Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Inorganic 2

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Name of the Student:_____
Max. Marks : 23Marks **Time : 23 Minutes**

Q1.

Copper(II) complexes are coloured.
The colour is caused by the d electrons of copper moving from their ground state to an excited state.

(a) Explain why aqueous solutions containing $[CuCl_4]^{2-}$ ions are yellow.

_____

_____

_____

_____

_____

(2)

(b) When a d electron moves from the ground state to the excited state in a copper complex, the energy change is 3.98×10^{-19} J

The Planck constant, $h = 6.63 \times 10^{-34}$ J s

Calculate the frequency, in s^{-1}, of the light absorbed.

Frequency _____ s^{-1}

(2)

(c) State **three** ways in which a transition metal complex can be changed to alter its colour.

1 _____

2 _____

3 _____

(3)

Consider the following reaction scheme in which **P**, **Q** and **R** are different complex ions of copper.

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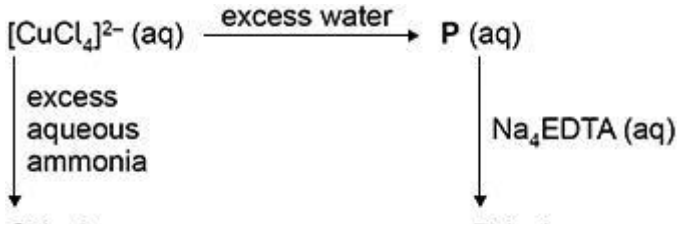

(d) Name the shape of the $[CuCl_4]^{2-}$ ion.

_____

(1)

(e) Give an ionic equation for the conversion of $[CuCl_4]^{2-}$ to complex ion **P**.

_____

(1)

(f) State the colour of the solution containing the complex ion **Q**.

Give an ionic equation for the conversion of $[CuCl_4]^{2-}$ to **Q**.

Colour _____

Equation

_____

(2)

(g) Identify complex ion **R**.

_____

(1)

(Total 12 marks)

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Q2.

This question is about catalysis.

(a) Zeolites are used as heterogeneous catalysts in the catalytic cracking of alkanes.

Tetradecane ($C_{14}H_{30}$) can be cracked to form octane and a cycloalkane.

Give an equation for this reaction.

State the meaning of the term heterogeneous.

Equation

_____

Heterogeneous _____

_____

_____

(2)

(b) A student determines the concentration of ethanedioate ions in an acidified solution by titration with potassium manganate(VII) solution.

$$2\ MnO_4^- + 5\ C_2O_4^{2-} + 16\ H^+ \rightarrow 2\ Mn^{2+} + 10\ CO_2 + 8\ H_2O$$

The mixture is warmed before the addition of potassium manganate(VII) solution because the reaction is slow at first. When more potassium manganate(VII) solution is added, the mixture goes colourless quickly due to the presence of an autocatalyst.

Explain the meaning of the term autocatalyst.

Explain, using equations where appropriate, why the reaction is slow at first and then goes quickly.

_____

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(6)

(c) The reaction between peroxodisulfate ions and iodide ions in aqueous solution can be catalysed by Co^{2+} ions.

$$S_2O_8^{2-} + 2\ I^- \rightarrow 2\ SO_4^{2-} + I_2$$

The table below gives relevant standard electrode potentials.

Electrode half-equation	$E^{\ominus}$ **/ V**
$S_2O_8^{2-}(aq) + 2\ e^- \rightarrow 2\ SO_4^{2-}(aq)$	+2.01
$Co^{3+}(aq) + e^- \rightarrow Co^{2+}(aq)$	+1.82
$I_2(aq) + 2\ e^- \rightarrow 2\ I^-(aq)$	+0.54

Use the electrode potential data to suggest how Co^{2+} catalyses the reaction.

(3)

(Total 11 marks)

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