

# Basic Inorganic Nomenclature

## Section (A) : Oxidation number

### Th-1 Oxidation Number

- It is an imaginary or apparent charge developed over atom of an element when it goes from its elemental free state to combined state in molecules.
- It is calculated on the basis of an arbitrary set of rules.
- It is a relative charge in a particular bonded state.
- In order to keep track of electron-shifts in chemical reactions involving formation of compounds, a more practical method of using oxidation number has been developed.
- In this method, it is always assumed that there is a complete transfer of electron from a less electronegative atom to a more electronegative atom.

### Rules governing oxidation number

The following rules are helpful in calculating oxidation number of the elements in their different compounds. It is to be remembered that the basis of these rule is the electronegativity of the element.

- **Fluorine atom :**  
Fluorine is most electronegative atom (known). It always has oxidation number equal to  $-1$  in all its compounds
- **Oxygen atom :**  
In general and as well as in its oxides, oxygen atom has oxidation number equal to  $-2$ .  
**In case of**  
(i) peroxide (e.g.  $\text{H}_2\text{O}_2$ ,  $\text{Na}_2\text{O}_2$ ) is  $-1$ ,  
(ii) super oxide (e.g.  $\text{KO}_2$ ) is  $-1/2$   
(iii) ozonide (e.g.  $\text{KO}_3$ ) is  $-1/3$   
(iv) in  $\text{OF}_2$  is  $+2$  & in  $\text{O}_2\text{F}_2$  is  $+1$
- **Hydrogen atom :**  
In general, H atom has oxidation number equal to  $+1$ . But in metallic hydrides (e.g.  $\text{NaH}$ ,  $\text{KH}$ ), it is  $-1$ .

### ● HALOGEN ATOM :

In general, all halogen atoms (Cl, Br, I) have oxidation number equal to  $-1$ .

But if halogen atom is attached with a more electronegative atom than halogen atom, then it will show positive oxidation numbers.

e.g.  $\overset{+5}{\text{K}}\overset{+5}{\text{ClO}}_3$ ,  $\overset{+5}{\text{H}}\overset{+5}{\text{IO}}_3$ ,  $\overset{+7}{\text{H}}\overset{+7}{\text{ClO}}_4$ ,  $\overset{+5}{\text{K}}\overset{+5}{\text{BrO}}_3$

### ● METALS :

(a) Alkali metal (Li, Na, K, Rb ..... ) always have oxidation number  $+1$ .

(b) Alkaline earth metal (Be, Mg, Ca ..... ) always have oxidation number  $+2$ .

(c) Aluminium always has  $+3$  oxidation number.

**Note :** *Metal may have positive or zero oxidation number*

- Oxidation number of an element in free state or in allotropic forms is always zero

e.g.  $\overset{0}{\text{O}}_2$ ,  $\overset{0}{\text{S}}_8$ ,  $\overset{0}{\text{P}}_4$ ,  $\overset{0}{\text{O}}_3$

- Sum of the oxidation numbers of atoms of all elements in a molecule is zero.
- Sum of the oxidation numbers of atoms of all elements in an ion is equal to the charge on the ion.
- If the group number of an element in modern periodic table is  $n$ , then its oxidation number may vary from

$(n - 10)$  to  $(n - 18)$

**(but it is mainly applicable for p-block elements)**

e.g. N-atom belongs to 15<sup>th</sup> group in the periodic table, therefore as per rule, its oxidation number may vary from  $-3$  to  $+5$ .

$\overset{-3}{\text{N}}\text{H}_3$ ,  $\overset{+2}{\text{N}}\text{O}$ ,  $\overset{+3}{\text{N}}_2\text{O}_3$ ,  $\overset{+4}{\text{N}}\text{O}_2$ ,  $\overset{+5}{\text{N}}_2\text{O}_5$

- The maximum possible oxidation number of any element in a compound is never more than the number of electrons in valence shell. (but it is mainly applicable for p-block elements)

**Table-1**  
List of common oxidation state of an element of periodic table,  
which can be show in compound state

|                                |                              |                                           |                                                        |                                                      |                                                             |                                                                   |                                                      |                                                |                                          |                                    |                              |                                           |                                                |                                                                        |                                                           |                                                                         |                                                     |
|--------------------------------|------------------------------|-------------------------------------------|--------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------|------------------------------------------|------------------------------------|------------------------------|-------------------------------------------|------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------|
| 1<br>1<br>H<br><b>+1</b><br>-1 |                              |                                           |                                                        |                                                      |                                                             |                                                                   |                                                      |                                                |                                          |                                    |                              |                                           |                                                |                                                                        |                                                           |                                                                         | 18<br>2<br>He                                       |
|                                | 2                            |                                           |                                                        |                                                      |                                                             |                                                                   |                                                      |                                                |                                          |                                    |                              | 13                                        | 14                                             | 15                                                                     | 16                                                        | 17                                                                      |                                                     |
| 3<br>Li<br><b>+1</b>           | 3<br>Be<br><b>+2</b>         |                                           |                                                        |                                                      |                                                             |                                                                   |                                                      |                                                |                                          |                                    |                              | 5<br><b>B</b><br><b>+3</b><br>-3          | 6<br><b>C</b><br><b>+4</b><br>+2<br>-4<br>etc. | 7<br><b>N</b><br><b>+5</b><br>+4<br>+3<br>+1<br>-3<br><b>0</b><br>etc. | 8<br><b>O</b><br><b>+2</b><br>-<br>1/2<br>-1<br><b>-2</b> | 9<br><b>F</b><br><b>-1</b>                                              | 10<br>Ne                                            |
| 11<br>Na<br><b>+1</b>          | 12<br>Mg<br><b>+2</b>        |                                           |                                                        |                                                      |                                                             |                                                                   |                                                      |                                                |                                          |                                    |                              | 13<br><b>Al</b><br><b>+3</b>              | 14<br><b>Si</b><br><b>+4</b><br>-4             | 15<br><b>P</b><br><b>+5</b><br>+3<br>+1<br>-3                          | 16<br><b>S</b><br><b>+6</b><br>+4<br>+2<br>-2             | 17<br><b>Cl</b><br><b>+7</b><br>+5<br>+3<br>+1<br><b>0</b><br><b>-1</b> | 18<br>Ar<br><b>0</b>                                |
|                                |                              | 3                                         | 4                                                      | 5                                                    | 6                                                           | 7                                                                 | 8                                                    | 9                                              | 10                                       | 11                                 | 12                           |                                           |                                                |                                                                        |                                                           |                                                                         |                                                     |
| 19<br><b>K</b><br><b>+1</b>    | 20<br><b>Ca</b><br><b>+2</b> | 21<br><b>Sc</b><br><b>+2</b><br><b>+3</b> | 22<br><b>Ti</b><br><b>+2</b><br><b>+3</b><br><b>+4</b> | 23<br><b>V</b><br><b>+2</b><br><b>+3</b><br>+4<br>+5 | 24<br><b>Cr</b><br><b>+2</b><br><b>+3</b><br>+4<br>+5<br>+6 | 25<br><b>Mn</b><br><b>+2</b><br>+3<br><b>+4</b><br>+5<br>+6<br>+7 | 26<br><b>Fe</b><br><b>+2</b><br>+3<br>+4<br>+5<br>+6 | 27<br><b>Co</b><br><b>+2</b><br>+3<br>+4<br>+5 | 28<br><b>Ni</b><br><b>+2</b><br>+3<br>+4 | 29<br><b>Cu</b><br><b>+1</b><br>+2 | 30<br><b>Zn</b><br><b>+2</b> | 31<br><b>Ga</b><br><b>+3</b>              | 32<br><b>Ge</b><br><b>+4</b><br>-4             | 33<br><b>As</b><br><b>+5</b><br><b>+3</b><br>-3                        | 34<br><b>Se</b><br><b>+6</b><br>+4<br>-2                  | 35<br><b>Br</b><br><b>+7</b><br>+5<br>+3<br>+1<br><b>-1</b>             | 36<br>Kr<br><b>+4</b><br>+2<br><b>0</b>             |
| 37<br><b>Rb</b><br><b>+1</b>   | 38<br><b>Sr</b><br><b>+2</b> |                                           |                                                        |                                                      |                                                             |                                                                   |                                                      |                                                |                                          |                                    |                              | 49<br><b>In</b><br><b>+3</b><br>+1        | 50<br><b>Sn</b><br><b>+4</b><br>+2             | 51<br><b>Sb</b><br><b>+5</b><br><b>+3</b><br>-3                        | 52<br><b>Te</b><br><b>+6</b><br>+4<br>-2                  | 53<br><b>I</b><br><b>+7</b><br>+5<br>+3<br>+1<br><b>0</b><br><b>-1</b>  | 54<br>Xe<br><b>+8</b><br>+6<br>+4<br>+2<br><b>0</b> |
| 55<br><b>Cs</b><br><b>+1</b>   | 56<br><b>Ba</b><br><b>+2</b> |                                           |                                                        |                                                      |                                                             |                                                                   |                                                      |                                                |                                          |                                    |                              | 81<br><b>Tl</b><br><b>+3</b><br><b>+1</b> | 82<br><b>Pb</b><br><b>+4</b><br><b>+2</b>      | 83<br><b>Bi</b><br><b>+5</b><br><b>+3</b>                              | 84<br><b>Po</b>                                           | 85<br><b>At</b>                                                         | 86<br>Rn                                            |

\* **Bold mark oxidation number are general stable oxidation number of an element in compound state.**

## Section (B) : Inorganic nomenclature

### Th-1 Elements

**General Rule :** The names of metals generally end with-ium or-um (examples are sodium, potassium, aluminum, and magnesium).

The exceptions are metals that were used and named in ancient times, such as iron, copper, and gold.

The names of nonmetals frequently end with-ine, -on, or -gen (such as iodine, argon, and oxygen.)

Given the names of the constituent elements and common ions, most of the common inorganic compounds can be named using the rules presented below.

### Th-2 Acids :

Acids are normally classified in two groups, hydracids and oxyacids

#### Hydracids :

Hydracids are acids which contain hydrogen and a non-metal, but no oxygen.

**General Rule :** The names of hydracids have the prefix hydro-(sometimes shortened to hydr-) and the suffix-ic attached to the stem based on the names of the constituent elements (other than hydrogen.)

For example, HCl (made of hydrogen and chlorine) is hydrochloric acid; HBr (made of hydrogen and bromine) is hydrobromic acid; HI (made of hydrogen and iodine) is hydroiodic acid; HCN (made of hydrogen, carbon and nitrogen) is hydrocyanic acid; and H<sub>2</sub>S (made of hydrogen and sulfur) is hydrosulfuric acid.

### Th-3 Cations (Positive ions)

#### Metal atoms with single positive charge

**Rule :** Names of positive ions end with-ium if the ion has only one oxidation state (Only one level of net charge). For example, the positive ion of sodium is Na<sup>+</sup> (sodium ion), and the positive ion of aluminium is Al<sup>3+</sup> (aluminium ion).

#### Metal atoms with more than one possible charges

**Rule :** If the cation has variable valency (charge), charge is specified in roman numerals in round brackets immediately after the name of metal atom. For example , Sn<sup>2+</sup> is written as tin (II) ion.

**Alternately, the less positive ion ends with -ous, and the more positive ion ends with -ic.** For instance, the two positive ions of copper are Cu<sup>+</sup> (cuprous) and Cu<sup>2+</sup> (cupric). The oxidation state of a positive ion can also be designated by placing a Roman numeral after the name of the elements. These positive ions of copper can also be written as copper(I) and copper(II), respectively.

| Ions             | Name         |
|------------------|--------------|
| Cu <sup>+</sup>  | cuprous ion  |
| Cu <sup>2+</sup> | cupric ion   |
| Sn <sup>2+</sup> | Stannous ion |
| Sn <sup>4+</sup> | Stannic ion  |
| Fe <sup>3+</sup> | Ferric ion   |
| Fe <sup>2+</sup> | Ferrous ion  |

#### General Rule-3

Suffix-nium is often used with cations containing non metals.

For example, the positive ion of ammonia is NH<sub>4</sub><sup>+</sup> (ammonium) and the positive ion of water (H<sub>2</sub>O) is H<sub>3</sub>O<sup>+</sup> or H<sup>+</sup> (hydronium).

#### Remember these names !

**NO<sub>2</sub><sup>+</sup> : nitronium**

**NO<sup>+</sup> : nitrosonium**

**H<sub>3</sub>O<sup>+</sup> : hydronium**

From NH<sub>3</sub> ammonia is derived NH<sub>4</sub><sup>+</sup> : ammonium.

Similarly.

N<sub>2</sub>H<sub>4</sub> : hydrazine → N<sub>2</sub>H<sub>5</sub><sup>+</sup> : hydrazinium

C<sub>6</sub>H<sub>5</sub>NH<sub>2</sub> : aniline → C<sub>6</sub>H<sub>5</sub>NH<sub>3</sub><sup>+</sup> : anilinium

C<sub>5</sub>H<sub>5</sub>N : pyridine → C<sub>5</sub>H<sub>5</sub>NH<sup>+</sup> : pyridinium

### Th-4 Anions (Negative Ions)

Anions can always be looked upon as ions derived from acids by removal of one or more protons. Accordingly, anions can be classified as follows :

### Anions derived from hydric acids

**Rule : Names of negative ions from hydric acids end in -ide.**

For example,  $\text{Cl}^-$  (chloride) from  $\text{HCl}$ , and  $\text{CN}^-$  (cyanide) from  $\text{HCN}$ . Following examples will give you a better insight in this nomenclature. It is also useful to remember them.

**Remember these names**

| Anion            | Name           |
|------------------|----------------|
| $\text{H}^-$     | Hydride ion    |
| $\text{D}^-$     | Deuteride ion  |
| $\text{F}^-$     | Fluoride ion   |
| $\text{Cl}^-$    | Chloride ion   |
| $\text{Br}^-$    | Bromide ion    |
| $\text{I}^-$     | Iodide ion     |
| $\text{O}^{2-}$  | Oxide ion      |
| $\text{S}^{2-}$  | Sulphide ion   |
| $\text{Se}^{2-}$ | Selenide ion   |
| $\text{Te}^{2-}$ | Telluride ion  |
| $\text{N}^{3-}$  | Nitride ion    |
| $\text{P}^{3-}$  | Phosphide ion  |
| $\text{As}^{3-}$ | Arsenide ion   |
| $\text{Sb}^{3-}$ | Antimonide ion |
| $\text{C}^{4-}$  | Carbide ion    |
| $\text{Si}^{4-}$ | Silicide ion   |
| $\text{B}^{3-}$  | Boride ion     |

### Th-5 Oxoacids or Oxyacids

The acids which contain hydrogen, oxygen and a metal or non-metal.

In this case, more than one possibility arises due to the presence of different number of oxygen atoms. An example of such an oxoacid series is as follows:  $\text{HClO}$ ,  $\text{HClO}_2$ ,  $\text{HClO}_3$ ,  $\text{HClO}_4$ . All these contain same three elements but differ in the number of oxygen atoms present.

#### General Rule-1 :

If a class of acids contains only one member, its name is given the suffix -ic.

For example, hydrogen, carbon and oxygen combine to form only one acid i.e.  $\text{H}_2\text{CO}_3$ . It is called carbonic acid (carbonic acid.)

#### General Rule-2 :

If an acid series contains two acids, such as  $\text{H}_2\text{SO}_4$  and  $\text{H}_2\text{SO}_3$ , the acid containing more oxygen atoms is given the suffix -ic, while the acid with fewer oxygen atoms is given the suffix -ous.

For example,  $\text{H}_2\text{SO}_4$  is sulphuric acid, and  $\text{H}_2\text{SO}_3$  is sulphurous acid.

Similarly,  $\text{HNO}_3$  is nitric acid and  $\text{HNO}_2$  is nitrous acid.

#### General Rule-3 :

The prefix ortho and meta have been used to distinguish acids differing in the 'content of water'

$(\text{H}_3\text{BO}_3)$ - orthoboric acid  $-\text{H}_2\text{O}$

$(\text{HBO}_2)_n$ - metaboric acid

#### General Rule-4 :

The prefix pyro has been used to designate an acid formed from two molecules of an ortho acid minus one molecule of water.

For example,  $\text{H}_4\text{P}_2\text{O}_7$  -pyro phosphoric acid

#### General Rule-5 :

The prefix peroxy indicates the substitution '-O-' by '-O-O-'

$\text{HNO}_4$  - peroxy nitric acid

$\text{H}_3\text{PO}_5$  - peroxy mono phosphoric acid

#### General Rule-6 :

Acid derived by oxoacids by replacement of oxygen by sulphur are called thio acids.

$\text{H}_2\text{S}_2\text{O}_2$  - thio sulphurous acid

$\text{H}_2\text{S}_2\text{O}_3$  - thio sulphuric acid

**Note :** when more than one oxygen atom can be replaced by sulphur the number of sulphur atom should generally indicated

$\text{H}_3\text{PO}_3\text{S}$  mono thio phosphoric acid

$\text{H}_3\text{PO}_2\text{S}_2$  Dithiophosphoric acid

In the case of an extensive acid series (such as  $\text{HClO}$ ,  $\text{HClO}_2$ ,  $\text{HClO}_3$ ,  $\text{HClO}_4$ ), the acid with the one oxygen atoms lesser than -ous acid is given the prefix hypo- and the suffix -ous, and the acid with the one oxygen atom more than the -ic acid is given the prefix per and a suffix -ic.

In the above example,  $\text{HClO}$  is hypochlorous acid  $\text{HClO}_2$  is chlorous acid,  $\text{HClO}_3$  is chloric acid, and  $\text{HClO}_4$  is perchloric acid.

**Th-6 Anions derived from oxyacids (oxyanions)**

- (i) Anion derived from an oxyacid by removal of one or more  $H^+$  ions is termed as oxyanion.

**Rule :** If the oxyacid is – ic acid, suffix - ate is used with oxy-anion.

For example

|              |                             |
|--------------|-----------------------------|
| $CO_3^{2-}$  | carbonate (from $H_2CO_3$ ) |
| $ZnO_2^{2-}$ | zincate                     |
| $SiO_3^{2-}$ | silicate                    |

- (ii) **Rule : If the oxyacid is - ous acid, suffix -ite is used with oxy-anion.**

**For example,**  $NO_2^-$  (nitrite) is derived from  $HNO_2$  (nitrous acid), and  $SO_3^{2-}$  (sulphite) is derived from  $H_2SO_3$  (sulphurous acid)

- (iii) **Rule : If the oxyacid has prefixes per-or hypo-, the oxyanion will have same prefixes.**

**For example,**  $ClO_4^-$  perchlorate ion from  $HClO_4$ , perchloric acid,  $ClO^-$  hypochlorite ion from  $HClO$ , hypochlorous acid

Remember these names !

|              |          |
|--------------|----------|
| $SO_4^{2-}$  | Sulphate |
| $SO_3^{2-}$  | Sulphite |
| $NO_3^-$     | Nitrate  |
| $NO_2^-$     | Nitrite  |
| $SnO_3^{2-}$ | Stannate |
| $SnO_2^{2-}$ | Stannite |
| $PbO_3^{2-}$ | Plumbate |
| $PbO_2^{2-}$ | Plumbite |

- (iv) **Anions containing replaceable hydrogen ions**

**Polyprotic acid.** Any acid containing more than one replaceable hydrogens is said to be a polyprotic acid.

- (v) **Replaceable hydrogens.** H atoms which can be lost as  $H^+$  in reactions with a base. H atoms connected to O atoms in oxyacids are all replaceable. If all the replaceable hydrogens are removed, we obtain the anions discussed in the sections above. However, in all the polyprotic acids it is always possible to remove less than the maximum number of replaceable hydrogens.

e.g.  $H_3PO_4$  is triprotic. We can remove one, two or three  $H^+$  ions from it to generate  $H_2PO_4^-$ ,  $HPO_4^{2-}$  and  $PO_4^{3-}$ .

You are already familiar with phosphate ion,  $PO_4^{3-}$ . The other two anions,  $H_2PO_4^-$  and  $HPO_4^{2-}$  still contain H atoms that are replaceable. We consider their nomenclature in this section.

- (vi) **Rule-1 :** A prefix bi- (old notation) or hydrogen – (IUPAC notation) is attached to the name of anion.

- (vii) **Rule-2 :** For triprotic or higher acids, numerical prefixes (e.g. mono, bi, tri) are also used to indicate the number of replaceable H atoms left in the sample).

eg.  $HCO_3^-$  is bicarbonate or hydrogen carbonate

$HSO_3^-$  bisulphite or hydrogen sulphite

$HS^-$  bisulphide or hydrogen sulphide etc.

when anion has –3 charge,

e.g.  $PO_4^{3-}$  then following possibilities arise.

$HPO_4^{2-}$  monohydrogen phosphate,

$H_2PO_4^-$  dihydrogen phosphate.

**Th-7 Miscellaneous Anions (To be committed to memory)**

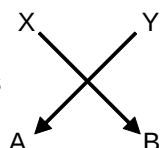
| Anion         | Name             |
|---------------|------------------|
| $HO^-$        | Hydroxide ion    |
| $O_2^{2-}$    | Peroxide ion     |
| $O_2^-$       | Superoxide ion   |
| $S_2^{2-}$    | Disulphide ion   |
| $I_3^-$       | Triiodide ion    |
| $N_3^-$       | Azide ion        |
| $NH_2^-$      | Imide ion        |
| $NH_2^-$      | Amide ion        |
| $CN^-$        | Cyanide ion      |
| $C_2^{2-}$    | Acetylide ion    |
| $O_3^-$       | Ozonide ion      |
| $MnO_4^{2-}$  | Manganate ion    |
| $MnO_4^-$     | Permanganate ion |
| $SCN^-$       | Thiocyanate ion  |
| $S_2O_3^{2-}$ | Thiosulphate ion |
| $CH_3COO^-$   | Acetate ion      |
| $C_2O_4^{2-}$ | Oxalate ion      |

### Th-8 Method of writing formula of an ionic compound

In order to write the formula of an ionic compound which is made up of two ions (simple or polyatomic) having net charges  $x$  and  $y$  respectively, follow the following procedure.

- Write the symbols of the ions side by side in such a way that positive ion is at the left and negative ion at the right as AB.
- Write their charges on the top of each symbol as  $A^x B^y$ .

- Now apply criss-cross rule as



i.e. formula  $A_y B_x$ .

- Cancel out any common factor (or HCF).

#### Examples :

|    |                     |                                                                                                                      |
|----|---------------------|----------------------------------------------------------------------------------------------------------------------|
| 1. | Calcium chloride    | $\begin{matrix} 2 & 1 \\ \swarrow & \searrow \\ \text{Ca} & \text{Cl} \end{matrix} = \text{CaCl}_2$                  |
| 2. | Aluminium oxide     | $\begin{matrix} 3 & 2 \\ \swarrow & \searrow \\ \text{Al} & \text{O} \end{matrix} = \text{Al}_2\text{O}_3$           |
| 3. | Potassium phosphate | $\begin{matrix} 1 & 3 \\ \swarrow & \searrow \\ \text{K} & \text{PO}_4 \end{matrix} = \text{K}_3\text{PO}_4$         |
| 4. | Magnesium nitride   | $\begin{matrix} 2 & 3 \\ \swarrow & \searrow \\ \text{Mg} & \text{N} \end{matrix} = \text{Mg}_3\text{N}_2$           |
| 5. | Calcium oxide       | $\begin{matrix} 2 & 2 \\ \swarrow & \searrow \\ \text{Ca} & \text{O} \end{matrix} = \text{Ca}_2\text{O}_2$           |
| 6. | Ammonium sulphate   | $\begin{matrix} 1 & 2 \\ \swarrow & \searrow \\ \text{NH}_4 & \text{SO}_4 \end{matrix} = (\text{NH}_4)_2\text{SO}_4$ |

Cancelling the common factor, answer is  $\text{CaO}$

### Th.9 : Some important points :

- If both element are non-metallic then more electronegative element is anionic part  
 $\text{As}_2\text{O}_3$  – arsenic (III) oxide  
 $\text{OF}_2$  – oxygen di fluoride,  
 $\text{ICl}_3$  – Iodine trichloride

- pyro name is attached with acid if it is derived by removing one water molecule from two acid molecules.

Two acid molecules  $\xrightarrow{-\text{H}_2\text{O}}$  pyro acid,  
 $\text{N, C, Cl, Br}$ , not forms pyroxy acids

$2\text{HClO}_4 \xrightarrow{-\text{H}_2\text{O}} \text{Cl}_2\text{O}_7$  not oxiaacid it is an oxide

- Meta acid:** If one water molecule is removing from one acid molecule then meta acid is obtained.

One acid molecule  $\xrightarrow{-\text{H}_2\text{O}}$  meta acid,

$\text{N, C, S, Cl}$ , not forms metaoxy  
only  $\text{Si, P, B}$  forms metaoxy acids,

- Naming of oxoanions derived from oxyacids**

– **ic** acid  $\equiv$  – ate

– **us** acid  $\equiv$  – ite

- There are some more anions which are very common like :

$\text{CrO}_4^{2-}$  – Chromate (name is derived from  $\text{SO}_4^{2-}$  sulphate as all features are same)

$\text{FeO}_4^{2-}$  – ferrate

$\text{MoO}_4^{2-}$  – molybdate

$\text{WO}_4^{2-}$  – tungstate

$\text{MnO}_4^{2-}$  – manganate

corresponding acids can be

$\text{H}_2\text{CrO}_4$  – chromic acid

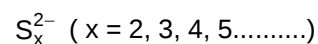
$\text{H}_2\text{MnO}_4$  – manganic acid

$\Rightarrow$  Higher oxidation state of manganese  $\equiv$

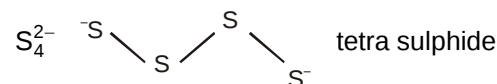
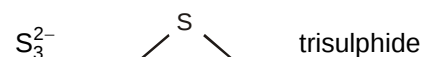


So called permanganate,  $\text{HMnO}_4$   
permanganic acid

- Polysulphides**



structures  $\text{S}_2^{2-}$  –  $\text{S} - \text{S}^-$  disulphide



Sodium disulphide  $\equiv \text{Na}_2\text{S}_2$

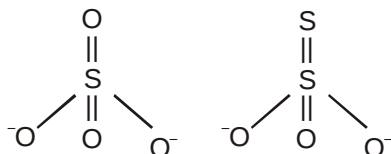
**(vii) Sulphate & thiosulphate (hypo)**

When ever oxygen of normal compound is replaced with sulphur then thio word is used before name of normal compound

alcohol –OH      Thioalcohol –SH

ether –O–      Thioether –S–

sulphate  $\text{SO}_4^{2-}$       Thiosulphate ( $\text{S}_2\text{O}_3^{2-}$ )



\*

Cyanate ion & Thiocyanate ion

Cyanic acid (HOCN)

Cyanate ion  $\Rightarrow$   $\text{N}\equiv\text{C}-\text{O}^-$

$^-\text{N}=\text{C}=\text{O}$

Resonating structure

Thio cyanate ion  $\Rightarrow$   $\text{N}\equiv\text{C}-\text{S}^-$

$^-\text{N}=\text{C}=\text{S}$

Resonating structure

**(viii) Metal cations –** Higher oxidation state of Cations ends with ic & lower by – us

$\text{Fe}^{3+}$  – ferric

$\text{Cu}^{2+}$  – cupric

$\text{Fe}^{2+}$  – ferrous

$\text{Cu}_2^{2+}$  – cuprous

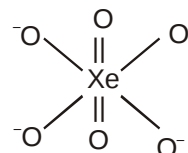
$\text{Hg}^{2+}$  – mercuric

$\text{Hg}_2^{2+}$  – mercurous

**(ix) Xenon :**

$\text{H}_4\text{XeO}_6$  – perxenic acid

$\text{XeO}_6^{4-}$  – perxenate ion



$\text{H}_2\text{XeO}_4$  – Xenic acid

$\text{XeO}_4^{2-}$  – Xenate ion

**Table-2: Difference between Atoms and ions**

|   | Atoms                                                                                                                                      |   | Ions                                                                                                                                                                                                                                                                               |
|---|--------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Atoms are perfectly neutral                                                                                                                | 1 | Ions are charged particles containing one or more atoms.                                                                                                                                                                                                                           |
| 2 | In atoms, the number of protons is equal to the number of electrons. Na (protons 11, electrons 11); Cl (protons 17, electrons 17).         | 2 | In cations (positively charged ions), number of protons is more than the number of electrons. In anions (negatively charged ions) the no. of protons is less than the number of electrons. e.g. $\text{Na}^+$ (protons 11, electrons 10). $\text{Cl}^-$ (protons 17, electrons 18) |
| 3 | Except noble gases, atoms have less than 8 electrons in the outermost orbit e.g. Na : 2, 8, 1; Ca : 2, 8, 8, 2; Cl : 2, 8, 7; S : 2, 8, 6. | 3 | Ions have generally 8 electrons in the outermost orbit, i.e., $ns^2np^6$ configuration. $\text{Na}^+$ : 2, 8; $\text{Cl}^-$ : 2, 8, 8; $\text{Ca}^{2+}$ : 2, 8, 8                                                                                                                  |
| 4 | Chemical activity is due to loss or gain or sharing of electrons as to acquire noble gas configuration.                                    | 4 | The chemical activity is due to the charge on the ion. Oppositely charged ions are held together by electrostatic forces.                                                                                                                                                          |

**Table - 3 : Naming of Oxyacid**

| Acid end with IC suffix                      |                      | Suffix-ous                                   |                      | Prefix -per ; suffix-ic                      |                            | Prefix -pyro         |
|----------------------------------------------|----------------------|----------------------------------------------|----------------------|----------------------------------------------|----------------------------|----------------------|
| Formula                                      | Name                 | Formula                                      | Name                 | Formula                                      | Name                       | Name                 |
| H <sub>3</sub> BO <sub>3</sub>               | Orthoboric acid      | HNO <sub>2</sub>                             | Nitrous Acid         | HNO <sub>4</sub>                             | Peroxynitric acid          | Pyrophosphoric acid  |
| H <sub>2</sub> CO <sub>3</sub>               | Carbonic acid        | H <sub>2</sub> SO <sub>3</sub>               | Sulphurous acid      | H <sub>3</sub> PO <sub>5</sub>               | Peroxy monophosphoric acid | Pyrophosphorous acid |
| HONC                                         | Isocyanic acid       | H <sub>2</sub> S <sub>2</sub> O <sub>5</sub> | Disulphurous acid    | H <sub>4</sub> P <sub>2</sub> O <sub>5</sub> | Peroxy diphosphoric acid   | Pyroboric acid       |
| HO-CN                                        | Cyanic acid          | HClO <sub>2</sub>                            | Chlorous acid        | H <sub>2</sub> SO <sub>5</sub>               | Peroxy mono sulphuric acid | Pyro silicic acid    |
| HNO <sub>3</sub>                             | Nitric Acid          | <b>Prefix - Hypo ; suffix-ic</b>             |                      | H <sub>2</sub> S <sub>2</sub> O <sub>8</sub> | Peroxy disulphuric acid    | Pyrosulphuric acid   |
| H <sub>2</sub> NO <sub>2</sub>               | Nitroxylic acid      | H <sub>2</sub> N <sub>2</sub> O <sub>2</sub> | Hyponitrous acid     | HClO <sub>4</sub>                            | Perchloric acid            |                      |
| H <sub>3</sub> PO <sub>4</sub>               | Orthophosphoric acid | HClO                                         | Hypochlorous acid    | <b>Prefix-thio</b>                           |                            |                      |
| H <sub>2</sub> SO <sub>4</sub>               | Sulphuric acid       | <b>Prefix-meta ; suffix-ic</b>               |                      | H <sub>2</sub> S <sub>2</sub> O <sub>3</sub> | Thio sulphuric acid        |                      |
| HClO <sub>3</sub>                            | Chloric acid         | (HBO <sub>2</sub> ) <sub>n</sub>             | Metaboric acid       | H <sub>2</sub> S <sub>2</sub> O <sub>2</sub> | Thio sulphurous acid       |                      |
| H <sub>2</sub> S <sub>2</sub> O <sub>6</sub> | Dithionic acid       | (HPO <sub>3</sub> ) <sub>n</sub>             | Meta phosphoric acid | H <sub>2</sub> S <sub>2</sub> O <sub>6</sub> | Dithionic acid             |                      |
|                                              |                      |                                              |                      | H <sub>2</sub> S <sub>2</sub> O <sub>4</sub> | Dithionous acid            |                      |

## Exercise-1

☞ Marked questions are recommended for Revision.

☞ चिह्नित प्रश्न दोहराने योग्य प्रश्न है।

### PART - I : SUBJECTIVE QUESTIONS

#### भाग - I : विषयात्मक प्रश्न (SUBJECTIVE QUESTIONS)

#### Section (A) : Oxidation number

##### खण्ड (A) : ऑक्सीकरण संख्या

A-1. What is the general oxidation states of following elements.

निम्न तत्वों की सामान्य ऑक्सीकरण अवस्थाएँ क्या हैं।

|                   |    |    |    |    |    |    |    |    |    |    |  |
|-------------------|----|----|----|----|----|----|----|----|----|----|--|
| Na                | Ca | Al | Zn | F  | O  | Ne | Rb |    |    |    |  |
| Element :         |    |    | Na | Ca | Al | Zn | F  | O  | Ne | Rb |  |
| (तत्व)            |    |    |    |    |    |    |    |    |    |    |  |
| Oxidation state : |    |    | +1 | +2 | +3 | +2 | -1 | -2 | 0  | +1 |  |
| ऑक्सीकरण अवस्था   |    |    |    |    |    |    |    |    |    |    |  |

A-2. Write the oxidation state of manganese in the following compounds.

निम्न यौगिकों में मैंगनीज की ऑक्सीकरण अवस्थाएँ लिखिए।

MnSO<sub>4</sub>, Mn<sub>2</sub>O<sub>3</sub>, MnCl<sub>2</sub>, HMnO<sub>4</sub>, H<sub>2</sub>MnO<sub>4</sub>

|                    |                     |                                  |                     |                     |                                 |
|--------------------|---------------------|----------------------------------|---------------------|---------------------|---------------------------------|
| Ans.               | MnSO <sub>4</sub> , | Mn <sub>2</sub> O <sub>3</sub> , | MnCl <sub>2</sub> , | HMnO <sub>4</sub> , | H <sub>2</sub> MnO <sub>4</sub> |
| Oxidation number : | +2                  | +3                               | +2                  | +7                  | +6                              |
| ऑक्सीकरण संख्या    |                     |                                  |                     |                     |                                 |

A-3. Write the oxidation Number of underlined element in following given compound/ions

निम्न दिये गये यौगिकों में अद्योरेखांकित तत्वों की ऑक्सीकरण संख्या लिखिए।

|                                                 |                                                |                                                 |                                                  |
|-------------------------------------------------|------------------------------------------------|-------------------------------------------------|--------------------------------------------------|
| (i) H <sub>3</sub> <u>P</u> O <sub>4</sub> ,    | (ii) H <sub>2</sub> <u>C</u> 2O <sub>4</sub> , | (iii) H <sub>2</sub> <u>N</u> 2O <sub>2</sub> , | (iv) H <sub>2</sub> <u>S</u>                     |
| (v) H <sub>2</sub> <u>S</u> O <sub>3</sub> ,    | (vi) <u>F</u> e <sub>3</sub> O <sub>4</sub> ,  | (vii) Na <sub>2</sub> <u>O</u> ,                | (viii) <u>O</u> F <sub>2</sub>                   |
| (ix) K <sub>2</sub> <u>Cr</u> 2O <sub>7</sub> , | (x) H <sub>2</sub> <u>Xe</u> O <sub>4</sub> ,  | (xi) H <sub>4</sub> <u>Xe</u> O <sub>6</sub> ,  | (xii) <u>Al</u> 2(SO <sub>4</sub> ) <sub>3</sub> |

Ans. Oxidation number (ऑक्सीकरण संख्या) :

(i) +5, (ii) +3, (iii) +1, (iv) -2, (v) +4, (vi) +8/3, (vii) -2, (viii) +2, (ix) +6, (x) +6, (xi) +8, (xii) +3.

#### Section (B) : Inorganic nomenclature

##### खण्ड (B) : अकार्बनिक नामकरण

B-1. Write the name of following cations.

NO<sup>+</sup><sub>2</sub>, NO<sup>+</sup>, H<sub>3</sub>O<sup>+</sup>, NH<sub>4</sub><sup>+</sup>, N<sub>2</sub>H<sub>5</sub><sup>+</sup>, C<sub>6</sub>H<sub>5</sub>NH<sub>3</sub><sup>+</sup>, C<sub>5</sub>H<sub>5</sub>NH<sup>+</sup>

निम्नलिखित धनायनों के नाम लिखिए।

NO<sup>+</sup><sub>2</sub>, NO<sup>+</sup>, H<sub>3</sub>O<sup>+</sup>, NH<sub>4</sub><sup>+</sup>, N<sub>2</sub>H<sub>5</sub><sup>+</sup>, C<sub>6</sub>H<sub>5</sub>NH<sub>3</sub><sup>+</sup>, C<sub>5</sub>H<sub>5</sub>NH<sup>+</sup>

|      |                                                          |                                                                        |                                                            |                                         |
|------|----------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------|
| Ans. | NO <sup>+</sup> <sub>2</sub> : Nitronium,                | NO <sup>+</sup> : nitrosonium,                                         | H <sub>3</sub> O <sup>+</sup> : hydronium,                 | NH <sub>4</sub> <sup>+</sup> : ammonium |
|      | N <sub>2</sub> H <sub>5</sub> <sup>+</sup> : hydrazinium | C <sub>6</sub> H <sub>5</sub> NH <sub>3</sub> <sup>+</sup> : anilinium | C <sub>5</sub> H <sub>5</sub> NH <sup>+</sup> : pyridinium |                                         |

|      |                                                              |                                                                          |                                                            |                                        |
|------|--------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------|----------------------------------------|
| Ans. | NO <sup>+</sup> <sub>2</sub> : नाइट्रोनियम ;                 | NO <sup>+</sup> : नाइट्रोसोनियम ;                                        | H <sub>3</sub> O <sup>+</sup> : हाइड्रोनियम ;              | NH <sub>4</sub> <sup>+</sup> : अमोनियम |
|      | N <sub>2</sub> H <sub>5</sub> <sup>+</sup> : हाइड्रेजिनियम ; | C <sub>6</sub> H <sub>5</sub> NH <sub>3</sub> <sup>+</sup> : एनीलिनियम ; | C <sub>5</sub> H <sub>5</sub> NH <sup>+</sup> : पीरीडिनियम |                                        |

B-2. Write the name of following anions.

निम्नलिखित ऋणायनों के नाम लिखिए।

|                                |                                |                                |                              |                               |                               |                  |                               |                              |                                |                                |                                |
|--------------------------------|--------------------------------|--------------------------------|------------------------------|-------------------------------|-------------------------------|------------------|-------------------------------|------------------------------|--------------------------------|--------------------------------|--------------------------------|
| F <sup>-</sup>                 | Cl <sup>-</sup>                | Br <sup>-</sup>                | I <sup>-</sup>               | O <sup>2-</sup>               | S <sup>2-</sup>               | N <sup>3-</sup>  | P <sup>3-</sup>               | As <sup>3-</sup>             | Cu <sup>-</sup>                | H <sup>-</sup>                 | Au <sup>-</sup>                |
| CO <sub>3</sub> <sup>2-</sup>  | ZnO <sub>2</sub> <sup>2-</sup> | SiO <sub>3</sub> <sup>2-</sup> | NO <sub>2</sub> <sup>-</sup> | SO <sub>3</sub> <sup>2-</sup> | ClO <sub>4</sub> <sup>-</sup> | ClO <sup>-</sup> | SO <sub>4</sub> <sup>2-</sup> | NO <sub>3</sub> <sup>-</sup> | SnO <sub>3</sub> <sup>2-</sup> | SnO <sub>2</sub> <sup>2-</sup> | PbO <sub>3</sub> <sup>2-</sup> |
| PbO <sub>2</sub> <sup>2-</sup> |                                |                                |                              |                               |                               |                  |                               |                              |                                |                                |                                |

|      |                                         |                                           |                                         |                                         |
|------|-----------------------------------------|-------------------------------------------|-----------------------------------------|-----------------------------------------|
| Ans. | F <sup>-</sup> fluoride                 | Cl <sup>-</sup> chloride                  | Br <sup>-</sup> bromide                 | I <sup>-</sup> iodide                   |
|      | O <sup>2-</sup> oxide                   | S <sup>2-</sup> sulphide                  | N <sup>3-</sup> nitride                 | P <sup>3-</sup> phosphide               |
|      | As <sup>3-</sup> arsenide               | Cu <sup>-</sup> cupride                   | H <sup>-</sup> hydride                  | Au <sup>-</sup> auride                  |
|      | CO <sub>3</sub> <sup>2-</sup> carbonate | ZnO <sub>2</sub> <sup>2-</sup> zincate    | SiO <sub>3</sub> <sup>2-</sup> silicate | NO <sub>2</sub> <sup>-</sup> nitrite    |
|      | SO <sub>3</sub> <sup>2-</sup> sulphite  | ClO <sub>4</sub> <sup>-</sup> perchlorate | ClO <sup>-</sup> hypochlorite           | SO <sub>4</sub> <sup>2-</sup> sulphate  |
|      | NO <sub>3</sub> <sup>-</sup> nitrate    | SnO <sub>3</sub> <sup>2-</sup> stannate   | SnO <sub>2</sub> <sup>2-</sup> stannite | PbO <sub>3</sub> <sup>2-</sup> plumbate |
|      | PbO <sub>2</sub> <sup>2-</sup> plumbite |                                           |                                         |                                         |

|             |                        |                      |                       |                       |
|-------------|------------------------|----------------------|-----------------------|-----------------------|
| <b>Ans.</b> | $F^-$ फ्लोराइड         | $Cl^-$ क्लोराइड      | $Br^-$ ब्रोमाइड       | $I^-$ आयोडाइड         |
|             | $O^{2-}$ ऑक्साइड       | $S^{2-}$ सल्फाइड     | $N^{3-}$ नाइट्राइड    | $P^{3-}$ फॉस्फाइड     |
|             | $As^{3-}$ आर्सेनाइड    | $Cu^-$ क्यूप्राइड    | $H^-$ हाइड्राइड       | $Au^-$ ऑराइड          |
|             | $CO_3^{2-}$ कार्बोनेट  | $ZnO_2^{2-}$ जिंकेट  | $SiO_3^{2-}$ सिलिकेट  | $NO_2^-$ नाइट्राइट    |
|             | $SO_3^{2-}$ सल्फाइट    | $ClO_4^-$ परक्लोरेट  | $ClO^-$ हाइपोक्लोराइट | $SO_4^{2-}$ सल्फेट    |
|             | $NO_3^-$ नाइट्रेट      | $SnO_3^{2-}$ स्टेनेट | $SnO_2^{2-}$ स्टेनाइट | $PbO_3^{2-}$ प्लम्बेट |
|             | $PbO_2^{2-}$ प्लम्बाइट |                      |                       |                       |

## PART - II : ONLY ONE OPTION CORRECT TYPE

### भाग - II : केवल एक सही विकल्प प्रकार (ONLY ONE OPTION CORRECT TYPE)

#### Section (A) : Oxidation number

#### खण्ड (A) : ऑक्सीकरण संख्या

- A-1.** The oxidation number that iron does not exhibit in its common compounds or in its elemental state is -  
ऑक्सीकरण अंक जो आयरन इसके सामान्य यौगिक या इसके तात्विक अवस्था में नहीं दर्शाता है?  
(A) 0 (B\*) +1 (C) +2 (D) +3
- A-2.** The oxidation state of nitrogen varies from:  
(A\*) -3 to +5 (B) 0 to +5 (C) -3 to 1 (D) +3 to +5  
नाइट्रोजन की ऑक्सीकरण अवस्था परिवर्तित होती है :  
(A\*) -3 से +5 (B) 0 से +5 (C) -3 से 1 (D) +3 से +5
- A-3.** When  $H_2SO_3$  is converted into  $H_2SO_4$  the change in the oxidation state of sulphur is from :  
(A) 0 to +2 (B) +2 to +4 (C) +4 to +2 (D\*) +4 to +6  
जब  $H_2SO_3$ ,  $H_2SO_4$  में रूपान्तरित होता है तब सल्फर की ऑक्सीकरण अवस्था में परिवर्तन होता है :  
(A) 0 से +2 (B) +2 से +4 (C) +4 से +2 (D\*) +4 से +6
- A-4.** The halogen that shows same oxidation state in all its compounds with other elements is :  
हेलोजन अन्य तत्वों के साथ सभी यौगिकों में समान ऑक्सीकरण अवस्था दर्शाता है, वह है :  
(A)  $I_2$  (B\*)  $F_2$  (C)  $Cl_2$  (D)  $Br_2$
- A-5.** Most stable oxidation state of gold is -  
(A) +1 (B) +3 (C) +2 (D\*) zero  
गोल्ड की सर्वाधिक स्थायी ऑक्सीकरण अवस्था है :  
(A) +1 (B) +3 (C) +2 (D\*) शून्य
- A-6.** The most stable oxidation state of chromium is -  
क्रोमियम की सर्वाधिक स्थायी ऑक्सीकरण अवस्था है -  
(A) +5 (B\*) +3 (C) +2 (D) +4
- A-7.** Which can have both +ve and -ve oxidation states?  
निम्न में से कौन धनात्मक व ऋणात्मक दोनों ऑक्सीकरण अवस्थाएँ रखता है?  
(A) F (B\*) I (C) Na (D) He
- A-8.** Which metal exhibits more than one oxidation states?  
निम्न में से कौनसी धातु एक से अधिक ऑक्सीकरण अवस्था दर्शाती है?  
(A) Na (B) Mg (C) Al (D\*) Fe
- A-9.** The most common oxidation state of an element is -2. The number of electrons present in its outer most shell is :  
एक तत्व की सर्वाधिक सामान्य ऑक्सीकरण अवस्था -2 है। इसके बाह्यतम कोश में उपस्थित इलेक्ट्रॉनों की संख्या है :  
(A) 2 (B) 4 (C\*) 6 (D) 8

- A-10.** Conversion of  $\text{PbSO}_4$  to  $\text{PbS}$  the oxidation number of sulphur in  $\text{PbS}$  is-  
 $\text{PbSO}_4$  से  $\text{PbS}$  में रूपान्तरण के दौरान  $\text{PbS}$  में सल्फर का ऑक्सीकरण अंक है-  
 (A\*) -2 (B) +6 (C) +4 (D) -1
- A-11.** Oxidation state of oxygen in  $\text{H}_2\text{O}_2$  is :  
 $\text{H}_2\text{O}_2$  में ऑक्सीजन की ऑक्सीकरण अवस्था है :  
 (A) -2 (B\*) -1 (C) +1 (D) +2
- A-12.** The oxidation number of phosphorus in  $\text{Mg}_2\text{P}_2\text{O}_7$  is :  
 $\text{Mg}_2\text{P}_2\text{O}_7$  में फॉस्फोरस का ऑक्सीकरण अंक है :  
 (A\*) +5 (B) -5 (C) +6 (D) -7
- A-13.** In the conversion of  $\text{Br}_2$  to  $\text{BrO}_3^-$ , the oxidation state of bromine changes from-  
 (A\*) 0 to +5 (B) -1 to +5 (C) 0 to -3 (D) +2 to +5  
 $\text{Br}_2$  का  $\text{BrO}_3^-$  में, रूपान्तरण के दौरान ब्रोमीन की ऑक्सीकरण अवस्था में परिवर्तन होता है-  
 (A\*) 0 से +5 (B) -1 से +5 (C) 0 से -3 (D) +2 से +5
- A-14.** Oxidation number of S in  $\text{S}_2\text{Cl}_2$  is :  
 $\text{S}_2\text{Cl}_2$  में सल्फर का ऑक्सीकरण अंक है :  
 (A\*) +1 (B) +6 (C) 0 (D) -1
- A-15.** Which of the following element shows only -1 oxidation number in combined state :  
 निम्नलिखित में से कौनसा तत्व संयोजित अवस्था में केवल -1 ऑक्सीकरण अंक दर्शाता है :  
 (A\*) F (B) Cl (C) Br (D) I
- A-16.** The oxidation number of Fe in  $\text{FeS}_2$  is  
 (A) +4 (B\*) +2 (C) +1 (D) zero  
 $\text{FeS}_2$  में Fe का ऑक्सीकरण अंक है :  
 (A) +4 (B\*) +2 (C) +1 (D) शून्य
- Sol.** In  $\text{FeS}_2$  ;  $\text{Fe}^{2+}$ ,  $\text{S}_2^{-2}$  ions exist. Oxidation number of Fe is +2.

## Section (B) : Inorganic nomenclature

### खण्ड (B) : आकार्बनिक नामकरण

- B-1.** Correct formula of aluminium perchlorate is :  
 एल्युमिनियम परक्लोरेट का सही सूत्र है :  
 (A)  $\text{Al}(\text{ClO})_3$  (B)  $\text{Al}(\text{ClO}_2)_3$  (C)  $\text{Al}_2(\text{ClO}_3)_3$  (D\*)  $\text{Al}(\text{ClO}_4)_3$
- B-2.** Sodium chlorite is :  
 सोडियम क्लोराइट है :  
 (A)  $\text{NaClO}_3$  (B\*)  $\text{NaClO}_2$  (C)  $\text{NaClO}$  (D)  $\text{NaClO}_4$
- B-3.** Aluminium phosphide is :  
 एल्युमिनियम फॉस्फाइड है :  
 (A)  $\text{AlP}_3$  (B)  $\text{Al}_2\text{P}_3$  (C\*)  $\text{AlP}$  (D)  $\text{Al}_3\text{P}_2$
- B-4.** Formula of Dioxygen difluoride is :  
 डाईऑक्सीजन डाईफ्लोराइड का सूत्र है :  
 (A)  $\text{OF}_2$  (B)  $\text{O}_2\text{F}$  (C\*)  $\text{O}_2\text{F}_2$  (D)  $\text{O}_2\text{F}_3$
- B-5.** Barium azide is :  
 बेरीयम एजाइड है :  
 (A)  $\text{BaN}$  (B)  $\text{Ba}_2\text{N}_3$  (C\*)  $\text{Ba}(\text{N}_3)_2$  (D)  $\text{Ba}_3\text{N}_2$
- B-6.** Silicon fluoride Formula is :  
 सिलिकॉन फ्लोराइड का सूत्र है :  
 (A)  $\text{SiF}$  (B)  $\text{SiF}_3$  (C\*)  $\text{SiF}_4$  (D)  $\text{SiF}_6$

- B-7.** Aluminium carbide is :  
एल्युमिनियम कार्बाइड है :  
(A)  $\text{Al}_2\text{C}$  (B\*)  $\text{Al}_4\text{C}_3$  (C)  $\text{AlC}_3$  (D)  $\text{AlC}$
- B-8.** Which of the following oxyacids forms pyroxyacids :  
(A)  $\text{H}_3\text{PO}_4$  (B)  $\text{H}_3\text{BO}_3$  (C)  $\text{H}_2\text{SO}_4$  (D\*) All of these  
निम्न में से कौनसे ऑक्सीअम्ल, पायरोऑक्सी अम्ल बनाते हैं :  
(A)  $\text{H}_3\text{PO}_4$  (B)  $\text{H}_3\text{BO}_3$  (C)  $\text{H}_2\text{SO}_4$  (D\*) उपरोक्त सभी
- B-9.** Which of the following set of element not forms metaoxy acids:  
निम्न तत्वों का कौनसा समूह मेटा ऑक्सी अम्ल नहीं बनाता है :  
(A\*) Cl, S, N (B) Cl, S, P (C) Si, C, B (D) C, Si, P
- Sol.** Cl, S, N and C oxyacids not forms metaoxyacids.  
Cl, S, N तथा C के ऑक्सीअम्ल मेटा ऑक्सी अम्ल नहीं बनाते हैं।
- B-10.** Name of oxyanion of boric acid ( $\text{H}_3\text{BO}_3$ ) is :  
(A\*) Borate ion (B) Boraite ion (C) Hypo Borite ion (D) Per borate ion  
बोरीक अम्ल ( $\text{H}_3\text{BO}_3$ ) के ऑक्सीऋणायन का नाम बताइये  
(A\*) बोरेट आयन (B) बोराइट आयन (C) हाइपो बोराइट आयन (D) परबोरेट आयन
- B-11.** Correct match is :  
(i)  $\text{CrO}_4^{2-}$  = chromate (ii)  $\text{MnO}_4^{2-}$  = Mangnate (iii)  $\text{BO}_3^{3-}$  = Borate (iv)  $\text{XeO}_4^{2-}$  = Xenate  
(A) Only (i) (ii) (B) Only (ii) (iii) (C) Only (iii) (iv) (D\*) All of these  
सही सुमेलित है :  
(i)  $\text{CrO}_4^{2-}$  = क्रोमेट (ii)  $\text{MnO}_4^{2-}$  = मेंग्नेट (iii)  $\text{BO}_3^{3-}$  = बोरेट (iv)  $\text{XeO}_4^{2-}$  = जीनेट  
(A) केवल (i) (ii) (B) केवल (ii) (iii) (C) केवल (iii) (iv) (D\*) उपरोक्त सभी
- B-12.** Sodium tri-sulphide Formula is :  
सोडीयम ट्राई सल्फाइड है :  
(A\*)  $\text{Na}_2\text{S}_3$  (B)  $\text{Na}_3\text{S}$  (C)  $\text{Na}_3\text{S}_2$  (D)  $\text{Na}_2\text{S}$
- B-13.**  $\text{PO}_4^{3-}$  is :  
(A\*) Phosphate ion (B) Phasphite ion (C) Hypophosphite ion (D) Pyrophosphite ion  
 $\text{PO}_4^{3-}$  है :  
(A\*) फास्फेट आयन (B) फॉस्फाइट आयन (C) हाइपोफॉस्फाइट आयन (D) पायरोफॉस्फाइट आयन
- B-14.** Pyrophosphoric acid is :  
पायरोफास्फोरिक अम्ल है :  
(A)  $\text{H}_3\text{PO}_4$  (B)  $\text{H}_4\text{P}_2\text{O}_5$  (C\*)  $\text{H}_4\text{P}_2\text{O}_7$  (D)  $\text{H}_3\text{PO}_3$
- B-15.** Correctly match codes are :
- |     |                                  |     |                      |
|-----|----------------------------------|-----|----------------------|
| (1) | $\text{H}_3\text{PO}_4$          | (p) | Meta phosphoric acid |
| (2) | $\text{HPO}_3$                   | (q) | Thio sulphuric acid  |
| (3) | $\text{H}_2\text{SO}_4$          | (r) | Phosphoric acid      |
| (4) | $\text{H}_2\text{S}_2\text{O}_3$ | (s) | sulphuric acid       |
- सही सुमेलित कोड है :
- |     |                                  |     |                     |
|-----|----------------------------------|-----|---------------------|
| (1) | $\text{H}_3\text{PO}_4$          | (p) | मेटा फॉस्फोरिक अम्ल |
| (2) | $\text{HPO}_3$                   | (q) | थायोसल्फ्यूरिक अम्ल |
| (3) | $\text{H}_2\text{SO}_4$          | (r) | फास्फोरिक अम्ल      |
| (4) | $\text{H}_2\text{S}_2\text{O}_3$ | (s) | सल्फ्यूरिक अम्ल     |
- (A)  $1 \rightarrow s, 2 \rightarrow q, 3 \rightarrow r, 4 \rightarrow s$  (B)  $1 \rightarrow q, 2 \rightarrow r, 3 \rightarrow p, 4 \rightarrow q$   
(C\*)  $1 \rightarrow r, 2 \rightarrow p, 3 \rightarrow s, 4 \rightarrow q$  (D)  $1 \rightarrow s, 2 \rightarrow r, 3 \rightarrow q, 4 \rightarrow p$

## PART - III : MATCH THE COLUMN

### भाग - III : कॉलम को सुमेलित कीजिए (MATCH THE COLUMN)

1. ✎ Match the column.

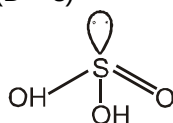
|     | Column-I                   |     | Column-II                        |
|-----|----------------------------|-----|----------------------------------|
| (A) | Sulphurous acid            | (p) | $\text{H}_2\text{S}_2\text{O}_8$ |
| (B) | Per oxo disulphuric acid   | (q) | $\text{H}_2\text{S}_2\text{O}_7$ |
| (C) | Pyro sulphuric acid        | (r) | $\text{H}_2\text{SO}_3$          |
| (D) | Peroxo mono sulphuric acid | (s) | Sulphur O.S + 6                  |

निम्न का मिलान कीजिए :

|     | कॉलम-I                       |     | कॉलम-II                          |
|-----|------------------------------|-----|----------------------------------|
| (A) | सल्फ्यूरस अम्ल               | (p) | $\text{H}_2\text{S}_2\text{O}_8$ |
| (B) | पर ऑक्सो डाईसल्फ्यूरिक अम्ल  | (q) | $\text{H}_2\text{S}_2\text{O}_7$ |
| (C) | पाइरो सल्फ्यूरिक अम्ल        | (r) | $\text{H}_2\text{SO}_3$          |
| (D) | परऑक्सो मोनो सल्फ्यूरिक अम्ल | (s) | सल्फर की ऑक्सीकरण अवस्था +6 है।  |

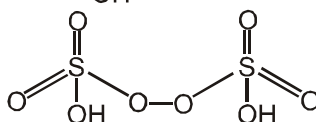
Ans. (A – r) ; (B – p, s) ; (C – q, s) ; (D – s)

Sol. (A) Sulphurous acid



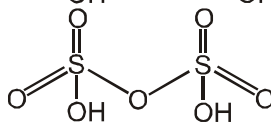
Oxidation state of S  $\Rightarrow 5 = +4$

(B) Peroxo disulphuric acid



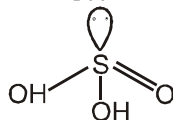
Oxidation state of S  $\Rightarrow 5 = +6$

(C) Pyro sulphuric acid



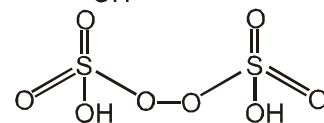
Oxidation state of S = +6

हल. (A) सल्फ्यूरस अम्ल



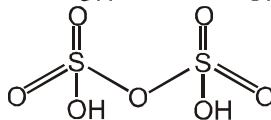
S की ऑक्सीकरण अवस्था  $\Rightarrow 5 = +4$

(B) पर ऑक्सो डाईसल्फ्यूरिक अम्ल



S की ऑक्सीकरण अवस्था  $\Rightarrow 5 = +6$

(C) पाइरो सल्फ्यूरिक अम्ल



S की ऑक्सीकरण अवस्था = +6

2. ✎ Match the column :

|     | Column-I                 |     | Column-II                    |
|-----|--------------------------|-----|------------------------------|
| (A) | $\text{HIO}_2$           | (p) | Magnesium hydrogen phosphite |
| (B) | $\text{Mg}(\text{IO})_2$ | (q) | Iodous Acid                  |
| (C) | $\text{HIO}$             | (r) | Magnesium hypoiodite         |
| (D) | $\text{MgHPO}_3$         | (s) | Hypoiodous acid              |

निम्न का मिलान कीजिए :

|     | कॉलम-I                   |     | कॉलम-II                       |
|-----|--------------------------|-----|-------------------------------|
| (A) | $\text{HIO}_2$           | (p) | मैग्नीशियम हाइड्रोजन फॉस्फाइट |
| (B) | $\text{Mg}(\text{IO})_2$ | (q) | आयोडस अम्ल                    |
| (C) | $\text{HIO}$             | (r) | मैग्नीशियम हाइपोआयोडाइट       |
| (D) | $\text{MgHPO}_3$         | (s) | हाइपोआयोडस अम्ल               |

Ans. (A – q) ; (B – r) ; (C – s) ; (D – p)

Sol. (A)  $\text{HIO}_2$  – Iodous acid आयोडस अम्ल

(B)  $\text{Mg}(\text{IO})_2$  – Magnesium hypoiodite मैग्नीशियम हाइपोआयोडाइट

(C)  $\text{HIO}$  – Hypoiodous acid हाइपोआयोडस अम्ल

(D)  $\text{MgHPO}_3$  – Magnesium hydrogen phosphite मैग्नीशियम हाइड्रोजन फॉस्फाइट

## Exercise-2

Marked questions are recommended for Revision.

चिह्नित प्रश्न दोहराने योग्य प्रश्न है।

### PART - I : ONLY ONE OPTION CORRECT TYPE

#### भाग - I : केवल एक सही विकल्प प्रकार (ONLY ONE OPTION CORRECT TYPE)

- The oxidation number of sulphur in  $\text{H}_2\text{SO}_5$   
 $\text{H}_2\text{SO}_5$  में सल्फर की ऑक्सीकरण संख्या है :  
(A) +3 (B) +5 (C\*) +6 (D) +8
- Which of the following is a correct statement.  
(A\*) The name of  $\text{SeO}_3^{2-}$  is selenite  
(B)  $\text{CdF}_3$  is correct formula  
(C) Zn can only show the oxidation state +3  
(D) The element having atomic numbers 29 lies in p-block  
निम्न में से कौनसा कथन सत्य है :  
(A\*)  $\text{SeO}_3^{2-}$  का नाम सेलीनाइट है। (B)  $\text{CdF}_3$  सही सूत्र है।  
(C) Zn केवल +3 ऑक्सीकरण अवस्था दर्शाता है। (D) परमाणु क्रमांक 29 का तत्व p-ब्लॉक तत्व है।
- In the given formula which one is correct :  
दिये गये सूत्रों में से कौनसा सही है :  
(A)  $\text{SiI}_2$  (B)  $\text{Cr}_2\text{O}_7$  (C)  $\text{Ti}_2\text{O}_5$  (D\*)  $\text{Na}_2\text{C}_8\text{H}_4\text{O}_4$
- Prefix per- is attached to the name  
किसके नाम में पूर्वलग्न, 'पर' प्रयुक्त होता है?  
(A)  $\text{H}_2\text{SnO}_3$  (B)  $\text{Sb}_2\text{O}_5$  (C\*)  $\text{H}_3\text{PO}_5$  (D)  $\text{HNO}_2$
- Match column-I with column II and select correct.

|       | Column-I                  |     | Column-II     |
|-------|---------------------------|-----|---------------|
| (I)   | $\text{CO}_3^{2-}$        | (P) | Carbonate ion |
| (II)  | $\text{N}_3^-$            | (Q) | Azide ion     |
| (III) | $\text{O}_2^{2-}$         | (R) | Acetate ion   |
| (IV)  | $\text{CH}_3\text{COO}^-$ | (S) | Peroxide ion  |

कॉलम-I का कॉलम-II के साथ मिलान कीजिए तथा सही विकल्प का चयन कीजिए।

|       | कॉलम-I                    |     | कॉलम-II       |
|-------|---------------------------|-----|---------------|
| (I)   | $\text{CO}_3^{2-}$        | (P) | कार्बोनेट आयन |
| (II)  | $\text{N}_3^-$            | (Q) | एजाइड आयन     |
| (III) | $\text{O}_2^{2-}$         | (R) | एसिटेट आयन    |
| (IV)  | $\text{CH}_3\text{COO}^-$ | (S) | परऑक्साइड आयन |

Code (कोड) :

|     |   |    |     |    |      |   |    |     |    |
|-----|---|----|-----|----|------|---|----|-----|----|
|     | I | II | III | IV |      | I | II | III | IV |
| (A) | P | Q  | R   | S  | (B*) | P | Q  | S   | R  |
| (C) | R | S  | Q   | R  | (D)  | R | P  | Q   | S  |

6. Dichromate ion is :  
डाइक्रोमेट आयन है :  
(A)  $\text{CrO}_4^{2-}$  (B\*)  $\text{Cr}_2\text{O}_7^{2-}$  (C)  $\text{CrO}_3$  (D)  $\text{Cr}_2\text{O}_4$
7. In following compound dithionic acid is :  
निम्न में से डाइथायोनिक अम्ल है :  
(A\*)  $\text{H}_2\text{S}_2\text{O}_6$  (B)  $\text{H}_2\text{S}_2\text{O}_4$  (C)  $\text{H}_2\text{SO}_5$  (D)  $\text{H}_2\text{S}_2\text{O}_3$

## PART - II : SINGLE AND DOUBLE VALUE INTEGER TYPE

### भाग - II : एकल एवं द्वि-पूर्णांक मान प्रकार (SINGLE AND DOUBLE VALUE INTEGER TYPE)

1. How many acid are pyro acid in the following given acids ?  
निम्न में से कितने पायरो अम्ल है ?  
(i)  $\text{H}_4\text{P}_2\text{O}_7$  (ii)  $\text{H}_4\text{P}_2\text{O}_5$  (iii)  $\text{H}_2\text{S}_2\text{O}_3$  (iv)  $\text{HNO}_2$   
(v)  $\text{H}_3\text{PO}_4$  (vi)  $\text{HNO}_3$  (vii)  $\text{H}_6\text{Si}_2\text{O}_7$

Ans. 3 [(i), (ii), (vii)]

2. How many of these names are correct.

|       |                     |   |              |
|-------|---------------------|---|--------------|
| (i)   | $\text{N}^{3-}$     | — | Nitride ion  |
| (ii)  | $\text{O}^{2-}$     | — | Peroxide ion |
| (iii) | $\text{ZnO}_2^{2-}$ | — | Zincate ion  |
| (iv)  | $\text{SO}_4^{2-}$  | — | Sulphite ion |
| (v)   | $\text{NO}_2^-$     | — | Nitrate ion  |
| (vi)  | $\text{PbO}_2^{2-}$ | — | Plumbite ion |
| (vii) | $\text{Fe}^{2+}$    | — | Ferric ion   |

निम्न में से सही नामों की संख्या बताइये।

|       |                     |   |               |
|-------|---------------------|---|---------------|
| (i)   | $\text{N}^{3-}$     | — | नाइट्राइड आयन |
| (ii)  | $\text{O}^{2-}$     | — | परऑक्साइड आयन |
| (iii) | $\text{ZnO}_2^{2-}$ | — | जिंकेट आयन    |
| (iv)  | $\text{SO}_4^{2-}$  | — | सल्फाइट आयन   |
| (v)   | $\text{NO}_2^-$     | — | नाइट्रेट आयन  |
| (vi)  | $\text{PbO}_2^{2-}$ | — | प्लम्बाइट आयन |
| (vii) | $\text{Fe}^{2+}$    | — | फेरिक आयन     |

Ans. 3 [(i), (iii), (vi)]

3. Count the correct number of statement.

- (i) Possible O.N. for Nitrogen +5, +4, +3, +1, -3, 0.  
(ii) Alkaline earth metal always have oxidation number +1.  
(iii)  $\text{HClO}$  is hypochlorous acid and  $\text{HClO}_3$  is perchloric acid.  
(iv)  $(\text{NH}_4)_2\text{SO}_4$  is ammonium sulphate  
(v) Aluminium hydrogen phosphite is  $\text{Al}(\text{H}_2\text{PO}_3)_3$   
(vi) Oxidation number of oxygen in  $\text{OF}_2$  is +2 and  $\text{O}_2\text{F}_2$  is +1  
(vii)  $\text{Cu}^+$ ,  $\text{Sn}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Sn}^{4+}$  respectively cuprous, stannous, ferric, stannic, ion.

सही कथनों की संख्या बताइए।

- (i) नाइट्रोजन की सम्भव ऑक्सीकरण संख्या +5, +4, +3, +1, -3, 0 है।  
(ii) क्षारीय मृदा धातु की ऑक्सीकरण संख्या सदैव +1 होती है।  
(iii)  $\text{HClO}$  हाइपोक्लोरस अम्ल है तथा  $\text{HClO}_3$  परक्लोरिक अम्ल है  
(iv)  $(\text{NH}_4)_2\text{SO}_4$  अमोनियम सल्फेट है।  
(v) एल्युमिनियम हाइड्रोजन फॉस्फाइट  $\text{Al}(\text{H}_2\text{PO}_3)_3$  है।  
(vi)  $\text{OF}_2$  में ऑक्सीजन की ऑक्सीकरण संख्या +2 तथा  $\text{O}_2\text{F}_2$  में +1 है।  
(vii)  $\text{Cu}^+$ ,  $\text{Sn}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Sn}^{4+}$  क्रमशः क्यूप्रस, स्टेनस, फेरिक, स्टेनिक आयन है।

Ans. 5 [(i), (iv), (v), (vi), (vii)]

4. In how many of the compound or ion nitrogen (N) shows positive oxidation state.  
निम्न दिये गये यौगिकों में से कितने यौगिकों या आयनों में नाइट्रोजन (N) धनात्मक ऑक्सीकरण अवस्था दर्शाता है।

(i)  $\text{NH}_3$  (ii)  $\text{Na}_3\text{N}$  (iii)  $\text{AlN}$  (iv)  $\text{N}_2\text{O}$  (v)  $\text{NF}_3$  (vi)  $\text{HNO}_2$   
(vii)  $\text{NH}_4^+$  (viii)  $\text{N}_2\text{O}_3$  (ix)  $\text{Ca}(\text{N}_3)_2$  (x)  $\text{Mg}_3\text{N}_2$  (xi)  $\text{NaNO}_3$

Ans. 5 [(iv), (v), (vi), (viii), (xi)]

Sol.  $\text{NH}_3$ ,  $\text{Na}_3\text{N}$ ,  $\text{AlN}$ ,  $\text{N}_2\text{O}$ ,  $\text{NF}_3$ ,  $\text{HNO}_2$ ,  $\text{NH}_4^+$ ,  
-3 -3 -3 (+1) (+3) (+3) (-3)  
 $\text{N}_2\text{O}_3$ ,  $\text{Ca}(\text{N}_3)_2$ ,  $\text{Mg}_3\text{N}_2$ ,  $\text{NaNO}_3$ .  
(+3) (-1/3) (-3) (+5)

5. How many of the following formula are correctly match with their name.

|        |                                   |   |                       |
|--------|-----------------------------------|---|-----------------------|
| (i)    | $\text{CaF}_2$                    | → | Calcium fluoride      |
| (ii)   | $\text{ICl}_2$                    | → | Iodine trichloride    |
| (iii)  | $\text{O}_2\text{F}_2$            | → | dioxygen difluoride   |
| (iv)   | $\text{AlN}$                      | → | Aluminium nitride     |
| (v)    | $\text{Na}_3\text{BO}_3$          | → | Sodium borate         |
| (vi)   | $\text{Zn}_2\text{P}_2\text{O}_7$ | → | Zinc pyrophosphate    |
| (vii)  | $\text{Na}_2\text{S}_2\text{O}_3$ | → | Sodium thio sulphate  |
| (viii) | $\text{XeO}_4$                    | → | Xenon tetraoxide      |
| (ix)   | $\text{Mg}(\text{ClO}_4)_2$       | → | Magnesium perchlorate |
| (x)    | $\text{Mg}(\text{OH})_2$          | → | Magnesium hydroxide   |

निम्न में से कितने सूत्र उनके नाम के साथ सुमेलित है।

|        |                                   |   |                          |
|--------|-----------------------------------|---|--------------------------|
| (i)    | $\text{CaF}_2$                    | → | कैल्शियम फ्लोराइड        |
| (ii)   | $\text{ICl}_2$                    | → | आयोडीन ट्राइक्लोराइड     |
| (iii)  | $\text{O}_2\text{F}_2$            | → | डाई ऑक्सीजन डाइफ्लोराइड  |
| (iv)   | $\text{AlN}$                      | → | एल्युमिनियम नाइट्राइड    |
| (v)    | $\text{Na}_3\text{BO}_3$          | → | सोडियम बोराइट            |
| (vi)   | $\text{Zn}_2\text{P}_2\text{O}_7$ | → | ज़िंक पायरोफॉस्फेट       |
| (vii)  | $\text{Na}_2\text{S}_2\text{O}_3$ | → | सोडियम थायो सल्फेट       |
| (viii) | $\text{XeO}_4$                    | → | जीनोन टेट्राऑक्साइड      |
| (ix)   | $\text{Mg}(\text{ClO}_4)_2$       | → | मैग्नीशियम पर क्लोरेट    |
| (x)    | $\text{Mg}(\text{OH})_2$          | → | मैग्नीशियम हाइड्रॉक्साइड |

Ans. 8 [Except (ii), (v)]

Sol.  $\text{Na}_3(\text{BO}_3)$  = Sodium borate;  $\text{ICl}_2$  = Iodine dichloride  
 $\text{Na}_3(\text{BO}_3)$  = सोडियम बोरेट ;  $\text{ICl}_2$  = आयोडीन डाइक्लोराइड

## PART - III : ONE OR MORE THAN ONE OPTIONS CORRECT TYPE

### भाग - III : एक या एक से अधिक सही विकल्प प्रकार

1. Match Column-I with column-II and the select correct answer with respect to name given below.

|       | Column-I           |     | Column-II                |
|-------|--------------------|-----|--------------------------|
| (I)   | Mercurous Chloride | (p) | $\text{K}_2\text{O}_2$   |
| (II)  | Calcium Phosphide  | (q) | $\text{SrH}_2$           |
| (III) | Potassium peroxide | (R) | $\text{Hg}_2\text{Cl}_2$ |
| (IV)  | Strontium hydride  | (S) | $\text{Ca}_3\text{P}_2$  |

कॉलम-I का कॉलम-II के साथ सुमेलित कीजिए तथा सही विकल्प का चयन कीजिए—

|       | कॉलम-I                 |     | कॉलम-II                  |
|-------|------------------------|-----|--------------------------|
| (I)   | मरक्यूरस क्लोराइड      | (p) | $\text{K}_2\text{O}_2$   |
| (II)  | कैल्शियम फॉस्फाइड      | (q) | $\text{SrH}_2$           |
| (III) | पोटेशियम परॉक्साइड     | (R) | $\text{Hg}_2\text{Cl}_2$ |
| (IV)  | स्ट्रॉन्शियम हाइड्राइड | (S) | $\text{Ca}_3\text{P}_2$  |

Code (कोड) :

|     |   |    |     |    |      |   |    |     |    |
|-----|---|----|-----|----|------|---|----|-----|----|
|     | I | II | III | IV |      | I | II | III | IV |
| (A) | R | Q  | S   | P  | (B*) | R | S  | P   | Q  |
| (C) | R | S  | Q   | P  | (D)  | Q | P  | S   | R  |

2. Which of the following statement(s) is /are correct ?  
 (A\*) The formula of aluminium arsenide is  $AlAs$   
 (B\*) The oxidation state of manganese in  $KMnO_4$  is +7  
 (C) Fe can only show one oxidation state  
 (D\*) Oxidation number of F element is always -1 in its compounds  
 निम्न में से सही कथन है/हैं—  
 (A\*) एल्युमिनियम आर्सेनाइड का सूत्र  $AlAs$  होता है।  
 (B\*)  $KMnO_4$  में मैंगनीज की ऑक्सीकरण अवस्था +7 होती है।  
 (C) Fe केवल एक ऑक्सीकरण अवस्था दर्शाता है।  
 (D\*) F तत्व की ऑक्सीकरण संख्या इसके यौगिकों में सदैव -1 होती है।
3. Which statement is/are incorrect ?  
 (A)  $KO_3$  is potassium ozonide  
 (B\*)  $NaAu$  is sodium aurite  
 (C\*)  $NO_2^+$  is nitrosonium  
 (D\*)  $PbO_3^{2-}$  is plumbite  
 निम्न में से कौनसा कथन असत्य है ?  
 (A)  $KO_3$ , पोटैशियम ओजोनाइड है  
 (B\*)  $NaAu$ , सोडियम एयूराइट है  
 (C\*)  $NO_2^+$ , नाइट्रोसोनियम है  
 (D\*)  $PbO_3^{2-}$ , प्लम्बाइट है
4. Which of the following statements is/are true for the acids [ $H_2CO_3$ ,  $H_2N_2O_2$ ,  $HClO_2$ ,  $H_2SO_5$ ]  
 (A)  $H_2CO_3$  is acid of carbon and the correct name is carbonous acid.  
 (B\*) The correct name of  $H_2N_2O_2$  is hyponitrous acid  
 (C)  $HClO_2$  is perchloric acid of chlorine  
 (D\*) Peroxo mono sulphuric acid is  $H_2SO_5$   
 अम्ल [ $H_2CO_3$ ,  $H_2N_2O_2$ ,  $HClO_2$ ,  $H_2SO_5$ ] के लिए निम्न में से सही कथन है/हैं ?  
 (A)  $H_2CO_3$  कार्बन अम्ल है तथा इसका सही नाम कार्बोनस अम्ल है।  
 (B\*)  $H_2N_2O_2$  का सही नाम हाइपोनाइट्रस अम्ल है।  
 (C)  $HClO_2$  क्लोरीन का परक्लोरिक अम्ल है।  
 (D\*)  $H_2SO_5$  परऑक्सो मोनो सल्फ्यूरिक अम्ल है।
5. Which statement (s) about oxidation number are correct.  
 (A\*) It is a relative charge in a particular bonded state  
 (B\*) Aluminium always has +3 oxidation number in its compounds  
 (C\*) The oxidation number of Cl in  $HClO_4$  is +7  
 (D\*) It is an imaginary or apparent charge developed over atom of an element when it goes from its elemental free state to combined state.  
 ऑक्सीकरण अंक के संदर्भ में सही कथन है/हैं ?  
 (A\*) यह किसी विशिष्ट बंधित अवस्था का एक आपेक्षिक आवेश है।  
 (B\*) एल्युमिनियम की ऑक्सीकरण संख्या इसके यौगिकों में सदैव +3 होती है।  
 (C\*)  $HClO_4$  में Cl की ऑक्सीकरण संख्या +7 होती है।  
 (D\*) यह एक तत्व के परमाणु पर उत्पन्न एक काल्पनिक या अवास्तविक आवेश है जब यह इसकी तात्त्विक मुक्त अवस्था से संयोजित अवस्था में जाता है।
6. Prefix per is attached to the name :  
 किसके नाम में पूर्वलग्न पर प्रयुक्त होता है :  
 (A\*)  $H_4XeO_6$  (B\*)  $H_3PO_5$  (C\*)  $H_2SO_5$  (D\*)  $HMnO_4$   
**Sol.** (A) Perxenic acid ;  $H_4XeO_6$  (B) Perphosphoric acid ;  $H_3PO_5$   
 (C) Persulphuric acid ;  $H_2SO_5$  (D) Permanganic acid ;  $HMnO_4$   
 (A) परजेनिक अम्ल ;  $H_4XeO_6$  (B) परफास्फोरिक अम्ल ;  $H_3PO_5$   
 (C) परसल्फ्यूरिक अम्ल ;  $H_2SO_5$  (D) परमैंगनिक अम्ल ;  $HMnO_4$

7. Identify the meta-acids  
मेटा अम्लों को पहचानिये।  
(A)  $\text{HMnO}_4$  (B\*)  $\text{H}_2\text{SnO}_3$  (C)  $\text{HClO}_3$  (D\*)  $\text{HPO}_3$
8. Which of the following acids are ortho-acids  
निम्न अम्लों में से कौनसे अम्ल ऑर्थो अम्ल है।  
(A\*)  $\text{H}_3\text{PO}_4$  (B\*)  $\text{H}_3\text{BO}_3$  (C)  $\text{H}_4\text{SiO}_7$  (D)  $\text{H}_3\text{PO}_2$

## PART - IV : COMPREHENSION

### भाग - IV : अनुच्छेद (COMPREHENSION)

Q.1, Q.2 and Q. 3 by appropriately matching the information given in the three columns of the following table.

| Oxyacid Formula                      | Oxidation Number | Name Prefix-Suffix                    |
|--------------------------------------|------------------|---------------------------------------|
| (P) $\text{H}_4\text{B}_2\text{O}_5$ | 1. (+3)          | (I) Pyro - ic oxyacid                 |
| (Q) $\text{H}_2\text{P}_2\text{O}_7$ | 2. (+5)          | (II) Pyro-us oxyacid                  |
| (R) $\text{H}_2\text{S}_2\text{O}_5$ | 3. (+6)          | (III) Meta-ic oxyacid                 |
| (S) $\text{HClO}_2$                  | 4. (+4)          | (IV) $\text{N}_\text{A}$ - us oxyacid |
| (T) $\text{HPO}_3$                   | 5. (+1)          | (V) $\text{N}_\text{A}$ - ic oxyacid  |

निम्न सारणी के तीनों कॉलम में दी गयी सूचनाओं के आधार पर Q.1, Q. 2 तथा Q. 3 के उत्तरी दीजिये?

| ऑक्सीअम्ल का सूत्र                   | ऑक्सीकरण संख्या | नाम पूर्वलग्न-अनुलग्न                    |
|--------------------------------------|-----------------|------------------------------------------|
| (P) $\text{H}_4\text{B}_2\text{O}_5$ | 1. (+3)         | (I) पायरो- इक ऑक्सीअम्ल                  |
| (Q) $\text{H}_2\text{P}_2\text{O}_7$ | 2. (+5)         | (II) पायरो- अस ऑक्सीअम्ल                 |
| (R) $\text{H}_2\text{S}_2\text{O}_5$ | 3. (+6)         | (III) मेटा- इक ऑक्सीअम्ल                 |
| (S) $\text{HClO}_2$                  | 4. (+4)         | (IV) $\text{N}_\text{A}$ - अस ऑक्सी अम्ल |
| (T) $\text{HPO}_3$                   | 5. (+1)         | (V) $\text{N}_\text{A}$ - इक ऑक्सीअम्ल   |

1. Which combination is in correct.  
कौनसा संयोजन सही नहीं है।  
(A) (P), (1), (I) (B\*) (Q), (2), (II) (C) (R), (4), (II) (D) (S), (1), (IV)
2. Which one combination is correct  
कौनसा एक संयोजन सही है।  
(A\*) (P), (1), (I) (B) (Q), (2), (I) (C) (R), (4), (IV) (D) (S), (2), (III)
3. Which of the following combination is correct  
निम्न में से कौनसा संयोजन सही है।  
(A) (R), (4), (II) (B) (S) (1) (IV) (C\*) (T) (2) (III) (D) (Q) (2) (III)

**Sol.**  $\text{H}_4\text{B}_2\text{O}_5$ ; O.No. +3; Pyro boric acid  
 $\text{H}_2\text{P}_2\text{O}_7$ ; O.No. +5; Pyro phosphoric acid  
 $\text{H}_2\text{S}_2\text{O}_5$ ; O.No. +4; Pyro sulphurous acid  
 $\text{HClO}_2$ ; O.No. +3; Chlorus acid  
 $\text{HPO}_3$ ; O.No. +5; Meta phosphoric acid

**Sol.**  $\text{H}_4\text{B}_2\text{O}_5$ ; O.No. +3; पायरो बोरीक अम्ल  
 $\text{H}_2\text{P}_2\text{O}_7$ ; O.No. +5; पायरो फास्फोरिक अम्ल  
 $\text{H}_2\text{S}_2\text{O}_5$ ; O.No. +4; पायरो सल्फयूरस अम्ल  
 $\text{HClO}_2$ ; O.No. +3; क्लोरस अम्ल  
 $\text{HPO}_3$ ; O.No. +5; मेटा फास्फोरिक अम्ल

## Additional Problems for Self Practice (APSP)

\* Marked Questions may have more than one correct option.

### PART - I : ONLY ONE OPTION CORRECT TYPE

- Strontium metaphosphate is  
(A)  $\text{Sr}(\text{PO}_3)_2$  (B)  $\text{SrHPO}_3$  (C)  $\text{Sr}_3(\text{PO}_4)_2$  (D)  $\text{Sr}_2\text{P}_2\text{O}_7$
- Nickel (II) pyroselenate is  
(A)  $\text{Ni}_2\text{Se}_2\text{O}_7$  (B)  $\text{NiSe}_2\text{O}_7$  (C)  $\text{Ni}_2\text{Se}_2\text{O}_5$  (D)  $\text{NiSe}_2\text{O}_5$
- The formula of sodium tungstate is  $\text{Na}_2\text{WO}_4$  and that of lead phosphate is  $\text{Pb}_3(\text{PO}_4)_2$ . What is the formula for lead tungstate ?  
(A)  $\text{PbWO}_4$  (B)  $\text{Pb}_2(\text{WO}_4)_3$  (C)  $\text{Pb}_3(\text{WO}_4)_2$  (D)  $\text{Pb}_3(\text{WO}_4)_4$
- Mercurous azide is  
(A)  $\text{Hg}_2(\text{N}_3)_2$  (B)  $\text{HgN}_3$  (C)  $\text{Hg}_2\text{N}_3$  (D)  $\text{Hg}(\text{N}_3)_2$
- $\text{Fe}[\text{Fe}(\text{CN})_6]$  is  
(A) ferroferrocyanide (B) Ferriferrocyanide (C) ferroferricyanide (D) ferriferrocyanide
- Ethyl methyl ether,  $\text{CH}_3\text{—O—C}_2\text{H}_5$ , is used as an anaesthetic. Formula for corresponding thioether would be  
(A)  $\text{CH}_3\text{—S—C}_2\text{H}_5$  (B)  $\text{CH}_3\text{—O—S—C}_2\text{H}_5$  (C)  $\text{C}_2\text{H}_5\text{—O—CH}_3$  (D)  $\text{C}_2\text{H}_5\text{—O—CH}_2\text{SH}$
- Hydracid which contains nitrogen is  
(A)  $\text{HN}_3$  (B)  $\text{HNO}_3$  (C)  $\text{HNO}_2$  (D)  $\text{NH}_3$
- Anhydride of  $\text{HClO}_4$  is  
(A)  $\text{Cl}_2\text{O}_7$  (B)  $\text{ClO}_3$  (C)  $\text{Cl}_2\text{O}_5$  (D)  $\text{ClO}_2$
- Correct name of the compound  $\text{NaCrO}_2$  will be  
(A) Sodium metachromate (B) Sodium metachromite  
(C) Sodium orthochromate (D) Sodium orthochromite
- A-pyro acid cannot be formed by  
(A)  $\text{HClO}_4$  (B)  $\text{H}_2\text{SO}_4$  (C)  $\text{H}_3\text{PO}_4$  (D)  $\text{H}_3\text{BO}_3$
- Correct name for  $\text{Na}_2\text{CaP}_2\text{O}_7$  is  
(A) Sodium calcium pyrophosphate (B) Sodium calcium metaphosphate  
(C) Sodium calcium orthophosphate (D) None of these
- Correct formula for rubidium metagallate is  
(A)  $\text{RbGaO}_2$  (B)  $\text{Ru}_2\text{GeO}_2$  (C)  $\text{Rb}_3\text{GaO}_3$  (D)  $\text{Ru}_2\text{GaO}_3$

### PART - II : ONE OR MORE THAN ONE OPTIONS CORRECT TYPE

- Names of which of the following acids end in -ic acid?  
(A)  $\text{H}_2\text{SO}_4$  (B)  $\text{HClO}_4$  (C)  $\text{H}_2\text{SO}_3$  (D)  $\text{HNO}_2$
- Names of which of the following end in -ous acid ?  
(A)  $\text{HNO}_2$  (B)  $\text{H}_2\text{CO}_3$  (C)  $\text{H}_2\text{SO}_3$  (D)  $\text{HBO}_2$
- Identify the meta-acids  
(A)  $\text{HMnO}_4$  (B)  $\text{H}_2\text{SnO}_3$  (C)  $\text{HClO}_3$  (D)  $\text{HPO}_3$
- Prefix pyro-is attached to the names  
(A)  $\text{As}_2\text{O}_3$  (B)  $\text{S}_2\text{O}_7^{2-}$  (C)  $\text{Sb}_2\text{O}_5$  (D)  $\text{H}_4\text{As}_2\text{O}_7$
- Which of the following acids are ortho-acids  
(A)  $\text{H}_3\text{PO}_4$  (B)  $\text{H}_3\text{BO}_3$  (C)  $\text{H}_4\text{Si}_2\text{O}_7$  (D)  $\text{H}_5\text{IO}_6$

6. Correct name is written against which of the following chemical formulae ?  
 (A)  $\text{CaSe}_2\text{O}_7$  Calcium pyroselenate (B)  $\text{Ni}(\text{HSO}_3)_2$  nickel(II) metasulphite  
 (C)  $\text{N}_2\text{H}_5\text{N}_3$  hydrazinium nitride (D)  $\text{CsOBr}$  Cesium hypobromite
7. What formula would be expected for a binary compound formed between strontium and nitrogen ?  
 (A)  $\text{Sr}_3\text{N}$  (B)  $\text{Sr}_2\text{N}_3$  (C)  $\text{Sr}(\text{N}_3)_2$  (D)  $\text{Sr}_3\text{N}_2$
8. Which of the following acids cannot be simply converted into other acids by addition or removal of water ?  
 (A)  $\text{H}_3\text{PO}_4$  (B)  $\text{HPO}_3$  (C)  $\text{H}_3\text{PO}_3$  (D)  $\text{H}_3\text{PO}_2$

### PART - III : SUBJECTIVE QUESTIONS

1. Write the names the following compounds  
 (a)  $\text{Ca}(\text{HS})_2$  (b)  $\text{Ca}(\text{OCl})_2$  (c)  $\text{CH}_3\text{COONa}$  (d)  $\text{NaOCN}$   
 (e)  $\text{Ca}(\text{HCO}_3)_2$  (f)  $\text{Mg}(\text{HSO}_4)_2$  (g)  $\text{Hg}_2\text{SO}_4$  (h)  $\text{Cu}_2\text{S}$
2. Write the names the following compounds  
 (a)  $\text{Co}(\text{ClO}_3)_3$  (b)  $\text{Al}_2\text{S}_3$  (c)  $\text{Mg}_3(\text{BO}_3)_2$  (d)  $\text{Na}_2(\text{MnO}_4)$   
 (e)  $\text{Mg}_3(\text{AsO}_3)_2$  (f)  $\text{Ca}(\text{C}_2\text{O}_4)$  (g)  $\text{Ca}_3(\text{AsO}_4)_2$  (h)  $\text{FeAsO}_4$   
 (i)  $\text{ClO}_2^-$  (j)  $\text{SeO}_3^{2-}$  (k)  $\text{CaWO}_4$  (l)  $\text{Mg}(\text{IO})_2$   
 (m)  $\text{Hg}_2\text{I}_2$  (n)  $\text{HgCl}_2$
3. Give the chemical formulae for  
 (a) hydroiodic acid (b) hypoiodous acid (c) iodous acid (d) iodic acid  
 (e) periodic acid (f) iodide ion (g) hypoiodite ion (h) iodite ion  
 (i) iodate ion (j) periodate ion
4. Give the formula of compounds :  
 (a) Magnesium nitride (b) Barium fluoride (c) Iron(III) sulphide  
 (d) Strontium hydride (e) Indium (I) chloride (f) Rubidium superoxide  
 (g) Cesium iodide (h) Calcium phosphide (i) Stannous chloride  
 (j) Potassium ozonide (k) Chromium (III) oxide (l) Potassium peroxide
5. Write the chemical formula of following compounds :  
 (a) Potassium pyrosulphite (b) Potassium hydrogenpyrophosphate (c) Barium permanganate  
 (d) Vanadium(III) phosphate (e) Ferric sulphate (f) Magnesium phosphite  
 (g) Cadmium nitride (h) Calcium metaborate (i) Ammonium hyponitrite  
 (j) Aluminium hydrogenphosphite

# APSP Answers

## PART - I

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

## PART - II

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (AB) | 2. (AC) | 3. (BD) | 4. (BD) | 5. (AB) |
| 6. (AD) | 7. (CD) | 8. (CD) |         |         |

## PART - III

- |    |                                                                                                                                                |                                                                                                                                                |
|----|------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | (a) Calcium bisulphide or hydrogen sulphide<br>(c) Sodium acetate<br>(e) Calcium bicarbonate<br>(g) Mercurous sulphate or Mercury (I) sulphate | (b) Calcium hypochlorite<br>(d) Sodium cyanate<br>(f) Magnesium bisulphate or hydrogen sulphate<br>(h) Cuprous sulphide or copper (I) sulphide |
| 2. | (a) Cobalt(III) chlorate<br>(d) Sodium manganite<br>(g) Calcium (ortho) arsenate                                                               | (b) Aluminium sulphide<br>(e) Magnesium orthoarsenite<br>(h) Ferric (ortho) arsenate or Iron(III) ortho arsenate                               |
| 3. | (a) HI<br>(g) IO <sup>-</sup>                                                                                                                  | (b) HIO<br>(h) IO <sub>2</sub> <sup>-</sup>                                                                                                    |
| 4. | (a) Mg <sub>3</sub> N <sub>2</sub><br>(g) CsI                                                                                                  | (b) BaF <sub>2</sub><br>(h) Ca <sub>3</sub> P <sub>2</sub>                                                                                     |
| 5. | (a) K <sub>2</sub> S <sub>2</sub> O <sub>5</sub><br>(g) Cd <sub>3</sub> N <sub>2</sub>                                                         | (b) KH <sub>3</sub> P <sub>2</sub> O <sub>5</sub><br>(h) Ca(BO <sub>2</sub> ) <sub>2</sub>                                                     |