## Learning Technique Card 1

### ELECTROCHEMICAL SERIES

| | | | |
|---|---|---|---|
| Li ले | Al अली | Ni नीचे | Hg होगे |
| K के | Mn महान | Sn सुनो | Br ब्रह्मानंद |
| Ba बारह | Zn जान | Pb प्रभात | Pt पंडित |
| Sr सरदार | Cr कर | H है | O और |
| Ca का | Fe फेंके | Cu कौन | Cl कलावती |
| Na नाम | Cd CD | I आइये | Au सोना लायी |
| Mg मांगे | Co कोई | Ag आगे | F फ्री मे |

### AMPHOTERIC OXIDES

ZnO, $Al_2O_3$, BeO, $Cr_2O_3$, $Ga_2O_3$, PbO, SnO

जनाबे अली ने बेकार गाया पंजाबी सौंग

### ACID RADICALS

**DILUTE ACID GROUP**

| | | | | | | |
|---|---|---|---|---|---|---|
| $HCO_3^-$, $CO_3^{-2}$, | $CH_3COO^-$, | $NO_2^-$, | $S_2O_3^{-2}$ | $SO_3^{-2}$ | $S^{-2}$ |
| C | A | N | T | $HSO_3^-$, Sure | success |

**CONCENTRATED ACID GROUP :**

| | | | | | | |
|---|---|---|---|---|---|---|
| $Cl^-$ | $Br^-$ | $I^-$ | $NO_3^-$ | $C_2O_4^{-2}$, | $BO_3^{3-}$, | $F^-$ |
| C | B | I | ने 8 | Ox | ब्राजील फ्रांस से पकड़े | |

**SPECIAL GROUP :**

| | | |
|---|---|---|
| $AsO_3^{3-}$ | $SO_4^{2-}$ | $MnO_4^-$ |
| $AsO_4^{3-}$ | $PO_4^{3-}$ | $CrO_4^{2-}$, $Cr_2O_7^{2-}$ |

## Learning Technique Card 3

### n' FACTOR OF $KMnO_4$ IN DIFFERENT MEDIUMS

| B (Basic) | A (Acidic) | N (Neutral) |
|---|---|---|
| 1 | 5 | 3 |

### GROUPS OF BASIC RADICALS & REAGENTS

| Groups | Radicals |
|---|---|
| Zero | $NH_4^+$ |
| I. | $Ag^+$ $Hg_2^{+2}$ $Pb^{+2}$ |
| | आज होगा प्रभात |
| IIA | $Hg^{+2}$ $Pb^{+2}$ $Cu^{+2}$ $Cd^{+2}$ $Bi^{+3}$ |
| | होंगे पंजाब के कुत्ते कोढ़ी बीमार |
| II B | $As^{+3}$ $Sb^{+3}$ $Sn^{+2}$ $Sn^{+4}$ |
| | आज सब सन्नाटा ही सन्नाटा |
| III | $Fe^{+3}$ $Cr^{+3}$ $Al^{+3}$ |
| | फेंक कर आलू |
| IV | $Mn^{+2}$ $Co^{+2}$ $Zn^{+2}$ $Ni^{+2}$ |
| | मन को जाना नहीं |
| V | $Ba^{+2}$ $Sr^{+2}$ $Ca^{+2}$ |
| | बाटा शू कम्पनी |
| VI | $Na^+$, $K^+$, $Mg^{+2}$ |
| | नाकमाँगो |

Sulphides of IIA is not soluble in yellow ammonium sulphide (Y.A.S.) where as sulphides of II B is soluble in Y.A.S.

A not S B S

ऐश्वर्या नहीं सुधारपायी बिगड़े सलमान को

## BASES STRONGER THAN $OH^-$ ION

| | | |
|---|---|---|
| $H^-$ | Hydride | H |
| $O^{-2}$ | Oxide | O |
| $O_2^{-2}$ | Peroxide | Pe |
| $O_2^-$ | Super Oxide | SO |
| $N^{-3}$ | Nitride | News |
| $P^{-3}$ | Phosphide | Paper |
| $As^{-3}$ | Aresnide | Aaj |
| $Sb^{-3}$ | Stebenide | Sub |
| $Bi^{-3}$ | Bismuthide | Bikega |
| $NH^{-2}$ | Imide | India & |
| $NH_2^-$ | Amide | America mein |

## TO REMEMBER

1. $Na_3[Ag(S_2O_3)_2]$
   3 1 2 complex.
2. $Na_4[Cu_6(S_2O_3)_5]$
   4 6 5 complex
3. $Na_3[Bi(S_2O_3)_3]$
   3 1 3 complex
4. $Na_3[Ag(S_2O_3)_2]$
   3 1 2 complex

## $Pb^{2+}$ $Zn^{2+}$ $Cu^{2+}$ $Mg^{2+}$

| | | | |
|---|---|---|---|
| पंडित | जानकीदास | कुत्ता | माँगे |

The soluble salts of $Pb^{2+}$ $Zn^{2+}$ $Cu^{2+}$ $Mg^{2+}$ . When they reacts with sodium carbonante solution they forms basic metal carbonates.



## EXCEPTIONS OF CHROMYL CHLORIDE TEST

| | | | | |
|---|---|---|---|---|
| $Ag^+$ | $Cu_2^{+2}$ | $Hg_2^{+2}$ | $Sn^{+4}$ | $Pb^{+4}$ |
| आज | क्यों | होगा | सुनहरा | फल |

## DIFFERENCE BETWEEN IIA & IIB

ऐश्वर्या नहीं सुधार पायी बिगड़े सलमान को

Sulphides of **IIA** **Not Soluble** **IIB Soluble** in yellow ammonium sulphide

## REACTIONS OF METALS WITH $HNO_3$

Following metal become passive with nitric acid

| | | | | |
|---|---|---|---|---|
| **Fe** | **Co** | **Ni** | **Cr** | **Al** |
| फें | को | नहीं | करारे | आलू |

Following metal will give $NH_4NO_3$ on reaction with dilute & very dilute nitric acid

| | | | | |
|---|---|---|---|---|
| **Zn** | **Sn** | **Mg** | **Fe** | **Mn** |
| जन | संघ | मांगे | फे | मिना |

Following metal will give $H_2$ on reaction with conc. Nitric acid

| | |
|---|---|
| **Mn** | **Mg** |
| मन | माँगे |

## ALUM

| | | | | | |
|---|---|---|---|---|---|
| $M = NH_4^+$ | $Na^+$ | $K^+$ | $Rb^+$ | $Cs^+$ | |
| अमीना | कब्र | | से | बोली | |
| $M' = Fe^{+3}$ | $Al^{+3}$ | $Co^{+3}$ | $Ga^{+3}$ | $Cr^{+3}$ | $Mn^{+3}$ |
| फिलहाल कोई | गा | | कर | मनाये | |

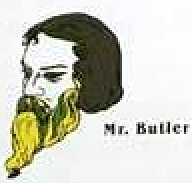
## Learning Technique Card 5

To avoid the confusion in name of $HgCl_2$(corrosive sublimate) and $Hg_2Cl_2$(calomel):

**नाम(Chemical name) बड़े तो दर्शन (Chemical formula)छोटे**

| | अमीना | कब्र | से | | | |
|---|---|---|---|---|---|---|
| M = | $NH_4^+$ $Na^+$ | $K^+$ $Rb^+$ | $Cs^+$ | | | बोली |
| | फिलहाल | कोई | गा | कर | मनाए | |
| M' = | $Fe^{+3}$ $Al^{+3}$ | $Co^{+3}$ | $Ga^{+3}$ | $Cr^{+3}$ | $Mn^{+3}$ | . |

### KCN TEST FOR COBALT AND NICKEL




for **Co** **and** **Ni**

**BUTLER'S BEARD YELLOW GREEN YELLOW**

**BUFF BROWN**

## Learning Technique Card 7

| Metal | Occurence |
|---|---|
| Lithium | Spodumene $LiAlSi_2O_6$, Lepidolite $(Li, Na, K)_2 Al_2(SiO_3)_3.F(OH)$ |
| Sodium | rock salt, NaCl feld spar $Na_3AlSiO_8$ |
| Magnesium | Carnalite $KCl.MgCl_2.6H_2O$ magnesite $MgCO_3$ |
| Calcium | Lime stone $CaCO_3$ Dolomite $MgCO_3.CaCO_3$ Gypsum, $CaSO_4.2H_2O$ |
| Copper | Copper pyrite $CuFeS_2$ Cuprite, $Cu_2O$ Melachite, $CuCO_3.Cu(OH)_2$ |
| Aluminium | Bauxite $Al_2O_3.2H_2O$ cryolite $Na_3AlF_6$ Alumino silicates |
| Zinc | Zinc blende or spharelite ZnS Calamine, $ZnCO_3$ |
| Lead | Galena PbS |
| Tin | Cassetarite $SnO_2$ |
| Silver | Argentite $Ag_2S$ Hornsilver, AgCl |
| Gold | Native, small amount in mangnese ores such as those of Cu & Ag |
| Chromium | Chromite $Cr_2O_3.FeO$ |

## Learning Technique Card 8

| Extraction method | Remark |
|---|---|
| Electrolysis of fused LiCl/KCl | Because of their high reactivity they are expected under anhydrous condition. |
| Electrolysis of fused NaCl(or) NaCl/$CaCl_2$ | |
| Electrolysis of rusted MgO (or) $MgCl_2$/KCl<br>Carbon reduction of MgO | Carbon reduction is not possible with alkaline earths as a carbide is formed with them. |
| Electrolysis of fused $CaCl_2$/$CaF_2$ | |
| Roasting of sulphide partially and reduction $2Cu_2O+Cu_2S \rightarrow 6Cu+SO_2$ | It is self reduction in a specially derived converter. $H_2SO_4$ leaching is also employed. |
| Electrolysis of $Al_2O_3$ dissolved in molten cryolite (or) in $Na_3AlF_6$ | A good source of electricity is needed in the extraction of Al. |
| Roasting & then reduction with 'C' | Metal may be purified by fraction distillation. |
| Roasting of sulphide ore and then reduction of the oxide. Carbon reduction of the oxide | |
| Carbon reduction of the oxide | Magnetic separated is employed as the impurities in this case are magnetic. |
| Sodium cyanide leaching of the sulphide ore & finally replacement of Ag by Zn. | |
| Cyanide leach same as in case of silver | |
| Si (or) Al reduction of the oxide (Alumino-thermite process) | |

## Learning Technique Card 6

### TEST OF $Co^{2+}$

$CoO + ZnO \longrightarrow CoO.ZnO$

Rinmann 's green

$CoO + MgO \longrightarrow CoO.MgO$

Cobalt Pink

$CoO + Al_2O_3 \longrightarrow CoO.Al_2O_3$

Thenard Blue

$CoO + SnO \longrightarrow CoO.SnO$

Cobalt Green

Learning Technique Card 9

## AAROHAN

1. $O^{2-} > F^- > Na^+ > Mg^{2+}$
All the four species are isoelectronic ($1s^2 2s^2 2p^6$). The number of positive charges in the nucleus decreases in the order 12 Mg > 11 Na > 9F > 8O. Hence $O^{2-}$ involved minimum nucleus -electrons attraction and maximum electron-electron repulsion while $Mg^{2+}$ involves maximum nucleus electrons attraction and minimum electron-electron repulsion. These factors make the size of anion greater than the corresponding neutral atom and that of cation lesser than the corresponding atom.

2. $Na_2O_2 < MgO < ZnO < P_2O_5$
Oxides of electropositive elements are alkaline while those of electronegative elements are acidic. Alkaline property will increase of electropositive character of metal and acidic characteristics increase with increase of electronegative characteristic of nonmetals. Since the electronegativity increases in the order Na < Mg < Zn. The acidic character of oxide will also increases in the same order.

3. Na < Al < Mg < Si

| | |
|---|---|
| $_{11}Na$ | $1s^2 2s^2 2p^6 3s^1$ |
| $_{12}Mg$ | $1s^2 2s^2 2p^6 3s^2$ |
| $_{13}Al$ | $1s^2 2s^2 2p^6 3s^2 3p^1$ |
| $_{14}Si$ | $1s^2 2s^2 2p^6 3s^2 3p^2$ |

Aluminium will have lower ionization potential than magnesium as the removal of one electron leads to the formation of stable completely filled orbital configuration. So it is loosely held and can be removed more easily than to remove electron from filled 3s orbital of magnesium atom.

4. $N_2 < O_2 < F_2 < Cl_2$
Nitrogen contains triple bond, oxygen contains double bond and fluorine and chlorine contain a single bond each chlorine involves bonding of 3p orbitals while fluorine involves 2p orbitals.

5. $Ca^{2+} < Cl^- < S^{2-} < Ar$
the given species are isoelectronic. The size of cation will be the smallest. The mononegative anion will have smaller size than the dinegative anion. The size of the noble gas Ar will be maximum.

6. $HClO < HClO_2 < HClO_3 < HClO_4$
These acids are better represented as Cl-OH, OCl-OH, $O_2$Cl-OH, $O_3$Cl-OH.
The large the number of oxygen atoms attached to chlorine, greater the electron pull towards oxygen. Hence, more easy to remove hydrogen from the acid.

Learning Technique Card 11

## AAROHAN

18. Li < Na < K < Rb < Cs
The reactivity increases on descending the group I.

19. Cs < Rb < K < Na < Li
The ease of formation of hydrides decreases on descending the group I.

20. Cs < Rb < K < Na < Li
The melting (or boiling) point decreases on descending the group.

21. LiOH < NaOH < KOH < RbOH < CsOH
The basic nature of hydroxides of elements of group I increases on descending the group.

22. LiOH < NaOH < KOH < RbOH < CsOH
Thermal stability of hydroxides increases on descending the group.

23. LiCl < LiBr < LiI
The smaller sized $Li^+$ ions polarised the larger anion more predominately giving larger covalent character.

24. $BeCl_2 < MgCl_2 < CaCl_2 < SrCl_2 < BaCl_2$

25. $BeCO_3 < CaCO_3 < MgCO_3 < BaCO_3$
On moving down the group, the lattice energies of carbonates do not decreases much while the degree of hydration of the metal ions decreases significantly leading to increases solubility.

26. $BeF_2 > MgF_2 > CaF_2 > BaF_2$
Lattice energy variation is more dominating than the variation in hydration energy.

27. $Be(OH)_2 < Mg(OH)_2 < Ca(OH)_2 < Ba(OH)_2$
same as 26.

28. $Be(OH)_2 < Mg(OH)_2 < Ca(OH)_2 < Ba(OH)_2$

29. $Ba^{2+} < Sr^{2+} < Ca^{2+} < Mg^{2+} < Be^{2+}$
The extent of hydration of ion decreases with increases in ionic size.

30. Be < Mg < Ca < Sr < Ba
The reaction of alkaline earth metals becomes increasingly vigorous with increasing in atomic number.

31. Be < Mg < Ca < Sr < Ba

32. $BaSO_4 < SrSO_4 < CaSO_4 < MgSO_4 < BeSO_4$,
Hydration of ion plays a dominating role as compared to lattice energy.

## AAROHAN

33. $BCl_3 < GaCl_3 < AlCl_3$
Increases in the electropositivity of element increases its ionic character.

34. $BF_3 < BCl_3 < BBr_3$
Besides σ bond between boron and halogen atoms, there exit additional $p\pi - p\pi$ bond between the two atoms resulting from back donation of electrons from fluorine to boron (back bonding). The tendency to from $p\pi - p\pi$ bond is maximum in $BF_3$($2p\pi - 2p\pi$) back bonding and falls rapidly on passing to $BCl_3$ ($2p\pi - 3p\pi$) back bonding and $BBr_3$ ($2p\pi$–$4p\pi$ back bonding). The tendency to accept electron pair, therefore, increase from $BF_3$ to $BBr_3$.

35. $InCl_3 < GaCl_3 < AlCl_3$
with increases in size of elements of group 13, the tendency to accept electron pair is decreased.

36. $PbCl_2 < SnCl_2 < GeCl_2$
The stability of element in +II oxidation state increases on ascending the group 14. This is due to inert pair effect.

37. $GeCl_4 < SnCl_4 < PbCl_4$
The stability of element in +IV oxidation state decrease on ascending the group 14. This is due to inert-pair effect.

38. $Sn < Si < C$
The number of hybride orbitals and ease with which these are formed decreases from carbon to lead.

39. $SbH_3 < AsH_3 < PH_3 < NH_3$
The decrease in electronegativity and increase in size of element cause the decrease in tendency to accept proton.

40. $SbH_3 < AsH_3 < PH_3 < NH_3$

41. $H_3SbO_4 < H_3AsO_4 < H_3AsO_3 < HNO_3$

42. $H_3SbO_4 < H_3AsO_4 < H_3AsO_3 < HNO_3$

43. $Bi < Sb < As < P < N$

44. $NCl_3 < PCl_3 < AsCl_3 < SbCl_3 < BiCl_3$

45. $H_2Te < H_2Se < H_2S < H_2O$

46. $H_2S < H_2Se < H_2Te < H_2Po$



## AAROHAN

7. $HI < HBr < HCl < HF$
As the size of the halogen atom increases, the strength of HX bond decreases. Besides this decreasing percent ionic character from HF to HI makes the bond less stable.

8. $HI < I_2 < ICl < HIO$
The oxidation state of iodine in HI, $I_2$, ICl and $HIO_4$ are –1, 0, + 1 and +7 respectively.

9. $HOCl < HOClO < HOClO_2 < HOClO_3$
The stability is explained by the increasing number of electron involved in the formation of σ and π bonds in going from HOCl to $HOClO_3$. In $ClO_4^-$ ion all the valence orbitals and electrons of chlorine are involved in the formation of bonds.

10. $F_2 < Cl_2 < O_2 < N_2$
$N_2$ involves a triple bond, $O_2$ involves a double bond, $F_2$ and $Cl_2$ involve a single bond each. $F_2$ has a lower bond enthalpy than $Cl_2$. This is due to more repulsion of nonbonding electrons in $F_2$. Besides this, there is a possibility of multiple bonding in $Cl_2$ involving d orbitals.

11. $SiO_2 < CO_2 < N_2O_5 < SO_3$
Increasing electronegativity of an element makes its oxide more acidic.

12. $Mg^{2+} < Na^+ < F^- < O^{2-} < N^{3-}$

13. $NiO < MgO < SrO < K_2O < Cs_2O$
increasing electropositive nature of the element makes its oxide more basic.

14. $CCl_4 < MgCl_2 < AlCl_3 > SiCl_4 < PCl_5$
In covalent halides, hydrolysis occurs as a result of co-ordination of a water molecule to the less electronegative element. $CCl_4$ does not undergo hydrolysis as carbon cannot expand its octet to accommodate water molecules.

15. $S < Cl < N < O < F$
The negative charge on X in HX increase with increasing electronegativity of X. This makes the hydrogen bonding more strong.

16. $Cs^+ < Rb^+ < K^+ < Na^+ < Li^+$
The ions in solution are present as hydrated ions. The smaller the size of the ion, the greater the extent of hydration. So the size of hydrated ions becomes larger for smaller sized ion and vice verca.

17. $Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$
$Li^+$ ion being heavily hydrated has the lowest mobility and $Cs^+$ ion being less hydrated has the highest mobility.

## AAROHAN

47. $H_2O < H_2S < H_2Se < H_2Te$
Large the size of X (=O, S, Se, Te) weaker its bonds with hydrogen and more easily $H^+$ gets lost in aqueous solution.

48. $H_2TeO_3 < H_2SeO_3 < H_2SO_3$
Decreasing size and increasing electronegativity from Te to S with draws electrons from O – H bond towards itself, thus, facilitating the release of proton.

49. $H_2SO_3 < H_2SeO_3 < H_2TeO_3$

50. $H_2TeO_4 < H_2SeO_4 < H_2SO_4$

51. $H_2TeO_4 < H_2SeO_4 < H_2SO_4$

52. $Cl > F > Br > I$

53. $HF < HCl < HBr < HI$

54. $I_2 > Br_2 > Cl_2 > F_2$

55. $HF < HCl < HBr < HI$

56. $HCl < HBr < HF < HI$
Anomalous behaviour of HF is due to hydrogen bonding.

57. $HCl < HBr < HI < HF$
Anomalour behaviour of HF is due to hydrogen bonding.

58. $HFO_3 < HClO_3 < HBrO_3 < HIO_3$
Ions of these acids are stabilized due to strong $p\pi$–$p\pi$ bonding between full 2p orbitals on oxygen and empty orbitals on the halogen atom. Fulorine has no d orbitals and cannot from $p\pi$-$d\pi$ bonds.

59. $TiCl_2 < TiCl_3 < TiCl_4$
Increasing oxidation state of Ti increases charge density on the metal leading to increases in the polarization of the anionic charge cloud and thus covalency increases. Thus oxacid of fluorine are not known.

60. $Zn^{2+} < Ti^{3+} < Ni^{2+} < Co^{2+} < Cr^{2+}$,
Increasing number of unpaired electrons increases magnetic moment. The number of unpaired electron in the given species are as follows.
$Ti^{3+}$ one, $Ni^{2+}$ two, $Co^{2+}$ three, $Cr^{2+}$ four and $Zn^{2+}$ zero.

61. $VCl_4 < VCl_3 < VCl_2$
Decreasing oxidation state of element increases the ionic character.



## FAMOUS PROCESS AND RELATED METAL

| S.No. | Some Famous process | Related meal |
|---|---|---|
| 1. | Poling | Cu. Sn |
| 2. | Parkes Process | Ag |
| 3. | Pattinson process | Ag |
| 4. | Cupellation process | Ag |
| 5. | Baeyer's process | Al |
| 6. | Serpek's process | Al |
| 7. | Hall's process (or) | Al |
| 8. | Siemen's Martins Open hearth process | Fe |
| 9. | Bessemer's process | Fe |

## OXIDE ORE

| | | |
|---|---|---|
| *$ZnO$ | → | Zincite |
| *$Fe_2O_3$ | → | Haematite |
| *$Fe_3O_4$ | → | Magnetite |
| *$Al_2O_3 . 2H_2O$ | → | Bauxite |
| *$Fe_2O_3 . 3H_2O$ | → | Limonite |
| *$Cu_2O$ | → | Cuprite or Ruby Copper |
| $MnO_2$ | → | Pyrolusite |
| $SnO_2$ | → | Tinstone or Casseterite |
| $TiO_2$ | → | Rutile |
| $Fe.Cr_2O_4$ | → | $(FeO + Cr_2O_3)$ Chromite ore |
| $Na_2B_4O_7.10H_2O$ | → | Borax or Tincal |
| $Ca_2B_6O_{11}.5H_2O$ | → | Colemanite |
| $U_3O_8$ | → | Pitch Blende |
| $FeO.TiO_2$ | → | Ilmenite |

## SULPHURISED ORE

| | | |
|---|---|---|
| *PbS | → | Galena |
| HgS | → | Cinnabar |
| *Zns | → | Zinc blende/sphalerite |
| *$Cu_2S$ | → | Copper glance/Chalococite |
| $CuFeS_2$ | → | Copper Pyrite (Chalcopyrite) |
| *$FeS_2$ | → | Iron pyrite of Fool's gold |
| $Ag_2S$ | → | Silver glance or Argentite |

## HALIDE ORE

| | | |
|---|---|---|
| NaCl | → | Rock Salt |
| KCl | → | Sylvine |
| $CaF_2$ | → | Fluorspar |
| $Na_3AlF_6$ | → | Cryolite |
| AgCl | → | Horn Silver |
| $KCl.MgCl_2.6H_2O$ | → | Carnalite |
| $Cu_2Cl(OH)_3$ | → | Atacamite |

## OXY SALT ORE

**1. *Carbonate Ore:***

| | | |
|---|---|---|
| $CaCO_3$ | → | Lime stone |
| $MgCO_3$ | → | Magnesite |
| $CaCO_3 . MgCO_3$ | → | Dolomite |
| *$FeCO_3$ | → | Siderite |
| * $ZnCO_3$ | → | Calamine |
| * $Cu(OH)_2 . CuCO_3/Cu_2(OH)_2CO_3$ | → | Malachite or Basic Copper Carbonate |
| $Cu(OH)_2 . 2CuCO_3$ | → | Azurite |
| $PbCO_3$ | → | Cerrusite |



**2. *Sulphate Ore:***

| | | |
|---|---|---|
| $CaSO_4 . 2H_2O$ | → | Gypsum |
| $MgSO_4 . 7H_2O$ | → | Epsom Salt |
| $PbSO_4$ | → | Anglesite |
| $BaSO_4$ | → | Baryte |
| $Na_2SO_4 . 10H_2O$ | → | Glauber Salt |
| $CuSO_4 . 5H_2O$ | → | Chalcanthite |

**3. *Nitrate Ore:***

| | | |
|---|---|---|
| $KNO_3$ | → | Indian Salt Peter |
| $NaNO_3$ | → | Chile Salt Peter |

## METALS IN LIVING ENTITIES

(a) **Magnesium** is found in chlorophyll.
(b) **Potassium** is present in plant roots.
(c) **Manganese**, **iron** and **copper** are present in chloroplast.
(d) **Zinc** is present in eyes of cats and cows.
(e) **Iron** is present in haemoglobin.
(f) **Calcium** is present in bones.
(g) **Vanadium** is present in cucumbers.
(h) **Chromium** is present in prawn.
(i) **Cobalt** is present in eynocobalamin (Vitamine)

## ALLOYS

| S.No. | Name of Alloy | Composition | Uses |
|---|---|---|---|
| 1. | Magnelium | Al : 98%, Mg : 2% | For making balance |
| 2. | Duralumin | Al : 95%, Cu : 4% Mg : 0.5%, Mn : 0.5% | Air craft parts boat machinary |
| 3. | Aluminium bronze | Al : 10%, Cu : 90% | Making coins, photo frames utensils, golden paints |
| 4. | Alnico | Al : 20%, Ni : 20% Co : 10% Steel : 50% | For making permanent magnet |
| 5. | γ-Alloy | Al : 92%, Cu : 4% Mg : 1.5%, Ni : 2.5% | Pistons and machine parts |
| 6. | Nickeloy | Al : 95%, Cu : 4%, Ni : 1% | Air craft parts |
| 7. | Pewter | Pb : 20, Sn : 80 | Utensils |
| 8. | Solder | Pb : 50, Sn : 50 | Soldering |
| 9. | Type metal | Pb : 75, Sn : 5, Sb : 20 | Printing type |
| 10. | Bell metal | Cu : 80, Sn : 20 | Bells making |
| 11. | Babbit metal | Sn : 90, Sb : 7, Cu : 3 | Bearing of machinary |
| 12. | Frary metal | Pb : 97%, Ba : 2%, Ca : 1% | Bearing of machine |
| 13. | Lino type metal | Pb : 83%, Sn : 3%, Sb:14% | Printing type |
| 14. | Brass | Cu : 70%, Zn: 30% | Making utensils condenses tube making |
| 15. | Bronze | Cu : 88-96%, Sn 4-12% | Utensils, coins, statues |



| | | | |
|---|---|---|---|
| 16. | Monel metal | Cu : 27%, Ni : 68%, Fe : 5% | Making pumps, turbines of ships, boilers etc. |
| 17. | German silver | Cu:50%, Zn: 30%, Ni:20% | Flower Vase & ornaments |
| 18. | Electron | Mg:95%, Zn:4.5,Cu:0.5% | Parts of aeroplane and motor cars |
| 19. | Dutch metal | Cu: 80%, Zn: 20% | Golden yellow colour used for decorative purpose |
| 20. | Nichrome | Ni, Cr, Fe | |
| 21. | Gun Metal | Cu : 87%, Zn:3%,Sn:10% | |
| 22. | Constantan | Cu:60 %, Ni : 40% | |
| 23. | Artifical Gold | Cu : 90%, Al : 10% | |
| 24. | 14 Carat Gold | Au : 54%, Ag : 14% to 30%, Cu : 12-28% | |
| 25. | 24 Carat Gold | 100% Au | |

## ALLOY OF STEEL

| | | |
|---|---|---|
| 1. | Vanadium | V : 0.2 - 1% |
| 2. | Chromium | Cr : 2 - 4% |
| 3. | Nickel | Ni : 3 - 5% |
| 4. | Manganese steel | Mn : 10 - 18% |
| 5. | Stainless steel | Cr : 12 - 14% and Ni : 2 - 4% |
| 6. | Tungsten | W : 10 - 20% |
| 7. | Invar | Ni : 36% |

## Learning Technique Card 20

## SOME IMPORTANT COMPOUNDS, MINERALS, MIXTURES & THE FORMULA'S

| | | |
|---|---|---|
| 1. | Epsom salt | $MgSO_4.7H_2O$ |
| 2 | Gypsum salt | $CaSO_4.2H_2O$ |
| 3. | Glauber's salt | $Na_2SO_4.10H_2O$ |
| 4. | Lime water | $Ca(OH)_2$(slaked lime) |
| 5. | Quick lime | $CaO$ |
| 6. | Washing Soda | $Na_2CO_3.10H_2O$ |
| 7. | Crystal carbonate | $Na_2CO_3.H_2O$ |
| 8. | Soda ash | $Na_2CO_3$ |
| 9. | Baking Soda | $NaHCO_3$ |
| 10. | Turn bull's blue | $Fe_3[Fe(CN)_6]_2$ |
| 11. | Chile salt petre | $NaNO_3$ |
| 12. | Indian salt petre | $KNO_3$ |
| 13. | Brine or Table salt or Rock Salt | $NaCl$ |
| 14. | Potash ash or Pearl ash | $K_2CO_3$ |
| 15. | Nitre or Indian salt petre or Chemical refrigenant | $KNO_3$ |
| 16. | Norwegian salt petre | $Ca(NO_3)_2$ |
| 17. | Salt Cake | $K_2SO_4$ |
| 18. | Carnallite | $KCl.MgCl_2.6H_2O$ |
| 19. | Hypo | $Na_2S_2O_3.5H_2O$ |
| 20. | Borax or Tincal | $Na_2B_4O_7.10H_2O$ |
| 21. | Barytes or Heavy spar or Barium meal | $BaSO_4$ |
| 22. | Baryta | $Ba(OH)_2$ |
| 23. | Magnesia | $MgO$ |
| 24. | Microcosmic salt | $NaNH_4HPO_4.4H_2O$ |
| 25. | Nitrolium | $CaCN_2$ |
| 26. | Hydrolith | $CaH_2$ |
| 27. | Fusion mixture | $Na_2CO_3 + K_2CO_3$ |
| 28. | Gun powder | $KNO_3 + K_2CO_3$ |
| 29. | Pink salt | $(NH_4)_2SnCl_6$ |
| 30. | Laughing gas | $N_2O$(nitrous oxide) |
| 31. | Red Lead | $Pb_3O_4$ |
| 32. | Blue vitriol | $CuSO_4.5H_2O$ |
| 33. | Green vitriol | $FeSO_4.7H_2O$ |
| 34. | Chiense White | $ZnO$ |
| 35. | Philosopher's wool | $ZnO$ |

## Learning Technique Card 18

## PPT OF BASIC RADICALS

1. I-group radicals are precipitated in form of colorides.

| | |
|---|---|
| $AgCl$ | White |
| $Hg_2Cl_2$ | White |
| $PbCl_2$ | White |

2. IIA and IIB-groups radicals are precipitated in form of sulphides.

| | | | |
|---|---|---|---|
| $HgS$ | Black | $AS_2S_3$ | Yellow |
| $PbS$ | Black | $Sb_2S_3$ | Orange |
| $GuS$ | Black | $SnS$ | Brown |
| $CdS$ | Yellow | $SnS_2$ | Yellow |
| $Bi_2S_3$ | Black | | |

3. III-group radicals are precipitated in form of their hydro-oxides.

| | |
|---|---|
| $Fe(OH)_3$ | Red/ Brown |
| $Cr(OH)_3$ | Green |
| $Al(OH)_3$ | Gel White |

4. IV-group radicals are precipitated in form of sulphides.

| | |
|---|---|
| $MnS$ | Buff |
| $CoS$ | Black |
| $ZnS$ | White |
| $NiS$ | Black |

5. V-group radicals are precipitated in form of carbonates

| | |
|---|---|
| $BaCO_3$ | White |
| $SrCO_3$ | White |
| $CaCO_3$ | White |

## Learning Technique Card 21

### SOME IMPORTANT COMPOUNDS, MINERALS, MIXTURES & THE FORMULA'S

| | | |
|---|---|---|
| 36. | Oil of Vitriol | $H_2SO_4$ |
| 37. | Mohr's salt (Ferrous ammonium sulphate) | $FeSO_4(NH_4)_2SO_4.6H_2O$ |
| 38. | Lunar Caustic | $AgNO_3$ |
| 39. | Calomel | $Hg_2Cl_2$ |
| 40. | Corrosive sublimate | $HgCl_2$ |
| 41. | Potash alum | $K_2SO_4.Al_2(SO_4)_3.24H_2O$ |
| 42. | Chrome alum | $K_2SO_4.Cr_2(SO_4)_3.24H_2O$ |
| 43. | Ferric alum | $Fe_2(SO_4)_3.(NH_4)_2SO_4.24H_2O$ |
| 44. | Chrome lemon (or) yellow chrome | $PbCrO_4$ |
| 45. | Pyrolusite | $MnO_2$ |
| 46. | Cementitte (Iron Carbide) | $Fe_3C$ |
| 47. | Nessler's reagent | $K_2HgI_4$ |
| 48. | Lead sugar | $(CH_3COO)_2Pb$ |
| 49. | White lead | $Pb(OH)_2.2PbCO_3$ |
| 50. | Rock Phosphate | $Ca_3(PO_4)_2$ |
| 51. | Rochelle salt | CH(OH)COONa<br>\|<br>CH(OH)COOK |
| 52. | Flour spar | $CaF_2$ |
| 53. | Anhydrone | $Mg(ClO_4)_2$ |
| 54. | Asbestos | $CaMg_3(SiO_3)_4$ |
| 55. | Sorel's cement | $MgCl_2.5HgO, H_2O$ |
| 56. | Lithopone | $BaSO_4 + ZnS$ |
| 57. | Witherite | $BaSO_3$ |
| 58. | Tough pitch Copper | 99.5% pure Cu |
| 59. | Lead pencil | Graphite |
| 60. | Aqua regia | Conc. $HNO_3$ + Conc. HCl (1 : 3) |
| 61. | Ammonium alum | $(NH_4)_2SO_4.Al_2(SO_4)_3.24H_2O$ |
| 62. | Sodium Alum | $Na_2SO_4.Al_2(SO_4)_3.24H_2O$ |
| 63. | Prussian blue | $Fe_4[Fe(CN)_6]_3$ |
| 64. | Baking powder | $NaHCO_3$, Tartaric acid |
| 65. | Plaster of Paris | $2CaSO_4.H_2O$ or $CaSO_4.1/2\,H_2O$ |
| 66. | Killed Salt (or) Butter of Zinc | $ZnCl_2.2H_2O$ |
| 67. | oxymuriate (or) Butter of Tin | $SnCl_4.5H_2O$ |
| 68. | Verdigris | $Cu(OH)_2.CuCO_3$ |

## Learning Technique Card 23

### IMPORTANT FACTS TO REMEMBER

| | | |
|---|---|---|
| 1. | Lowest electronegativity | : Cs, Fr |
| 2. | Highest electronegativity | : F |
| 3. | Highest ionisation potential | : He |
| 4. | Lowest ionisation potential | : Cs, Fr |
| 5. | Lowest electron affinity | : Noble gases |
| 6. | Highest electron affinity | : Chlorine |
| 7. | Least electropositive element | : F |
| 8. | Lowest m.pt. metal | : Hg |
| 9. | Highest m.pt. and b.pt. metal | : W (Tungesten) |
| 10. | Lowest m.pt. and b.pt. non metal | : He |
| 11. | Notorious element | : Hydrogen |
| 12. | Lightest element | : Hydrogen |
| 13. | Smallest atomic size | : H |
| 14. | Largest atomic size | : Cs |
| 15. | Largest anionic size | : $I^-$ |
| 16. | Smallest cation | : $H^+$ |
| 17. | Most electropositive element | : Cs, Fr |
| 18. | Volatile d block elements | : Zn, Cd, Hg |
| 19. | Most stable element | : Te |
| 20. | Highest density (Metals) | : Os, Ir |
| 21. | Highest density (Non metals) | : Boron |
| 22. | Total number of radioactive elements in periodic table | : 25 |
| 23. | Liquid element of radioactive nature | : Fr |
| 24. | Element containing no neutron | : H |
| 25. | Most abundant element on earth | : Oxygen |
| 26. | Rarest element on earth | : At (astatine) |
| 27. | Most abundant metal on earth | : Al |
| 28. | Metals showing highest ox. no | : Os (+ 8) |
| 29. | Most electrovalent compound | : CsF |
| 30. | Most stable carbonate | : $Cs_2CO_3$ |
| 31. | Strongest alkali | : CsOH |
| 32. | Strongest basic oxide | : $Cs_2O$ |
| 33. | Best electricity conductor among metals | : Ag |
| 34. | Best electricity conductor among non metals | : graphite |
| 35. | Element having maximum tendency for catenation | : Carbon |
| 36. | Element with electronegativity next to Fluorine | : Oxygen |
| 37. | Group containing maximum no. of gaseous elements in periodic table | : Zero group |
| 38. | Amphoteric non metal | : Si |
| 39. | Liquid non metals | : Br |

## IMPORTANT FACTS TO REMEMBER

| | | |
|---|---|---|
| 40. | Elements sublime on heating | : $I_2$ |
| 41. | Noble metals | : Au, Pt etc. |
| 42. | Some polymorphic elements | : O, S, P |
| 43. | Poorest conductor of electricity | : Diamond |
| 44. | Hardest naturally occurring element | : Diamond |
| 45. | Lightest solid metal | : Li |
| 46. | 90% of Sun mass | : Hydrogen |
| 47. | Dry Bleacher | : $H_2O_2$ |
| 48. | Dry ice | : Solid $CO_2$ |
| 49. | Element having maximum isotopes | : Sn (10) |
| 50. | Oldest known organic acid | : $CH_3COOH$ |
| 51. | Total number of solid elements in periodic table | : 89 |
| 52. | Amphoteric metal | : Be, Zn, Al, Sn, Pb |
| 53. | First man made element | : $Tc_{43}$ (Technicium) |
| 54. | Smallest period | : Ist (2 element) |
| 55. | Largest period in periodic table | : 6th (32 element) |
| 56. | Largest group in periodic table | : IIIB (32 element) |
| 57. | Most abundant d-block metal | : Fe |
| 58. | Most abundant s- block metal | : Ca |
| 59. | Most poisonous element | : Pu (Plutonium) |
| 60. | Elements kept in water | : Phosphorous |
| 61. | Neutral oxides of non metals | : NO, CO, $H_2O$, $N_2O$ |
| 62. | Non metals having metallic lusture | : Graphite, Iodine |
| 63. | Heaviest naturally occurring elements | : Uranium |
| 64. | Non metal having highest m. pt. b. pt | : Carbon (diamond) |
| 65. | Total number of gaseous elements in periodic table | : 11 (H, N, O, F, Cl, He, Ne, Ar, Kr, Xe, Rn) |
| 66. | Total number of liquid elements in periodic table | : 5 (Ga, Br, Cs, Hg, Fr) |
| 67. | Elements kept in kerosene | : IA group element (Na etc.) |
| 68. | Metalloids elements | : B, Si, As, Te, At, Ge, Sb etc. |
| 69. | Amphoteric oxides | : BeO, $Al_2O_3$, ZnO, PbO, $SnO_2$, $Sb_2O_3$ etc. |
| 70. | Artificial explosive | : TNT, RDX (Research Developed Explosive etc.) |
| 71. | First noble prize of chemistry was given to | : Van't Haff |
| 72. | Some isomorphous substances | : $FeSO_4.7H_2O$, $MgSO_4.7H_2O$, $ZnSO_4.7H_2O$ |
| 73. | Some efflorescent substances | : $Na_2CO_3$. $10H_2O$, $MgSO_4.7H_2O$ etc. |



## SOME IMPORTANT COMPOUNDS, MINERALS, MIXTURES & THE FORMULA'S

| | | |
|---|---|---|
| 69. | Bourdex mixture | $CuSO_4$(40%) + lime(60%) |
| 70. | Candy fluid | $KMnO_4$ |
| 71. | Per Hydrol | $H_2O_2$ |
| 72. | Blue Vitriol | $CuSO_4.5H_2O$ |
| 73. | White vitriol | $ZnSO_4.7H_2O$ |
| 74. | Green vitriol | $FeSO_4.7H_2O$ |
| 75. | Sal Ammonic | $NH_4Cl$ |
| 76. | Smelling salt | $(NH_4)_2SO_4$ |
| 77. | Fruit salt | $Mg(HCO_3)_2$ |
| 78. | Cal gon | $Na_2[Na_4(PO_3)_6]$ |
| 79. | Red chrome | $PbCrO_4.PbO$ |
| 80. | Sorel cement | $MgCl_2.5MgO.xH_2O$ |
| 81. | Common salt | NaCl |
| 82. | Silvine | KCl |
| 83. | Lime water | $Ca(OH)_2$ |
| 84. | Quick lime | CaO |
| 85. | Alumina | $Al_2O_3$ |
| 86. | Muriatic acid | HCl |
| 87. | Aqua fortis | $HNO_3$ |
| 88. | Silicates. | $(SiO_4)^{4-}$ |
| 89. | Inorganic graphite | $(BN)_x$ |
| 90. | Inorganic benzene | $B_3N_3H_6$ |
| 91. | Boric acid | $H_3BO_3$ |
| 92. | Indian red | $Fe_2O_3$ |
| 93. | Indian yellow /Fishcer salt | $K_3[Co(NO_2)_6]$ |
| 94. | Diborane | $B_2H_6$ |
| 95. | Smuglling agent | $Na[Ag(CN)_2]$ |
| 96. | Caro's acid | $H_2SO_5$ |
| 97. | Marshells acid | $H_2S_2O_7$ |
| 98. | Tear gas | $CCl_3NO_2$ |
| 99. | Zieses salt | $K[Pt\text{-}(\eta^2\text{-}C_2H_4)\text{-}Cl_3]H_2O$ |
| 100. | Vaska's compound | trans-$(Ir(Cl)(CO)(PPh_3)_2)$ |
| 101. | Cobalt cene | $[Co^{II}(\eta^5\text{-}C_5H_5)_2]$ |
| 102. | Magnesia alba | $MgCO_3.Mg(OH)_2.3H_2O$ (used in tooth powders and tooth paste) |

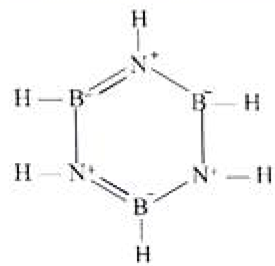
103. Portland cement : Homogeneous mixture of silicates and aluminates of calcium.

# PRECIPITATION CHART

| Cation | Anion | Solubility | Exception |
|---|---|---|---|
| Any | $HS^-$, $NO_3^-$, $NO_2^-$, $OCl^-$, $ClO_2^-$, $ClO_3^-$, $ClO_4^-$, $HSO_3^-$, $HCO_3^-$, $CH_3COO^-$<br>हरि शंकर के नाई कोल्हू का बैल और बाई एक से हैं। | Yes | $ClO_4^-$ of $NH_4^+$, $Rb^+$, $Cs^+$, $K^+$ are insoluble<br>अमीन रब से कहे<br>$AgNO_2$ is insoluble. $CH_3COOAg$ is partially soluble |
| $Na^+$ | Any | Yes | $Na_2SiO_3$ and $Na_2PbO_3$ are insoluble |
| $NH_4^+$, $Rb^+$, $Cs^+$, $K^+$<br>अमीन रब से कहे | Any | Yes | $ClO_4^-$, $[PbCl_6]^{2-}$, $[Co(NO_2)_6]^{3-}$ are insoluble |
| Any | $Cl^-$, $Br^-$, $I^-$<br>C . B . I. | Yes | $Ag^+$, $Cu_2^{2+}$, $Pb^{2+}$, $Hg_2^{2+}$ are insoluble<br>आज कुत्ते पागल होगें<br>$CuBr_2$, $PbCl_2$, $HgCl_2$ are soluble in warming and reappear on cooling. $HgBr_2$, $HgI_2$, $BiI_3$ are insoluble |
| Any | $SO_4^{2-}$ | Yes | $Ag^+$, $Sr^{2+}$, $Ba^{2+}$, $Pb^{2+}$, $Hg_2^{2+}$<br>आज सारे बाराती पागल होगें<br>$Ca^{2+}$, $Sn^{2+}$ are partially soluble. |
| Any | $O^{-2}$(Oxide), $C_2O_4^{-2}$ (Oxalate)<br>OX- दो<br>$OH^-$, $CO_3^{-2}$, $F^-$<br>हाथी एक Cow एक Fox एक<br>$PO_4^{-3}$<br>के पांव चार | No | $NH_4^+$, $Na^+$, $Rb^+$, $Cs^+$, $K^+$ are soluble.<br>अमीन रब से कहे<br>$BeF_2$, AgF are soluble.<br>oxides and hydroxides of Ca and Ba are partially soluble |
| Any | $CN^-$, $OCN^-$, $SCN^-$, $S^{-2}$ | No | IA, IIA and $Al^{+3}$, $NH_4^+$ are soluble. |
| Any | $CrO_4^{2-}$ (is similar to $SO_4^{2-}$) | Yes | $SrCrO_4$ is soluble (same as sulphates) |
| Any | $MnO_4^-$ (is similar to $ClO_4^-$) | Yes | $KMnO_4$ is soluble |

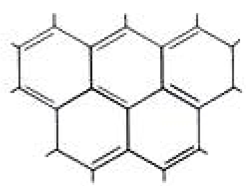
## IMPORTANT STRUCTURES

1. **Inorganic benzene (or) Borazine**



**(or) Borazole**

2. **$(BN)_n$ Inorganic graphite**



3. **Calcium carbide**

$CaC_2 + N_2$ □ □ $\underbrace{CaCN_2}$ + C

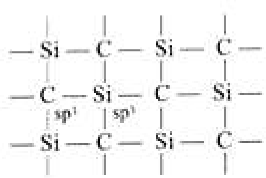
Nitrolium
(Used as fertilizer)

$Ca^{2+}[C \equiv C]^{2-}$

$Ca^{2+}[N^- = C = N^-]$

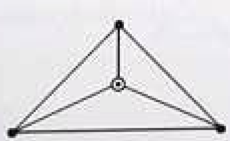
Calcium cynamide

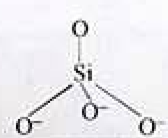
4. **Carborundum**



Used for cutting of glass

5. **Silicates**

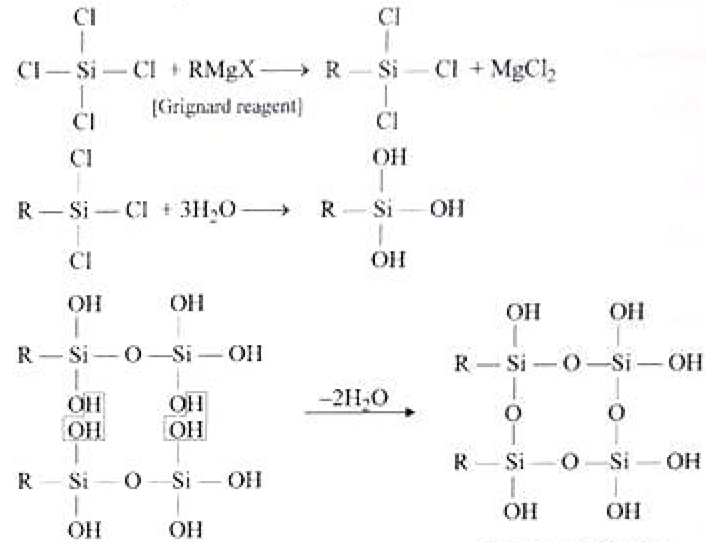






## IMPORTANT STRUCTURES

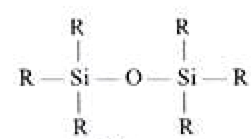
1. **Conversion $SiCl_4$ to Silicon**



**Network Silicones**

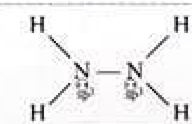
If 2 molecules of RMgX are taken

**Chain Silicate**



**Dimer**

2. **Hydrazine**

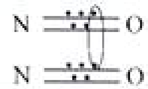


3. **Hydrazoic Acid**

## IMPORTANT STRUCTURES

4. $C_3O_2$ — O = C = C = C = O

5. NO [paramagnetic]as monomer ($N_2O_2$)



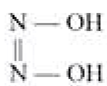
odd electron bond

6. $NO_2$ ($N_2O_4$)

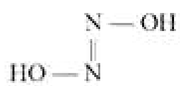
white colour in solid

[Dimagnetic, colourless]

7. **Hypo nitrous acid**

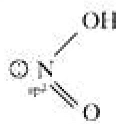


Cis



Trans

8. $HNO_2$



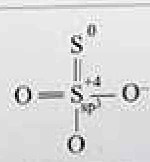
9. $NO_2^-$

10. $NO_3^-$

11. NOCl [Nitrosyl chloride]

12. Hydroxyl Amine

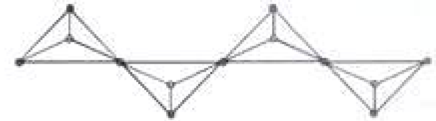
13. $S_2O_3^{2-}$ (Thiosulphate ion)





## IMPORTANT STRUCTURES

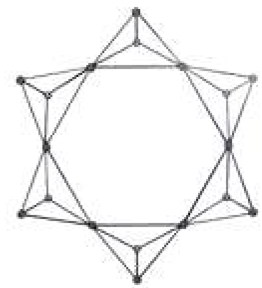
6. **Chain Silicate**



$[Si_4O_{11}]^{-10}$

e.g., pyroxene

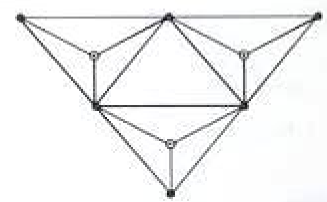
7. **Ring silicate**



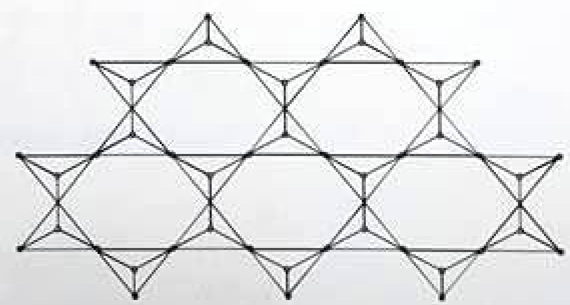
$[Si_6O_{18}]^{-12}$

e.g., Jwell Emerald

8. $[Si_2O_7]^{6-}$



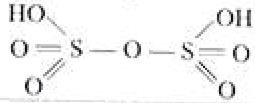

Sheet silicate



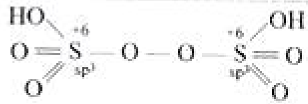
e.g., Mica/ Asbestos

## IMPORTANT STRUCTURES

14. **Oleum [Fuming sulphuric acid] [Northason's sulphuric acid] [pyrosulphuric acid]**

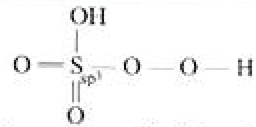


15. **Marshall's acid**



**Peroxodisulphuric acid**

16. **Caro's acid**

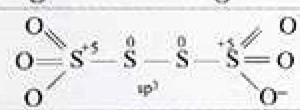


**Peroxomonodisulphuric acid**

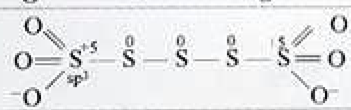
17. **Dithionate ion**

18. **Trithionate ion**

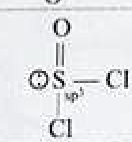
19. **Tetrathionate ion**



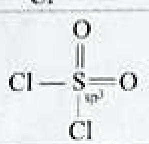
20. **Pentathionate ion**



21. **Thionyl chlorice**



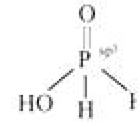
22. **Sulphuryl chloride**



23. **$OCl_2$**

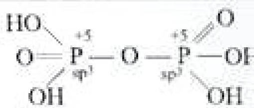
## IMPORTANT STRUCTURES

32. **Hypophosphorous acid $H_3PO_2$**

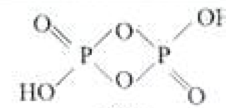


Monobasic acid
[acts as reducing agent]

33. **Pyrophosphoric acid**



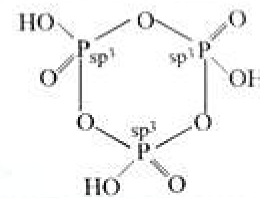
34. **Metaphosphoric acid**



Dimer

2POP

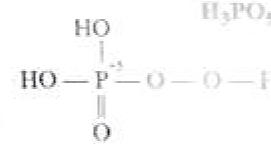
35.



**Trimer**
**3POP**

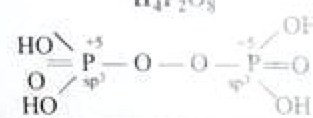
36. **Peroxyphosphoric acid($H_3PO_5$)**

$H_3PO_5$

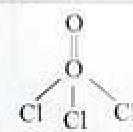


37. **Peroxy diphosphoric acid**

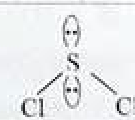
$H_4P_2O_8$



38. **$POCl_3$**

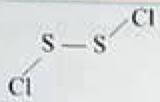


39. **$SCl_2$**



## IMPORTANT STRUCTURES

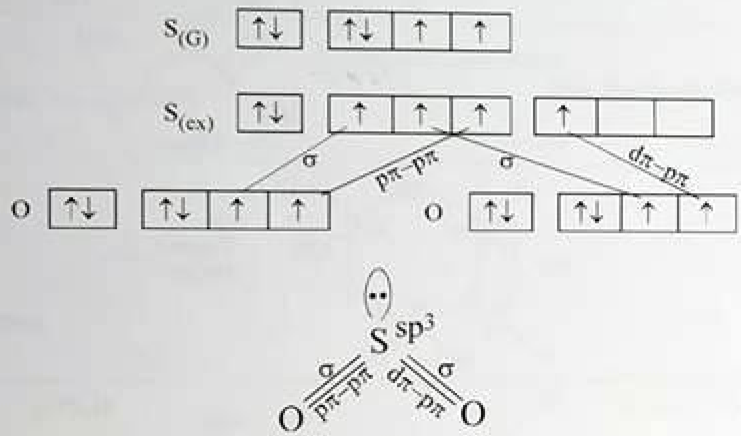
**40.** **$S_2Cl_2$ half open booklet**



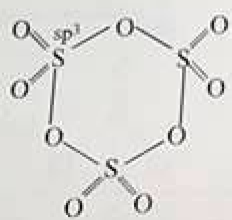

**41.** **$SeO_2$**


Solid $SeO_2$

**42.** **$SO_2$**




**43.** **$SO_3$**


3SOS bonsa
O-O bond is zero
S – S bond is zero
12 S – O bonds

**Cyclic Trimer [Vapour]**

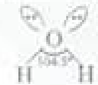
HCl - Muriatic acid; $HNO_3$ - Aqua fortis



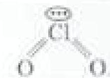
## IMPORTANT STRUCTURES

**24.** $OF_2$


**25.** $H_2O$



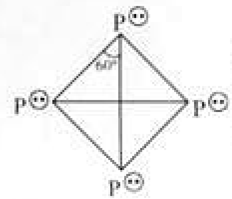

**26.** $ClO_2$




**27.** $Cl_2O_7$

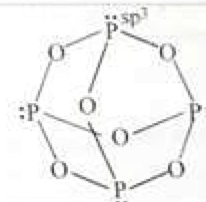

**28.** **[$ClO_3^-$] [Chlorate ion]**


**29.** **$P_4$**

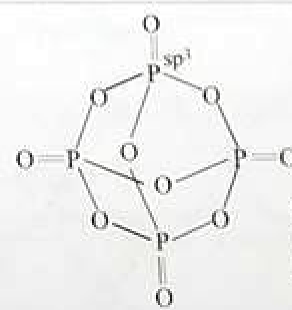



Angle = 60°
Total no. of bonds = 6
Each P has one lone pair of electron

**30.** **$P_4O_6$**




**31.** **$P_4O_{10}$**



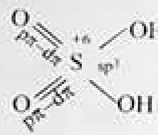

6 POP bonds
16 σ bonds
4 π bonds

## IMPORTANT STRUCTURES

44. $SO_4^{2-}$

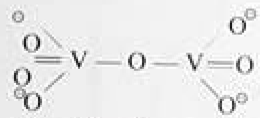
Sulphate ion

45. $H_2SO_4$ [oil of vitriol]



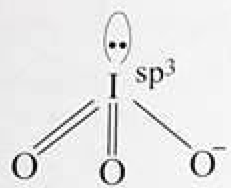
[king of chemicals]

46. $V_2O_7^{4-}$



Divandium heptaoxide

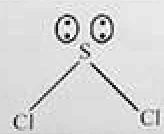
47. $IO_3^-$



48. Calcium carbide — $Ca^{2+}(C\equiv C)^{2-}$

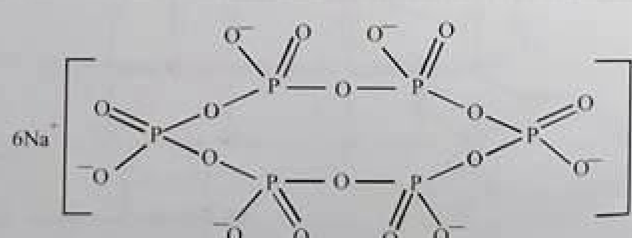
49. $S_2Cl_2$ — Cl – S – S – Cl

50. $SCl_2$



51. $CaCN_2$ (Calcium Cynamide) — $Ca^{2+}(N^-=C=N^-)$

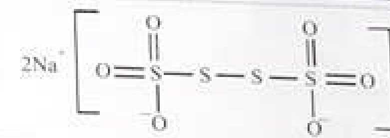
52.



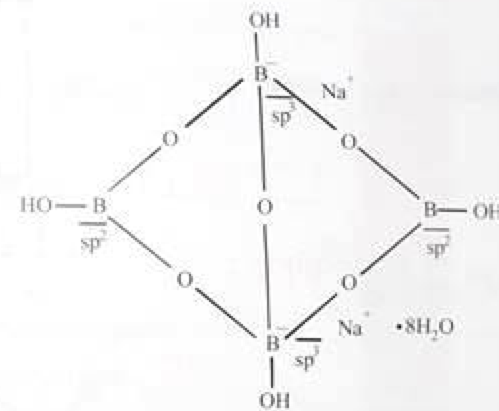


## IMPORTANT STRUCTURES

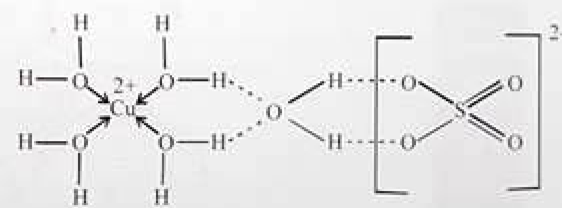
60. $Na_2S_4O_6$



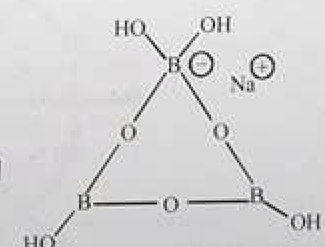
61. $Na_2B_4O_7 . 10H_2O$



62. $CuSO_4 . 5H_2O$

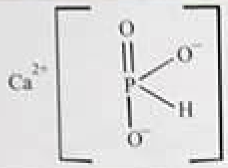


63. Na $[B_3O_3(OH)_4]$

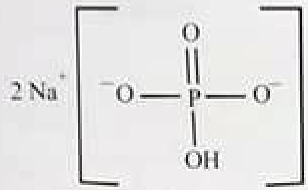


## IMPORTANT STRUCTURES

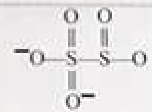
64. **Calciumphosphite**



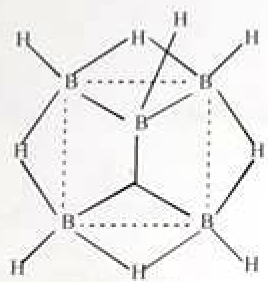
65. **Disodiumhydrogen phosphate**



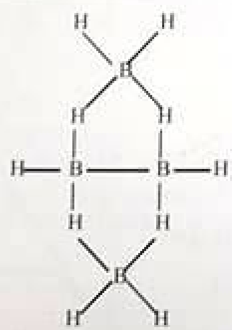
66. $[S_2O_5]^{2-}$



67. $B_5H_9$



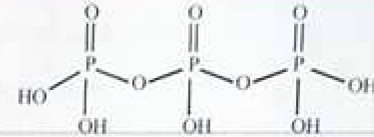
68. $B_4H_{10}$



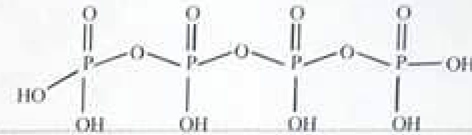


## IMPORTANT STRUCTURES

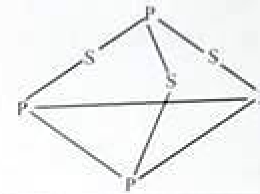
53. $H_5P_3O_{10}$



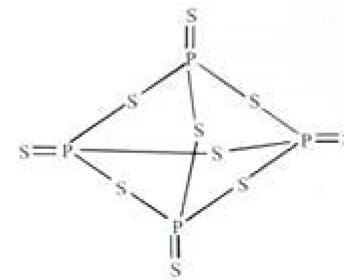
54. $H_6P_4O_{13}$



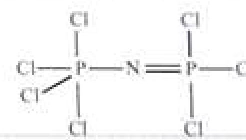
55. $P_4S_3$



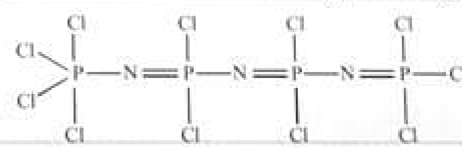
56. $P_4S_{10}$



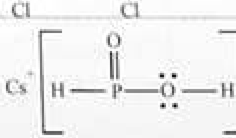
57. $P_2NCl_7$ (linear phosphagine)



58. $P_4N_3Cl_{11}$

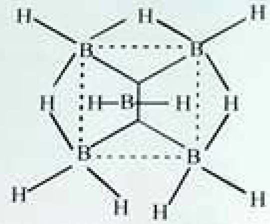


59. $CsH_2PO_2$

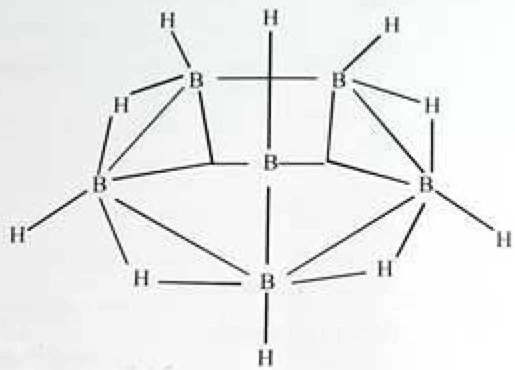


## IMPORTANT STRUCTURES

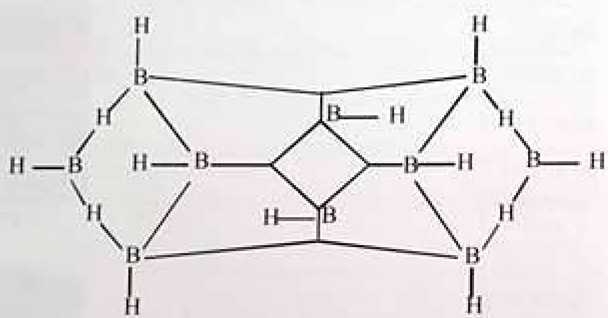
69. $B_5H_{11}$



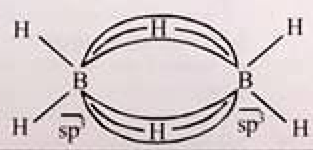
70. $B_6H_{10}$



71. $B_{10}H_{14}$



72. $B_2H_6$




## COLOUR OF COMPOUNDS

| | |
|---|---|
| $PbO_2$ | Black Brown |
| PbO(Massicot) | Yellow |
| $Na_2O_2$ | Yellow White |
| ZnO(Philospher's wool) | White |
| CaO(Quick lime) | White |
| PbO(litharge) | Red |
| $Pb_3O_4$(minium; red lead) | Red |
| $Cu_2O$ | Red |
| $Fe_2O_3$(Indian Red) | Red |
| HgO | Orange Red |
| CdO | Brown |
| CoO.ZnO(Rinmann's green) | Green |
| CoO.MgO (Cobalt pink) | Pink |
| CoO.SnO(Cobalt green) | Green |
| $CoO.Al_2O_3$(Thenard blue) | Blue |
| $Cr_2O_3$ | Green |
| $Cr(O_2)_2O$ (butterfly structure) | Blue |
| $KO_2$(Super oxide) | Orange |
| $Li_2O$ | Red |
| $Na_2O$ | Black |

### FERRO CYNIDE

| | |
|---|---|
| $K_4[Fe(CN)_6]$ | Pale Yellow |
| $K_3[Fe(CN)_6]$ | Light Blue |
| $Cu_2[Fe(CN)_6]$ | Chocolet Brown |
| $Fe_4[Fe(CN)_6]_3$(Prussian blue) | Blue |
| $Fe_2[Fe(CN)_6]_3$(Turnbull's blue) | Blue |

## COLOUR OF COMPOUNDS

| | |
|---|---|
| $Zn_2[Fe(CN)_6]$ | White |
| $Cd_2[Fe(CN)_6]$ | Light Blue |

### HALIDES

| | |
|---|---|
| AgCl | White |
| $Hg_2Cl_2$ | White |
| $HgCl_2$ | White |
| $Cu_2Cl_2$ | White |
| $PbCl_2$ | White |
| $PbBr_2$ | White |
| $ZnCl_2.H_2O$(Butter of zinc; killed salt) | White |
| KCl (Silvine) | White |
| $NH_4Cl$ (Salammonic) | White |
| $SnCl_4.5H_2O$ (Oxymuriate; butter of tin) | White |
| AgI | Yellow |
| $PbI_2$ | Yellow |
| $BiI_3$ | Yellow |
| HOBr (Layer test) | Yellow |
| AgBr | Yellow |
| $Cu_2I_2$ | Yellow |
| $NiCl_2$ | Green |
| $CrCl_3$ | Green |
| $FeCl_2$ | Green |
| $CoCl_2$(An hydrous) | Blue |
| $CoCl_2$ (dil. solution; symphathetic ink) | Pink |
| $CuCl_2$ | Blue Green |
| $FeCl_3$ | Black Red |



## COLOUR OF COMPOUNDS

### SULPHIDES

| | |
|---|---|
| HgS (vermillion) | Black |
| PbS | Black |
| CuS | Black |
| $Bi_2S_3$ | Black |
| $Cu_2S$ | Black |
| CoS | Black |
| $Ag_2S$ | Black |
| FeS | Black |
| NiS | Black |
| $Na_2S$ | Black |
| CdS | Yellow |
| $SnS_2$ (Artificial gold) | Yellow |
| $FeS_2$ (fool's gold) | Yellow |
| $As_2S_3$ | Yellow |
| $As_2S_5$ | Yellow |
| $Sb_2S_3$ | Orange |
| $Sb_2S_5$ | Orange |
| SnS | Brown |
| ZnS | White |

### OXIDES

| | |
|---|---|
| $Hg_2O$ | Black |
| $Ag_2O$ | Black |
| $MnO_2$(Pyrolusite) | Black |
| CuO | Black |
| $Ni_2O_3$ | Black |

## COLOUR OF COMPOUNDS

| | |
|---|---|
| $FeCl_3.6H_2O$ | Red Brown |
| $FeCl_3.6H_2O$(Solution) | Yellow |
| $BiI_3$ | Black |
| $KI_3$ | Brown |
| $HgI_2$ | Red |
| $K[BiI_4]$ (Solution) | Orange |

### CHROMATES

| | |
|---|---|
| $PbCrO_4$ (Yellow chrome) | Yellow |
| $BaCrO_4$ | Yellow |
| $Na_2CrO_4$ (Solution) | Yellow |
| $Ag_2CrO_4$ | Brick Red |
| $Hg_2CrO_4$ | Scarlet Red |
| $PbCrO_4.PbO$ (Red chrome) | Red |
| $K_2Cr_2O_7$(Prismatic structure) | Orange |

### SULPHATES AND SULPHITES

| | |
|---|---|
| $Ag_2SO_4$ | White |
| $Hg_2SO_4$ | White |
| $SrSO_4$ | White |
| $BaSO_4$ | White |
| $PbSO_4$ | White |
| $Ag_2SO_3$ | White |
| $Hg_2SO_3$ | White |
| $SrSO_3$ | White |
| $BaSO_3$ | White |
| $PbSO_3$ | White |
| $CaSO_4.2H_2O$(Gypsum) | White |



## COLOUR OF COMPOUNDS

| | |
|---|---|
| $Cr_2O_3$ | Green |
| $[Cr(H_2O)_5Cl]Cl_2.H_2O$ | Pale Green |
| $[Cr(H_2O)_4Cl_2]Cl.2H_2O$ | Dark Green |
| $[Cr(H_2O)_6]Cl_3$ | Violet |

### $Ni^{+2}$

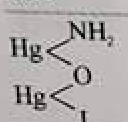
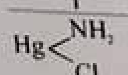
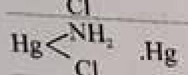
| | |
|---|---|
| $NiCl_2$ | Green |
| $Ni(OH)_2$ | Green |
| $(DMG)_2Ni$ | Rosy Red |

### $Ag^+$

| | |
|---|---|
| $AgCl$ | White |
| $AgBr$ | Pale Yellow |
| $AgI$ | Yellow |
| $Ag_2SO_4$ | White |
| $Ag_2S_2O_3$ | White |
| $Ag_2CO_3$ | Yellow |
| $Ag_3PO_4$ | Yellow |
| $Ag_3AsO_3$ | Yellow |
| $Ag_3AsO_4$ | Red |
| $Ag_2CrO_4$ | Red |
| $Ag_2S$ | Black |
| $Ag_2O$ | Black |

### MISCELLANEOUS

| | |
|---|---|
| $K_3[Co(NO_2)_6]$(Indian Yellow; Fisher salt) | Yellow |
| $Cs_3[Co(NO_2)_6]$ | Yellow |
| $Rb_3[Co(NO_2)_6]$ | Yellow |

| | |
|---|---|
| $(NH_4)_3[Co(NO_2)_6]$ | Yellow |
| $(NH_4)_3PO_4.12MoO_3$ | Canary Yellow |
| $(NH_4)_3AsO_4.12MoO_3$ | Canary Yellow |
| $KMnO_4$ | Pink |
| $NaMnO_4$ | Pink |
| $HMnO_4$ | Pink |
| $Mn(OH)_2$ | Pink |
| $CoCl_2.2H_2O$ | Pink |
| $(NH_4)_2SnCl_6$ (Mordant; Pink salt) | Pink |
| $Na_2MnO_4$ | Green |
| $Co(CN)_2$ | Buff |
| MnS | Buff |
| $Fe(SCN)_3$ (ppt.) | Blood red |
| $Fe(CH_3COO)_3$ | Blood red |
| $CrO_2Cl_2$ (Fumes) | Red |
| $Cu_2C_2$ (Explosive) | Red |
| $[Cu(NH_3)_4]SO_4$ (Switzer's reagent) | Dark Blue |
| $CuHAsO_3$ (Scheel's green) | Green |
| $FeSO_4.NO$ (Brown ring) | Brown |
| $[Fe(H_2O)_5NO]SO_4$ (Brown complex) | Brown |
| $Na_4[Fe(CN)_5NOS]$ | Purple |
| BiOI | Orange |
|  | Brown |
|  | White |
|  | Black |

## COLOUR OF COMPOUNDS

| | |
|---|---|
| $ZnSO_4.7H_2O$ (white vitriol) | White |
| $CaSO_4.1/2H_2O$ (Plaster of paris) | White |
| $CuSO_4.5H_2O$ (Blue vitriol) | Blue |
| $FeSO_4.7H_2O$ (Green vitriol) | Green |

## HYDROXIDES

| | |
|---|---|
| $Fe(OH)_3$ | Red Brown |
| $Cr(OH)_3$ | Green |
| $Cu(OH)_2$ | Blue |
| $Al(OH)_3$ | White |
| $Zn(OH)_2$ | White |
| $Pb(OH)_2$ | White |
| $Pb(OH)_2.2PbCO_3$ (White lead) | White |

## CYNIDES

| | |
|---|---|
| $Pb(CN)_2$ | White |
| AgCN | White |
| $Cd(CN)_2$ | White |
| $Zn(CN)_2$ | White |
| $Hg.Hg(CN)_2$ | Black |
| $Co(CN)_2$ | Buff |
| $Cu(CN)_2$ | Pale Yellow |
| $Fe(CN)_2$ | Yellow Brown |
| $Ni(CN)_2$ | Green |

## $Cr^{+3}$

| | |
|---|---|
| $Cr(OH)_3$ | Green |
| $Cr_2(SO_4)_3$ | Green |
| $CrCl_3$ | Green |