CHEM1902/4 Worksheet 12 – Answers to Critical Thinking Questions

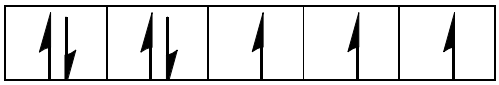
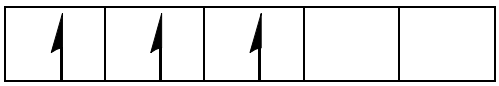
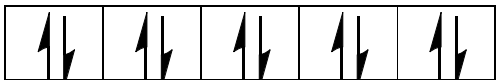
The worksheets are available in the tutorials and form an integral part of the learning outcomes and experience for this unit.

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	*d* Configuration	Electron Arrangement	Paramagnetic?
$Na[MnO_4]$	+7	d^0		No
$(NH_4)_2[CoCl_4]$	+2	d^7		Yes
$[Cr(NH_3)_5(H_2O)]Cl_3$	+3	d^3		Yes
$[Zn(en)_2Cl_2]$	+2	d^{10}		No

Model 3: Iron in Biology (1): Transferrin

1. Five unpaired electrons.
2. Coordination number is 6 and coordination geometry is approximately octahedral. CO_3^{2-} is bidentate.
3. CO_3^{2-} 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

1. Coordination number is 4 and coordination geometry is approximately tetrahedral.
2. Fe(II): four unpaired. Fe(III): five unpaired electrons.
3. 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.
4. 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.