Q1 - 2024 (04 Apr Shift 1)

In the precipitation of the iron group (III) in qualitative analysis, ammonium chloride is added before adding ammonium hydroxide to :

(1) increase concentration of Cl^- ions

(2) increase concentration of NH_4^+ ions

(3) prevent interference by phosphate ions

(4) decrease concentration of ^-OH ions

Q2 - 2024 (05 Apr Shift 1)

In a borax bead test under hot condition, a metal salt (one from the given) is heated at point B of the flame, resulted in green colour salt bead. The spin-only magnetic moment value of the salt is _____ BM (Nearest integer)

[Given atomic number of $Cu = 29, Ni = 28, Mn = 25, Fe = 26$]

Q3 - 2024 (06 Apr Shift 1)

Match List I with List II

	List - I (Precipitating reagent and conditions)		List - II (Cation)
A.	$NH_4Cl + NH_4OH/ARKS$	I.	Mn^{2+}
B.	$NH_4OH + Na_2CO_3$	II.	Pb^{2+}
C.	$NH_4OH + NH_4Cl + H_2S$ gas	III.	Al^{3+}
D.	dilute HCl	IV.	Sr^{2+}

Choose the correct answer from the options given below:

(1) A-III, B-IV, C-I, D-II

(2) A-III, B-IV, C-II, D-I

(3) A-IV, B-III, C-II, D-I

(4) A-IV, B-III, C-I, D-II

Q4 - 2024 (06 Apr Shift 2)

During the detection of acidic radical present in a salt, a student gets a pale yellow precipitate soluble with difficulty in NH_4OH solution when sodium carbonate extract was first acidified with dil. HNO_3 and then $AgNO_3$ solution was added. This indicates presence of :

(1) Br^-

(2) I^-

(3) Cl^-

(4) CO_3^{2-}

Q5 - 2024 (06 Apr Shift 2)

Match List - I with List - II.

List - I Reaction	List - II Type of redox reaction
(A) Li	(I) 589.2
(B) Na	(II) 455.5
(C) Rb	(III) 670.8
(D) Cs	(IV) 780.0

Choose the correct answer from the options given below :

(1) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)

(2) (A)-(I), (B)-(IV), (C)-(III), (D)-(II)

(3) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)

(4) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Q6 - 2024 (08 Apr Shift 1)

Match List I with List II

	List-I (Name of the test)		List-II (Reaction sequence involved) [M is metal]
A.	Borax bead test	I.	$MCO_3 \rightarrow MO \xrightarrow{Co(NO_3)_2} CoO \cdot MO$
B.	Charcoal cavity test	II.	$MCO_3 \rightarrow MCl_2 \rightarrow M^{2+}$
C	Cobalt nitrate test	III	$MSO_4 \xrightarrow[\Delta]{Na_2B_4O_7} M(BO_2)_2 \rightarrow MBO_2 \rightarrow M$
D.	Flame test	IV	$MSO_4 \xrightarrow[\Delta]{Na_2CO_3} MCO_3 \rightarrow MO \rightarrow M$

Choose the correct answer from the options given below:

(1) A-III, B-II, C-IV, D-I

(2) A-III, B-IV, C-I, D-II

(3) A-III, B-I, C-II, D-IV

(4) A-III, B-I, C-IV, D-II

Q7 - 2024 (09 Apr Shift 2)

Consider the following test for a group-IV cation.

$M^{2+} + H_2S \rightarrow A$ (Black precipitate) + by product

$A +$ aqua regia $\rightarrow B + NOCl + S + H_2O$

$B + KNO_2 + CH_3COOH \rightarrow C +$ by product

The spin-only magnetic moment value of the metal complex C is _____ BM (Nearest integer)

Answer Key

Q1 (4) **Q2** (6) **Q3** (1) **Q4** (1)

Q5 (4) **Q6** (2) **Q7** (0)

Q1

$NH_4OH \rightleftharpoons NH_4^+ + OH^-$

$NH_4Cl \rightarrow NH_4^+ + Cl$

Due to common ion effect of NH_4^+, $[OH^-]$ decreases in such extent that only group-III cation can be precipitated, due to their very low K_{sp} in the range of 10^{-38}.

Q2

Fe^{+3} will give green coloured bead when heated at point B.

Number of unpaired e^- in $Fe^{+3} = 5$

$\mu = 5.92$

Nearest integer $= 6$

Q3

Theory based question

Q4

$Ag^+ + I^- \rightarrow AgI$ Yellow ppt.

$Ag^+ + Cl^- \rightarrow AgCl$ White ppt

$Ag^+ + Br^- \rightarrow AgBr$ Pale yellow ppt

Q5

Fact Based

Q6

Cobalt nitrate test

$MCO_3 \rightarrow MO \xrightarrow[+\Delta]{Co(NO_3)_2} CoO.\ MO$

Flame test

$MCO_3 \rightarrow MCl_2 \rightarrow M^{2+}$

Borax Bead test

$$MSO_4Na_2 \underset{\Delta}{B_4O_7M(BO_2)_2} \rightarrow MBO_2 \rightarrow M$$

Charcoal cavity test

$$MSO_4 \xrightarrow[\Delta]{Na_2CO_3} MCO_3 \rightarrow MO \rightarrow M$$

Q7

If $M^{+2} = Co^{+2}$

then

$$Co^{+2} + H_2S \rightarrow \underset{\text{Black}}{\underset{[A]}{CoS}} + \text{byproduct}$$

$$CoS + \text{aqua regia} \rightarrow \underset{[B]}{CoCl_2} + NOCl + S + H_2O$$

$$CoCl_2 + KNO_2 \xrightarrow{CH_3COOH} k_3\left[CO(NO_2)_6\right] + \text{byproduct}$$

$[C] = Co^{+3} \rightarrow 3d^6 \Rightarrow NO_2$ is SFL so Co +3 has zero unpaired e^-

$\Rightarrow n = 0 \Rightarrow u = \sqrt{n(n+2)} = 0B.M$