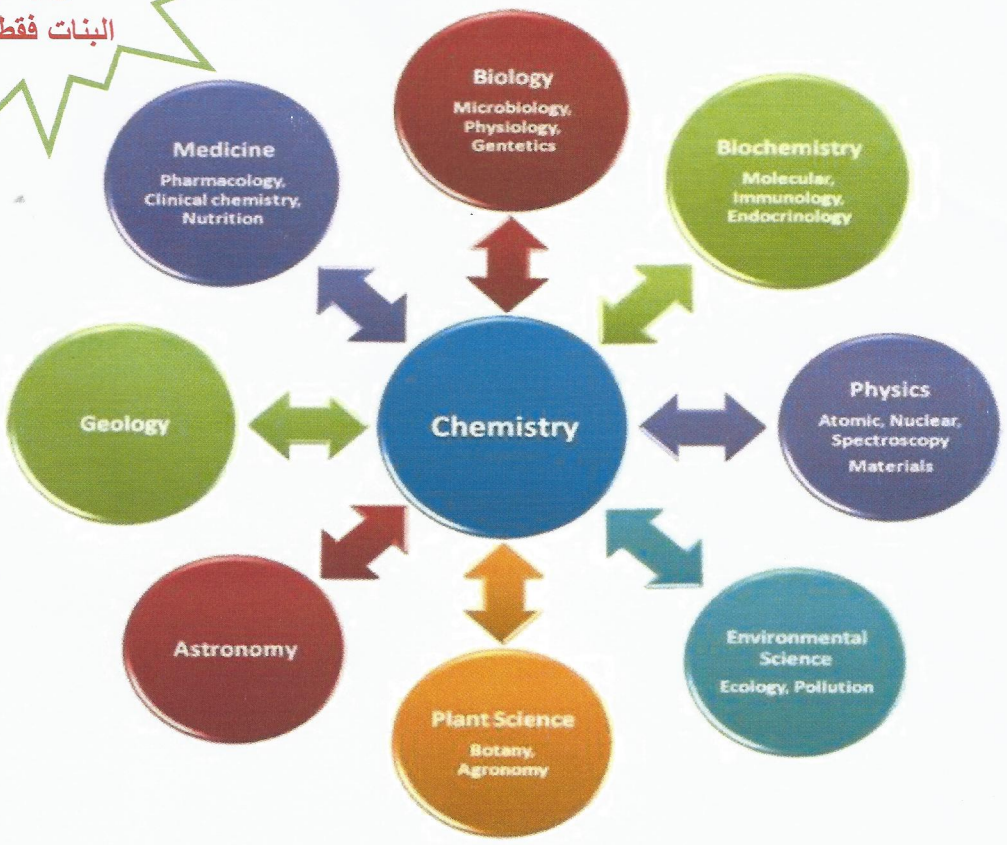
Chemistry

110

الدوري الثاني 1440

هذا الملخص
خاص بمنهج
البنات فقط



0543635821

د/ محمد خير الل...

Gases الغازات

Video (1)

- **Gases assume the volume and shape of their containers.**

  يأخذ الغاز حجم وشكل الإناء الموضوع فيه .

- **Gases are the most compressible state of matter.**

  الغاز أكثر قابليه لانضغاط أكثر من المادة الصلبة والسائلة .

- **Gases will mix evenly and completely when confined to the same container.**

  ينتشر الغاز بشكل كامل ومتساوي عند وضعه في نفس الأناء .

- **Gases have much lower densities than liquids and solids.**

  كثافة الغاز أقل من كثافة المواد الصلبة والسائلة .

حفظ

TABLE 5.1 Some Substances Found as Gases at 1 atm and 25°C

Elements	Compounds
H_2 (molecular hydrogen)	HF (hydrogen fluoride)
N_2 (molecular nitrogen)	HCl (hydrogen chloride)
O_2 (molecular oxygen)	HBr (hydrogen bromide)
O_3 (ozone)	HI (hydrogen iodide)
F_2 (molecular fluorine)	CO (carbon monoxide)
Cl_2 (molecular chlorine)	CO_2 (carbon dioxide)
He (helium)	NH_3 (ammonia)
Ne (neon)	NO (nitric oxide)
Ar (argon)	NO_2 (nitrogen dioxide)
Kr (krypton)	N_2O (nitrous oxide)
Xe (xenon)	SO_2 (sulfur dioxide)
Rn (radon)	H_2S (hydrogen sulfide)
	HCN (hydrogen cyanide)*

*The boiling point of HCN is 26°C, but it is close enough to qualify as a gas at ordinary atmospheric conditions.

عناصر تتواجد في صورة غاز في درجة حرارة الغرفة و 1 ضغط جوي .

Video (2-3)

Gases

- monatomic
  - Nobel gas: He , Ne , Ar , Kr . Xe .
- Diatomic
  - H_2, O_2, N_2, F_2, Cl_2, H_2
  - HF, HBr, HCL, HI , CO
- Poly atomic
  - Ammonia : NH_3
- Tri atomic
  - O_3
  - N_2O , CO_2

Pressure of Gasses ضغط الغاز

Pressure: The force applied per unit .

الضغط : هي القوة المؤثرة علي وحدة المساحات.

Pascal (Pa) : is the SI unit of pressure .

$$\text{Pressure} = \frac{force}{Area} = 1\ \text{Pa} = \text{N/m}^2$$

A barometer : A device that can weigh the atmosphere above us . **(filled with mercury).**

A manometer : A device for measuring the pressure of a gas in a container .

Common Units of Pressure

Atmospheric pressure: is the pressure exerted by Earth´s atmosphere.

Video (4)

1 atm = 1.013×10^5 Pa

1 atm =1.013 Barr

1 atm = 76 cm Hg

1 atm =760 mmHg (torr)

1 atm = 14.7 psi

Pascal : **is Si unit of pressure .**

1. **Convert 2.0 atm to mmHg is :**

Video (5)

a-115 mmHg b- 0.27 mmHg c-1520 mmHg d- 1250 mmHg

2. **Convert 688 torr to atm (atmosphere) is :**

a -11 atm b- 1.27 atm c- 0.9atm d- 1250 atm

Video (6)

3. **Convert 5 atm to k pa**

a) 0.739 atm b) 4.27×10^5atm c) 1.05 atm d) 0.562 atm

$$5 \times 1.013 \times 10^5 = 506500 \text{ Pa} / 1000 = 506.5 \text{ k pa}$$

Video (7)

5. **The atmospheric pressure in san Francisco was 732 mmHg .What was the pressure in K Pascal ?**

هنحول من mmHg الي atm ثم إلي pa

732 mmHg **/760** = 0.96 atm

0.963 atm × **1.013×10^5** = 9756 pa /1000 = 97.5 **K** pa

Gas Laws قوانين الغازات

- Boyle's Law , V – P relationship
- Charles Law , V – T– relationship
- Avogadro's Law ,V and Amount

Video (8-9)

Boyle's Law (v - p Relationship)

Boyles Law states that: The pressure of a fixed amount of gas (**n is constant**) **at a constant temperature** is **inversely** proportional to the volume of the gas .

عند ثبوت درجة الحرارة يتناسب حجم الغاز عكسياً مع ضغطة .

When you double the pressure on a gas, the volume is cut in half .

$$V \propto \frac{1}{P}$$

$$V = k\frac{1}{P}$$

$$V \times P = K \text{ constant}$$

$$P_1 \bullet V_1 = P_2 \bullet V_2$$

$$P_1V_1 = P_2V_2$$

$$\frac{P_1}{P_2} = \frac{V_2}{V_1}$$

أشكال مختلفة للقانون (حفظ)

$$\frac{P_1}{V_2} = \frac{P_2}{V_1}$$

$$\frac{V_2}{P_1} = \frac{V_1}{P_2}$$

1. Under conditions of fixed temperature and amount of gas , Boyle's law requires that

I. $P_1V_1 = P_2V_2$ II. PV = constant III. $P_1/P_2 = V_2/V_1$

Video (9)

a) I only b) II only c) III only d) I, II, and III

2. For a gas, which pair of variables are inversely proportional to each other (if all other conditions remain constant)?

a) P, V b) V, T c) n, V d) n, P

ملاحظات هامه قبل بدء المسائل

Video (10 - 11 – 12)

3. A sample of chlorine gas occupies a volume of 946 mL at a pressure of 726 mmHg. What is the pressure of the gas (in mmHg) if the volume is reduced at constant temperature to 154 mL ?

Video (13)

SOLUTION

P_1 = 726 mmHg , V_1 = 946 mL

P_2 = ?? mmHg , V_2 = 154 mL

➢ $P_1 V_1 = P_2 V_2$

$$P_2 = \frac{P_1V_1}{V_2} = \frac{726 \times 946}{154} = 4459.7 \text{ mmHg}$$

4. A balloon is put in a bell jar and the pressure is reduced from 762 torr to 0.500 atm. If the volume of the balloon is now 2780 mL , what was

Video (14)

SOLUTION

$P_1 = 762 \text{ torr} = \frac{762}{760} = 1.003 \text{ atm}$, $V_1 = ??$ mL

$P_2 = 0.500 \text{ atm}$, $V_2 = 2780$ mL

➢ $P_1 V_1 = P_2 V_2$

$$V_1 = \frac{P_2 V_2}{p_1} = \frac{0.5 \times 2780}{1.003} = 1385 \text{ mL}$$

5. A sample of oxygen occupies 47.2 liters under a pressure of 1240 torr at 25°C .

What volume would it occupy at 25°C if the pressure were decreased to 730 torr ?

a) 27.8 L b) 29.3 L c) 32.3 L d) 80.2 L

P_1 = 1240 torr , V_1 = 47.2 L

P_2 = 730 torr , V_2 = ?? L

$$P_1 V_1 = P_2 V_2$$

$$V_2 = \frac{P_1 * V_1}{P_2}$$

$$V_2 = \frac{1240 \times 47.2}{730} = \mathbf{80.2\ L}$$

Charles and Gay Lussac's Law

Video (15)

Charles's and Gay-Lussac's Law states that : the volume of a fixed amount of gas (n is constant) **at a constant pressure** is **directly** proportional to the temperature .

عند ثبوت الضغط يتناسب حجم الغاز طردياً مع درجة حرارته .

$$V \propto T$$

$$V = \text{constant} \times T$$

Video (16)

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$T_k = T_C + 273$ درجة الحرارة بالكلفن

Charles's Law in different forms

أشكال مختلفة للقانون (حفظ)

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \qquad V_1 T_2 = V_2 T_1$$

$$\frac{T_1}{V_1} = \frac{T_2}{V_2} \qquad \frac{V_1}{V_2} = \frac{T_1}{T_2}$$

1. A sample of carbon monoxide gas occupies 3.20 L at 125 ^{0}C.

Video (17)

At what temperature will the gas occupy a volume of 1.54 L if the pressure remains constant?

T_1 = 125 ^{0}C = 398 K , v_1 = 3.20 L

T_2 = ?? k , v_2 = 1.54 L

➢ $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

➢ $T_2 = \frac{V_2 * T_1}{V_1} = \frac{1.54 \times 398}{3.20}$ ➢ T_2= 191.5 k

2. A gas has a volume of 2.57 L at 0.00°C. What was the temperature at 2.80 L?

Video (18)

V_1 = 2.57 L , T_1 = 0.00 °C =273 k

V_2 = 2.80 L , T_2 = ?? K

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

➢ $T_2 = \frac{T_1 * V_2}{V_1} = \frac{273 \times 2.80}{2.57} = 297.4$ k

Avogadro's Law

Video (19)

At **constant pressure and temperature**

the volume is **directly** proportional to the number of moles of the gas .

عند ثبوت الضغط والحرارة يتناسب حجم الغاز طرديا مع عددالمولات

Equal volumes of gases contain equal numbers of molecules

The gas doesn't matter

$$V \alpha n$$

$$V = \text{constant} \times n$$

$$\frac{V_1}{n_1} = \frac{V_2}{n_2}$$

1. 0.82 mole of Hydrogen gas has a volume of 2.00L at a certain Temp and pressure

What is volume of 0.125 mole of this gas (at same T and P) .

a-0.0512 L b- 0.250 L c-0.305 L d-40 L

SOLUTION

v_1 = 2 L , n_1 = 0.82 mol

v_2 = ?? L , n_2 = 0.125 mol

➢ $\frac{V_1}{n_1} = \frac{V_2}{n_2}$

➢ $V_2 = \frac{V_{1\times n2}}{n_1} = \frac{2 \times 0.125}{0.82} = 0.3048$ L

2. A 0.225 mol sample of He has a volume of 4.65 L. How many moles must be added to give 6.48 L

v_1 = 4.65 L , n_1 = 0.255 mol

v_2 = 6.48 L , n_2 = ?? mol

➢ $\frac{V_1}{n_1} = \frac{V_2}{n_2}$

➢ $n_2 = \frac{n_{1\times V2}}{V_1} = \frac{0.255 \times 6.48}{4.65} = 0.355$ L

Moles added = n_2 . n_1 = 0.355 - 0.255 = 0.1 mol

Pressure law قانون الضغط

Video (20)

عند ثبوت الحجم يتناسب ضغط كمية معينة من غاز طرديا مع درجة الحرارة

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

1. The gas pressure in an aerosol can is 1.8 atm at 25°C If the gas is an ideal gas what pressure would develop in the can if it were heated to 475 °C :

a-0.095 atm b-0.717 atm c-3.26 atm d-4.52 atm

SOLUTION

$p_1 = 1.8$ atm , $T_1 = 25 = 298$ K

$p_2 = ??$ atm , $T_2 = 475 = 748$ K

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$P_2 = \frac{P_1 * T_2}{T_1} = \frac{1.8 \times 748}{298} = 4.52 \text{ atm}$$

القانون العام للغازات

Video (21)

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

1. A small bubble rises from the bottom of a lake , Where the temperature and pressure are 4 ^{0}C and 3.0 atm , Where the temperature is 25°C and the pressure is 0.75 atm . Calculate the final volume of the bubble if its initial volume was 2.1 m L

a- 0.72mL b-6.2 mL c- 41.4 Ml d- 9.03 mL

Video (22)

p_1 = 3 atm , T_1 = 277 K , V_1 = 2.1 mL

p_2 = 0.75 atm , T_2 = 298 K , V_2 = ?? mL

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$V_2 = \frac{P_1 * V1 * T_2}{T_1 * P_2} = \frac{3 \times 2.1 \times 298}{277 \times 0.75} = 9.03 \text{ mL}$$

2.The volume of a sample of nitrogen is 6.00 liters at 35°C and 740 torr. What volume will it occupy at STP?

a) 6.59 L b) 5.46 L c) 6.95 L d) 5.18 L

Video (23)

V_1 = 6 L , p_1 = 740 torr , T_1 = 35 ^{0}C = 35+273 =308 K

v_2 = ?? L , p_2 = 1 atm = 760 torr , T_2= 273 K

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{740 \times 6}{308} = \frac{760 \times V_2}{273}$$

V_2 = 5.18 L

The Ideal Gas Equation

Video (24)

قانون الغاز المثالي

☛ الحجوم المتساوية من الغازات المختلفة لها نفس عدد المولات (الجزيئات) عند نفس الظروف من الضغط ودرجة الحرارة .

➢ $PV = nRT$

➢ R = 0.082

STP : Standard temperature and pressure : The conditions 0 ^{0}C and 1 atm .

- **Standard temperature 0 °C = 273.15 K**
- **Standard pressure = 1 a tm**
- **Standard Volume = 22.4 L**

Fact : One mole of any gas at the STP condition will occupy a volume equals 22.41 L.

1. Calculate the pressure (in atm) exerted by 1.82 moles of the sulphur hexa flouride in a steel vessel of volume 5.43 L at 69.5 °C .

Video (25)

p = ?? atm , V = 5.43 L , n = 1.82 mol , T = 342.5 K

➢ $PV = nRT$

➢ R = 0.082

$$P = \frac{n \times R \times T}{V} = \frac{1.82 \times 0.082 \times 342.5}{5.43} = 9.42 \text{ atm}$$

2. How many mole of H_2 gas occupy 2000 ml at 1520 torr , 100 ^{0}C ?

Video (26)

P = 1520 torr/760 =2atm , v =2000/1000 = 2L ,

T = 100 ^{0}c + 273 = 373 ^{0}k , n =? ?

$PV = nRT$

$$n = \frac{PV}{RT} = \frac{2 \times 2}{0.082 \times 373} = 0.13 \text{ mol}$$

فديو بيفكرك كيف تحسبي مولار ماس

3. What is the mass of <u>oxygen gas</u> in 2 L flask at 2 liter and 760 torr at 100 ^{0}c ?

Video (27-28)

v = 2 L T = 100+273 = 373 K P= 760/760 =1

$$n = \frac{PV}{RT} = \frac{1 \times 2}{0.082 \times 373} = 0.065 \text{ mol}$$

Mass = n × M_m Mass = 0.065 × 32 = 2.09 g

4. What pressure in atm would be exerted by 76 g of fluorine gas F_2 in 1.50 liter at -37^0C ?

Video (29)

$$n = \frac{mass}{M_m} = \frac{76}{38} = 2 \text{ moles}$$

V = 1.50 L T = -37+273 = 236 K

R = 0.082 P= ?? atm

PV = n R T

$$p = \frac{nRT}{V} = \frac{2\times 0.082 \times 236}{1.5} = 25.8 \text{ atm}$$

5. Calculate the volume (in liters) occupied by 7.40 g of NH_3 at STP condition .

n = ??

$$n = \frac{mass}{M_m} = \frac{7.40}{17} = 0.44 \text{ moles}$$

V = ?? L T = 273 K

R = 0.082 P= 1 atm

$$V = \frac{nRT}{P} = \frac{0.44 \times 0.082 \times 273}{1} = 9.7 \text{ L}$$

6. What is the mass of nitrogen gas in 1040.0 mL flask at STP ?

Video (30)

v = 1040 /1000 =1.04 L T = 273 K

P= 1 atm R = 0.082 n = ??

PV = n R T

$$n = \frac{PV}{RT} = 0.047 \text{ mol}$$

Mass = n × M_m Mass = 0.047 × 28 = 1.3 g

7. A container with volume 71.9 mL contains water vapor at a pressure of 10.4 atm and a temperature of 465°C. How many grams of the gas are in the container?

a) 0.421 g b) 0.222 g c) 0.183 g d) 0.129 g

v = 71.9 /1000 =0.0719 L T = 465+273=738 K

P= 10.4 atm R = 0.082 n = ??

PV = n R T

$$n = \frac{PV}{RT} = = \frac{10.4 \times 0.0719}{0.082 \times 738} = 0.012 \text{ mol}$$

Mass = $n \times M_{m\,(H2O)}$

Mass = 0.012 × 18 = 0.222 g

اعرفي أن water vapor بخار الماء رمزه H_2O

8. Calculate the mass, in grams, of 2.74 L of CO gas measured at 33°C and 945 mmHg.

p = 945 / 760 =1.24 atm , V = 2.74 L , T = 33+273 =306 K

➢ $n = = \frac{PV}{RT}$ = 0.135 mol .

mass = n × M_m = 0.135 × 28 = 3.8 g

9. A 1.2 g sample of gas has volume 0.1 L at 25 ^{0}c and 1.15 atm .Calculate the molar mass of the gas ?

Video (31)

Mass = 1.2 g , p = 1.15 atm , V = 0.1 L ,

n = ?? mol , T = 25+273 =298 K

- R = 0.082 .
- $PV = nRT$ ➢ n = 0.0047 mol

mass = n × M_m

$$M_m = \frac{mass}{n} = \frac{1.2}{0.0047} = 255\ g/mol$$

10. A 4.37 gram sample of a certain diatomic gas occupies a volume of 3.00 L at 1.00 atm and a temperature of 45°C. Identify this gas.

Video (32)

a) F_2 b) N_2 c) H_2 d) O_2

p = 1 atm , V = 3 L , n = ?? mol , T = 45+273 =318 K

- $PV = nRT$
- $n = \frac{PV}{RT} = \frac{1 \times 3}{0.082 \times 318} = 0.115\ mol$

mass = n × M_m

$$M_m = \frac{mass}{n} = \frac{4.37}{0.115} = 38\ (F_2)$$

11 - 10.0 L flask contain 14.1 g of unknown gas .If the pressure in the flask 2.3 atm at 65 ^{0}C . What is the identity of the gas ?

a- CH_3 b- NH_3 c- NH_4 d- CH_4

12. Determine the molar mass of chloroform gas if a sample weighing 0.389 g is collected in a flask with a volume of 102 cm^3 at 97°C. The pressure of the chloroform is 728 mmHg.

a) 187 g/mol b) 121 g/mol c) 112 g/mol d) 31.6 g/mol

P = 728/760 = 0.95 atm , Mass = 0.389 g , n = ??

v = 102 cm^3 (ml) = 102 /1000 = 0. 102 L , T = 273 + 97 = 370 K

PV = nRT R = 0.082

$$n = \frac{PV}{RT} = 3.18 \times 10^{-3} \text{ mol}$$

$$\text{Mass} = n \times M_m$$

$$M_m = \frac{0.389}{3.18 \times 10^{-3}} = 121 \text{ g/mol}$$

13. Calculate the molar mass of a gas with mass 0.311 g that has a volume of 0.225 L at 55°C and 886 mmHg

P = 886/760 = 1.16 atm , Mass = 0.311 g ,

n = ??

v = 0.255 L , T = 273 + 55 = 328 K

$$PV = nRT \qquad R = 0.082$$

$$n = \frac{PV}{RT} = \frac{1.16 \times 0.255}{0.082 \times 328} = 0.011 \text{ mol}$$

$$\text{Mass} = n \times M_m$$

$$M_m = \frac{0.311}{0.011} = 28 \text{ g/mol}$$

14. How many molecules of N_2 can be present in a 2.5 L

Flask at 50 ^{0} C and 650 mmHg ?

a- 1×10^{-3} b-1×10^{23} c- 4.9×10^{22} d-3.6×10^{25}

p = 650/760 = 0.855 atm V = 2.5 L , n = ?? mol

T = 50+273 = 323 K

- $PV = nRT$
- R = 0.082
- $n = \frac{p\times V}{R\times T} = 0.081$ mol

☛ **Number of molecules = n × N_A**

Number of molecules $= 0.081\times6.022\times10^{23} = 4.9\times10^{22}$ molecules

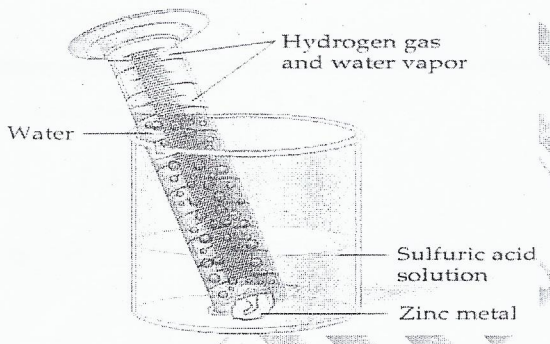
15. **A sample of hydrogen gas was collected over water** at 21°C and 685 mmHg.

The volume of the container was 7.80 L. **Calculate the mass of $H_2(g)$ collected.**

(Vapor pressure of water = 18.6 mmHg at 21°C.)

a) 0.283 g **b) 0.57 g** **c) 0.589 g** **d) 7.14 g**

ة الضغط في المسالة يمثل الضغط الكلي للغاز والماء . (نبغا فقط ضغط الغاز لكي نحسب مولات الغاز ثم كتلته) .



Video (33-34)

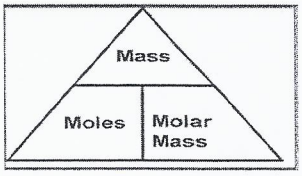
When gas collection over water displacement

$$P_{Total} = P_{gas} + P_{Water\ vapor}$$

$$P_{Total} = P_{gas} + P_{Water\ vapor}$$

$$685 = P_{gas} + 18.6$$

$$P_{gas} = 685 - 18.6 = 666.4 \text{ mmHg} \ (\ 0.876 \text{ atm}\ )$$



$$PV = nRT$$

$$0.876 \times 7.80 = n \times 0.082 \times 294$$

$$n = 0.283 \text{ mol}$$

$$\text{mass} = n \times M_m$$

$$\text{mass} = 0.283 \times 2 = 0.57 \text{ gram}$$

Video (35)

16. A sample of hydrogen gas collected by displacement of water occupied 30.0 mL at 24°C and pressure 736 torr. The vapor pressure of water at 24.0°C is 22.4 torr.

What volume would the hydrogen occupy if it were dry and at STP?

a) 32.4 mL b) 21.6 mL c) 36.8 mL d) 25.9 mL

$$P_{Total} = P_{gas} + P_{Water\ vapor}$$

$$736 = P_{gas} + 22.4$$

$$P_{gas} = 736 - 22.4 = 713.6 \text{ torr}$$

$$P_{gas} = 713.6 / 760 = 0.94 \text{ atm}$$

$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{0.94 \times 0.03}{0.082 \times 297} = 1.15 \times 10^{-3} \text{ moles}$$

at STP $V = \frac{nRT}{p} = \frac{1.15 \times 10^{-3} \times 0.082 \times 273}{1} = 0.026 \text{ L} \times 1000 = 25.89 \text{ mL}$

Dalton's Law of Partial Pressures قانون دالتون

♋ عند خلط عدة غازات في وعاء واحد :

Video (36)

$$P_t = P_1 + P_2 + P_3 + ...$$

الكسر المولي **Mole fractions (X)** = $\frac{p_X}{p_t} = \frac{n_X}{n_t}$

♋ Mole fraction : is the ratio of the number of moles of one components to the number of all components present . (It has not units)

1. What is the unit of mole fraction

a) mol b) mol^{-1} c) unitless

2. Refer to Dalton's law of partial pressures and explain what mole fraction is

a) The number of moles of one component

b) The ratio of the number of moles of one component to the number of moles of all components present.

c) The number of moles of one component divided by 100

d) The ratio of the number of moles of all components present to the number of moles of one component.

3. A mixture of three gases has a total pressure of 1,380 mmHg at 298 K . The mixture is analyzed and is found to contain 1.27 mol CO_2 , and 1.50 mol Ar and Co 3.04 mol. What is the partial pressure of Ar ?

a- 0.258 atm b- 356 mmHg c- 5,345 d- 8,020

Video (37)

P t = 1,380 mmHg n_{co2} = 1.27 mol n_{co} = 3.04 mol

n_{Ar} = 1.5 mol n_t = 5.81 mol

$$\frac{p_{Ar}}{p_t} = \frac{n_{Ar}}{n_t}$$

$$p_{Ar} = \frac{p_t \times n_{Ar}}{n_t} = \frac{1380 \times 1.5}{5.81} = 356 \text{ mmHg}$$

4. A mixture of 90.0 grams of CH_4 and 10.0 grams of argon has a pressure of 250 torr under conditions of constant temperature and volume. The partial pressure of CH_4 in torr is:

(a) 143 (b) 100 (d) 239

$n(CH_4) = \frac{90}{16} = 5.6$, $n(Ar) = \frac{10}{40} = 0.25$, $n_t = 5.85$, $p_t = 250$ torr

$$\frac{p_1}{p_t} = \frac{n_1}{n_t} \quad \Rightarrow \quad \frac{p_{CH4}}{p_t} = \frac{n_{CH4}}{n_t}$$

$$\frac{p_{CH4}}{250} = \frac{5.6}{5.85} \quad \Rightarrow \quad pCH_4 = 239 \text{ torr}$$

5. The mole fraction of nitrogen in air is 0.6808 .Calculate the partial pressure of N_2 in air when the atmospheric pressure 1.2 atm .

X (mole fraction) = 0.6808 p_t = 1.2 atm
$X = \frac{p_1}{p_t}$ $P(N_2) = (X) \times p_t = 0.6808 \times 1.2 = 0.82$ atm

Video (38)

6. The partial pressure partial of oxygen was observed to be 130 Torr in air with atmospheric pressure of 650 Torr . Calculate the mole fraction of O_2.

Partial pressure =130 torr p_t = 650 torr
$X = \frac{p_1}{p_t} = \frac{130}{650} = 0.2$

Density of Gas كثافة الغازات

❄ The density of air decreases very rapidly with increasing distance from earth.

Video (39)

تتناسب الكثافة طردياً مع كتلته الجزيئية عند ثبوت درجة الحرارة والضغط .

$$d = \frac{p\,M_m}{R\,T} = \quad g/L$$

Video (40)

1. **Calculate the density in g / L , of CO_2 gas at 55 °C and 0.99 atm pressure .**

p = 0.99 atm , M_m = 44 g/ mol , T = 328 k

$d = \frac{p\,M_m}{R\,T}$, R = 0.082 .

$d = \frac{0.99 \times 44}{0.082 \times 328} = 1.62$ g/ L

2. **A chemist has synthesised a green-yellow gaseous compound of chlorine and oxygen and finds that its density is 7.71 g/L at 36 °C and 2.88 atm.**

Calculate the molar mass of the compound and determine its molecular formula

M_m = ؟؟ g/ mol T = 309 k R= 0.082 p = 2.88 atm

$d = \frac{p\,M_m}{R\,T}$

$M_m = \frac{dRT}{P} = \frac{7.71 \times 0.082 \times 309}{2.88} = 67.8$ g/mol

3. The density of chlorine gas at STP, in grams per liter, is approximately:

a) 6.2 b) 3.2 c) 3.9 d) 4.5

$M_m = 35.5 \times 2 = 71$ g/ mol R= 0.082

at STP : T = 273 k p = 1 atm

$$\text{Density} = \frac{p\,M_m}{R\,T}$$

$$\text{Density} = \frac{1 \times 71}{0.082 \times 273} = 3.17 \text{ g/L}$$

4. What is the density of ammonia gas at 2.00 atm pressure and a temperature of 25.0°C?

a) 0.720 g/L b) 0.980 g/L c) 1.39 g/L d) 16.6 g/L

$M_{m\ (NH3)} = 17$ g/ mol

T = 25+273 =298 k R= 0.082 p = 2 atm

$$\text{Density} = \frac{p\,M_m}{R\,T}$$

$$\text{Density} = \frac{2 \times 17}{0.082 \times 298} = 1.39 \text{ g/L}$$

5. What is the molar mass of a pure gaseous compound having a density of 4.95 g/L at -35 °C and 1020 torr ?

a) 24 g/mole b) 11 g/mole c) 72 g/mole d) 120 g/mole

d = 4.95 g/L M_m = ?? g/ mol T = 238 k R= 0.082

p = 1020 mmHg /760 =1.34 atm

$$d = \frac{p\,M_m}{R\,T}$$

$$4.95 = \frac{1.34 \times Mm}{0.082 \times 238}$$ ☛ M_m = 72 g/mole

6. What is the molar mass of Freon-11 gas if its density is 6.13 g/L at STP?

a) 0.274 g/mol b) 3.64 g/mol c) 78.2 g/mol d) 137 g/mol

مسائل حساب كميات المتفاعلات والنواتج للغازات

1. What the volume of Oxygen gas at 320 K and 680 torr will react Completely with 2.50 L of NO Gas at the same temperature and pressure ?

Video (41)

$$2\,NO\,(g) + O_2\,(g) \longrightarrow 2NO_2$$

$$2\,NO\,(g) + O_2\,(g) \longrightarrow 2NO_2$$

2.5 L — x L

2 — 1

$$x = \frac{2.5 \times 1}{2} = 1.25\ L$$

2. Calculate the volume of O_2(in L) required for the complete combustion of 7.64 L of (C_2H_2) measured at the same T & P .

$$2\,C_2H_{2\,(g)} + 5O_{2\,(g)} \longrightarrow 4CO_{2\,(g)} + 2H_2O_{(l)}$$

$$2\,C_2H_{2\,(g)} + 5O_{2\,(g)} \longrightarrow 4CO_{2\,(g)} + 2H_2O_{(l)}$$

7.64 L — x L

2 — 5

$$x = \frac{7.64 \times 5}{2} = 19.1\ L$$

4. Ammonia burns in oxygen gas to form nitric oxide (NO) and water vapor. How many volumes of NO are obtained from one volume of ammonia at the same temperature and pressure ?

Video (42)

$$4\ NH_3\ (g) + 5\ O_2\ (g) \rightarrow 4NO\ (g) + 6\ H_2O\ (g)$$

a) One b) Two c) Three d) Four

$$4\ NH_3\ (g) + 5\ O_2\ (g) \rightarrow 4NO\ (g) + 6\ H_2O\ (g)$$

1 liter — x L

4 — 4

X= 1

5. What volume of CO_2 gas at 645 torr and 800 k could be produced by the reaction of 45 g of $CaCO_3$?

Video (43)

$CaCO_3\ (s) \longrightarrow CaO\ (S) + CO_2\ (g)$

45 g — x mol

100 g — 1 mol

n= x = 0.45 mole

P = 645/ 760 = 0.85 atm , v = ? ? , n = x = 0.45 mole , T= 800 k .

- P V = n R T
- R = 0.082
- V = 34.8 L

6. How many liters of chlorine gas at 25°C and 0.950 atm can be produced by the reaction of 12.0 g of MnO_2?

$MnO_{2(s)} + 4HCl_{(aq)} \rightarrow MnCl_{2(aq)} + 2H_2O_{(l)} + Cl_{2(g)}$

Video (44)

a) 5.36×10^{-3} L b) 0.138 L c) 0.282 L d) 3.35 L

$MnO_{2\,(s)} + 4HCl_{\,(aq)} \rightarrow MnCl_{2\,(aq)} + 2H_2O_{\,(l)} + Cl_{2\,(g)}$

12.0 g x (n)

87 g 1 mol

X (n) = 0.13 mol

☛ T = 298 K , p = 0.95 atm R = .082

$$PV = nRT$$

$$V = \frac{nRT}{P} = \frac{0.13 \times 0.0821 \times 298}{0.95} = 3.35 \text{ L}$$

7. Calculate the volume of N_2 generate at 80°C and 823 mmHg by the decomposition of

60 g of NaN_3 : $2NaN_{3\,(s)} \rightarrow 2\,Na_{(s)} + 3N_{2\,(g)}$

Video (45)

$$2NaN_{3\,(s)} \longrightarrow 2\,Na_{(s)} + 3N_{2\,(g)}$$

60 g . x (n)

130 g 3 mol

X (n) = 1.38 mol

T = 353 K , p = 1.08 atm R = .082

$$PV = nRT$$

$$V = \frac{nRT}{P} = \frac{1.38 \times 0.0821 \times 353}{1.08} = 36.9\ L$$

Quantum Theory and the Electronic Structure of Atoms

حفظ

Wave : vibrating disturbance by which energy is transmitted .

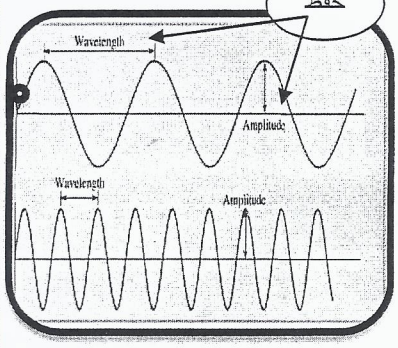
Video (1)

Wave length (λ) : The distance between identical points on successive waves .

Amplitude : is the vertical distance from the midline of a wave to the peak or trough .

Frequency(ν) : Is the number of waves that pass through a particular point in 1 second .

حفظ



الطول الموجي : هي المسافة بين نقطتين متتاليين (تضاغطين أو تخلخلين) .

Video (2)

التردد : عدد الاهتزازات الكاملة التي يصنعها الجسم المهتز في الثانية الواحدة.

Electromagnetic radiation

Electromagnetic radiation :

is the emission and transmission of energy in the form of electromagnetic waves.

☼ الاشعة الكهرومغناطيسية : هي انتقال الطاقة في صورة موجات كهرومغناطيسية .

- تختلف الموجات المغناطيسية عن بعضها في التردد والطول الموجي .
- تختلف طاقة الفوتونات باختلاف الموجات الكهرومغناطيسية .

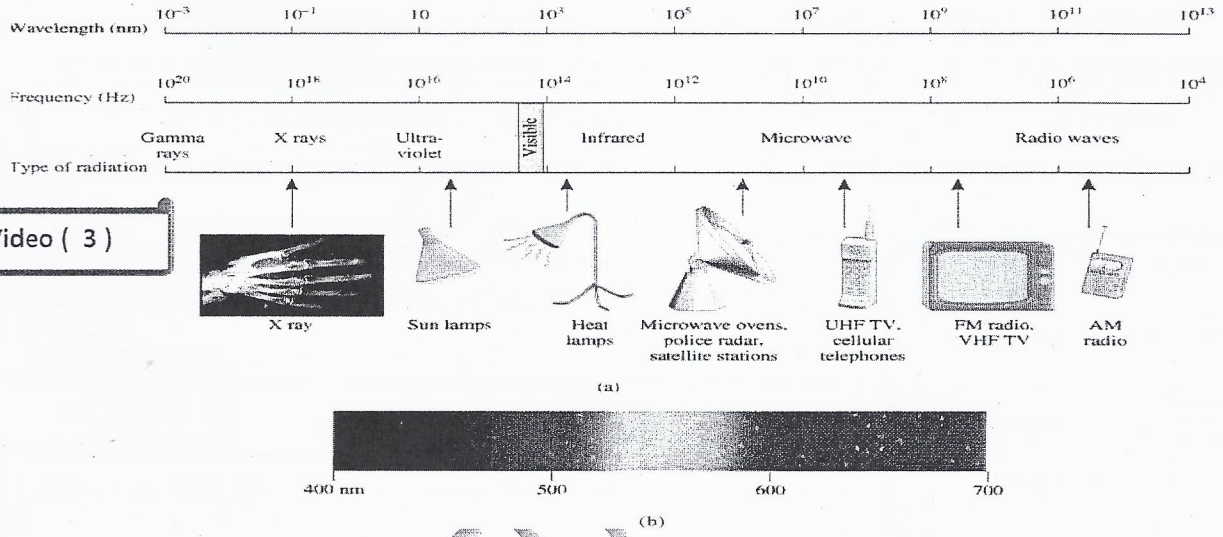
All electromagnetic radiation travels at the same velocity: the speed of light (*c*) .

- جميع الموجات الكهرومغناطيسية لها نفس السرعة .

Speed of light (*c*) in vacuum = 3.00×10^8 m/s

العلاقة بين التردد (ν) والطول الموجي (λ) والسرعة (C)

$$c = \lambda \times \nu$$



Video (3)

1.The energy of a photon of light is ..... proportional to its frequency and ..... proportional to its wave length

a) directly , directly b) inversely, inversely c) inversely, directly d) directly, inversely

2. Which one of the following is correct?

a) $\nu + \lambda = c$ b) $\nu/\lambda = c$ c) $\lambda = c\nu$ d) $\nu\lambda = c$

$$c = \lambda \times \nu \longleftarrow$$

Video (4)

ملحوظة مهمة قبل تطبيق القانون

Video (5)

3. What is the frequency (s^{-1}) of electromagnetic radiation that has a wavelength of 0.53 m?

a) 5.66×10^{8} b) 1.8×10^{-9} c) 1.6×10^{8} d) 1.3×10^{-33}

$\lambda = 0.53$ $C = 3 \times 10^{8}$ m/s

$$C = \lambda \times \upsilon$$

$$\upsilon = \frac{C}{\lambda} = \frac{3\times10^{8}}{0.53} = 5.66 \times 10^{8} \text{ Hz}$$

4. What is the wavelength (in nanometer) of light having frequency of 8.6×10^{13} Hz ?

Video (6)

a-3.5 nm b- 3.5×10^{3} nm c- 3.5×10^{6}nm d- 2.9×10^{5}

$C = 3 \times 10^{8}$ m/s , $\nu = 8.6 \times 10^{13}$ Hz , λ = ??

$$C = \lambda \times \nu$$

$$\lambda = \frac{C}{\upsilon} = \frac{3 \times 10^{8}}{8.6 \times 10^{13}} = 3.5 \times 10^{-6} \text{ m} = 3.5 \times 10^{-6} \times 10^{9} = 3.5 \times 10^{3} \text{ nm}$$

$\times 10^{9}$

m ⇄ nm

$\div 10^{9}$

Video (7)

5. The wave length of the green light from a traffic signal is centered at 522nm .

What is the frequency of this radiation?

$C = 3\times 10^{8}$ m/s , $\lambda = 522$ nm / $10^{9} = 5.22\times 10^{-7}$ m , ν = ?? Hz
➤ $c = \lambda \times \nu$ $\upsilon = \frac{C}{\lambda} = \frac{3 \times 10^{8}}{5.22 \times 10^{-7}} = 5.74 \times 10^{14}$ Hz

Planck's Quantum Theory

Video (8)

The amount of radiant energy emitted by an object at a certain temperature depend on the wave length

للمعرفة **Plank explain this**: Energy (light) is emitted or absorbed in discrete units (quantum).

Quantum : is the smallest quantity of energy that can be emitted (or absorbed) in the form of electromagnetic radiation.

Quantum Theory: energy is always emitted in integrals multiples of hv .

$$E = h\nu$$
$$\Rightarrow E = \frac{hc}{\lambda}$$

E : is the energy of photon	طاقة (الفوتون)
h : Plank's constant , h = 6.63 x 10^{-34} J.s	ثابت بلانك
λ : wave length (m)	الطول الموجي
ν : frequency of radiation Hz (s^{-1})	التردد

1. Calculate the energy (in J) of a photon with a wavelength of 5.00 x 10^4 nm (IR region)

Video (9)

$\lambda = 5\times10^4$ nm $= 5\times10^4 / 10^9 = 5\times10^{-5}$ m

- $E = \frac{hC}{\lambda}$
- $E = \frac{hC}{\lambda} = \frac{6.626\times10^{-34}\times3\times10^8}{5\times10^{-5}} = 3.98\times10^{-21}$ J

2. The wavelength of a photon of energy 5.25×10^{-19} J is ..... m

a) 2.64×10^{6} b) $\underline{3.79 \times 10^{-7}}$ c) 2.38×10^{23} d) 4.21×10^{-24}

λ = ?? $c = 3 \times 10^{8}$ m/s $E = 5.25 \times 10^{-19}$ J $h = 6.626 \times 10^{-34}$

$$\lambda = \frac{hC}{E} = \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{5.25 \times 10^{-19}} = 3.79 \times 10^{-7} \text{ m}$$

3. The blue color of sky result from scattering of sunlight by air molecules .the blue light has a frequency of about 7.5×10^{14} Hz .Calculate the energy in joules of a single photon associated with this frequency:

a-2.6×10^{-31} J b- 2.6×10^{-19} J c- $\underline{5.0 \times 10^{-9}\ J}$ d- 5.0 J

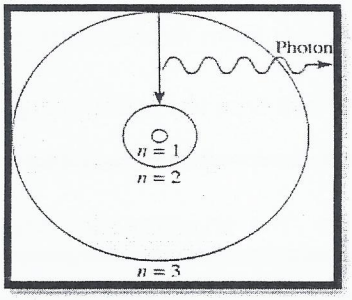
$\upsilon = 7.5 \times 10^{14}$ Hz , E = ?? J

- $E = h \times \upsilon$ استخدمنا دا القانون لأن إعطان تردد
- $E = 6.626 \times 10^{-34} \times 7.5 \times 10^{14} = 5.0 \times 10^{-19}$ J

4. What is the frequency (S^{-1}) of a photon of energy 4.38×10^{-18} J ?

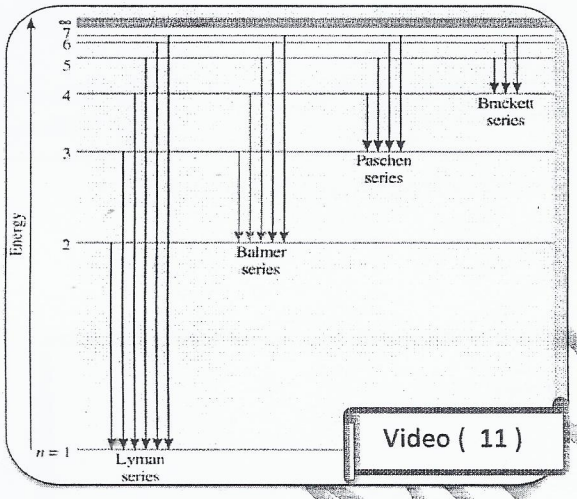
a) 438 b) 1.45×10^{-16} c) $\underline{6.61 \times 10^{15}}$ d) 2.30×10^{7}

Bohr's Theory of Hydrogen Atom طيف ذرة الهيدروجين



Video (10)

Emission Spectra of atoms : are bright lines (spectral lines) in the visible spectrum.



Video (11)

TABLE 7.1 The Various Series in Atomic Hydrogen Emission Spectrum

Series	n_f	n_i	Spectrum Region
Lyman	1	2, 3, 4,...	Ultraviolet
Balmer	2	3, 4, 5,...	Visible and ultraviolet
Paschen	3	4, 5, 6,...	Infrared
Brackett	4	5, 6, 7,...	Infrared

يتكون الطيف نتيجة انتقال الالكترونات المثارة من مستوي الطاقة العالي الي مستوي الطاقة المنخفض :

Video (12)

- **Lyman Series** : تنبعث عند انتقال الالكترونات من المستويات المثارة الي المستوي 1 .
- **Ballmer Series** : تنبعث عند انتقال الالكترونات من المستويات المثارة الي المستوي 2.
- **Panchen Series** : تنبعث عند انتقال الالكترونات من المستويات المثارة الي المستوي 3.
- **Brackett Series** : تنبعث عند انتقال الالكترونات من المستويات المثارة الي المستوي 4.
- **pfund Series** : تنبعث عند انتقال الالكترونات من المستويات المثارة الي المستوى 5 .

- **Neil Bohr:** study the emission spectrum of the Hydrogen Atom .

للمعرفة

- **Bohr postulates that the electron is occupied** ONLY certain orbits of specific energies .

  THUS: the emission spectrum of the H atom results from: the hydrogen atom is energised .

- **Electron excited to higher energy orbit →** drop to a lower-energy orbit emits a quantum of energy .

In the case of hydrogen atom spectra , the energies that the electron can possess

$$E_n = -R_H\left(\frac{1}{n^2}\right)$$

R_H : Rydberg constant = $2.18 x 10^{-18}$ J

n : integer called the principal quantum number;

n = 1, 2, 3,.......

Video (13)

1. **Calculate the value of the energy level (n =3) of the Hydrogen atom according to Bohr - Theory .**

$$\Delta E = -R_h\left[\frac{1}{n^2}\right]$$

$$\Delta E = -2.18 \times 10^{-18}\ \frac{1}{3^2} = -2.42 \times 10^{-19}\ J$$

2. An electron is a Bohr hydrogen atom has energy of -1.36 x 10^{-19} J. The value of n for this electron is

a) 1 b) 2 c) 3 d) 4

n = ?? E = -1.362 x 10^{-19} R_h = 2.18×10^{-18}

$$\Delta E = -R_h\left[\frac{1}{n^2}\right]$$

$$-1.362 \times 10^{-19} = 2.18 \times 10^{-18}\left[\frac{1}{n^2}\right]$$

n^2 = 16 n =4

In the case of Electron transfer from ground state to excited state then return back to ground state

Video (14 -15)

$$\Delta E = R_h \left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]$$

When photon is emitted	When photon is absorbed
$n_i > n_f$	$n_i < n_f$
ΔE is negative	ΔE is positive
Energy is lost to the surrounding	Energy is gained from the surrounding
في حالة فقد طاقة (emitted) .	في حالة امتصاص (Absorb) طاقة .
n = 1 Ground State n_i : المستوي الابتدائي n_f : المستوي النهائي	n = 2, 3, 4, ... الحالات المثارة Excited States

Quantum :

Is the smallest quantity of energy that can be emitted or absorbed in the form radiation .

1. Calculate the energy in joules , required to excite a hydrogen atom by causing an electronic transition from n =1 to n = 4 (principle energy level) (R_h = 2.18× 10^{-18} J)1/n^2.

$$\Delta E = R_h \left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]$$

$$\Delta E = 2.18 \times 10^{-18} \left[\frac{1}{1} - \frac{1}{16}\right] = +2.04 \times 10^{-18} \text{ J}$$

2. What process will be observed in a hydrogen atom when its electron drops from n=5 state to the n= 3 state .

Video (16)

a- A photon with energy 1.55 × 10^{-19} J will be absorbed .

b- A photon with energy 1.55 × 10^{-19} J will be emitted .

c- A photon with energy 6.54 × 10^{-19} J will be absorbed .

d- A photon with energy 6.54 × 10^{-19} J will be emitted .

n_1 = 5 , n_2 = 3 , R_h = 2.18× 10^{-18} ثابت الطاقة

$$\Delta E = R_h \left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]$$

$$\Delta E = 2.18 \times 10^{-18} \left[\frac{1}{25} - \frac{1}{9}\right]$$

$$= 1.55 \times 10^{-19} \text{ J}$$

3 . The second line of the Paschen series occurs at a wave length of 1282.4 nm . What is the energy difference between the initial (n=5) and final levels of the hydrogen atom in this emission process?

Video (17)

a- 2.44×10^{18} J b- 6.81×10^{-21} J c- 1.55×10^{-19} J d- 3.09×10^{-22} J

$n_1 = 5$, $n_2 = 3$ **(Paschen) .** , $R_h = 2.18 \times 10^{-18}$ ثابت الطاقة

$$\Delta E = R_h \left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]$$

$$\Delta E = 2.18 \times 10^{-18} \left[\frac{1}{25} - \frac{1}{9}\right]$$

$$= -1.55 \times 10^{-19} \text{ J}$$

4. Calculate the frequency and wave length of hydrogen atom spectrum when electron transfer from n = 5 to n= 2 .

Video (18)

$$\Delta E = R_h \left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]$$

$$\Delta E = 2.18 \times 10^{-18} \left[\frac{1}{25} - \frac{1}{4}\right] = -4.5 \times 10^{-19} \text{ J}$$

$$\lambda = \frac{hC}{E}$$

$$\lambda = \frac{hC}{E} = \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{4.5 \times 10^{-19}} = 4.3 \times 10^{-7} \text{ m}$$

➢ $E = h \times \upsilon$

$$\upsilon = \frac{E}{h} = \frac{4.5 \times 10^{-19}}{6.626 \times 10^{-34}} = 6.7 \times 10^{14} \text{ Hz}$$

5. The n = 2 to n = 6 transition in the Bohr hydrogen atom corresponds to the ..... of a photon with a wavelength of ..... nm.

a) emission, 411 b) absorption, 410 c) absorption, 657 d) emission, 389

☛ The electron is moving from a smaller value of n (2) to a larger value of n (6), it must be absorbing energy E = + value .

$$\Delta E = R_h \left[\frac{1}{n_i^2} - \frac{1}{n_f^2}\right]$$

$$\Delta E = 2.18 \times 10^{-18} \left[\frac{1}{4} - \frac{1}{36}\right] = 4.8 \times 10^{-19} \text{ J}$$

$$\lambda = \frac{hC}{E} = \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{4.8 \times 10^{-19}} = 4.10 \times 10^{-7} \text{ m}$$

$$\lambda = 4.10 \times 10^{-7} \text{ m} \times 10^{9} = 410 \text{ nm}$$

Quantum Numbers أعداد الكم

فيديوهات حماتي أم دنيا

هي أعداد تصف توزيع الألكترونات في ذرة الهيدروجين وباقي الذرات .

1. Principal Quantum number

أعداد الكم ارئيسي (n)

- determines the energy of an orbital .
- determines the distance of the electron from the nucleus.

عدد يحدد مستويات الطاقة الرئيسية.

وعدد مستويات الطاقة في أثقل الذرات سبعه.

تاخذ المستويات الرموز (K , L , M , N , O , P , Q).

يحدد عدد الالكترونات التي يتشبع بها كل مستوي طاقة :

$2n^2$

K	L	M	N
2	8	18	32

لا يصلح هذا القانون : O, P , Q

يتسع المستوي الخامس نظريا لـ50 الكترونا لكن الذرة ستصبح غير مستقرة.

2. Angular momentum quantum number

أعدد الكم الثانوي (L)

- **Determine the shape of orbital in atom.**
- depends on the value of n .

عدد يحدد مستويات الطاقة الفرعية في كل مستوي طاقة رئيسي وعددها.

تأخذ المستويات الفرعية الرموز (S , P , d , f) .

لتحديد اقصي عدد من الالكترونات في المستوي الفرعي

$\ell = 2(2\ell + 1)$

s.shell	s	p	d	f
ℓ	0	1	2	3

No .of electrons :

S = 2 p = 6 d =10 f = 14

3. Electron spin quantum number أعداد الكم المغزلي (m_s)	4. Magnetic quantum number اعدد الكم المغناطيسي $n^2 = (m L)$
يحدد نوعية حركة الالكترون المغزلية . ☛ Determine the orientation of an electron in atom تتخذ حركة الالكترونات اتجاهين : عقارب الساعة ↑ $+\frac{1}{2}$. عكس عقارب الساعة ↓ $-\frac{1}{2}$.	يحدد عدد الاوربيتالات التي يحتوي عليها مستوي فرعي معين. ☛ Determine the orientation of orbital in atom . ☛ depends on the value of l . S : 1 orbital (Spherical) P : 3 orbital (Bills) D : 5 orbital (Complex) F : 7 orbital (Complex) $m\ell = 2\ell + 1$

The orbital for first for shell

n	L	Number of orbital	orbital name	ml	n. of electeron
1	0	1	1s	0	2
2	0	1	2s	0	2
	1	3	2p	-1,0,+1	6
3	0	1	3s	0	2
	1	3	3p	-1,0,+1	6
	2	5	3d	-2, -1,0,+1,+2	10
4	0	1	4s	0	2
	1	3	4p	-1,0,+1	6
	2	5	4d	-2, -1,0,+1,+2	10
	3	7	4f	-3,-2, -1,0,+1,+2,+3	14

1. S sub shell (الشقه) have an angular quantum number (L) have value :

نبغا في السؤال رقم الشقه S

a- 0 b- 1 c- 2 d- 3

2. p sub shell have an angular quantum number (L) have value :

Video (19)

a- 0 b- 1 c- 2 d- 3

3. d sub shell have an angular quantum number (L) have value :

a- 0 b- 1 c- 2 d- 3

4. f sub shell have an angular quantum number (L) have value :

a- 0 b- 1 c- 2 d- 3

5. The angular quantum number (L) عدد الكم الثانوي is 3 in .... orbitals . (مهم)

a) s b) p c) d d) f

6. The number of orbital's (عدد الغرف) in S sub shell (الشقة) is :

a- 1 b- 3 c- 5 d- 7

نبغا في السؤال عدد الغرف لشقه S

7. The number of orbital in P sub shell is :

a-1 b- 2 c- 3 d-5

Video (20)

8. The number of orbital in d sub shell is :

a-1 b- 2 c- 3 d-5

9. How many 2p orbital's are there in an atom ? (3 ثابت) في اي دور p عدد الغرف في

a-1 b- 2 c- 3 d-5

10. The number of orbital in f sub shell is :

a-1 b- 2 c- 3 d- 7

نبغا في السؤال عدد الالكترونات لشقه S

11. How many electrons can be placed in the S sub shell ?

a-2 b- 6 c- 10 d- 14

12. How many electrons can be placed in the P sub shell ?

a-2 b- 6 c- 10 d- 14

13. How many electrons can be placed in the d sub shell ?

a-2 b- 6 c- 10 d- 14

14. How many electrons can be placed in the f sub shell ?

a-2 b- 6 c- 10 d- 14

معني السؤال : أيش هو القانون ال يحسب لنا الالكترونات كلها في كل الدور الرئيسي بالكامل

Video (21)

15 .The maximum number of electrons that can occupy an energy level described by the principal quantum number n is

a) n + 1 b) 2n c) $2n^2$ d) n^2

نبغي عدد الالكترونات في المستوي الرئيسي 3 بالكامل (الدور 3)

16. What is the total number of electrons associated with the principal quantum number n = 3 ?

a) 8 b) 2 c) 18 d) 32

☛ n = 3 : for know the maximum number of electrons in principal shell : $2n^2 = 2 \times 3^2 = 18$

17. What is the total number of electrons associated with the principal quantum number n = 2 ?

a) 8 b) 2 c) 18 d) 32

18. What is the total number of electrons associated with the principal quantum number n = 3 ?

a) 8 b) 2 c) 18 d) 32

نبغي عدد الالكترونات في المستوي الرئيسي 3 بالكامل (الدور 3)

معني السؤال : أيش هو القانون ال يحسب لنا الالكترونات كلها في كل الدور الرئيسي بالكامل

Video (22)

20 .The maximum number of electrons that can occupy an energy level described by the principal quantum number n is

a) n + 1 b) 2n c) $2n^2$ d) n^2

معني السؤال : أيش هو القانون ال يحسب لنا الغرف كلها في كل الدور الرئيسي بالكامل

21. The maximum number of orbital that occupy energy level described by principal quantum number n is :

a-n b- n+1 c- n^2 d- $3n^2$

نبغي عدد الغرف في المستوي الرئيسي 2 بالكامل (الدور 2)

22. What is the total number of orbital's associated with the principal quantum number n = 2 ?

a) 1 b) 3 c) 4 d) 9

☛ **n = 1** : for know the maximum number of **orbital's** in principal shell : $n^2 = 2^2 = 4$

23. What is the maximum number of electrons described by the quantum numbers :

Video (23)

a) 1 b) 3 c) 18 d) 9

24. What is the maximum number of electrons described by the quantum numbers : n = 3 l = 0

a) 1 b) 3 c) 2 d) 9

25 What is the total number of orbital's associated with the principal quantum number n = 3 ?

a) 1 b) 3 c) 4 d) 9

☛ **n = 3** : for know the maximum number of orbitals in principal shell : $n^2 = 3^2 = 9$.

Video (24)

نبغي عدد الغرف في إلمستوي الرئيسي 3 بالكامل (الدور 3)

نبغي عدد الغرف في المستوي الرئيسي 3 (الدور 3) الشقه S فقط

26. What is the maximum number of orbitals described by the quantum numbers : n = 3 l = 0

a) 1 b) 3 c) 5 d) 9

27. What is the maximum number of orbital s described by the quantum numbers : n = 3 , l = 2

a) 7 b) 14 c) 5 d) 48

Video (25) لتأكيد المعلومات

Video (26-27)

➢ List the values of n , l and m_l for orbital's in 3d sub shell .

☛ n : 3 , L : 2 , ml : -2 ,-1 , 0 , 1 , 2 , ms : +1/2 , -1/2 .

---

1. Give the values of the <u>quantum numbers</u> associated with the 3S sub shell :

a- <u>n = 3 , L =0 , Ml = 0</u>

b- n = 3 , L = 1 , Ml = 1,0,1

c- n = 3 ,1 L = 2 , Ml = -2,-1,0,1,2

3S	n	L	ml
m تتراوح من -L إلي L	3	0	0

Video (28 -29)

2. Which one of the following sets of quantum numbers is not possible ?

	n	L	m L	ms
Row 1	4	3	-2	+ 1/2
Row 2	3	0	1	- 1/2
Row 3	3	0	0	+ 1/2
Row 4	2	1	1	- 1/2
Row 5	2	0	0	+ 1/2

a- Row 1 b- <u>Row 2</u> c- Row 3 d- Row 4

Video (30)

3. Which of the following is not a valid set of four quantum numbers? (n, ℓ, mℓ, ms)

a) 2, 0, 0, + ½ b) 2, 1, 0, - ½ c) <u>1, 1, 0, + ½</u> d) 1, 0, 0, + ½

The Energies of Orbitals

☞ Energy of orbitals in a single electron atom : depends only on principal quantum number n .

Video (31)

Orbitals on the same energy level have the same energy .

$$1s < 2s = 2p < 3s = 3p = 3d < 4s = 4p = 4d = 4f$$

(That is, they are degenerate لهم نفس الطاقه)

☞ Energy of orbitals in a multi-electron atom : depends on n and l .

As the number of electrons increases, the repulsion between them increase.

$$1s < 2s < 2p < 3s < 3p < 4s < 3d < 4p < 5s < 4d < 5p < 6s$$

orbitals on the same energy level are **no longer degenerate ليس لهم نفس الطاقه**

1 . The lowest energy state of an atom is referred to as its

a) bottom state. b) ground state. c) fundamental state. d) original state

Electron configuration التوزيع الالكتروني

Video (32 – 33 -34 – 35)

حفظ

Aufbau Principle ("Fill up" electrons):

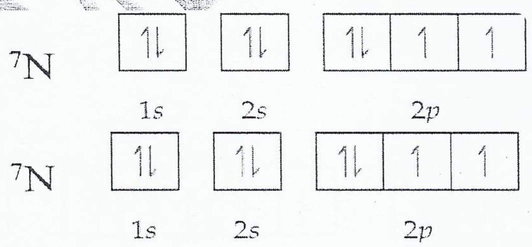
The electrons are added one by one to the atomic orbitals in lowest energy orbitals.

تملا الالكترونات المستويات ذات الطاقة الاقل ثم مستويات الطاقة ذات الطاقة الاعلي .

حفظ

Hund's Rule : The most stable arrangement of electrons in sub shells is the one with the greatest number of parallel spins.

قاعدة هوند : عندما تتوزع الإلكترونات في المستويات الفرعية فإنها تشغل الاوربيتالات فرادي اولا قبل الازدواج.

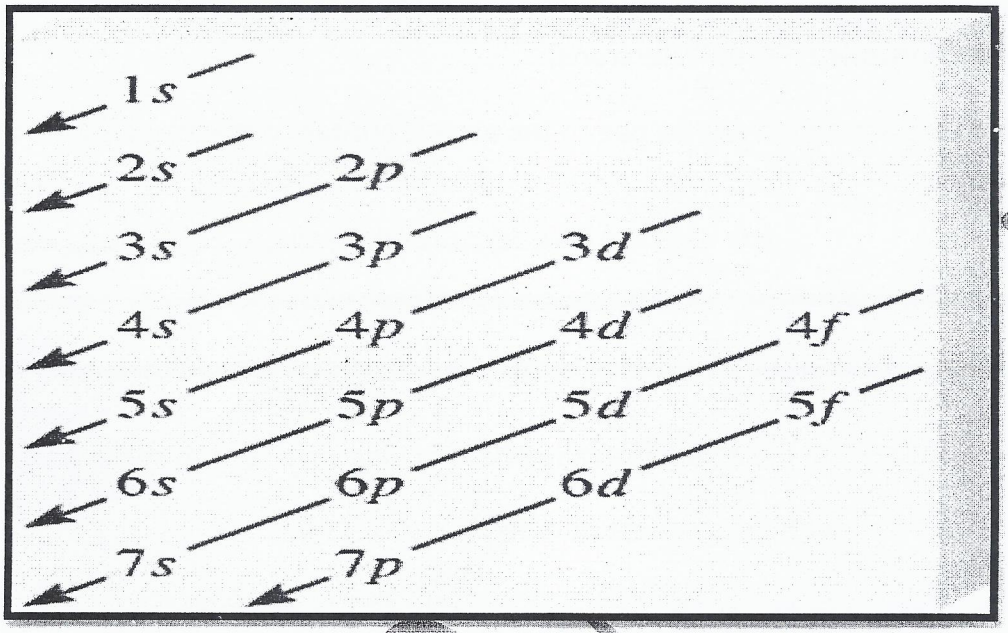


حفظ

The Pauli exclusion principle : No two electrons in the same atom can have identical values for all four of their quantum numbers .

لا يوجد الكترونين في ذرة واحدة لهم نفس أعداد الكم الاربعة الكتروني الاوربيتال الواحد متعاكسين .

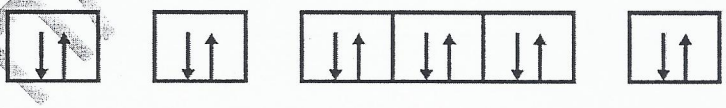
Electron configuration التوزيع الالكتروني



1. What is the electron configuration of Mg?

$1s^2$, $2s^2$, $2p^6$, $3s^2$

- **Orbital Diagram**



$1s^2$ $2s^2$ $2p^6$ $3s^2$

2. What are the possible quantum numbers for the last (outermost) electron in Cl ?

Video (36)

$1s^2$, $2s^2$, $2p^6$, $3s^2$, $\underline{3p^5}$.

3p : n : 3 , L : 1 , ml : 1 , 0 , 1 , ms : +1/2 , -1/2 .

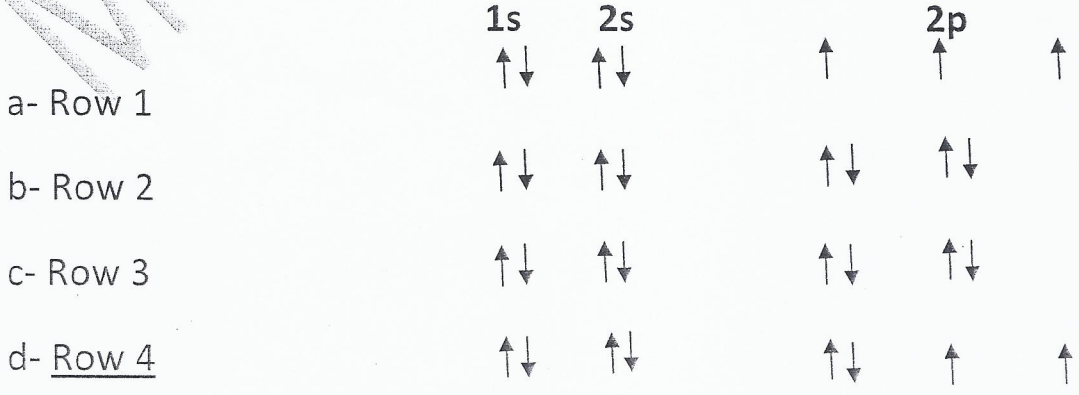
3. A possible set of quantum numbers for the last electron added to complete an atoms for gallium Ga in its ground - state is

	n	l	ml	ms
a- Row 1.	4	0	0	-1/2
b- Row 2.	3	1	0	- 1/2
c- Row 3.	3	1	1	+1/2
d- Row 4.	4	2	1	+1/2

4. The electron configuration of a neutral atom is [Ne] $3s^2 3p^1$. The four quantum numbers of the last electron are:

a) (2, 1, -1, +1/2) b) (3, 3, -1 , +1/2) c) (3, 0, -1, +1/2) d) (3, 1, -1, +1/2)

5. The orbital diagram for aground - state Oxygen atom is :



6. **The maximum number of electron in 2P in $_7N$:** Video (37)

a- 1 b- 6 c- 4 d- 3

7. **No two electrons in atom can have the same four quantum Number is a statement of**

a-the Pauli exclusion principle . b- Bohr's equation

c- Hund's rule d- de Broglie's relation

8. **The electron congura on of a neutral atom is $1s^2$ $2s^2$ $2p^6$ $3S^2$**

a- Si b- Na c-Mg d-Al

الطريقة المختصرة للتوزيع الالكتروني

- نحدد الدورة التي بها العنصر .
- نكتب الغاز الخامل في الدورة السابقة لدورة العنصر .
- يتم الإكمال عليه بباقي المستويات الفرعية .

(الغاز الخامل الذي يسبق العنصر)$_z$: ns - (n-1)d - np .

z : العدد الذري للغاز الخامل ويتم الإكمال عليه   n : الدورة التي بها العنصر

Video (38)

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

^{12}Mg : $1s^2\ 2s^2\ 2p^6\ 3s^2$ (OR) [Ne] $3s^2$.

^{16}S : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$ (OR) [Ne] $3s^2\ 3p^4$.

^{19}K : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$ (OR) [Ar] $4s^1$

^{20}Ca : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$ (OR) [Ar] $4s^2$

^{21}Sc : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^1$ (OR) [Ar] $4s^2\ 3d^1$

^{23}V : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^3$ (OR) [Ar] $4s^2\ 3d^3$

^{30}Zn : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}$ (OR) [Ar] $4s^2\ 3d^{10}$

^{34}Se : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^4$ (OR) [Ar] $4s^2\ 3d^{10}\ 4p^4$

1. Use the Auf bau principle to obtain the ground -state electron configuration of Tc_{43} :

a- Tc : $[Kr]\ 4d^6$ b- Tc : $[Kr]\ 4d^7$ c- <u>Tc : $[Kr]\ 5s^2 4d^5$</u>   d- Tc : $[Kr]\ 4d^6$

2. Use the Auf bau principle to obtain the ground -state electron configuration of Se_{34} :

a-Se : $[Ar]\ 4s^2\ 3d^{10}\ 4p^3$ b- <u>Se : $[Ar]\ 4s^2\ 3d^{10}\ 4p^4$</u>

c- Se : $[Ar]\ 4s^2\ 3d^{10}\ 4p^5$ d- Se : $[Ar]\ 4s^2\ 3d^{10}\ 4p^6$

3. Determine whether all the ground - state electron configuration for the elements in correct:

a- Ge : $[Ar]$ $4s^2$ $3d^{10}$ $4p^2$

b- Fe : $[Ar]$ $4s^2$ $3d^6$

c- <u>Zn : $[Ar]$ $4s^1$ $3d^{10}$</u>

d- Ni : $[Ar]$ $4s^2$ $3d^8$

5. The electron configuration of Cr_{24} atom is :

Video (39)

a- $[Ar]$ $4s^2$ $4d^4$

b- $[Ar]$ $4s^2$ $4p^6$ $3d^3$

c- $[Ar]$ $4s^2$ $3d^9$

d- <u>$[Ar]$ $4s^1$ $3d^5$</u>

☛ نفس طريقة التوزيع الالكتروني للنحاس .

☛ Cr_{24} : $[Ar]_{18}$ $4s^1$ $3d^5$

ملحوظة : الشذوذ هذا يشمل عمود النحاس كله وعمود الكروم كله 0

☛ Cu , Ag , Au ☛ Cr , Mo , w .

4. The electron configuration of Cu_{29} atom is :

a- $[Ar]$ $4s^2$ $4d^4$

b- $[Ar]$ $4s^2$ $4p^6$ $3d^3$

c - $[Ar]$ $4s^2$ $3d^9$

d- <u>$[Ar]$ $4s^1$ $3d^{10}$</u>

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

☛ لكن المستوي d يكون مستقر إذا كان

d^5 أو d^{10}

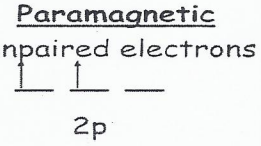
☛ لذا ينتقل الالكترون من $4s^2$ الي $3d^9$

Cu_{29} : $[Ar]$ $4s^1$ $3d^{10}$

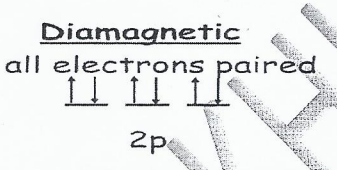
Paramagnetic & Diamagnetic

Video (40-41)

Paramagnetic substance: is the that contain net unpaired electrons in the outermost sub shell and is attracted by a magnet .



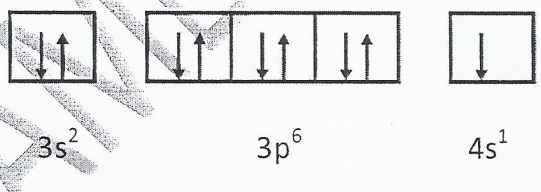
Diamagnetic substance: is the that do not contain net unpaired electrons (all electrons are paired) in the outermost sub shell and is repelled by a magnet.



^{19}K

Electronic configuration: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$

Orbital diagram:

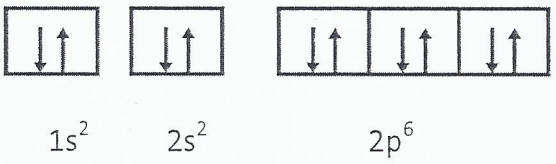


Net one unpaired electron → Paramagnetic substance

^{10}Ne

Electronic configuration: $1s^2\ 2s^2\ 2p^6$

Orbital diagram:



All electrons are paired → Diamagnetic substance

Video (42)

1. How many unpaired electrons does chromium have?

^{24}Cr : [Ar] $4s^2\ 3d^4$ (EXCEPTION) → ^{24}Cr: [Ar] $4s^1\ 3d^5$ Unpaired electrons is 6 .

2.What are the valence electrons of vanadium (V)? ^{23}V : [Ar] $4s^2\ 3d^3$.

3. What are the valence electrons of gallium Ga? ^{31}Ga : [Ar] $4s^2\ 3d^{10}\ 4p^1$.

4. How many unpaired electrons does chromium(Cr) have?

a) 0 b) 2 c) 4 d) 6

5. How many unpaired electrons does selenium(Se) have?

a) 0 b) 2 c) 4 d) 6

6. A ground-state atom of nickel has ..... unpaired electrons and is ..... .

a) 0, diamagnetic b) 6, diamagnetic c) 3, paramagnetic d) 2, paramagnetic

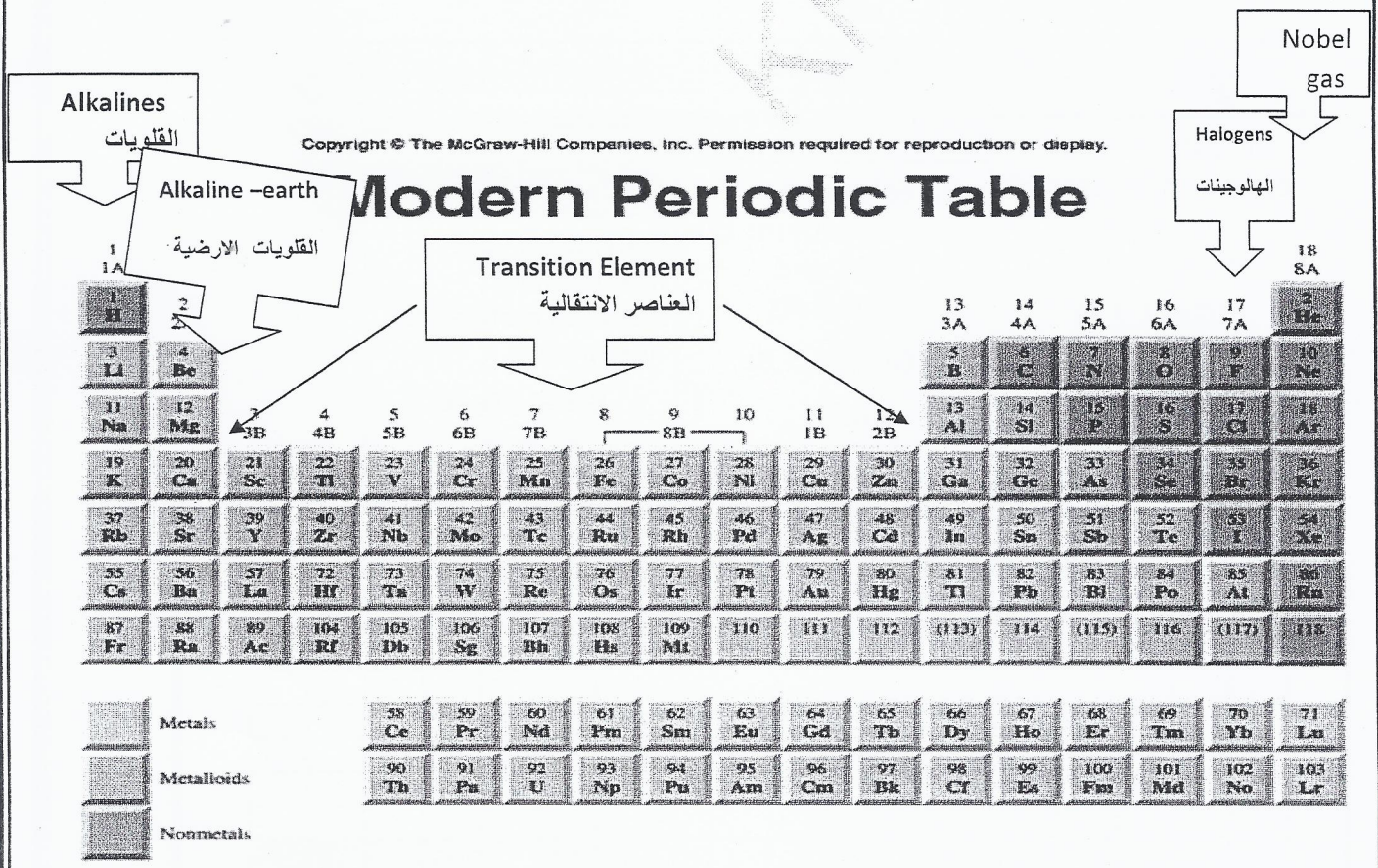
Periodic Relationship Among the Elements

- **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 .

يتم ترتيب العناصر في الجدول الدوري حسب الزيادة في العدد الذري .

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

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



عنصر Br و Hg هي العناصر السائلة في الجدول الدوري .

Important Notes

- **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** : (Li, Na, K, Rb, Cs and Fr) are called **Alkali Metals** (المعادن القلوية) .
- **Group 2A elements** : (Be, Mg, Ca, Sr, Ba and Ra) 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).

الفلزات METALs

Most metals is agood conductor of heat and electericity.

(Gp: 1,2,3)

(Transition metal)

الافلزات NON METALs

17 Eelements : iS poor conductor of heat and Electericity.

(Gp: 5,6,7,8)

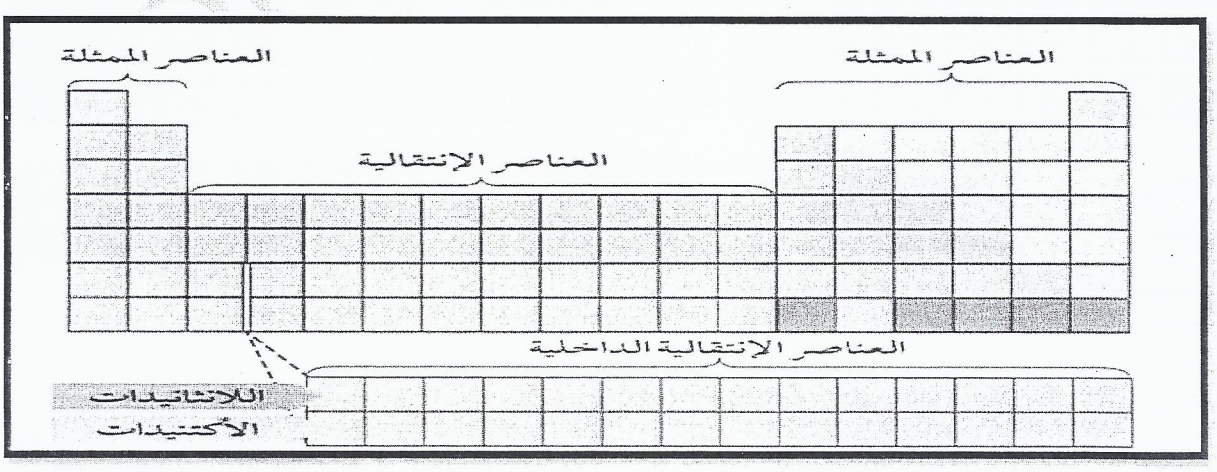
and H .

أشباه الفلزات metalloids

8 elements : are intermediate between metals and non metals .

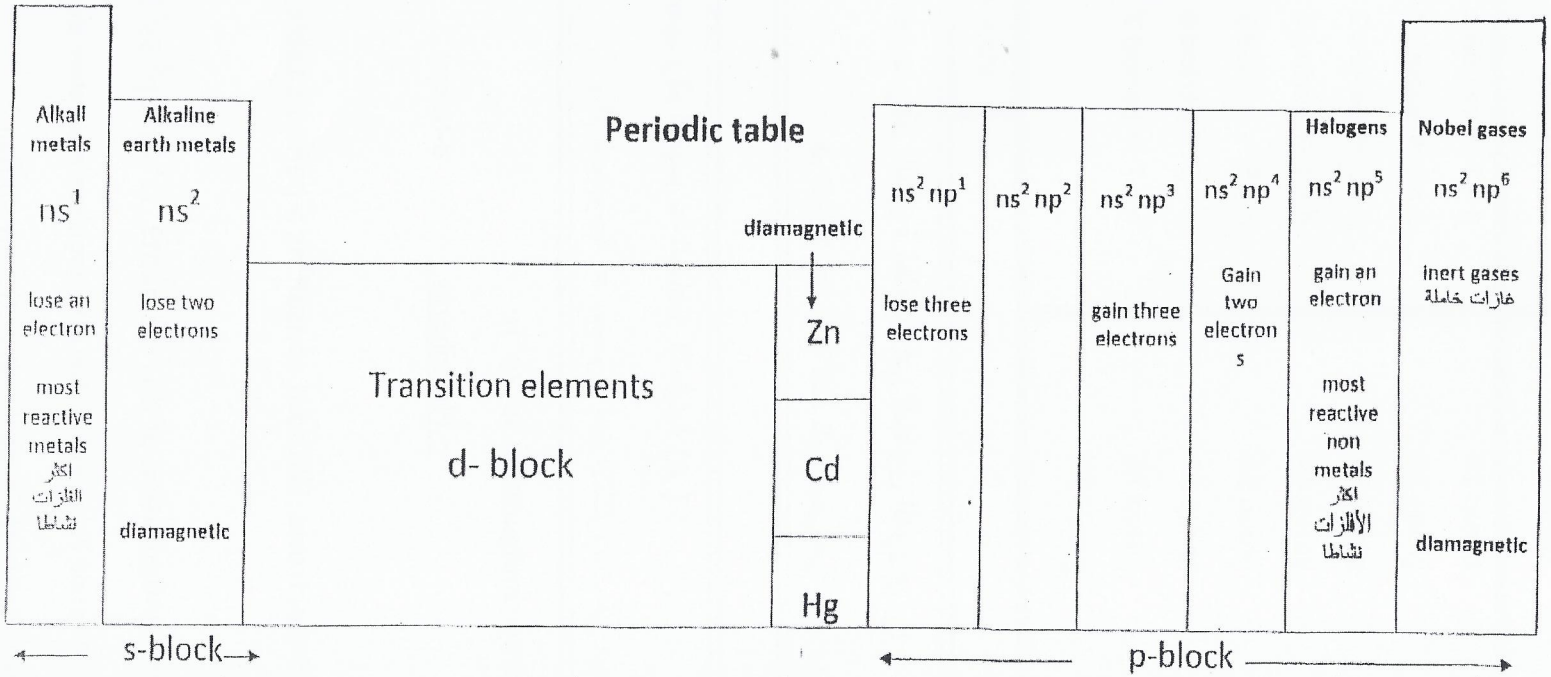
B-Si-As Te-At

Ge-Sb -Po



العلاقة بين التوزيع الإلكتروني وترتيب العناصر في الجدول الدوري

Video (1-2-3)



Inner transition elements عناصر انتقالية داخلية	Lanthanide series	f-block
Inner transition elements عناصر انتقالية داخلية	Actinide series	f-block

Representative elements: groups 1,2,3,4,5,6,7,8

عناصر تمثيلية (غير انتقالية)

☆ **from the electron configuration** → we could know the position of the element??

Electron configuration التوزيع الالكتروني	Position of element Groups	The period of the Element
ns^1	group **1A**	n = 1 → **period 1**
ns^2	group **2A**	n = 2 → **period 2**
$ns^2\ np^1$	group **3A**	n = 3 → **period 3**
$ns^2\ np^2$	group **4A**	n = 4 → **period 4**
$ns^2\ np^3$	group **5A**	n = 5 → **period 5**
$ns^2\ np^4$	group **6A**	n = 6 → **period 6**
$ns^2\ np^5$	group **7A**	n = 7 → period **7**
$ns^2\ np^6$	group **8A**	

Video (4)

Video (5)

لتحديد رقم الدورة لعنصر في الجدول الدوري :

رقم الدورة = أكبر عدد كم رئيسي في التوزيع الالكتروني (أكبر n) .

لتحديد رقم المجموعة للعناصر التمثيلية (A) :

رقم المجموعة = مجموع عدد الالكترونات في مجال الطاقة الرئيسي الأخير .

1. The element that has the valance electron configuration $3s^2\ 3p^3$ is:

a- Carbon b- Nitrogen c- Phosphorus d-Neon

2. An atom of a certain element has 15 electrons. Without consulting a periodic table, answer the following questions:

(a) What is the ground-state electron configuration of this element? $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

(b) How should be element be classified ? Period 3, group 5A . The element is representative element.

(c) Is the element diamagnetic or paramagnetic ? paramagnetic (3 un pair)

1.Which of the following sets of elements is expected to have similar chemical properties?

a) Sulfur and phosphorous b) Sulfur and oxygen c) Sulfur and argon d) argon

2. Titanium (Ti)element is found in the periodic table in

(a) s-block (b) P-block (c) d-block (d) f-block

3. Characteristics of noble gases include:

a. filled s and p sub shells. b. monatomic gases.

c. generally un reactive chemically. d. all of the above

6. An example of representative element is :

a-Cr b- Ca c- Cu d- Fe

7. Representative elements are also called :

a-sub group b- main group c- non metals d- metals

8. Which of the following is a metalloids ?

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

9. The element in group 2A are know by what name ?

a- transition element b- halogens

c- alkali metals d-alkaline earth metals

10. The alkali metal elements are found in .....of periodic table

a-Goup 1A b- Goup 1B c- Goup 2A d- Goup 3A

11. Which one of these elements in a transition element?

a-Nickel b-Tin c- Sodium d- Sulfur

12. The liquid in the fourth period is :

a- Ca b-Br c- As d- Sc

13. Which of the following is not a representative element?

a- Cs b- Al c- S d- Ni

14. Sc to Zn are called ..... row transition metals :

a- Second b- third c- fourth d- first

15. The sub shell which is gradually filled in the transition metals is :

a- S b- d c- F d- p

16. which of the following is the general electron Configuration for outer most electrons in the alkaline Earth group :

a- ns^2 b- ns^2 c- $ns^1 np^2$ d- ns^1

17. Elements having eight electrons in their valence Shell are :

a- noble gas b- halogens c- alkali metals d-metal

18. The elements having ns^1 configuration in their outermost shell are :

a- noble gas b-halogens c-alkali metals d-metalloids

19. Anon metals of the following is :

Video (6)

a-Ba b-Fe c-P d- Cu

20. The general electron configuration for atoms of halogen group is :

a- $ns^2\ np^6$ b- $ns^2\ np^5$ c- $ns^2\ np^6\ (n-1)d^7$ d- $ns^2\ np^7$

ملحوظة : valence electron : هي الكترونات مستوي الطاقة الاخير في الذرة وتساوي رقم مجموعه الذرة .

21.Consider the element with the electron configuration $[Kr]\ 5s^2\ 4d^7$:

a- Non Metal b- a transition metal c-metalloids d- representative element

22 - Which two electron configurations represent that would similar chemical properties

Video (7)

(1) $1s^2\ 2s^2 2p^4$ (2) $1s^2\ 2s^2 2p^5$

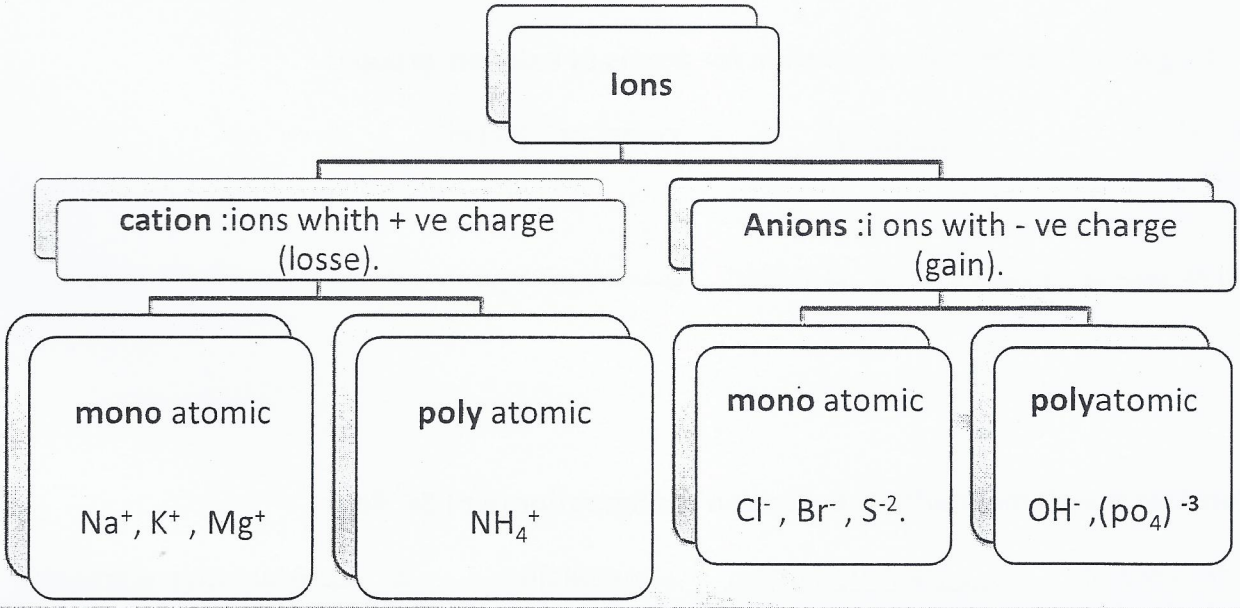
(3) $[Ar]\ 4s^2\ 3d^{10} 4p^3$ (4) $[Ar]\ 4s^2\ 3d^{10} 4p^4$

a- (1) and (2) b- (1) and (3) c- (1) and (4) d- (2) and (4)

Video (8)

Electron Configuration of Cations and Anions

معلومات من الدوري الأول



H: $1s^1$ H^- $1s^2$ or [He]

F: $1s^2 2s^2 2p^5$ F^- $1s^2 2s^2 2p^6$ or [Ne]

O: $1s^2 2s^2 2p^4$ O^{2-} $1s^2 2s^2 2p^6$ or [Ne]

N: $1s^2 2s^2 2p^3$ N^{3-} $1s^2 2s^2 2p^6$ or [Ne]

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

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

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

Video (9-10)

Ions derived from transition metals :

When **a cation** is formed from an atom of a transition metal :

Electrons are always removed first from the **ns orbital** and then from the **nd orbital .**

Fe: [Ar]$4s^2 3d^6$

Fe^{2+}: ?????

Fe^{2+}: [Ar]$4s^1 3d^1$ ✗

Fe^{2+}: [Ar]$4s^0 3d^6$ or [Ar]$3d^6$ √

Mn: [Ar]$4s^2 3d^5$

Mn^{2+} : ????

Mn^{2+}: [Ar] $4s^2$ $3d^3$ ✗

Mn^{2+}: [Ar]$4s^0 3d^5$ or [Ar] $3d^5$ √

Video (11-12-13)

1. Write the electronic configuration for Co^{2+}

(a) [Ar] $4s^2$ $3d^5$ (b) [Ar] $3d^7$ (c) [Ar] $4s^1$ $3d^6$

Iso electronic المتشابهات الالكترونية

Video (14)

Species with the same number of electrons.

^{11}Na	Na^+	→ (10 e)
^{13}Al	Al^{3+}	→ (10 e)
^{7}N	N^{3-}	→ (10 e)
^{9}F	F^-	→ (10 e)
^{8}O	O^{2-}	→ (10 e)
^{10}Ne		→ (10 e)

THUS : Na^+ , Al^{3+}, F^-, O^{2-}, and N^{3-} are all iso electronic with Ne .

1. which of these species make an isoelectronic pairs Cl^- , O^{-2} , F , Ca^{2+} , Fe^{+3}

a- Ca^{+2} and Fe^{+3} b- O^{2-} and F c- F^- and cl^- d- <u>Cl^- and Ca^{2+}</u>

2. Which of the following species is isoelectronic with Cl^-

(a) F^- (b) O^{2-} <u>(c) K^+</u> (d) Na^+

3. Two ions are referred to as iso electronic if they have the same number of

a) <u>electrons</u>. b) protons. c) atoms. d) neutrons

4.Which of the following is an isoelectronic series?

a) B^{5-} , Si^{4-} , As^{3-} , Te^{2-}

b) $\underline{O^{2-}, F^{-}, Ne, Na^{+}}$

c) S , C1 , Ar , K

d) None of the above

5. ..... is isoelectronic with argon and ..... is isoelectronic with neon.

a) $\underline{C1^{-}, F^{-}}$

b) $C1^{-}, C1^{+}$

c) F^{+}, F^{-}

d) Ne, Kr

6. Which ion is isoelectronic with Ar?

a) Ni^{2+}

b) F^{-}

c) Br^{-}

d) $\underline{K^{+}}$

7. Which of the following species is isoelectronic with Cl^{-}

a) $\underline{K^{+}}$

b) Na^{+}

c) F^{-}

d) O^{-2}

Periodic Variation in Physical Properties

Video (15)

Effective Nuclear Charge

- The core electrons الالكترونات الداخليه are closer to nucleus than the valence electrons .
- The core electrons shield valence electrons **much more** than valence electrons shield one another.

In the same period	• **Increases** from **left to right** in the same period.
In the same group	• Decrease from **top to bottom** in the same group .

حجم الذرة Size of atom

Video (16)

Atomic Radius: is ½ the distance between the two nuclei in two adjacent metal atoms or in a diatomic molecule .

In the same period	• **Decreases** from **left to right** in the same period.
In the same group	• **Increases** from **top to bottom** in the same group .

في نفس الدورة : يقل قطر الذرة (الحجم) من اليسار إلي اليمين .

في نفس المجموعة : قطر الذرة (الحجم) يزيد عند الانتقال من أعلي إلي اسفل .

لترتيب مجموعة من العناصر في اماكن مختلفة من الجدول :

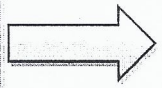
أكبر ذرة توجد في الدورة الاكبر . عند تساوي الدورات نأخذ المجموعة الاقل .

1. Which of these atoms has the smallest radius ?

Video (17-18)

a- Al b- P c- As d- Na e- Te

	p	g
Al	3	3
P	3	5
As	4	5
Te	5	6
Na	3	1



الدورة والمجموعة لكل عنصر

Te > As > Na > Al > P

2.Referring to a periodic table, arrange the following atoms in order of increasing atomic radius: P, Si, N.

N < P < Si

3. Which choice below correctly lists the elements in order of increasing atomic radii?

a- Na < Mg < K < Rb

b- Mg < Na < K < Rb

c - Rb < K < Na < Mg

d- Rb < K < Mg < Na

Ionic radius rules

Video (19-20)

- **For ions in the same group :**
  The ionic radius increases from the top to the bottom .

- **For ions in different groups : they should be isoelectronic .**

Isolelectronic cations :

☚ الاكبر في الشحنة الموجبة هو الاصغر في الحجم

Ex : Al^{3+}, Mg^{2+}, Na^{+} $\quad Al^{3+} < Mg^{2+} < Na^{+}$

Isoelectronic anions :

☚ الاكبر في الشحنة السالبة هو الأكبر في الحجم

Ex : O^{2-}, F^{-} $\quad F^{-} < O^{2-}$

☚ لترتيب مجموعة من الأيونات الموجبة والسالبة :

- كلما زادت الشحنة الموجبة كلما قل الحجم الذري (حجم الأيون الموجب أصغر من حجم ذرته).
- كلما زادت الشحنة السالبة كلما زاد الحجم الذري (حجم الأيون السالب أكبر من حجم ذرته) .
- حجم الأيونات السالبة أكبر من حجم الأيونات الموجبة .

cations < anions : example $Na^{+} < F^{-}$

1. Order the following according to increasing atomic/ionic radius.

a- $N^{3-} < O^{2-} < C < Li^{+}$ b- $Li^{+} < C < N^{3-} < O^{2-}$

c- $Li^{+} < C < N^{3-} < O^{2-}$ d- $Li^{+} < C < O^{2-} < N^{3-}$

2. Which choice below correctly lists the elements in order of increasing atomic radii?

a- Na < Mg < K < Rb b- Mg < Na < K < Rb

c- Rb < K < Na < Mg d- Rb < K < Mg < Na

3. The correct order of radius of an atom A to its ion is :

a- $A^{-} < A$ b- $A^{2+} > A$ c- $A^{2+} < A$ d- $A^{+} > A^{-}$

4. The correct order of atomic radius of following is :

a- Na > Al > Cl > Mg b- Na < Al < Cl < Mg

c- Na < Mg < Al < Cl d- Na > Mg > Al > Cl

5. The smallest atom in group 7 A is :

a-F b- I c- Br d-Cl

6. The correct order of the size of the atom or ion is:

a- $Cl^{-} < Cl$ b- $O^{-2} < S^{-2}$ C-$Na^{+} > Na$ d-$Mg^{+2} < Al^{+3}$

الاكسجين والكبريت في المجموعة 6A والاكسجين هو الاقل حجما.

7 . Which of these atoms has the largest radius

a-B b- Ga c-Br d- Si e-Cl

	p	g
B	2	3
Ga	4	3
Br	4	7
Si	3	4
Cl	3	7

يتم الترتيب اولا بترتيب الدورات تنازلي والمجموعات تصاعدي

Ga > Br > Si > Cl >B

Ionization energy جهد التأين

Video (21)

Ionization energy (IE) : Is the minimum energy (kJ/mol) required to remove an electron from a gaseous atom in its ground state .

The higher ionization energy, the more difficult is to remove the electrons

طاقة التأين : هي الحد الادنى من الطاقة الازم لفصل أبعد الكترون عن النواة في الذرة المفردة الغازية.

يرتبط جهد التأين عكسيا مع حجم الذرة في الدورة والمجموعة .

In the same period	• Increases from **left to right** in the same period.
In the same group	• Decreases from **top to bottom** in the same group

اذا كان فقد الالكترون يقلل استقرار الذرة يكون جهد التأين مرتفع .

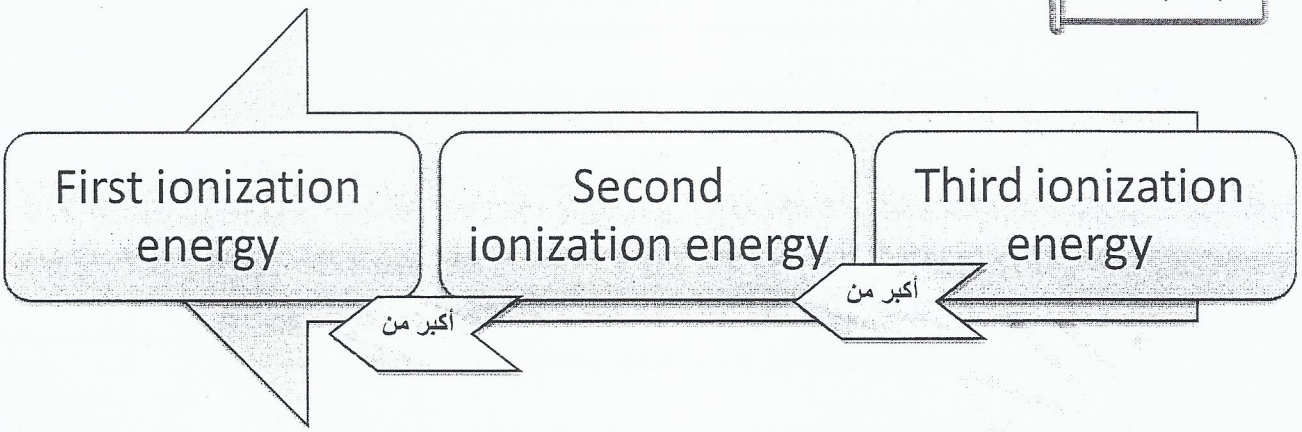
اذا كان فقد الالكترونات يزيد استقرار الذرة يكون جهد التأين منخفض

1A < **3A** < **2A** < 4A < **6A** < **5A** < 7A < 8A

Video (21-23)

2A		3A		5A		6A
Be		B		N		O
Mg	اكبر من	Al		P	اكبر من	S
Ca		Ga		AS		Se
مستقر		اقل استقرار		مستقر		اقل استقرار

Video (24)



The first ionization energy: is the amount of energy required to remove the 1st electron from an atom in the gaseous state

Metals have low ionization energy

Alkali metals have the lowest ionization energy .

Inert gases have the highest ionization energy .

---

1. The property , which increase from left to right in the period , is :

a-ionized energy b-atomic radius c-metallic character d- covalent radius

2. The property , which decrease along a group from top to bottom is :

a-atomic radius b-metallic character c- ionized energy d-ionic radius

Video (25)

3. Which of these element has the highest first ionized Energy ?

a- Cs b- O c- K d-N

4. Arrange the following in order of increasing first ionization energy: F, K, P, Ca, and Ne.

Electron Affinity الالفة الالكترونية

Video (26 -27)

Electron affinity (EA): the ability of atom to accept one or more electrons.

هي قدرة الذرة علي جذب الكترون او اكثر .

The negative of the energy change that occurs when an electron is accepted by an atom in the gaseous state to form an anion.

The higher electron affinity, the greater affinity to accept the electron. Video (28)

In the same period	• **Increases** from **left to right** in the same period.
In the same group	• **Decreases** from **top to bottom** in the same group

Non metals have high electron affinity . Video (29)

exceptions:

Group 2A (ns^2) lower than 1A (ns^1) in the same period.

Group 5A ($ns^2 np^3$) lower than 4A ($ns^2 np^2$) in the same period.

THUS: 8A < 2A < 1A < 3A < 5A < 4A < 6A < 7A

- The EA decreases from top to the bottom of the group.
- Noble gases have the lowest electron affinities .
- Halogens (7A) have the highest electron affinities (Cl) .

Effective nuclear charge increases

Atomic radius decreases

First ionization energy increases (with exceptions)

Electron affinity increases (with exceptions)

Effective nuclear charge increases

Atomic radius increases

Ionic radius increases

ايونات من مجموعات مختلفه؟
الكاتيونات اصغر من الانيونات
كاتيونات: الاصغر ذو الشحنه الموجبه الاكبر
انيونات : الاصغر ذو الشحنه السالبه الاصغر

First ionization energy decreases

Electron affinity decreases

52

1. Which choice correctly lists the elements in order of decreasing electron affinity?

a- O, Cl, B, C b- O, Cl, C, B c- Cl, O, C, B d- Cl, O, B, C

B < C < O < Cl

2. Specify which of the following elements you would expect to have the greatest electron affinity and which have the least:

He, K , Co, S , Cl

☛ Greatest EA: Cl ☛ Least EA: He

3. Which of these elements has the greatest electron affinity ?

a- Mg b- Al c- Cl d- P

4. Electron affinity is the energy liberated when an atom forms a .....

a- Free radiation b- cation c- anion d- molecule

5. Electron affinity is highest for :

Video (30)

a- C b- Li c- N d- Al

تزيد الالفة عكس الحجم لكن هناك شذوذ في المجموعة 4A , 5A

Al Li C N c > N