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CHEMISTRY

INORGANIC CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	REACTIONS OF IONS IN AQUEOUS SOLUTION
PAPER TYPE:	QUESTION PAPER - 1
TOTAL QUESTIONS	10
TOTAL MARKS	40

Reactions of Ions in Aqueous Solution - 1

1. Corrosion can be defined as the degradation of a material when it comes into contact with the environment.
For iron, this process is called rusting.

(a) When iron rusts it reacts with oxygen and water vapour in the air initially to form a brown, flaky solid that can be regarded as iron(III) hydroxide

Write an equation, including state symbols, for the overall reaction of the iron with oxygen and water vapour to form iron(III) hydroxide.

(2)

(b) Explain why this type of corrosion is not seen on aluminium structures that have been exposed to the environment for a similar time as iron structures.

(2)

2. What is the final species produced when an excess of aqueous ammonia is added to aqueous aluminium chloride?

A. $[Al(NH_3)_6]^{3+}$
B. $[Al(OH)_3(H_2O)_3]$
C. $[Al(OH)_4(H_2O)_2]^-$
D. $[Al(OH)(H_2O)_5]^{2+}$

(1)

3. A co-ordinate bond is formed when a transition metal ion reacts with a ligand.

(a) Explain how this co-ordinate bond is formed.

(2)

(b) Describe what you would observe when dilute aqueous ammonia is added dropwise, to excess, to an aqueous solution containing copper(II) ions.
Write equations for the reactions that occur.

(4)

4. When the complex ion $[Cu(NH_3)_4(H_2O)_2]^{2+}$ reacts with 1,2-diaminoethane, the ammonia molecules but not the water molecules are replaced.

(a) Write an equation for this reaction**.**

(1)

(b) Suggest why the enthalpy change for this reaction is approximately zero.

(2)

(c) Explain why the reaction occurs despite having an enthalpy change that is approximately zero.

(2)

5. A student dissolved 1980 mg of iron tablets in an excess of dilute sulfuric acid.

The solution was titrated with 0.0200 mol dm^{-3} potassium manganate(VII) solution.

A 32.50 cm^3 volume of potassium manganate(VII) solution was required to reach the end point in the titration.

(a) Calculate the percentage of iron in the sample of iron tablets.
Give your answer to the appropriate number of significant figures.

(4)

(b) State the colour change at the end point in this titration.

(1)

6. Iron forms many complexes that contain iron in oxidation states +2 and +3.

(a) Hexaaquairon(III) ions react with an excess of hydrochloric acid in a ligand substitution reaction.
Write an equation for this reaction.

(1)

(b) Explain why the initial and final iron(III) complexes in the equation above have different shapes.

(2)

(c) Hexaaquairon(II) ions react with an excess of $H_2NCH_2CH_2NH_2$ in a ligand substitution reaction.

Draw the structure of the iron(II) complex formed showing its charge.

(2)

7. The following tests were carried out to identify an unknown green salt Y.

An aqueous solution of Y gave a cream precipitate of compound A when reacted with silver nitrate solution.

Compound A gave a colourless solution when reacted with concentrated ammonia solution.

Another aqueous solution of Y gave a green precipitate B when reacted with sodium carbonate solution.

The green precipitate B was filtered and dried and then reacted with sulfuric acid to give a pale green solution containing compound C and a colourless gas D.

(a) Identify by name or formula the compounds A, B, C, D and Y.

(5)

(b) Write the simplest ionic equation for the reaction of silver nitrate solution with the anion that is present in compound Y.

(1)

(c) Write the simplest ionic equation for the reaction that occurs between the green precipitate B and sulfuric acid.

(1)

8. When an excess of magnesium metal is added to an aqueous solution of iron (III) nitrate, effervescence occurs, and a brown precipitate forms.

Identify the gas evolved, give the formula of the brown precipitate and construct an equation, or equations, for the reaction occurring.

(3)

9. 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 aqueous sodium carbonate is added to separate aqueous solutions containing $[Fe(H_2O)_6]^{2+}$ and $[Fe(H_2O)_6]^{3+}$

(5)

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 concentrated hydrochloric acid is added to separate aqueous solutions containing $[Cu(H_2O)_6]^{2+}$ and $[Co(H_2O)_6]^{2+}$.

I am Sorry !!!!!

(4)

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