Bihar Board 12 Chemistry (Practical) 2023 Question Paper with Solutions

Time Allowed :3 Hours 15 mins	**Maximum Marks :**70	**Total questions :**96

General Instructions

Instructions to the candidates:

1. **Candidate must enter his/her Question Booklet Serial No. (10 Digits) in the OMR Answer Sheet.**
2. Candidates are required to give their answers in their own words as far as practicable.
3. Figures in the right-hand margin indicate full marks.
4. An extra time of 15 minutes has been allotted for the candidates to read the questions carefully.
5. This question booklet is divided into two sections — **Section-A** and **Section-B**.

1. Identify one anionic radical in the given inorganic salt "M_3" by performing dry and wet tests.

Solution:

Aim.

To detect *one* acidic radical (anion) present in the sample "M_3" using standard preliminary (dry) and confirmatory (wet) tests.

Apparatus & Reagents (as needed).

Test tubes, glass rod, dropper, corked test tube for brown–ring, watch glass, lead acetate paper, blue/red litmus, lime water ($Ca(OH)_2$), freshly prepared $FeSO_4$ solution, $BaCl_2$ solution, dil. & conc. H_2SO_4, $AgNO_3$, dil. NH_3, chlorine water, starch–KI paper, $KMnO_4$/acid, etc.

Step 1: Preliminary (physical) check.

Note colour/odour/texture. (Most anion tests are independent of this, but note any vinegar smell $\Rightarrow$ acetate, rotten-egg odour on moistening $\Rightarrow$ sulphide hints.)

Step 2: Dry tests (on solid or with conc. acid).

(A) Action of dilute H_2SO_4 on a pinch of salt. Observe the gas.

Observation	**Inference (possible anion)**
Brisk effervescence; gas turns lime water milky, extinguishes flame	CO_3^{2-} (carbonate)
Pungent gas with smell of burning sulphur; acidified dichromate paper turns green / moist blue litmus turns red then bleached	SO_3^{2-} (sulphite) $\rightarrow SO_2$
Rotten-egg smell; blackening of moist lead acetate paper	S^{2-} (sulphide) $\rightarrow H_2S$
Vinegar smell on warming	CH_3COO^- (acetate)
Brown fumes appear only on adding Cu turnings too	NO_2 from NO^-/NO_3^- (nitrite/nitrate screening)

(B) Action of conc. H_2SO_4 (cautiously).

Observation	Inference
Dense white fumes (HCl) that fume with NH_3	Cl^-
Reddish–brown vapours (Br_2)	Br^-
Violet vapours/black deposit (I_2)	I^-
No obvious change (screen out SO_4^{2-}, PO_4^{3-} etc.)	Test by wet method

Step 3: Wet (confirmatory) tests on aqueous extract.

Prepare an aqueous extract of "M_3" (boil gently with distilled water, cool, filter). Perform appropriate tests guided by Step 2. Use **at most one** confirmatory set and record the matching result.

(i) Halides (Cl^-, Br^-, I^-) — $AgNO_3$ test:

To 2 mL extract add dil. HNO_3, then $AgNO_3$. Note precipitate and its behaviour with NH_3.

White ppt. $\rightarrow$ dissolves in dil. NH_3	Cl^- (AgCl)
Pale cream ppt. $\rightarrow$ dissolves only in conc. NH_3	Br^- (AgBr)
Yellow ppt. $\rightarrow$ insoluble in NH_3	I^- (AgI)

(ii) Sulphate (SO_4^{2-}): Add dil. HCl then $BaCl_2$. **White heavy ppt. that is insoluble in acids** $\Rightarrow$ $BaSO_4$ confirms SO_4^{2-}.

(iii) Sulphite (SO_3^{2-}): Acidify extract and add acidified $KMnO_4$ (or dichromate). **Decolourisation with smell of SO_2** confirms SO_3^{2-}. Also gives **white ppt. with $BaCl_2$ soluble in dil. HCl** ($BaSO_3$).

(iv) Carbonate (CO_3^{2-}): Add dil. acid; pass gas through lime water $\Rightarrow$ **milky $CaCO_3$** which clears on excess CO_2 (due to $Ca(HCO_3)_2$) confirms CO_3^{2-}.

(v) Nitrate (NO_3^-) — Brown-ring test:

To 2 mL extract add freshly prepared $FeSO_4$, then carefully add conc. H_2SO_4 down the side to form two layers. **A brown ring at the junction** $\Rightarrow$ NO_3^-.

(vi) Nitrite (NO_2^-): Acidify a portion and add freshly prepared starch–KI paper: **blue colour**

(via I_2) confirms NO_2^-. Also, with dil. H_2SO_4 and Cu turnings $\Rightarrow$ **brown fumes** of NO_2.

(vii) Phosphate (PO_4^{3-}): Acidify with HNO_3, warm, then add **ammonium molybdate** and heat gently: **canary yellow ppt.** of ammonium phosphomolybdate confirms PO_4^{3-}.

(viii) Acetate (CH_3COO^-): Warm the solid/extract with **conc. H_2SO_4 + ethanol**: **fruity odour** of ethyl acetate; or heat with conc. H_2SO_4 alone: **vinegar smell** (acetic acid).

Step 4: Inference and Report.

Match your *observations* from Step 2 with *confirmatory* evidence from Step 3 and write:

Anion present in "M_3": _____ (write the confirmed radical).

Quick Tip

Do *screening* with acid tests first, then run only the relevant confirmatory test. For halides: $AgNO_3$ colour + NH_3 solubility pattern is decisive. For sulphite vs sulphate: Ba^{2+} test + acid solubility separates them. Handle conc. H_2SO_4 and NO_x fumes in a fume hood.

OR

1. Identify one cationic radical in the given inorganic salt "M_3" by performing dry and wet tests.

Solution:

Aim.

To identify one cation (metal ion) from the given salt "M_3" using dry and wet tests.

Apparatus.

Bunsen burner, test tubes, glass rod, droppers, conc. HCl, $BaCl_2$, sodium tetraphenylborate, ammonium hydroxide, etc.

Dry Tests:

Step 1: Flame Test.

Take a small quantity of "M_3" and place it in the Bunsen flame. The flame color will help identify the cation.

- Sodium (Na^+) will give a yellow flame.

- Potassium (K^+) will give a lilac flame.

- Copper (Cu^2+) will give a green flame.

Step 2: Action with Concentrated Acids.

Place a small quantity of salt in a test tube and add dilute HCl or HNO_3.

Observe any reactions that occur, such as precipitation or gas formation.

Wet Tests:

Step 1: Precipitation with $BaCl_2$.

To a portion of the aqueous extract of "M_3", add dilute HCl and $BaCl_2$. Observe for a white precipitate. This indicates the presence of Pb^2+ or Ca^2+.

Step 2: Reaction with Ammonium Hydroxide.

Add ammonium hydroxide to the solution. If a blue precipitate forms, this suggests the presence of Cu^2+.

Step 3: Specific Ion Tests.

- For $NH_4\hat{+}$ (Ammonium): Add sodium tetraphenylborate to detect $NH_4\hat{+}$.

- For Fe^2+ (Iron): Confirm with potassium ferrocyanide.

Conclusion:

Based on the dry and wet test results, the cationic radical present in "M_3" is identified as _____. (Write the confirmed cation here).

Quick Tip

Perform the dry test first to narrow down possibilities, then use targeted wet tests to confirm. For example, a blue precipitate with NH_4OH confirms Cu^2+, while a white precipitate with $BaCl_2$ confirms Pb^2+.

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2. Determine the molarity of the given $KMnO_4$ solution with the help of supplied Mohr's salt solution by titration method.

Solution:

Aim.

To determine the molarity of the given $KMnO_4$ solution using Mohr's salt solution (Fe^{2+}).

Apparatus.

Burette, conical flask, pipette, Bunsen burner, test tube, HCl, H_2SO_4, Mohr's salt solution.

Procedure.

1. Fill the burette with the $KMnO_4$ solution.
2. Take a known volume of Mohr's salt solution (Fe^{2+}) in a conical flask.
3. Add a few drops of dilute H_2SO_4 to provide H^+ for the reaction.
4. Titrate the $KMnO_4$ solution into the Mohr's salt solution while stirring continuously.
5. A persistent pink color will appear near the endpoint. This indicates that all the Fe^{2+} has reacted, and the endpoint is reached.
6. Note the volume of $KMnO_4$ used.

Calculation.

Using the equation:

$$M_1V_1 = M_2V_2$$

Where: - M_1 = Molarity of $KMnO_4$ - V_1 = Volume of $KMnO_4$ used in titration - M_2 = Molarity of Mohr's salt solution - V_2 = Volume of Mohr's salt solution used in titration

Since the balanced reaction between $KMnO_4$ and Mohr's salt is:

$$2MnO_4^- + 5Fe^{2+} \rightarrow 2Mn^{2+} + 5Fe^{3+}$$

The molar ratio between $KMnO_4$ and Fe^{2+} is 2:5.

Quick Tip

Always perform the titration slowly near the endpoint to avoid overshooting the pink color.

OR

2. Determine the molarity of the given $KMnO_4$ solution with the help of supplied oxalic acid solution by volumetric analysis method.

Solution:

Aim.

To determine the molarity of the given $KMnO_4$ solution using oxalic acid solution by volumetric analysis.

Apparatus.

Burette, conical flask, pipette, Bunsen burner, test tube, H_2SO_4, oxalic acid solution.

Procedure.

1. Fill the burette with the $KMnO_4$ solution.
2. Prepare a known volume of oxalic acid solution in the conical flask.
3. Add a few drops of dilute H_2SO_4 to the flask to provide H^+ for the reaction.
4. Titrate the $KMnO_4$ solution into the oxalic acid solution while stirring continuously.
5. A persistent pink color will appear near the endpoint. This indicates that the reaction is complete.
6. Note the volume of $KMnO_4$ used.

Calculation.

Using the equation:

$$M_1V_1 = M_2V_2$$

Where: - M_1 = Molarity of $KMnO_4$ - V_1 = Volume of $KMnO_4$ used in titration - M_2 = Molarity of oxalic acid solution - V_2 = Volume of oxalic acid solution used in titration

Since the balanced reaction between $KMnO_4$ and oxalic acid is:

$$2MnO_4^- + 5C_2H_2O_4^{2-} \rightarrow 2Mn^{2+} + 5CO_2 + 8H_2O$$

The molar ratio between $KMnO_4$ and oxalic acid is 2:5.

Quick Tip

Ensure you use fresh oxalic acid solution and maintain a steady titration speed to prevent errors.

OR

2. Determine the molarity of HCl solution with the help of supplied NaOH solution by volumetric analysis method.

Solution:

Aim.

To determine the molarity of HCl solution using NaOH solution by volumetric analysis.

Apparatus.

Burette, conical flask, pipette, Bunsen burner, test tube, NaOH solution, HCl solution, phenolphthalein indicator.

Procedure.

1. Fill the burette with the NaOH solution of known molarity.
2. Pipette out a known volume of HCl solution into the conical flask.
3. Add a few drops of phenolphthalein indicator.
4. Titrate the NaOH solution into the HCl solution until a persistent pink color appears.
5. Record the volume of NaOH used.

Calculation.

Using the equation:

$$M_1V_1 = M_2V_2$$

Where: - M_1 = Molarity of NaOH - V_1 = Volume of NaOH used - M_2 = Molarity of HCl (unknown) - V_2 = Volume of HCl used

Since the reaction is 1:1, the equation simplifies to:

$$M_1V_1 = M_2V_2$$

Quick Tip

Always perform titration slowly near the endpoint to avoid overshooting the pink color.

OR

2. Determine the molarity of Na_2CO_3 solution with the help of supplied H_2SO_4 solution by volumetric analysis method.

Solution:

Aim.

To determine the molarity of Na_2CO_3 solution using H_2SO_4 solution by volumetric analysis.

Apparatus.

Burette, conical flask, pipette, Bunsen burner, test tube, H_2SO_4 solution, Na_2CO_3 solution, methyl orange indicator.

Procedure.

1. Fill the burette with the H_2SO_4 solution of known molarity.
2. Pipette out a known volume of Na_2CO_3 solution into the conical flask.
3. Add a few drops of methyl orange indicator.
4. Titrate the H_2SO_4 solution into the Na_2CO_3 solution until a color change from yellow to red is observed.
5. Record the volume of H_2SO_4 used.

Calculation.

Using the equation:

$$M_1V_1 = M_2V_2$$

Where: - M_1 = Molarity of H_2SO_4 - V_1 = Volume of H_2SO_4 used - M_2 = Molarity of Na_2CO_3 (unknown) - V_2 = Volume of Na_2CO_3 used

Since the reaction is 1:1, the equation simplifies to:

$$M_1V_1 = M_2V_2$$

Quick Tip

Ensure to carefully monitor the color change with methyl orange indicator for accurate results.

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3. Identify one functional group in the given organic compound O.

Solution:

Functional Group Identification.

Based on the molecular structure of O, the functional group can be identified as a carbonyl group ($C = O$), which is typically found in aldehydes and ketones. This functional group imparts distinctive chemical properties to the compound.

Carbonyl Group (C=O)

Quick Tip

The carbonyl group is a versatile functional group, present in a wide variety of organic compounds.

OR

3. Determine the presence of nitrogen atom in the given organic compound O.

Solution:

Test for Nitrogen Presence.

To test for nitrogen in O, perform a reaction with Nessler's reagent or Sodium nitroprusside. If nitrogen is present, these reagents will produce a color change, confirming the presence of nitrogen.

Presence of Nitrogen: Confirmed by reaction with specific reagents.

Quick Tip

Nessler's reagent turns yellow to brown when nitrogen is present, making it a useful test.

OR

3. Prepare soap in the laboratory and submit it for inspection.

Solution:

Soap Preparation.

To prepare soap, heat fat/oil and add sodium hydroxide solution. Stir continuously until saponification occurs. Once the soap is formed, allow it to solidify, then inspect it for texture and lathering ability.

Inspection.

Check the soap's purity, texture, and lathering ability to confirm it meets the required standards.

Soap prepared and ready for inspection.

Quick Tip

The saponification reaction involves the reaction of fat with sodium hydroxide to produce soap and glycerol.
