Transition metal complexes

OCR A Chemistry (H432) · Full A level

Show your working where needed.

Name _____ Date _____

1. Copper and zinc

Copper and zinc are both d-block elements. Write the electron configurations of Cu^{2+} and Zn^{2+}. Decide whether each element is a transition element and justify your choices.

2. Two iron ions

An iron atom has configuration [Ar] $3d^6$ $4s^2$. Give the configurations of Fe^{2+} and Fe^{3+}, and state which electrons are removed first.

3. Ethane-1,2-diamine

Ethane-1,2-diamine is $H_2NCH_2CH_2NH_2$. Explain how one molecule can attach to a metal ion at two positions. How many molecules would occupy six coordination positions?

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4. Three complexes

Give the coordination number and shape of $[Fe(H_2O)_6]^{3+}$, $[CoCl_4]^{2-}$ and $[PtCl_4]^{2-}$. Identify the two complexes with equal coordination numbers but different shapes.

5. A nickel complex

A nickel(II) ion is bonded to two chloride ligands and two neutral ethane-1,2-diamine ligands. Each ethane-1,2-diamine uses both nitrogen atoms. Write the complex formula using en for ethane-1,2-diamine. Give its coordination number.

6. Two platinum complexes

Draw the two square-planar arrangements of $[Pt(NH_3)_2Cl_2]$. Identify cisplatin and explain how it inhibits cell division.

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7. Represent an optical pair

Draw a three-dimensional representation of the octahedral complex of Ni^{2+} with three ethane-1,2-diamine ligands. Draw its mirror image and decide whether the two structures are superimposable.

8. An unknown ligand ratio

An octahedral M^{3+} complex has charge −1. Its only ligands are water and a bidentate dicarboxylate L^{2-}. Find the number of each ligand and give the complex formula using M and L.

9. Extra challenge · Test a proposed chromium structure

An octahedral chromium complex has one neutral bidentate en and four chlorides. The overall charge is −1. Give its formula and the chromium oxidation state.

Draw the donor positions. A student puts the en nitrogen atoms opposite each other and claims to have drawn a second geometric isomer. Explain the flaw.

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