COMBINING HALF EQUATIONS

The two half equations are added together so that the electrons cancel out.

e.g. combine $MnO_4^- + 8\,H^+ + 5\,e^- \rightarrow Mn^{2+} + 4\,H_2O$ and $2\,Cl^- \rightarrow Cl_2 + 2\,e^-$

The first equation has 5 electrons and the second has 2 electrons. To balance these out, multiply the first by 2 (to give 10 electrons) and the second by 5 (to give 10 electrons)

x2 $2\,MnO_4^- + 16\,H^+ + 10\,e^- \rightarrow 2\,Mn^{2+} + 8\,H_2O$

x5 $10\,Cl^- \rightarrow 5\,Cl_2 + 10\,e^-$

combining $2\,MnO_4^- + 16\,H^+ + \cancel{10\,e^-} + 10\,Cl^- \rightarrow 2\,Mn^{2+} + 8\,H_2O + 5\,Cl_2 + \cancel{10\,e^-}$

final answer $2\,MnO_4^- + 16\,H^+ + 10\,Cl^- \rightarrow 2\,Mn^{2+} + 8\,H_2O + 5\,Cl_2$

Sometimes H^+ and/or H_2O may appear on both sides of the combined equation – these should be cancelled down. For example if there are 10 H_2O on the left and 2 H_2O on the right, this cancels down to 8 H_2O on the left.

Look at the following half equations. Use these to create the redox equations stated below.

$MnO_4^- + 8\,H^+ + 5\,e^- \rightarrow Mn^{2+} + 4\,H_2O$

$FeO_4^{2-} + 8\,H^+ + 3\,e^- \rightarrow Fe^{3+} + 4\,H_2O$

$H_2O_2 \rightarrow 2\,H^+ + O_2 + 2\,e^-$

$Ce^{3+} \rightarrow Ce^{4+} + e^-$

$C_2O_4^{2-} \rightarrow 2\,CO_2 + 2\,e^-$

1) oxidation of Ce^{3+} by H^+/MnO_4^- ……

……

……

2) oxidation of H_2O_2 by H^+/MnO_4^- ……

……

……

3) oxidation of $C_2O_4^{2-}$ by H^+/MnO_4^- ……

……

……

4) oxidation of Ce^{3+} by H^+/FeO_4^{2-} ……

……

……

5) oxidation of H_2O_2 by H^+/FeO_4^{2-} ……

……

……

6) oxidation of $C_2O_4^{2-}$ by H^+/FeO_4^{2-}

……

……