^3 b-900 g/ m^3 c-9000 Kg/cm^3 d- 90 cm^3

6. A piece of iron in the form of box weighted 60 gram has : length 3.56 Cm , width is 2.49

And its height 4.02 Cm   calculate density of piece ? هاااام

Video (18)

Mass = 60 gram   , volume = ??

الحجم = الطول x العرض x الارتفاع

Volume = length × width × height

Volume = $3.56 × 2.49 × 4.023 = 35.635$ Cm^3

☞ Density = $\dfrac{mass}{Volme}$

☞ Density = $\dfrac{60}{35.635}$ = **1.68**   g/cm^3

7. A cube مكعب   of iron metal has length 1.26 cm and weighted 30 g ,

Calculate the density of the cube ? هاااام

لاحظي أن قطعه الحديد علي شكل مكعب أضلاعه متساوية

Mass = 60 gram   , volume = ??

الحجم = الطول x العرض x الارتفاع

Volume = length × width × height

Volume = $1.26 × 1.26 × 1.26 = 2$ Cm^3

☞ Density = $\dfrac{mass}{Volme}$

☞ Density = $\dfrac{30}{2}$ = **15**   g/cm^3

8. If equal masses (or 1.32 g) of each substance .. What is the largest density ?

  a- 1.2 ml of NO   b- 0.56 mL of NO_2

  c- 2.35 mL of C_2H_2 d- 3.97 mL of CO_2

لاحظي أن الكتلة ثابتة الحل عن طريق العلاقة العكسية بين الكثافة والحجم .

Temperature Scales

Video (19)

There are three temperature scales, their units are :

👆 **Degrees Celsius ^0C**   ☛ **Scale**   **0 → 100**

✌ **Degrees Fahrenheit ^0F**   ☛ **Scale**   **32 → 212**

👌 **Kelvin K**   ☛ **Scale**   **273 → 373**

C^0 > ^0F > K   (ملحوظة هامه)

$$\text{Celsius} \xrightleftharpoons[- 273]{+ 273} \text{Kelvin}$$
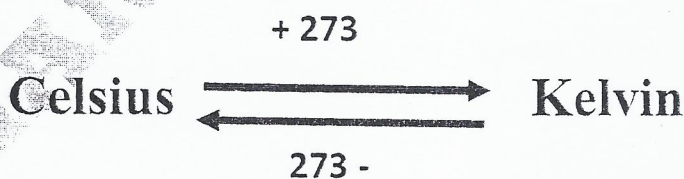
$$\frac{C^0}{5} = \frac{(F^0 - 32)}{9}$$

1. the melting point of sulfur is 113 ^{0}c . what temp is This in K^0 ?

$$K = C^0 + 273$$
$$K = 113 + 273 = 386\ ^0K$$

2. convert 295 Kelvin to Celsius ?

$$C^0 = K + 273$$
$$C^0 = 295 - 273 = 22$$

3. Lead melts at 601 .0 ^{0}c .what the temperature is this in ^{0}F ?

Video (20)

a-320 F^0 b- 365 F^0 c-1.050 F^0 <u>d- 1114 F^0</u>

$$\frac{C^0}{5} = \frac{(F^0 - 32)}{9}$$

$$\frac{601}{5} = \frac{F^0 - 32}{9}$$

$$F^0 = 1114$$

4. Ammonia boils at -33.4°C. What temperature is this in °F?

a. -60.1°F   b. -92.1°F   <u>c. -28.1°F</u>   d. +13.5°F

5. Many home freezes maintain a temperature of _0 F⁰_ Express this temperature to <u>Kelvin</u>?

    a-320^{0}c   <u>b- -18 ^{0}c</u>   c- 0 ^{0}c   d- 18^{0}c

لا يوجد علاقة مباشره بين الكلفين والفهرنهيت . نحول أولا إلي سليزيوس ثم كيلفن .

$$\frac{C^0}{5} = \frac{(F^0 - 32)}{9}$$

$$\frac{C^0}{5} = \frac{0 - 32}{9}$$

$$C^0 = -18$$

$$\text{Kelvin} = -18 + 273 = 255 \text{ K}$$

6. Which of the following is the lowest possible temperature ?

    a- -273.5 K   b- -273.15 ^{0}C   c- 273.15 K   d- 0 ^{0}C

SI derived units

| ✌ Volume   الحجم |

m^3 : cubic meter Cm^3 : cubic centimeter dm^3 : cubic deci meter .

Video (21)

☛ أولا وحدات نفس بعض (حفظ) :

$$mL = Cm^3$$

$$Liter = dm^3$$

☛ convert 100 liter to cubic deci meter (dm^3) :

Answer :   100 liter = 100 dm^3

☛ ثانيا   تحويلات الحجم (حفظ) :

$$1 m = 10^2 \ cm$$

$$1 m^2 = 10^4 \ cm^2$$

$$1 m^3 = 10^6 \ cm^3 \ (mL)$$

☛A liter : is the volume occupied by one cubic decimeter.

$$1 m^3 = 10^3 \ liter \ (dm^3)$$

$$1 liter = 10^3 \ cm^3 \ (ml)$$

1. How many cubic centimeters are there in exactly one cubic meter?

    a- 1×10^{-6} cm^3 b- 1×10^{-3} cm^3 c- 1×10^{-2} cm^3 <u>d- 1×10^{6} cm^3</u>

2 . How many liter are there in 100 mL ?

    1 Liter $\longrightarrow$ 10^3 mL

    X liter $\longrightarrow$ 100 mL

$$X = \frac{100}{10^3} = 0.1 \text{ mL}$$

2 . How many cubic meter are there in 100 L ?

    1m^3 $\longrightarrow$ 10^3 Liter

    X m^3 $\longrightarrow$ 100 liter

$$X = 0.1$$

3 . convert 5 cubic meter to ml

    1m^3 $\longrightarrow$ 10^6 ml

    5 m^3 $\longrightarrow$ x ml

$$X = 5 \times 10^6 \text{ ml}$$

Atom & Molecule

خاص بمنهج رابغ

Atom : The smallest unit of matter that maintains its chemical identity .

Ex : N , O , H , Na , K , Cl .

Molecules : Composed of at least two atoms .(may be element or compound).

Ex : N_2, O_2 , H_2 (Elements). CO_2, CO , H_2O (Compound).

```
                                                    ┌─────────────┐
                                                    │   Element   │
                                    ┌───────────┐   └─────────────┘
                                    │ substance │
                                    └───────────┘   ┌─────────────┐
                                                    │  Compound   │
        ┌──────────┐                                └─────────────┘
        │  Matter  │
        └──────────┘                                ┌─────────────┐
                                    ┌───────────┐   │ Homogeneous │
                                    │  mixture  │   └─────────────┘
                                    └───────────┘
                                                    ┌─────────────┐
                                                    │Heterogeneous│
                                                    └─────────────┘
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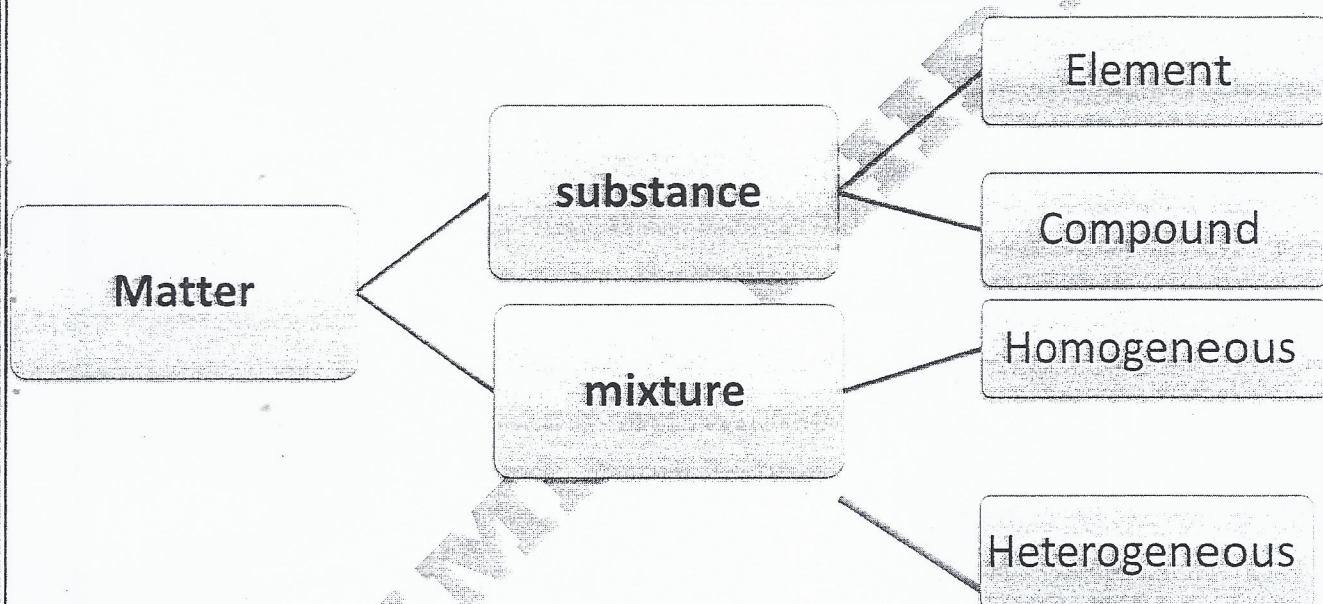
Substance: Is a form of matter that has a definite composition and distinct properties .

| Element | • Any substance made from one kind of atoms
• EX :   Na , H_2 , Cl_2, F_2
•   Li , O_2, N_2, Fe . |

☜ مادة تتكون من نوع واحد فقط من الذرات .

| Compound | • Any substance made from more than one kind of atoms chemically joined together .
• EX : HCl , H_2O , CO_2 , NH_3 ,
   CH_4 ,   NaOH , H_2SO_4 . |

☜ أي مادة تتكون من اكثر من نوع من الذرات مرتبطة كيميائياً معا

1. Which of the following is an element ?

      a- CO   b- CO_3 c- B   d- NO

2. What is the compound from the following formulas ?

      a-Cl_2 b- O_3 c- Pt   d- H_2O

3. The right example for amolecule is :

      a-N_2 b- N   c- O   d- Air

4. Hydrogen(H) is an example of :

      a- an element   b- a compound

      c- a Homogeneous mixture   d- a Heterogeneous mixture

Atoms , Molecules and Ions

Electrons : negative charge particles
الالكترون : جسيم سالب الشحنة

Video (1)

Atom
الذرة

Proton : Popsitively charged particles
البروتون : جسيم موجب الشحنة

Neutron:Uncharged Particles
النيوترون : جسيم متعادل الشحنة
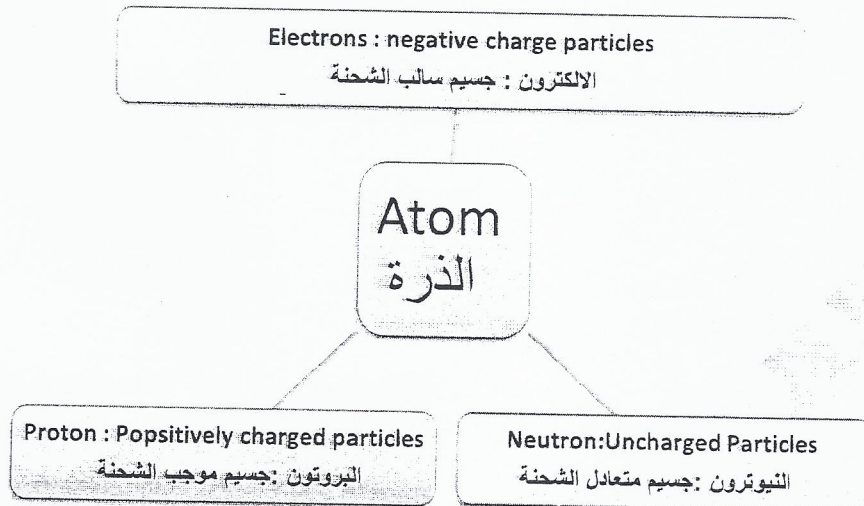
⧖ The mass of an atom in atomic mass units (amu) :

is the total number of protons and neutrons in the atom.

☛   **Atom**   : Is the basic (smallest) unit of matter .

☛   **Neutral atom**   : Atom has the same number of electrons and protons .

☛   **Different atom**   : Have different number of proton .

☛   **Ion**   : Has different number of electrons .

☛   **Cation**   : Atoms or group of atoms with net positive charge .

☛   **Anion**   : Atoms or groups of atoms with net negative charge .

$$\text{mass p} = \text{mass n} = 1840 \times \text{mass e}^-$$

1. The Proton is characterized by :

Video (1)

a-Mass less like photo   b- Mass with negative charge

c- Mass without charge   d- Mass with positive charge

2. A particle which has negative charge is :

a-proton   b- Neutron   c- Electron   d- Nucleus

3. An anion is defined as :

  a- a stable atom

  b- group of stable atom

  c- <u>a charged atom or group of atoms with a net negative charge</u>

4. The species S^{2-} , F^- , and Cl^- are all :

  a- cations   <u>b- anions</u>   c- isotopes   d- Halogens

5. An cation is defined as :

  a- a stable atom

  b- group of stable atom

  c- <u>a charged atom or group of atoms with a net positive charge</u>

5. Atoms with the <u>same number</u> of <u>electrons and number of protons</u> are called...

   a-ions   b-isotopes   <u>c-neutral atoms</u>   d-different atoms

6. Atoms which have <u>different number of electrons</u> are called...

   <u>a- ions</u>   b- isotopes   c- neutral atoms   d- different atoms

Mass Number & Atomic number

☞العدد الكتلي : هو مجموع أعداد البروتونات + أعداد النيترونات داخل النواة .

Atomic number (Z) = number of protons in nucleus .

Mass Number (A) = number of protons + number of neutrons .

Mass Number (A) = atomic number (Z) + number of neutrons .

The number of neutrons = A - Z

Symbols of Elements

Mass Number ⟶ A

Atomic Number ⟶ Z **X** ⟵ Element Symbol

Key:

Atomic number ——— 6

Symbol ——— C

Name ——— Carbon

Average atomic mass ——— 12.0107

Electron configuration ——— $[He]2s^2 2p^2$

1. The nucleus of an atom (نواة الذرة) contains:

   a- protons and neutrons.   b- electrons and neutrons.

   c- protons and electrons.   d- air.

2. The difference between the mass number (A) of an atom and the atomic number (Z)

   of the atom is always equal to ....

   a- 6.02×10^{23} b- the atomic number of element

   c- the atomic mass unit   d- the number of neutrons in nucleus

| Video (4) |

3. An atom of the isotope $_7N^{14}$ consists of how many protons, neutrons, and electrons ?

(p = proton , n = neutron , e = electron)

a-15 p , 16 n , 15 e   b-7 p , 7 n , 7 e   c-16 p , 31 n , 16 e   d- 32 p , 31 n , 32 e

4. The number of <u>neutrons</u> $^{197}_{79}Au$ is :   (نطرح الرقم الكبير من الرقم الصغير)

a-110   b-118   c- 79   d-197

5. How many <u>neutrons</u> are there in an atom of lead $_{82}Pb$ whose mass number is 208   ?

(نطرح الرقم الكبير من الرقم الصغير للحصول علي عدد النيترونات)

a-82   b-126   c- 208   d- 290

نفس فكره الفديو السابق

6. Magnesium ion Mg^{+2} , has : (لو ما كان في أرقام تروحي علي الجدول الدوري) (لاحظي +2 ننقص 2 إلكترون)

a-12 protons and 13 electrons   b- 24 protons and 26 electrons

c- 12 protons and 10 electrons   d- 24 protons and 22 electrons

7. An oxide ions , O^{-2} , has :   (لاحظي 2 - نزيد 2 إلكترون)

a-8 protons and 10 electrons   b- 8 protons and 9 electrons

c- 10 protons and 8 electrons   d- 8 protons and 7 electrons

8. The number of electrons in <u>a neutral atom</u> of an element is always equal to the .... of element .

a-mass number   b-atomic number   c- isotope number   d- weight number

6. Use the following table :

Atom or ion element	I	II	III	IV	V	VI
Atom or ion electrons (e)	6	10	18	10	28	7
Atom or ion protons (p)	6	8	17	11	30	7
Atom or ion neutrons (n)	6	8	18	11	36	6

A. Which of the species are neutral ?

     a. III and V   b . II and III   c. IV and V   <u>d . I and VI</u>

b. Which of the species are negatively charged?

     a. III and V   <u>b . II and III</u>   c. IV and V   d . I and VI

c. Which of the species are positive charged?

     a. III and V   b . II and III   <u>c. IV and V</u>   d . I and VI

Isotopes النظائر

❄ **Isotopes :**

Are atoms of the same element has the same number of proton with different numbers of neutrons in their nuclei .

☞ **النظائر :** هي ذرات نفس العنصر التي لها نفس أعداد البروتونات لكن تختلف في أعداد النيترونات.

Hydrogen

^1_1H

Deuterium

$^2_1H\ (D)$

Tritium

$^3_1H\ (T)$
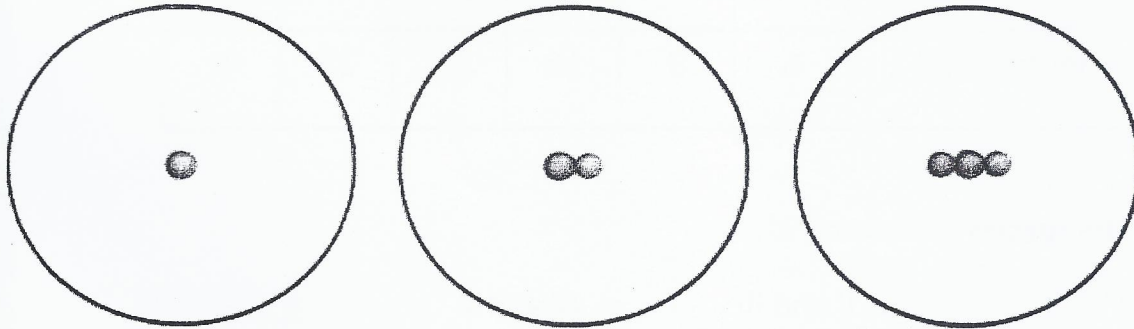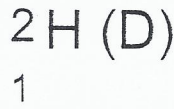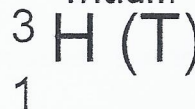
Examples : $^{35}_{17}Cl$, $^{37}_{17}Cl$. $^{14}_{7}N$, $^{15}_{7}N$. $^{15}_{8}O$, $^{16}_{8}O$.

Chemically , isotopes are not very different from each other.

☞ نظائر نفس العنصر لها نفس الخصائص الكيميائية .

1. Atoms of the same element with different mass numbers (or number of neutrons) are called

   a- ions   b-neutrons.   c- allotropes   d- isotopes.

2. Which of the following pair of atoms are isotopes ?

   a- $^{45}_{21}Sc$ and $^{45}_{23}V$ b- $^{40}_{20}Ca$ and $^{40}_{21}Sc$ c- $^{45}_{21}Sc$ and $^{45}_{22}Tl$ d- $^{44}_{21}Sc$ and $^{45}_{21}Sc$

3. which pair of species has the most nearly identical متماثلة تقريباً chemical properties ?

   a-$^{19}_{9}F$ and $^{19}_{9}F$ b- $^{35}_{17}C$, $_{11}Na^{23}$ c- $^{12}_{6}C$, $^{13}_{6}C$ d-none of all

Periodic Relationship Among the Elements

§ The periodic Table : is a chart in which elements having similar chemical

and physical properties are grouped together .

§ **In the periodic Table** : elements arranged in order of increasing the atomic number .

§ Horizontal Rows in periodic table are called **periods** (الدورات) .

§ **Periods**: are the horizontal rows , There are 7 Periods .

§ Vertical Columns are **groups** (المجموعات) families; elements have similar properties .

§ **Groups**: are the vertical rows There are 8 groups, assigned as **1A-to-8A** ,

Also 8 groups are assigned as **1B-to-8B** .

Modern Periodic Table

Important Notes

Video (5)

☛ **Elements in the same group** have similar chemical and physical properties.

🍎 **Groups 1B-to-8B** : are called the **Transition Metals** (العناصر الانتقالية) .

🍎 **Group 1A elements** : are called **Alkali Metals** (المعادن القلوية) .

🍎 **Group 2A elements** : are called **Alkaline Earth Metals** (المعادن الأرضية).

🍎 **Group 7A elements** : (F, Cl, Br, I and At) are as **Halogens**.

🍎 **Group 8A elements** : (He, Ne, Ar, Kr, Xe and Rn) are called **Noble Gases or Rare gasses** .

(الغازات النبيلة او الغازات النادرة).

METALs الفلزات

NON METALs الافلزات

metalloids أشباه الفلزات

Most metals is agood conductor of heat and electericity. (Gp: 1,2,3) (Transition metal)	17 Eelements : iS poor conductor of heat and Electericity. (Gp: 5,6,7,8) and H .	8 elements : are intermediate between metals and non metals . B-Si-As Te-At Ge-Sb -Po

العناصر الممثلة   العناصر الممثلة

العناصر الانتقالية

العناصر الانتقالية الداخلية

اللانثانيدات
الأكتينيدات

9. Gallium (Ga) element is found in the periodic table in

  a- period 3, group 1B   b- period 3A, group 4

  c- period 4, group 1A   d- period 4, group 3A

10.The elements in a column of the periodic table are known as

  a- metalloids.   b- a period.   c- noble gases.   d- a group.

11. Elements in Group 8A are known as the.

  a- halogens   b- alkali metals   c-noble gases   d- alkaline metals

12. An element in the upper right corner of the periodic table is .

  a- either a metal or metalloid   b- definitely a metal

  c- definitely a non-metal   d- either a metalloid or a non-metal

7. An element that appears in the lower left corner of a periodic table is ....

  a- either a metal or metalloid   b- definitely a metal

  c- either a metalloid or a non-metal   d- definitely a non-metal

13 . Which element is the 15th element in period 4 :

  a- Ca   b- As   c- P   d- S

14 . The element in group 3A and period 3 is :

  a-Ga   b- Sc   c- Al   d-B

15 . Which of these elements is most likely to be a good conductor of electricity?

a- N   b- S   c- He   d- Fe

16 .The elements in a column are usually poor conductor of heat and electricity :

a- metals   b- metalloids   c- non metal   d- alkali

17.   Which of the following is a metalloids ?

a-N   b- Pb   c- Mg   d-Te

18 . Which of these elements is chemically similar to magnesium?

a-Sulfur   b- Calcium   c- iron   d- nickel

19 . Which of these elements is chemically similar to oxygen ?

a- Sulfur   b- Calcium   c- Iron   d- Sodium

20. The elements located in group 7A of the periodic table are called:

a- alkali metals   b- noble gases   c- chalogens   d- halogens

21 . which of the following is a metalloid :

a- Bi   b- Cu   c- Ca   d- As

Molecules and Ions   الجزيئات و الأيونات

✿ **Molecules :** Is an aggregate of two or more atoms in a definite arrangement held

together by chemical forces.

☞ الجزيئات : تنشاء نتيجة اتحاد ذرتين او أكثر عن طريق روابط كيميائية.

Molecules

Video : 10

Diatomic : Conaint only two atom.

H_2 , N_2 , O_2 , HCl , CO.
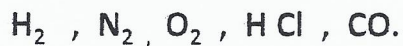
Poly atomic : Contain more thanTwo atoms.

Ex : O_3 , NH_3 , H_2O , CH_4 .

Ions

cation : ions whith + ve charge (losse).
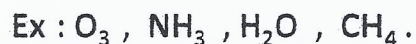
Anions : ions with - ve charge (gain).

mono atomic

Na^+, K^+ , Mg^+

poly atomic

NH_4^+

mono atomic

Cl^- , Br^- , S^{-2}.

polyatomic

OH^- ,$(po_4)^{-3}$
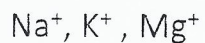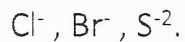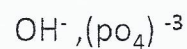
1. an example of a diatomic molecule is : (جزيء ثنائي الذرة)

    a- H_2O <u>b- H Cl</u>   c- Ba^{2+} d- O_3
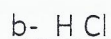
2. Which of the following molecule is a <u>diatomic</u> molecule ?

    a- N_2O b- N_2O_4 c- NO_2 <u>d- NO</u>
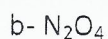
3. One of the following molecule is <u>not</u> a polyatomic molecule: (جزيء ليس عديد الذرات)

    a-NH_3 b- CH_4 c- H_2O <u>d- HCl</u>

4. Which of these ions is <u>a monatomic ions</u> ?

    <u>a- Na^+</u>   b- SO_4^{2-} c- NO_3^- d- NH_4^+
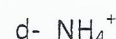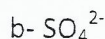
5. An example of <u>monatomic ion</u> is :

    a- <u>N^{-3}</u>   b- NO_2^{-1} c- N   d- NO_3^{-1}

6. Al^{3+} is an example of one of the following:

    a- monatomic anion   <u>b- monatomic cation</u>

    c- a polyatomic cation   d- a polyatomic anion

7. SO_4^{2-} is an example of one of the following:

    a- amonatomic anion   b- monatomic cation

    c- a polyatomic cation   <u>d-a polyatomic anion</u>

Molecular Mass and Mole

- الكتلة الجزيئية (Molecular Mass) : هي مجموع كتل الذرات المكونة للجزيء .

- الكتل الذرية لبعض العناصر $C = 12$, $Na = 23$, $S = 32$, $O = 16$, $H = 1$.

Compound	Molecular Mass
H_2O	$(1 \times 2) + (16 \times 1)$ $= 18$ g/mol
H_2SO_4	$(1 \times 2) + 32 + (4 \times 16) = 98$ g/mol
CH_3OH	$12 + (1 \times 3) + 16 + 1 = 32$ g/mol

Ex : Penicillin is $C_{16}H_{18}N_2O_4S$. What is the molecular weight of Penicillin ?

   a- 316   <u>b- 334</u>   c- 388   d- 280

($H = 1$, $O = 16$, $S = 32$, $Na = 23$, $C = 12$)

☞ $C_{16}H_{18}N_2O_4S$: $(12 \times 16) + (18 \times 1) + (14 \times 2) + (16 \times 4) + (32 \times 1) = 334$

2. Which molecule from the following has the largest mass

   a- HBr   b- HCl   c- HF   <u>d- HI</u>

Mass percent   النسبة المئوية لكتلة عنصر في مركب

$$\% \text{ العنصر} = \frac{\text{عدد ذرته} \times \text{الوزن الذري للعنصر}}{\text{الوزن الجزيء للمركب}} \quad x100$$

Percent Composition by Mass : is the percent by mass of each element in a compound

1. In pure ethanol C_2H_6O the mass percent of carbon , Hydrogen and Oxygen are :

$$C \% = \frac{2 \times 12}{46} \quad x \ 100 = 52.17 \ \%$$

$$H \% = \frac{6 \times 1}{46} \quad x \ 100 = 13.04 \ \%$$

$$O \% = \frac{1 \times 16}{46} \quad x \ 100 = 34.78 \ \%$$

2. The percent by mass of Sulfur in $Al_2(SO_4)_3$ is :

   a-28.07 %   b- 13.05 %   c- 32.13 %   d- 14.25 %

$$S \% = \frac{(32 \ x3)}{(27 \times 2) + (32 \times 3) + (16 \ x \ 12)} \quad x \ 100 = 28.07 \ \%$$

حساب الكتلة الذرية للعنصر (Average atomic mass)

Video (15)

الكتلة الذرية للعنصر (Am) = (نسبة وجود النظير الأول × الكتلة) + (نسبة وجود النظير الثاني × الكتلة)

1.What information would you need to calculate the average atomic mass of an element :

a- The number of neutrons in the element .

b- The atomic number of the element .

c- The atomic mass and abundance of each isotope the element .

d- The position in the periodic table of the element .

2. An element Consists of two of masses 10.02 and 11.02 u The abundances 25 % and

75% , respectively .the atomic mass of   this element be :

a-10.77   b- 21.04   c- 10.5   d-1.077

الكتلة الذرية للعنصر (Am) = (نسبة وجود النظير1 × كتلة) + (نسبة وجود النظير 2 × كتلة)

Atomic mass = ($10.02 \times \frac{25}{100}$) + ($11.02 \times \frac{75}{100}$) = 10.77 a.m.u

3. Calculate the average atomic mass of silicon which consists of three stable isotopes ;

Silicon^{28} (92.22%) . Silicon ^{29}(4.69%) and silicon ^{30} (3.09%) which have atomic masses

of 27.98 amu ,   28.98 amu and 29.97 amu .   (Exam 1435)

a- 27.67 amu   b-30.08 amu   c- 28.09 amu   d- 32.18 amu

Video (16)

الكتلة الذرية للعنصر (Am) = (نسبة وجود النظير1× كتلة) + (نسبة وجود النظير 2 × كتلة) + ...

$Am = (27.98 \times \frac{92.22}{100}) + (28.98 \times \frac{4.69}{100}) + (29.97 \times \frac{3.09}{100}) = 28.09$ amu

4. Cupper (Cu) has two stable isotopes (^{63}Cu and ^{65}Cu).the average atomic mass is 63.5460 amu

^{63}Cu has mass of 62.9296 amu with an abundance of 69.15%   نفس فكره الفديو السابق

the mass of (^{65}Cu) isotopes in amu with an abundance of 30.85 % is :

a-64.8792   b-64.2978   c-64.9278   d-64.7892

الكتلة الذرية للعنصر (Am) = (نسبة وجود النظير1× كتلة) + (نسبة وجود النظير 2 × كتلة)

$63.5460 = (62.9296 \times \frac{69.15}{100})   + (mass_2 \times \frac{30.85}{100})$

$mass_2 = 64.9278$

5. The atomic masses of Cl (75.53 %) and Cl (24.47 %) are 34.968 amu and 36.956 amu, respectively.

Calculate the average atomic mass of chlorine.

نفس فكره الفديو السابق

A) 35.96 amu

B) 35.45 amu

C) 36.47 amu

D) 71.92 amu

الكتلة الذرية للعنصر (Am) = (نسبة وجود النظير1× كتلة) + (نسبة وجود النظير 2 × كتلة) + ...

$$Am = (34.968 \times \frac{75.53}{100}) + (36.956 \times \frac{24.47}{100}) = 35.45 \quad amu$$

| Chemical Formulas | الصيغ الكيميائية | | Video (27) |

Molecular Formula

Show the number and type of atoms in the molecules.

Ex : CH_4 , H_2O_2 , C_2H_4 , $C_6H_{12}O_6$.

Empirical Formula

show the smallest whole number ratio of atoms

in a molecule . CH_4 , HO , CH_2 , CH_2O .

Ionic Formula

Show the number of electrons lost & gained must be equal,

so + and - charge cancel out.

molecular	empirical
H_2O	H_2O
$C_6H_{12}O_6$	CH_2O
O_3	O
N_2H_4	NH_2

1. An empirical formula always indicates ....

  a) which atoms are attached to which in a molecule

  b) how many of each atom are in a molecule

  c) the simplest whole-number ratio of different   atoms in a compound

  d) the geometry of a molecule

2. A molecular formula always indicates ....

  a) how many of each atom are in a molecule

  b) the simplest whole-number ratio of different atoms in a compound

  c) which atoms are attached to which in a molecule
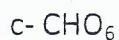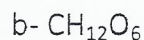
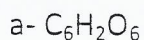 d) the isotope of each element in a compound
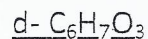
3. Which of the following, the only empirical formula is:
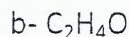
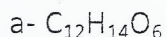a- P_2O_5 b-O_3 c-Na_2O_2 d- C_3H_6
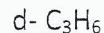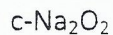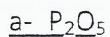
4. What is the empirical formula of P_4O_{10}?

a-P_4O_5 b- PO   c-P_2O_5 d- PO_5
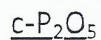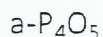
5. The empirical formula $C_6H_{12}O_6$ is :

a- $C_6H_2O_6$ b- $CH_{12}O_6$ c- CHO_6 d- C H O
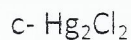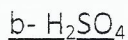
6. The empirical formula of a compound with molecules containing 12 carbon atoms,

   14 hydrogen atoms,   and 6 oxygen atoms is ....

a- $C_{12}H_{14}O_6$ b- C_2H_4O c- CH_2O d- $C_6H_7O_3$

7. The only empirical formula from the following is :

a-N_2F_2 b-H_2c_2 c-HNF_2 d- N_2F_4
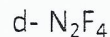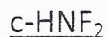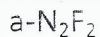
8. Which of the following is an empirical formula:

a- $C_{12}H_{22}O_{10}$.   b- H_2SO_4 c- Hg_2Cl_2 d- S_8.
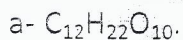
9. The empirical formula of a compound containing of

(7.45 % ^7Li) , (11.7 % ^{11}B) and (80.85 % ^{19}F)   is :

a- $Li_2B_2F_8$ b- $LiBF_4$ c- $LiBF_2$ d- $Li_2B_2F_4$
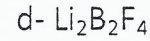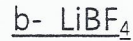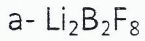
	Li	B	F
MASS نقسم كل نسبة علي الكتلة الذرية لكل للعنصر	7.45÷7	11.7÷11	80.85÷19
Moles نقسم كل النتائج علي اقل ناتج منهم .	$\dfrac{1.064}{1.064}$	$\dfrac{1.064}{1.064}$	$\dfrac{4.255}{1.064}$
	1	1	4

10. The empirical formula of a compound is 50.70 % Carbon 4.23% Hydrogen

and 45.07 % Oxygen is :

a-$C_3H_2O_2$ b- $C_6H_6O_4$ c- $C_3H_3O_2$ d- $C_{12}H_{12}O_8$
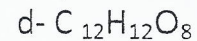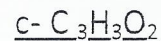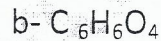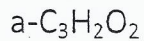
	C	H	O
Mass	50.70÷12	4.23÷1	45.07÷16
Moles	4.225	4.23	2.817
÷ 2.817	1.5	1.5	1
× 2	3	3	2

11 . A compound consist of the following elements by weight percent 40.0 % carbon   53.3 % Oxygen

and 6.7 %hydrogen . the ratio of carbon Oxygen , hydrogen in the empirical formula is

a- 1 : 2 :1   b-1 : 1 : 2   c-1 : 2 : 1   d- 2 : 1 : 2

	C	O	H
Mass	$40 \div 12$	$53.3 \div 16$	$6.7 \div 1$
Moles	3.3	3.3	6.7
$\div 3.3$	1	1	2

12 . Ascorbic acid composed of 40.92 % C , 4.58 % H , and 54.50% O by mass.

Determine its empirical formula   نفس فكره الفديو السابق

	C	O	H
Mass	$40.92 \div 12$	$54.50 \div 16$	$4.58 \div 1$
Moles	3.41	3.4	4.58
$\div 3.4$	1	1	1.35
× 3	3	3	4

13. What is the <u>empirical formula</u> of the compound with the following composition?

2.1 percent H, 65.3 percent O, 32.6 percent S.

نفس فكره الفديو السابق

A) H_2SO_4

B) H_2SO_3

C) $H_2S_2O_3$

D) HSO_3
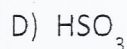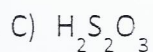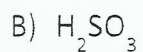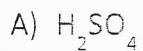
	H	S	O
Mass	2.1 ÷ 1	32.6 ÷ 32	65.3 ÷ 16
Moles	2.1	1	4
÷ 1	2	1	4

كتابة الصيغة الجزيئية باستخدام الكتل الجزيئية والصيغة الاولية

Vicec 21

$$Molecular\ formula = \frac{Mm\ For\ molecular\ formula}{Mm\ for\ Empirical\ formula} \times Emprical\ formula$$

الكتلة الجزيئية الصيغة الاولية :EM(Empirical mass) , الكتل الجزيئي لصيغة للمادة مجهولة : Mm

1. A compound has a simple formula P_2O_5 and molecular weight 284 g/ mol find

   molecular formula (p = 31 , O = 16) .

$$Molecular\ formula = \frac{Mm}{Em} \times P_2O_5 = \frac{284}{(31\times2)+(16\times5)} = 2\times p_2o_5 = p_4O_{10}$$

2. The empirical formula of a compound is CH_2. if the molecular weight of the

   compound is 56 .how many carbon atom does a molecule contain?

   <u>a-4</u>   b-1   c-2   d-6

$$E.m = 12 + 2 = 14$$

$$Molecular\ formula = \frac{Mm}{Em} \times Emprical\ formula$$

$$Molecular\ formula = \frac{56}{14} \times CH_2 = 4 \times CH_2 = C_4H_8$$

3. compound has the empirical formula H_1C_1 and molecular mass 78.11

   The molecular formula could be A written as:

   a) H_2C_2 b) H_4C_4 c) H_5C_5 <u>d) H_6C_6</u>

4. An organic compound which has the empirical formula CHO has molar mass 232 .

Its molecular formula is

نفس فكره الفديو السابق

a-CHO   b- $C_2H_2O_2$ c - $C_4H_4O_4$ d-$C_8H_8O_8$
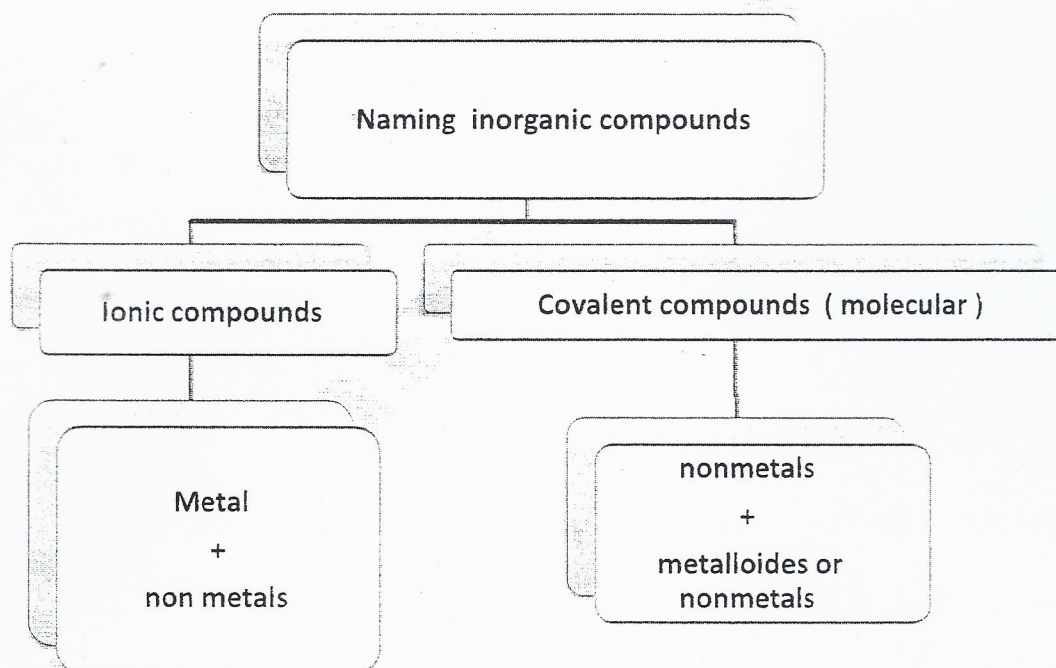
$$Mm (الكتلة الجزيئية معطي)=232 \qquad 29 = (كتلة الصيغة البسيطة) \ E.m : CHO$$

$$M.F = \frac{M_m}{E_m} \times CHO = \frac{232}{29} \times CHO = 8 \times CHO = C_8H_8O_8$$

Naming Compound   Video (22 - .....)

✿ **Chemical nomenclature**:   is naming the chemical compounds .

```
                    ┌─────────────────────┐
                    │     COMPOUND        │
                    └─────────────────────┘
                      │               │
          ┌───────────────────┐   ┌───────────────────┐
          │ Organic compounds │   │ In organic Compound│
          └───────────────────┘   └───────────────────┘
```

```
            ┌─────────────────────────────┐
            │ Naming  inorganic compounds │
            └─────────────────────────────┘
                │                    │
        ┌───────────────┐   ┌──────────────────────────────┐
        │ Ionic compounds│  │ Covalent compounds ( molecular )│
        └───────────────┘   └──────────────────────────────┘
                │                         │
         ┌─────────────┐         ┌──────────────────┐
         │   Metal     │         │   nonmetals      │
         │     +       │         │      +           │
         │ non metals  │         │ metalloides or   │
         │             │         │ nonmetals        │
         └─────────────┘         └──────────────────┘
```
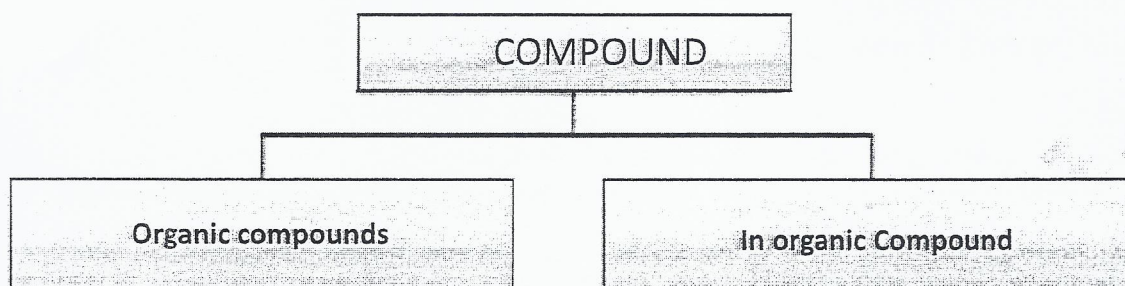
1. Which of these pairs of elements would be most likely to form an ionic compound?

   (a) P and Br   (b) Cu and K   (c) C and O   (d) O and Zn   (e) Al and Rb

2. Which of these pairs of elements would be most likely to form a molecular compound?

   (a) Na and Br   (b) C and O   (c) Ca and O   (d) Zn and O   (e) Mg and Cl

Naming of Ionic Compounds

❧ consist of a combination of cations (metals) and an anions (non metals) .

☛ The sum of the charges on the cations and anions in each formula unit must equal zero.

☛ The formula of the ionic compound must be neutral.

اولا : المركبات الأيونية التي ليس بها عنصر انتقالي

✍ نكتب الرمز الخاص بكل أيون (الأيون الموجب دائما علي اليسار).

كلوريد الصوديوم $Na^+ Cl^-$

✍ نكتب تكافؤ كل أيون أسفله .

$$Na \qquad Cl$$
$$1+ \qquad 1$$

✍ نكتب الصيغة الكاملة مع تبديل التكافؤات .

$$Na \qquad Cl$$
$$1+ \qquad 1$$

☛ عند التسمية نبدأ بالأيون الموجب ثم الأيون السالب.

👍 Metal Cation   : Takes their names from the element .

✍ Non metal anion : Take the first part of the element name and add –ide.

     Sodium Chloride $NaCl$: sodium chloro ide .

1. which of pairs elements would be most likely to form ionic compound?

     a- C and O   <u>b- O and zn</u>   c- Cu and K   d- Al and Rb

2. Which one is an ionic compound ?

     a-CH_4 <u>b- $Pd\,Cl_2$</u>   c-NH_3 d- PH_3

3. Which of these pairs of elements would be most likely To form an ionic compound ?

     a-P and C   b-Zn and K   <u>c- F and Al</u>   d- C and S

Name	Symbol	Valence
Ammonium	NH_4	+1
Hydroxide	OH	-1
Cyanide	CN	-1
Nitrate	NO_3	-1
Nitrite	NO_2	-1
Chlorate	ClO_3	-1
Bicarbonate	HCO_3	-1
Bisulfate	HSO_4	-1
Permanganate	MnO_4	-1
Sulfate	SO_4	-2
Sulfite	SO_3	-2
Carbonate	CO_3	-2
Chromate	CrO_4	-2
Dichromate	Cr_2O_7	-2
Nitride	N	-3
Hydrogen phosphate	HPO_4	-2
Dihydrogen phosphate	H_2PO_4	-1
phosphate	PO_4	-3

1. What are the ions present in the compound $(NH_4)_2 SO_4$?

a- NH_3 , H_2 , and SO_2

b- N^{3-}, H^+, S^{2-}, O^{2-}

c- NH_4^{2+} and SO_4^-

d- $(NH_4^+)_2$ and SO_4^{2-}

e- NH_4^+ and SO_4^{2-}

| Cation	Anion	Name of compound		
Ca^{++}	Po_4^{-2}	Ca Po$_4$ $\longrightarrow$ $Ca_3(PO_4)_2$		
		2 3 calcium phosphate		
Al^{+3}	O^{-2}	Al O $\longrightarrow$ Al_2O_3		
		3 2 Aluminum Oxide		
NH_4^+	Co_3^{-2}	NH$_4$ Co$_3$ $\longrightarrow$ $(NH_4)_2 CO_3$		
		1 2 ammonium Carbonate		
Al^{+3}	S^{-2}	Al S $\longrightarrow$ Al_2S_3		
		3 2 Aluminum Sulfide		
Mg^{+2}	$H CO_3^{-1}$	Mg H CO$_3$ $\longrightarrow$ $Mg(HCO_3)_2$		
		2 1 Magnesium bicarbonate		

(a) $Cu(NO_3)_2$: Copper (II) nitrate .

(b) KH_2PO_4 : Potassium di hydrogen phosphate

(c) NH_4ClO_3 : Ammonium chlorate .

قاعدة تبادل التكافؤات

Element	Molecule	Ion	Element	Molecule	Ion
Na	Na	Na^+	Li	Li	Li^+
Mg	Mg	Mg^{++}	Be	Be	Be^{+2}
Al	Al	Al^{+3}	B	B	B^{+3}
Si	Si	Si^{+4}	C	C	$C^{\pm4}$
P	P	P^{-3}	N	N_2	N^{-3}
S	S	S^{-2}	O	O_2	O^{-2}
Cl	Cl_2	Cl^-	F	F_2	F^-
Ar	Ar	-	Ne	Ne	-

Ex $_1$: Potassium Bromide : k Br

$$K^+ \qquad Br^-$$
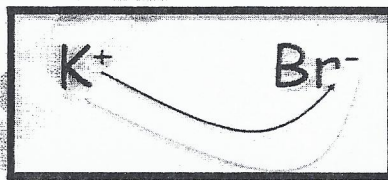
Ex $_2$: Zinc Chloride : Zn Cl_2

$$Zn^{2+} \qquad Cl^-$$
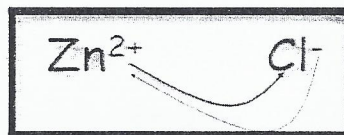
Ex $_3$: magnesium nitride,

$$Mg^{2+} \qquad N^{3-}$$
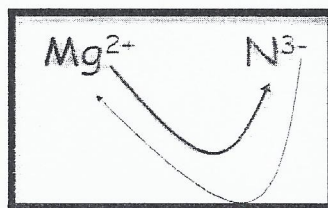
1. .... typically forms ions with a 2+ charge.

   a- Transition metals   b- Halogens   c- Alkaline earth metals   d- Alkali metals

2. Which one these species is a cation ?

   a-B^{+3} b- Cl^- c- He   d- ^{14}C

3. The element would be most likely to form anion is :

   a- F   b-Zn   c- Hg   d- Li

4. The species O^{2-} , Br^- , F^- all are :

   a-isotopes   b- cations   c- anions   d- halogens

5. The formula of stannic oxide is SnO_2. The valence of Sn is:

   a- +1   b- +2   c- +3   d- +4

6. The charge on the manganese in the salt MnF_3 is

   a- +1   b- -1   c- +3   d- -2

7. Aluminum forms an ion with a charge of

   a- +2   b- -3   c- +3   d- +1

8. Iodine forms an ion with a charge of

   a- -7   b- +1   c- -1   d- +2

9 . Barium forms an ion with a charge of

   a- +1   b--2   c- +3   d- None of the above.

ثانياً : المركبات الأيونية (ionic compound) التي بها عنصر انتقالي

Fe^{+3}	NO_2^{-1}	Fe $(NO_2)_3$	IRON (III) nitrite
CO^{+2}	Po_4^{-3}	$Co_3(po_4)_2$	Cobalt (II) phosphate
CU^{+2}	Co_3^{-2}	Cu_2CO_3	Coper (I) Carbonate

Fe^{2+} iron(II)   , Au^- gold(I), Cu^- copper(I) ,
Fe^{3+} iron(III) $Au3^+$ gold(III) Cu^{2-} copper (II)
Hg_2^- mercury(I) Hg^{2-} mercury (II)

(a) Cesium sulphide   : Cs_2S

(b) Calcium phosphate : $Ca_3(PO_4)_2$

(c) Mercury (I) nitrite   : $Hg_2(NO_2)_2$

Note:

Mercury (Hg) is the only metal has this formula when it form cation with only one positive charge :

Hg_2^{2+} NOT Hg^+ . The cation of two positive charges has the formula Hg_2^+ .

Some Cations of variable charge have name for each oxidation state

Example

Fe^{2+} iron(II) ferrous , Fe^{3+} iron(III) ferric

Cu^+ copper(I) cuprous , Cu^{2+} Copper (II) cupric

Hg_2^{+2} mercury(I) **mercurous** , Hg^{2+} mercury (II) **mercuric**

Molecular Compounds   تسمية المركبات التساهمية

➤ Place the name of the first element in the formula first, and the second

element is named by adding –ide at the last of the name.

HCl	Hydrogen chloride
HBr	Hydrogen bromide
SiC	Silicone carbide

✿ المركبات التساهمية : مركبات تتكون نتيجة اتحاد عنصر فلز مع أخر لا فلز .

☛ في حال وجود أكثر من ذرة لنفس العنصر في المركب التساهمي يتم استخدام المقاطع الاتية لتدل

علي عدد ذرات نفس العنصر في المركب :

1. mono   2. di   3. tri   4. Tetra   5. penta   6. hexa   7. hepta   8. octa

CO	Monocarbon monooxide → Carbon monoxide
CO_2	Carbon dioxide
SO_2	Sulphur dioxide
SO_3	Sulphur trioxide
NO_2	Nitrogen dioxide
N_2O_4	Dinitrogen tetroxide

(a) $SiCl_4$: Silicon tetrachloride .   (b) P_4O_{10} :Tetra phosphorus decoxide

(C) carbon disulphide : CS_2 (d) Di silicon hexa bromide : S_2Br_6

2- common names of some molecular compounds

B_2H_6	Diborane
CH_4	Methane
SiH_4	Silane
NH_3	Ammonia
PH_3	Phosphine
H_2O	Water
H_2S	Hydrogen sulfide

(a) Na_2CrO_4 → ionic → sodium chromate

(b) K_2HPO_4 → ionic → potassium hydrogen phosphate

(c) HBr → molecular → hydrogen bromide

(d) Li_2CO_3 → ionic → lithium carbonate

(e) $K_2Cr_2O_7$ → ionic → potassium dichromate

(f) NH_4NO_2 → ionic → ammonium nitrite

(g) PF_3 → molecular → phosphorus triflouride

(h) PF_5 → molecular → phosphorus pentaflouride

(i) P_4O_6 → molecular → tetraphosphourus hexoxide

(j) CdI_2 → ionic → cadmium iodide

(k) $SrSO_4$ → ionic → strontium sulphate

(l) $Al(OH)_3$ → ionic → aluminium hydroxide

(m) Na_2CO_3 → ionic → sodium carbonate

(n) $FeCl_2$ → ionic → iron (II) chloride

(o) FeO → ionic → iron (II) oxide

(p) Fe_2O_3 → ionic → iron (III) oxide

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Write the formulas for the following
compounds:

(a) Rubidium nitrite $\rightarrow RbNO_2$

(b) potassium sulphide $\rightarrow K_2S$

(c) magnesium phosphate $\rightarrow Mg_3(PO_4)_2$

(d) calcium hydrogen phosphate $\rightarrow CaHPO_4$

(e) potassium dihydrogen phosphate $\rightarrow KH_2PO_4$

(f) iodine heptaflouride $\rightarrow IF_7$

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(g) ammonium sulphate $\rightarrow (NH_4)_2SO_4$

(h) silver perchlorate $\rightarrow AgClO_4$

(i) boron trichloride $\rightarrow BCl_3$

(j) copper (I) cyanide $\rightarrow CuCN$

(k) copper (II) cyanide $\rightarrow Cu(CN)_2$

(l) lead (II) carbonate $\rightarrow PbCO_3$

(m) lead (IV) carbonate $\rightarrow Pb(CO_3)_2$

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Cu_2SO_4	Copper I sulfate	$Cr SO_4$	Chromium II sulfate
$Cu SO_4$	Copper II sulfate	CrO_3	Chromium VI oxide
$Cr O$	Chromium II oxide	MnO_2	Manganese IV oxide
Cr_2O_3	Chromium III oxide	Mn_2O	Manganese I oxide
$bpCl_4$	Lead IV oxide	Mn_2O_7	Manganese VII oxide

1. The correct name for PCl_5 is

    a- monophosphate pentachloride   b- phosphorus chloride

    c- monophosphate tetrachloride   d- phosphorus pentachloride

2. The correct name for N_2O is ?

    a-nitrogen dioxide   b- nitrogen oxide

    c-dinitrogen oxide   d- dinitrogen monoxide

3 . Which is the formula for the dinitrogen pentoxide

    a- NO_2 b- N_2O_5 c- N_2O_7 d- N_2O_2

4. The Stock system name for Mn_2O_7 is

    a-dimanganeseheptaoxide.   b- magnesium oxide.

    c- manganese(VII) oxide.   d-manganese(II) oxide.

5. The correct name for K_2O is ?

    a-potassiun dioxide   b-dinitrogen oxide

    c-potassium oxide   d- dipotassium monoxide

6. The Stock system name for $FeCl_3$

    a- Iron (II) chloride   b- Iron (III) trichloride

    c- Iron (III) chloride   d- monoiron trichloride

7. Which is the correct formula for lead (IV) Chloride ?

  a-Pb_4Cl b- $PbCl_2$ c- $PbCl_3$ d- $\underline{PbCl_4}$

$$Pb \quad\quad Cl$$
$$4 \quad\quad 1$$
$$PbCl_4$$
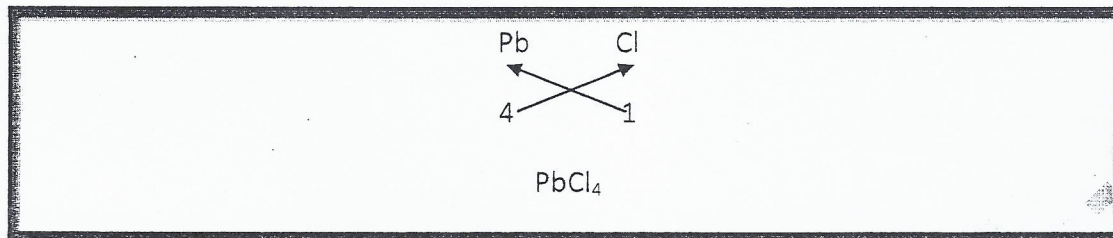
8. what the formula for the binary compound formed by potassium and nitrogen ?

  a-KN   b- k_2N c- Nk_2 $\underline{d- K_3N}$

9. The stock system name for $Cr SO_4$ is :

  a- chromic sulfide   <u>b- chromium (II)sulfate</u>

  c- chromium (II) sulfite   d-chromium (III) sulfite

10. The systematic name of Ag_2CO_3 is :

  a- Silver (I) Carbonate   b- Silver (II) Carbonate

  <u>c- Silver Carbonate</u>   d- Silver (I)bi Carbonate

11.The systematic name of $Fe(NO_3)_2$ is :

  a-Iron (II) nitrite   <u>b- Iron (II) nitrate</u>

  c-Ferric nitrate   d-Iron (II)nitride

12. The correct name for $KHCO_3$ is :

  <u>a-potassium bicarbonate</u>   b- calcium carbonate

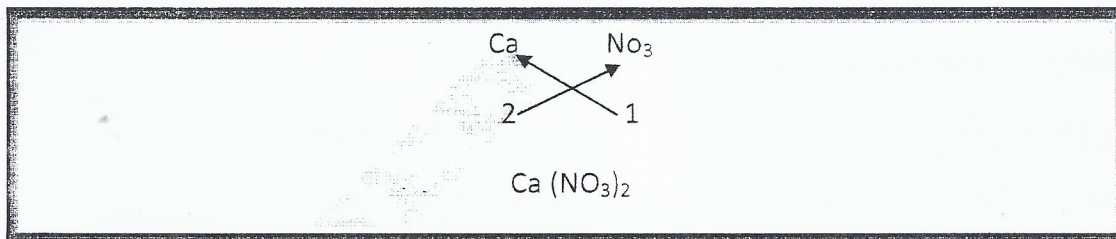 c-potassium carbonate   d- calcium hydrogen carbon tri oxide
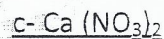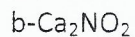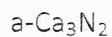
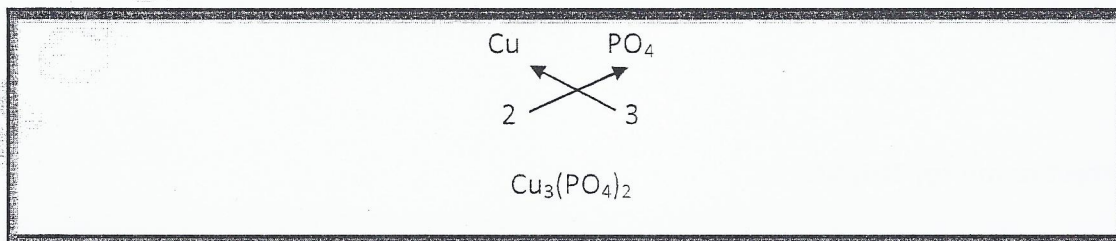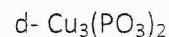13. What is the formula for the ionic compound formed by calcium ions and nitrate ions?

    a-Ca_3N_2 b- $Ca(NO_3)_2$ c- Ca_2NO_3 d- Ca_2NO_2
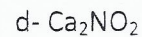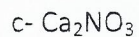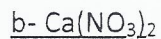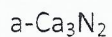
14. The formula for magnesium sulfate is :
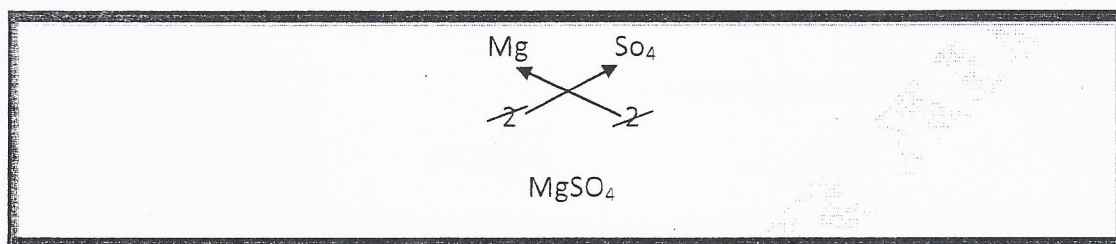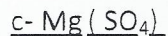
    a- Mn   b- Mgs   c- $Mg(SO_4)$ d- $MnSO_3$

$$Mg \qquad SO_4$$
$$2 \qquad\qquad 2$$
$$MgSO_4$$

15. what is the formula for the ionic compound formed by calcium ions and nitrate ions ?
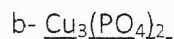
    a-Ca_3N_2 b-Ca_2NO_2 c- $Ca(NO_3)_2$ d- Ca NO
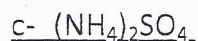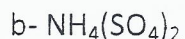
$$Ca \qquad NO_3$$
$$2 \qquad\qquad 1$$
$$Ca(NO_3)_2$$

16. Which is the correct formula for copper (II) phosphate ?

    a-$CuPO_4$ b- $Cu_3(PO_4)_2$ c- $CuPO_3$ d- $Cu_3(PO_3)_2$
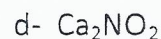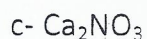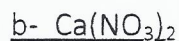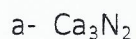
$$Cu \qquad PO_4$$
$$2 \qquad\qquad 3$$
$$Cu_3(PO_4)_2$$

17. Which of the following compounds is named lithium carbonate?

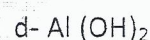   a- Na_2CO_3 b- $LiHCO_3$ c- Li CO   d- Li_2CO_3
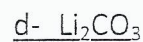
18. What is the formula for ammonium sulfate?

a- NH_4SO_4 b- $NH_4(SO_4)_2$ c- $(NH_4)_2SO_4$ d- NH_4S

19. What is the formula for the ionic compound formed by calcium ions and nitrate ions?

a- Ca_3N_2 b- $Ca(NO_3)_2$ c- Ca_2NO_3 d- Ca_2NO_2

20. The right formula for aluminum hydroxide is :

a- $Al\ OH$ b- $Al\ (OH)_3$ c- $Al_2(OH)_3$ d- $Al\ (OH)_2$

21. Which is the correct formula for copper(II) phosphate?

a- Cu_2PO_4 b- $Cu_3(PO_4)_2$ c- Cu_2PO_3 d- $Cu(PO_4)_2$
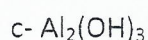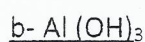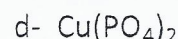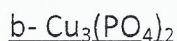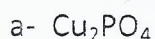
22. The systematic name of $Si\ Cl_4$ is :

a- Silicon tetra chloride   b- Silicon IV chloride

c- Silicon chloride   d- Silicon tri chloride

23. The name of $Si\ Cl_4$ stock system is :

a- Silicon tetra chloride   b- Silicon IV chloride

c- Silicon chloride   d- Silicon tri chloride

24. The correct name for NH_4NO_3 is

a- ammonium nitrate.   b- ammonium nitrogen trioxide.

c- ammonia nitrogen oxide.   d- hydrogen nitrogen oxide

خاص بمنهج الفيصليه د. سميرة سعيد

Chemistry In Action

Natural abundance of elements in Earth's crust

Mantle
Crust
Core

All others 5.3%
Magnesium 2.8%
Calcium 4.7%
Oxygen 45.5%
Iron 6.2%
Silicon 27.2%
Aluminum 8.3%

2900 km 3480 km
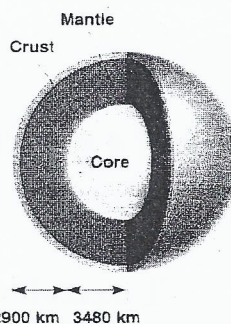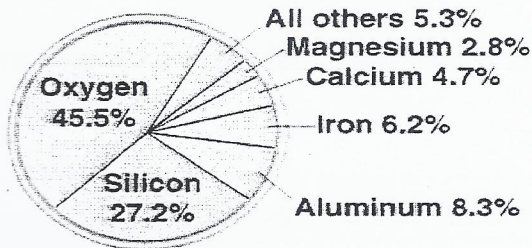
Natural abundance of elements in human body

Oxygen 65%
All others 1.2%
Phosphorus 1.2%
Calcium 1.6%
Nitrogen 3%
Carbon 18%
Hydrogen 10%

2.4

Gases

monoatomic

Nobel gas
He , Ne , Ar
Kr . Xe .

Diatomic

O_2 , N_2 , F_2 , Cl_2, H_2

HF, HBr , HCL, HI , CO

Tri atomic

O_3

N_2O , CO_2
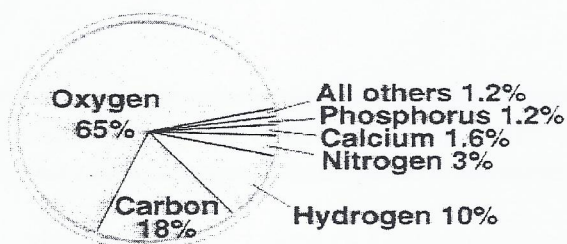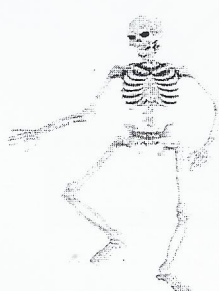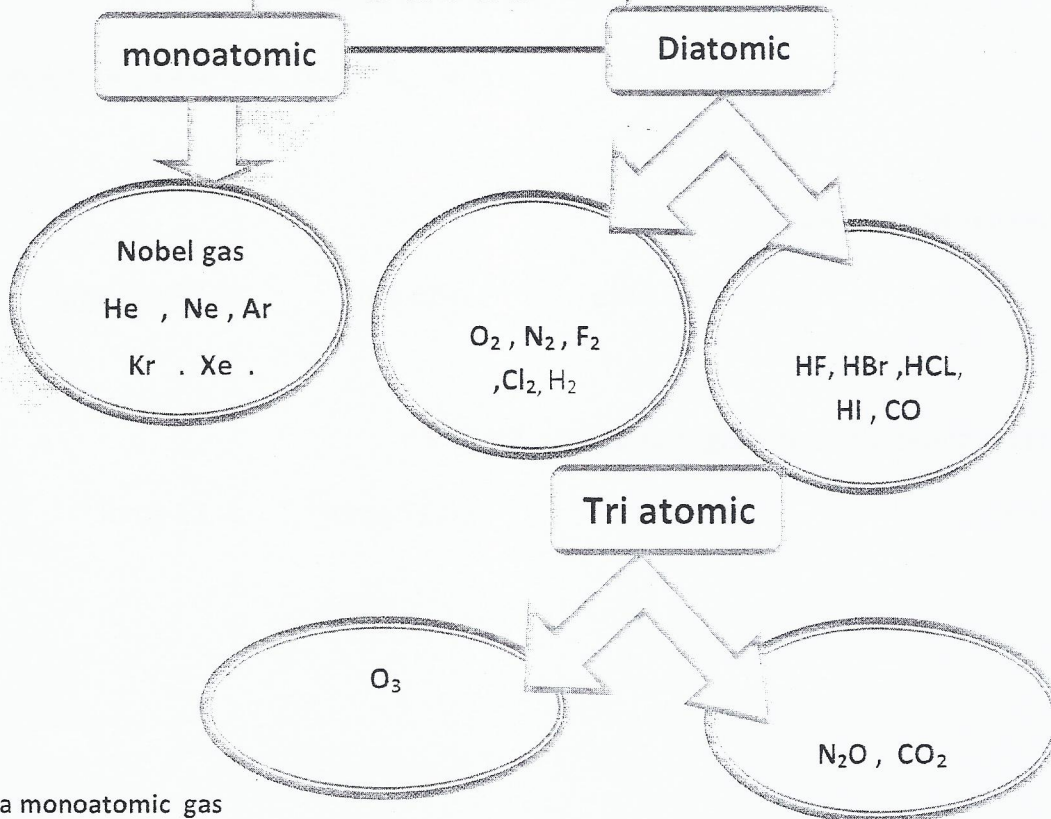
1. An example of a monoatomic gas

a- Br_2 b- HCl   c- NO   d- Ar

▶ **One mole of a substance contains an Avogadro's Number of units**

$$1 \text{ mol} = N_A = 6.0221367 \times 10^{23}$$

Molecular Mass (Molar mass) (mass/mole Or g/ mole)

☞ Is the sum of the atomic masses (in amu) in the molecule .

☞ multiply the atomic mass of each element by the number of atoms of

  that element present in the molecule and sum over all the elements .

✎ الكتلة الجزئية : هي مجموع كتل الذرية في الجزيء .

1. Molecular Mass of H_2O is :

 a- 17amu   b- 19.5 amu   c-16 amu   d-18.02 amu

2. What is the molecular weight of $CuSO_4 . 5H_2O$?

 a-249.5 g mol^{-1} b- 177.5 gmol^{-1} c-127 gmol^{-1} d- 87 gmol^{-1}

من طلب العلا من غير كد أضاع العمر في طلب المحال

Molar Mass

Molar mass (M): the mass (in g or kg) of **one mole of a substance** .

Video (2)

= Atomic Mass unit (amu)

One mole of any a substance :

contains 6.022×10^{23} particles (atoms or molecules or ions etc)

For one mole : 1 amu = 1 g has 6.022×10^{22} particles

Example : -

1 mole of ^{12}C = 12.00 amu = 12.00 g = has N_A of atoms = 6.022×10^{23} atoms

$$1 \text{ g} = 6.022 \times 10^{23} \text{ amu}$$

1 . How many amu are there in 8.4 g ?

1 gram $\longrightarrow$ 6.022×10^{23} amu

8.4 gram $\times$ x amu

$X = 5 \times 10^{24}$

خريطة ذهنية مهمة   Video 3

العلاقة بين الكتلة وعدد المولات لمادة ما

mass : كتلة المادة بالجرام M_m : كتلة المول من المادة   n: عدد مولات المادة

Video (4)

1. Calculate mass of 5 mol of CO_2 ?

mass= ?? g   ,   Mm = 44   g / mol   ,   n = 5 mol

mass = n $\times$ Mm = 5 × 44 = 220 gram

العلاقة بين عدد المولات وعدد الجزيئات (عدد أفوجادرو)
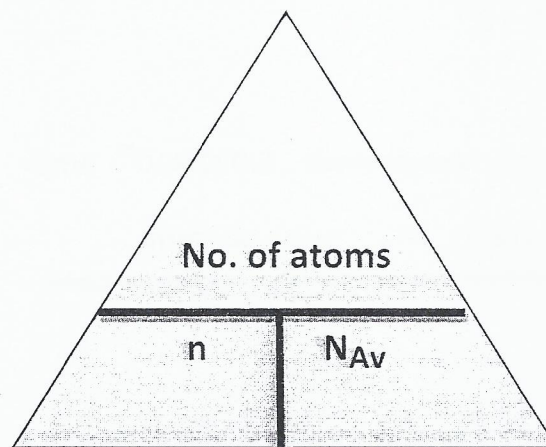
عدد المولات : n N_{Av} : عدد أفوجادرو

2. How many grams of Zn are in 0.356 mole of Zn?

mass= ?? g   ,   Mm = 65.39 g / mol   ,   n = 0.356

mass = 65.39 × 0.356 = 23.3 gram

مسائل حساب عدد جرامات العنصر في المركب

عدد جرامات العنصر في المركب= الكتلة الذرية للعنصر × عدد ذرات العنصر × عدد مولات المركب .

$$m = Am_{للعنصر} \times f_{العنصر} \times n_{compound}$$

$$\Large n_{compound} = \frac{mass\ of\ compound}{Mm\ of\ compound}$$

1.The number of grams of Oxygen present in 50 g of water H_2O :

$$m_{Oxygen} = Am_{للعنصر} \times f_{العنصر} \times n_{compound}$$

$$m_{Oxygen} = 16 \times 1 \times \left[\frac{mass}{M_m}\right] compound$$

$$m_{Oxygen} = 16 \times 1 \times \left[\frac{50}{18}\right] compound$$

$$m_{Oxygen} = 44.4\ g$$

---

2. How many grams of oxygen are in 65.0 g of $C_2H_2O_2$?

a) 18   b) 29   c) 9.5   d) 35.8

$$m_{Oxygen} = Am_{للعنصر} \times f_{العنصر} \times n_{compound}$$

$$m_{Oxygen} = 16 \times 2 \times \left[\frac{mass}{M_m}\right]_{compound}$$

$$m_{Oxygen} = 16 \times 2 \times \left[\frac{65}{58}\right]_{compound}$$

$$m_{Oxygen} = 35.8\ g$$

3. Tin(II) fluoride (SnF_2) is often added to toothpaste as an ingredient to prevent tooth decay.

What is the mass of F in grams in 24.6 g of the compound?

نفس فكره الفديو السابق

a- 18.6 g   b- 24.3 g   c- 5.95 g   d- 75.7 g

$$m_{sulfur} = Am_{للعنصر} \times f_{العنصر} \times n_{compound}$$

$$m_{sulfur} = 19 \times 2 \times \left[\frac{mass}{M_m}\right]_{compound}$$

$$m_{sulfur} = 19 \times 2 \times \left[\frac{24.6}{157}\right]_{compound}$$

$$m_{sulfur} = 5.95\ g$$

Video (8)

مسائل حساب عدد ذرات

1 . How many molecules of 5 mol of H_2O ?

$$Atoms = n \times N_{AV} = 5 \times 6.022 \times 10^{23} = 1.8 \times 10^{24} \text{ atoms}$$

مسائل حساب عدد ذرات العنصر في المركب

عدد ذرات العنصر في المركب = عدد المولات × عدد افوجادرو × تكرار ذرات العنصر

$$Atoms = \text{n} \times N_{AV} \times \text{f}$$

1 . How many oxygen atoms of 5 mol of $\underline{H_2O}$?

$$Atoms = \text{n} \times N_{AV} \times \text{f} = 5 \times 6.022 \times 10^{23} \times 1 = 1.8 \times 10^{24} \text{ atoms}$$

Video (9)

2. The number of Hydrogen atoms in 1.5 mole of $\underline{H_2SO_4}$ is :

$$Atoms = \text{n} \times N_{AV} \times \text{f} = 1.5 \times 6.022 \times 10^{23} \times \underline{\textbf{2}} = 1.8 \times 10^{24} \text{ atoms}$$

مسائل حساب عدد المولات
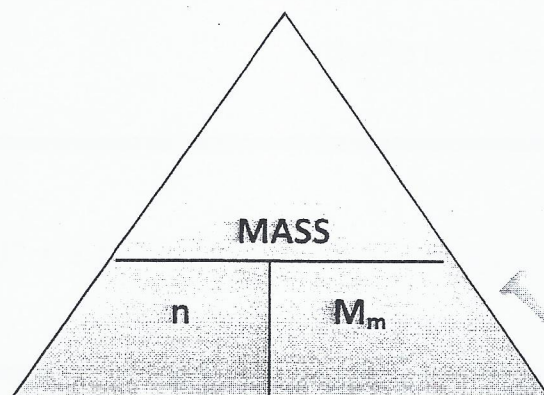
| عدد مولات المادة: n | كتلة المول من المادة : M_m | كتلة المادة بالجرام : mass |

| عدد المولات : n | عدد أفوجادرو : N_{Av} |
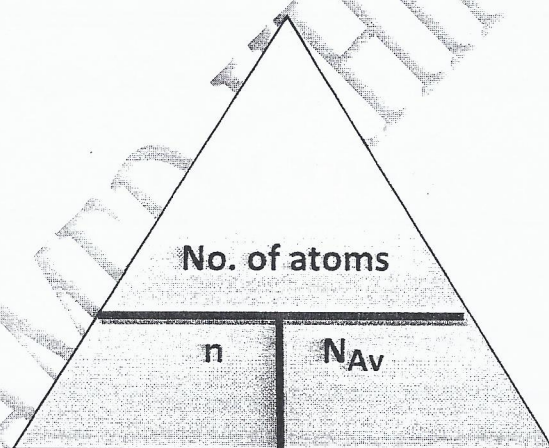
1. How many moles of carbon dioxide are there in 52.06 g of carbon dioxide?

mass = 52.06 g   ,   Mm = 44 g/mol   ,   n = ? ?

$$n = \frac{mass}{M_m}$$

$$n = \frac{52.06}{44} = 1.183 \ \text{mol}$$

نفس فكره الفديو السابق

2. How many moles of He atoms are in 6.46 g of He?

mass= 6.46 g ,   Mm = 4 g / mol ,   n = ? ?

$$n = \frac{mass}{M_m}$$

$$n = \frac{6.46}{4} = 1.6 \text{ mol}$$

3 . How many moles of the compound magnesium nitrate, $Mg(NO_3)_2$ are in a 2.35 g sample of this compound ?

M_m =148 g / mol ,   n = ?? mol ,   mass= 2.35 g

$$n = \frac{mass}{M_m} = \frac{2.35}{148} = 0.0158 \text{ mole}$$

نفس فكره الفديو السابق

4. The number of moles in 5×10^{13} atoms of Oxygen is :

a- 5×10^{12} b- 8.3×10^{-11} c- 8×10^{11} d- 5×10^{23}

$N_a = 6.022 \times 10^{23}$, $Atoms = 5 \times 10^{13}$ atoms ,   n = ?? mol

$$n = \frac{Atoms}{N_{AV}}$$

$$n = \frac{5 \times 10^{13}}{6.022 \times 10^{23}} = 8.3 \times 10^{-11} \text{ mole}$$

5. The formula for rust can be represented by Fe_2O_3 . How many moles of Fe are

present in 24.6 g of the compound ?

a- 2.13 mol   b- 0.456 mol   c- 0.154 mol   <u>d- 0.308 mol</u>

mass = 24.6 g   ,   Mm = 160 g/mol ,   n = ??

$$n = \frac{mass}{M_m}$$

(للمادة كلها) $n = \frac{24.6}{160}$ = 0.15375 **mol**

No .Mole of Fe = 0.15375 × 2 (تكرار الحديد بداخل المركب)= 0. 308 mole Fe

6. How many <u>moles of Ca</u>   are in 25.7 g of $CaSO_4$?

a- 0159 g   b- 0.755 mol   c-4.00 mol   <u>d-0.189 mol</u>

$$n = \frac{mass}{M_m}$$

(للمادة كلها) $n = \frac{25.7}{(40+32+64)}$ = 0.189 mol

No .Mole of Ca = 0.189 × 1 (تكرار الكالسيوم بداخل المركب) = 0.189 mole Ca

7. A 25.5 g sample of ammonium carbonate contain .... mol of ammonium ions .

a- 0.468   b- 0.288   <u>c- 0.531</u>   d- 2.0

Ammonium carbonate : $(NH_4)_2CO_3$

$$n = \frac{mass}{M_m}$$

(للمادة كلها) $n = \frac{25.5}{96}$ = 0.265 mol

No .Mole of Ammonium = 0.265 × 2 (تكرار الأمنيوم بداخل المركب) = 0.531 mole Ca

حساب كتلة الذرة أو الجزيء لمادة ما بمعلومية عدد الذرات
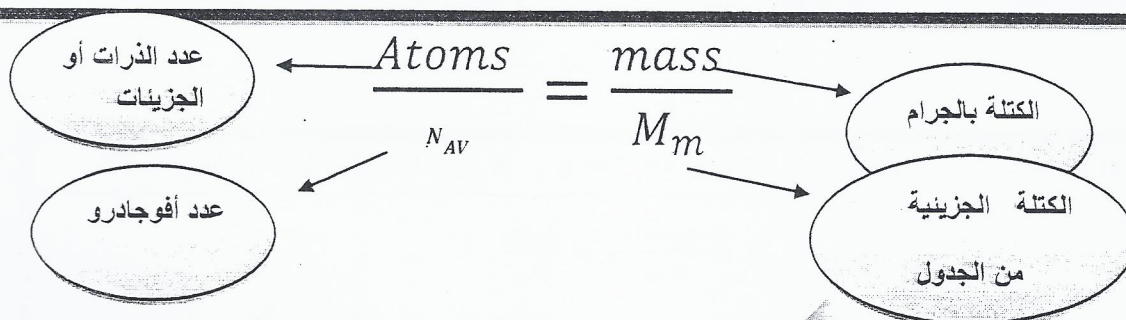
1 . How many gram of 5×10^{20} molecules of CO_2 ?

Atoms $= 5 \times 10^5$ atom , $N_{Av} = 6.022 \times 10^{23}$, $M_m CO_2 = 44$ g/mol ,   Mass =?

$$\frac{Atoms}{N_{AV}} = \frac{mass}{M_m}$$

$$\frac{5 \times 10^{20}}{6.022 \times 10^{23}} = \frac{mass}{44}$$

Mass $= \frac{5 \times 10^{20} \times 44}{6.022 \times 10^{23}} = 0.036$ g

2. The mass of one atom of Hydrogen is (in Kg) :

Atoms $= 1$ atom , $N_{Av} = 6.022 \times 10^{23}$, $M_m (H) = 1$,   Mass =?

$$\frac{Atoms}{N_{AV}} = \frac{mass}{M_m}$$

Mass $= \frac{Atoms \times M_m}{N_{AV}}$

Mass $= \frac{1 \times 1}{6.022 \times 10^{23}} = 1.66 \times 10^{-24}$ g /1000 $= 1.66 \times 10^{-27}$ K.g (sl)

5. How many molecules of ethane (C_2H_6) are present in 0.334 g of C_2H_6 ?   Video (14)

a- 2.01×10^{23} b- 6.69×10^{21} c- 4.96×10^{22} d- 8.89×10^{20}

$Atoms$ = ?? molecules ,   Mass = 0.334 g , $N_{AV} = 6.022 \times 10^{23}$, $M_m = 30$

$$\frac{molecules}{N_{AV}} = \frac{mass}{M_m}$$

$$\frac{molecules}{6.022 \times 10^{23}} = \frac{0.334}{30}$$

$$molecules = \frac{0.334 \times 6.022 \times 10^{23}}{30} = 6.69 \times 10^{21} \text{ molecules}$$

4. How many atoms are present in 3.14 g of copper (Cu)?   نفس فكره الفديو السابق

a) 2.98×10^{22} b) 1.92×10^{23} c) 1.89×10^{24} d) 6.02×10^{23}

$Atoms$ = ?? atoms ,   Mass = 3.14 g , $N_{Av} = 6.022 \times 10^{23}$, $M_m(Cu) = 63.5$

$$\frac{Atoms}{N_{AV}} = \frac{mass}{M_m}$$

$$\frac{Atoms}{6.022 \times 10^{23}} = \frac{3.14}{63.5}$$

$$Atoms = 2.98 \times 10^{22} \text{ atoms}$$

5. How many <u>carbon (C) atoms</u> are present <u>in 2 g of nitroglycerin</u> $C_3H_5N_3O_9$?

<u>a-1. 59 x10^{22}</u>   b- 2.65 x10^{22} c- 4.74 x10^{23} d- none

Video (15)

Atoms $_{compound}$ = ?? atoms   ,   Mass=2 g   , N_{Av} = 6.022 ×10^{23} , M_m = 227

اولاً نحسب عدد ذرات المادة كلها . ◄

$$\frac{Atoms}{N_{AV}} = \frac{mass}{M_m}$$

$$\frac{Atoms}{6.022×10^{23}} = \frac{2}{227}$$

Atoms $_{compound}$ = 5.3 × 10^{21} (هذا الناتج يمثل ذرات المادة كلها)

Number of atoms for C = 5.3 × 10^{21} × 3 (تكرار الكربون في المركب) = 1. 59 x10^{22} atoms

8. How many <u>hydrogen atoms</u> <u>are present</u> <u>in 25.6 g of urea</u> [$(NH_2)_2CO$].

(The molar mass of urea is 60 g/mol) .

نفس فكره الفديو السابق

<u>a-1.03×10^{24}</u>   b-9.97×10^{22} c- 4.46×10^5 d- 6.68×10^{-3}

Atoms $_{compound}$ =?? atoms   ,   Mass=25.6 g   , N_{Av} = 6.022 ×10^{23} , M_m = 60

اولاً نحسب عدد ذرات المادة كلها . ◄

$$\frac{Atoms}{N_{AV}} = \frac{mass}{M_m}$$

$$\frac{Atoms}{6.022×10^{23}} = \frac{25.6}{60}$$

$Atoms$ = 2.5 × 10^{23} (هذا الناتج يمثل ذرات المادة كلها)

Number of atoms for H : 2.5 × 10^{23} × 4 (تكرار الهيدروجين في المركب) = 1.03×10^{24} atoms

9. How many <u>sulfur atoms</u> are present <u>in</u> 25.6 g of $Al_2(S_2O_3)_3$?   نفس فكره الفديو السابق

a- 0.393   b- 3.95×10^{22} c- 7.90×10^{22} <u>d- 2.37×10^{23}</u>

Atoms $_{compound}$ =?? atoms   ,   Mass =25.6 g , N_{Av} = 6.022 ×10^{23} , M_m = 390

$$\frac{Atoms}{N_{AV}} = \frac{mass}{M_m}$$

$$\frac{Atoms}{6.022 \times 10^{23}} = \frac{25.6}{390}$$

Atoms $_{compound}$ = 3.9×10^{22} (هذا الناتج يمثل ذرات المادة كلها)

Number of atoms for S : 3.9×10^{22} ×6 (تكرار الكبريت في المركب) = 2.37×10^{23} atoms

Chemical Reactions and Chemical Equations   (وزن المعادلة) Video

❋ **Chemical Reaction** : is a process in which one or more substances is changed into one or more new substances .

☞ **التفاعل الكيميائي** : هي العملية التي تحدث بها تغير مواد أو اكثر لينتج مواد جديد .

❋ **Chemical Equation:** uses chemical symbols to show what happens during a chemical reaction.

☞ **المعادلة الكيميائية** : هي أستخدم الرموز الكيميائية للتعبير عن سير التفاعل الكيميائي.

Reactants متفاعلات   ➡️   **Product s** نواتج

$$2 H_2O_{(g)} + O_{2(g)} \longrightarrow 2H_2O_{(L)}$$

L : liquid (سائل)   **g** : gas (غاز)   **s** :solid (صلب)   **eq**: aqueous (مائي)

Balancing Chemical equation

موازنة المعادلة الكيميائية

- ☜ نكتب الصيغة الصحيحة لكلا من المتفاعلات والنواتج .
- ☞ يتم وزن المعادلة بتغير الارقام بجانب الجزيئات وليس التي تحتها .
- ☞ توزن اولا العناصر الأقل ظهورا ثم العناصر الأكثر ظهورا .
- ☞ التأكد بعد عملية الوزن من تساوي عدد ذرات العنصر الواحد في كلا الطرفين.

$$Al + O_2 \longrightarrow Al_2O_3 \iff 4Al + 3O_2 \longrightarrow 2Al_2O_3$$

$$CO_2 + H_2 \longrightarrow CH_4 + H_2O \iff CO_2 + 4 H_2 \longrightarrow CH_4 + 2H_2O$$

$$NO + O_2 \longrightarrow NO_2 \iff 2NO + O_2 \longrightarrow 2 NO_2$$

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1. What is the sum of all coefficients جمع المعاملات when the following equations

is balanced:

$$CS_2 + Cl_2 \longrightarrow CCl_4 + S_2Cl_2 \ :$$

a-6   b- 8   c-10   d-14

المطلوب : مجموع كل معاملات المعادلة بعد الوزن .

وزن المعادلة $\underline{1} \ CS_2 + \underline{3} \ Cl_2 \longrightarrow \underline{1} \ CCl_4 + \underline{1} \ S_2Cl_2$
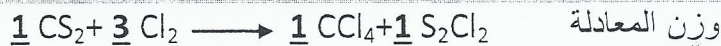
جمع المعاملات $1 + 3 + 1 + 1 = \ 6$

2. Balance the following equation then what is the coefficient for H_2O IN balanced equation ?

$$C_4H_{10} + O_2 \longrightarrow CO_2 + H_2O$$
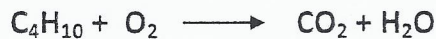
a-9   b-5   c-10   d-13

المطلوب معامل الماء .

وزن المعادلة $C_4H_{10} + 7.5 \ O_2 \longrightarrow 4 \ CO_2 + 5 \ H_2O$

نضرب العوامل ×2 لجعل العوامل أعداد صحيحة .

$$2C_4H_{10} + \underline{13} \ O_2 \longrightarrow \underline{8} \ CO_2 + \underline{10} \ H_2O$$

3. Balance the following equation then what is the coefficient for H_2O IN balanced equation ?

$$C_2H_6 + O_2 \longrightarrow CO_2 + H_2O$$

وزن المعادلة $C_2H_6 + 3.5 \ O_2 \longrightarrow 2 \ CO_2 + 3 \ H_2O$

نضرب العوامل ×2 لجعل العوامل أعداد صحيحة .

$$2C_2H_6 + 7 \ O_2 \longrightarrow 4 \ CO_2 + 6 \ H_2O$$

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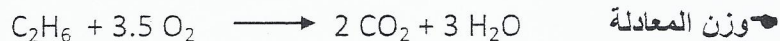
4. What is the coefficient of H_2O when the equation is balanced:

$$... Al_4C_3 \ + ... H_2O \ \rightarrow \ ... Al(OH)_3 \ + \ 3 CH_4$$

a- 13   b- 4   c- 6   <u>d- 12</u>

$$Al_4C_3 \ + 12 H_2O \ \rightarrow \ 4 Al(OH)_3 \ + \ 3CH_4$$
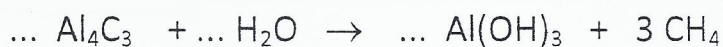
5. When the following equation is balanced, the coefficients are

$$NH_3 (g) + O_2 (g) \longrightarrow NO_2 (g) + H_2O (g)$$

(a). 1, 1, 1, 1   (b). 2, 3, 2, 3   <u>(c). 4, 7, 4, 6</u>   (d). 1, 3, 1, 2

6. Which of the following equations is balanced?

A) $2C + O_2 \rightarrow CO$ <u>B) $2CO + O_2 \rightarrow 2CO_2$</u>

C) $H_2 + Br_2 \rightarrow HBr$ D) $2K + H_2O \rightarrow 2KOH + H$
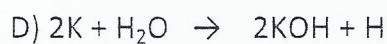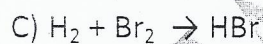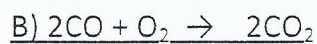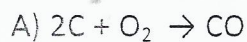
مسائل حساب كميات المتفاعلات والنواتج

1. نكتب المعادلة الموزونة المعبرة عن التفاعل ثم نحدد فيها المعطي والمطلوب .
2. نضع المعطي بنفس وحداته تحت المادة في المعادلة ونضع X بالوحدة المطلوبة
3. نعبر في المعادلة عن المعطي والمطلوب بنفس الوحدات .
4. نستخدم طريقة المقص الايجاد المطلوب فيكون الناتج بالوحدة المطلوبة .

1. If 856 g of $C_6H_{12}O_6$ is consumed by a person over a certain period,

   what is the mass of CO_2 produced?

   $$C_6H_{12}O_6 + 6O_2 \longrightarrow 6\,CO_2 + 6\,H_2O$$

   $$C_6H_{12}O_6 + 6O_2 \longrightarrow 6\,CO_2 + 6\,H_2O$$

856 gram	X gram
180 gram	264 gram

   $$X = \frac{264 \times 856}{180} = 1255 \text{ gram} = 1.255 \times 10^3 \text{ gram}$$

2. How many moles of O_2 are required to react with 23.5 Moles of methanol CH_2OH ?

   $$2CH_2OH + 3\,O_2 \longrightarrow 2CO_2 + 4H_2O$$

   $$2CH_2OH + 3\,O_2 \longrightarrow 2CO_2 + 4H_2O$$

23.5 mol	x mol
2 mol	3 mol

   $$X = \frac{3 \times 23.5}{2} = 35.25 \text{ mol}$$

8. Nitrous oxide (N_2O) is also called "laughing gas.

" It can be prepared by the thermal decomposition of ammonium Nitrate (NH_4NO_3). The

other product is H_2O. The balanced equation for this reaction is:

$$NH_4NO_3 \rightarrow \quad N_2O + 2H_2O$$

How many grams of N_2O are formed if 0.46 mole of NH_4NO_3 is used in the reaction?

a) 2.0 g   b) 3.7×10^{1} g   c) 2.0×10^{1} g   d) 4.6×10^{-1} g

Video (24)

$$NH_4NO_3 \longrightarrow N_2O + 2H_2O$$

0.46 mole   x gram

1   mole   44 gram

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X = 20.2 g = 2.0×10^{1} g
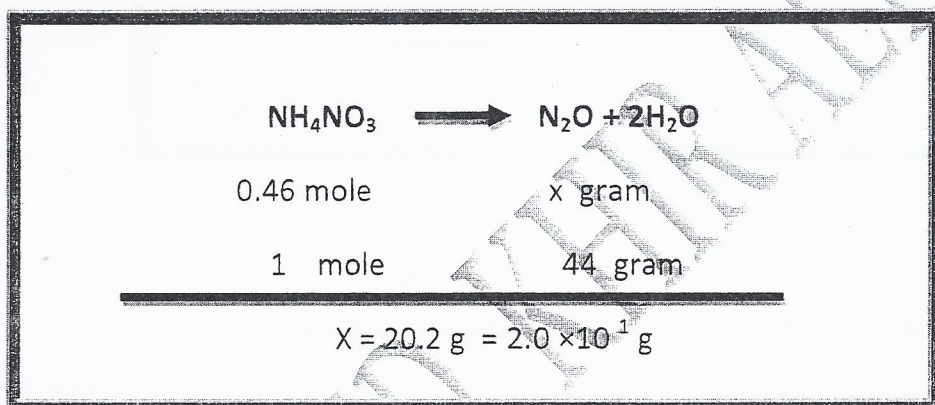
3. How many gram of silver nitrate (Ag NO_3) are necessary to react completely

with 7.000 moles of copper Cu? $Cu + 2AgNO_3 \longrightarrow Cu(NO_3)_2 + 2Ag$

a- 2380 g   b- 234 g   c-3240   d-9342g

نفس فكره الفديو السابق

$$Cu \quad + \quad 2AgNO_3 \longrightarrow \quad Cu(NO_3)_2 + 2Ag$$

7 mol   x g

1 mol   340 g

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X = 2380 g

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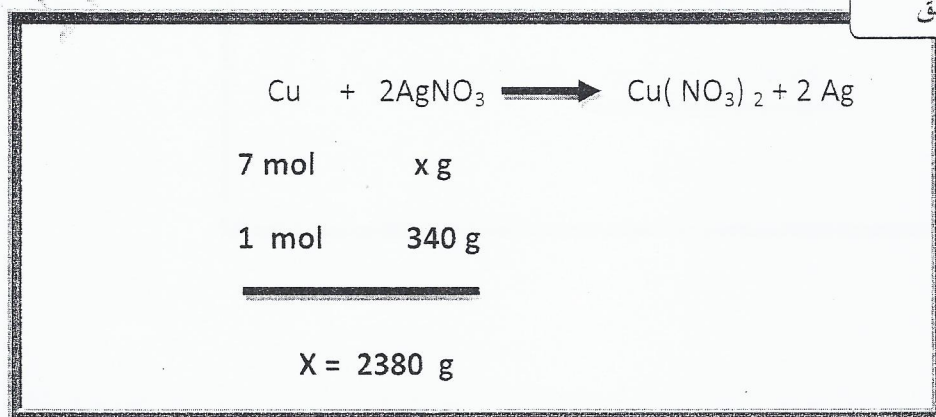
4. How many moles of SO_3 are produced by reaction Of 10 g Oxygen according to the reaction

$$2SO_2 + O_2 \longrightarrow 2SO_3$$

نفس فكره الفديو السابق

a-1.0625   b- 0.875   c-0.625   d-075

$$2SO_2 + O_2 \longrightarrow 2\,SO_3$$

10 g   x mol

32 g   2 mol
─────────────────────────────

X = 0.625
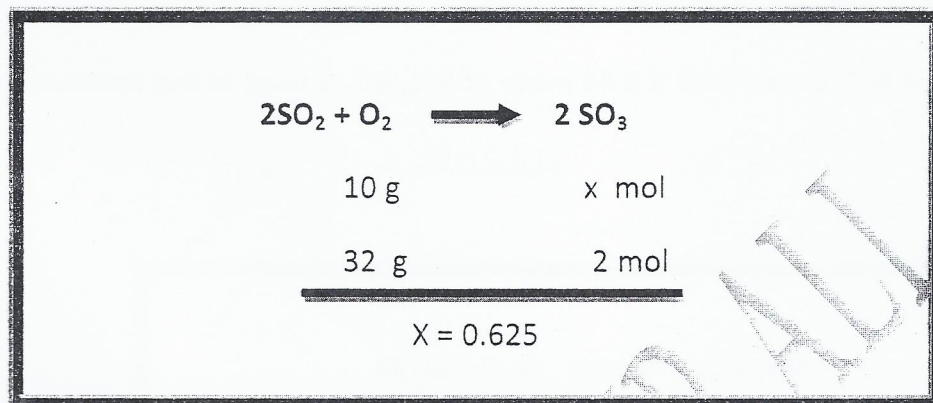
9.How many grams of sulfur (S) are needed to react completely with 246 g

of mercury

نفس فكره الفديو السابق

(Hg) to form Hg S ?   S + Hg $\longrightarrow$ Hg S

a- 39.2 g   b- 24.6 g   c- 9.66 g   d- 201 g

$$S + Hg \longrightarrow Hg\,S$$

x g   246 g

32 g   201 g
──────────────

X = 39.2 g

من طلب العلا من غير كد أضاع العمر في طلب المحال
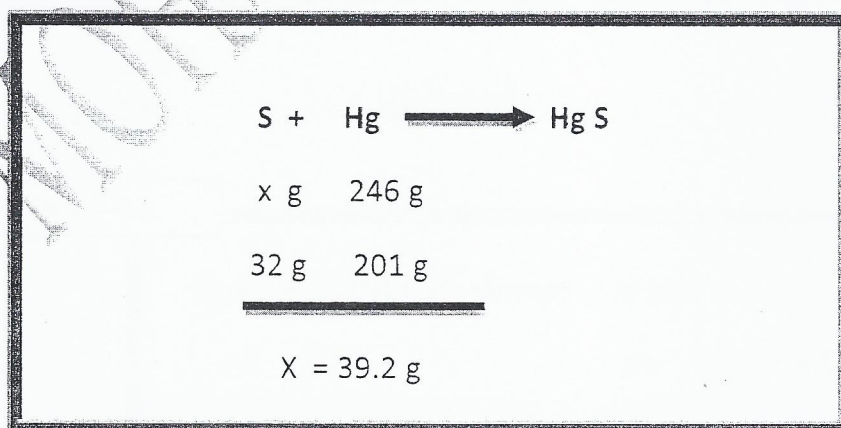
Video (25)

Limiting reagent & Excess reagent

الكاشف الفائض & الكاشف المحدد

هي المادة التي تستهلك أولا وتحدد كمية النواتج

Limiting Reagent

· Is the reactant used up first in a reaction and thus determine the amount of product

هي المادة المتبقية من أحد المتفاعلات في نهاية التفاعل

Excess Reagent

· Is the reactant present in quantities greater than necessary to react with the quantity of the limiting reagent (the one that is left at the end of the reaction).

Ex : If 58 moles of NH_3 are combined with 32 moles of

Sulfuric acid , what is the limiting reactant and how much excess reactant is left ?

$$NH_3 + H_2SO_4 \longrightarrow (NH_4)_2 SO_4.$$

Video (26)

خطوات تحديد الكاشف المحدد

كتابة المتفاعلات والنواتج في معادلة كيميائية .	$NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$
وزن المعادلة لتحديد عدد مولات المتفاعلات كلا على حده .	$2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2 SO_4$

◄ نحسب لكل من المتفاعلات خارج قسمة (عدد المولات المعطاة / عدد مولات المعادلة).

عدد مولات المتفاعل الاول في التفاعل (NH_3) : $\frac{58}{2} = 29$

عدد مولات المتفاعل الثاني في التفاعل (H_2SO_4) : $\frac{32}{1} = 32$

◄ المادة ذات الناتج الأقل تكون هي الكاشف المحدد. ✓ الكاشف المحدد هو NH_3

2. When 22.0 g Na Cl and 21.0 g H_2SO_4 are mixed and react according to the | Video (27)

equation below, which is the limiting reagent ? $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$

(a) NaCl   (b) H_2SO_4 (c) Na_2SO_4 (d) HCl   (e) No reagent is limiting

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- نحسب لكل من المتفاعلات خارج قسمة (عدد الجرامات المعطاة / عدد الجرامات المعادلة).

1. عدد جرامات المتفاعل الاول في التفاعل (Na Cl) : $\frac{22}{117} = 0.18$

2. عدد جرامات المتفاعل الثاني في التفاعل (H_2SO_4) : $\frac{21.0}{98} = 0.21$

- المادة ذات الناتج الأقل تكون هي الكاشف المحدد.   ✓ الكاشف المحدد هو Na Cl

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3. If 400 g Fe were mixed with 300 g O_2 to react as : | نفس فكره الفديو السابق

$$4\,Fe\,(s) + 3O_2(g) \longrightarrow 2\,Fe_2O_3\,(s).\ \text{determine the limiting reagent}$$

- نحسب لكل من المتفاعلات خارج قسمة (عدد الجرامات المعطاة / عدد الجرامات المعادلة).

1. عدد جرامات المتفاعل الاول في التفاعل (Fe) : $\frac{400}{224} = 1.78$

2. عدد جرامات المتفاعل الثاني في التفاعل (O_2) : $\frac{300}{96} = 3.12$

- المادة ذات الناتج الأقل تكون هي الكاشف المحدد.

✓ الكاشف المحدد هو Fe

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4. Calculate the mass of Fe S formed when 9.42 g of Fe with   Fe react with 8.50 S : من طلب

Video | 28

$$Fe\ (s)\ + S\ (s) \longrightarrow Fe\ S\ (s)$$

a-17.9 g   b- 87.9 g   c-26.0g   d-14.8

▶ نحسب لكل من <u>المتفاعلات</u> خارج قسمة (عدد الجرامات المعطاة / عدد الجرامات المعادلة):

1. عدد جرامات المتفاعل الاول في التفاعل (Fe) : $\dfrac{9.42}{56} = 0.168$

2. عدد جرامات المتفاعل الثاني في التفاعل (S) : $\dfrac{8.5}{32} = 0.262$

▶ المادة ذات الناتج الأقل تكون هي الكاشف المحدد.   ✓ الكاشف المحدد هو Fe

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$$Fe\ (s)\ + S\ (s) \longrightarrow Fe\ S\ (s)$$

9.42 g   X g

56 g   تجاهل   88 g

X = 14.8 g

5. Nitric oxide (NO) reacts with oxygen gas to form nitrogen dioxide (NO_2), $\boxed{\text{Video (29)}}$

a dark-brown gas : $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ In one experiment 0.886 mole

of NO is mixed with 0.503 mole of O_2 .

Calculate the number of moles of NO_2 produced

<u>a) 0.886 mol</u>   b) 0.503 mol   c) 1.01 mol   d) 1.77 mol

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نحسب لكل من <u>المتفاعلات</u> خارج قسمة (عدد المولات المعطاة / عدد مولات المعادلة):

1. عدد مولات المتفاعل الاول في التفاعل (NO) : $\dfrac{0.886}{2} = 0.443$

2. عدد مولات المتفاعل الثاني في التفاعل (O_2) : $\dfrac{0.503}{1} = 0.503$

المادة ذات الناتج الأقل تكون هي الكاشف المحدد ✓ الكاشف المحدد هو NO

$$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$$

x mole   تجاهل   0.886 mole

2 mole   2 mole

X = 0.886 mole

Chemical reaction yield ناتج التفاعل الكيميائي

Theoretical Yield is the amount of product that would result if all the limiting reagent reacted.

Actual Yield is the amount of product actually obtained from a reaction.

☞ الناتج من التجربة العملية **A.Y** .

☞ الناتج من المعادلة الكيميائية **T.Y** .

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

الناتج العملي دائما اقل من الناتج الحسابي (النظري) لذلك لا يوجد تفاعل كفائتة 100%

1. If the percent yield of a reaction is 100% this means :

   a- Theoretical yield = practical yield .   b-There will be no reactions

   c- There is no limiting reactant.   d- Always one mole is produced.

2. In an expermint the actual yield was 6.85 g and the theoretical was 8.55 g ,

   what the percentage yield of the producer?

   a-84.80 %   b-82.46%   c- 80.12 %   d-77.78 5%

$$\% Y = \frac{A.Y}{T.Y} \times 100 = \frac{6.85}{8.55} \times 100 = 80.12 \%$$

3. What's the percent yield of CO_2 if the reaction of 10.0 g of CO with excess   Video (31)

o_2 produced 12.8 g of CO_2 ? $2CO\ (g) + O_2(g) \longrightarrow 2CO_2(g)$

a-76.4 %   b-78.1 %   <u>c-81.5 %</u>   d- 84.4%

$2CO\ (g) + O_2(g) \longrightarrow 2CO_2(g)$ A.Y = 12.8 OF co_2

10 g   X g

56 g   88 g

$$X = T.Y = \frac{10 \times 88}{56} = 15.71\ g\ .$$

$$\%Y = \frac{A.Y}{T.Y} \times 100 = \frac{12.8}{15.71} = 81.5\ \%$$

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4. In a process 500 g of Na Cl are treated with an excess of H_2SO_4 And yield 500 g of Na $2SO_4$

calculate the percent yield of Na_2SO_4 . $2Na\ Cl + H_2SO_4 \longrightarrow Na_2SO_4 + 2HCl$ Video (32)

a-77.51 %   b- 90.7 %   <u>c-82.39 %</u>   d-85.79 %

$2Na\ Cl + H_2SO_4 \longrightarrow Na_2SO_4 + 2HCl$

500 g   X g

117 g   142 g

X= 606.84 النظري

$$Y\% = \frac{500 \times 100}{606.84} = 82.39\ \%$$

Reaction in aqueous solution

 The concentration of solution : is the amount of solute (solid or liquid)

present in a given amount of solvent (liquid).

تركيز المحلول : هي كمية المذاب الذائبة في المذيب .

 Molarity (M): is the number of moles of solute per liter of solution.

المولارية : هي عدد مولات المادة الذائبة في لتر واحد من المحلول .

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

$$M = \frac{n}{V}$$

M: المولارية (التركيز)   ,   n : عدد المولات   ,   V :حجم المحلول باللتر .

➢ The unit of molarity is mol/L ≡ Molar ≡ M .

1. The volume of 3.0 M HCl solution containing 0.800 moles HCl is :

    a-385L   b- 417 ml   c-2.40L   <u>d-267ml</u>

M= 3 M   ,   n =0.8   ,   V = ?? L = ?? mL

$$M = \frac{n}{V}$$

$$v = \frac{n}{M} = \frac{0.8}{3} = 0.267 \text{ L} \times 1000 = 267 \text{ ml}$$

2. How many moles of Ag NO_3 are there in 25.0 ml solution Of 0.60 M of $AgNO_3$?

a-0.015 mole   b-0.015 gm   c-2.5mole   d-1.5 molar

M= 0.6 M ,   V = 25 ml /1000 = 0.025 litter , n = ??

$$M = \frac{n}{V}$$

n = M × v = 0.6 × 0.025 = 0.015 mole

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3. How many moles of K^+ are present in 34.3 mL of a 1.27 M solution of K_3PO_4?

a) 0.436   b) 0.131   c) 1.27   d) 0.034310 M

V= 34.3 /1000 ml = 0.0343 L , n = ?? , M = 1.27 M

n = M × v

$n_{compound}$ = 1.27 × 0.0343 = 0.044   mole

moles for K^+ = 0.044 × 3 =0.1306 K^+ moles

حساب كتلة المذاب في محلول ما
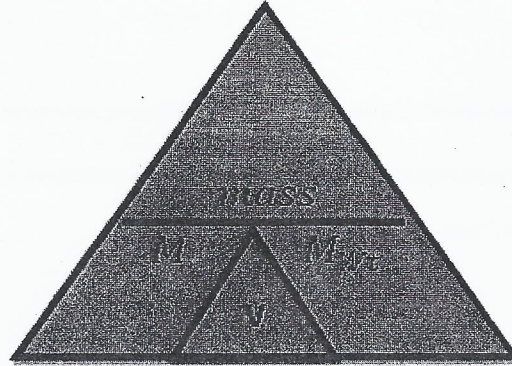
| كتلة المذاب بالجرام : Mass | الوزن الجزيء : M_{Wt} | عدد المولات :n | حجم المحلول باللتر :V |

1. In a biochemical assay, a chemist needs to add 3.81 g of glucose $C_6H_{12}O_6$ to a reaction mixture.

Calculate the <u>volume in ml</u> of a 2.53 M glucose solution she should use for the addition.

mass= 3.81 g   ,   M = 2.53 M   ,   V =?? L = ?? m L, M_{Wt} ($C_6H_{12}O_6$) = 180

$$mass = M . V . M_{Wt}$$

$$V = \frac{mass}{M \times M_m}$$

$$V = \frac{3.81}{2.53 \times 180} = 8.36 \times 10^{-3} \, L \times 1000 = 8.36 \, mL$$

2. The molarity M of a solution that contain 3.65 g of HCl in 2.00 Liters of solution is :

     a-5.0 M   b- 0.50 M   c-0.05 M   d- 0.005 M

mass = 3.65 g   ,   v = 2 L   , M_m= 36.5 ,   M = ?? M

$$M = \frac{m}{V . M_m}$$

$$M = \frac{3.65}{2 \times 36.5} = 0.05 \, M .$$

3. What is the concentration (M) of CH_3OH in a solution prepared by dissolving 11.7 g of CH_3OH

in sufficient water to give exactly 230 mL of solution?

a) 11.7   b) 2.30 x 10^{-2} c) 0.0841   d) 1.59

mass= 11.7 g   ,   M = ?? M   ,   V = 230 mL / 1000 = 0.23 L ,   M$_{Wt}$ = 32

$$Mass = M . V . M_{Wt}$$

$$M = \frac{MASS}{V.M_m}$$

$$M = \frac{11.7}{0.23 \times 32} = 1.59 \ M$$

4. What is the concentration (M) of a Na_2SO_4 solution prepared by dissolving 5.35 g of Na_2SO_4

in sufficient water to give 330 mL of solution?

a) 1.14 x 10^2 b) 0.016   c) 61.7   d) 0.114

mass= 5.35 g   ,   M = ?? M   ,   V = 330 mL / 1000 = 0.33 L , M$_{Wt}$ = 142

$$Mass = M . V . M_{Wt}$$

$$M = \frac{MASS}{V.M_m} = \frac{5.35}{0.33 \times 142} = 0.114 \ M$$

5. How many <u>grams</u> of potassium dichromate ($K_2Cr_2O_7$) are required to prepare

   250 ml whose concentration is 2.16 M .

V = 250 ml /1000 = 0.25 L   ;   M = 2.16 mol/L

mass = M . V . M_m = 2.16 × 0.25 × 294 = 158.76 g

6 . How many grams of H_3PO_4 are in 35.1 mL of a 2.75 M solution of H_3PO_4?

   a) 0.61   <u>b) 9.46</u>   c) 20   d) 4.9

V = 35.1 ml /1000 = 0.0351 L   ;   M = 2.75 M , M_m = 98

Mass = M . V . M_m = 0.0351 × 2.75 × 98 = 9.459 g

7. How many grams of Li OH are there in 750.0 mL of a 0.0158 M Li OH solution?

   a) 2.11 x 10^{-5} b) 11.3   <u>c) 0.284</u>   d) 3.50

V = 750 ml = 250 ml/1000 = 0.75 L   ;   M = 0.0158 mol/L , M_m = 24

mass = M . V . M_m

mass = 0.0158 × 0.75 × 24 = 0.284 g

8. What volume, in mL, of a 3.89 x 10^{-2} M solution is required to provide 2.12 g of KBr ?

   (Atomic weights: K = 39.10, Br = 79.90).

   A. 520 mL
   B. 458 mL
   C. 389 mL
   D. 420 mL

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mass= 2.12 g   ,   M = 3.89 x 10^{-2} M   ,   V = ?? L = ?? mL , M$_{Wt}$ = 119

$$\text{Mass} = M . V . M_{Wt}$$

$$V = \frac{MASS}{M \times M_m}$$

$$V = = \frac{2.12}{119 \times 3.89 \times 10^{-2}} = 0.458 \; L \times 1000 = 458 \; ml$$

Dilution   التخفيف

🍎 Dilution : is the procedure for preparing a less concentrated solution from a more

concentrated one.

The process in which the concentration of solutions is changed by adding more solvent.

☞ هي عملية تحويل المحلول من تركيز أعلي الي تركيز أقل بإضافة كمية من المذيب .

Dilution law: قانون التخفيف

$$M_1V_1 = M_2V_2$$

M_1 : التركيز قبل التخفيف

V_1 : الحجم قبل التخفيف

M_2 : التركيز بعد التخفيف

V_2 : الحجم بعد التخفيف

1. How many milliliters would you need to prepare 60.0 mL of 0.200 M HNO_3 from

   a stock solution of 4.00 M HNO_3?

   a) 3 mL   b) 240 mL   c) 24 mL   d) 1000 mL

M_1= 4.00 M   , V_1 = ?? mL   , M_2 = 0.2 M , V_2 = 60 mL

$$M_1 V_1 = M_2 V_2$$

$$4 \times V_1 = 0.2 \times 60$$

$$V_1 = 3 \underline{mL}$$

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2. The volume of 2.00M HCl required to prepare 1 L of 0.2 M HCl is :

   a- 10 L   b- 50 mL   c- 100 mL   d- 1 mL

3. What volume of 2.0 M KOH should be used to prepare 4.0 L of 1.5 KOH ? and

   what the volume of water needed (added) ?

M_1=2.0 M   , V_1 = ??   , M_2 =1.5 , V_2 = 4 L

$$M_1 V_1 = M_2 V_2$$

$$2.0 \times V_1 = 4.0 \times 1.5$$

$$V_1 = 3.0 \underline{L}$$

➤ حجم الماء المضاف = حجم الماء في المحلول – الحجم قبل التخفيف

$$V_{added} = V_2 - V_1 = 4 - 3 = 1 L$$

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4. The concentration of a solution prepared from <u>15 mL</u> of 2.0 M KOH in a <u>2 L</u> volumetric flask is

<u>a-0.015M</u>   b- 15M   c- 0.067M   d-30 M

$M_1 = ??$ M , ($V_1 = 2$ L $\times 1000 = 2000$ ml) , $M_2 = 2$ M $V_2 = 15$ <u>mL</u>

لازم يكون الحجم بنفس الوحدات (ما يفرق الوحدة أي وحدة شيء يكونوا مثل بعض قبل التعويض)

$$M_1 V_1 = M_2 V_2$$

$$M_1 \times 2000 = 2 \times 15$$

$$M_2 = 0.015 \text{ M}$$

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5. Water is added to 25.0 mL of a 0.866 M KNO_3 Solution until the volume of the solution

is exactly 500 ml . the concentration of the final solution is :

a-0.015 M   b- 15M   <u>c-0.043 M</u>   d- 30 M

$M_1 = 0.866$ M , $V_1 = 25$ ml , $M_2 = ??$, $V_2 = 500$ ml

$$M_1 V_1 = M_2 V_2$$

$$0.866 \times 25 = M_2 \times 500$$

$$M_2 = 0.043 \text{ } \underline{M}$$

        مهمتنا في الحياة ليست أن نسبق غيرنا بل أن نسبق أنفسنا

6. How would you prepare 60.0 mL of 0.200 M HNO_3 from a stock

   solution of 4.00 M HNO_3

M_1= 0.2 M , V_1 = 60 ml   , M_2 =4   , V_2 = ?? ml

$$M_1 V_1 = M_2 V_2$$

$$0.2 \times 60 = 4 \times V_2$$

$$V_2 = 3 \quad ML$$

7. How would you prepare 200 mL of 0.866 M NaOH from a

   stock solution of 5.07 M NaOH ?

M_1= 0.866 M , V_1 = 200 ml   , M_2 =5.07   , V_2 = ?? ml

$$M_1 V_1 = M_2 V_2$$

$$0.866 \times 200 = 5.07 \times V_2$$

$$V_2 = 34.2 \ ML$$

تركيز الايونات في المحاليل

$$M^+ = M \times F$$

تركيز الايون M^+ = تركيز المحلول $M \times$ تكرار الايون داخل المركب F

1. A 4.691 g sample of $MgCl_2$ is dissolved in enough water to give 750 mL of solution .

What is the <u>chloride ion concentration</u> in this <u>solution</u> ?

<u>a- 13.00 $\times 10^{-2}$</u>   b- 4.41 $\times 10^{-2}$ c- 0.118   d- 8.01 $\times 10^{-2}$

V = 750/1000 = 0.75 L , M_m = 95 g/ mol , mass = 4.691 g

بالكامل (المركب) تركيز المحلول $M = \dfrac{m}{V.M_m} = \dfrac{4.691}{0.75 \times 95} = 0.067$

تركيز الايون M^+ = تركيز المحلول $M \times$ تكرار الايون داخل المركب F

$$M^+{}_{Cl} = \quad 0.067 \quad \times 2 = 0.13 = 13.00 \times 10^{-2} M$$

2. What mass of K_2CO_3 is needed to prepare 200 mL of a solution having <u>a potassium</u>

<u>ion concentration</u> of 0.150 M ?

    a- 4.15 g   b-10.4 g   c-13.8 g   d-<u>2.07 g</u>

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v= 200 mL M_m = 138 g/ mol   mass = ?? gram

نبغي الكتلة ولازم يكون عندنا تركيز المحلول بالكامل وفي السؤال موجود تركيز الأيون فقط .

تركيز الايون M^+ = تركيز المحلول M × F تكرار الايون داخل المركب

تركيز المحلول M × 2   = 0.150

M تركيز المحلول $= \dfrac{0.150}{2}$ = 0.075 M

Mass = M .V . M_m = 0.075 x   0.2 x138 = **2.07 g**

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3. A 50.0 mL sample of 0.436 M NH_4NO_3 is diluted with water to a total volume of 250.0 mL.

What is the ammonium nitrate concentration in the resulting solution?

a) 21.8 M   b) 0.459 M   c) 2.18×10^{-2} M   <u>d) 8.72×10^{-2} M</u>

$M_1 = 0.436$ M , $V_1 = 50$ ml , $M_2 = ??$, $V_2 = 250$ ml

$$M_1 V_1 = M_2 V_2$$

$$0.436 \times 50 = M_2 \times 250$$

$M_2 = 0.087$ <u>M</u>   (التركيز الجديد)

تركيز الايون M^+ = تركيز المحلول M × تكرار الايون داخل المركب F

M^+_{NH4} = $0.087 \times 1 = 0.087 = 8.72 \times 10^{-2}$ M

4. A 3.682 g sample of $KClO_3$ is dissolved in enough water to give 375 mL of solution .

What is the chlorate ion (ClO_3) concentration in this solution ?

a- 3.00×10^{-2} b- 4.41×10^{-2} c- 0.118   <u>d- 8.0×10^{-2}</u>

V = 375/1000 = 0.375 L , M_m = 122.5 g/ mol , m = 3.682 g

$$M = \frac{m}{V.M_m} = \frac{3.682}{0.375 \times 122.5} = 0.080$$

تركيز الايون M^+ = تركيز المحلول M × تكرار الايون داخل المركب F

$M^+ ClO_3$ = $0.080 \times 1 = 0.080 = 8.0 \times 10^{-2}$ M