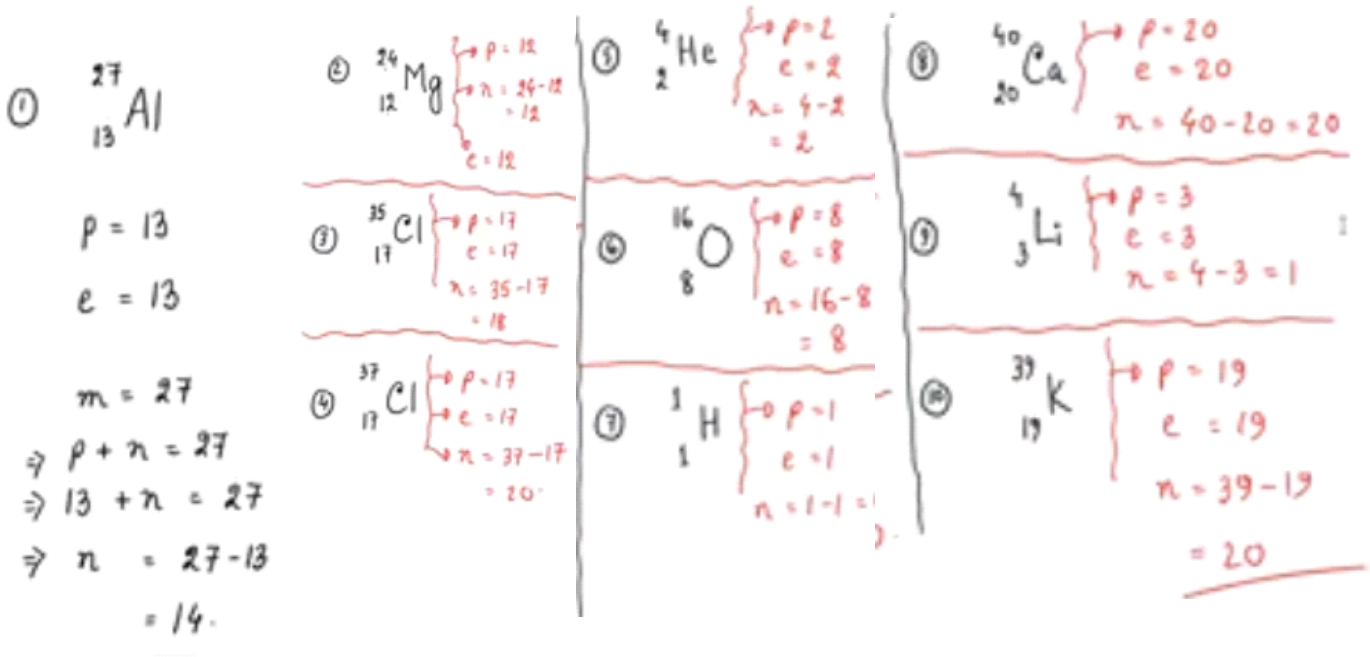
ATOMIC STRUCTURE #2

Practice Problem:



* Each shell can hold a FIXED number of electrons.

So, each shell has a FIXED CAPACITY, that is, they can hold a FIXED NUMBER of MAXIMUM electrons.

* FORMULA to find the MAXIMUM number of electrons in a shell is $2n^2$ (n → number of shell/shell number)

SHELLS	N	MAXIMUM NO. OF ELECTRONS THAT THE SHELL CAN HOLD

1st Shell	1	$2n^2 = 2(1)^2 = 2$
2nd Shell	2	$2n^2 = 2(2)^2 = 8$
3rd Shell	3	$2n^2 = 2(3)^2 = 18$

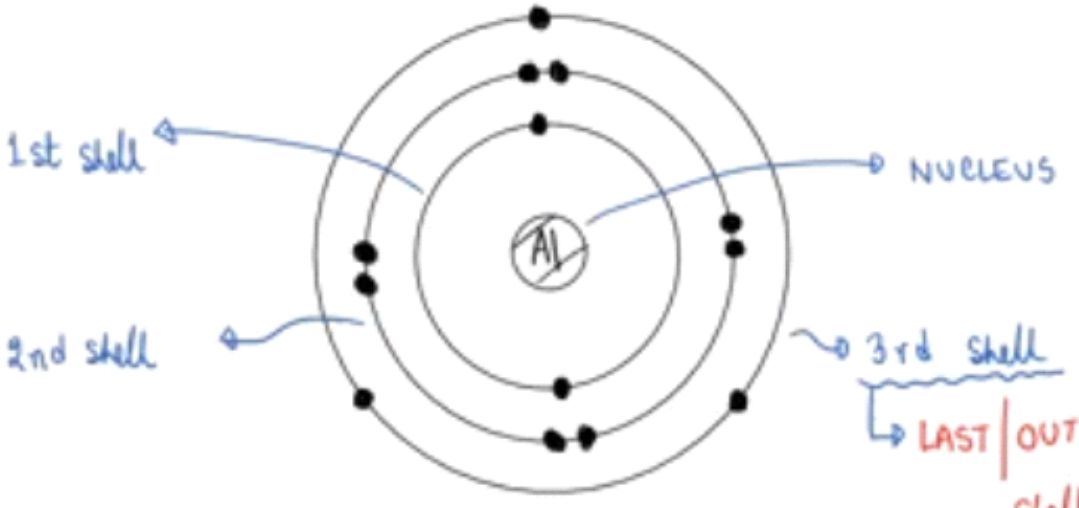
FOR the first 20 elements, the third shell can hold upto ONLY 8 electrons.

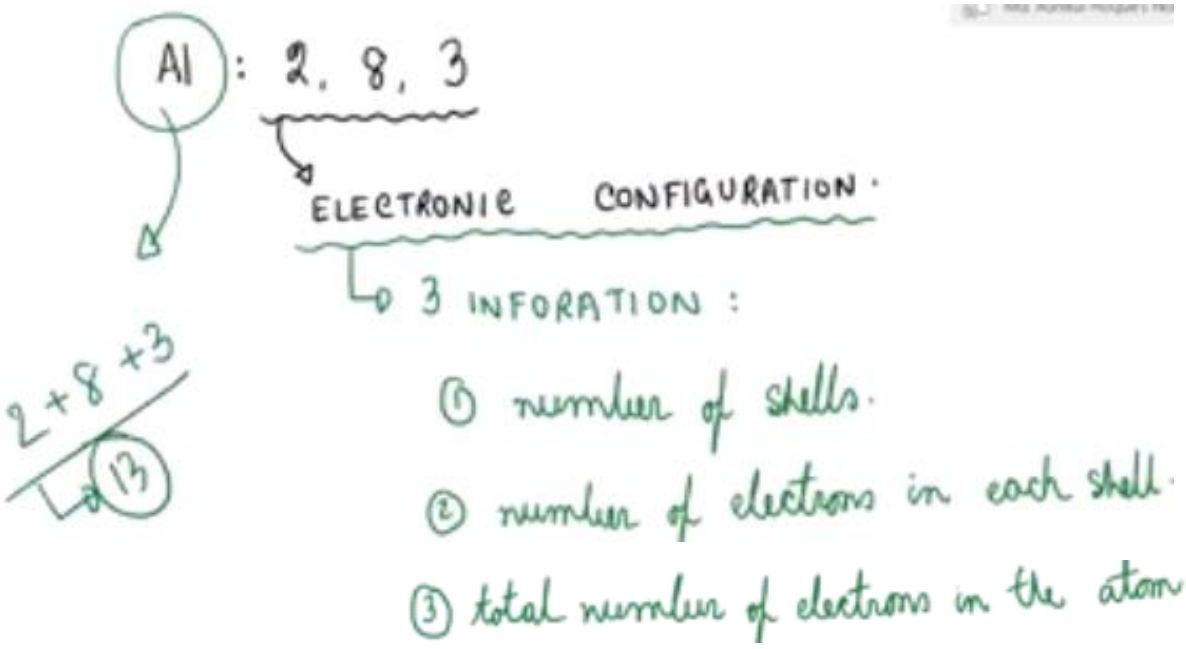
*** In an atom, electrons always fill up the first shell first, then the second shell and then it continues if required.

EXAMPLE

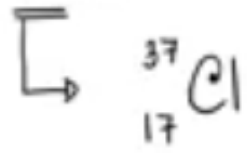
$^{27}_{13}Al$ → p = 13
n = 27 - 13 = 14
e = 13.

13 - 2 = 11 - 8 = (3)
1st shell → 2nd shell → 2nd shell.





QUESTION:



a) Prove, mathematically, that this atom is neutral.
b) Draw the atomic structure of this atom and label it.
c) Deduce the electronic configuration of the atom.

ANSWER :

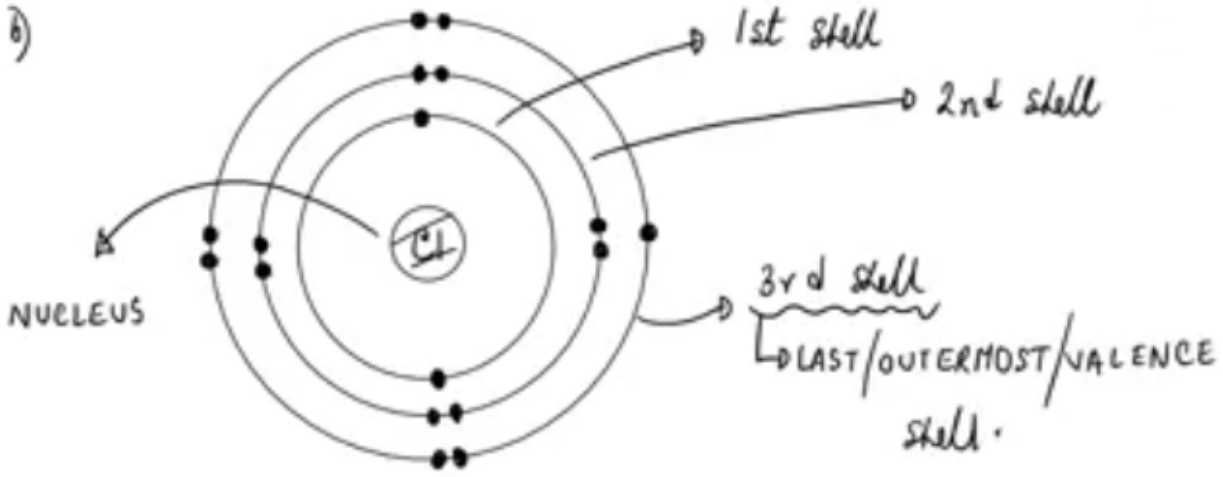
a) $^{37}_{17}Cl$

	CHARGE
p = 17	(+1) × 17 = +17
n = 37 − 17 = 20	0 × 20 = 0
e = 17	(−1) × 17 = −17
	0

0 → OVERALL / NET charge is ZERO.

∴ Cl atom is NEUTRAL.

b)



c) Cl : 2, 8, 7

A nuclide is an atom characterized by a definite atomic number and mass number. The Notation for any nuclide consists of the symbols of the element with the atomic number Subscript on the left and the mass number as a superscript on the left. The nuclide symbol is as follows:

Mass number or Nucleon number → ^{A}
Atomic number or Proton number → $_{Z}X$

The **Mass number** or the **Nucleon number (A)** is the total number of protons and neutrons in a nucleus.

The **Atomic number** or **Proton number (Z)** is the number of protons in the nucleus of an atom. It can be determined experimentally. An atom is normally electrically neutral, so it has as many electrons about its nucleus as the nucleus has protons; that is, the number of electrons in a neutral atom equals its atomic number.

Other than the nucleus, the atom consists of different energy levels which are known as **Shells**. Electrons in an atom are always situated on these shells. There is a limitation of the number of electrons that a specific shell can contain. In order to find out the maximum number of electrons a shell can contain, we can use the formula:

Number of electrons $= 2n^2$ => n= number of shells.

The 1st shell is known as Duplet. The maximum number of electrons it can contain is 2.
The 2nd shell is known as Octet. The maximum number of electrons it can contain is 8.
The maximum number of electrons the 3rd shell can contain is 8 (EXCEPTION).
The outermost shell of an atom is known as the Valence Shell.

Electronic configuration is the numeric details notation of the numbers of electrons and shell of an atom.

	ELEMENT	SYMBOL	ELECTRONS IN SHELL 1	ELECTRONS IN SHELL2	ELECTRONS IN SHELL 3	ELECTRONS IN 4TH SHELL
1.	Hydrogen	H	1			
2.	Helium	He	2			
3.	Lithium	Li	2	1		
4.	Beryllium	Be	2	2		
5.	Boron	B	2	3		
6.	Carbon	C	2	4		
7.	Nitrogen	N	2	5		
8.	Oxygen	O	2	6		
9.	Flourine	F	2	7		
10.	Neon	Ne	2	8		
11.	Sodium	Na	2	8	1	
12.	Magnesium	Mg	2	8	2	
13.	Aluminium	Al	2	8	3	
14.	Silicon	Si	2	8	4	
15.	Phosphorus	P	2	8	5	
16.	Sulfur	S	2	8	6	
17.	Chlorine	Cl	2	8	7	
18.	Argon	Ar	2	8	8	
19.	Potassium	K	2	8	8	1
20.	Calcium	Ca	2	8	8	2