SALT MARKING SCHEME
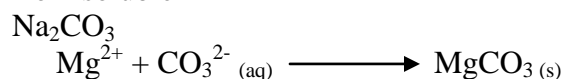
1. **1989 Q34b, c**
   (b) Mg^{2+}, Ca^{2+} are responsible for hardness in water precipitated by carbonate ions from soluble
   Na_2CO_3
   $$Mg^{2+} + CO_3^{2-}\ _{(aq)} \longrightarrow MgCO_{3\ (s)}$$

   (c) Glass making, Paper making, manufacturer of NaOH, metal refining

2. **1989 Q7 P1**
   White precipitate is formed which is soluble in excess sodium hydroxide

3. **1989 Q18 P1**
   P= NaCl   Q=$MgSO_4$

4. **1991 Q27 P1**
   (a) (i) Prevent loss of salt/solid during evaporation
   (ii) Ensure that all water is removed
   (iii) 80.6 -50.6 = 30
   (iv) 62.6-50.6 =12
   (v) Mass of water = 30-12 =18 , 80.6-62.6 =18
   (vi) Solubility = 12.0 $\longrightarrow$ 18g

   $$\frac{100 \times 12}{18} = \frac{66.7g}{100g}\text{ of water}$$

6. **1994 Q30 P1**
   (a) 19.0 to 19. ^{0}C
   (b) Place 80g of KNO_3 in 100g of water and heat up to 50^0C /heat to 60^0C and cool to 50^0C
   (c) All solids would dissolve because solubility of calcium ethanoate increases with decrease in temperature/cooling

7. **1995 Q21 P1**
   W because its solubility decreases with increase in temperature

8. **1995 Q25 P1**
   Dissolve the potassium sulphate ($^1/_2$) in water, dissolve ($^1/_2$) the lead carbonate in the nitric acid, mix the two solutions ($^1/_2$) and filter ($^1/_2$) off the lead sulphate precipitate//
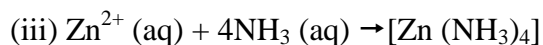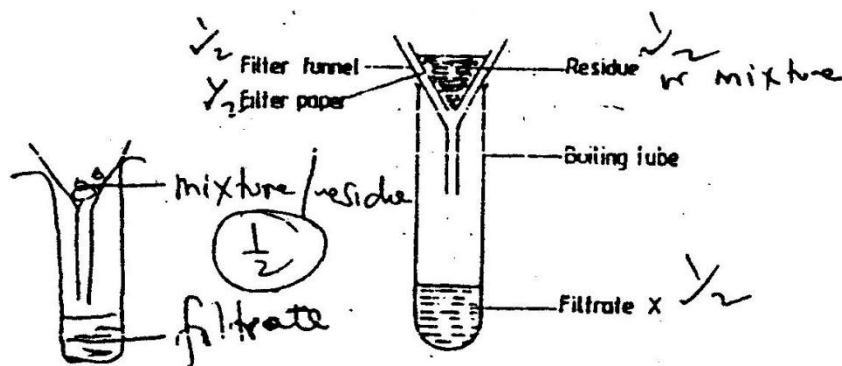   Dissolve lead carbonate in nitric acid add solid $pbSO_4$ and filter off (max^1 ½)//
   Dissolve this in HNO_3 and add solid $pbCO_3$ and filter off the precipitate.

9. **1995 Q5 P2**
   (a) (i) Heating

(ii)

(iii) Zn^{2+} (aq) + $4NH_3$ (aq) $\rightarrow$ [Zn $(NH_3)_4$]
(iv) Brown coloured gas OR reddish brown   (1 mark)

   a. Addition of anhydrous or white $CuSO_4$ copper (II) sulphate which turns blue in presence of water or cobalt chloride paper which turns pink   (1 mark)

(b)   (i) One of the salts in R is not soluble in water because a residue is formed on addition of water   (2 marks)
      (ii) CO_3^{2-} because CO_2 (g) is produced on addition of acid   (2 marks)
      (iii) Pb^{2+}(aq)

(c)   Zinc nitrate   (1 mark)
      Lead carbonate   (1 mark)

10.   1996 Q6 P2
  a) i)   Hygroscopic / Hygroscopy   (1 mark)
      ii)   Deliquescent / Deliquescence   (1 mark)
      iii)   Efflorescent / efflorescence's   (1 mark)

  b) i)   Zn(OH)$_4{}^{2+}$
      ii)   Cu (OH)$_4{}^{2-}$

  c) i)

Fe	O	S	H_2O
20.2	23.0	11.5	45.3
56	16	32	18
0.36	1.44	0.36	2.52
1	4	1	6

Empirical formula $FeSO_4$.$7H_2O$
Empirical mass = (56+3+64+7(18) = 278
         Formula $FeSO_4$ $7H_2O$
      ii)   6.95g =6.95 = 0.025 moles
          0.05 moles in 50cm3 = $\underline{0.025 \times 1000}$ = 0.1
                          250
         Concentration is 0.1 Mol^{-1} $\underline{6.95 \times 1000}$
                              278250

12. 1998 Q2 P1

Add water to the solid mixture A dissolves while B does Not
   i. Filter the mixture
   ii. Evaporate the filtrate to dryness
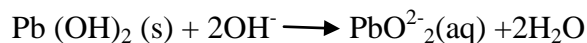
13. 1998 Q19 P1

a. Add dilute HNO_3 to the carbonate
b. Allow the ran to go to completion
c. Add excess dilute HCI to the mixture
d. Filter

14. 1999 Q2 P1

a) i) Dilute nitric acid

ii) Lead II Sulphate or Lead Sulphate.

b) $Pb(OH)_2 (s) + 2OH^- \longrightarrow [Pb(OH)]^{2-}_4 (aq)$

$Pb(OH)_2 (s) + 2OH^- \longrightarrow PbO^{2-}_2 (aq) + 2H_2O$
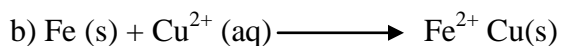
15. 1999 Q4 P2

a) i) Chlorine
   Condition- Heat

ii) I –Iron (III) Oxide (Fe_2O_3)
   II – Iron (II) Sulphide(FeS)
   III – Coke or Carbon (C)

i) Green Fe^{2-} (aq) is oxidized by hydrogen peroxide to yellow Fe^{3+}(aq)
ii) $Fe^{2+} + 3OH (aq) = Fe(OH)_3 (s)$ ($^1/_2$ for states)
iii) Ammonia solution(ammonia hydroxide) (KOH(aq))

b) $Fe (s) + Cu^{2+} (aq) \longrightarrow Fe^{2+} Cu(s)$
Moles of Fe (s) $= \underline{3.36} = 0.06$ ($^1/_2$)

$\qquad\qquad\quad$ 56 (I)
Moles of Cu $= 0.06$
Mass of Cu$= 0.06 \times 63.5$ (I) $= 3.81$ ($^1/_2$)

16. 1999 Q3 P1

The blue crystals turn into a white powder, concentrated H_2SO_4 removes water
of crystallization or is dehydrating agent.
   $CuSO_4.H_2O (s) \longrightarrow CuSO_4(s) + 5H_2O$
   Blue hydrated $\qquad$ White powder
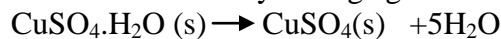
17. 1999 Q8 P1

Precipitation occurs because the solubility of the salt decreases with an increase in
Temperature

18.   **2000 Q8 P1**
Crystals of $KClO_3$ come out because at 83^0C the solution is saturated with $KClO_3$. Cooling causes crystallization. All KNO_3 OR $KClO_3$ forms solid   (40-9) 31g. KNO_3 do not form solid

19.   **2001 Q6c P2**
$2Q (s) + 2H_2O(L) \rightarrow 2QOH (aq) + H_2 (g)$
$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

20.   **2003 Q1c P2**
c)   Starting with aqueous magnesium sulphate, describe how you would obtain a sample
of magnesium oxide.   (3 marks)
Add an alkali solution to precipitate $Mg (OH)_2$, Filter; heat the residue to obtain   MgO
OR Add Na or K carbonate or hydrogen carbonate to form $MgCO_3$ ppt filter, heat the
residue to obtain MgO

21.   **2004 Q2b P2**
(b)(i) Step 2   Carbon dioxide // CO_2
       Step 4   Dil. Hydrochloric acid

(ii) $Ca(HCO_3)_2 (aq) \rightarrow CaCO_3 (s)   + CO_2 (g) + H_2 O(g)$

(iii) Add an aqueous solution of sulphuric acid. Add aqueous $NaSo_4$/ K_2SO_4 H_2SO_4
/ $(NH4)_2SO_4$; Filter to obtain calcium sulphate as residue. Heat the residue to
Dryness
Reject conc. Sulphuric acid // accept all aqueous sulphate // rej solid sulphate. Accept add
sulphuric acid

22.   **2005 Q2a P2**
a)   Brine(Sodium Chloride)

23.   **2005 Q1 P1**
Used in the manufacture of glass, treatment of hard water, making of baking powder
preservation of soft drinks etc.   (1 mark)

24.   **2006 Q27 P1**
a)   Conc. H_2SO_4 (1 mark)
b)   Heat the solution to concentrate it. Allow for crystal for form. Filter.
c)   Anhydrous copper(II) Sulphate   (1 mark)

25.   **2007 Q6 P1**
a)   Colour change from green to brown.
b) $Fe^{3+} +3OH^-$ $\rightarrow$ $Fe (OH)_3$
          (aq) (aq)   (s)
26.   **2007 Q9 P1**
a) Dilute Nitric acid
b) Silver metal
c) oxygen

27.   2007 Q13 P1
   (a) (i) Deliquescence

28.   2007 Q18 P1
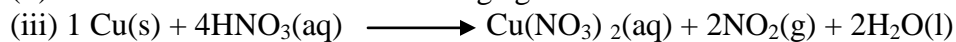   React sodium with water to get sodium hydroxide
   Bubble into this solution excess carbon (iv) oxide to get sodium hydrogen carbonate.

29.   2007 Q3 P2
   (a) (i)Effervescence and brown gas produced
       Blue solution formed
   (ii)   Dilute HCl is not an oxidizing agent
   (iii) 1 $Cu(s) + 4HNO_3(aq) \longrightarrow Cu(NO_3)_2(aq) + 2NO_2(g) + 2H_2O(l)$
        II moles of $Cu = \dfrac{0.5}{63.5} = 0.007874$

        Moles of $HNO_3 = 0.0067874 \times 4 = 0.31496$
        Volume of $HNO_3 = \dfrac{0.031496 \times 1000}{3} = 10.49cm^3$

   (b)   Step 4 - Neutralization
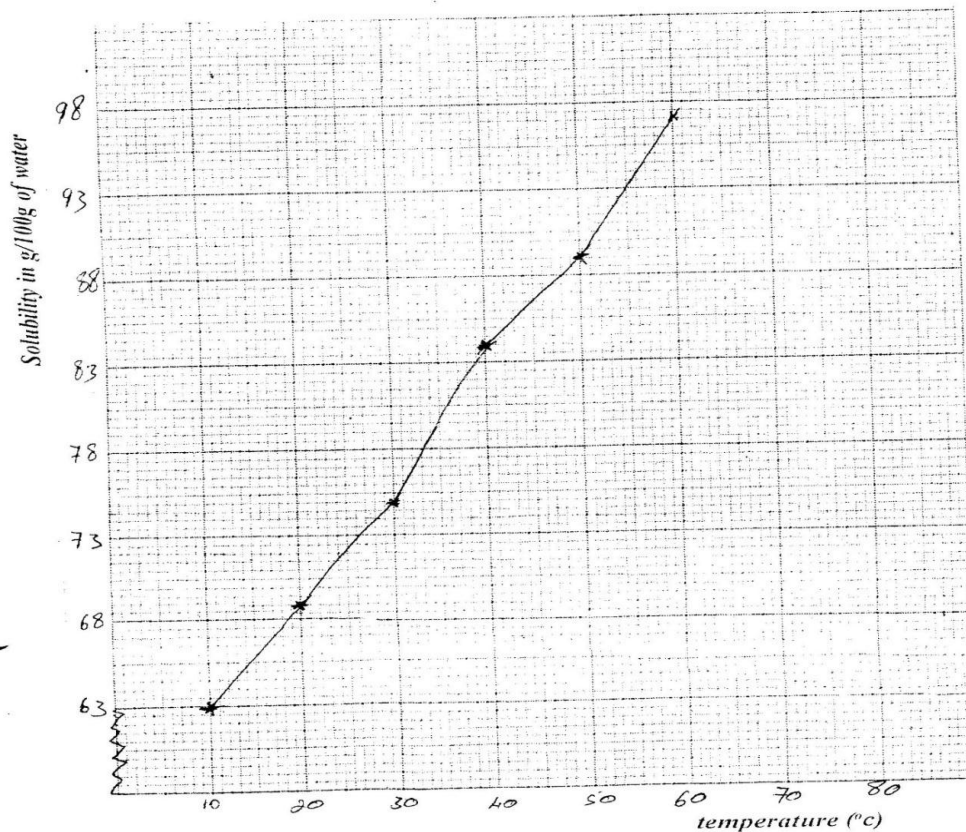   Step 5 – Displacement

   (c)   Resistant to corrosion
         It is tough, 1 strong metal

30.   2007 Q6b P2
   (b)(i)

(ii) 71g/100mm of water
(iii) I   a solution which has dissolved a lot of solute till it can dissolve no
            more

II   Mass of solution at $25^0C = 100 + 71 = 171$ g
          Mass in (g) = $\underline{1000 \times 71}$ = 41.52g
                   171

31.   2008 Q15 P1

J- the solubility of the substance decreases with increase with temperature it dissolves more in cold water than in hot water.

32.   2008 Q16 P1

Heat the metal in air to form the oxide CuO
Add excess dilute HCL to the oxide to get $CuCl_2$

Concentrate the filtrate and leave to crystallize Filter and dry the crystals at room temperature between pieces of filter paper Add excess Cu to nitric acid (dilute concentrate)
   K_2CO_3/ $(NH_4)_2$ CO_3

Filter to remove unreacted copper. Add Na_2 CO_3 to the filtrate to pp $CuCO_3$ filter and add dilute HCL to residue to obtain $CuCl_2$

Add nitric to obtain Cu $(NO_3)_2$. Filter to remove excess Cu. Add NaOH

33.   2008 Q17 P1
   (a)   Amphoteric
   (b)   Lead (II), Zinc and Aluminium (any two)

34.   2009 Q2 P1

   (a) Ca $(HCO_3)_2$ (aq) $\rightarrow CaCO_3$(S) + H_2O(l) + CO_2 (g)
  (b) Sodium carbonate (l) Soda ash/ washing soda
        Calcium hydroxide (l) / Lime water $_2$ Ammonia Sol;
        Sol; Sodium per mutito/ Sodium Duminium Silicate.

35.   2009 Q11 P1
    To 50 cm^3 of 2.8 M NaOH, add 25 cm^3 of 2.8 M H_2SO_4 or 50 cm^3 of 1.4 M/ $100m^3$ of
    0.7 m
-      Heat mixture to concentrate (½)
-      Cool it for crystals to form (½)
-      Filter and dry the residue   (3 marks)

36.   2009 Q18 P1

Bottle	Correct label
1	Sodium chloride
2	Sugar
3	Sodium carbonate

                                                                 (3 marks)

37.   2009 Q23 P1

(a) Pale green solution turns yellow (i)
(b) Sodium hydroxide (l) Potassium hydroxide
  (c) Water (l)

38. 2009 Q25 P1
   (a) Colourless solution becomes brown/ black
      L_2 (aq)/S
   (b) Blue ppt dissolving to form a deep blue solution (l) $Cu(NH_3)_4^{2+}$ (3 marks)

39. 2010 Q5 P1
   Heat the hydrate salt in a sealed container. The pink substance changes to blue.
   Allow the blue substance to cool. It changes to a pink substance. Heat the hydrated
   salt. Pink substance changes to blue content vapour and cool. Add liquid to blue
   solid it turns to pink.

40. 2010 Q24 P1
   React iron metal with sulphuric acid to form iron (II) sulphate. React aqueous
   ammonia with sulphuric acid to form Ammonium Sulphate. Mix the two solutions,
   Iron (II) sulphate and ammonium sulphate to form a solution of ammonium iron (II)
   sulphate. Heat/evaporate, until crystallization starts then cool, filter. Add excess
   H_2SO_4 to iron metal to form $FeSO_4$. Add aqueous NH_3 to form NH_4SO_4. The two
   salts in SO react to form ammonium iron (II) sulphate. Evaporate until crystallization
   starts. Cool and filter to obtain ammonium Iron (II) sulphate.

41. 2011 Q3 P1
   - Heat the mixture to sublime the NH_4Cl
   - Add water to dissolve the NaCl or Copper (II) oxide does not dissolve. Filter and
     evaporate the filtrate to obtain sodium chloride
   - Add water to the mixture to dissolve NaCl or/ Copper (II) Oxide does not
     dissolve. Filter and evaporate to dryness.
   - Heat to sublime NH_4Cl. NaCl remains behind.

42. 2011 Q13 P1
   - Deliquescent substance absorbs water from the atmosphere to for forma solution
     / dissolve
   - Efflorescent substance loses water of crystalisation to the atmosphere
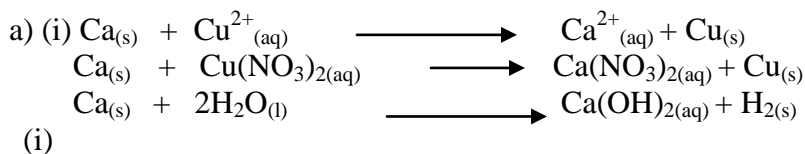
43. 2011 Q30 P1
   Add aqueous Ammonia until in excess
   A formation of white ppt which dissolve in excess shows presence of Zinc ions
     Add acqueous acidified $Ba(NO_3)_2$ // $BaCl_2$ //$PbNO_3)_2$
     Formation of white ppt shows presence of SO_4^{2-}

44. 2011 Q4 P2

a) (i) $Ca_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Ca^{2+}_{(aq)} + Cu_{(s)}$

$Ca_{(s)} + Cu(NO_3)_{2(aq)} \longrightarrow Ca(NO_3)_{2(aq)} + Cu_{(s)}$

$Ca_{(s)} + 2H_2O_{(l)} \longrightarrow Ca(OH)_{2(aq)} + H_{2(s)}$

(i)

- The reaction is highly explosive / highly exothermic because sodium is more reactive than calcium
- Na is more electropositive than calcium

b. No. of moles of copper (II) nitrate

$$\frac{50 \times 2}{1000} = 1 \text{moles}$$

Ratio 1:1

Moles of calcium = 0.1

Mass of calcium = 0.1 x 40 = 4g

c. A white ppt is formed which is insoluble in excess.

d. (i)Add CaO to dilute HNO_3/ HCl/H_2O. Add Na_2CO_3.K_2Co_3/NH_4CO_3 /CO_2 to a solution filter out $CaCO_3$ as residue
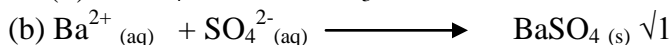
(ii)
- Preparation of Co_2 in the laboratory
- Manufacture cement
- Extraction of metals
- Manufacture of Na_2Co_3 in survey process
- Manufacture of CaO

45. 2012 Q6 P2

(a) (i) O_2^- √1

(ii) $ZnSo_4$ √1 and $CuCo_3$√1

(b) $Ba^{2+}_{(aq)} + SO_4^{2-}_{(aq)} \longrightarrow BaSO_{4 (s)}$ √1

(c) a brown solid√1 is formed the blue√1 colour of the solution fades / magnesium Dissolves

This is mg displaces cu^{2+} √1 from the solution since it is more reactive than copper.

Or apparatus become warm – rxn is exothermic

(d) (i)
– Add excess lead (II) oxide, to dilute √ ½ nitric acid in beakers, until no ore dissolves
- filter to remove excess lead (II) oxide.
- to the filtrate add a soluble√ ½ sulphate to precipitate lead sulphate. Filter√ ½ and dry√ ½ the solid between the filter papers
(ii) Determine melting √1point; the solid is heated until it melts, the temp at which it melts is noted, if it is constant√1 / fixed then it is pure
rej: determine b.p

46. 2012 Q6, 16 P1

   (a) $CuSO_4$ // copper sulphate

   At 40^0c only 28g is soluble // or $Pb(NO_3)_2$ all dissolves at 400c // $Pb(NO_3)_2$ not saturated or $CuSO_4$ is highly saturated.

   (b) mass $= 35 - 28$
   $= 7g$

47. 2012 Q16 P1

   (a) S.H.V.T $= 2$ marks

   if TVHS student must show the direction of reactivity

   NB if SVHT – award 1 mark, if any letter is missing award 0

   (b) $T_{(s)} + V^{2+}_{(aq)} \longrightarrow T^{2+}_{(aq)} + V_{(s)}$