Unit 1 : lesson 2 : Periodic table for classification of elements

Chemical elements differ in physical properties and chemical properties... Therefore, there have been multiple attempts to classify the elements, and their goal is to facilitate study and find the relationship between the elements and their physical and chemical properties.

The most important attempts to classify elements:-

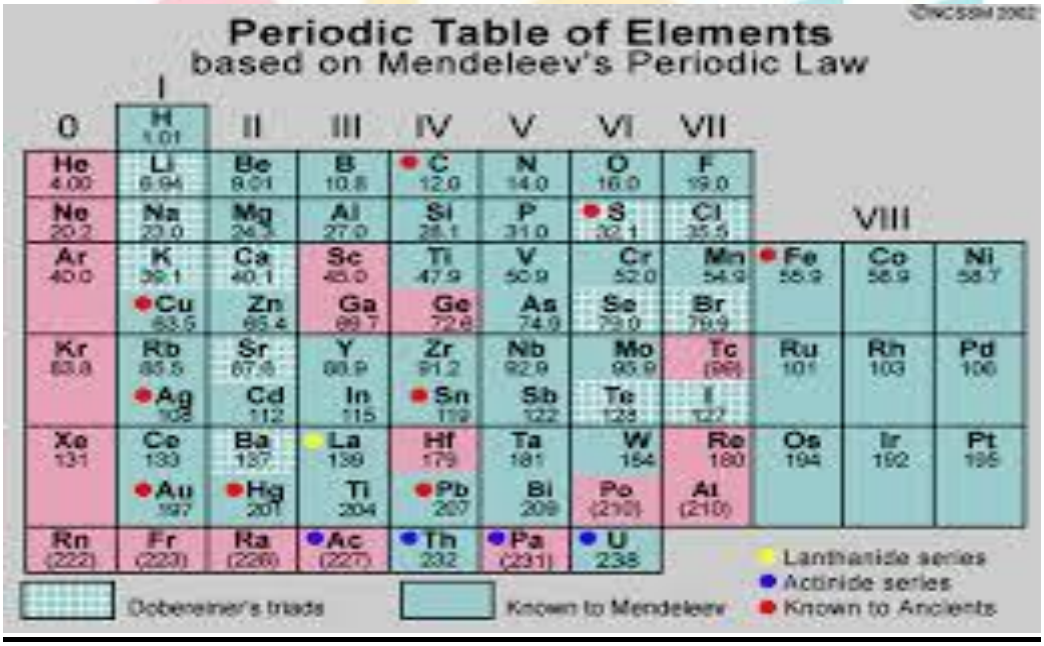
1) The periodic table of the scientist Mendeleev

2) The periodic table of the scientist Moseley

3) The modern periodic table

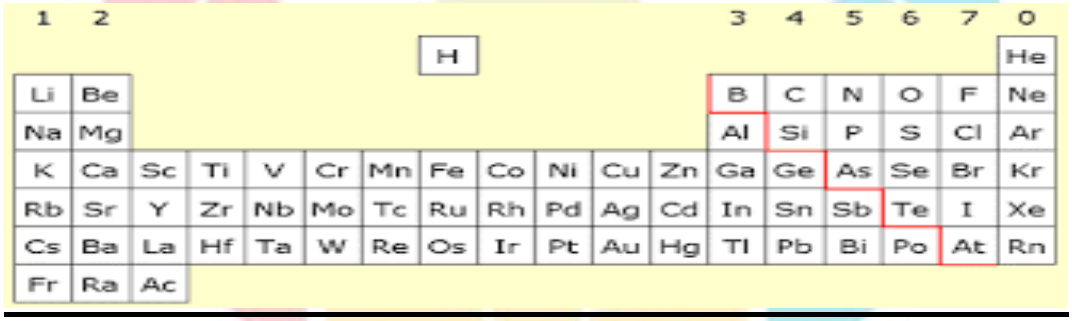
1) The periodic table of the scientist Mendeleev...

- **The scientist Mendeleev's table is considered the first true periodic table for classifying elements...**
- **The elements are arranged in ascending order according to their atomic mass, without a regular progression when moving from left to right in horizontal rows.**
- **He discovered that the properties of the elements are repeated periodically at the beginning of each new row.. This means that the elements that exist in the form of vertical columns are similar in properties**



2) The periodic table of the scientist Moseley…

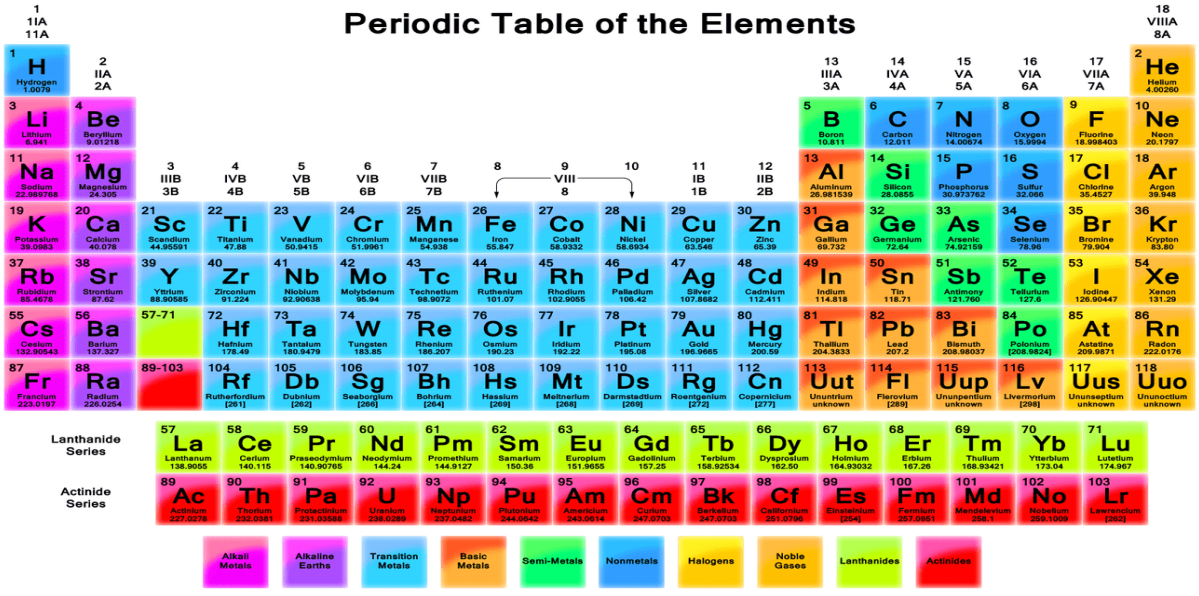
- After the discovery of protons by the scientist Rutherford, the scientist Moseley discovered that the periodicity of the properties of elements is related to their atomic numbers and not to the atomic mass.
- Moseley modified Mendeleev's table in which the elements were arranged in ascending order according to their atomic number.
- Each element exceeds the element that precedes it in the same period by one integer
- Moseley added to the scientist Mendeleev's table the group of inert gases and other new elements that were discovered after the publication of Mendeleev's table.



1	2											3	4	5	6	7	0
							H										He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac															

3) The modern periodic table:-

- The elements are arranged in ascending order according to their atomic numbers and the method of filling the sub-energy levels with electrons.



Description of the modern periodic table:-

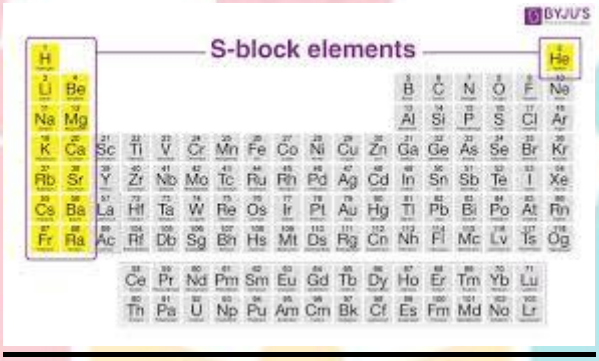
- The modern periodic table consists of 7 horizontal period and 18 vertical groups

(7 cycles because the number of energy levels is 7 levels... In each cycle we begin to fill a new energy level with electrons)

- **The number of elements in the modern periodic table is 118**

Elements are found in 4 basic Blocks: S, P, D, and F

Block s elements:-

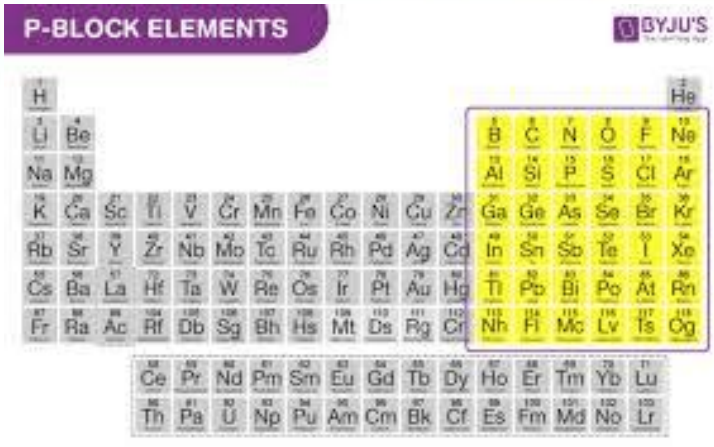


- **Location: left of the modern periodic table**
- **It consists of two vertical groups: 1A and 2A**

(1A alkali metals , 2A are called alkaline earth metals)

- **All of its elements are solid metals except hydrogen, which is not a gas metal.**

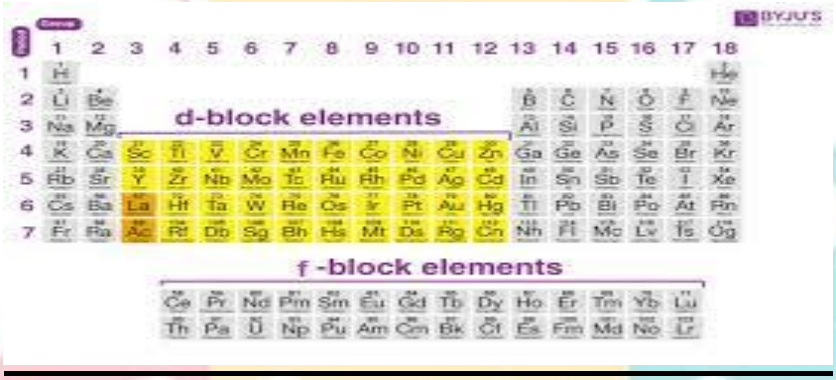
Block p elements:-



- **Location: Right of the modern periodic table**
- **It consists of 6 groups starting with group 3A and ending with group zero**
- **Most of its elements are non-metals, in addition to metalloids and some other metals**
- **Its elements exist in solid and gaseous forms, with the exception of bromine (Br), which is a liquid nonmetal**
- **One of its most important groups is the penultimate group 7A, which is called the halogens, and the last group (zero) is called the noble gases.**

Block d Elemens

- **Location: in the middle of the modern periodic table**
- **It consists of 10 groups starting with Group 3B and ending with Group 2B**
- **It begins to appear in the fourth period and its elements are called transitional elements**
- **All of its elements are metallic elements in the solid state, except for mercury (Hg), which is a liquid fluid element**



Block f Elemens

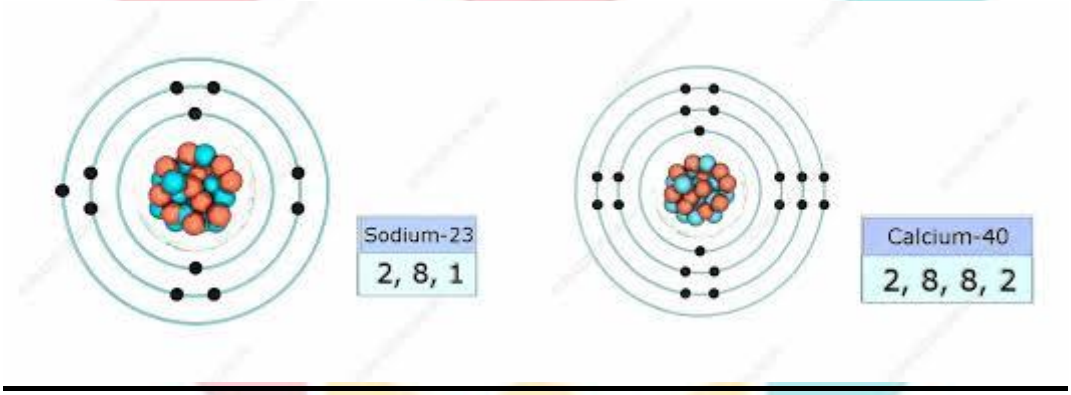
- **Location at the bottom of the modern periodic table**
- **It consists of two series: the lanthanide series and the actinide series.**
- **All of its elements are metallic elements.**

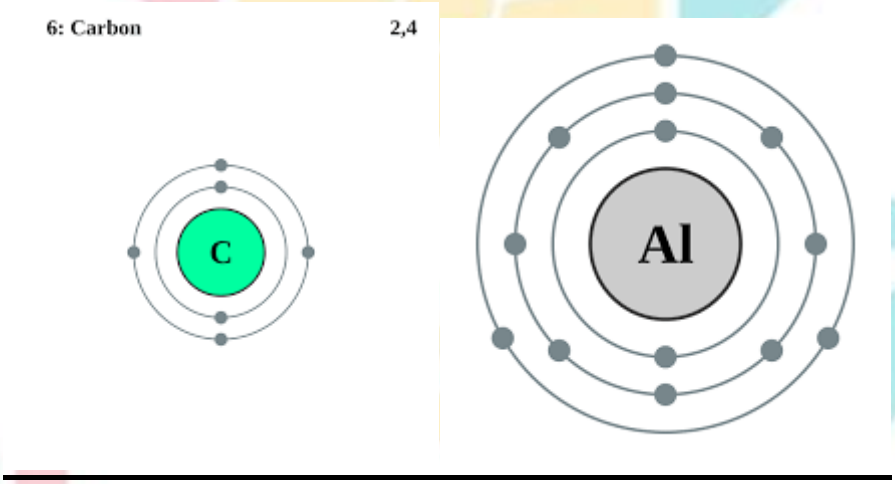
WEEK 2 : SESSION 1 : UNIT 1 : LESSON 2

The location of the elements in the groups symbolized by the symbol A can be determined by the atomic number...

(1) The electron configuration of the atom is determined (The number of energy levels is the period number)

(2) The number of electrons in the last energy level determines the group number (we put the letter A next to the number of electrons in the last energy level)





$_{11}$Na : 2, 8 , 1 — period 3 / group 1A

$_{20}$Ca : 2, 8 ,8 ,2 — period 4 / group 2A

$_{6}$C : 2. 4 — period 4 / group 4A

^{13}Al : 2, 8 ,3 — period 3 / group 3A

symbol	Electronic distribution	period	group
$_{19}K$			
$_{8}O$			
$_{18}Ar$			
$_{17}Cl$			
$_{3}Li$			
$_{1}H$			
$_{4}Be$			
$_{9}F$			

How to determine the atomic number of an element given its location in the table:-

1- The period number of an element is equal to the number of energy levels occupied by the electrons

2- The group number of the element is equal to the number of electrons in the last energy level

3- The atomic number of an element is equal to the sum of the numbers of electrons in its energy levels

Examples:-

1- Calculate the atomic number of the element X which is located in the second period and group 1A

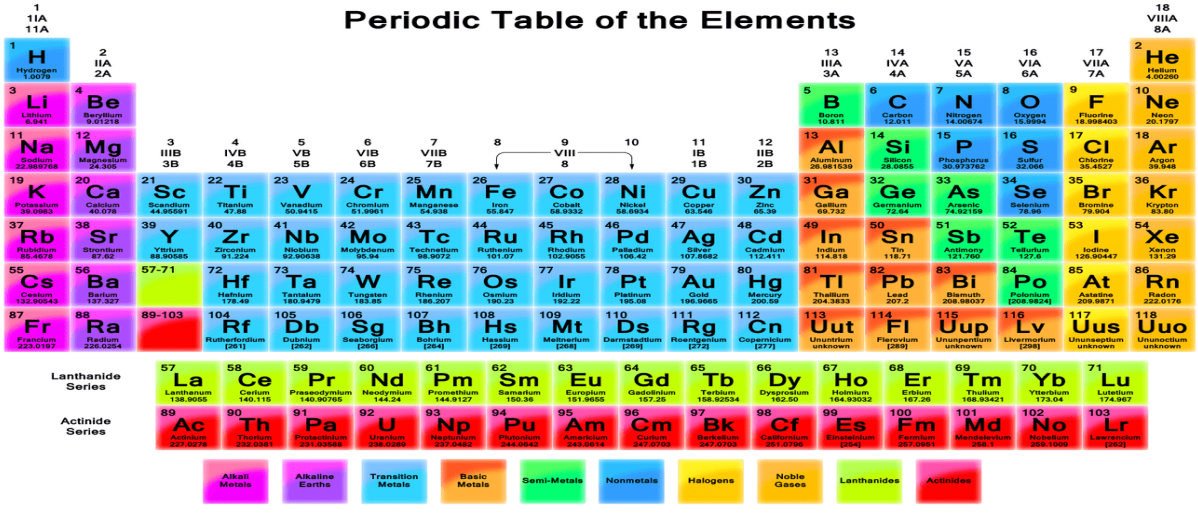
2- Calculate the atomic number of element Y located in the third period and group 7A

3- Calculate the atomic number of the element Z, which is located in the second period and the zero group

4- Calculate the atomic number of the element Q, which is located in the third period and group 3A

5- Calculate the atomic number of the element M located in the first period and the zero group

Elements of one period	Elements of one group
- They differ in the number of electrons in the last energy level	- They agree in the number of electrons in the last energy level
- They agree in the number of levels of energy	- They differ in the number of energy levels
- They differ in chemical properties	- They are similar in chemical properties
Each element has one more proton than the preceding element in the period	- Each element has 8 electrons more than the previous element, or a full energy level



WEEK 2 : SESSION 2 : UNIT 1 : LESSON 2

The elements are divided according to their properties and the distribution of electrons into four types of elements:-

Metals nonmetals metalloids inert gases.

Metals:-

They are characterized by the last energy level often contains less than four electrons

Nonmetals:-

They are characterized by the last energy level often contains more than four electrons

Metalloids:-

elements that combine the properties of metals and nonmetals. These elements fall into the S block.

Inert gases:-

gaseous elements that do not react under normal conditions because the last energy level is filled with electrons

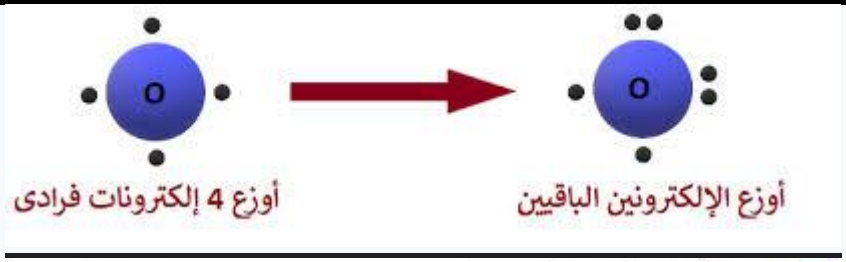
Types of gaseous elements:-

Inert gases	Gases (non-metallic)
- It is in the zero group	It is found in the P-block elements, except for hydrogen (H), which is in the S-block
- 6 items	- 5 items
- Do not participate in chemical reactions under normal conditions	- Participates in chemical reactions under normal conditions
- It includes the elements Helium(He), Neon(Ne), Argon(Ar), Krypton(Kr), Xenon(Xe), and Radion(Rn)	-It includes the elements Hydrogen(H) – Nitrogen(N)- Oxygen(O) – Fluorine(F) – Chlorine(Cl)

The electrons of the last energy level play an important role in the formation of chemical bonds

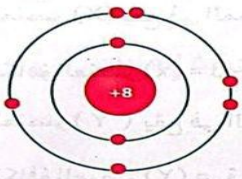
valence:-

It is the number of single electrons in the Lewis structure of an element



مثـــال توضيحى

- التمثيل النقطى لإلكترونات تكافؤ ذرة الأكسجين O_8
- التوزيع الإلكترونى لذرة الأكسجين هو
- طبقًا لطريقة لويس يتم توزيع إلكترونات المستوى الخارجى فرادى أولًا على الجوانب الأربعة لرمز العنصر، ثم يبدأ الازدواج حتى يتم توزيعها جميعا كالآتى:



التكافؤ (Valency):

هو عدد الإلكترونات المفردة فى تركيب لويس للعنصر.

- الجدول الآتى يوضح التمثيل النقطى بطريقة لويس لإلكترونات مستوى الطاقة الأخير (إلكترونات التكافؤ) لمجموعات الجدول الدورى من المجموعة 1A حتى المجموعة الصفرية .

رقم المجموعة	1A	2A	3A	4A	5A	6A	7A	0
العنصر	Li	Be	B	C	N	O	F	Ne
التكافؤ	أحادى	ثنائى	ثلاثى	رباعى	ثلاثى	ثنائى	أحادى	0

- الجدول التالى يوضح بعض المعلومات الخاصة بعناصر الدورة (2) من الجدول الدورى الحديث بدلالة تركيب لويس النقطى :

عناصر الدورة (2)	$_3Li$	$_4Be$	$_5B$	$_6C$	$_7N$	$_8O$	$_9F$	$_{10}Ne$
التوزيع الإلكترونى	2 , 1	2 , 2	2 , 3	2 , 4	2 , 5	2 , 6	2 , 7	2 , 8
تركيب لويس النقطى	Li	Be	B	C	N	O	F	Ne
التكافؤ بمعلومية تركيب لويس	أحادى	ثنائى	ثلاثى	رباعى	ثلاثى	ثنائى	أحادى	صفر
رقم مجموعة العنصر	1A	2A	3A	4A	5A	6A	7A	0

ويلاحظ من الجدول السابق أن :

تكافؤ عناصر المجموعات من 1A : 4A يساوى رقم المجموعة.

تكافؤ عناصر المجموعات من 5A : 0 يساوى (8 – عدد إلكترونات مستوى الطاقة الأخير).

تكافؤ مجموعة الغازات الخاملة يساوى صفر ... علل ؟

لاكتمال مستوى الطاقة الأخير فى ذراتها بالإلكترونات وبالتالى لا يحتوى تركيب لويس لها على إلكترونات مفردة.

Atomic number	Name of element	Symbol	Valency	Atomic number	Name of element	Symbol	Valency
1	Hydrogen	H	1	11	Sodium	Na	1
2	Helium	He	0	12	Magnesium	Mg	2
3	Lithium	Li	1	13	Aluminium	Al	3
4	Beryllium	Be	2	14	Silicon	Si	4
5	Boron	B	3	15	Phosphorous	P	3
6	Carbon	C	4	16	Sulphur	S	2
7	Nitrogen	N	3	17	Chlorine	Cl	1
8	Oxygen	O	2	18	Argon	Ar	0
9	Fluorine	F	1	19	Potassium	K	1
10	Neon	Ne	0	20	Calcium	Ca	2

The electron configuration of element atoms reflects their properties

The chemical properties of elements depend on the number of electrons in the last energy level

- Graduation of the physical properties of some alkali metals and halogens

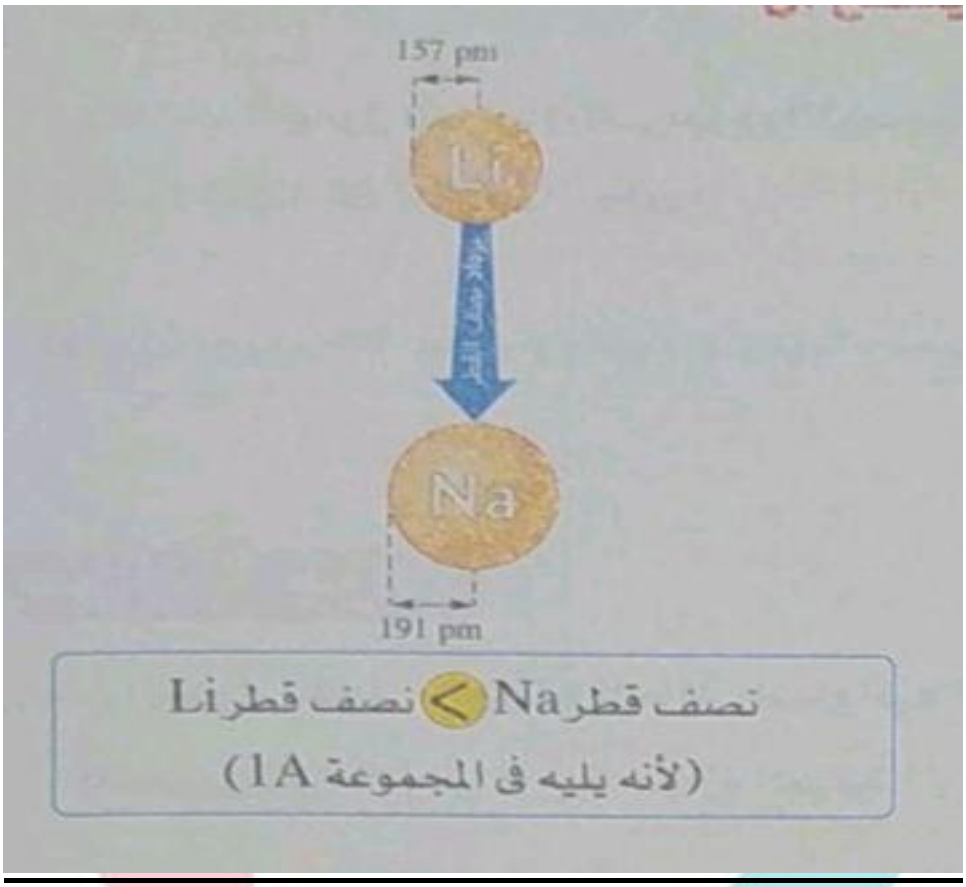
والجدولان التاليان يوضحان تدرج بعض الخواص الفيزيائية لبعض فلزات الأقلاء والهالوجينات :

فلـزات الأقلاء	نصف قطر الذرة	درجة الانصهار	درجة الغليان
ليثيـوم $_{3}Li$ 2 , 1	157 pm	181°C	1347°C
صوديوم $_{11}Na$ 2 , 8 , 1	191 pm	98°C	883°C
بوتاسيوم $_{19}K$ 2 , 8 , 8 , 1	235 pm ↑ يزداد	64°C ↓ تقل	774°C ↓ تقل

بـزيـادة العـدد الـذرى

الهالوچينات	نصف قطر الذرة	درجة الانصهار	درجة الغليان
كلـور $_{17}Cl$ 2 , 8 , 7	99 pm	– 101°C	– 34°C
بـروم $_{35}Br$ 2 , 8 , 18 , 7	114 pm	– 7°C	59°C
يـود $_{53}I$ 2 , 8 , 18 , 18 , 7	133 pm ↑ يزداد	114°C ↑ تزداد	184°C ↑ تزداد

بـزيـادة العـدد الـذرى



The relationship between the physical state of an element and its melting and boiling points at room temperature:-

The physical state of matter	Melting point	Boiling point
Solid elements	more than 25	
Liquid elements	less than 25	greater than 25
Gaseous elements	less than 25	

Give a reason: The melting and boiling points of lithium(Li) and potassium(K) are higher than room temperature?

Because both of them are solid elements at room temperature.

Give a reason: The melting and boiling points of chlorine(Cl) are lower than room temperature?

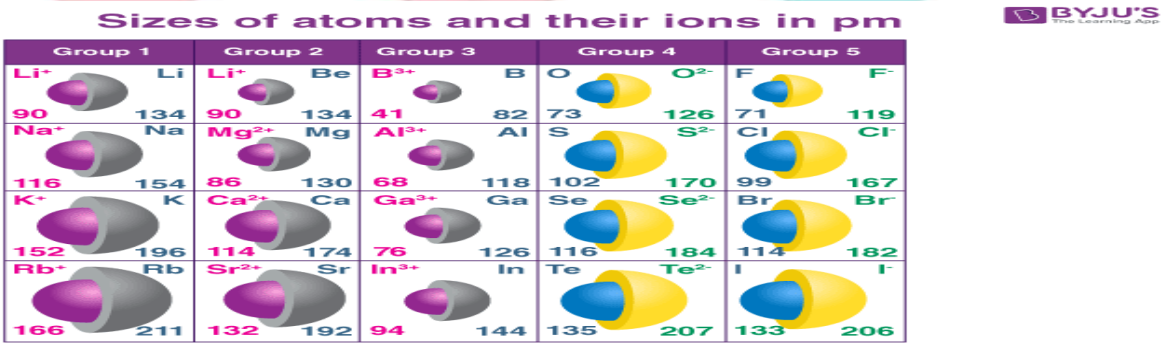
Because chlorine is a gaseous element At room temperature

Chemical activity

1) In the two groups of alkali(1A) and alkali earth metals(2A), the degree of activity increases with an increase in the atomic number as it descends downward in the group.

2) The degree of activity of the alkali metal elements is greater than the degree of activity of the ground alkali metals

3) In the group of Halogens(7A), the chemical activity decreases as the atomic number increases from top to bottom



Exercises : Complete the following phrases:-

1. **The period number is equal to the number of -----**
2. **Block s is located ----- the modern periodic table**
3. **Block p contains ----- group**
4. **Noble gases fall into the category -----**
5. **Block d is located in ------ the modern periodic table**
6. **The first scientist to create a true periodic table -----**
7. **Moseley arranged the elements in ascending order according to -----**
8. **Number of elements in the modern periodic table -----**
9. **The scientist discovered ----- that the nucleus contains positively charged protons**
10. **The scientist added -------- the group of inert gases to the periodic table**
11. **The Block ---------- contains the largest number of items**
12. **The alkali earth group is located in ----------the periodic table**

13. **The zero group in the modern periodic table belongs to the block --------**
14. **Potassium belongs to the group --------**
15. **The 1A group is called ----------, the 2A group is called ----------, the 7A group is called ----------, and the zero group is called-- ----- ----**
16. **The transitional elements begin to appear in the period ----------**
17. **The valency of the alkali group elements ---------- while the halogen group ----------**
18. **The element that falls in the third period and group 3A has the atomic number ----------**
19. **In group 1A, it increases --------- from top to bottom**
20. **In halogens, the boiling point ---------- from top to bottom, in alkali elements, the melting point ---------- from top to bottom.**