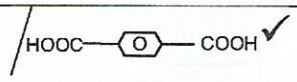
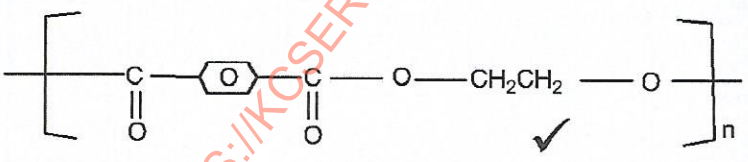
4.7.2 Chemistry Paper 2 (233/2)

No.	Responses	Marks
1a	**A** – Fermentation ✓½ **B** – Dehydration ✓½ **C** – Addition polymerization / polymerization ✓½ **D** – Saponification ✓½	(2 marks)
b (i)	Process **B** Reagent – Concentrated sulphuric(VI) acid✓1 Conditions – Temperature of 160°C - 180°C. ✓1 **OR** -Al_2O_3 -Temperature 300 °C **OR** - H_3PO_4 - warm	(2 marks)
(ii)	Process **D** Reagent – Potassium hydroxide ✓1 / Sodium hydroxide Condition -Boil ✓1/ Boiling	(2 marks)
(iii)	The vegetable oil is mixed with sodium hydroxide and boiled ✓1, Solid sodium chloride is added to the resulting mixture, to precipitate out the soap from glycerol. ✓1	(2 marks)
(iv)	Perfume ✓½ and builders / tetraoxophosphates / dye✓½	(1 mark)
c (i)	Step **F** – acidified potassium manganate (VII) ✓1	(1 mark)
(ii)	Monomer G – Benzene – I, 4 - dioic acid ✓1  ✓	(1 mark)
(iii)	 ✓	(1 mark)
d(i)	Polyethene / polythene✓1	(1 mark)
(ii)	- It is non-biodegradable hence pollutes the environment; - Produces poisonous gases when burnt. (Any one correct)	(1 mark) **(14 marks)**

No.	Responses	Marks
2(a) (i)	**K** ✓½ and **J** ✓½	(1 mark)
(ii)	K^+ ✓, L^{2+} ✓, M^{3+} ✓1 3 ions for 1 mark; 2 ions for ½ mark. 1 ion for 0 mark	(1 mark)
b(i)	$K_{(g)} \rightarrow K^+_{(g)} + e$ $\quad \Delta H_{IE} = 494kJ/mol$ $M_{(g)} \rightarrow M^+_{(g)} + e$ $\quad \Delta H_{IE} = 577kJ/mol$	(1 mark)
(ii)	Across the period, size of atoms decreases therefore more energy required to remove electrons from an atom in its gaseous state hence, 1st ionization energy for **M** will be greater than that of **K**. ✓1 **OR** **K** has lower nuclear charge / attraction than **M** / **K** has less protons than **M**.	(1 mark)
(iii)	L_3I_2 ✓1	(1 mark)
(iv)	Being an inert gas, **V** is used in fluorescent tubes and bulbs ✓1/ arch welding	(1 mark)
c(i)	Group 7. ✓1 Because **G** can either lose an electron to form G^+ or gain an electron to form G^-.✓1	(2 marks)
(ii)	**J** is more reactive than **K** because of increase in the size of atoms. As we go down the group, the atoms increase in size so does reactivity. Outer electrons do not experience much nuclear attraction for bigger atoms. **OR** Reactivity increases down the group, effective nuclear attraction is greater in **K** than **J**/ atomic radius of **J** is greater than that of **K**.	(2 marks)
d(i)	**Element** / **Formula of chloride** / **Nature of chloride solution** **L** / LCl_2 ✓½ / Neutral ✓½ **M** / MCl_3 / M_2Cl_6✓½ / Acidic ✓½	(2 marks)
(ii)	Chloride of **M** vaporizes easily because of weak van der Waals forces between its dimer /.✓1 Its oxide has a high melting point because of strong ionic bond is difficult to break. ✓1	(2 marks) **(14 marks)**

<table>
<tr><th>No.</th><th>Responses</th><th>Marks</th></tr>
<tr><td>3(a)</td><td>
<table>
<tr><th></th><th>Experiment</th><th>Observations</th><th>Type of change</th><th>Name of product</th></tr>
<tr><td>(i)</td><td>Heat candle wax strongly on a test tube.</td><td>It melts and solidifies on cooling. ✓1</td><td>Temporary✓½</td><td>Candle wax ✓½</td></tr>
<tr><td>(ii)</td><td>Anhydrous copper (II) sulphate is left exposed overnight.</td><td>Turns from white to blue ✓1</td><td>Temporary✓½</td><td>Hydrated copper(II) sulphate ✓½</td></tr>
<tr><td>(iii)</td><td>Iron wool is soaked in tap water for two days.</td><td>Turns from grey to brown. ✓1</td><td>Permanent.✓½</td><td>Hydrated Iron(III) oxide / rust. ✓½</td></tr>
</table>
</td><td>(6 marks)</td></tr>
<tr><td>b(i)</td><td>Coloured water moves towards the flask. ✓1 Cold cloth contributes to decrease in temperature causing decrease ✓1 in volume; this creates a vacuum making the ink to move towards the flask.</td><td>(2 marks)</td></tr>
<tr><td>(ii)</td><td>Charle's law ✓1</td><td>(1 mark)</td></tr>
<tr><td>c (i)</td><td>$W^{+}_{(aq)}$, $W_{2(g)}$ / Pt ✓1</td><td>(1 mark)</td></tr>
<tr><td>(ii)</td><td>U, Z, W_2, V, Y ✓1</td><td>(1 mark)</td></tr>
<tr><td>(iii) I</td><td>V^{2+}/ V and W^{+}/ W_2 ✓1</td><td>(1 mark)</td></tr>
<tr><td>II</td><td>e.m.f = 0.00- (-0.40)✓½
= +0.40 V✓½</td><td>(1 mark)

(13 marks)</td></tr>
<tr><td>4a (i)</td><td>$Mg_{(s)} + H_2SO_{4(aq)} \rightarrow MgSO_{4(aq)} + H_{2(g)}$ ✓1</td><td>(1 mark)</td></tr>
<tr><td>(ii)</td><td>To ensure all the acid was used up. ✓1</td><td>(1 mark)</td></tr>
<tr><td>(iii)</td><td>When effervescence stops ✓½ and presence of unreacted magnesium. ✓½</td><td>(1 mark)</td></tr>
<tr><td>(iv)</td><td>Saturated solution is one that cannot dissolve any more solute at a particular temperature.✓1</td><td>(1 mark)</td></tr>
<tr><td>(v)</td><td>Because magnesium sulphate is a hydrated salt✓1 and evaporation to dryness causes it to lose it water of crystallization / crystals would not be formed because water of crystallization is lost through heating.✓1</td><td>(2 marks)</td></tr>
<tr><td>b (i)</td><td>$CaOCl_{2(s)} + 2HNO_{3(aq)} \rightarrow Ca(NO_3)2_{(aq)} + Cl_{2(g)} + H_2O_{(l)}$</td><td>(1 mark)</td></tr>
<tr><td>(ii)</td><td>Volume of chlorine produced
Mass of $CaOCl_2$ = 40 + 16 + 71
= 56 + 71
= 127 ✓½</td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Responses</th><th>Marks</th></tr>
<tr><td></td><td>Moles of $CaOCl_2 = \frac{10}{127} = 0.0787$ moles ✓1
Moles of $CaOCl_2$ = moles of Cl_2 ✓½
1 mole Cl_2 = 22.4 dm^3
0.0787 = ?
0.0787 × 22.4 = 1.763 dm^3 ✓1</td><td>(3 marks)</td></tr>
<tr><td>(c)</td><td>• Manufacture of hydrochloric acid; ✓½
• Manufacture of PVC polymers; ✓½
• Manufacture of potassium chlorate(V);
• Manufacture of carbon tetrachloride;
• Manufacture of chloroform.
(Any 2 correct @ ½ mark)</td><td>(1 mark)
(11marks)</td></tr>
<tr><td>5a (i)</td><td>Concentrated sulphuric(VI) acid and sodium chloride. ✓1</td><td>(2 marks)</td></tr>
<tr><td>(ii)</td><td>Concentrated sulphuric(VI) acid. ✓1</td><td>(1 mark)</td></tr>
<tr><td>(iii)</td><td>Grey Iron powder turns green / solid glows red . ✓1</td><td>(1 mark)</td></tr>
<tr><td>(iv)</td><td>$Fe_{(s)} + 2HCl_{(g)} \rightarrow FeCl_{2(s)} + H_{2(g)}$ ✓1</td><td>(1 mark)</td></tr>
<tr><td>(v)</td><td>Open a bottle of concentrated ammonia and place it near $HCl_{(g)}$ dense white fumes of NH_4Cl are observed.</td><td>(1 mark)</td></tr>
<tr><td>b (i)</td><td>Hydrogen gas. ✓1</td><td>(1 mark)</td></tr>
<tr><td>(ii)</td><td>To prevent an explosion since a mixture of hydrogen and oxygen explodes✓1</td><td>(1 mark)</td></tr>
<tr><td>c</td><td>-to prevent suck back. ✓1
-to increase surface area for dissolution of hydrogen chloride in water. ✓1</td><td>(2 marks)</td></tr>
<tr><td>d</td><td>The flame will go off.</td><td>(1 mark)</td></tr>
<tr><td>e (i)</td><td><table><tr><th>Solution of hydrogen chloride gas in</th><th>blue litmus paper</th><th>Marble chips</th></tr><tr><td>Water</td><td>Turns red ✓½</td><td>Effervescence / gas bubbles✓½</td></tr><tr><td>Methlybenzene</td><td>Remain blue ✓½</td><td>No effervescence ✓½</td></tr></table></td><td></td></tr>
<tr><td>(ii)</td><td>In water the hydrogen chloride ionizes to form hydrogen ions and chloride ions. ✓½ The hydrogen ions turn blue litmus red and also react with marble chips to liberate carbon(IV) oxide hence effervescence. ✓½
In methylbenzene which is non polar, ✓½ HCl is not able to ionize since it is polar. ✓½
Therefore, negative results with blue litmus paper and marble chips.</td><td>(2 marks)
(2 marks)
(15 marks)</td></tr>
</table>

No.	Responses	Marks
6 a (i)	$Na_2CO_3.NaHCO_3.H_2O$ ✓1	(1 mark)
(ii)	Fractional crystallization. ✓1	(1 mark)
b (i)	Solvay process ✓1	(1 mark)
(ii)	Brine, ammonia, calcium carbonate and water✓1	(2 marks)
(iii)	$NH_{3(g)} + CO_{2(g)} + H_2O_{(l)} \rightarrow NH_4HCO_{3(aq)}$ ✓1	(1 mark)
	$NH_4HCO_{3(aq)} + NaCl_{(aq)} \rightarrow NH_4Cl_{(aq)} + NaHCO_{3(s)}$ ✓1	(1 mark)
(iv)	Ammonia and Carbon(IV) oxide, water **(Any 2 correct @ ✓½ mark)**	(1 mark)
(v) I	Calcium hydroxide ✓1 $(Ca(OH)_2)$	(1 mark)
II	Thermal decomposition ✓1	(1 mark)
(vi)	$NH_4Cl_{(aq)} + Ca(OH)_{2(s)} \rightarrow 2NH_{3(g)} + CaCl_{2(aq)} + H_2O_{(l)}$ ✓1	(1 mark)
(vii)	Uses of sodium carbonate • Glass making ✓1 • Paper industry ✓1 • Sodium silicate in making detergents **(Any 2 correct @ 1 mark)**	(2 marks) **(13 marks)**