

Solutions

Original marking guidance: M1 method, A1 accuracy, B1 explanation.

2.1 Cr: $3d^5 4s^1$; Cu: $3d^{10} 4s^1$.

2.2 Fe^{2+} $3d^6$; Cu^{2+} $3d^9$; 4s electrons are removed before 3d.

2.3 Stable Zn^{2+} is d^{10} , with no incomplete d subshell; stable Cu^{2+} is d^9 , incomplete.

3.1 Chromium: +3, coordination number 6. Cobalt: +3, coordination number 6. Neutral water/en do not alter charge; two Cl^- contribute -2 in the first complex.

3.2 Changing ligand changes d-orbital splitting, changing the wavelength absorbed. A full d subshell has no vacant d state for the required d–d promotion.

3.3 The same four donor atoms can occupy different arrangements. In cisplatin the two Cl ligands are adjacent, not opposite.