

CHEM1102 Worksheet 12 – Answers to Critical Thinking Questions

The worksheets are available in the tutorials and form an integral part of the learning outcomes and experience for this unit.

Model 1: The oxidation number and electronic configuration of transition metal cations in coordination compounds

1 – 2. See table below.

Model 2: To minimize repulsion, electrons occupy orbitals singly before they pair up

1 – 2. See table below.

Coordination Compound or Complex	Oxidation Number	<i>d</i> Configuration	Electron Arrangement	Paramagnetic?
Na[MnO ₄]	+7	<i>d</i> ⁰		No
(NH ₄) ₂ [CoCl ₄]	+2	<i>d</i> ⁷		Yes
[Cr(NH ₃) ₅ (H ₂ O)]Cl ₃	+3	<i>d</i> ³		Yes
[Zn(en) ₂ Cl ₂]	+2	<i>d</i> ¹⁰		No

Model 3: Iron in Biology (1): Transferrin

- Five unpaired electrons.
- Coordination number is 6 and coordination geometry is approximately octahedral. CO₃²⁻ is bidentate.
- CO₃²⁻ is a weak base and will become protonated at low pH. This will lead to it detaching from the iron.

Model 4: Iron in Biology (2): Ferredoxins

- Coordination number is 4 and coordination geometry is approximately tetrahedral.
- Fe(II): four unpaired. Fe(III): five unpaired electrons.
- Although there are 5 unpaired electrons on each Fe(III) atom, the electrons on one Fe(III) have *opposite* spins to those on the other Fe(III) atom. Overall, there are no *net* unpaired electrons.
- Fe(III) will have 5 unpaired electrons and Fe(II) will have 4 unpaired electrons. If these point in opposite directions, there will be 1 net unpaired electron.