

- what reagent(s) would distinguish between
- barium nitrate and lead nitrate solution?
  - copper (ii) nitrate and barium nitrate solution ?
  - silver nitrate and sodium nitrate solution ?
  - sodium nitrate and sodium sulfate solution ?

**Answer:**

a) We use potassium iodide (KI) to distinguish lead nitrate from barium nitrate. Bright yellow precipitate of lead iodide forms when lead nitrate solution is mixed with *a* solution. The ionic equation is:

$Pb^{2+}_{(aq)} + 2I^{-}_{(aq)} = PbI_{2(s)}$ . Bright yellow precipitate of  $PbI_2$  is obtained from hot solution after fast cooling.

The presence of barium nitrate in solution *a* we can verify by reaction with sodium sulfate:  
 $Ba^{2+}_{(aq)} + SO_4^{2-}_{(aq)} = BaSO_4$  (white precipitate) which is insoluble in acid conditions.

b) We use sodium sulfate ( $Na_2SO_4$ ) to distinguish barium nitrate from copper (II) nitrate. White precipitate of barium sulfate forms when sodium sulfate solution is mixed with *b* solution. The ionic equation is:

$Ba^{2+}_{(aq)} + SO_4^{2-}_{(aq)} = BaSO_4(s)$ .

It is noted that barium sulfate is insoluble in acid conditions.

The presence of copper (II) nitrate in solution *b* we can verify by reaction with sodium sulfide. Black precipitate of copper (II) sulfide will form by the ionic equation:

$Cu^{2+}_{(aq)} + S^{2-}_{(aq)} = CuS$  (black precipitate).

c) We use sodium chloride (NaCl) to distinguish silver nitrate from sodium nitrate. White precipitate of silver chloride forms when sodium chloride solution is mixed with *c* solution: The ionic equation of this reaction is:

$Ag^{+}_{(aq)} + Cl^{-}_{(aq)} = AgCl(s)$ . Silver chloride is insoluble in acid conditions but it is soluble in strong solution of  $NH_4OH$ .

Sodium nitrate can be verified when solution of  $(Zn(UO_2)_3(CH_3COO)_8 + CH_3COOH)$  is mixed with *c* solution. The pale yellow crystals of  $Na_2(UO_2)_3(CH_3COO)_8$  will form by the ionic equation:  
 $Na^{+} + Zn(UO_2)_3(CH_3COO)_8 + CH_3COOH + 9H_2O = NaZn(UO_2)_3(CH_3COO)_9 \cdot H_2O \downarrow + H^{+}$ .

d) We use barium chloride ( $BaCl_2$ ) to distinguish sodium sulfate from sodium nitrate. White precipitate of barium sulfate forms when sodium sulfate solution is mixed with *d* solution: The ionic equation is:

$SO_4^{2-}_{(aq)} + Ba^{2+}_{(aq)} = BaSO_4(s)$ . Barium sulfate is insoluble in acid conditions.

Sodium nitrate in solution *d* we identify by means of diphenylamine test. The solution which includes  $NO_3^{-}$  ions is painted in black blue color.