



مدونة المناهج السعودية

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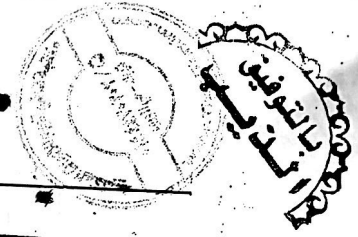
الموقع التعليمي لجميع المراحل الدراسية

في المملكة العربية السعودية

State of Matter

حالات المادة

- A **solid** has a rigid shape and a fixed volume.
- A **liquid** has a fixed volume but is not rigid in shape.
- A **gas** has neither a fixed volume nor a rigid shape.



matter

**Mixture**  
(مختلط)

**Pure substance**  
(مادة نقية)

Combination two or more substance by any ratio  
إعداد مادتين أو أكثر بأي نسبة

Can be separated by  
يمكن فصله  
فيزيائياً

homogenous

heterogenous

**Homogeneous Mixture**  
(مختلط متجانس)

**Heterogeneous Mixture**  
(مختلط غير متجانس)

uniform Throughout  
متجانس

not uniform Throughout  
غير متجانس

- Ex Sea water ماء البحر  
Solution محلول  
Air هواء  
Brass سبائك  
milk لبن  
solder سبائك

- Ex oil-water زيت و ماء  
rocks صخور  
Cement أسمنت  
iron / sand رمل  
Salade سلطة  
Caco<sub>2</sub> + H<sub>2</sub>O محلول طباشير

Compounds

elements 118  
عناصر

**Compounds**  
(مركبات)

**Elements**  
(عناصر)

more than one element  
Can be separated by chemical means  
أكثر من عنصر  
يمكن فصله كيميائياً

Cannot be separated by chemical means  
لا يمكن فصله كيميائياً

- Ex NaCl salt ملح  
H<sub>2</sub>O water ماء  
NH<sub>3</sub> ammonia, نيتروجين  
C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> sacavuse سكر

- Ex silver Ag فضة  
gold Au ذهب

# Chapter 1

## Atoms , Molecules , Ions & Formulas

**Chemistry:** دراسة الكيمياء study the composition, behavior, structure, and properties of matter المادة

**Matter:** المادة it is anything that has mass لكتلة and occupies space فراغ.

**Matter:** two types 1- Mixture 2- Pure substance

**Substance:** المواد Matter of constant composition تركيب ثابت (distilled  $H_2O$  and  $NH_3$ ) can't be separated into simpler ones by physical means.

**Mixture:** مدخلوط combination two or more substances مادتين أو أكثر.

**Eg<sub>1</sub>:** air ( $O_2$  ,  $N_2$  ,  $CO_2$  , ..... ) **eg<sub>2</sub>:** sea water ( $H_2O$  ,  $NaCl$  , ..... ) **eg<sub>3</sub>:** Milk

يمكن فصله Can be separated into simpler ones by physical means. نوع فردي من الذرات

**Substance ① Element:** it is composed of unique kind (type) of atoms. لا يمكن فصله

**eg** ( $Fe$ ,  $Na$  ,  $H_2$  ,  $O_2$  ,  $Cl_2$ ) can't be separated into simpler ones by chemical means.

**② Compound:** مركب it is composed of different types of atoms. two or more atoms ذراته اختلفت

**Eg:** ( $H_2O$  . $NH_3$  . $CO_2$  . $CO$  . $CH_3OH$ ) can be separated into simpler ones by chemical means. يمكن فصله

**Mixture:** ممتزج two types ① **Homogeneous** (solution): it is uniform throughout **eg** :drinking water موحد

2- **Heterogeneous:** غير ممتزج it is not uniform throughout **eg<sub>1</sub>** (Oil +water) **eg<sub>2</sub>** ( $CaCO_3 + H_2O$ )

## القياسات Measurements

**The International system of Units ( SI ):** there are seven SI base units ٧ وحدات أساسية

Table 1.1 International Standards ( SI ) Units

Property	Unit	Symbol
Length طول	Meter	m
Mass كتلة	Kilogram	kg
Time زمن	Second	s
Amount of substance الكمية	Mole	mol
Temperature الحرارة	Kelvin	K
Electrical Current التيار الكهربائي	Ampere	A
Luminosity الاضاءة	Candela	Cd

الوحدات المشتقة

Derived unite ① energy الطاقة و ② pressure ضغط ③ volume حجم  
(Joule) جول (Pascal) بالاسكال (L) لتر

## chapter 1

## دراسة المادة

1. study of matter and the changes it under goes.....?
- a)physical      b)biology      c)chemistry      d)mathematic
2. it is anything that has mass and occupies space.....?
- a)mixture      b)gas      c)water      d)matter
3. matter that has adeinite cöposition.....?
- a)solid      b)gas      c)pure substance      d)liquid
4. a substance that can not be separated into simpler.....?
- a)element      b)mixture      c)compound      d)matter
5. number of element have been identified.....?
- a)83      b)35      c)118      d)92
6. the matter that has fixed volume and rigid shape.....?
- a)gas      b)solid      c)liquid      d)solution
7. the matter that has fixed volume and rigid shape.....?
- a)gas      b)solid      c)liquid      d)sands
8. the matter that has nither a fixed volume nor rigid shape.....?
- a)gas      b)solid      c)liquid      d)solution
9. the elements have been ceated by scientists equal.....?
- a)35      b)83      c)118      d)92
10. the matter that can be separated into simpler ones by physical means.....?
- a)elements      b)mixture      c)compound      d)pure substance
11. it is composed of diffrent types of atoms, and can be separated into simpler ones by chemical means.....?
- a)mixture      b)element      c)compound



فهره رمز

1. The correct symbol for silver element is:

- a) S
- b) Si
- c) Ag
- d) Au

2. Which one of the following is an example of mixture? مخلوط

- a) air
- b) O<sub>2</sub>
- c) Na
- d) Ai

3. A ..... is substance composed of two or more elements chemically united in fixed proportions عنصرية أو أكثر

- a) Compound
- b) element
- c) atom
- d) none

4. Gaseous state of matter has a ..... غازات

- a) Different shape and volume
- b) fixed shape
- c) fixed shape and volume
- d) fixed shape and different volume

5. The ..... carbon. Combine with ..... oxygen to form ..... carbon dioxide CO<sub>2</sub>

- a) element ,element ,compound
- b) element ,compound ,mixture
- c) compound ,compound ,element
- d) compound, element , mixture

6. The chemical symbols C, Al and N stand respectively for

- a) Copper , Silver and Gold
- b) Carbon , Aluminum and Nitrogen
- c) Copper , Sliver and Zinc
- d) Copper , Mercury and Gold

7. Which of the following is the correct symbol of gold? ذهب

- a) F
- b) Au
- c) Ai
- d) Hg

8. An element can broken into simpler substance ينكسر عليه

- a) true
- b) false

9. Which of the following is not mixture? ليس مخلوط

- a) milk
- b) water
- c) fruit salad



Table 1.2 Prefix symbol and their numerical values

Prefix	البادئة	Symbol	الرمز	Numerical Equivalent
exa-		E		$10^{18}$
peta-		P		$10^{15}$
tera-		T		$10^{12}$
Giga		G		$10^9$
Mega		M		$10^6$
Kilo		k		$10^3$
hecto-		h		$10^2$
deca-		da		$10^1$
deci-		d		$10^{-1}$
Centi		c		$10^{-2}$
milli-		m		$10^{-3}$
micro-		$\mu$		$10^{-6}$
nano-		n		$10^{-9}$
pico-		p		$10^{-12}$
femto-		f		$10^{-15}$
atto-		a		$10^{-18}$

(١) عند التحويل (من البادئة) إلى الوحدة نضرب الرقم في قيمة البادئة

Examples: (1) Convert  $35.4 \text{ kJ}$  to  $\text{J}$ ?  $= 35.4 \times 10^3 \text{ J}$

(2) Convert  $18.2 \text{ pm}$  to  $\text{m}$ ?  $= 18.2 \times 10^{-12} \text{ m}$

(٢) عند التحويل من الوحدة إلى البادئة نضرب الرقم في قيمة البادئة بإشارة مخالفة

(3) Convert  $0.56 \text{ g}$  to  $\text{mg}$ ?  $= 0.56 \times 10^3 \text{ mg}$

(4) Convert  $7.5 \times 10^{-7} \text{ s}$  to  $\text{nano}$ ?  $= 7.5 \times 10^{-7} \times 10^{+9} = 7.5 \times 10^{+2} \text{ nano s}$

(٣) عند التحويل من بادئة إلى بادئة أخرى نضرب الرقم في قيمة البادئة الأولى بنفس الإشارة ثم في قيمة البادئة الثانية بإشارة

مخالفة ثم الجمع أو المحسوس

(5) Convert  $8.4 \text{ f}$  to  $\text{G}$ ?  $= 8.4 \times 10^{-15} \times 10^{-9} = 8.4 \times 10^{-24} \text{ G}$

⑥  $2.3 \text{ Tm} = \text{Gm} = 2.3 \times 10^{12} \times 10^{-9} = 2.3 \times 10^3 \text{ Gm}$

⑦  $82 \text{ ng} = \text{Mg} = 82 \times 10^{-9} \times 10^{+6} = 82 \times 10^{-3} \text{ Mg}$

weight and Mass

Mass الكتلة	Weight الوزن
Quantity of matter in an object كمية ما يحتويه الجسم من مادة	Force of gravity exerts on an object قوة جذب الارض للأجسام
*Mass is <u>constant</u> and do not depend on location الكتلة ثابتة لا تعتمد على المكان	*Weight is <u>not</u> <u>Constant</u> and <u>depend</u> on location الوزن غير ثابت يعتمد على المكان
unit الوحدة Kg كجم	unit الوحدة Newton نيوتن

**Weight = C x mass**

الوزن = الكتلة x C

على الأرض  
On earth C = 1

على القمر  
On moon C = 1/6

Ex  
On earth = 60  
الوزن على الأرض = 60

On moon = 1/6 x 60 = 10kg  
الوزن على القمر = 10

**Volume الحجم**

SI unit الوحدة

الوحدة الدولية المشتقة

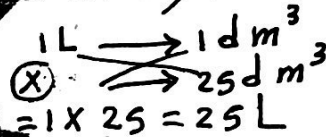
**SI derived unit for volume is cubic meter (m<sup>3</sup>)**

Volume [L] لتر

1 cm<sup>3</sup> = (1x10<sup>-2</sup> m)<sup>3</sup> = 1x10<sup>-6</sup> m<sup>3</sup>

how many liters in 25 dm<sup>3</sup>

1 dm<sup>3</sup> = (1x10<sup>-1</sup> m)<sup>3</sup> = 1x10<sup>-3</sup> m<sup>3</sup>



1 L = 1000 mL = 1000 cm<sup>3</sup> = 1 dm<sup>3</sup>

how many milliliters in 32 cm<sup>3</sup>

**1 mL = 1cm<sup>3</sup>**



**Macroscopic properties:**

Measurements which can be determined directly... قياسات تحدد مباشرة

**Microscopic properties:**

Measurements which can be determined indirectly... قياسات غير مباشرة

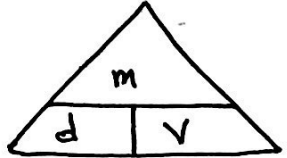
**Density الكثافة**

الوحدة مشتقة دولية

**SI derived unit for density is kg/m<sup>3</sup>** (وحدة القياس)

1 g/cm<sup>3</sup> = 1 g/ml = 1 g/L

Common unit  
الوحدات الشائعة للكثافة



كثافته كتلة  
 Density =  $\frac{\text{mass}}{\text{Volume}}$  كثافة حجم  
 $d = \frac{m}{v}$

## chapter (1)

Choose the correct answer

1. The SI unit of time is the

- a) hour
- b) second
- c) minute
- d) ampere

2. The diameter of an atom is approximately  $1 \times 10^{-7}$  mm. What is this diameter when expressed in nanometers?

- a)  $1 \times 10^{-18}$  nm
- b)  $1 \times 10^{-15}$  nm
- c)  $1 \times 10^{-9}$  nm
- d)  $1 \times 10^{-1}$  nm

3. 6.0 km is how many micrometers?

- a)  $6.0 \times 10^6$   $\mu\text{m}$
- b)  $1.7 \times 10^{-7}$   $\mu\text{m}$
- c)  $6.0 \times 10^9$   $\mu\text{m}$
- d)  $1.7 \times 10^{-4}$   $\mu\text{m}$

4. The SI prefixes giga and micro represent, respectively:

- a)  $10^{-9}$  and  $10^{-6}$ .
- b)  $10^6$  and  $10^{-3}$ .
- c)  $10^3$  and  $10^{-3}$ .
- d)  $10^9$  and  $10^{-6}$ .

5. Which of these quantities represents the largest mass?

- a)  $2.0 \times 10^2$  mg
- b) 0.0010 kg
- c)  $1.0 \times 10^5$   $\mu\text{g}$
- d)  $2.0 \times 10^2$  cg

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

- a)  $1 \times 10^{-6}$   $\text{cm}^3$
- b)  $1 \times 10^{-3}$   $\text{cm}^3$
- c)  $1 \times 10^{-2}$   $\text{cm}^3$
- d)  $1 \times 10^6$   $\text{cm}^3$



3 ✓ 7. Ammonia boils at -33.4°C. What temperature is this in °F?

- a) -60.1°F
- b) -92.1°F
- c) -28.1°F
- d) +13.5°F

2 ✓ 8. Which of the following is not an SI base unit?

- a) Kilometer
- b) Kilogram
- c) Second
- d) Kelvin

2 9. Which of the following SI base units is not commonly used in chemistry?

- a) kilogram
- b) kelvin
- c) candela
- d) mole

2 10. Which of the following prefixes means 1/1000?

- a) kilo
- b) deci
- c) centi
- d) milli

2 11. Which of the following prefixes means 1000?

- a) kilo
- b) deci
- c) centi
- d) milli

3 ✓ 12. Convert -77°F to kalvin ?

- a) 212.6 K
- b) -212.6 K
- c) -28.1 K
- d) +13.5 K

Ex The mass of matter is 257g and

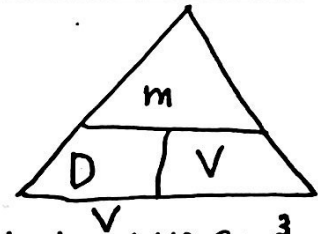
Volume  $13.3 \text{ cm}^3$  calculate the density?

$D = m/V$        $d = 257 \div 13.3 \text{ g/cm}^3 =$

Ex = a piece of platinum metal a density of  $21.5 \text{ g/cm}^3$  and volume  $4.449 \text{ cm}^3$

what the mass?

$M = d \times v$        $M = 21.5 \times 4.49$



Unit of temperature



$F = 20$     1-  $F \rightarrow C$      $C = (F - 32) \times \frac{5}{9}$      $\Rightarrow C = (20 - 32) \times \frac{5}{9} =$   
 $C = 30$     2-  $C \rightarrow F$      $F = (C \times \frac{9}{5}) + 32$      $\Rightarrow F = (30 \times \frac{9}{5}) + 32 =$   
 $C = 100$     3-  $C \rightarrow K$      $K = C + 273$      $\Rightarrow K = 100 + 273 = 373 \text{ K}$   
 $K = 200$     4-  $K \rightarrow C$      $C = K - 273$      $\Rightarrow C = 200 - 273 = -73 \text{ C}$

Convert

1)  $37 \text{ celcius to kelven}$      $C \rightarrow K$      $K = C + 273$   
 $K = C^\circ + 273$

$= 37 + 273 = 310 \text{ K}$

2)  $0 \text{ C}^\circ$  to kelven     $C \rightarrow K$      $K = C + 273$   
 $K = C^\circ + 273$

$= 0 + 273 = 273 \text{ K}$

3)  $0 \text{ K}$  to  $C^\circ$      $K \rightarrow C$      $C = K - 273$   
 $C^\circ = K - 273$

$= 0 - 273 = -273 \text{ C}^\circ$

4)  $572 \text{ C}^\circ$  to  $F^\circ$      $C \rightarrow F$      $F = (C \times \frac{9}{5}) + 32$   
 $F^\circ = (C \times \frac{9}{5}) + 32$      $= (572 \times \frac{9}{5}) + 32$   
 $= (572 \times \frac{9}{5}) + 32 =$

5)  $250 \text{ F}^\circ$  to  $C^\circ$      $F \rightarrow C$      $C = \frac{5}{9} (F - 32)$   
 $C = \frac{5}{9} (250 - 32) =$      $= \frac{5}{9} (250 - 32)$

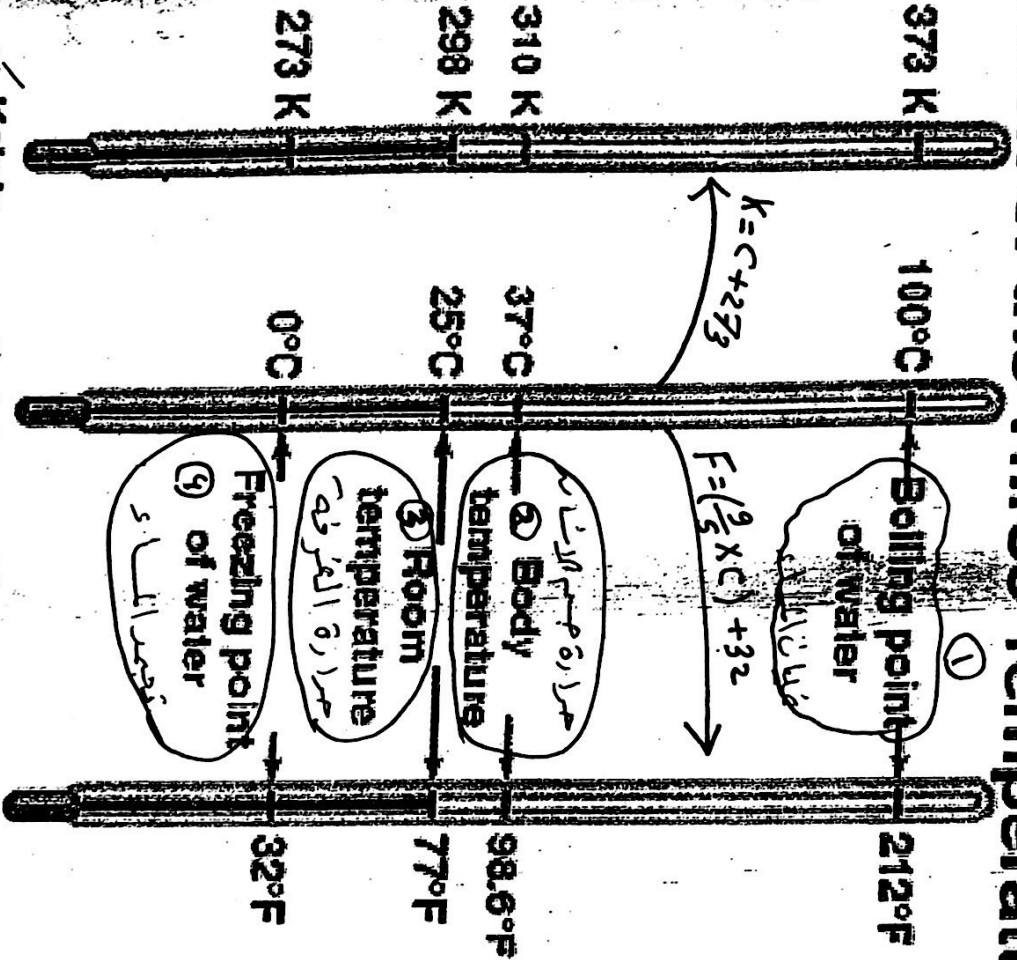
# Comparison of the Three Temperature Scales

Know these!

كالفين Kelvin

سنتيغرادس Celsius

فهرنهايت Fahrenheit



Ex 1

$$K = 0^{\circ}C + 273.15$$

$$273 K = 0^{\circ}C$$

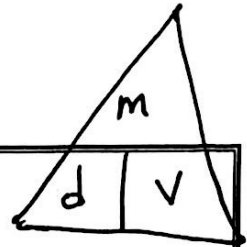
$$373 K = 100^{\circ}C$$

$$0^{\circ}F = \frac{9}{5} \times 0^{\circ}C + 32$$

$$32^{\circ}F = 0^{\circ}C$$

$$212^{\circ}F = 100^{\circ}C$$

$$1L = 1000cm^3 = 1000mL = 1dm^3$$



$$2L = 2 \times 10^3 cm^3 = 2 \times 10^3 mL$$

23. 2L = .....

- a)  $10^4 cm^3$       b)  $2 \times 10^3 cm^3$       c)  $2 \times 10^3 ml$       d) b+c

24. a piece of platinum metal with a density of  $21.5 g/cm^3$  has volume of  $10 cm^3$ , what is the mass..?  $m = d \times v$

- a) 215 g      b) 2.15 g      c)  $215 \times 10^{-3} kg$       d) a+c

25. a piece of metal with mass 279g and has a volume of  $10 cm^3$ , what is density.....?  $d = \frac{m}{v}$

- a)  $2.7 g/cm^3$       b)  $2.7 \times 10^3 kg/m^3$       c)  $270 g/cm^3$       d) a+b

26. amount of liquid has a density of  $0.8 g/ml$  and the mass is 40 g, what is the volume.....?  $v = \frac{m}{d}$

- a)  $50 cm^3$       b) 5ml      c) 50 ml      d) a+d

27. نقطة غليان الماء boiling point of water is.....?

- a) 373 k, 100 c, 212 f      b) 273 k, 100 c, 212 f      c) 212 f

- d) 273 k      e) 0 c      f) a,c,d

28. حرارة جسم الانسان body or human temperature = .....

- a) 37 k      b) 37 f      c) 31 c      d) 37 c, 310 k, 98.6 f

29. convert 180 f to degree celsius.....?

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

solution:  $T_c = (T_f - 32) \frac{5}{9} = (180 - 32) \frac{5}{9} = 82.22 c$

30. convert 248 k to degree fahrenheit.....?

solution:  $T_c = T_k - 273 = 298 - 273 = 25 c$

31. if the weight on the earth = 120, then the weight on the moon.....?

- a) 20      b) 720      c) 120      d) 12

$$W_{moon} = W_{earth} \times \frac{1}{6} = 120 \times \frac{1}{6}$$

13. The number 0.0005678 expressed in scientific notation is:

- a)  $5.678 \times 10^4$
- b)  $5.67 \times 10^{-7}$
- c)  $5.678 \times 10^{-4}$
- d)  $5.678 \times 10^{-3}$

**Explanation:** Since this number is less than one start moving the decimal point to the right until there is ONE non-zero number to the left of the decimal point. Write the rest of the number as is. Write the exponent as the number of places the decimal point was moved.

14. Which of the following is the smallest distance?

- a) 21 m
- b)  $2.1 \times 10^2$  cm
- c) 21 mm
- d)  $2.1 \times 10^4$  pm

**Explanation:** Even though  $2.1 \times 10^4$  is the largest number in this question, the units of pm (picometers) are the smallest units here, making it the smallest distance.

3) ✓ 15. What temperature is 95 °F when converted to degrees Celsius?

- a) 63 °C
- b) 35 °C
- c) 127 °C
- d) 15 °C

3) ✓ 16. What temperature is 37 °C when converted to kelvin?

- a) 310.15
- b) 99 k
- c) 236 k
- d) 67.15

3) ✓ 17. What temperature is 77 K when converted to degrees Celsius?

- a) -296 °C
- b) 105 °C
- c) -196 °C
- d) 25 °C

2) ✓ 18. Express 75 Tg as pg

- a) 0.75 pg
- b)  $75 \times 10^{24}$  pg
- c) 0.75 pg
- d)  $75 \times 10^{-24}$  pg



8

12. one of the following is classified as heterogeneous mixture.....?  
نيز متجانس

- a) sea water      b) drinking water      c) oil+water      d) milk

13. one of the following is classified as... homogeneous متجانس

- a) oil+water      b) sand+water      c) element      d) solution محلول

14. the matter that has unique kind of atoms.....?  
من الذرات نوع متمايز

- a) compound      b) mixture      c) element      d) solution

15. sugar+water classified as.....?

- a) solution      b) homogeneous mixture      c) compound      d) a+b

16.  $(0.43 \times 10^2) \text{ mg} = \dots \text{ g} \dots = 0.43 \times 10^2 \times 10^{-3} \text{ g} \dots$  (m =  $10^{-3}$ )  
بالمضروب X قيمة البادئة (m =  $10^{-3}$ )

- a)  $0.43 \times 10^{-1} \text{ g}$       b)  $4.3 \times 10^{-3} \text{ g}$       c)  $4.3 \times 10^{-2} \text{ g}$       d) a+c  
الإظهار

17. melting point is.....

- a) chemical property      b) extensive property      c) intensive property      d) c+d  
خواص داخلية لا تعتمد على الكمية

18. extensive property as.....?  
خواص خارجية

- a) density      b) freezing point      c) mass      d) burning  
تعتمد على الكمية

19. intensive property as.....?  
داخلية

- a) volume      b) mass      c) area      d) distance      e) none

20. SI unit of speed is.....?

- a) km/hour      b)  $\text{m/s}^3$       c) m/s      d) m.s

21.  $1 \text{ dm}^3$  equal.....?

- a)  $10^3 \text{ ml}$       b)  $10^3 \text{ cm}^3$       c)  $10^3 \text{ m}^3$       d) all

22.  $1 \text{ cm}^3 = \dots$ ?

- a)  $1 \times 10^3 \text{ m}^3$       b)  $1 \times 10^3 \text{ dm}^3$       c)  $1 \times 10^{-6} \text{ m}^3$       d) b+c

٧  
السنة التحضيرية



# CHEMISTRY

ch (1-2-3)

Chapter (1)-2-3

1439 – 1440

التيرم الثاني

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مكتبة ثاني تميم  
الكيمياء - للميد الإزوك

ت / ٣٠٩ - ١٤٤٤٣



# السنة التحضيرية

## CHEMISTRY

### Chapter (2)

1439 – 1440

التيرم الثانى



# عبد الرحيم الديب

☎ **0507832506**





The Modern Atomic Theory

نظرية دالتون

Dalton's Atomic theory

- 1- Elements are composed of extremely small particles called Atoms
- 2- All atoms of element are identical (having the same size, mass and chemical properties).
- 3- The atoms of one element are different from atoms of another element.
- 4- Compound are composed of two or more atoms
- 5- Chemical reaction involves separation or combination or rearrangement of atoms

Structure of the Atoms



بروتون protons (p <sup>+</sup> )	إلكترونات electrons (e <sup>-</sup> )	نيترون neutrons (n <sup>0</sup> )
في النواة Located in the nucleus	خارج النواة out side the nucleus	في النواة In the nucleus
شحنة charge = +1 (كولوم 1.6 × 10 <sup>-19</sup> )	كولوم (-1) (-1.6 × 10 <sup>-19</sup> )	charge = Zero
كتلة mass = 1.00727 amu	mass = 0.000548 amu (5.48 × 10 <sup>-4</sup> )	mass = 1.00866 amu

Atomic number (Z)

$Z = P = e$

Is the number of protons Or the number of electrons In the neutral atom nucleus of an atom.

Note: in the neutral : no of (p<sup>+</sup>) = no of (e<sup>-</sup>) عدد البروتونات = عدد الإلكترونات

Mass number (A)



Is the sum of the number of protons and neutrons in the nucleus of an atom

$A = p + n$

$A = z + n$

عدد النيوترونات = كتلة - ذرات

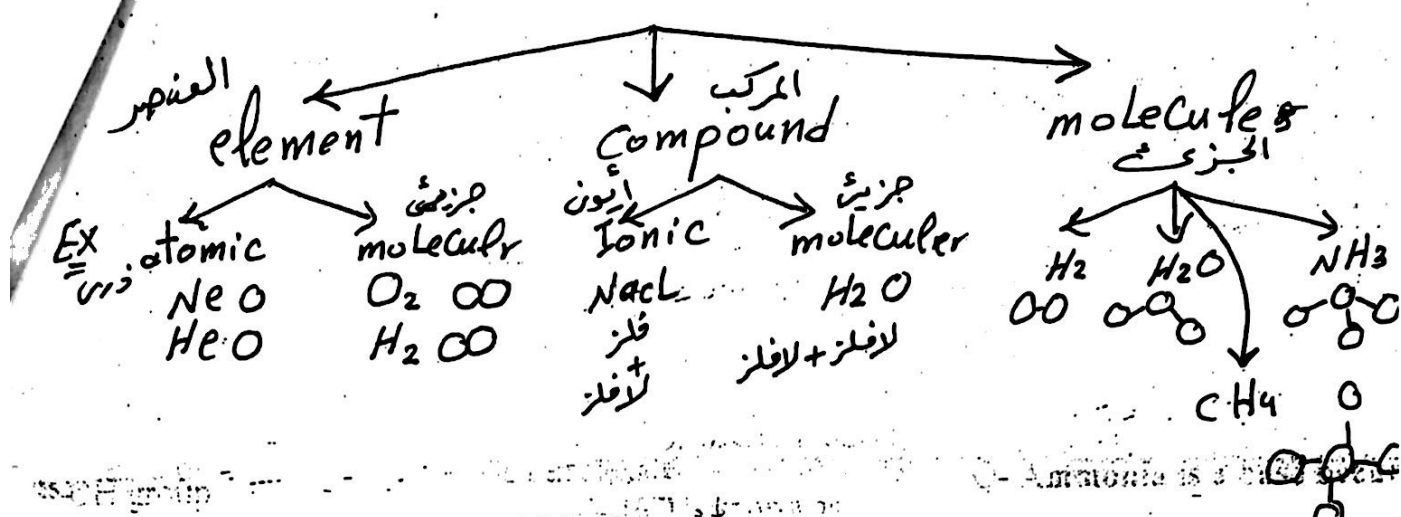
Note: Number of neutrons = A - p or = A - z

Symbols:

<sup>195</sup> / <sub>79</sub> Au	<sup>18</sup> / <sub>9</sub> F	<sup>12</sup> / <sub>6</sub> C
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Ex: give the number of protons and neutrons and electrons

In:	<sup>195</sup> / <sub>79</sub> Au	<sup>18</sup> / <sub>9</sub> F	<sup>12</sup> / <sub>6</sub> C	<sup>23</sup> / <sub>11</sub> Na	<sup>35</sup> / <sub>17</sub> Cl
p =	79	9	6	11	17
e =	79	9	6	11	17
n =	195 - 79 = 116	18 - 9 = 9	12 - 6 = 6	23 - 11 = 12	35 - 17 = 18



**CHAPTER-2: Atoms, Molecules and Ions**

(Q.1) According to Dalton's Atomic Theory elements are made of

- (a) molecules (b) compounds (c) atoms (d) none

X (Q.2) Matter can neither be created nor destroyed but can be changed form one form to another

(a) Law of conservation of mass (b) Newton's Law (c) Avogadro's Law

(d) Boyle's Law

(Q.3) The subatomic particle, which has no charge and a mass of 1 amu is called

- (a) proton (b) neutron (c) electron (d) positron

(Q.4) The subatomic particle, which has (-1) charge and negligible mass is called

- (a) proton (b) neutron (c) electron (d) positron

(Q.5) Atoms of an element having the same atomic number but different mass numbers are:

- (a) Isobars (b) Isotopes (c) Isotones (d) All

X (Q.6) Atoms of an element having the same number of protons but different number of neutrons are called:

- (b) Isobars (c) Isotopes (d) All



## Plum pudding model (Thomson)

The number of (+)charge(P)=(-)charge (e)



العدد الذري (Z): العدد الكلي للبروتونات أو عدد البروتونات  
 - Is the number protons or number of electrons In the neutral atom

Note: in the neutral :no of(P<sup>+</sup>) = (e<sup>-</sup>) Z=P=e

العدد الكلي للبروتونات + عدد النيوترونات في النواة  
 - Is the sum of the number of protons and neutrins in the nucleus

$$A=p+n$$

$$A=z+n$$

عدد النيوترونات = كتلى - ذرى

Note: Number of neutrons = A-z

Symbols: 79<sup>195</sup>Au

9<sup>18</sup>F

6<sup>12</sup>C

Ex 1 P=e=79

Ex 2 p=e=9

Ex 3 p=e=6

N=195-79

n=18-9=9

n=12-6=6



	Mass number	Atomic number	P	e	n
<sup>11</sup> Na <sup>23</sup>	= 23	= 11	= 11	= 11	23-11=12
<sup>8</sup> O <sup>17</sup>	= 17	= 8	= 8	= 8	= 17-8 = 9



تختلف نظائر  
(Q.7) Isotopes have different number of

- (a) protons (b) neutrons (c) electrons (d) positrons

(Q.8) The potassium atom (K) has 19 protons and 20 neutrons. What is its

العدد الذري A  
mass number?

$$A = p + n$$

- (a) 35 (b) 19 (c) 20 (d) 39

العدد الذري (Z)

(Q.9) Sodium atom (Na) has 11 protons and 12 neutrons. What is its atomic number?

$$Z = p = e$$

- (a) 11 (b) 12 (c) 23 (d) 17

(Q.10) Chlorine atom (Cl) has 17 protons and 18 neutrons. What will be its number of electrons.

عدد الإلكترونات  $p = e$

- (a) 40 (b) 18 (c) 38 (d) 17

(Q.11) The mass number of gold (Au) is 197 and the atomic number is 79.

Calculate the number of neutrons  $\text{نيوترونات} = A - Z$   
 $\text{ذري} = \text{ذري}$

- (a) 79 (b) 197 (c) 118 (d) 108

(Q.12) The chemical symbols: Cu, Ag and Au stands respectively for:

- (a) Cu, Ag and Au  
(a) Copper, Silver and Gold (b) Copper, Nickel and Gold (c) Copper, Silver and Zinc (d) Copper, Mercury and Gold

(Q.13) The chemical symbols Zn, Cd and Hg stands respectively for

- (a) Zinc, Cadmium and Silver (b) Zn, Cd and Hg  
(a) Zinc, Cadmium and Mercury (b) Zinc, Cadmium and Mercury  
(c) copper, silver and Mercury (d) Zinc, Cadmium and Mercury



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**Isotopes: النظائر**

Atoms with the same number of protons (atomic number) but different number of neutrons then have different mass number.

ذرات نفس البروتونات والعدد الذري تختلف في النيوترونات والعدد الكلي

EX1:	$8^{16}\text{O}$	$8^{17}\text{O}$	$8^{18}\text{O}$
different تختلف	$A=16$ $n=8$	$A=17$ $n=9$	$A=18$ $n=10$
Same نفس	$Z=8$ $P=8$	$Z=8$ $P=8$	$Z=8$ $P=8$

**isobar**  
Same (A) atomic but different (Z)  
نفس الكتل وتختلف في الذري (Z)  
Ex  $^{58}_{26}\text{Fe}$ ;  $^{58}_{28}\text{Ni}$  [ $^{48}_{20}\text{Ca}$  on  $^{48}_{22}\text{Ti}$ ]

EX2:	$1^1\text{H}$ Hydrogen	$1^2\text{H}$ Deuterium	$1^3\text{H}$ Tritium
different تختلف	$n=0$	$n=1$	$n=2$
Same نفس	$P=1$	$P=1$	$P=1$

**ISOTONES**  
Same (n) but different (A)  
نفس نيوترونات وتختلف في الكتل  
Ex  $^{39}_{18}\text{Ar}$   $^{39}_{19}\text{K}$   
 $n=21$   $n=21$

**Molecules: الجزيئات**

Are at least two atoms together by chemical forces

ارتباط ذريته بقوة كيميائية

ذرة واحدة	ثنائي	عدي
mono	Diatomic molecule	Poly atomic molecule
(8A) Ne, H	$\text{H}_2 - \text{O}_2$ : الماء ذريته	$\text{HNO}_3 - \text{H}_2\text{O} - \text{NH}_3 - \text{O}_3$
Contain one atoms	Contain two atoms	Contain more than two atoms

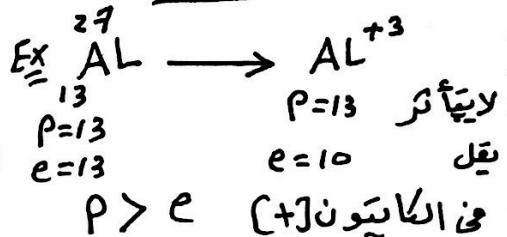
**الأيون**

- An ion is an atom, or group of atoms, that has a net positive or negative charge

سالب او موجب

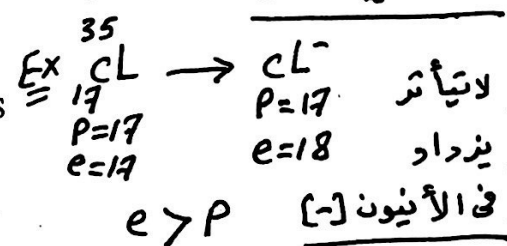
**Cation** كاتيون (+)

- ion with a positive charge
- if a neutral atom loses one or more electrons it becomes a cation [ + ]



**anion** (-)

- ion with a negative charge
- if a neutral atom gains one or more electrons it becomes a cation

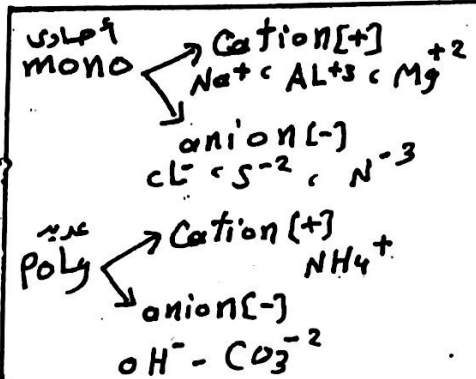


A polyatomic ion contains more than one atom  
 $\text{OH}^+, \text{CN}^-, \text{NH}_4^+, \text{NO}_3^-$

**أحادى**

A monatomic ion contains only one atom

Ex	$\text{Na}^+, \text{Cl}^-, \text{Ca}^{2+}, \text{O}^{2-}, \text{Al}^{3+}, \text{N}^{3-}$
Ex	How many protons and electrons are in 13 protons, 10 (13-3) electrons
Ex	How many protons and electrons are in 34 protons, 36 (34+2) electrons



The abundance of C-12 and C-13 are 98.99% and 1.01%. Calculate average abundance of atomic mass

$$= \frac{12 \times 98.99 + 13 \times 1.01}{100} = \frac{12.02 + 13.01}{100} = 12.01$$

(موز) (موز)



(Q.14) The Chemical symbols Cr, Mn, Fe, Co and Ni stands respectively for

- (a) Chromium, magnesium, Fluorine, Carbon and nitrogen
- (b) Chromium, Manganese, Iron, Cobalt and Nickel
- (c) Chromium, Manganese, Fluorine, Carbon and nitrogen

(d) Chromium, magnesium, Iron, Carbon and nitrogen

Cr    Mn    Fe    C    N  
المجزيئات عديد

(Q.15) Which set is an example of polyatomic molecules.

- (a) O<sub>2</sub> and H<sub>2</sub> (b) NH<sub>3</sub> and H<sub>2</sub>O (c) Cl<sub>2</sub> and I<sub>2</sub> (d) He and Ne

(Q.16) \_\_\_\_\_ is an atom or group of atoms that has a net positive or negative charge.

- (a) A molecule (b) A compound (c) An ion (d) none

(Q.17) \_\_\_\_\_ is formed by the loss of one or more electrons from a neutral atom

- (a) Cation (b) Anion (c) Both (d) None

(Q.18) If a neutral atom accepts (gains) one or more electrons from an atom it becomes

- (a) Anion (b) Cation (c) Both (d) None

(Q.19) Chlorine atom (Cl) has 17 protons and 17 electrons. Then chloride ion (Cl<sup>-</sup>) will have.

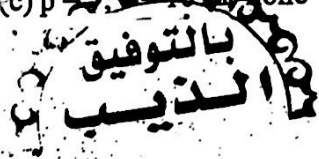
Cl	Cl <sup>-</sup>
e = 17	e = 18
p = 17	p = 17

- (a) p = 17, e = 18 (b) p = 18, e = 17 (c) p = 18, e = 18 (d) none

(Q.20) Nitrogen (N) has 7 protons and 7 electrons. Then N<sup>3-</sup> will have.

N	N <sup>3-</sup>
p = 7	p = 7
e = 7	e = 10

- (a) p = 7, e = 7 (b) p = 10, e = 7 (c) p = 7, e = 10 (d) none



PAGE

**Periodic table**

**Periodic table:** is the classification of the elements in groups and periods.

Contain: يحتوي

18 مجموعة رئيسية

Horizontal rows (Periods) سبع دورات أفقية

Vertical columns (Groups) 18 عمودات رأسية

group (1A): called alkaline metals (3Li, 11Na, 19K, 37Rb, 55Cs, 87Fr) فلزات قلوية

group (2A): called alkaline earth metals (4Be, 12Mg, 20Ca, 38Sr, 56Ba, 88Ra) أرضية

group (7A): called halogens (9F, 17Cl, 35Br, 53I) هالوجينات

group (8A): called noble gases or inert gases (2He, 10Ne, 18Ar, 36Kr, 54Xe, 86Rn) خاملة

Note: \*group 1A, 2A, 3A called metals so conduct electricity, and heat التوصيل

\*group 5A, 6A, 7A called non metals so don't conduct electricity and heat خصائص فلزات ولا فلزات لا توصيل

\*metalloid 8 elements (B, Si, Ge, As, Sb, Te, Po, At) property metal and non metal أشباه

\*Transition elements: Form 3B to 12B in periodic table الانتقالية

\*Lanthanides: elements beginning with 58Ce, 4f orbital begin to be filled and finished with 71Lu

\*Actinides: elements beginning with 90Th, 5f orbital begin to be filled and finished with 103Lr

Metals فلزات	Non metals لافلزات
Group 1A, 2A, 3A most element	Group 5A, 6A, 7A (17 element)
Conduct electricity, and heat توصيل الكهرباء والحرارة	Don't conduct electricity and heat لا توصيل
Lose electron → ion <sup>+</sup> (Cation) كاتيون	Accept (gain) electron → ion <sup>-</sup> (anion) أنيون

(1A) (2A) 3B 4B 5B 6B 7B 8B 9B 10B 11B 12B (3A) (4A) (5A) (6A) (7A) (8A)

1H	Group (A) → representative element																2He																	
3Li	4Be	Group (B) → Transition element عناصر انتقالية										5B	6C	7N	8O	9F	10Ne																	
11Na	12Mg	13Al	14Si	15P	16S	17Cl	18Ar	19K	20Ca	21Sc	22Ti	23V	Cr	Mn	26Fe	27Co	28Ni	29Cu	30Zn	Ga	Ge	As	Se	35Br	36Kr									
37Rb	38Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	47Ag	48Cd	In	Sn	Sb	Te	53I	54Xe	55Cs	56Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	79Au	80Hg	Tl	Pb	Bi	Po	86Rn
87Fr	88Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Bs	Rg	Uub	Uut	Uuq	Uup	Uuh	Uuo																		

Lanthanides & Actinides

58Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	71Lu
90Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	103Lr

(Q.29) The Correct name of HCl acid is

- (a) Hydrochloric acid (b) Hydrogen chloride (c) both (d) none

هيدروكلوريك

(Q.30) The correct chemical formula of sodium hydroxide is

- (a) Ba(OH)<sub>2</sub> (b) Na<sub>2</sub>OH (c) NaOH (d) none

الهيدروكسيد الصوديوم

(Q.31) The correct name of N<sub>2</sub>O<sub>4</sub> is

- (a) Nitrogen oxide (b) nitrogen dioxide (c) nitrogen tetroxide

(d) dinitrogen tetroxide

(Q.32) Chemical name of PBr<sub>5</sub> is-

- (a) Phosphorous tribromide (b) Phosphorous bromide (c) Phosphorous

pentabromide (d) Phosphorous dibromide

(Q.33) Compounds with water molecules attached to them are called

- (a) hydrous (b) anhydrous (c) hydrates (d) none

(Q.34) Group 1A elements are called.

(a) Alkali metals (b) Halogens (c) Alkaline earth metals (d) Noble gases

(Q.35) Group 2A elements are called.

(a) Alkali metals (b) Halogens (c) Alkaline earth metals (d) Noble gases

(Q.36) Group 7A elements are called.

(a) Alkali metals (b) Halogens (c) Alkaline earth metals (d) Noble gases

(Q.37) Group 8A elements are called.

(a) Alkali metals (b) Halogens (c) Alkaline earth metals (d) Noble gases

(Q.38) The horizontal rows in the periodic table are called

- (a) columns (b) periods (c) groups (d) families



## Chemical Formula

**The chemical formula:** الصيغة الكيميائية للتعرف على تركيب الجزيئات والمركبات  
usually used to illustrates the composition of molecules and compounds.

**Molecular Formula:** الصيغة الجزيئية معرفة عدد الذرات في الجزيء  
shows how many or each type of atom are in molecule

(exact number) كم نوع الذرات **Ex**  $C_2H_6$

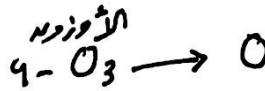
**Empirical Formula:** الصيغة الأولية معرفة نسب الذرات في الجزيء  
(simplest formula) shows the **Ex**  $CH_3$   
simplest whole number ratio of atoms.

**Structure Formula:** الصيغة البنائية

(S.F) show how atoms are bonded to one in a molecule. بالتفصيل يوضح الروابط الذرات.

Molecular  $\xrightarrow{\text{الأولية}} \rightarrow$  empirical  
الأولية العتمة على عنصر من الجزيئية

Ex1-  $C_2H_6 \rightarrow CH_3$   
2-  $N_2H_4 \rightarrow NH_2$   
3-  $C_6H_{12}O_6 \rightarrow CH_2O$



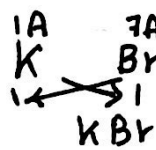
**Allotropes:** is two or more distain at forms of on element two allo tropic form of element .

Ex Carbon (diamond and graphite) المركبات الأيونية  
ماس كربون جرافيت

- Formed by metals and nonmetals.

- between cation (+) and neon (-)

Ex: Potassium Bromide  $\{KBr\}$



Ex Aluminum oxide  $\{Al_2O_3\}$

## Naming Compounds

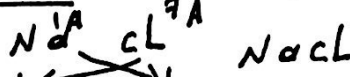
1- Organic compound: compound contain carbon main element  
المركبات العضوية كاربون

2- In organic compound : compound don't contain carbon  
لا تحتوي على كاربون

**A-Ionic compound :**

1) **Binary** compound contain two element  
عنصرية

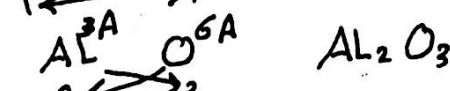
EX sodium chloride (NaCl)



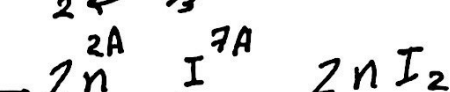
Potassium bromide (KBr)



Aluminum oxide ( $Al_2O_3$ )



Zinc iodide ( $ZnI_2$ )



المجموعة	1A	2A	3A	5A	6A	7A
الصفة	+1	+2	+3	-3	-2	-1

(Q.21) Magnesium has 12 protons and 12 neutrons. The Magnesium ion ( $Mg^{2+}$ )

will have

	$Mg$	$Mg^{+2}$	نقعد (+)
	$P=12$	$P=12$	
	$e=12$	$e=10$	

(a)  $p=13, e=12$  (b)  $p=12, e=10$  (c)  $p=10, e=12$  (d)  $p=14, e=12$

(Q.22) A neutral atom has the same number of

$P = e$   
(a) protons and electrons (b) protons and neutrons (c) neutrons and electrons

(d) none

(Q.23) What will be the number of neutrons in isotopes of carbon C-12, C-13 and C-14

عدد النيوترونات  
عدد النيوترونات = كتلي - ذري

	$^{12}C$	$^{13}C$	$^{14}C$
	$n=6$	$n=7$	$n=8$

(a) 6,6 and 6 (b) 6,8 and 9 (c) 6,7 and 8 (d) none

(Q.24) What will be the number of neutrons in isotopes of Oxygen O-16, O-17 and O-18

عدد النيوترونات

	$^{16}O$	$^{17}O$	$^{18}O$
	$n=8$	$n=9$	$n=10$

(a) 8,9 and 10 (b) 7,8 and 9 (c) 8, 10 and 11 (d) none

(Q.25) The empirical formula of hydrazine whose molecular formula is  $N_2H_4$

الصيغة الاولى هيدرازين الأولية القسمة على أصغر عدد

(a) NH (b)  $N_2H_2$  (c)  $N_2H$  (d)  $NH_2$

(Q.26) Non metals tend to \_\_\_\_\_ electrons.

لافلزات  
(a) give (b) accept (c) donate (d) none

(Q.27) Metals tend to \_\_\_\_\_ electrons.

فلزات  
(a) gain (b) accept (c) loss (d) none

(Q.28) The Correct name of  $BaCl_2 \cdot 2H_2O$  is

(a) barium chloride (b) barium chloride monohydrate

(c) barium chloride dihydrate (d) none

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الترتبية

ترتبه عناصر

2) Ternary compound : consists of three element

Ex: FeCl<sub>2</sub> → {feyrous iron} {iron(11)chloride}

FeCl<sub>3</sub> → {Ferric iron} {iron(111)chloride}

Mn<sub>2</sub>O<sub>3</sub> → manganese(111)oxide

FeCl<sub>2</sub>  
iron(11) chloride  
FeCl<sub>3</sub>  
iron(111) chloride

المركبات الجزيئيه  
B) Molecular compounds:

1) Binary compound consists of two element

Ex: HCl : hydrogen chloride

HBr : hydrogen Bromide

Sic : Silicon orbide

اسم العنصر الاول كما هو  
العنصر الثاني  
ide +

المركبات التساهمية  
C) Covalent compound:

Compound Formed between [non metal + metalloide]

{nonmetal + nonmetal}

عدد الذرات	1	2	3	4	5	6
الاسم	mono	di	tri	tetra	pento	hexa

Ex: Co ( carbon mono oxide )- SO<sub>2</sub>(Sulfur di oxide )-

N<sub>2</sub> O<sub>4</sub> (dinitrogentetraoxide) – P<sub>3</sub>O<sub>5</sub>(tri phosphor Penta oxide)

Common name: الاسم الشائع:

1. B<sub>2</sub> H<sub>6</sub> (dipyrone) حايبرون

2. CH<sub>4</sub>(met hand) ميثان

3. H<sub>2</sub>O (water) ماء

4. NH<sub>3</sub>(ammonia) أمونيا

5. pH<sub>3</sub> (phosphine) فوسفين

6. Si H<sub>4</sub> (Si lane) سيلان



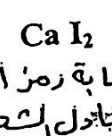
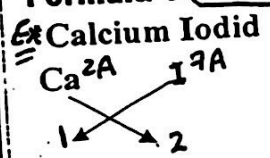
③ الإبتعالية  
 ② تسمية الأيون (-) العنصر + ide  
 ① تسمية الكاتيون (+) العنصر + ion

Na<sup>+</sup> Sodium Ion      Cl<sup>-</sup> chloride  
 Ca<sup>2+</sup> Calcium Ion      Br<sup>-</sup> Bromide  
 Cu<sup>+</sup> Copper (I)  
 Fe<sup>3+</sup> Iron (III)

Table 1.5 Example of cations and anions

Element	Name	Ion	Type	Name
Li	Lithium	Li <sup>+</sup>	Cation	Lithium ion
Na	Sodium	Na <sup>+</sup>	Cation	Sodium ion
K	Potassium	K <sup>+</sup>	Cation	Potassium ion
Mg	Magnesium	Mg <sup>2+</sup>	Cation	Magnesium ion
Al	Aluminum	Al <sup>3+</sup>	Cation	Aluminum ion
Cl	Chlorine	Cl <sup>-</sup>	Anion	Chloride
Br	Bromine	Br <sup>-</sup>	Anion	Bromide
O	Oxygen	O <sup>2-</sup>	Anion	Oxide

Formula of ionic compound: ionic compound contain cation and anion  
 مركبات الأيونية تحتوي على أيون



① كتابة رمز العنصر  
 ② تبادل الشحنتين

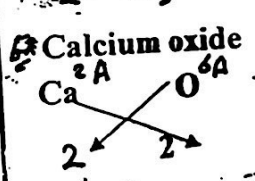
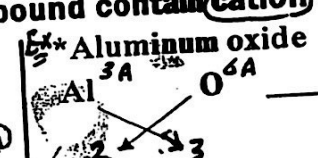
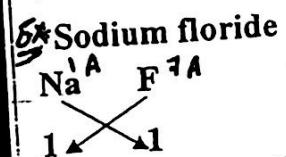


Table 1.6 Poly atomic ions الأيونات العنصرية

Name	Formula	Name	Formula
Ammonium	(NH <sub>4</sub> <sup>+</sup> )	Hydroxide	(OH <sup>-</sup> )
Chlorate	(ClO <sub>3</sub> <sup>-</sup> )	Permanganate	(MnO <sub>4</sub> <sup>-</sup> )
Cyanide	(CN <sup>-</sup> )	Thiocyanate	(SCN <sup>-</sup> )
Nitrate	(NO <sub>3</sub> <sup>-</sup> )	Nitrite	(NO <sub>2</sub> <sup>-</sup> )
Carbonate	(CO <sub>3</sub> <sup>2-</sup> )	Bicarbonate	(HCO <sub>3</sub> <sup>-</sup> )
Chromate	(CrO <sub>4</sub> <sup>2-</sup> )	Dichromate	(Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup> )
Sulfite	(SO <sub>3</sub> <sup>2-</sup> )	Sulfate	(SO <sub>4</sub> <sup>2-</sup> )
Phosphate	(PO <sub>4</sub> <sup>3-</sup> )		

Note: Some Mono atomic Ions have more than one oxidation number :

Ex1: Iron has 2 oxidation number  $Fe^{+2}$  (II) ,  $Fe^{+3}$  (III)

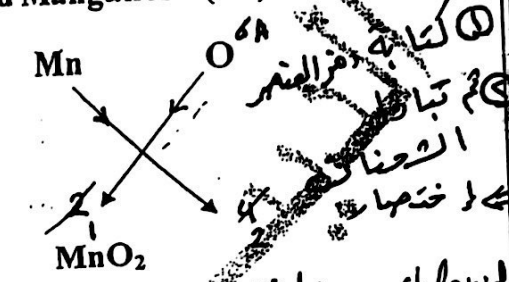
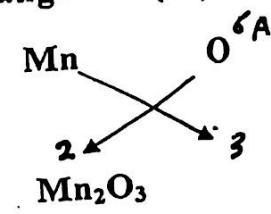
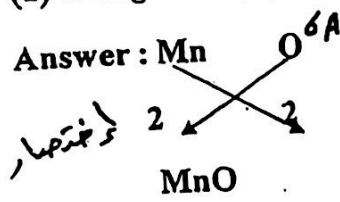
Ex2: Manganese has more than one oxidation number

$Mn^{+2}$  (II) ,  $Mn^{+3}$  (III) ,  $Mn^{+4}$  (IV)

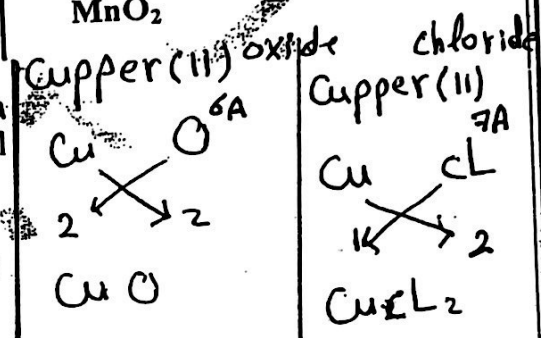
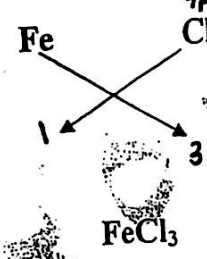
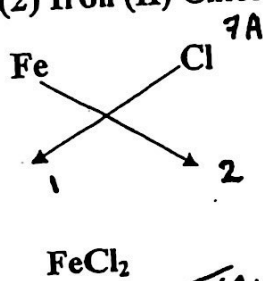
Ionic compounds: \* Write chemical formula

المركبات الأيونية للضامير الانتقالية [B]

(1) Manganese (II) oxide, Manganese (III) Oxide and Manganese (IV) Oxide?



(2) Iron (II) Chloride and Iron (III) Chloride?



Write the names for the following molecules :  $AlCl_3$  ,  $Na_2S$  ,  $K_2O$  ,  $MgH_2$

$CaCO_3$  ,  $AlPO_4$  ,  $Zn(OH)_2$  ,  $LiClO_3$  ,  $PbO$  ,  $Fe(NO_3)_2$  ,  $HgNO_3$  ,  $AgNO_3$  ,  $FeCl_3$   
 $MnO_2$  ,  $Cs_2O$  ,  $SiC$

Answer:

Compound	Name	المركب	الاسم
$AlCl_3$	Aluminum Chloride	$LiClO_3$	Lithium Chlorate
$Na_2S$	Sodium Sulfide	$PbO$	Lead Oxide
$K_2O$	Potassium Oxide	$Fe(NO_3)_2$	Iron (II) Nitrate
$MgH_2$	Magnesium Hydride	$HgNO_3$	Mercury (I) Nitrate
$CaCO_3$	Calcium Carbonate	$AgNO_3$	Silver Nitrate
$AlPO_4$	Aluminum Phosphate	$FeCl_3$	Iron (III) Chloride
$Zn(OH)_2$	Zinc Hydroxide	$MnO_2$	Manganese (IV) Oxide

**Covalent Compounds:** Contain no charge and they are formed from non-metals the number of atoms must be written before the name of element

تكتب عدد الذرات أولاً

ثم اسم العنصر

**Number of atoms and prefix**

Number of atoms عدد الذرات	Prefix الوحدة	Number of atoms عدد الذرات	Prefix الوحدة
1	Mono-	6	Hexa-
2	Di-	7	Hepta-
3	Tri-	8	Octa-
4	Tetra-	9	Nona-
5	Penta-	10	Deca-

Example:

Compound	Name	Compound	Name
CO	Carbon <u>mon</u> oxide	PBr <sub>5</sub>	Phosphorus <u>penta</u> bromide
CO <sub>2</sub>	Carbon <u>dio</u> xide	Cl <sub>2</sub> O <sub>7</sub>	<u>Dichloro</u> <u>hepta</u> oxide
SO <sub>2</sub>	Sulfur <u>dio</u> xide	NF <sub>3</sub>	Nitrogen <u>tri</u> fluoride
NO <sub>2</sub>	Nitrogen <u>dio</u> xide	HCl	Hydrogen <u>mono</u> chloride
N <sub>2</sub> O <sub>4</sub>	<u>Dinitrogen</u> <u>tetra</u> oxide	HBr	Hydrogen <u>mono</u> bromide

Write chemical formula:

Compound	Chemical formula	Compound	Chemical formula
Carbon monoxide		Phosphorus penta bromide	
Carbon dioxide		Dichloro hepta oxide	
Sulfur dioxide		Nitrogen trifluoride	
Nitrogen dioxide		Bromine tri fluoride	
Dinitrogen tetraoxide		Hydrogen monobromide	
Dinitrogen pentaoxid		Dihydrogen monooxide	

Chapter 2

رمز

1- Write the symbol for an atom with the following components; 11 protons and 12 neutrons.

a. Cl

ص الجود 11 = 11

b. Na

c. N

d. F

الأولية العينة على صفر عدد

2- The empirical formula for Butanoic acid  $C_4H_8O_2$  is .....

a.  $C_4H_8O_2$

b.  $C_3H_6O$

c.  $C_2H_4O$

d. CHO

صانه

3- What is the appropriate SI unit for distance?

a. centimeters

b. inches

c. meters

d. kilometers

صالوهم

4- Which of the following is classified as a halogen? (7A)

a. C

b. Ar

c. F

d. Na

ص الجود

العدد الذري

5- The atomic number indicates.....

a) the number of neutrons in a nucleus

b) the total number of neutrons and protons in a nucleus

c) the number protons or electrons in a neutral atom

d) the number of atoms in 1 g of an element

$Z = P = e$

العدد الذري

6- The mass number indicates.....

a) the number of neutrons in a nucleus

b) the total number of neutrons and protons in a nucleus

c) the number protons or electrons in a neutral atom

d) the number of atoms in 1 g of an element

كمية المادة

7- The SI unit for measuring the amount of substance is.....

a) Kg

b) Kelvin

c) mole

d) Pascal



$\overset{-}{X} \Rightarrow A = P + n$  8- A certain isotope  $X^-$  contains 54 electrons and 78 neutrons. What is the mass number of this isotope? A

$\overset{-}{X} \Rightarrow A = P + n - 1$  a) 132

b) 131

$X^+ \rightarrow A = P + n + 1$  c) 24

d) 54

$$A = P + n - 1$$

$$= 54 + 78 - 1 = 131$$

يجب

9- The prefix Giga used in the metric system has a value of .....

a.  $10^{10}$

b.  $10^{12}$

c.  $10^{19}$

d.  $10^6$

A

10- The mass number of an atom containing 7 protons, 7 electrons and 7 neutrons is .....; this is the ..... element.

- a) 14; Argon
- b) 12; Carbon
- c) 14; Nitrogen
- d) 21; Carbon

$N=7$  ص 7 بروتون

مخلوط

11- One of the following is classified as a mixture;

- a) Sodium chloride
- b) Oxygen
- c) Sea water
- d) Hydrogen.

نظية

12- The correct symbol for silver element is .....

- a) Ag
- b) S
- c) Si
- d) Au

13- The correct name of  $CF_4$  compound is.....

- a) Carbon florite
- b) Carbon florite
- c) Carbamide
- d) carbon tetrafluoride

14-  $CH_4$  is considered as.....

- a) Element
- b) Polyatomic molecule
- c) Diatomic molecule
- d) Mixture

عددية

15- The chemical formula for iron (III) chloride is.....

- a)  $Fe_2Cl_3$
- b)  $FeCl_2$
- c)  $FeCl_3$
- d)  $Fe_3Cl_2$

$FeCl_3$  A  
1 ← 3

الدولية

16- The empirical formula for ethane  $C_2H_6$  is .....

- a.  $C_2H_5$
- b.  $C_3H_8$
- c.  $CH_3$
- d.  $C_3H_7$

عدد الالكترونات

17- How many electrons does Iron (Al) atom have?

- a) 10
- b) 13
- c) 27
- d) 30

$AL=13$  ص 13 بروتون

نظائر

تختلف

18- Isotopes are atoms of the same element with different.....

- a) Mass number
- b) Atomic number
- c) Number of electrons
- d) Number of protons





11 → atomic mass  
 $Na \rightarrow mass$   
 $3 \rightarrow$  الكتلة  
 $= e = 11$   
 $3 - 11 = 12$

Alkaline Earth  
 Transition

# The Periodic Table

1 H 1.01 IA	2 He 4.00 VIIA	3 Li 6.94	4 Be 9.01	5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95		
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (99)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4
55 Cs 132.91	56 Ba 137.3	57 La* 138.9	72 Hf 178.9	73 Ta 180.9	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.22	78 Pt 195.1
87 Fr (223)	88 Ra (226)	89 Ac*	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (264)	108 Hs (265)	109 Mt (266)	110 Ds (271)

3

أمونيوم  
 استات  
 هيدروكسيد  
 سيانيد  
 برمنجنات  
 كربونات

### Most Common Polyatomic Ions

$NH_4^+$ = ammonium ion	$NO_3^-$ = nitrate ion
$CH_3COO^-$ = acetate ion	$NO_2^-$ = nitrite ion
$OH^-$ = hydroxide ion	$SO_4^{2-}$ = sulfate ion
$CN^-$ = cyanide ion	$SO_3^{2-}$ = sulfite ion
$MnO_4^-$ = permanganate ion	$PO_4^{3-}$ = phosphate ion
$CO_3^{2-}$ = carbonate ion	$CrO_4^{2-}$ = chromate ion

المعادن

Metals

Nonmetals

metals

non metals

بعض الأيونات

sodium = Na	حديد = Fe
potassium = K	زئبق = Hg
silver = Ag	مغنيسيوم = Mg
copper = Cu	الرصاص = Pb
gold = Au	الكبريت = S
zinc = Zn	كوبالت = Co
calcium = Ca	كروم = Cr
Nickel = Ni	كربون = C
Nitrogen = N	
Cadmium = Cd	

عنصر بيروكسيد النحاس

# السنة التحضيرية

## CHEMISTRY

### Chapter (3)

1439 – 1440

التيرم الثانى



# عبد الرحيم الذيب



0507832506

## Chapter 2

### Stoichiometry

**Atomic Mass or Atomic weight** : في العنصر is the average mass of atoms of an element نصف

**Molecular Mass or Molecular weight** : نصف The molecular mass of a compound is the sum of the atomic masses of the atoms in the molecules that form these compound.

\*مثال أحسب الكتلة الجزيئية للماء  $H_2O$  ؟  
 (ج) من الجدول الدوري الكتلة الذرية للعنصر (الرقم الكبير)  
 $H=1$        $O=16$   
 الكتلة الجزيئية =  $(1 \times 2) + 16 = 18 \text{ amu}$  (molecular mass)

Ex <sub>1</sub>	Ex <sub>2</sub>	Ex <sub>3</sub>	Atomic masses
CO <sub>2</sub> 12+(16×2) = 44 amu	NH <sub>3</sub> 14+(1×3) = 17 amu	C <sub>12</sub> H <sub>22</sub> O <sub>11</sub> 12×12+(1×22)+(16×11) =342amu	H=1 O=16 C=12 N=14

من جدول الدوري  
العدد الكبير للعنصر

**The mole** : One mole is defined as number of carbon atoms in exactly 12.00 grams of C<sup>12</sup>

\*Note : **Molar mass** = atomic mass or molecular mass by grams or g/mole

Ex<sub>1</sub> : Molar mass of C = 12 gram/mole      Ex<sub>2</sub> Molar mass of Na = 23 gram/mole

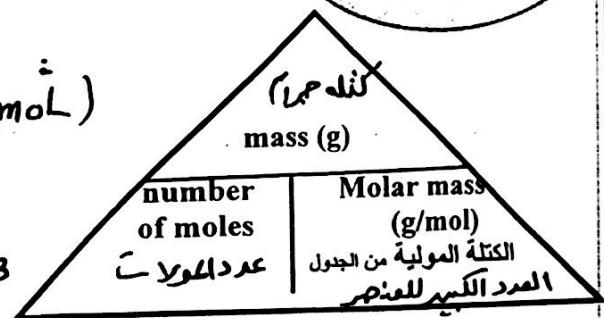
Ex<sub>3</sub> : Molar mass of CO<sub>2</sub> = 12+(16×2) = 44 gram/mole

Ex<sub>4</sub> : Molar mass of C<sub>12</sub>H<sub>22</sub>O<sub>11</sub> = 12×12+(1×22)+(16×11) = 342 g/mole

بالتوفيق  
 عبد الرحيم الديب  
 0507832506

Molecular mass  
الكتلة الجزيئية  
(a.m.u)

Molar mass  
الكتلة المولية  
(g) or (g/mol)



Ex

Ex<sub>1</sub> :

How many moles are there in 46 g of sodium

Answer : number of moles =  $\frac{\text{mass (g)}}{\text{molar mass (g/mole)}} = \frac{46 \text{ g}}{23 \text{ g/mole}} = 2 \text{ mole}$

Ex<sub>2</sub> : How many moles are there in 10 g of chlorine?  $Cl = 35.45$  من الجدول

Answer : number of moles = \_\_\_\_\_ = \_\_\_\_\_ = \_\_\_\_\_



Ex3: How many moles are there in 1.6 g of CH<sub>4</sub>?

$$\begin{aligned} \text{CH}_4 &= 12 + 1 \times 4 \\ &= 16 \end{aligned}$$

Molar mass of CH<sub>4</sub> = 12 + (1 × 4) = 16 g/mole

$$\text{number of moles} = \frac{\text{mass (g)}}{\text{molar mass (g/mole)}} = \frac{1.6 \text{ g}}{16 \text{ g/mole}} = 0.1 \text{ mole}$$

من الجيرول

Ex4: How many grams are there in 0.2 mole of SO<sub>2</sub>?

$$\begin{aligned} \text{SO}_2 &= 32 + 16 \times 2 \\ &= 64 \end{aligned}$$

Mass of SO<sub>2</sub> =

Ex5: Calculate the number of grams of lead (Pb) in 12.4 moles of lead.  $p_b = 207$

من الجيرول

- (a) 2.569 g    (b) 256.92 g    (c) 2569.28 g    (d) 4235.12 (g)

Avogadro's number: 1 mole of any thing contains the Avogadro's number (N<sub>A</sub>)

1 mole of particles = 6.022 × 10<sup>23</sup> particles for any substance

1 mole of carbon atoms = 6.022 × 10<sup>23</sup> carbon atoms

1 mole of cars = 6.022 × 10<sup>23</sup> car \* 1 mole of carbon atoms = 6.022 × 10<sup>23</sup> carbon atoms

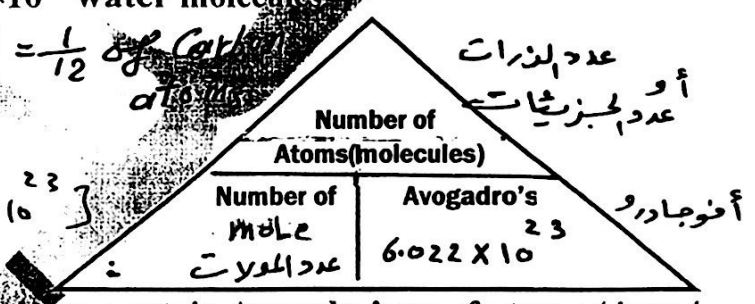
1 mole of water molecules = 6.022 × 10<sup>23</sup> water molecules

atomic mass unite: (a.m.u) =  $\frac{1}{12}$  of Carbon atom

Avogadro's number and the mole

3 mol of any thing

$$[3 \times 6.022 \times 10^{23} - 6.022 \times 10^{23}]$$



\*Note: A mole is amount of Substance contain Avogadro's no of atoms / ions /

molecules present in 12 g of Carbon

K = 39    من الجيرول

Ex1: Calculate the number of atoms in 55 g of potassium

①

②

- (a) 4.71 × 10<sup>23</sup> atoms    (b) 8.49 × 10<sup>23</sup> atoms    (c) 8.85 × 10<sup>23</sup> atoms    (d) 2.21 × 10<sup>23</sup> atoms

Ex2: Calculate the number of atoms in 3 mole in hydrogen .

Answer :

Number of hydrogen atom =  
عدد الذرات

Ex3: Calculate the number of atoms in 46 gram of sodium.  $Na=23$

Answer :

من الجدول

بالتوفيق  
عبد الرحيم الديب  
0507832506

Number of atom =

كتلة المركب  $\times$  عدد أفوجادرو  $\times$  عدد ذرات نفس العنصر  
عدد ذرات العنصر  
كتلة العنصر

من الجدول

C=12  
O=16  
N=14  
H=1

Ex4: Calculate the number of oxygen atoms in 20 gram of caffeine  $C_8H_{10}N_4O_2$ .

Number of oxygen atom =  $\frac{20 \times 6.22 \times 10^{23} \times 2}{194} = 1.2 \times 10^{23}$  oxygen atoms

Number of Carbon atom = \_\_\_\_\_

$C_8H_{10}N_4O_2$   
 $= 12 \times 8 + 1 \times 10$   
 $+ 14 \times 4 + 16 \times 2$   
 $= 194$

Percent composition : النسبة التركيبية

Is the percent by mass of each element in compound  
نسبة اللدلة للعنصر في المركب

Mass Percent of an element =  $\frac{(nx) \text{ molar mass of element}}{\text{molar mass of compound}} \times 100$

كتلة العنصر  
نسبة العنصر =  $100 \times \frac{\text{كتلة العنصر}}{\text{كتلة المركب}}$

Ex : Molar mass of  $H_3PO_4$  is 97.99 gm. Calculate the % composition by mass of H, P and O?

Mass% of H =  $\frac{\text{mass of H}}{\text{molar mass of compound}} \times 100 = \frac{3 \times 1}{97.9} \times 100 = 3\%$

من الجدول  
H=1  
P=31

Mass% of P =

Mass% of O =



O=16

الصيغة الأولية  
Empirical formula :

حساب الصيغة الجزيئية

Ex1 : A compound has an empirical formula is  $NPCL_2$  and a molecular weight is 347.66

ما هي الصيغة الجزيئية  
What is its molecular formula?

الصيغة الجزيئية للمركب =  $\frac{\text{الكتلة الجزيئية للمركب}}{\text{كتلة الصيغة الأولية}} \times \text{الصيغة الأولية}$

من الجدول  
 $NPCL_2$   
 $= 14 + 31 + 35.5 \times 2$

(a)  $NPCL_2$  (b)  $3NPCL_2$

(d)  $N_3P_3Cl_6$

Ex2 : The empirical formula for the compound with molecular formula  $C_2H_4O_2$  is

(a)  $C_4H_2O_2$  (b)  $CH_4O$

(c)  $CHO_2$  (d)  $CH_2O$

العمدة على أصغر عدد

Ex3 : compound contain 40.9% C and 4.5% H and 54.6 O . what is empirical formula for the compound ?

[C=12, H=1, O=16]

	C	H	O
	empirical formula [C <sub>3</sub> H <sub>4</sub> O <sub>3</sub> ]		

Ex4 : compound contain 1.5 gram of nitrogen and 3.5 gram of oxygen.

من الجدول

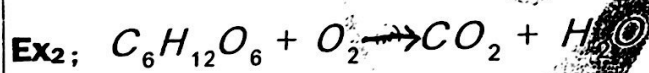
. what is empirical formula for the compound ?

[N=14, O=16]

	N	O
	empirical formula	

Balancing the following equation

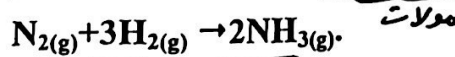
no. of atom of each element in Reactants = products



عدد ذرات لينواتح  
معامل الوزنه  
The Coefficient of oxygen is  
[12 - 6 - 9 - 3]

بالتوفيق  
عبد الرحيم الديب  
0507832506

Ex3 : How many moles of H<sub>2</sub> is required to produce 4 mole of NH<sub>3</sub> in reaction



ملاحظة عند ما يكون المطلوب حساب عدد المولات والمعطى في السؤال مولات يكون الحل مباشر

- (a) 9 moles
- (b) 4 moles
- (c) 6 moles
- (d) none

Ex<sub>4</sub>: Ammonia is produced on an industrial scale by the reaction of nitrogen gas with hydrogen gas. According to this balanced equation:  $N_2 + 3H_2 \rightarrow 2NH_3$  من الجبرول

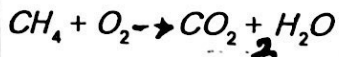
How many grams of  $N_2$  necessary to produce 7.50 g of  $NH_3$ ?  $[N = 14 \cdot H = 1]$

لا بد منه لتحويل  
لدى جبرام

$$\begin{array}{l} N H_3 \\ = 14 + 1 \times 3 \\ = 17 \end{array}$$

- (a) 6.18g  $N_2$  (b) 8.18g  $N_2$

Ex<sub>5</sub>: calculate the number of mole of  $H_2O$  result from 8 mole of  $CH_4$  for equation معلوم



=

$$\frac{\text{مولات المادة المعطومة} \times \text{معامل المادة المجهولة}}{\text{معامل المادة المعطومة}} = \text{عدد مولات المادة المجهولة}$$

المعامل المحدد  
**Limiting Reagent**: the reactant used up first in a reaction

المعامل الزائد  
**Excess Reagent**: the reactant present in greater quantity than necessary to react with limiting reagent.

Ex 1: Suppose 12g of C is mixed with 64g of  $O_2$  on following reaction  $C + O_2 \rightarrow CO_2$

$$[C = 12 \cdot O = 16]$$

$$\begin{array}{l} CO_2 \\ = 12 + 16 \times 2 \\ = 44 \end{array}$$

(a) Here 22g  $CO_2$  are produced and C is the limiting reagent

(b) Here 44g  $CO_2$  are produced and C is the limiting reagent

(c) Here 66g  $CO_2$  are produced and C is the limiting reagent

بالتوفيق  
عبد الرحيم الديب  
0507832506

Ex 2: If 400 gram of (Fe) mixed with 300 gram  $O_2$  with reaction

Which is limiting reagent  $4Fe + 3O_2 \rightarrow 2Fe_2O_3$  [O = 16 · Fe = 56]   
ما هو العامل المحدد

حاصل عدد المولات	Fe	$O_2$

## Chapter 3

1- Calculate the percent, by weight, of carbon in  $C_4H_8O_3$ ?

- a. 46%
- b. 31%
- c. 72%
- d. 27%

2- In an experiment to prepare aspirin, the theoretical yield is 153.7 g. If the actual yield is 124.3 g, what is the percent yield?

- a. 30.84 %
- b. 70.54 %
- c. 80.87 %
- d. 20.82 %

3- What is the molar mass of methanol  $CH_3OH$ ?

- a. 32 amu
- b. 32 g/mole
- c. 60 amu
- d. 60 g/mole

4- How many molecules are in 1 mole of  $H_2O$ ?

- a.  $12.044 \times 10^{23}$
- b.  $6.022 \times 10^{23}$
- c.  $3.022 \times 10^{23}$
- d.  $12.044 \times 10^{-23}$

5- Which of the following equations is NOT balanced correctly?

- a.  $H_2O(l) + H_2O(l) \leftrightarrow H_3O^+(aq) + OH^-(aq)$
- b.  $Ca(OH)_2(aq) + HCl(aq) \rightarrow CaCl_2 + H_2O(l)$
- c.  $2SO_2(g) + O_2(g) \leftrightarrow 2SO_3(g)$
- d.  $4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$

6- The limiting reagent in a chemical reaction is one that:

- a. Has the largest molar mass (formula weight).
- b. Has the smallest molar mass (formula weight).
- c. Is consumed completely.
- d. Is in excess.

7- A sample of a compound containing boron (B) and hydrogen (H) contains 11 g of B and 3 g of H. What is its empirical formula?

- a.  $B_2H$
- b.  $BH_2$
- c.  $BH_3$
- d.  $B_3H$

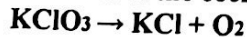
8- Calculate the number of atoms in 40.5 g of aluminum (Al).

- a.  $9.0 \times 10^{23}$
- b.  $2 \times 10^{-23}$
- c.  $56 \times 10^{32}$
- d.  $4 \times 10^{56}$

9- Which one of the samples contains the most molecules?

- a. 1 mol of  $CO_2(g)$
- b. 1 mol of  $NH_3(g)$
- c. 1 mol of  $CH_3COCH_3(l)$
- d. all contain the same number of molecules

10- What is the coefficient for  $O_2$  when the reaction below is balanced?



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

11- A sample of element consisting of two isotopes, one with mass = 79 amu and abundance 50.0%, and one with mass = 81 amu. Calculate the atomic mass for this element.

- a. 80
- b. 37
- c. 36
- d. 38



12- A sample of a compound containing nitrogen (N), Hydrogen (H), and oxygen (O) contains 14 g (N), 1 g (H), and 48 g (O). What is its empirical formula?

- a. HNO
- b. HNO<sub>2</sub>
- c. HN<sub>2</sub>O
- d. HNO<sub>3</sub>

13- How many moles are in 36 g of H<sub>2</sub>O?

- a. 1 mole
- b. 2 moles
- c. 3 moles
- d. 4 moles

14- The percent composition of carbon in CH<sub>4</sub> is -----.

- a. 87%
- b. 30%
- c. 25%
- d. 75%

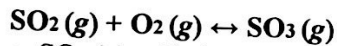
15- How many molecules are in 1 mole of H<sub>2</sub>O?

- a.  $12.044 \times 10^{23}$
- b.  $6.022 \times 10^{23}$
- c.  $3.022 \times 10^{23}$
- d.  $12.044 \times 10^{-23}$

16- If the theoretical yield for a reaction was 156 grams and I actually made 122 grams of the product, what is my percent yield?

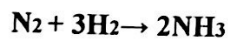
- a. 30.8 %
- b. 70.5 %
- c. 78.2 %
- d. 20.8 %

17- Balance the following equation;



- a.  $\text{SO}_2(g) + \text{O}_2(g) \leftrightarrow 2 \text{SO}_3(g)$
- b.  $2\text{SO}_2(g) + \text{O}_2(g) \leftrightarrow 2 \text{SO}_3(g)$
- c.  $\text{SO}_2(g) + \text{O}_2(g) \leftrightarrow \text{SO}_3(g)$
- d.  $2\text{SO}_2(g) + 2 \text{O}_2(g) \leftrightarrow 2 \text{SO}_3(g)$

18- For the chemical reaction, how many moles of NH<sub>3</sub> are formed when 2 moles of N<sub>2</sub> react with 8 moles of H<sub>2</sub>?



- a. 2 moles
- b. 7 moles
- c. 4 moles
- d. 10 moles

19- What are the combining ratios of the elements in perchloric acid HClO<sub>4</sub>?

- a. 1:1:2
- b. 1:1:4
- c. 1:1:3
- d. 1:1:1

20- How many grams are there in 1 mole of sodium (Na)

- a. 11.1 g
- b. 23.0 g
- c. 67.8 g
- d. 18.8 g

21- The percent composition of fluorine (F) in HF solution is.....

- a. 47.30%
- b. 58.99%
- c. 34.89%
- d. 95.00% 5

22- How many molecules are in 2 mole of H<sub>2</sub>O?

- a.  $12.044 \times 10^{23}$
- b.  $6.022 \times 10^{23}$
- c.  $3.022 \times 10^{23}$
- d.  $12.066 \times 10^{-23}$

14. Determine the empirical formula for compound present

K=24.75 g ,      Mn= 34.77 g and      O=40.51g

15. Ascorbic acid composed of 40.92% C and 4.58% H and 54.50% O  
Determine empirical formula

16. Compound contains 1.52g of N and 3.47g of O

The molar mass of compound is 92g Determine the molecular formula



قلوبه

(1A) Alkaline  
(2A) Alkaline earth

$Z = P - E$   
 $A = P + n$

11 → atomic number (Z)  
Na → mass. number (A)  
 $n = 23 - 11 = 12$

[3A → 8A]  
P Block

P Block

(5A) chalcogenes  
(7A) halogenes

(8A) Noble gases  
غازات نبيلة

Hydrogen H 1.0079 1	Beryllium Be 9.0122 4	Lithium Li 6.941 3	Sodium Na 22.990 11	Potassium K 39.098 19	Calcium Ca 40.078 20	Scandium Sc 44.956 21	Titanium Ti 47.887 22	Vanadium V 50.942 23	Chromium Cr 51.996 24	Manganese Mn 54.938 25	Iron Fe 55.845 26	Cobalt Co 58.933 27	Nickel Ni 58.693 28	Copper Cu 63.546 29	Zinc Zn 65.38 30	Aluminum Al 26.982 13	Carbon C 12.011 6	Nitrogen N 14.007 7	Oxygen O 15.999 8	Fluorine F 18.998 9	Neon Ne 20.180 10	Boron B 10.811 5	Silicon Si 28.086 14	Phosphorus P 30.974 15	Sulfur S 32.065 16	Chlorine Cl 35.453 17	Argon Ar 39.948 18	Gallium Ga 69.723 31	Germanium Ge 72.61 32	Arsenic As 74.922 33	Selenium Se 78.96 34	Bromine Br 79.904 35	Krypton Kr 83.80 36	Indium In 114.82 49	Tin Sn 118.71 50	Antimony Sb 121.76 51	Tellurium Te 127.60 52	Iodine I 126.90 53	Xenon Xe 131.29 54	Thallium Tl 204.38 81	Lead Pb 207.2 82	Bismuth Bi 208.98 83	Po 209 84	Astatine At 210 85	Radium Ra 226 88	Francium Fr 223 87	Actinium Ac 227 89
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(d) Block  
(f) Block  
Transition elements

لانثانويدات  
lanthanoids  
آكتينويدات  
actinoids

Lanthanum La 138.91 57	Cerium Ce 140.12 58	Praseodymium Pr 140.91 59	Neodymium Nd 144.24 60	Promethium Pm [145] 61	Samarium Sm 150.36 62	Europium Eu 151.96 63	Gadolinium Gd 157.25 64	Terbium Tb 158.93 65	Dysprosium Dy 162.50 66	Holmium Ho 164.93 67	Erbium Er 167.26 68	Thulium Tm 168.93 69	Ytterbium Yb 173.04 70	Actinium Ac 227 89	Thorium Th 232.04 90	Protactinium Pa 231.04 91	Uranium U 238.03 92	Neptunium Np [237] 93	Plutonium Pu [244] 94	Americium Am [243] 95	Curium Cm [247] 96	Berkelium Bk [247] 97	Californium Cf [251] 98	Einsteinium Es [252] 99	Fermium Fm [257] 100	Mendelevium Md [258] 101	Nobelium No [259] 102
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(f) Block  
لانثانويدات

السلسلة	1A	2A	3A	5A	6A	7A
العدد	+1	+2	+3	-3	-2	-1