

PREVIOUS YEAR QUESTIONS (Chapter wise)

CHAPTER NAME: ANALYTICAL CHEMISTRY

SUMMARY POINTS

Concept	Key Points	Examples/Notes	Formulae
Cation Detection with Ammonium Hydroxide	- Ammonium hydroxide reacts with specific metal ions to form precipitates.	- Fe^{3+} : Reddish-brown ppt. $\text{Fe}(\text{OH})_3$ - Cu^{2+} : Deep blue solution in excess NH_4OH	None
Cation Detection with Sodium Hydroxide	- NaOH reacts with metal ions, forming precipitates with specific solubility behavior.	- Zn^{2+} : White ppt soluble in excess - Ca^{2+} : White ppt, insoluble in excess - Fe^{2+} : Dirty green ppt	None
Anion Detection with Silver Nitrate	- AgNO_3 reacts with halide ions to form precipitates of specific colors.	- Chloride (Cl^-): White ppt soluble in NH_4OH - Bromide (Br^-): Pale yellow ppt - Iodide (I^-): Yellow ppt, insoluble in NH_4OH	None
Amphoteric Oxides	- Oxides that react with both acids and bases.	- Example: PbO reacts with HCl to form PbCl_2 and with NaOH to form $\text{Na}_2[\text{Pb}(\text{OH})_4]$.	None
Reaction with Ammonium Hydroxide	- Ammonium hydroxide reacts with transition metal salts to form characteristic colored precipitates.	- CuSO_4 : Blue ppt ($\text{Cu}(\text{OH})_2$) dissolves in excess to form deep blue solution - ZnSO_4 : White ppt ($\text{Zn}(\text{OH})_2$) soluble in excess.	None

Reaction with NaOH	- NaOH produces precipitates with specific metal ions.	- Fe^{2+} : Dirty green ppt ($\text{Fe}(\text{OH})_2$) - Fe^{3+} : Reddish-brown ppt ($\text{Fe}(\text{OH})_3$).	None
Flame Test	- Metal salts produce characteristic flame colors.	- K^+ : Lilac flame - Na^+ : Yellow flame - Ca^{2+} : Brick red flame.	None
Distinguishing Tests	- Specific reagents identify or distinguish between salts based on reaction outcomes.	- Pb^{2+} and Zn^{2+} (with NH_4OH): Pb^{2+} forms ppt insoluble in excess; Zn^{2+} forms ppt soluble in excess.	None
Reactions of Metal Nitrates	- Metal nitrates produce specific reactions with alkalis like NH_4OH and NaOH .	- $\text{Pb}(\text{NO}_3)_2$ with NaOH : Forms white ppt of $\text{Pb}(\text{OH})_2$, soluble in excess.	None
Carbonate Test	- Carbonates react with dilute acids to release CO_2 , which turns lime water milky.	- $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$	$\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$

Key Notes:

- Cation Identification:** Use the behavior of the precipitate (color, solubility in excess reagent) to identify cations like Fe^{3+} , Cu^{2+} , Zn^{2+} , etc.
- Anion Identification:** Analyze the reactions with AgNO_3 and confirm solubility in NH_4OH to detect halides.
- Amphoteric Oxides:** Oxides like ZnO and PbO react with both acids and bases, distinguishing them from normal oxides.
- Chemical Tests:**
 - Flame Test:** To detect alkali and alkaline earth metals.
 - Reagent Tests:** NH_4OH , NaOH , or dilute acids help identify unknown salts.
- Precipitation Reactions:**
 - Precipitate formation and solubility in excess reagent confirm the presence of specific ions.
 - e.g., $\text{Cu}(\text{OH})_2$: Soluble in NH_4OH , forming deep blue complex.
- Observation-Based Questions:**
 - Focus on characteristic colors, precipitates, and solubility in excess.

Q.NO.: 1

Rita was given an unknown salt for identification. She prepared a solution of the salt and divided it into two parts.

YEAR

	• To the first part of the salt solution, she added a few drops of ammonium hydroxide and obtained a reddish-brown precipitate. • To the second part of the salt solution, she added a few drops of silver nitrate solution and obtained a white precipitate. Name: a. the cation present and b. the anion present in the salt given for identification.	[2024]
ANS.:	The cation present is Fe³⁺ (ferric ion) and the anion is Cl⁻ (chloride ion) . Ferric chloride gives a reddish-brown precipitate with ammonium hydroxide. A white precipitate forms when silver nitrate solution is added.	
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Q.NO.: 2	The metallic hydroxide which forms a deep inky blue solution with excess ammonium hydroxide solution is: a. Fe(OH) ₂ b. Cu(OH) ₂ c. Ca(OH) ₂ d. Fe(OH) ₃	YEAR [2023]
ANS.:	(B) Copper hydroxide	
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Q.NO.: 3	Fill in the blank with the choices given in the bracket: .. [Silver chloride / Lead chloride] is a white precipitate that is soluble in excess of Ammonium hydroxide solution.	YEAR [2023]
ANS.:	Silver chloride	
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Q.NO.: 4	Identify the cation in each of the following cases: (a) Ammonium hydroxide solution when added to Solution B gives a white precipitate which does not dissolve in excess of ammonium hydroxide solution. (b) Sodium hydroxide solution when added to Solution C gives a white precipitate which is insoluble in excess of sodium hydroxide solution.	YEAR [2023]
ANS.:	The cation in the first solution is lead (Pb²⁺) . The cation in the second solution is calcium (Ca²⁺) .	

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Q.NO.: 5	Choose the substances given in the box below to answer the following question: The solution of this compound produces dirty green precipitate	YEAR [2023]
ANS.:	FeSO ₄	
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Q.NO.: 6	State one relevant observation for each of the following: (a) To the copper nitrate solution, initially few drops of sodium hydroxide solution is added and then added in excess.	YEAR [2023]
ANS.:	When a few drops of sodium hydroxide are added to copper nitrate, a blue precipitate of copper hydroxide is formed. Excess sodium hydroxide does not dissolve the precipitate.	
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Q.NO.: 7	Choose the answer from the list which fits in the description: [CCl, PbO, NaCl, CuO, NH ₄ Cl] (a) An amphoteric oxide.	YEAR [2022]
ANS.:	PbO	
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Q.NO.: 8	Distinguish between the following as directed: Lead salt solution and zinc salt solution. [using NH ₄ OH solution in excess]	YEAR [2023]
ANS.:	Lead salt solution will form a chalky white precipitate.2 Zinc salt solution will form a gelatinous white precipitate that dissolves in excess ammonium hydroxide.	
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Q.NO.: 9	State one relevant observation for each of the following reactions: Addition of excess ammonium hydroxide into copper sulphate solution.	YEAR [2020]
ANS.:	A deep blue or inky blue solution forms.	
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Q.NO.: 10	Distinguish between the following pairs of compounds using a reagent as a chemical test: (i) Calcium nitrate and Zinc nitrate solution.	YEAR [2020]
ANS.:	When ammonium hydroxide is added to zinc nitrate solution, a white precipitate of zinc hydroxide forms which is soluble in an excess of ammonium hydroxide. ³ Calcium nitrate does not form a precipitate when excess ammonium hydroxide is added.	
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Q.NO.: 11	Distinguish between the following pair of compounds using the reagent given in the bracket. Ferrous sulphate solution and ferric sulphate solution. (using sodium hydroxide solution)	YEAR [2012]
ANS.:	When sodium hydroxide is added to ferrous sulfate solution, a dirty green precipitate (ferrous hydroxide) is formed. When sodium hydroxide is added to ferric sulfate solution, a reddish-brown precipitate (ferric hydroxide) is formed.	
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Q.NO.: 12	The salt solution which does not react with ammonium hydroxide is: i. Calcium Nitrate ii. Zinc Nitrate iii. Lead Nitrate iv. Copper Nitrate	YEAR [2018]
ANS.:	(1) Calcium nitrate	
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Q.NO.: 13	State one relevant observation for each of the following: (i) Lead nitrate solution is treated with sodium hydroxide solution drop wise till it is in excess	YEAR [2018]
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ANS.:	A chalky white precipitate (lead hydroxide) forms. The precipitate dissolves in excess sodium hydroxide, forming a colorless solution.	
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Q.NO.: 14	Give a chemical test to distinguish between the following pair of chemicals: i) Lead nitrate solution and Zinc nitrate solution	YEAR [2018]
ANS.:	When sodium hydroxide is added, lead nitrate solution gives a chalky white precipitate (lead hydroxide). Zinc nitrate solution gives a gelatinous white precipitate (zinc hydroxide). Using ammonium hydroxide, lead nitrate forms a chalky white precipitate, and zinc nitrate forms a gelatinous white precipitate. In excess ammonium hydroxide, the zinc hydroxide precipitate will dissolve, but the lead hydroxide precipitate will not.	
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Q.NO.: 15	A chloride which forms a precipitate that is soluble in excess of ammonium hydroxide, is: i. Calcium chloride ii. Ferrous chloride iii. Ferric chloride iv. Copper chloride	YEAR [2017]
ANS.:	(4) Copper chloride	
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Q.NO.: 16	State one relevant observation for the following reaction: * Action of Sodium hydroxide solution on ferrous sulphate solution.	YEAR [2017]
ANS.:	A dirty green precipitate (ferrous hydroxide) is formed. The precipitate is insoluble in excess sodium hydroxide.	
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Q.NO.: 17	How will you distinguish between Ammonium hydroxide and Sodium hydroxide using copper sulphate solution?	YEAR [2017]
ANS.:	With sodium hydroxide, copper sulfate solution forms a pale blue precipitate (copper hydroxide) that is insoluble in excess sodium hydroxide. With ammonium hydroxide, copper sulfate solution forms a pale blue precipitate (copper hydroxide)	

	that dissolves in excess ammonium hydroxide to form a deep blue or inky blue solution.	
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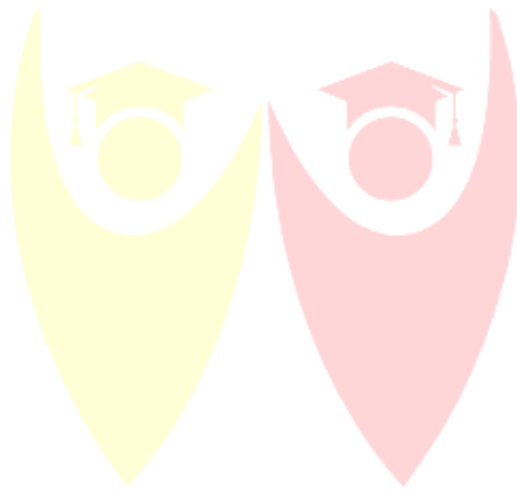
Q.NO.: 18	Identify the salts P and Q from the observations given below: (i) On performing the flame test salt P produces a lilac coloured flame and its solution gives a white precipitate with silver nitrate solution. which is soluble in Ammonium hydroxide solution. Potassium Chloride (ii) When dilute HCl is added to a salt Q, a brisk effervescence is produced and the gas turns lime water milky. When NH₄OH solution is added to the above mixture (after adding dilute HCl), it produces a white precipitate which is soluble in excess NH₄OH solution.	YEAR [2017]
ANS.:	The first salt is potassium chloride . Potassium chloride gives a white precipitate of silver chloride when mixed with silver nitrate. Silver chloride is soluble in ammonium hydroxide solution. The lilac flame confirms the presence of potassium. The second salt is zinc carbonate . The brisk effervescence and the gas turning lime water milky confirms the presence of a carbonate. Zinc chloride forms a white precipitate that is soluble in excess ammonium hydroxide.	
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Q.NO.: 19	Fill in the blank with the choices given in bracket: (AgCl / PbCl₂), a white precipitate is soluble in excess NH₄OH.	YEAR [2016]
ANS.:	AgCl (Silver chloride)	
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Q.NO.: 20	State your observations when ammonium hydroxide solution is added drop by drop and then in excess to each of the following solutions: (i) copper sulphate solution (ii) zinc sulphate solution.	YEAR [2016]
ANS.:	In copper sulfate solution, a pale blue precipitate of copper hydroxide forms, which turns into a deep blue or inky blue solution upon adding excess ammonium hydroxide. In zinc sulfate solution, a gelatinous white precipitate of zinc hydroxide forms initially. Adding excess ammonium hydroxide dissolves the precipitate, resulting in a colorless solution.	
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Q.NO.: 21	Identify the cations in each of the following case: (i)NaOH solution when added to the solution 'A' gives a reddish brown precipitate. (ii)NH₄OH solution when added to the solution 'B' gives a white ppt which does not dissolve in excess. (iii)NaOH solution when added to the solution 'C' gives a white ppt which is insoluble in excess.	YEAR [2016]
ANS.:	The cation in the first solution is Ca²⁺ (Calcium ion) . The cation in the second solution is Fe³⁺ (Ferric ion) . The cation in the third solution is Pb²⁺ (Lead ion) .	
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Q.NO.: 22	<u>2015</u> 21.The following table shows the tests a student performed on four different aqueous solutions which are X, Y, Z and W. Based on the observations provided, identify the cation present: <table border="1"> <thead> <tr> <th>Chemical test</th><th>Observation</th><th>Conclusion</th></tr> </thead> <tbody> <tr> <td>To solution X, ammonium hydroxide is added in minimum quantity first and then in excess.</td><td>A dirty white precipitate is formed which dissolves in excess to form a clear solution.</td><td>(i)</td></tr> <tr> <td>To solution Y ammonium hydroxide is added in minimum quantity first and then in excess.</td><td>A pale blue precipitate is formed which dissolves in excess to form a clear inky blue solution.</td><td>(ii)</td></tr> <tr> <td>To solution W a small quantity of sodium hydroxide solution is added and then in excess.</td><td>A white precipitate is formed which remains insoluble.</td><td>(iii)</td></tr> <tr> <td>To a salt Z calcium hydroxide solution is added and then heated.</td><td>A pungent smelling gas turning moist red litmus paper blue is obtained.</td><td>(iv)</td></tr> </tbody> </table>	Chemical test	Observation	Conclusion	To solution X, ammonium hydroxide is added in minimum quantity first and then in excess.	A dirty white precipitate is formed which dissolves in excess to form a clear solution.	(i)	To solution Y ammonium hydroxide is added in minimum quantity first and then in excess.	A pale blue precipitate is formed which dissolves in excess to form a clear inky blue solution.	(ii)	To solution W a small quantity of sodium hydroxide solution is added and then in excess.	A white precipitate is formed which remains insoluble.	(iii)	To a salt Z calcium hydroxide solution is added and then heated.	A pungent smelling gas turning moist red litmus paper blue is obtained.	(iv)	YEAR [2015]
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ANS.:	The cation in Solution X is Zinc . The cation in Solution Y is Copper . The cation in Solution W is either Calcium or Magnesium . Both have similar observations with NaOH. The cation in Solution Z is Ammonium . The pungent-smelling gas is ammonia which turns red litmus paper blue.																



Students Point

Let's Result Speak