K.C.S.E CHEMISTY PAPER 233/2
MARKING SCHEME 2004

1. a) i) green/yellow✓ gas
ii) slightly soluble✓
iii) Violet/purple/grey/black solid✓ (3 marks)

b) i) $4HCl_{(aq)} + MnO_{2(s)} \rightarrow MnCl_{2(aq)} + 2H_2O_{(l)} + Cl_{(2)(g)}$✓

OR

$MnO_{2(s)} + 4H^+ + 2Cl^-_{(aq)} \rightarrow Mn^{2+}_{(aq)} + 2H_2O_{(l)} + Cl_{2(g)}$✓

OR

$4HCl_{(aq)} \rightarrow 4H^+_{(aq)} + 2Cl^-_{(aq)}$ (1 mark)

ii) - To oxidise the chloride ions to chlorine gas✓ /oxidising agent (1 mark)

c) i) Iron III Chloride/$FeCl_3$✓ (1 mark)

ii) Mass of chlorine used= 8.06 - 6.30 = 1.76✓
R.M.M. of Cl_2 = 71✓
Mole of Chlorine = $\frac{1.76}{71}$ ✓
= 0.0248 × 24000✓ = 595.2cm³✓

OR

Moles of $FeCl_2$ $\frac{6.30}{127} = 0.0496$
Moles of $FeCl_3$ $\frac{8.06}{162.5} = 0.049$
Moles of Cl_2 $\frac{0.049}{2} = 0.0248$
Vol of Cl_2 = 0.0248 × 24000 = 595.2cm³✓

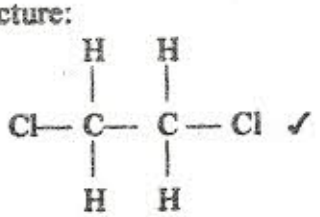
ALTERNATIVE

$2FeCl_{2(s)} + Cl_{2(g)} \rightarrow 2FeCl_{3(s)}$

$\frac{6.30 \times 24000}{254}$ = 595.2cm³ $\frac{8.06 \times 24000}{325}$ = 595.2cm³

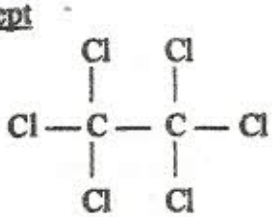
(3 marks)

d) Structure:



Name: 1, 2 Dichloroethane ✓

Accept



1, 1, 1, 2, 2, 2 Hexachloroethane (2 marks)

e) - Manufactuire of HCl✓
- Manufacture of PVC, bleaching powder, DDT, Tetra chloromethane, chloroform
- Manufacture of chloroethane
- Manufactureof antiseptic

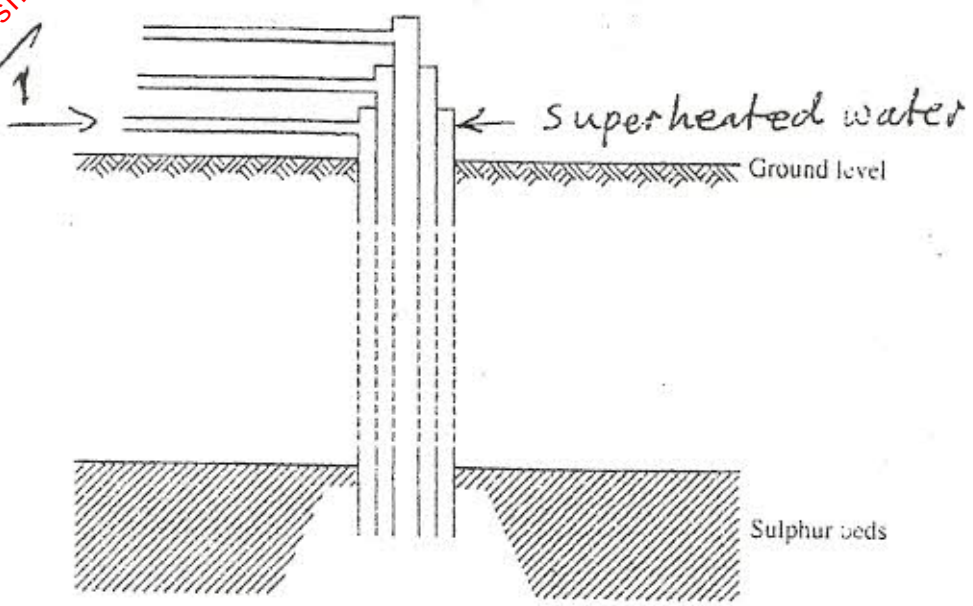
2. a) i) Hydrogen gas✓ (1 mark)
ii) $Ca(OH)_2$✓ is slightly soluble in water✓ //only a few OH^- are produced in solution. (2 marks)
iii) It is used for testing presence of CO_2✓
/used in preparation of ammonia//calcium oxide (1 mark)

b) i) Step 2 - Carbon dioxide✓ /CO_2
Step 4 - Dilute hydrochloric acid✓ (2 marks)

ii) $Ca(HCO_3)_{(aq)} \rightarrow CaCO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$✓

iii) Add an aqueous solution of sulphuric acid.✓ (*Conc. sulphuric acid is not accepted*)
Add aqueous $NaSO_4$/ K_2SO_4/H_2SO_4/$(NH_4)_2SO_4$✓
Filter to obtain calcium sulphate as residue✓
Heat the residue to dryness✓. (3 marks)

3. a)



Accept outermost pipe✓

b) i) Platinum/vanadium (V) oxide✓ (1 mark)

ii) I The yield decreases.✓ The extra heat decomposes✓ the SO_3 or The forward rxn is exothermic/Equilibrium shifts to the left (2 marks)

II Yield increases.✓ There is increase in pressure. Equilibrium shifts to the right.✓ (2 marks)

iii) Dissolve in concentrated H_2SO_4✓ to make oleum. ($H_2S_2O_7$). The Oleum is diluted with water to make sulphuric acid.✓
$SO_{3(g)} + H_2SO_{4(l)} \rightarrow H_2S_2O_{7(l)}$ / $H_2S_2O_{7(l)} + H_2O_{(l)} \rightarrow 2H_2SO_{4(l)}$

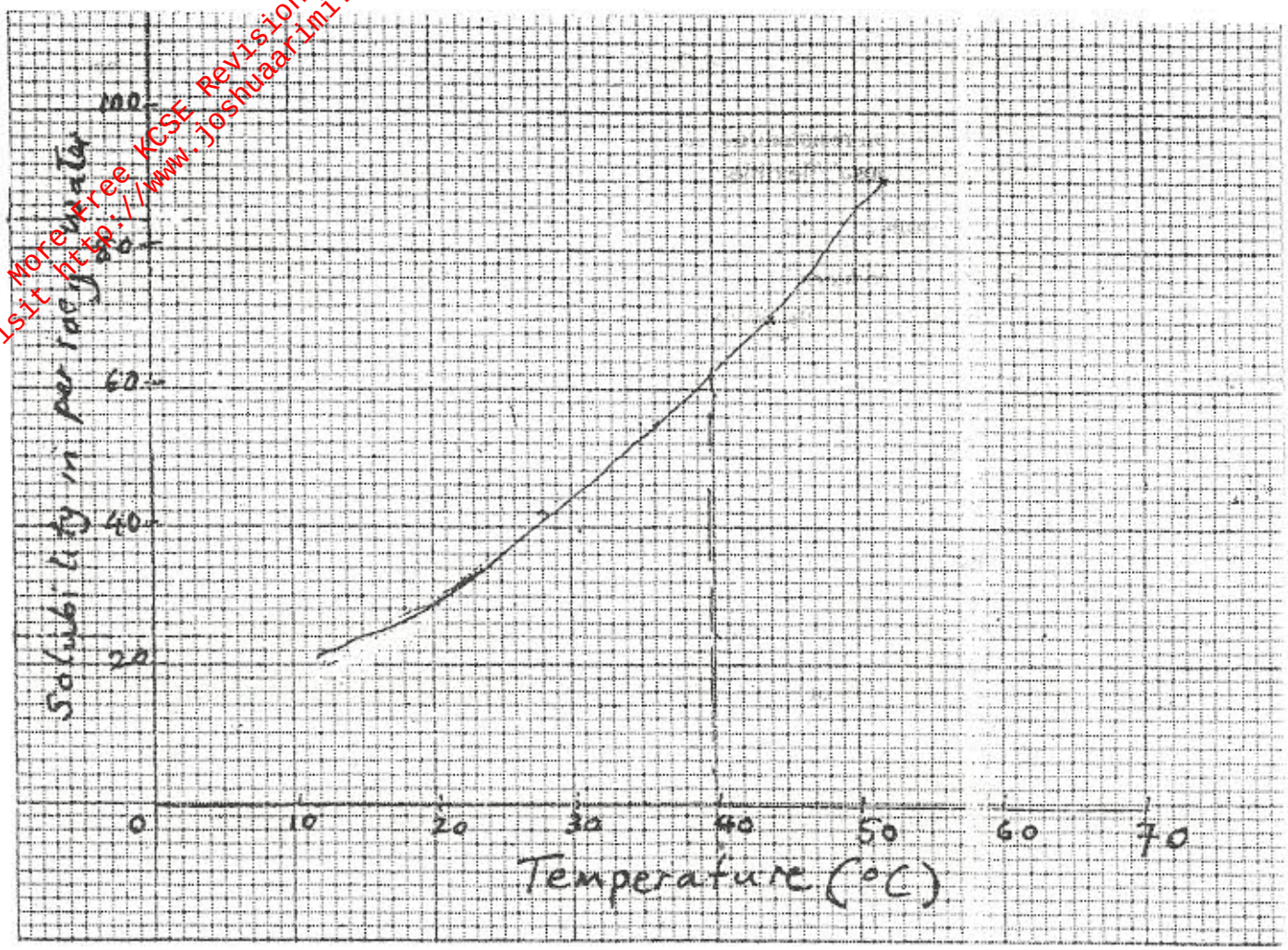
c) Formation of acid rain.✓
It is poisonous.✓ (2 marks)

d) i) $2NH_{3(g)} + H_2SO_{4(l)} \rightarrow (NH_4)_2SO_{4(s)}$

ii) $2NH_{3(g)} + H_2SO_{4(l)} \rightarrow (NH_4)_2SO_{4(s)}$
R.M.M of H_2SO_4 = 98✓½ Moles of fertilizer = $\frac{25}{132} \times 1000$ ✓½= 189.4 or 189.3
R.M.M. of $(NH_4)_2SO_4$ = 132✓½
Moles of H_2SO_4 = 189.4✓½
Mass of H_2SO_4 = $\frac{189.4 \times 98}{1000}$ ✓½ = 18.56kg✓½ (3 marks)

4. **a)** A solution which cannot dissolve any more solute at a particular temperature. (1 mark)

b) i) Horizontal label and covering 4 big squares ✓½
Vertical label and covering 4 big squares ✓½
Plotting six points ✓½
five points ✓½
Curve smooth ✓ (3 marks)



ii) I 25g/100g ✓ (1 mark)
II Mass dissolved = 62g ✓
Mass of undissolved = 80 – 62 = 18g ✓ (2 marks)

c) R.F.M of KNO_3 = 101 ✓½
Moles of KNO_3 in 100g of water
$= \frac{25}{101}$ ✓½ $= 0.2475$ ✓½
∴ Moles of 100g of water is
$\frac{0.2475 \times 1000}{100}$ ✓½
$= 2.475$ ✓

Alternative
Moles of KNO_3 in 100g of water
$= \frac{25}{101} \times 10$
$= 2.475$

(3 marks)

5. a) i) Heat✓ (*Warm is not accepted*) (1 mark)

ii) I $K_2CO_{3(aq)}/Na_2CO_{3(aq)}/(NH_4)_2CO_{3(aq)}$✓ (1 mark)

II Oxygen✓

III S Nitric acid/HNO_3✓

R Nitrous acid/HNO_2✓ (1 mark)

iii) I $Pb(OH)_4^{2-}{}_{(aq)}$✓ (1 mark)

II $PbO_{(s)} + H_{2(g)} \rightarrow Pb_{(s)} + H_2O_{(l)}$✓ (1 mark)

b) i) Cheap, corrosion resistant/durable✓
Lead is poisonous✓ /flexible✓ (2 marks)

ii) Lead is poisonous/harmful✓ (1 mark)

c) i) The reaction produces insoluble lead (II) sulphate✓ which coats✓ the surface of $Pb(NO_3)_2$ preventing further contact (2 marks)

ii) $KNO_3/NaNO_3$✓ (1mark)

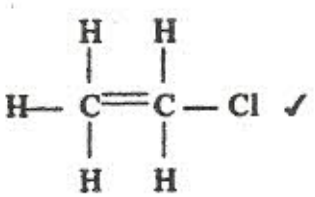
6 a) i) Fractional distillation

ii) - Molecular mass/density✓
- Boiling point✓ (2 marks)

b) i) C_3H_6✓ (1 mark)

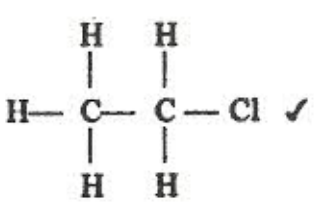
ii) Shake a sample with bromine✓ C_3H_8 does not decolourise.
C_3H_6 decolourises
OR Use acidified potassium✓ permanganate C_3H_8 does not decolourise. C_3H_6 decolourises. (2 marks)
OR Burn a sample of C_3H_8 burns with a non-luminous flame. C_3H_6 burns with luminous flame.
Alternative
Use acidified potassium dichromate - C_3H_8 does not change.
Orange potassium Dichromate. C_3H_6 turns acidified potassium dichromate from orange to green.

c) P_1

CH_2CHCL /  ✓

(1 mark)

P_2

CH_3CH_2CL /  ✓

(1 mark)

d) i) Ethanol/C_2H_5OH/CH_3CH_2OH✓ (1 mark)

ii) Slightly soluble in water/insoluble in water✓ (1 mark)

e) Name: Polythene
Advantage: It is non-biodegradable/pollutes the environment produces poisonous gases when burned (2 marks)

7 a) Add aqueous sodium carbonate✓½ to precipitate calcium carbonate✓½ and magnesium carbonates✓½ and filter✓½. (2 marks)

b) i) I $2H^+_{(aq)} + 2e^- \rightarrow H_{2(g)}$ ✓½ (1 mark)

II $2Cl^-_{(aq)} \rightarrow Cl_{2(g)} + 2e^-$ ✓½ (1 mark)

ii) I Sodium Hydroxide/NaOH (1 mark)
II Graphite/Platinum (1 mark)
III Sodium Chloride/NaCl (1 mark)

iii) - To prevent mixing of chlorine gas with sodium hydroxide to allow free movement.
- It prevents the mixing of chlorine gas and hydrogen gas. (2 marks)

c) - In paper industry
- Manufacture of soap/detergents
- Used to make bleaching agents
- Used in purification of bauxite (1 mark)