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CHEMISTRY

PHYSICAL CHEMISTRY II

| | |
|-----------------|--------------------|
| Level & Board | AQA (A-LEVEL) |
| TOPIC: | TRANSITION METALS |
| PAPER TYPE: | QUESTION PAPER - 4 |
| TOTAL QUESTIONS | 10 |
| TOTAL MARKS | 28 |

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Transition Metals - 4

1. Other than octahedral, there are several different shapes shown by transition metal complexes.

Name three of these shapes and for each one give the formula of a complex with that shape.

2. Which will not act as a ligand in the formation of a complex ion? (6)
 - A. CH_4
 - B. CO
 - C. H_2O
 - D. NH_3

3. An experiment was carried out to determine the original concentration of iron(II) ions in a solution that had been stored in air.

An excess of zinc and acid was added to this solution.

The mixture was then filtered to remove the excess zinc before titration.

(a) Suggest why the zinc and acid were added.

(1)

(b) Explain why it was necessary to remove the excess zinc.

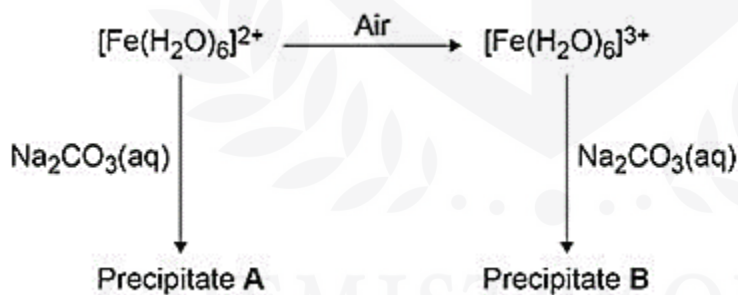
(1)

4. Which statement is not correct?

- A. CuCl_4^{2-} is square planar.
- B. NH_4^+ is tetrahedral.
- C. $[\text{Co}(\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2)_3]^{2+}$ is octahedral.
- D. $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ is octahedral.

(1)

5. The figure below shows some reactions of iron ions in aqueous solution.



(a) Identify A and state its colour.

(2)

(b) Give the formula of B and state its colour.

Give an ionic equation for the reaction of $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ with aqueous Na_2CO_3 to form B.

(3)

(c) Explain why an aqueous solution containing $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ ions has a lower pH than an aqueous solution containing $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ ions.

(3)

6. Which compound decolourises acidified potassium manganate(VII) solution?

- A. $\text{Al}_2(\text{SO}_4)_3$
- B. CuSO_4
- C. FeSO_4
- D. $\text{Fe}_2(\text{SO}_4)_3$

(1)

7. A flue-gas desulfurisation process involves the oxidation, by oxygen, of aqueous sulfate(IV) ions (SO_3^{2-}) into aqueous sulfate(VI) ions (SO_4^{2-}).

This reaction is catalysed by Co^{2+} ions in an acidic aqueous solution.

Write an equation for the overall reaction of sulfate(IV) ions with oxygen to form sulfate(VI) ions.

Suggest why this overall reaction is faster in the presence of Co^{2+} ions.

Suggest a mechanism for the catalysed reaction by writing two equations involving Co^{2+} and Co^{3+} ions.

You will need to use H^+ ions and H_2O to balance these two equations.

(4)

8. What is observed when concentrated hydrochloric acid is added to an aqueous solution of CuSO_4 until no further change occurs?

- A. A colourless gas is evolved and a precipitate forms.
- B. A colourless gas is evolved and no precipitate forms.
- C. A precipitate forms that dissolves in an excess of concentrated hydrochloric acid.
- D. The solution changes colour and no precipitate forms.

(1)

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

- Ligand
- Complex ion
- Co-ordination number

(3)

I am Sorry !!!!!

10. Which shows the correct oxidation state and co-ordination number of cobalt in $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$?

| | Oxidation State (+) | Coordination Number |
|----|---------------------|---------------------|
| A. | +2 | 5 |
| B. | +2 | 6 |
| C. | +3 | 5 |
| D. | +3 | 6 |

(1)



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