ICSE CLASS 10 CHEMISTRY – PRACTICE PAPER

STEP-BY-STEP SOLUTIONS AND MARKING SCHEME

Chapter 8: Study of Compounds – Hydrogen Chloride | Maximum Marks: 40

SECTION A (20 Marks)

Question 1 [8 × 1 = 8]

Part	Ans	Step-by-step reasoning
(i)	(a)	Conc. H_2SO_4 dries the gas without reacting with it. P_2O_5 and CaO react with HCl ($2P_2O_5 + 3HCl \rightarrow POCl_3 + 3HPO_3$; $CaO + 2HCl \rightarrow CaCl_2 + H_2O$) and cannot be used.
(ii)	(b)	$NH_3 + HCl \rightarrow NH_4Cl$: tiny solid particles of ammonium chloride appear as dense white fumes.
(iii)	(c)	$AgNO_3 + HCl \rightarrow AgCl\downarrow + HNO_3$. AgCl is a curdy white precipitate, insoluble in nitric acid but soluble in ammonium hydroxide (forming $[Ag(NH_3)_2]Cl$).
(iv)	(d)	Copper is below hydrogen in the electrochemical series, so it does not displace hydrogen from dilute HCl.
(v)	(a)	Aqua regia = 3 parts conc. HCl + 1 part conc. HNO_3.
(vi)	(c)	Both are true. Because HCl dissolves readily in water, it cannot be collected over water; (R) explains (A).
(vii)	(c)	$Na_2SO_3 + 2HCl \rightarrow 2NaCl + H_2O + SO_2\uparrow$.
(viii)	(b)	$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2\uparrow$; chlorine is greenish-yellow.

Question 2 [3 + 3 = 6]

(i) **[3 × 1]**

(a) **200 °C** – above 200 °C the glass may crack, fuel is wasted and a hard crust of Na_2SO_4 sticks to the flask.

(b) **does not** – dry HCl is not acidic; it needs water to form H_3O^+ ions.

(c) **22.2%** – at this composition the mixture boils at 110 °C as a constant boiling mixture (azeotrope).

(ii) **[3 × 1]**

(a) Fountain experiment → **2** (very high solubility of HCl).

(b) $AgNO_3$ + dilute HCl → **3** (curdy white precipitate).

(c) Dilute HCl + sodium thiosulphate → **1** (pale yellow sulphur and pungent SO_2).

Statement 4 (greenish-yellow gas) is the extra option.

Question 3 [3 + 3 = 6]

(i) **[3 × 1]**

(a) P is **sodium chloride**. **$NaCl + H_2SO_4$ (conc.) → $NaHSO_4 + HCl\uparrow$** (below 200 °C).

(b) Q is **concentrated sulphuric acid**; it **dries** the gas by absorbing moisture.

(c) **Upward displacement of air** (downward delivery), as HCl is about 1.28 times heavier than air. It is not collected over water because it is highly soluble in water.

(ii) **[3 × 1]**

(a) Anhydrous HCl is covalent and has no ions. In water it ionises: $HCl + H_2O \rightarrow H_3O^+ + Cl^-$, so the free ions conduct current.

(b) Conc. HNO_3 is volatile and would distil over along with HCl, contaminating the gas (it is also an oxidising agent).

(c) Both react with HCl: $2P_2O_5 + 3HCl \rightarrow POCl_3 + 3HPO_3$, and $CaO + 2HCl \rightarrow CaCl_2 + H_2O$.

SECTION B (20 Marks)

Question 4 [4 + 3 + 3 = 10]

(i) **[4 × 1]**

(a) The **fountain experiment**. When the dropper is pressed, the blue litmus solution rushes up the jet tube and forms a fountain in the flask.

(b) The fountain is **red**, because the solution of HCl formed is acidic and turns blue litmus red.

(c) The few drops of water dissolve the HCl gas in the flask, so the pressure inside falls. The higher atmospheric pressure outside pushes the litmus solution up the tube.

(d) HCl gas is **highly soluble in water** (and is acidic in solution).

(ii) **[3 × 1]**

(a) The funnel gives a large surface area for dissolving the gas and prevents water from being sucked back into the generating flask.

(b) **Back suction**.

(c) An **empty flask** (anti-suction device) between the generating flask and the trough, to collect any water that is sucked back.

(iii) **[3 × 1]**

(a) The aqueous solution turns blue litmus **red**; the solution in toluene has **no effect** on litmus.

(b) The **aqueous** solution conducts electricity (it contains H_3O^+ and Cl^- ions).

(c) HCl is a **covalent** compound; it forms ions only when it reacts with water.

Question 5 [4 + 3 + 3 = 10]

(i) **[4 × 1]**

(a) **Hydrogen** ($Zn + 2HCl \rightarrow ZnCl_2 + H_2$).

(b) **Carbon dioxide** ($NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$).

(c) **Sulphur dioxide** ($Na_2SO_3 + 2HCl \rightarrow 2NaCl + H_2O + SO_2$).

(d) **Hydrogen sulphide** ($FeS + 2HCl \rightarrow FeCl_2 + H_2S$).

(ii) **[3 × 1]**

(a) $\mathbf{MgO + 2HCl \rightarrow MgCl_2 + H_2O}$

(b) $\mathbf{Zn(OH)_2 + 2HCl \rightarrow ZnCl_2 + 2H_2O}$

(c) $\mathbf{Fe_2O_3 + 6HCl \rightarrow 2FeCl_3 + 3H_2O}$

(iii) **[3 × 1]**

(a) **$MnO_2 + 4HCl$ (conc.) → $MnCl_2 + 2H_2O + Cl_2\uparrow$**

(b) The gas is chlorine: it is greenish-yellow and turns moist starch-iodide paper blue-black.

(c) Aqua regia is **3 parts conc. HCl and 1 part conc. HNO_3**. It dissolves gold (or platinum).

Question 6 [4 + 3 + 3 = 10]

(i) **[4 × 1]**

(a) A **curdy white precipitate** of silver chloride is formed.

(b) The precipitate is **insoluble** in dilute nitric acid.

(c) The precipitate **dissolves** in ammonium hydroxide forming a clear solution of diamminesilver(I) chloride.

(d) **No change** – dry HCl gas does not turn dry blue litmus red.

(ii) **[3 × 1]**

(a) **$AgNO_3 + HCl \rightarrow AgCl\downarrow + HNO_3$**

(b) **$NH_3 + HCl \rightarrow NH_4Cl$**

(c) **$Pb(NO_3)_2 + 2HCl \rightarrow PbCl_2\downarrow + 2HNO_3$**

(iii) **[3 × 1]**

(a) HCl gas is highly soluble and combines with the water vapour of the air to form tiny droplets of hydrochloric acid, which appear as white fumes.

(b) **Pickling**.

(c) Dilute HCl is given to patients with decreased activity of the gastric juices (any one correct use, e.g. it also helps in the digestion of proteins).

Marks summary	Section A: Q1 = 8, Q2 = 6, Q3 = 6 → **20** | Section B: any two of Q4, Q5, Q6 at 10 each → **20** | Total = **40**