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CHEMISTRY

PHYSICAL CHEMISTRY II

Level & Board

AQA (A-LEVEL)

TOPIC:

TRANSITION METALS

PAPER TYPE:

QUESTION PAPER - 3

TOTAL QUESTIONS

10

TOTAL MARKS

33

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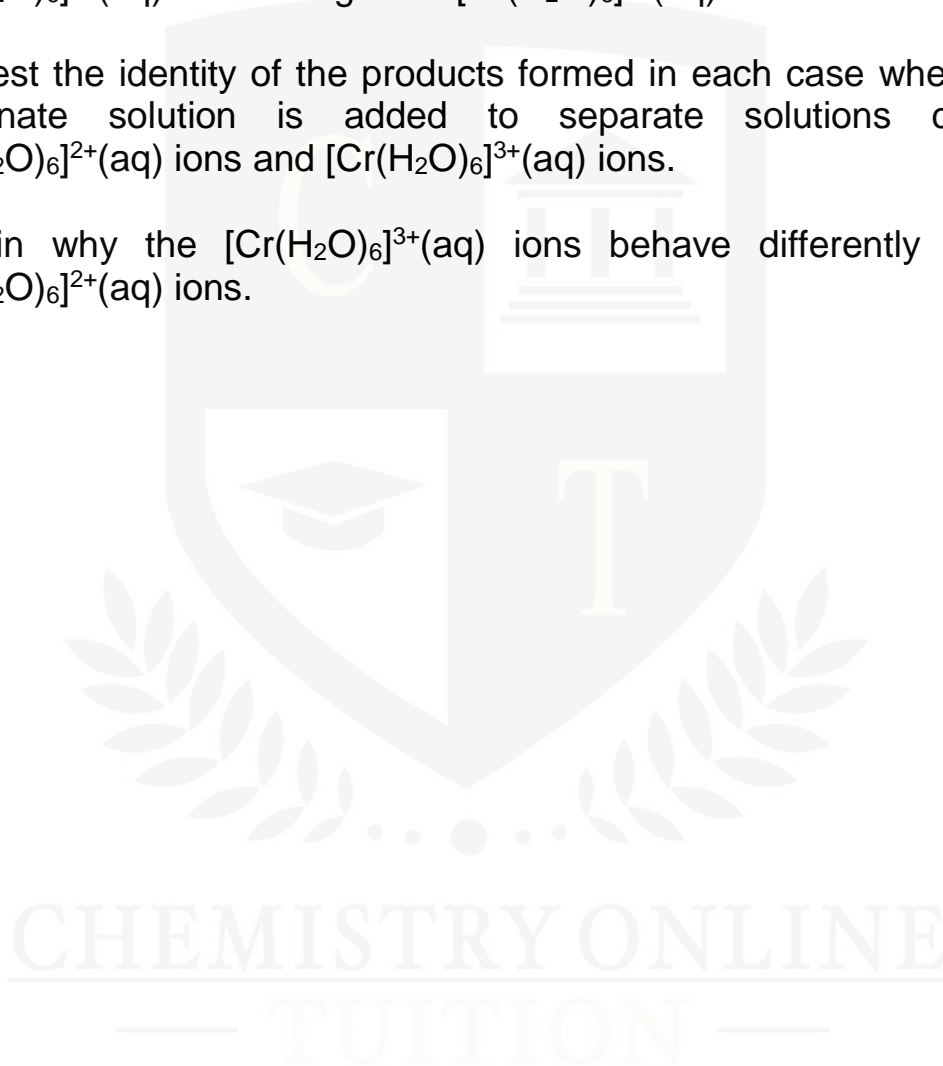
Transition Metals - 3

1. The chromium(II) ion $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ has different properties from the $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ ion.

Use data from the table above to explain why, in an open container, $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}(\text{aq})$ ions change into $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}(\text{aq})$ ions.

Suggest the identity of the products formed in each case when sodium carbonate solution is added to separate solutions containing $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}(\text{aq})$ ions and $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}(\text{aq})$ ions.

Explain why the $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}(\text{aq})$ ions behave differently from the $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}(\text{aq})$ ions.



(7)

2. Which one of the following would not reduce an acidified aqueous solution of potassium dichromate(VI)?
A. CH_3COOH
B. Zn

C. CH_3CHO

D. $\text{Fe}^{2+}(\text{aq})$

(1)

3. In each titration using potassium manganate(VII), a large excess of dilute sulfuric acid is used to avoid any possibility of the brown solid MnO_2 forming.

(a) Deduce a half-equation for the reduction of MnO_4^- ions in acidic solution to form MnO_2 .

(1)

(b) Give two reasons why it is essential to avoid this reaction in a titration between potassium manganate(VII) and iron(II) ions.

(2)

(c) Potassium manganate(VII) is an oxidising agent.

Suggest one reason why a $0.0200 \text{ mol dm}^{-3}$ solution of potassium manganate(VII) does not need to be kept away from flammable material.

(1)

4. Which one of the following could not act as a ligand?

A. F^-

B. CH_3CH_3

C. NH_2NH_2

D. CH_3OCH_3

(1)

5. Iron is an important element in living systems.

It is involved in redox and in acid–base reactions.

Explain how and why iron ions catalyse the reaction between iodide ions and $\text{S}_2\text{O}_8^{2-}$ ions.

Write equations for the reactions that occur.

(5)

6. The vanadium does not have an oxidation state of +3 in

- A. $[\text{V}(\text{H}_2\text{O})_6]^{3+}$
- B. $[\text{V}(\text{C}_2\text{O}_4)_3]^{3-}$
- C. $[\text{V}(\text{OH})_3(\text{H}_2\text{O})_3]$
- D. $[\text{VCl}_4]^{3-}$

(1)

7. The redox reaction, in aqueous solution, between acidified potassium manganate(VII) and sodium ethanedioate is autocatalysed.

Write an equation for this redox reaction.

Identify the species that acts as the catalyst.

Explain how the properties of the species enable it to act as a catalyst in this reaction.

(6)

8. A 0.0720 g sample of reducing agent R was dissolved in water and acidified with an excess of dilute H_2SO_4 .

The resulting solution was found to react with exactly 18.0 cm^3 of a $0.0200 \text{ mol dm}^{-3}$ solution of KMnO_4 .

In this reaction, 5 mol of R react with 3 mol of KMnO_4 .
The Mr of R is

- A. 120
- B. 167
- C. 240
- D. 333

(1)

9. When petrol is burned in a car engine, carbon monoxide, carbon dioxide, oxides of nitrogen and water are produced.

Catalytic converters are used as part of car exhaust systems so that the emission of toxic gases is greatly reduced.

- (a) Write an equation for a reaction which occurs in a catalytic converter between two of the toxic gases.
Identify the reducing agent in this reaction.

(2)

(b) Identify a transition metal used in catalytic converters and state how the converter is constructed to maximise the effect of the catalyst.

(3)

10. When vanadium reacts with chlorine at 400°C , a brown compound is obtained.

When an aqueous solution containing 0.193 g of this compound was treated with aqueous silver nitrate all the chlorine in the compound was precipitated as silver chloride.

The mass of silver chloride (AgCl) produced was 0.574 g.

Which one of the following could be the formula of the brown compound?

- A. VCl
- B. VCl_2
- C. VCl_3
- D. VCl_4

(1)

I am Sorry !!!!!



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