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CHEMISTRY

INORGANIC CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	REACTIONS OF IONS IN AQUEOUS SOLUTION
PAPER TYPE:	QUESTION PAPER - 2
TOTAL QUESTIONS	10
TOTAL MARKS	33

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Reactions of Ions in Aqueous Solution - 2

1. Describe what you would see if cobalt(II) chloride solution were treated with sodium hydroxide solution.

(a) Give the formula of the cobalt-containing product.

(2)

(b) Describe what you would see if hydrogen peroxide solution were added to the mixture produced above product.

Give the formula of the cobalt-containing product.

(2)

2. What forms when a solution of sodium carbonate is added to a solution of gallium(III) nitrate?

- A.** A white precipitate of gallium(III) carbonate.
B. A white precipitate of gallium(III) hydroxide.
C. A white precipitate of gallium(III) carbonate and bubbles of carbon dioxide.
D. A white precipitate of gallium(III) hydroxide and bubbles of carbon dioxide.

(1)

3. An aqueous solution of iron(II) sulphate is a pale-green colour.

When aqueous sodium hydroxide is added to this solution a green precipitate is formed.

On standing in air, the green precipitate slowly turns brown.

(a) Give the formula of the complex ion responsible for the pale-green colour.

(1)

(b) Give the formula of the green precipitate.

(1)

(c) Suggest an explanation for the change in the colour of the precipitate.

(2)

4. Which compound gives a colourless solution when an excess of dilute aqueous ammonia is added?

A. MgCl_2

B. AgCl

C. CuCl_2

D. AlCl_3

(1)

5. State what is meant by each of the following terms.

(a) Ligand

(1)

(b) Complex ion

(1)

(c) Co-ordination number

(1)

6. Study the passage below and answer the questions which follow.

Crystalline iron (III) nitrate nonahydrate, $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, has a very pale violet colour and contains the ion $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$.

When added to water, the crystals dissolve to form a brown solution.

Treatment of this brown solution with concentrated nitric acid yields a very pale violet solution.

(a) Name the shape of the $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ ion.

(1)

(b) Write an equation to show the $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ ion behaving as an acid in aqueous solution.

(1)

(c) Deduce the formula of the species responsible for the brown colour of the solution described above.

(1)

(d) Explain why the addition of concentrated nitric acid causes the colour of the solution to change from brown to very pale violet.

(2)

7. An excess of a given reagent is added to each of the following pairs of aqueous metal ions.

For each metal ion, state the initial colour of the solution and the final observation that you would make.

In each case, write an overall equation for the formation of the final product from the initial aqueous metal ion.

An excess of dilute aqueous sodium hydroxide is added to separate aqueous solutions containing $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$.

(4)

8. Define the terms reducing agent and Lewis acid in terms of electrons.

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(2)

9. The addition of sodium hydroxide or of sodium carbonate to aqueous chromium(III) chloride results in the formation of the green precipitate.

(a) Identify this green precipitate.

(1)

(b) State the role shown by both sodium hydroxide and sodium carbonate in the formation of this green precipitate.

(2)

(c) Identify the gas evolved when carbonate ions react with aqueous chromium(III) ions and write an equation for the reaction occurring.

(2)

10. An excess of a given reagent is added to each of the following pairs of aqueous metal ions.

For each metal ion, state the initial colour of the solution and the final observation that you would make.

In each case, write an overall equation for the formation of the final product from the initial aqueous metal ion.

An excess of dilute aqueous ammonia is added to separate aqueous solutions containing $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$ and $[\text{Ag}(\text{H}_2\text{O})_2]^+$

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