SL & HL Questions on Oxidation & reduction (2)

1. Consider the following four reactions:

$Mg(s) + Fe^{2+}(aq) \rightarrow Mg^{2+}(aq) + Fe(s)$
$Fe(s) + Ni^{2+}(aq) \rightarrow Fe^{2+}(aq) + Ni(s)$
$Zn(s) + Fe^{2+}(aq) \rightarrow Zn^{2+}(aq) + Fe(s)$
$Mg(s) + Zn^{2+}(aq) \rightarrow Mg^{2+}(aq) + Zn(s)$

i. Place the metals in order of their decreasing reactivity (most reactive first).

ii. Identify the strongest oxidizing agent among the species above.

iii. Identify the strongest reducing agent among the species above.

2. A 'tin' can is actually a steel can coated with tin. When the can is dented and exposed to air and water it rusts much quicker than if the steel had been coated with zinc. Explain this fact and suggest why cans for storing food are coated with tin rather than zinc to protect them from rusting.

3. Consider the following three reactions:

$Cl_2(aq) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$
$Cl_2(aq) + 2I^-(aq) \rightarrow 2Cl^-(aq) + I_2(aq)$
$Br_2(aq) + 2I^-aq) \rightarrow 2Br^-(aq) + I_2(aq)$

i. Identify the species that is the strongest oxidizing agent.

ii. Identify the species that is the strongest reducing agent.

iii. Explain how bromine is behaving in first and third reactions.

iv. Describe what will be observed when a yellow-brown aqueous solution of iodine is added to an aqueous solution of sodium chloride.

4. An excess of manganese(II) sulfate in alkaline solution was added to 250 cm^3 of a sample of water taken from a local lake. The oxygen in the water reacts with manganese(II) sulfate according to the equation:

$2Mn^{2+}(aq) + 4OH^{-}aq) + O_2(g) \rightarrow 2MnO_2(s) + 2H_2O(l)$

The solution was then acidified and excess potassium iodide was then added which released iodine according to the equation:

$MnO_2(s) + 2I^{-}(aq) + 4H^{+} \rightarrow Mn^{2+}(aq) + I_2(aq) + 2H_2O(l)$

The iodine formed was then titrated with 1.00×10^{-2} mol dm^{-3} sodium thiosulfate solution using starch as an indicator:

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

The volume of thiosulfate solution required to react completely with the iodine was 20.0 cm^3.

i. Calculate the solubility of the oxygen in the lake water in mol dm^{-3}.

ii. Calculate the solubility of the oxygen in the lake water in mg dm^{-3}, which is the same as ppm.