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### **Solubility of various substances in liq. $\text{SO}_2$ :**

#### **A. Solubility of ionic compounds (inorganic salts):**

Iodide and thiocyanates : **Most soluble**

Sulphates, sulphides, oxides and hydroxides : **Partially insoluble**

Ammonium, thallium and mercuric salts : **Soluble**

#### **B. Solubility of non-ionic compounds (covalent compound) :**

Covalent halide like  $\text{IBr}$ ,  $\text{BCl}_3$ ,  $\text{AlCl}_3$ ,  $\text{AsCl}_3$ ,  $\text{PBr}_3$ ,  $\text{CCl}_4$ ,  $\text{SiCl}_4$  and  $\text{SnCl}_4$  : **Soluble**

Organic compound like amines, ether, alcohols, benzene, alkenes, pyridine, quinoline, Halogen derivatives and acid chlorides : **Soluble**

Alkanes : **Insoluble**

#### **C. Solubility of metals:**

Metals are insoluble in liq. $\text{SO}_2$

#### **D. Conductivity of salt solution:**

Conductivity of electrolyte solution of salt containing

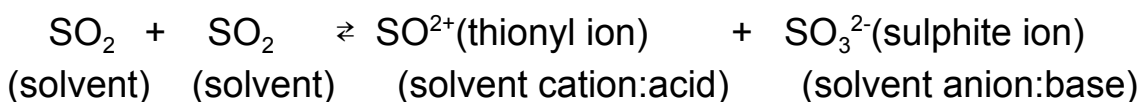
$\text{Na}^+$ ,  $\text{NH}_4^+$ ,  $\text{K}^+$ ,  $(\text{CH}_3)_3\text{S}^+$  and  $(\text{CH}_3)_4\text{N}^+$  increase with the increase in the size of these cations. Increasing order of conductivity :

$\text{Na}^+ < \text{NH}_4^+ < \text{K}^+ < (\text{CH}_3)_3\text{S}^+ < (\text{CH}_3)_4\text{N}^+$

Size of anions in increasing order of conductivity:

$\text{SCN}^- < \text{ClO}_4^- < \text{Cl}^- < \text{I}^-$

### **Auto-Ionisation of liq. $\text{SO}_2$ :**

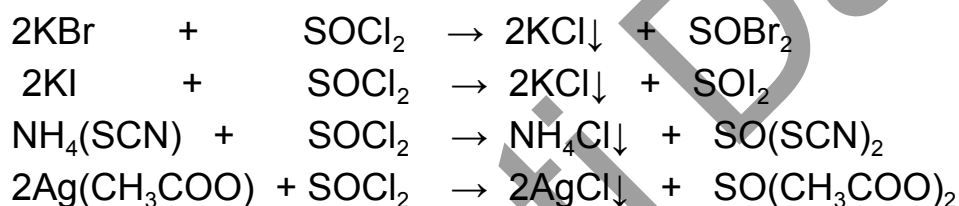


Compare the self ionisation of liq.  $\text{SO}_2$  with water and liq.  $\text{NH}_3$ :  $\text{SO}^{2+}$  ion analogous to  $\text{H}_3\text{O}^+$  and  $\text{NH}_4^+$  ions while  $\text{SO}_3^{2-}$  ion is analogous to  $\text{OH}^-$  and  $\text{NH}_2^-$  ions produced by the self-ionisation of  $\text{H}_2\text{O}$  and liq.  $\text{NH}_3$  respectively.

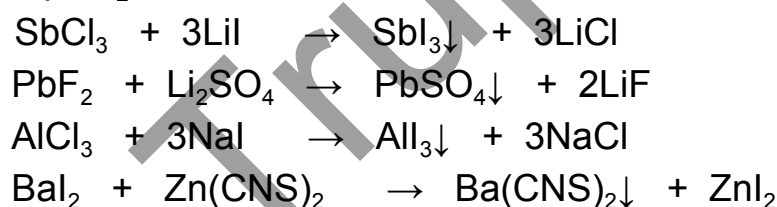
## Chemical reaction taking place in Liq. $\text{SO}_2$ :

### 1) Metathetical (Precipitation) Reaction:

- a) Thionyl chloride ( $\text{SO}_2\text{Cl}_2$ ) in liq.  $\text{SO}_2$  has helped to prepare many compounds.

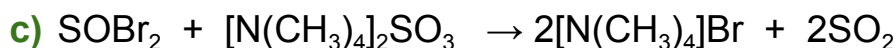
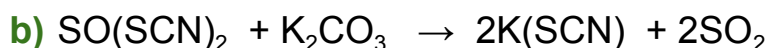
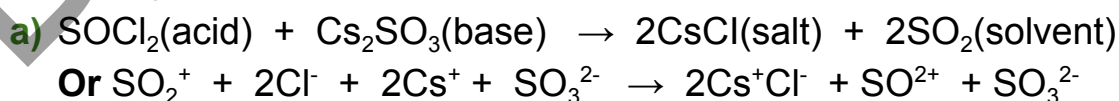


- b) Some other reaction precipitation reaction that carried out in liq.  $\text{SO}_2$ :



### 2) Acid-Base neutralisation (salt formation) reaction:

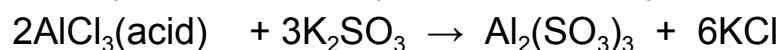
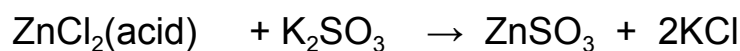
In these reactions compounds contain  $\text{SO}_2^+$  ion(acid) combined with compounds containing  $\text{SO}_3$  ion(base) to form the salt and the solvent (liq.  $\text{SO}_2$ ).E.g.



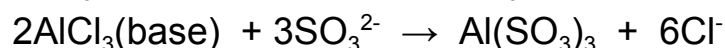
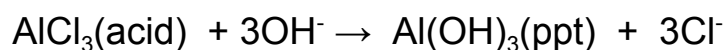
### 3) Amphoteric behavior of salts in liq. $\text{SO}_2$ :



a) Acidic and basic character with salts of Zn(II) and Al(III)



b) Acidic and basic behavior with  $\text{AlCl}_3$  and  $\text{GaCl}_3$

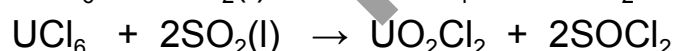


#### 4) Solvation Reactions : Formation of Solvates:

Like water and liq.  $\text{NH}_3$ , liq.  $\text{SO}_2$  also form addition compounds (solvates) with solutes.

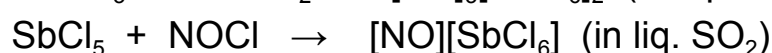
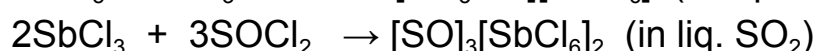
E.g.  $\text{Li} \cdot 2\text{SO}_2$ ,  $\text{KBr} \cdot 4\text{SO}_2$ ,  $\text{M} \cdot 4\text{SO}_2$  ( $\text{M} = \text{Na}, \text{K}, \text{Rb}$ ),  $\text{M}_2 \cdot 4\text{SO}_2$  ( $\text{M} = \text{Ca}, \text{Ba}, \text{Sr}$ ),  $\text{AlCl}_3 \cdot 2\text{SO}_2$

#### 5) Solvolytic or solvolysis reaction:



#### 6) Complex formation reaction:

A large number of complex compounds is formed by  $\text{SbCl}_3$  and  $\text{SbCl}_5$  in liq.  $\text{SO}_2$ .

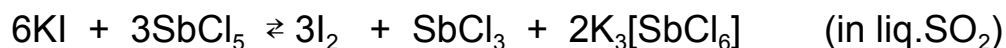


#### 7) Redox reaction:

Liq.  $\text{SO}_2$  does not have any strong oxidising or reducing properties, although it may serve as a medium for redox reaction. It reduced iodine but not bromine.

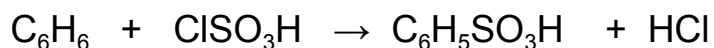


Conversely soluble iodide oxidised to free iodine by  $\text{SbCl}_5$ .



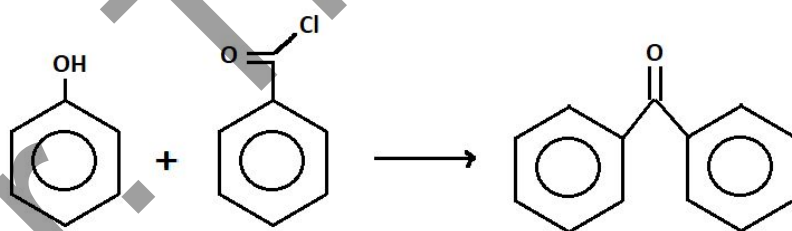
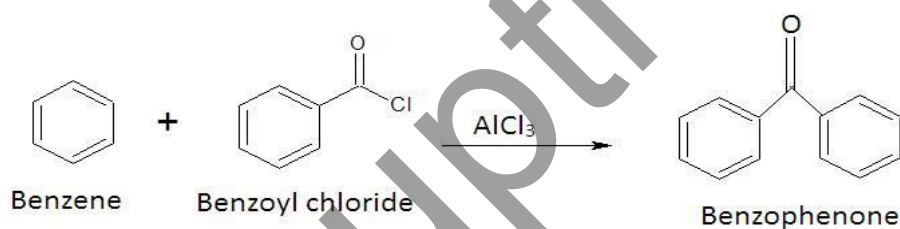
### 8) Reactions with Organic compounds:

a) Hydrocarbons undergo sulfonation in liq.  $\text{SO}_2$  :

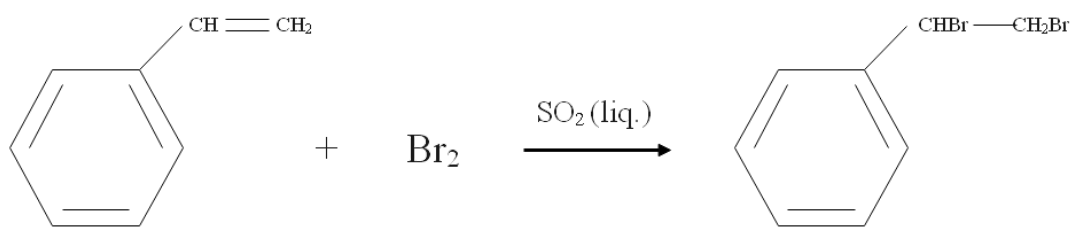


b) Friedel-Craft's reaction :

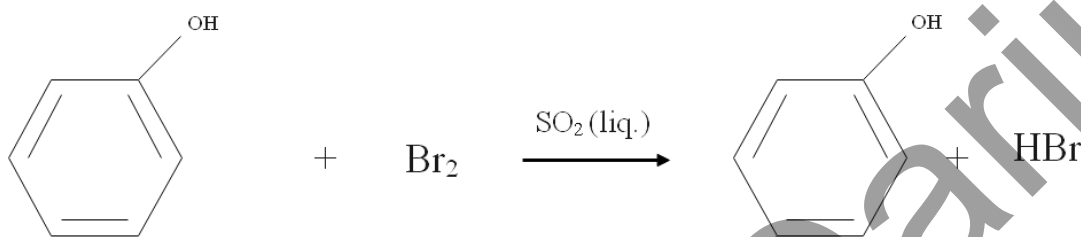
$\text{AlCl}_3$  which is used as a catalyst and reaction carried out in liq.  $\text{SO}_2$  medium.



c) Bromination: Liq.  $\text{SO}_2$  is also used as a solvent in various Bromination reactions.



Additional Compound



Substitutional Compound