Question	Marking Guidance	Mark	Comments
8(a)	Electron <u>pair</u> donor	1	Allow lone <u>pair</u> donor
8(b)	$[Cu(H_2O)_6]^{2+} + 2NH_3 \rightarrow Cu(H_2O)_4(OH)_2 + 2NH_4^+$ (Blue solution) gives a (pale) <u>blue precipitate/solid</u>	1 1	 M2 only awarded if M1 shows Bronsted-Lowry reaction
8(c)	$[Cu(H_2O)_6]^{2+} + 4NH_3 \rightarrow [Cu(H_2O)_2(NH_3)_4]^{2+} + 4H_2O$ (Blue solution) gives a <u>dark/deep blue solution</u>	1 1	Allow formation in two equations via hydroxide If 8(b) and 8(c) are the wrong way around allow one mark only for each correct equation with a correct observation (max 2/4) M2 only awarded if M1 shows Lewis base reaction
8(d)	(Start with) green (solution) <u>Green precipitate</u> of $Fe(H_2O)_4(OH)_2$ / $Fe(OH)_2$ / iron(II) hydroxide Slowly changes to <u>brown solid</u> (Iron(II) hydroxide) oxidised by air (to iron(III) hydroxide)	1 1 1 1	 Do not allow observation if compound incorrect or not given Allow red-brown ppt Allow turns brown or if precipitate implied Can only score M3 if M2 scored Allow $Fe(OH)_2$ oxidised to $Fe(OH)_3$ by air / O_2 Ignore equations even if incorrect

8(e)(i)	$2[Al(H_2O)_6]^{3+} + 3H_2NCH_2CH_2NH_2 \rightarrow 2Al(H_2O)_3(OH)_3 + 3[H_3NCH_2CH_2NH_3]^{2+}$	1 1	For correct Al species For correct balanced equation Allow equation with formation of $3[H_2NCH_2CH_2NH_3]^{+}$ from 1 mol $[Al(H_2O)_6]^{3+}$
	White precipitate	1	

8(e)(ii)	$[Co(H_2O)_6]^{2+} + 3H_2NCH_2CH_2NH_2 \rightarrow [Co(H_2NCH_2CH_2NH_2)_3]^{2+} + 6H_2O$	1	
	Complex with 3 en showing 6 correct bonds from N to Co	1	Ignore charge Accept N – N for ligand Ignore incorrect H If C shown, must be 2 per ligand
	Co-ordinate bonds (arrows) shown from N to Co	1	Can only score M3 if M2 correct
	$4[Co(H_2NCH_2CH_2NH_2)_3]^{2+} + O_2 + 2H_2O \rightarrow$	1	For Co(III) species
	$4[Co(H_2NCH_2CH_2NH_2)_3]^{3+} + 4OH^-$	1	For balanced equation (others are possible) Allow $+ O_2 + 4H^+ \rightarrow 2H_2O$ If en used can score M4 and M5 only If Cu not Co, can only score M2 and M3 Allow $N_2C_2H_8$ in equations