CHLORINE AND ITS COMPOUND MARKING SCHEME

1. 1990 Q19 P1

(a) Distillation or fractional distillation:
Reason: boiling point o f compound of the mixture are far apart / different boiling points

(b) Fractional distillation
Reason: boiling point of components is close

2. 1993 Q15 P1

(a) $Cl_2(g) + NaOH(aq) \longrightarrow Nacl\ (aq) + NaoCl(aq) + H_2o\ (I)$

(b) Naocl decomposes to give oxygen (o) that bleaches

3. 1995 Q1 P1

a) addition (1mark)

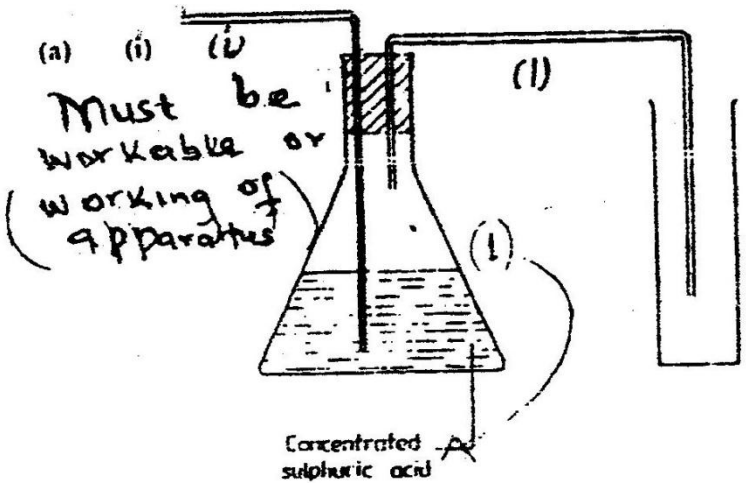
b) $CH_3CH = CH_2(g) + Cl_2(g) \longrightarrow CH_3\ CHCICH_2\ CL\ (g)$

OR

$C_3H_6 + Cl_2$ (1 mark)

4. 1996 Q2 P2

a) (i)



(ii) MnO_2 is reduced
In MnO_2 Mn has oxidation +4 where as on $MnCl_2$ it has oxidation number $+^2$ (2marks)

(iii) To remove HCL fumes/ absorb as/spray (1 mark)

5. 1997 Q14 P1

(a) - Yellow solid formed/ yellow substance/ sulphur deposited

(b) - $H_2S(g) + Cl_2(g) \rightarrow 2HCl(g) + S(s)$

(c) - In a fume cupboard/ in open air

- Both $H_2S(g)$ and Cl_2 (g) are poisonous gases (They have irritating/ pungent smell)

6. 1997 Q28 P1

No. of moles of hydrogen H_2 = $^{10}/_{2}$ = 5 Moles
No. of moles of Nitrogen dioxide NO_2 = 46
Relative molecular mass of NO_2 = 46
1 Mole of No_2 = 5 x 46
5 Moles = 30g

7. 1997 Q7(a) P2

a) (i) To remove excess / unreacted HCL gas.

S
$2HCl(g) + Zn(s) \longrightarrow ZnCl_2(s) + H_2(g)$
$PbO(s) + H_2(g) \longrightarrow Pb(s) + H2O\ (g)$

(ii)Mass will be lower at the end of the experiment because the combined O_2 in PbO is removed/reduced.

b) (i) I To produce HCl gas /$HCl_{(g)}$
II To oxidize $HCl_{(g)}$ to chlorine gas/produce chlorine gas.
(ii) Sodium hypochlorite/ NaOCl / Sodium chlorate
(iii) Kill germs /disinfectant/antiseptic

c) $MgCl_2$ requires 2 mol of $Ag.NO_3$
Moles of $MgCl_2$ = $\frac{1.9}{95}$ =0.02
Moles of $AgNO_3$ = $\frac{1.9}{95}$ x 2 = 0.04
R.F.M of $AgNO_3$ = 170
Mass of $AgNO_3$ = $\frac{1.9x2x170}{95}$ = 0.04x170
= 6.8 gm

8. 1998 Q29 P1

x + 4 (-2) = -1
x – 8 =-1
x = 7

9. 1998 Q4 P1

(a) Remove oxygen (I) which could react with the element to form an oxide

(b) absorb excess chloride
- Absorb moisture from the atmosphere

(c) Sodium chloride has a high melting point (I) and the burner flame Temperature is not able to vaporize sodium chloride

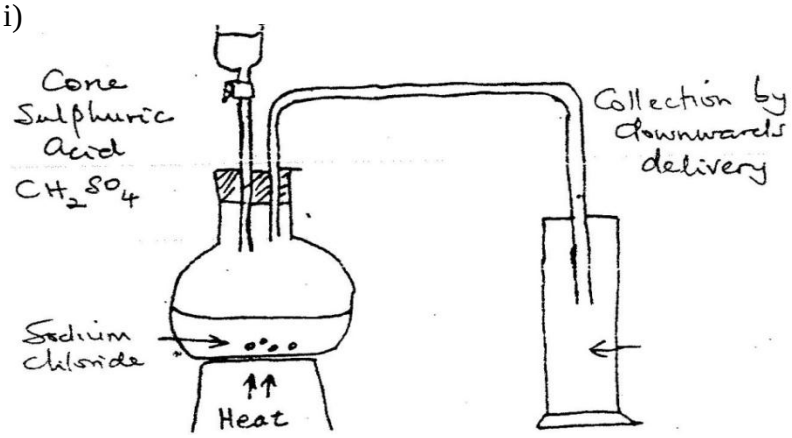
(d) Calcium oxide OR quick lime/ CaO

(e) $2P(s) + 3CI_2(g)\ 2\ PCI_3(g) \longrightarrow P_4 + 6CI_2\ (g)\ 4\ PCI_3(I)$

(f) – Heat the mixture
- Aluminium chloride sublimes
- Cool to obtain aluminium chloride
- Sodium chloride is left in the vessel

10. 2000 Q4a P2

a i)



ii) $NaCl_{(S)} + H_2SO_{4(l)} \longrightarrow NaHSO_{4(s)} + HCL_{(g)}$

iii) - Concentrate sulphuric acid
- Silica gel
- Anhydrous $CaCl_2$ (anyone = 1mark)

iv) A white precipitate of $pbCl_2$ is produced.HCl gas in water ionizes to form H^+ ions and Cl ions; the Cl- ions combine with pb+2 to form Lead (II) Chloride.$pbCl_{2(s)}$

$HCl_{(aq)} \longrightarrow H^+ + Cl_{(aq)}$

$Pb + 2Cl^-_{(aq)} \longrightarrow PbCl_2(s)$ (White ppt)

HCL is not oxidizing agent it only reacts and removes the oxides hence cleaning the surface.HNO3 is a strong oxiding agent; it re – oxidizes the cleaned surface.

11. 2001 Q5 P2

(a) Potassium permanganate, Manganese (IV) oxide, Lead (IV) oxide
$Kmno_4$ or MnO_2 or PbO_2

(b) I. to remove all oxygen or air which would form iron (III) oxide
II. CaO absorbs both $Cl_2(g)$ and moisture. $CaCl_2$ can only absorb Moisture

(c) It sublimes or changes directly from solid to gas

(d) $CaO(s) + H_2O(g) \rightarrow Ca(OH0_2$ or
$CaO(s) + Cl_2(g) \rightarrow CaOCl+2(s)$ or
$Ca(OH)_2 + Cl(g) \rightarrow CaOCl_2H_2O$

12. 2002 Q4 P1

(a) The hypochlorous acid decomposes to form (atomic oxygen)
The atomic oxygen attacks and bleaches the blue flower

(b) $2HOCl(aq) \rightarrow O_2(g) + 2HCl(aq)$

13. 2002 Q2 P2

(a) (i) Sodium hydroxide (1 mark)

(ii) ethne/C_2H_2 //H – C = C-H (1 mark)

(b) Polymerization // Addition polymerization (1mark)

(c) - making artificial leather/ rain coats/ manufacture of cromophone
- making plastic water pipes
- Making electrical insulators (1 mark)

(d) $2Cl^-(aq) \rightarrow Cl_2(g) + 2e$
$2Cl(aq) - 2e \rightarrow bCl_2(g)$

(e) Deep brown solution // dark black brown solid is formed. Chlorine is more reactive than iodine, it displaces if formed.

(a) (i) $2NaOH(aq) + Cl_2(aq) \rightarrow NaCl(aq) + NaOCl(aq) + H_2O(l)$//
$2OH^-(aq) + Cl_2(aq) \rightarrow OCl^-(aq) + Cl^-(aq) + H_2O(l)$

(ii) Moles $\frac{2 \times 15000}{1000} = 30$ or $2 \times 15 = 30$

R.F.M NaOCl = 23 + 16 + 35.5 = 74.5

Moles of NaOCl $= \frac{30 \times 1}{2} = 15$

Mass of NaOCl $= \frac{15 \times 74.5}{1000} = 1.1175$

Mass in kilograms of the sodium hypochlorite produced = 1.1175

14. 2003 Q1 P1

Add water to the mixture (1) Sodium chloride dissolves($^1/_2$) while Copper (II) oxide does not ($^1/_2$) filter ($^1/_2$) and heat the filtrate to dryness to obtain Sodium chloride($^1/_2$).

15. 2003 Q11 P1

The yellow phosphorous form liquid PCl_3, The PCl_3 is hydrolysed in air to form HCl which fumes.

16. 2003 Q22 P1

a) $FeCl_2$ or Iron (II) chloride.

b) The solution was basic / alkaline hence PH of 14.0 Excess HCl neutralized all the alkali and then the solution became acidic as HCl is acidic.

17. 2004 Q4 P1

a) Sulphur (iv) oxide

Thistle funnel dip in the non mixture

b) (i) The gas escape through the thistle funnel (1)

-the gas should be shorter or rising ½ the delivery tube above the mixture.

18. 2004 Q1b-e P2

(b) (i) $4HCl_{(aq)} + MnO_2(s) \rightarrow MnCl_2(aq) + 2H_2O(l) + Cl_2(g)$

OR

$Mn)_2(s) + 4H^+ + 2Cl^-(aq) \rightarrow Mn^{2+}(aq) + 2H_2O(l) + Cl(g)$

OR

$4HCl(aq) \rightarrow 4H^+(aq) + 2Cl(aq)$

(ii) To oxidize the chloride ions to chlorine gas/ oxidizing agent

(c) (i) Iron (III) chloride/ $FeCl_3$

(ii) Mass of chlorine used = 0.06 – 6.30 = 1.76

R.m.m of Cl_2 = 71

Moles of chlorine = $\frac{1.76}{71}$

= 0.0248 x 24000

= 595. 2 cm^3

Or moles of $FeCl_2$

$\frac{6.30}{127} = 0.0496$

Moles of $FeCl_3$

$\frac{8.06}{162.5} = 0.0496$

Moles of $Cl_2 = \frac{0.0496}{2} = 0.0248$ moles

Volume of Cl_2 = 0.0248 x 240 = 595. 2 cm^3

Alt

$2FeCl_2(aq) + Cl_2(g) \rightarrow 2FeCl_3(s)$

$\frac{6.30 \times 2400}{254}$

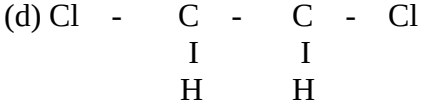
= 595. 2 cm^3

$\frac{8.06 \times 24000}{325}$

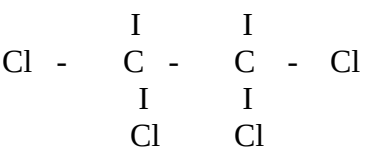
= 595.2 cm^3

Structure

(d)



Name 1,2 dichloroethane (rej) Dichloroethene)



(accept Hexachloroethane)

1,1,1,2,2,2, Hexachloetahne

(e) Manufacture of HCl

Manufacture of PVC

Manufacture of insecticides

Manufacture of chloroethane

Disinfectants

Manufacture of antiseptic
Bleaching powder, DDT, Tetrachloromethane, Chloroform
Reject – manufacture of plastics

19. 2005 Q2 P1

Hydrogen chloride reacts with calcium oxide in the presence of water to form calcium chloride.

$CaO(s) + 2HCl(g) \rightarrow CaCl_2(aq) + H_2O(l)$ (2marks)

20. 2005 Q11 P1

(a) $2NaOH(aq) + 2Cl_2(g) \rightarrow NaOCI_3(aq) + NaCl(aq) + H_2O(l)$

(b) Manufacture of bleaching agents

21. 2005 Q22 P1

a) N is Sodium ethanoate (CH_3COONa)while P is methane (CH4)

b) Substitution reaction

22. 2006 Q10b P1

b) Bleaching. (1mark)

23. 2006 Q13 P1

a) It is a drying agent. (1mark)

b) $Fe_{(s)} + 2HCL_{(g)} \longrightarrow FeCl_{2(s)} + H_{2(g)}$ (1mark)

c) Picking of metals (1mark)

24. 2007 Q24 P1

White flames produced, Ammonia react with chlorine producing hydrogen chloride gas which react with excess ammonia to give ammonium chloride

a) addition (1mark)

b) $CH_3CH = CH_2(g) + Cl_2(g) \longrightarrow CH_3\ CHCICH_2\ CL\ (g)$

OR

$C_3H_6 + Cl_2$ (1 mark)

25. 2007 Q7 P2

(a) Carry experiment in a fume cupboard
Chlorine should not be allowed to escape to the atmosphere

(b) Mno_2 or $K_2Cl_2O_7$

(c) General chlorine and drive out air which may combine with heat aluminium foil

(d) Aluminium chloride sublimes when heated

(e) (i) $2AI(s) + 3Cl(g) \rightarrow 2AlCl_3(s)$

Moles of Al = $\frac{1.08}{27} = 0.04$

Moles of $Cl_2 = 0.04 \times \frac{3}{2} = 0.6$

Mass of $Cl_2 = 0.06 \times 71 = 4.26g$

(iii) $\frac{3.47 \times 100}{4.26} = 81.45\%$

(f) Pass the vapor of phosphorous trichloride through a lie big condenser to condense it.

26. 2008 Q12 P1

(a) Oxygen; O_2

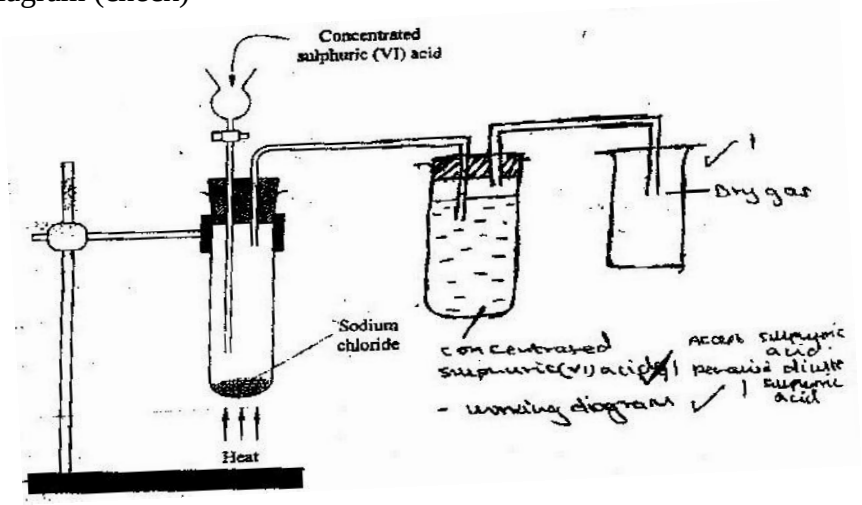
(b) The Ph decreases

HoCL decomposes to give more HCL in the mixture

$2\ HOCL_{(ag)} \rightarrow 2\ HCL_{(ag)} + O_{2\ (g)}$

27. 2008 Q22 P1

Diagram (check)



28. 2009 Q1 P2

(a) (i) $MnO_2 + 4HCl\ (aq) – MnCl_2\ (aq) + Cl_2(g) + 2\ H_2O(g)$

(ii) $KMnO_4$ / $CaOCl_2$ (aq) /PbO_2

(iii) Passing it through a U- tube containing dehydration calcium chloride (CaCl)

- Passing Chlorine gas through concentrated sulphuric acid in a flask.

(b) (i) Aluminium chloride – $AlCl_3$

(ii) $2Al(s) + 3Cl_2\ (g) \rightarrow 2\ AlCl_3(g)$

(iii) Moles of Al metal used = $\frac{0.84}{27}$

$= 0.0311$

Moles of Cl_2 gas $= 0.0311 \times 3/2$

$= 0.047$

Vol of Cl_2 gas $= 0.047 \times 24$

$= 1.12\ dm^3$

(iv) Prevent water moisture from entering the apparatus/ absorbing

- React with excess Chlorine/ prevent environmental pollution
- Prevent hydrolysis of Aluminium Chloride

29. 2011 Q18 P1

(a) At room temperature / cold and dilute sodium hydroxide

(b) Used in sterilizing of water/ treatment of water / killing germs

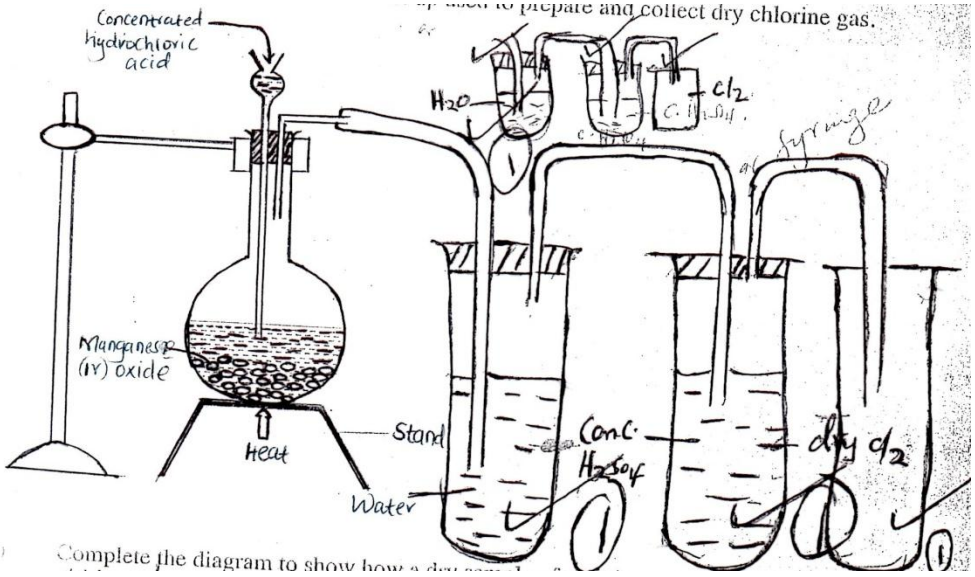
Used as a bleaching agent

Antiseptic for mouth wash

Fungicide

30. 2012 Q7 P2

(a) (i)



Complete the diagram to show how a dry ... of chlorine gas.

Award 1mark for each component

(ii) Potasium √ ½ manganate(VII) , no heating √ ½ required / PbO_2 and heat

(iii) I. $3Cl_2(g) + 2Fe(s) \longrightarrow 2Fecl_3(s)$ √1

II. $3Cl_{2(g)} + 6NaOH_{(aq)} \longrightarrow NaClO_{3\,(aq)} + 5NaCl + 3H_2O_{(aq)}$

(b)

Cl	O	
0.71	1.12g √ ½	
35.5 √ ½	16	
0.02	0.07 √ ½	Cl_2O_7 √ ½
x100	x100	formula - √ ½
	2:7 √ ½	

(c) – water treatement / sterilization of drinking water
- manufacture of bleaching agents e,g KIO_3, $NaClO_3$.
- Manufacture of hydrochloric acid
- manufacture of chloroform
- manufacture of tetrachloromethane