SYMBOLS AND FORMULAE

In previous chapter (Elements, Molecules and Compounds) , we have learnt about the different types of elemtns, nature of mistures and compunds. In this chapter we shall discuss about the Symbols of elements used for writing formulae of the copounds

§§ ***Symbol :***

As you denote '+' is a symbol to addition and ' ÷ ' is a symbol for division in mathematics similarly each element is denoted by a symbol in chemistry.

¶¶ **Definition :**

Short hand notation of an element is called Symbol. Symbols can be denoted by the single letter, two letters & three letters. Many elements have their symbol derived from either the first letter (H for Hydrogen) or the first two letterrs (He for Helium) of their names.

§§ **Rules for assigning symbols :**

1) An element is represented with the first letter in capital of the english name of the element.

H - Hydrogen, **N** - Nitrogen, **C** - Carbon, **O** - Oxygen.

2) When the names of two or more elements begins with the same initial letter, the letter followed by the next letter is used to represent the element.

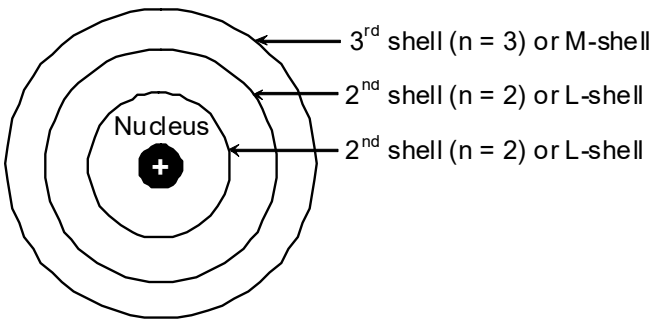
He - Helium, **Ca** - calcium, **Si** - Silicon.

§§ **Basic concept of an atom**

We know that an element is a pure substance which cannot be subdivided into two or more new substance by any means. Chemists have found 119 elements which exist in nature.

The smallest unit of any element is called an atom. The atoms of different elements combine with one another to form new substance called compounds. The compounds so formed are neutral in character, i..e, they have no electricc charges on them. All matters are made by the combination of atoms of different elements combined together in some fixed ratio. In a way, atoms are the basic building blocks of the matter.Atom is the smallest unit of matter which takes part in chemical reaction.

Geometrical structure of atom



(i) An atom consists of positively charged nucleus made up of protons which are responsible for almost the entire mass of the atom.

(ii) Electrons revolve around the nucleus in certain permitted circular orbits of definite radius and while revolving they do not radiate energy.

(iii)The different energy levels or orbits were numbered as 1, 2, 3, 4, … etc and called as K, L, M, N … etc. respectively.

As we have discussed above that there are a number of shells present in atom. These are numbered as 1, 2, 3, 4, …, 250 and so on or K, L, M, N, … 250 on respectively. As we move outwards from the nucleus and the electrons are present in these shells.

The distribution (arrangement) of the electrons in the different energy shells of the atom is known as the electronic configuration of that element.

The distribution of electrons into different orbit of an atom was suggested by Bohr and Bury.

§§ BOHR-BURY SCHEME OF DISTRIBUTION OF ELECTRONS :

The following rules are given by Bohr and Bury for writing the number of electrons in different energy levels or shells.

(i) The maximum number of electrons that can be present in a given shell is equal to $2n^2$, where n = number of shell.

Hence, the maximum number of electrons in different shells can be given as follows:

Shell	Maximum No. of electrons present
(a) 1st shell or K-shell (n = 1)	$2 \times (1)^2 = 2$
(b) 2nd shell or L-shell (n = 2)	$2 \times (2)^2 = 8$
(c) 3rd shell or M-shell (n = 3)	$2 \times (3)^2 = 18$
(d) 4th shell or N-shell (n = 4)	$2 \times (4)^2 = 32$

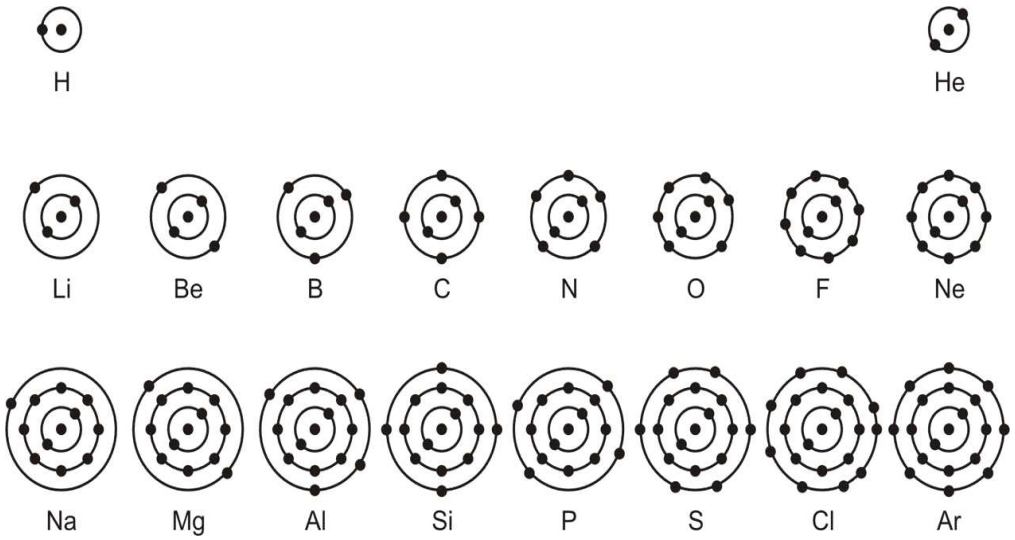
(ii) The maximum number of electrons that can be accommodated in the outermost orbit is 8 Except if atom has only one shell which can have two electrons (duplet)..

(iii) Electrons do not enter into a new shell until unless the inner shells are completely filled or we can easy that shells are filled in a step-wise manner.

(iv) The outermost orbit is also known as valence orbit and the number of electrons in that orbit are known as valence electrons.

Element	Symbol	Atomic No. (No. of electrons)	Distribution of electrons in different shells				Short representation of electronic configuration
			K	L	M	N	
Hydrogen	H	1	1				1
Helium	He	2	2				2
Lithium	Li	3	2	1			2, 1
Beryllium	Be	4	2	2			2, 2
Boron	B	5	2	3			2, 3
Carbon	C	6	2	4			2, 4
Nitrogen	N	7	2	5			2, 5
Oxygen	O	8	2	6			2, 6
Fluorine	F	9	2	7			2, 7
Neon	Ne	10	2	8			2, 8
Sodium	Na	11	2	8	1		2, 8, 1
Magnesium	Mg	12	2	8	2		2, 8, 2
Aluminium	Al	13	2	8	3		2, 8, 3
Silicon	Si	14	2	8	4		2, 8, 4
Phosphorus	P	15	2	8	5		2, 8, 5
Sulphur	S	16	2	8	6		2, 8, 6
Chlorine	Cl	17	2	8	7		2, 8, 7
Argon	Ar	18	2	8	8		2, 8, 8
Potassium	K	19	2	8	8	1	2, 8, 8, 1
Calcium	Ca	20	2	8	8	2	2, 8, 8, 2

Geometrical representation of few elements are as follows



§§ ***Atomic number:***

The number of protons is considered as atomic number and in case of neutral atom, electron number is also considered as atomic number.

Atomic number(Z)= protons number (or) electrons number

ILLUSTRATIONS

Illustration -1

Name the two elements present in bones and a write atomic number.

Solution : Phosphorus, calcium

Atomic Numbers= 15,20

Stability:

If any atom contains eight electrons in its outermost { octet nature} is considered as stable atom. So every atom tries to acquire eight electrons in the outermost orbit. This is called as *octet rule*.

In this process some atoms lose its electron and some atoms gain electrons to form stable ions.

Illustration -2

How many electrons present in M shell

Solution : Maximum number of electrons in shell $=2n^2$

$n=3$

$2n^2$

$2(3)^2$

$2 \times 9 = 18$ electrons

TEACHING TASK

I) MCQ's with single correct answer :

1. Which of the valence orbit in case of potassium

A) 4 C) 3 C) 2 D) 1

2. Number of valence electrons present in carbon

A) 1 B) 2 C) 3 D) 4

3. Maximum number of valence electrons present in the atom from the following

A) Nitrogen B) Oxygen C) Carbon D) Chlorine

4. The electronic configuration of an element X is 2, 8.

A) O_2 B) H_2 C) Cl D) Ne

5. Find the no. of neutrons in sulphur

A) 36 B) 16 C) 18 D) 20

6. The stable atom is

A) O_2 B) H_2 C) Cl D) Ne

7. The maximum of electrons which can be present in any shell of an atom is given by the formula

A) 2n B) $2n^2$ C) 3n D) n

8. The electrons in the shell close to nucleus are held strongly by the electric pull of protons these electrons are called

A) Valency electrons B) Free electrons

C) Bond electrons D) Bind electrons

9. Distribution of electrons revolving around the nucleus of an atom in different orbits is called

A) Electronegativity B) Electro positivity

C) Electorn effinity D) Electronic configuration

II) Multi correct answer type :

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

10. Which of the following symbols of elements are correct?

A)Mercury - Hg B)Sodium - S C) Potassium - K D) Fluorine - F

11. Which of the following elements following latin names

A)Sodium B) Potassium C) Iron D) Mercury

12. The orbits present in atom

A) k-shell B) B-shell C) M-shell D) L- shell

III) Comprehension Type

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which **ONLY ONE i**s correct. Choose the correct option.*

As we have discussed above that there are a number of shells present in atom.These are numbered as 1, 2, 3, 4, …, 250 and so on or K, L, M, N, … 250 on respectively. As we move outwards from the nucleus and the electrons are present in these shells.The distribution (arrangement) of the electrons in the different energy shells of the atom is known as the electronic configuration of that element.

13. The general configuration for Phosphorus is

A) 2,8,3 B) 2,8,5 C) 2,8,7 D) 2,8,6

14. The number of electrons that can be accomodated in M shell is

A) 36 B) 18 C) 8 D) 32

V) Match the following

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

15.

COLUMN -I	COLUMN -II
1) Oxygen	a)2,8,7
2) Neon	b)2,8,2

3)Magnesium c) 2,8
4) chlorine d) 2,6

16. **Element Name** **Valency electrons**
1) Fluorine a) 2
2) Aluminium b) 6
3)Sulphour c) 3
4) Calcium d) 7

KEY

SECTION-I							
1-A 2-D	3-D	4-D	5-B	6-D	7-B	8-D	9-D
SECTION-II							
10-A,C,D	11-A,B,C,D	12-A,C,D					
SECTION-III							
13-B	14-B						
SECTION-IV							
15-d,c,b,a	16-d,c,b,a						

LEARNER'S TASK

BEGINNERS (Level - I)

I) **MCQ's with single correct answer :**

1. Maximum number of electrons present in 3rd orbit of an atom
A) 3 B) 18 C) 8 D) 32

2. Configuration of calcium
A) 2, 8, 8 B) 2, 8, 2 C) 2, 8, 8, 2 D) 2, 8, 18

3. Magnesium will attain which element's configuration for its stability
A) He B) Mg C) Ne D) Ar

4. Configuration of the atom if is electrons are these in the atom
A) 2, 8, 3 B) 2, 2, 8, 1 C) 2, 7, 4 D) 2, 8, 2, 1

5. How many electrons should be share in the third shell, of an neutral atom, if its proton number is 7.
A) 7 B) 8 C) 18 D) 0

6. There are seven electrons in third orbit of a neutral atom by filling the before two orbits according to Bohr-Bury's formula. Then what is the atomic number of atom.
A) 7 B) 17 C) 18 D) 8

7. Maximum number of electrons that can be accomodated in M shell
A) 2 B) 8 C) 18 D) 32

8. Which of the following shells can be accomodated 32 electrons
A) K B) L C) M D) N

9. The symbol used to represent atomic number
A) Z B) A C) Y D) K

10. The formula used to find the no. of neutrons is
A) M - Z B) A - Z C) $2n^2$ D) None

11. The atomic number of sodium element is
A) 11 B) 22 C) 14 D) 32

12. Sn is the symbol of
A) Tin B) Antimony C) Sulphur D) Ferrus

13. The symbol H_2 means
A) One atom of hydrogen B) Two atoms of nascent hydrogen
C) Two molecules of hydrogen D) One molecule of hydrogen

14. The number of un paired electrons present in Cr
A)4 B) 6 C) 5 D)3

15. The electronic configuration of scandium (Sc)
A) $(Ar)4s^23d^1$ B) $(Ar)4s^13d^2$ C)$(Ar)4s^23d^2$ D)None

16. The element similar to carbons
A) Pb B)Mn C) Mg D) Ga

17. Latin Name of Mercury.
A)Hydragyrum B) Hydro C) Argentum D)All

18. The atomicity of sulphur is
A) 8 B) 2 C) 4 D)3

19. Latin Name of Tin
A)Stibium B) Stanum C) Aurum D) Ferrum

20. The atomicity of phosphorous is
A) 8 B)4 C) 2 D) 1

21. How many electrons present in N-Shell
A)32 B)18 C)8 D)All

ACHIEVERS (Level - II)

Fill in the blanks :

Element	Symbol	Atomic No. (No. of electrons)	Distribution of electrons in different shells				Short representation of electronic configuration
			K	L	M	N	
Beryllium	Be	_____	2	2			2,2
Aluminium	Al	13	2	8	3		_____
_____	Si	14	2	__	4		2,8,4
_____	P	15	2	__	5		2,8,5
Sulphur	S	16	2	8	6		_____
Chlorine	Cl	_____	2	8	7		2,8,7
_____	Ar	18	2	__	8		2,8,8
Potassium	K	19	2	8	__	1	_____
Calcium	Ca	20	2	8	8	2	2,8,8,2

EXPLORERS (Level - III)

I) MCQ's with more than one correct answer

*This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D),out of which **ONE or MORE** is correct. Choose the correct options*

1. Which of the following elements belongs to L - Shell

A) H B) C C) O D) Ne

2. The isotopes of hydrogen are

A) $_1P^1$ B) $_1D^2$ C) $_6C^{13}$ D) $_1T^3$

3. Which of the following statement is correct reg. Argon

A) Its general configuration is 2,8,7

B) atomic number is 18

C) It is a Noble gas

D) Its symbol is "ar"

4. Which of the following statement is wrong

A) Atomic number of Sodium is 11

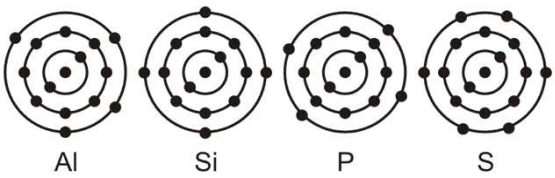
B) Symbol of Chlorine is "Ca"

C) General configuration of Silicon is 2,8,4

D) L-Shell can accomodate a maximum of 18 electrons

II) **Comprehension type**

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which **ONLY ONE i**s correct. Choose the correct option.*



5. The number of electrons present in sulphur

A) 16 B) 18 C) 14 D) 17

6. Number of protons present in Phosphorus is equal to its

A) Atomic number B) Valence electrons C) Both 1 & 2 D) None

III) Reason and Assertion type

- *This section contains certain number of questions. Each question contains Statement – 1 (Assertion) and Statement – 2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct Choose the correct option.*

A) Both statement I and statement II are true.
B) Both statement I and statement II are false.
C) statement I s true and statment II is false.
D) statement I s false and statment II is true.

7. **Assertion :** The path of rotation of electron is called as orbit.

Reason : Orbits are designated by K,L,M,N.....

8. **Assertion** : General configuration of neon is 2,8,8

Reason : Neon is a rare gas

9. **Assertion :** Atomic number of carbon is "6"

Reason : The number of protons is considered as atomic number and in case of neutral atom, electron number is also considered as atomic number.

V) Match the following :

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

24.	**Elements**	**Valency electrons**
	a) Oxygen	1) 1
	b) Flourine	2) 5
	c) Phosphorous	3) 6
	d) Hydrogen	4) 7

KEY

ΦΦ TEACHING TASK :

BEGINNERS LEVEL KEY										
1-B	2-C	3-C	4-A	5-D	6-B	7-C	8-D	9-A	10-B	11-A
12-A	13-D	14-B	15-A	16-A	17- A,	18-A,	19-B,	20-B	21-A	
EXPLORERS LEVEL KEY										
1--B,C,D	2-A,B,D	3-B,C	4-B,D	5-A	6-A	7-B	8-C	9-A	a-3,b-4,c-2,d-1	

§§ VALENCY :

The combining power of an element is know as "Valency".The number of electrons donated or accepted by an atom of an element so as to have eight electrons in its outermost orbit, is called as valency.

When an atom looses or gains electron it converts into an **"ion"**

§§ Types of ions :

Ions are two types depending upon the nature of the charge carried by them. They are Electro positive ions or cations and Electronegative ions or anions.

¶¶ ***Positive valency (Electropositive ions):***

If the atom donates its electrons from its outermost orbit to get stability, the valency is called as positive valency and the that ion is called as cation.

If it donates one electron or two electrons or three electrons is called as monovalent positive valency or divalent positive valency or trivalent positive valency respectively.

Example: Na^+, Ca^{2+}, Al^{3+}, NH_4^+

Monovalent electropositive ions

Monovalent Electopositive ions		
Name of Element	**Cation Symbol**	**Charge on cation**
Hydrogen	H^+	+1
Lithium	Li^+	+1
Sodium	Na^+	+1
Potassium	K^+	+1
Rubidium	Rb^+	+1
Copper	Cu+ Cuprous or Copper (I)	+1
Silver	Ag^+	+1
Gold	Au^+ Aurous or gold (I)	+1
Mercury	Hg^{+1} Mercurous or Mercury (I)	+1
Ammonium	NH_4^+	+1
Phosphonium	PH_4^+	+1

§§ Divalent electropositive ions

Divalent Electropositive ions are formed by loosing two electrons and has a charge of+2

Bivalent Electopositive ions		
Name of Element	**Cation Symbol**	**Charge on cation**
Beryllium	Be^{2+}	+2
Magnesium	Mg^{2+}	+2
Calcium	Ca^{2+}	+2
Strontium	Sr^{2+}	+2
Barium	Ba^{2+}	+2
Radium	Ra^{2+}	+2
Nickel	Ni^{2+}	+2
Manganese	Mn^{2+} Manganous or Manganese (II)	+2
Cadmium	Cd^{2+}	+2
Zinc	Zn^{2+}	+2
Tin	Sn^{2+} Stannous or Tin (II)	+2
Chromium	Cr^{2+} Chromous	+2
Cobalt	Co^{2+} Cobaltous of Cobalt (II)	+2
Mercury	Hg^{2+} Mercuric or Mercury (II)	+2
Lead	Pb^{2+} Plumbous or lead (II)	+2

§§ Trivalent electropositive ions

Trivalent Electropositive ions are formed by loosing two electrons and has a charge of +3

Trivalent Electopositive ions		
Name of Element	**Cation Symbol**	**Charge on cation**
Boron	B^{3+}	+3
Aluminium	Al^{3+}	+3
Antimony	Sb^{3+} Antimonous or Antimony (III)	+3
Arsenic	As^{3+} Arsenous or Arsenic (III)	+3
Chromium	Cr^{3+}	+3
Manganese	Mn^{3+} Manganic or Manganese (III)	+3
Iron	Fe^{3+} Ferric or Iron (III)	+3
Cobalt	Co^{3+} Cobaltic or Cobalt (III)	+3
Gold	Au^{3+} Auric or gold (III)	+3

§§ **Tetravalent electropositive ions**

Tetravalent Electropositive ions are formed by loosing two electrons and has a charge of +4

Tetravalent Electopositive ions		
Name of Element	**Cation Symbol**	**Charge on cation**
Lead	Pb^{4+} Plumbic or Lead (IV)	+4
Tin	Sn^{4+} Stannic or Tin (IV)	+4
Platinum	Pt^{4+} Platinic or Platinum (IV)	+4

¶¶ ***Variable electropositive valency:***

They are some elements which show different valencies in differtent compounds if the elements shows more than one valency in its compounds then the element is said to exhibit variable valency.

Examples:

1. The valency of Fe in $FeCl_2$ is 2 and that of $FeCl_3$ is 3
2. In Cu_2Cl_2 and $CuCl_2$ the valency of Cu is 1 and 2

How to name the element with two different valencies

The compound in which the element shows the higher valency is indicated by the suffix - **ic**, while the compound in which the element shows the lower valencies is indicated by the suffix -**ous**

Exmples :-

Iron exhibit two valencies 2 and 3

Iron in its lower valency 2 is named as **ferrous**

Iron in its higher valency 3, is named as **ferric**

§§ **Negative valence :**

Non metals tend to take electrons from other elements so as to have eight electrons in their outermost orbit. The number of electrons accepted by an atom of an element is its negative valency.

An ion or radical formed by the accepted of one electron or two electrons or three electrons for its stability is called as monovalent negative ion or divalent negative ion or trivalent negative ion respectively.

Example: $Cl^-, O^{2-}, N^{3-}, SO_4^{2-}, O_2^{2-}$

Monovalent Electronegative ions		
Name of the anion	**Symbol**	**Charge**
Fluoride	F^-	–1
Chloride	Cl^-	–1
Bromide	Br–	–1
Iodide	I^-	–1
Hypochlorite	ClO^-	–1
Iodate	IO_3^-	–1
Nitrite	NO_2^-	–1
Nitrate	NO3-	–1
Bicarbonate or Hydrogen Carbonate	HCO_3^-	–1
Bisulphate	HSO_4^-	–1
Bisulphite or Hydrogen Sulphite	HSO_3^-	–1
Bicarbonate or Hydrogen Carbonate	HCO3-	–1
Acetate	CH_3COO^- or $C_2H_3O_2^-$	–1
Formate	$HCOO^-$ or CHO_2^-	–1
Hypophosphite or Dihydrogen phosphate	$H2PO_2^-$	–1
Cyanide	CN^-	–1
Thiocyanate / Sulphocyanide	SCN^-	–1
Permanganate	MnO_4^-	–1
Hydride	H^-	–1
Hydroxide	OH^-	–1
Superoxide	O_2^-	–1
Hydrogen peroxide	HO_2^-	–1

Divalent Electronegative ions		
Name of Anion	**Symbol**	**Charge**
Sulphide	S^{2-}	-2
Sulphite	SO_3^{2-}	-2
Sulphate	SO_4^{2-}	-2
Oxide	O^{2-}	-2
Peroxide	O_2^{2-}	-2
Carbonate	CO_3^{2-}	-2
Chromate	CrO_4^{2-}	-2
Dichromate	$Cr_2O_7^{2-}$	-2
Manganate	MnO_4^{2-}	-2
Oxalate	$C_2O_4^{2-}$	-2
Zincate	ZnO_2^{2-}	-2

Trivalent Electronegative ion		
Name of Anion	**Symbol**	**Charge**
Aluminate	AlO_3^{3-}	-3
Arsenate	AsO_4^{3-}	-3
Boride	B^{3-}	-3
Nitride	N^{3-}	-3
Phosphide	P^{3-}	-3
Borate	BO_3^{3-}	-3
Phosphite	PO_3^{3-}	-3
Phosphate	PO_4^{3-}	-3

ILLUSTRATIONS

Illustration -2

Explain the variable valencies of phosphorous

Solution : Phosphorous shows two valencies they are 3,5.

Becuase of phosphorous shows three unpaired electrons in first excited state so valency is 3.

Phosphorous shows five unpaired electrons in secound excited state.So valency is 5

Illustration 3: If in an element X there are seven electrons present in its outer most orbit then it is a .....

Solution : it is an example of halogens , X=9

electronic configuration = $1s^2 2s^2 2p^5$

It is a flourine and non metal

TEACHING TASK

I) MCQ's with single correct answer

1. Fe^{3+} will be pronounced as

A) Ferrous B) Irum C) Ferric D) Ironic

2. Which of the following contains positive charge

A) Ammonium B) Nitrogen C) Oxide D) Argon

3. What is valency and valence electrons in nitride ion ?

A) 3, 5 B) 5, 8 C) 3, 8 D) 8, 8

4. Reason for variable valency

A) Outer orbit contains different electrons in different conditions

B) Along with valence electrons, inner electrons also participate under such conditions

C) Nuclear charge changes, so attraction decreases in certain conditions

D) All the above

5. Negative valency refers

A) Protons and neutrons are equal

B) Atom lost electrons

C) Atom gained electrons

D) Motion number is more than electron number

6. The valency of hydrogen is one in NH_3. What is the valency of nitrogen

A) 1 B) 2 C) 3 D) 4

7. The valency of phosphate radical is

A) 2 B) 3 C) 4 D) 5

8. The valency of nitrogen is

A) 1 B) 3 C) 5 D) both B, C

9. What is the symbol for the nitrate ion ?

A) NO^- B) NO_2^- C) NO_3^- D) NO_2^{3-}

10. The valency of carbon is

A) 1 B) 2 C) 3 D) 4

II) MCQ's with more than one correct answer

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

11. The valency of copper

A)+1 B)+2 C)-1 D)-3

12. Which of the following elements having valancy 3

A)chromium B)aluminium C)nitrogen D)phosphorous

13. valency is a

A) Number of electrons gained B)Number of electrons lost

C) Number of electrons shared D) Valency electrons

14. which of the following is a radical

A) Sulphate B)Phosphate C)Ammonium D) Sodium

15. which are divalent electrolent radical

A) Oxide B) Sulphide C)Zincate D)sodium

V) Match the following

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

  *If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

22. A) carbon 1) trivalent

B) hypochlorite 2) monovalent
C) sulphate 3) divalent
D) borate 4) tetravalent

KEY

SECTION-I									
1-C	2-A	3-C	4-D	5-C	6-C	7-B	8-B	9-C	10-D
Section-II					SECTION-III				
11. A,B	12-B,C,D	13-A,B	14-A,B,C	15-A,B,C	22-a-4,b-2,c-3,d-1				

LEARNER'S TASK

BEGINNERS (Level - I)

I) **MCQ's with single correct answer :**

1. The valency of lead is
A) +2 B) + 4 C) + 3 D) A & B

2. Which element occurs in free state in nature.
A) Fe B) CO C) Pt D) Ni

3. The metalloid amongest the following is
A) As B) Na C) Au D) Fe

4. The volatile metal is
A) Ag B) Cu C) Na D) Fe

5. Ferrous ion is
A) monovalent B) divalent C) trivalent D) None

6. In which of the following does manganese have an oxidation state of +4.
A) Mn_2O_3 B) Mn_2O C) Mn_2O_3 D) MnO_2

7. Valency of Nitride
A) +3 B) -3 C) +2 D) -2

8. Symbol for mercury
A) Mc B) Hg C) Mr D) My

9. Valency of the positive radical ammonium
A) 2 B) 3 C) 1 D) 0

10. One valency of copper is +1, the other one is
A) +2 B) +1 C) 0 D) +3

11. What is having the highest negative valency among the following
A) Nitrate B) Sulphate C) Oxide D) Carbide

12. Valence electrons and valency respectively in calcium
A) 2, 1 B) 2, 2 C) 8, 2 D) 2, 8

13. Formula for sulphate ion

A) SO_4^{2-} B) SO_3^{2-} C) SO_2^{2-} D) SO_4^{-}

14. The bivalent ion among the following is

A) Nitride B) Phosphade C) Antimony D) Sulphate

15. Identify tetra valent ion

A) Ferry cyanide B) Ferro cyanide C) Carbide D) Hydride

16. Which of the following is Monovalent anion

A) Acetate B) Oxide C) Zincate D) Nitride

17. Two atoms of hydrogen combine with one atom of oxygen to form a molecule of water. The valency of hydrogen is

A) 3 B) 1 C) 2 D) 4

ACHIEVERS (Level - II)

Descriptive type questions :

1. Write the symbols of following ions

A) Stannus B) Cobaltous C) Auric D) Platinic

2. Write about Electropositive cations and Electronegative anions

3. Write about variable valancy

4. Write three examples each for bivalent and trivalent electronegative ions

5. Write four differenes between Cations and Anions

EXPLORERS (Level - III)

I) MCQ's with more than one correct answer :

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

1. Which of the following has same valency

A) Sodium B) Ammonium C) Mercurus D) Plumbus

2. Which of the following Tri valent species

A) Ferric B) Manganese C) Arsenic D) Plumbic

3. Stability atom depends on

A) Octet configuration B) Energy C) Size D) proton numbe

4. Radicals are formed by

A) Single atoms only B) Two atoms of same element

C) Two atoms of different elements D) Loosing or gaining of electrons

5. Which of the followig startements are incorrect

A) Symbol of Chromate ion is CrO_4^{2-}

B) Symbol of Permanganate is MnO_4^{-}

C) Symbol of Oxalate ion is $C_2O_4^{-}$

D) Symbol of Acetate ion is CH_3COO^{-}

6. Which of the followig startements are correct

A) The valency of Fe in $FeCl_2$ is 2

B) In Cu_2Cl_2 and $CuCl_2$ the valency of Cu is 2 and 1

C) Valency of $FeCl_3$ is 3

D) All are incorrect

Reason and Asserton type

- *This section contains certain number of questions. Each question contains Statement – 1 (Assertion) and Statement – 2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct Choose the correct option.*

A) Both statement I and statement II are true.
B) Both statement I and statement II are false.
C) statement I s true and statment II is false.
D) statement I s false and statment II is true.

7. **Assertion :** Short hand notation of an element is called Symbol

Reason : Symbol of Argon is As

8. **Assertion :** Atom gains electron to become an electronegative ion

Reason : Symbol of Dichromate ion is $Cr_2O_7^{2-}$

Comprehension type

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which **ONLY ONE i**s correct. Choose the correct option.*

They are some elements which show different valencies in differtent compounds if the elements shows more than one valency in its compounds then the element is said to exhibit variable valency.

9. The valency exhibited by Iron are

A) 2 B) 3 C) Both D) None

10. Iron in its lower valency is named as

A) Ferrous B) Ferric C) Iron (III) D) None

II) ***Match the following:***

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

11.

Column - I	***Column - II***
a) carbide	1) one
b) Ferric	2) two
c) carbonate	3) three
d) Chloride	4) four

12.

Column - I	***Column - II***
a) Cation	1) NH_4^+
b) Anion	2) N^{3-}
c) Stable	3) CO_3^{2-}
d) compound	4) NH_3

KEY

BEGINNERS LEVEL KEY									
1-A	2-D	3-A	4-C	5-B	6-D	7-B	8-B	9-C	10-A
11-D	12-B	13-A	14-D	15-C	16-A	17-B			
EXPLORERS LEVEL KEY									
1-A,B,C	2-A,B,C	3-A,C	4- A, B,C,D	5-A,B	6-A,C	7-C	8-B	9-C	10-A
8- a-4,b-3,c-2,d-1	9- a-1,b-3,c-2,d-4								

§§ **FORMULA OF COMPOUND :**

Write the symbolic representation of one molecule of a compound representing the number of atoms of various elements present in it is called formula of the compound.

§§ ***Criss - cross Method:***

Step I: Write the symbol of positive ion or radical to the left side and for the negative ion or radical to the right side.

Step II: Put the valency number of each radical or ion on its top right. Divide the valency numbers by highest common factor, if any, to get simple ratio. Now ignore (+) and (-) symbols. Interchange the valency numbers of radicals or ions as once superscript to others subscript and vice versa.

Step III: If the radicals receives a number more than one, enclose it within brackets. Donot enclose ions in brackets.

Example 1 : **Step I:** Ca^{2+}, Cl^- **Step II:** $Ca^{2}\times^{1}Cl$ **Step III:** $CaCl_2$.

Example 2: **Step I:** Mg^{2+}, OH^- **Step II:** $Mg^{2}\times^{1}OH$ **Step III:** $Mg(OH)_2$.

§§ ***Information from the formula of a compound:***

When a numeral is written on the left hand side before the formula, it represents number of molecules of the compound.

Example: 2NaCl, 4ZnO etc.

When the numeral is written on the right bottom side of the symbol, it represents the number of atoms in one molecule of a compound .

Example: $Al_2(SO_4)_3$.

In this 2 atoms of aluminium , 3 atoms of sulphur and 12 atoms of oxygen are present.

It is able to calculate its molecular weight by looking at a molecular formula.

§§ ***Atomicity:***

Number of atoms present in a molecule of an element is called as atomicity.

Mono atomic molecules - All Noble gases[He,Ne, Ar, Xe, Kr, Rn]

Diatomic molecules - Hydrogen [H_2], Oxygen[O_2], Nitrogen[N_2],

Chlorine[Cl_2], Bromine,[Br_2], Iodine[I_2],

Tri atomic molecules - Ozone[O_3],

Tetra atomic molecules - Phosphorous[P_4],

Octa atomic molecules - Sulphur[S_8],

§§ **Isoelectronic:**

Isoclectronics species are elements or ions tht have the same or equal number of electrons

$C^{-4} > N^{-3} > O^{-2} > F^{-} > Ne > Na^{+} > Mg^{+2} > Al^{+3} > Si^{+4}$

TEACHING TASK

I) MCQ's with single correct answer

1. By using criss-cross method, the formula may obtain for oxide and potassium is

A) K_2O_3 B)K_2O_2 C) K_2O D) KO

2. Number of electrons present in ammonium ion are

A) 9 B) 10 C) 11 D) 12

3. Isoelectronic with O^{2-} is

A) CH_4 B) Al^{3+} C) Mg^{2+} D) all

4. To form a molecule of Aluminium nitride, how many aluminium and nitrogen atoms are required respectively

A) 2, 3 B) 3, 2 C) 2, 2 D) 1, 1

5. Formula for the radicals magnesium and sulphide

A) Mg_2S_3 B) MgS C) Mg_3S_2 D) MgS_2

6. Outermost shell of two elements X and Y have three and five electrons respectively. If they combine expected formula of the compound will be

A) XY B) X_2Y C) X_3Y_4 D) X_2Y_3

7. Molecular weight of $MgCO_3$

A) 74 B) 84 C) 72 D) 68

8. The chemical formula of photassium super oxide is

A) KO_2 B) K_2O C) K_2O_2 D) KO

9. Chemical formula for calcium sulphate is $CaSO_4$. The formula for ferric sulphate will be:

A) $Fe_2(P_2O_7)_3$ B) $Fe_4P_3O_{14}$ C) $Fe_2(SO_4)_3$ D) Fe_3PO_4

10. Select the correct formula for each of the following compounds:

i) Calcium carbonate

ii) Calcium hydrogen carbonate

	(i)	(ii)		(i)	(ii)
A)	$Ca(OH)_2$	$CaCO_3$	B)	$CaCO_3$	$Ca(HCO_3)_2$
C)	$CaCO_3$	$Ca(OH)_2$	D)	$Ca(HCO_3)_2$	$Ca(OH)_2$

11. A metal M forms a compound M_2HPO_4. What will be the formula of the metal sulphate?

A) M_2SO_4 B) $M_2(SO_4)_3$ C) MSO_4 D) $M(SO_4)_3$

II) MCQs with more than one answer:

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D),out of which **ONE or MORE** is correct. Choose the correct options*

12. In which of the following compounds metal is having valency 1?

A) NaCl B) LiCl C) $MgCl_2$ D) CsCl

13. which of the following are di atomic molecules?

A)Cl_2 B)Br_2 C)I_2 D)O_2

III) Match the following

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

  *If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

20.

Column-I	**Column -II**
a) Hg_2CI_2	1)Manganous sulphate
b) $Ca(OH)_2$	2)Sodium dichromate
c) $MnSO_4$	3)Calcium hydroxide
d) $Na_2Cr_2O_7$	4) Mercurous chloride
	5) Nickel bisulphate

KEY

Section-I										
1-C	2-B	3-D	4-D	5-B	6-A	7-B	8-A	9-C	10-B	11-A

Section-II	Section-III
1-A,B,D	2-A,B,C,D	1-a-4,b-3,c-1,d-2
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LEARNER'S TASK

ACHIEVERS (Level - II)

I) MCQ's with single correct answer

1. Number of electrons transfer takes place from magnesium to oxygen in the formation of magnesium oxide.

A) 4 B) 3 C) 2 D) 1

2. Name of the molecule that will form from two sodium atoms, one carbon atom and three oxygen atoms

A) Sodium Oxide B) Sodium Carbon trioxide

C) Sodium Carbonate D) Sodium Carbon dioxide

3. The atomicity of phosphorous is

A) 4 B) 8 C) 2 D) 1

4. The chemical formulae of a compound shows the

A) arrangement of atoms in the compound
B) mass of atoms in each of its molecule
C) number of atoms that have chemically combined in a molecule
D) number of atoms that have been mixed physically mixed in a molecule.

5. Molecular weight of water is
A) 28 B) 18 C) 8 D) None

6. The number of oxygen atoms in $Pb(NO_3)_2$ are
A) 2 B) 3 C) 5 D) 6

7. The number of oxygen atoms in sulphur dioxide is
A) 1 B) 2 C) 3 D) 4

8. The ratio of hydrogen and oxygen in water is
A) 1 : 2 B) 2 : 1 C) 4 : 1 D) 1 : 4

9. Formula for calcium carbonate is
A) $CaCO_3$ B)$CaHCO_3$ C) Na_2CO_3 D)$CuCO_3$

10. That symbol of lead is
A) Pb B) Cu C) Ag D) Au

11. A formula has
A) Qualitative significance only
B) Quantitative significance only
C) Both qualitative and quantitative significance. D) None of these

12. What is the formula of hydrochloric acid
A) HC*l* B) H_2 C) Cl_2 D) H_2SO_4

13. The symbolic representation of actual number of atoms in molecule is called
A) Valency B) Formula C) Both 1 & 2 D) Ion

14. The chemical formula of water is:
A) H_2O_2 B) H_2O C) O_2 D) H_2

15. The valency of tin in $SnCl_2$ is A_____ and $SnCl_4$ is B_____.

	A	B		A	B
A)	2	4	B)	4	2
C)	1	1	D)	2	2

16. Identify the right chemical formula for the following compounds.
i) Calcium sulphate ii) Magnesium oxide iii) Potassium nitrite

	i	*ii*	*iii*
A)	$Ca(HSO_4)_2$	MgO	KNO_3
B)	$CaSO_4$	MgO	KNO_2
C)	CaS	Mg_2O_2	KNO_3

D) None of the above

17. Sodium phosphate has the chemical formula
A) $Na_2P_2O_7$ B) Na_3PO_4 C) $Na_4P_2O_7$ D) Na_3PO_3

18. Correct formula of a trivalent metal nitride is:
A) M_3N_2 B) M_3N_3 C) MN D) Both 2 and 3

ACHIEVERS (Level - II)

Descriptive type questions :

1. A metal Ca forms a compound [$Ca_2P_2O_7$] Calcium pyro phosphate. Predict the formula of the Ferric pyrophosphate by criss cross method?

2. The formula of a metal phosphate is MPO_4. The formula of its nitrate according to criss cross method?

3. The atomicity of Ar is.....?

4. What is the molecular weight of tetra atomic phosphorus & Octa atomic Sulphur

5. Calculate the number of electrons in NH_3,CH_4 & N^{-3} species?

EXPLORERS (Level - III)

I) MCQ's with more than one correct answer

*This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D),out of which **ONE or MORE** is correct. Choose the correct options*

1. The information that you can observe from a formula

A) number of atoms B) shape of the molecule

C) molecular weight D) colour

2. Identify the atoms that which can form negative valencies

A) chlorine B) berylium C) oxygen D) nitrogen

3. Identify the elements which can form variable valency

A) oxygen B) copper C) Iron D) Flourine

4. Which contain same electron number from the following

A)H_2 B)He C) Li^+ D) Na^+

5. The atoms that will donate electrons for their stability

A) Na B) Li C) N D) Ca

6. The compounds that can form using two carbons one oxygen and six hydrogen from the following are

A) C_2H_5OH B) CH_3CHO C) CH_3CH_2O D) CH_3-O-CH_3

7. Which of the following contain same valence electrons

A) Argon B) Neon C) Magnesium ion D) Oxide ion

8. Which following contain same number as valence orbit

A) Sulphur (16) B) Oxygen (8) C) Silicon (14) D) Argon (18)

9. Identify the correct statement

A) The representation of a molecule of a substance (element or compound) in terms of symbols and subscript numbers is known as the formula.

B) Atoms of different elements combine in certain fixed ratio to form a compound.

C) All chemical compounds are represented by their respective formulae.

D) None of the above.

10. Which of the following formula is having 2 atoms?

A) HCl B) $HgCl_2$ C) CaO D) $CaCO_3$

II) Comprehension Type

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which **ONLY ONE i**s correct. Choose the correct option.*

The representation of a molecule of a substance in terms of symbols & subscripts numbers is known as formule. The representation of a molecule of a substance (element or compoun4) in terms of symbols and subscript numbers is known as the formula.

11. A metal M forms a compound MPO_4. What will be the formula of the metal sulphate?
A) M_2SO_4 B) $M_2(SO_4)_3$ C) MSO_4 D) $M(SO_4)_3$

12. Chemical formula for sodium sulphate is Na_2SO_4. The formula for trivalent metal sulphate will be:
A) $M_2(P_2O_7)_3$ B) $M_4P_3O_{14}$ C) $M_2(SO_4)_3$ D) M_3PO_4

13. The phosphate of a metal has the formula MPO_4. The formula of its nitrate will be:
A) MNO_3 B) $M_2(NO_3)_2$ C) $M(NO_3)_2$ D) $M(NO_3)_3$

III) Match the following

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*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

14.

Column-I	**Column-II**
a) Mercurous chloride	1) $PbCrO_4$
b) Lead chromate	2) $CaOCl_2$
c) Solid carbondioxide	3) CO_2
d) Calcium oxychloride	4) Hg_2Cl_2
	5) H_2SO_4

KEY

BEGINNERS LEVEL KEY									
1-C	2-C	3-A	4-C	5-B	6-D	7-B	8-B	9-A	10-A
11-C	12-A	13-B	14-B	15-A	16-B	17-B	18-D		
EXPLORERS LEVEL KEY									
1-A,C	2-A,C,D	3-B,C	4-A,B,C	5-A,B,D	6-A,D	7-A,B,C,D	8-A,C,D	9-A,B,C	10-A,C
11-B	12-C	13-D	14- a-4,b-1,c-3,d-2						