SL & HL Questions on Oxidation & reduction (1)

1. Give the oxidation state of sulfur in the reactants and products in the following reactions and in each case state whether it has been oxidized or reduced:

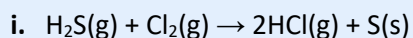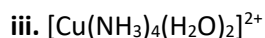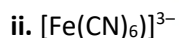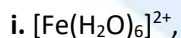 **i.** $H_2S(g) + Cl_2(g) \rightarrow 2HCl(g) + S(s)$

  ii. $Zn(s) + H_2SO_4(aq) \rightarrow Zn^{2+}(aq) + SO_4^{2-}(aq) + H_2(g)$

  iii. $2S_2O_3^{2-}(aq) + I_2(aq) \rightarrow S_4O_6^{2-}(aq) + 2I^-(aq)$

  iv. $3SO_3^{2-}(aq) + Cr_2O_7^{2-}(aq) + 8H^+(aq) \rightarrow 3SO_4^{2-}(aq) + 2Cr^{3+}(aq) + 4H_2O(l)$
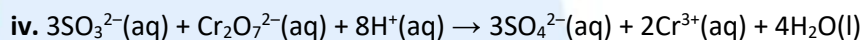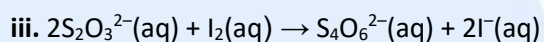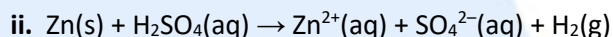
2. Give the oxidation state of the transition metal in the following compounds:

  i. $[Fe(H_2O)_6]^{2+}$,

  ii. $[Fe(CN)_6)]^{3-}$

  iii. $[Cu(NH_3)_4(H_2O)_2]^{2+}$

  iv. $[CuCl_4]^{2-}$

3. Explain the difference between the use of (III), 3+ and +3 when applied to Fe.

4. State the name of the following compounds using the correct oxidation number:

  i. Cu_2SO_4

  ii. $FeCl_2$

  iii. Na_2CO_3

  iv. Fe_2O_3

  v. MnO_2
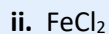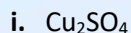
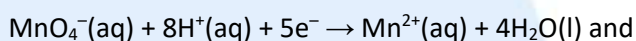**5.** When magnesium metal is placed in an aqueous solution of iron(II) ions, Fe^{2+}(aq), the magnesium dissolves and iron metal is precipitated. State the two half-equations and the overall redox equation for the reaction taking place.

6. Bubbling sulfur dioxide gas, SO_2(g) through an acidic solution of potassium manganate(VII), $KMnO_4$(aq), causes the colour of the solution to change from intense purple to colourless as the manganate(VII) ion, MnO_4^- is reduced to manganese(II) ions, Mn^{2+}(aq). The two half-equations for the reactions taking place are:

MnO_4^-(aq) + $8H^+$(aq) + $5e^-$ → Mn^{2+}(aq) + $4H_2O$(l) and

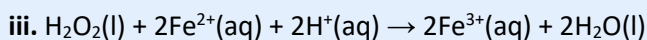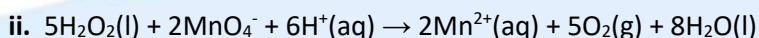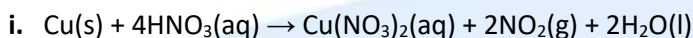SO_3^{2-}(aq) + H_2O(l) → SO_4^{2-}(aq) + $2H^+$(aq) + $2e^-$

i. Identify the oxidizing agent present.

ii. Deduce the overall equation for the redox reaction.

7. Identify the oxidizing agent in each case and state the equation for the reaction that occurs when:

i. chlorine gas is bubbled through an aqueous solution of potassium bromide.

ii. bromine water is added to an aqueous solution of potassium iodide.

8. Identify the oxidizing agent and the reducing reagent in the following reactions:

i. Cu(s) + $4HNO_3$(aq) → $Cu(NO_3)_2$(aq) + $2NO_2$(g) + $2H_2O$(l)

ii. $5H_2O_2$(l) + $2MnO_4^-$ + $6H^+$(aq) → $2Mn^{2+}$(aq) + $5O_2$(g) + $8H_2O$(l)

iii. H_2O_2(l) + $2Fe^{2+}$(aq) + $2H^+$(aq) → $2Fe^{3+}$(aq) + $2H_2O$(l)

9. Ethanol, CH_3CH_2OH, can be oxidized to ethanal, CH_3CHO, using an acidified solution of dichromate(VI) ions, $Cr_2O_7^{2-}$(aq). During the process the orange solution turns green due to the formation of chromium(III) ions, Cr^{3+}(aq). Deduce the two half-equations and the overall equation for the redox reaction that occurs.