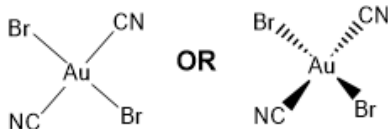


5(a)	<table><tr><th rowspan="2">species</th><th colspan="2">number of unpaired electrons</th></tr><tr><th>3d</th><th>4s</th></tr><tr><td>Cu</td><td>0</td><td>1</td></tr><tr><td>Cu²⁺</td><td>1</td><td>0</td></tr></table>	species	number of unpaired electrons		3d	4s	Cu	0	1	Cu ²⁺	1	0	
species	number of unpaired electrons												
	3d	4s											
Cu	0	1											
Cu ²⁺	1	0											
5(b)	• five 3d orbitals (lines, boxes) in the isolated Cu²⁺ ion of the same energy • splitting: three higher and two lower d orbitals • energy of all five d orbitals in complex higher than all d orbitals in isolated ion any two [1], all three [2]												
5(c)	M1: more than one (stable) oxidation state / exist in variable oxidation states M2: vacant / empty (d) orbitals are energetically accessible OR vacant / empty (d) orbitals can form dative bonds with ligands												
5(d)	<table><tr><th>metal ion</th><th>coordination number</th><th>formula of complex ion</th><th>charge of complex ion</th></tr><tr><td>Ag⁺</td><td>2</td><td><u>Ag(CN)₂</u></td><td>1-</td></tr><tr><td>Fe²⁺</td><td>6</td><td><u>Fe(CN)₆</u></td><td>4-</td></tr></table> each row [1]	metal ion	coordination number	formula of complex ion	charge of complex ion	Ag ⁺	2	<u>Ag(CN)₂</u>	1-	Fe ²⁺	6	<u>Fe(CN)₆</u>	4-
metal ion	coordination number	formula of complex ion	charge of complex ion										
Ag ⁺	2	<u>Ag(CN)₂</u>	1-										
Fe ²⁺	6	<u>Fe(CN)₆</u>	4-										
5(e)	M1:  M2: (shape) square planar AND (bond angle) 180°												
5(f)(i)	M1: moles MnO₄⁻ = 0.075 × 0.0225 = 1.6875 × 10⁻³ M2: moles V²⁺ = 5 / 3 × 1.6875 × 10⁻³ = 2.8125 × 10⁻³ M3: mass V = 50.9 × 2.8125 × 10⁻³ = 0.143 g % of V = 0.143 / 0.250 × 100 = 57.3 min 2sf												
5(f)(ii)	2VO₃⁻ + 3Zn + 12H⁺ → 2V²⁺ + 3Zn²⁺ + 6H₂O M1: 2 : 3 ratio on both sides M2: rest of the equation correct												