Inorganic Revision Sheet
Metal Aqua Ion Reactions for OCR (A)

Fe^{2+}, Fe^{3+}, Cu^{2+}, Cr^{3+} and Mn^{2+}

Iron (II), Fe^{2+}

dropwise NaOH or NH_3 = green ppt
excess NaOH = no change
excess NH_3 = no change

$[Fe(H_2O)_6]^{2+}(aq)$ —NaOH(aq) dropwise→ $Fe(H_2O)_4(OH)_2(s)$ —NaOH(aq) excess→ No change
green solution — *green precipitate*

$[Fe(H_2O)_6]^{2+}(aq)$ —NH_3(aq) dropwise→ $Fe(H_2O)_4(OH)_2(s)$ —NH_3(aq) excess→ No change
green solution — *green precipitate*

Iron (III), Fe^{3+}

dropwise NaOH or NH_3 = brown ppt
excess NaOH = no change
excess NH_3 = no change

$[Fe(H_2O)_6]^{3+}(aq)$ —NaOH(aq) dropwise→ $Fe(H_2O)_3(OH)_3(s)$ —NaOH(aq) excess→ No change
yellow solution — *brown precipitate*

$[Fe(H_2O)_6]^{3+}(aq)$ —NH_3(aq) dropwise→ $Fe(H_2O)_3(OH)_3(s)$ —NH_3(aq) excess→ No change
yellow solution — *brown precipitate*

Copper (II), Cu^{2+}

dropwise NaOH or NH_3 = blue ppt
excess NaOH = no change
excess NH_3 = deep blue solution

$[Cu(H_2O)_6]^{2+}(aq)$ —NaOH(aq) dropwise→ $Cu(H_2O)_4(OH)_2(s)$ —NaOH(aq) excess→ No change
blue solution — *pale blue precipitate*

$[Cu(H_2O)_6]^{2+}(aq)$ —NH_3(aq) dropwise→ $Cu(H_2O)_4(OH)_2(s)$ —NH_3(aq) excess→ $[Cu(H_2O)_2(NH_3)_4]^{2+}(aq)$
blue solution — *pale blue precipitate* — *deep blue solution*

Chromium (III), Cr^{3+}

dropwise NaOH or NH_3 = green ppt
excess NaOH = green solution
excess NH_3 = purple solution

$[Cr(H_2O)_6]^{3+}(aq)$ —NaOH(aq) dropwise→ $Cr(H_2O)_3(OH)_3(s)$ —NaOH(aq) excess→ $[Cr(OH)_6]^{3-}(aq)$
pale purple solution — *green precipitate* — *green solution*

$[Cr(H_2O)_6]^{3+}(aq)$ —NH_3(aq) dropwise→ $Cr(H_2O)_3(OH)_3(s)$ —NH_3(aq) excess→ $[Cr(NH_3)_6]^{3+}(aq)$
pale purple solution — *green precipitate* — *purple solution*

Manganese (II), Mn^{2+}

dropwise NaOH or NH_3 = brown ppt
excess NaOH = no change
excess NH_3 = no change

$[Mn(H_2O)_6]^{2+}(aq)$ —NaOH(aq) dropwise→ $Mn(H_2O)_4(OH)_2(s)$ —NaOH(aq) excess→ no change
(pale) pink solution — *(pale) brown precipitate*

$[Mn(H_2O)_6]^{2+}(aq)$ —NH_3(aq) dropwise→ $Mn(H_2O)_4(OH)_2(s)$ —NH_3(aq) excess→ no change
(pale) pink solution — *(pale) brown precipitate*

Inorganic Revision Sheet
Metal Aqua Ion Reactions for OCR (A)

Changing Oxidation States

$Fe^{2+}(aq)$ *green solution*	→	$Fe^{3+}(aq)$ *yellow solution*	$Fe^{2+}(aq)$ can be oxidised to $Fe^{3+}(aq)$ by H^+/MnO_4^-
$Fe^{3+}(aq)$ *yellow solution*	→	$Fe^{2+}(aq)$	$Fe^{3+}(aq)$ can be reduced to $Fe^{2+}(aq)$ by I^-
$Cr^{3+}(aq)$ *green solution*	→	$CrO_4^{2-}(aq)$ *yellow solution*	$Cr^{3+}(aq)$ can be oxidised to $CrO_4^{2-}(aq)$ with H_2O_2 / OH^- *$CrO_4^-(aq)$ is easily converted to $C_2O_7^{2-}$ with addition of H^+*
$Cr_2O_7^{2-}(aq)$ *orange solution*	→	$Cr^{3+}(aq)$ *green solution*	$Cr_2O_7^{2-}(aq)$ can be reduced to $Cr^{3+}(aq)$ with Zn /H^+
$Cu^{2+}(aq)$ *blue solution*	→	$Cu^+(aq)$ *colourless solution*	$Cu^{2+}(aq)$ can be reduced to $Cu^+(aq)$ with I^- *$Cu^+(aq)$ disproportionates readily to $Cu^{2+}(aq)$ and $Cu(s)$*

Ligand Exchange

Copper (II), Cu^{2+}	$[Cu(H_2O)_6]^{2+}(aq) + 4Cl^-(aq)$ *blue solution*	→	$[Cu(Cl)_4]^{2-}(aq) + 6H_2O(l)$ *yellow solution*
	$[Cu(H_2O)_6]^{2+}(aq) + 4NH_3(aq)$ *blue solution*	→	$[Cu(NH_3)_4(H_2O)_2]^{2+}(aq) + 4H_2O(l)$ *deep blue solution*
Chromium (III), Cr^{3+}	$[Cr(H_2O)_6]^{3+}(aq) + 6NH_3(aq)$ *pale purple solution*	→	$[Cr(NH_3)_6]^{3+}(aq) + 6H_2O(l)$ *purple solution*