ICSE CLASS 10 CHEMISTRY – PRACTICE PAPER

STEP-BY-STEP SOLUTIONS AND MARKING SCHEME

Chapter 4: Analytical Chemistry | Maximum Marks: 40

SECTION A (20 Marks)

Question 1 [8 × 1 = 8]

Part	Ans	Step-by-step reasoning
(i)	(c)	The Zn^{2+} ion is colourless, so zinc sulphate solution is colourless. Fe^{2+} is pale green, Cu^{2+} is blue and Fe^{3+} is yellowish brown.
(ii)	(b)	A reddish brown precipitate of $Fe(OH)_3$ forms from an iron(III) salt, whose solution is yellowish brown. Q is therefore the iron(III) salt. P (pale green) is iron(II), giving a dirty green precipitate; R (blue) is copper(II), giving a pale blue precipitate.
(iii)	(a)	$NH_4Cl + NaOH \rightarrow NaCl + H_2O + NH_3\uparrow$. Ammonia is alkaline, so it turns damp red litmus blue.
(iv)	(d)	Zinc, aluminium and lead react with hot concentrated alkalis, forming a soluble salt and hydrogen: $Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2\uparrow$. Iron, magnesium and copper do not react.
(v)	(a)	Al_2O_3 reacts with both acids and alkalis to form salt and water, so it is amphoteric. Na_2O, MgO and CuO are basic and react only with acids.
(vi)	(c)	(A) is true. (R) is true and explains (A): NH_4OH is weakly ionised, so $[OH^-]$ is too low to exceed the solubility of $Ca(OH)_2$.
(vii)	(d)	$Pb(OH)_2$ dissolves in excess NaOH, forming sodium plumbite, but is insoluble in excess NH_4OH. $Zn(OH)_2$ dissolves in both; $Cu(OH)_2$ dissolves only in excess NH_4OH; $Fe(OH)_3$ dissolves in neither.
(viii)	(a)	$FeSO_4 + 2NaOH \rightarrow Fe(OH)_2\downarrow + Na_2SO_4$. Iron(II) hydroxide is a dirty green precipitate (insoluble in excess). Reddish brown is $Fe(OH)_3$; white is Zn/Pb/Ca; pale blue is $Cu(OH)_2$.

Question 2 [3 + 3 = 6]

(i) **[3 × 1]**

(a) **soluble** – $Zn(OH)_2$ forms the soluble complex tetrammine zinc(II) sulphate with excess NH_4OH.

(b) **plumbite** – $Pb(OH)_2 + 2NaOH \rightarrow Na_2PbO_2 + 2H_2O$.

(c) **yellowish brown** – Fe^{3+} salts are yellowish brown, whereas Fe^{2+} salts are pale green.

(ii) **[3 × 1]**

(a) → **2** (tetrammine copper(II) sulphate gives a deep blue solution).

(b) → **1** ($Fe(OH)_2$, dirty green precipitate).

(c) → **3** ($Fe(OH)_3$, reddish brown precipitate).

Statement 4 (colourless solution) is the extra option.

Question 3 [3 + 3 = 6]

(i) **[3 × 1]**

(a) A: dirty green precipitate → **Fe^{2+}** (iron(II) ion). C: pale blue precipitate → **Cu^{2+}** (copper(II) ion).

(b) B: reddish brown precipitate of **iron(III) hydroxide, $Fe(OH)_3$**.

(c) A white precipitate that dissolves in excess NaOH: **Zn^{2+} and Pb^{2+}** (Al^{3+} is also accepted).

(ii) **[3 × 1]**

(a) Some hydroxides (zinc and lead hydroxides) redissolve in excess alkali. If the alkali is added too quickly, it is easy to miss the precipitate which then dissolves again.

(b) NH_4OH is a weak alkali which gives a very low concentration of OH^- ions. This is not enough to precipitate $Ca(OH)_2$.

(c) ZnO reacts with acids ($ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$) as well as with alkalis ($ZnO + 2NaOH \rightarrow Na_2ZnO_2 + H_2O$) to form salt and water, so it shows both basic and acidic character.

SECTION B (20 Marks)

Question 4 [4 + 3 + 3 = 10]

(i) **[4 × 1]**

(a) P: white gelatinous precipitate, soluble in excess of both alkalis → **Zn^{2+}**. Q: chalky white precipitate, soluble in excess NaOH but insoluble in excess NH_4OH → **Pb^{2+}**.

(b) R: pale blue precipitate and deep blue solution with excess NH_4OH → **Cu^{2+}**. Deep blue compound: **$[Cu(NH_3)_4]SO_4$** (tetrammine copper(II) sulphate).

(c) S is a calcium salt. NH_4OH is a weak alkali and gives a very low $[OH^-]$, too low to precipitate $Ca(OH)_2$.

(d) $Pb(NO_3)_2 + 2NaOH \rightarrow Pb(OH)_2\downarrow + 2NaNO_3$

(ii) **[3 × 1]**

(a) $ZnSO_4 + 2NaOH \rightarrow Zn(OH)_2\downarrow + Na_2SO_4$

(b) $Zn(OH)_2 + 2NaOH \rightarrow Na_2ZnO_2 + 2H_2O$

(c) **Sodium zincate** (a colourless soluble salt).

(iii) **[3 × 1]**

(a) Add NH_4OH drop by drop and then in excess. $ZnSO_4$: white precipitate which **dissolves** in excess. $Pb(NO_3)_2$: chalky white precipitate which is **insoluble** in excess.

(b) Add NH_4OH. $Ca(NO_3)_2$: **no precipitate**. $Pb(NO_3)_2$: **chalky white precipitate**.

(c) Add NaOH. $FeSO_4$: **dirty green** precipitate. $FeCl_3$: **reddish brown** precipitate.

Question 5 [4 + 3 + 3 = 10]

(i) **[4 × 1]**

(a) X is **ammonium hydroxide** solution. The cation in Y is **Cu^{2+}** (blue solution).

(b) **Copper(II) hydroxide**, $Cu(OH)_2$.

(c) **$[Cu(NH_3)_4]SO_4$** (tetrammine copper(II) sulphate).

(d) The pale blue precipitate of $Cu(OH)_2$ would **remain**; it is insoluble in excess of NaOH solution.

(ii) **[3 × 1]**

(a) $CuSO_4 + 2NH_4OH \rightarrow Cu(OH)_2\downarrow + (NH_4)_2SO_4$

(b) $Cu(OH)_2 + (NH_4)_2SO_4 + 2NH_4OH \rightarrow [Cu(NH_3)_4]SO_4 + 4H_2O$

(c) $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2\downarrow + Na_2SO_4$

(iii) **[3 × 1]**

(a) $Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2\uparrow$

(b) $2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + 3H_2\uparrow$

(c) **Hydrogen** gas. It burns with a pop sound when a burning splinter is brought near the mouth of the test tube.

Question 6 [4 + 3 + 3 = 10]

(i) **[4 × 1]**

(a) X is **zinc hydroxide**, $Zn(OH)_2$ (white gelatinous precipitate): $ZnSO_4 + 2NaOH \rightarrow Zn(OH)_2\downarrow + Na_2SO_4$.

(b) Y is **Na_2ZnO_2** (sodium zincate, colourless solution).

(c) Z is **$ZnCl_2$** (zinc chloride): $Zn(OH)_2 + 2HCl \rightarrow ZnCl_2 + 2H_2O$.

(d) W is **tetrammine zinc(II) sulphate**, $[Zn(NH_3)_4]SO_4$ (colourless solution).

(ii) **[3 × 1]**

(a) An amphoteric oxide is an oxide which reacts with both acids and alkalis to form salt and water.

(b) $ZnO + 2NaOH \rightarrow Na_2ZnO_2 + H_2O$

(c) $ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$

(iii) **[3 × 1]**

(a) Add $CuSO_4$ solution, drop by drop and then in excess, to each. With NaOH a pale blue precipitate is formed which does **not dissolve** in excess. With NH_4OH the pale blue precipitate **dissolves** in excess to give a deep blue solution.

(b) Warm each solution with NaOH solution. $(NH_4)_2SO_4$ gives **ammonia gas** (pungent smell, turns damp red litmus blue). Na_2SO_4 gives no gas.

(c) Heat each with concentrated NaOH solution. Aluminium dissolves and **hydrogen gas** is evolved (burns with a pop). Magnesium does **not react**.

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**