

### Reactivity Series

Potassium
Sodium
Calcium
Magnesium
Aluminium
Carbon
Zinc
Iron
Lead
Hydrogen
Copper
Silver
Gold

### Addition of Sodium Hydroxide

Cation	A few drops	In excess
$Al^{3+}$	White ppt	Ppt dissolves to give colourless soln
$Ca^{2+}$	White ppt	Ppt is insoluble
$Cu^{2+}$	Light blue ppt	Ppt is insoluble
$Fe^{2+}$	Green ppt	Ppt is insoluble
$Fe^{3+}$	Reddish-brown ppt	Ppt is insoluble
$Pb^{2+}$	White ppt	Ppt dissolves to give colourless soln
$Zn^{2+}$	White ppt	Ppt dissolves to give colourless soln
$NH_4^+$	No ppt	Ammonia gas evolved upon heating

### Addition of Aqueous Ammonia

Cation	A few drops	In excess
$*Al^{3+}$	White ppt	Ppt is insoluble
$Ca^{2+}$	No ppt	-

### Addition of Aqueous Ammonia (cont)

$Cu^{2+}$	Light blue ppt	Ppt dissolves to give dark blue soln
$Fe^{2+}$	Green ppt	Ppt is insoluble
$Fe^{3+}$	Reddish-brown ppt	Ppt is insoluble
$*Pb^{2+}$	White ppt	Ppt is insoluble
$Zn^{2+}$	White ppt	Ppt dissolves to give colourless soln

$*Al^{3+}$  and  $Pb^{2+}$  can be identified by using aqueous potassium iodide (KI) which forms yellow ppt in the presence of lead.

### Amphoteric Metal Oxides

Zinc (Zn)
Aluminum (Al)
Lead (Pb)
Mnemonic is ZAP

### Acidic Oxides

Sulfur Trioxide	$SO_3$	Sulfuric Acid	$H_2SO_4$
*Sulfur Dioxide	$SO_2$	Sulphurous Acid	$H_2SO_3$
Nitrogen Dioxide	$NO_2$	Nitric Acid	$HNO_3$
*Dinitrogen Pentoxide	$N_2O_5$	Nitric Acid	$HNO_3$
Carbon Dioxide	$CO_2$	Carbonic Acid	$H_2CO_3$
*Phosphorus (V) Oxide	$P_2O_5$	Phosphoric Acid	$H_3PO_4$
*Phosphorus (III) Oxide	$P_2O_3$	Phosphorous Acid	$H_3PO_3$
*Manganese Heptoxide	$Mn_2O_7$	Perman-ganic Acid	$HMnO_4$
*Dichlorine Monoxide	$Cl_2O$	Hypochlorous Acid	$HOCl$
*Dichlorine Heptoxide	$Cl_2O_7$	Perchloric Acid	$HClO_4$

\*Advanced (NIS)

### Basic Oxides

All Group I and II metals (except Beryllium)	$Li_2O$ , $Na_2O$ , $MgO$ , $CaO$ , etc.
*Thallium (I) Oxide	$Tl_2O$
*Bismuth (III) Oxide	$Bi_2O_3$

\*Advanced (NIS)

### Always Soluble

Sodium	$Na^+$
Potassium	$K^+$
Ammonia	$NH_4^+$
Nitrate	$NO_3^-$

Mnemonic: SPAN

### Soluble Salts

All halides	Except Pb and Ag compounds (e.g. $PbCl_2$ )
All sulphates	Except Ba, Ca (sparingly soluble) and Pb (e.g. $BaSO_4$ )

### Insoluble Salts

All Carbonates	Except SPA (Sodium, Potassium, Ammonium)
All Phosphates	Group I Metals and Ammonium compounds
All Hydroxides	Except SPCM (Sodium, Potassium, Calcium - sparingly soluble, Magnesium - very sparingly soluble)



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