# SL & HL Answers to Oxidation & reduction (2) questions

**1. i.** Mg > Zn > Fe > Ni (Magnesium can displace zinc(II) ions and iron(II) ions from solution, zinc can displace iron(II) ions and iron can displace nickel(II) ions from solution.)

**ii.** The strongest oxidizing agent is nickel(II) ions, $Ni^{2+}(aq)$, as it is the species that gains electrons the most readily.

**iii.** The strongest reducing agent is magnesium metal, Mg(s), as it is the species that loses electrons the most readily.

**2.** Iron (steel) is more reactive than tin so once the can is dented it will be exposed to the atmosphere and it will react with tin metal to form iron(II) ions. Zinc is more reactive than iron so it protects the iron from rusting as if any iron(II) ions are formed they are converted back to iron metal by the zinc which forms zinc(II) ions in the process.
Cans containing food are coated with tin to protect the iron from exposure to air and water. Although the iron would be better protected by coating with zinc, zinc cannot be used as it is poisonous.

**3. i.** The strongest oxidizing agent is chlorine, $Cl_2(aq)$, as it gains electrons the most readily.

**ii.** The strongest reducing agent is iodide ions, $I^-(aq)$ as they lose electrons the most readily.

**iii** In the first reaction the oxidation state of bromine goes from -1 to 0 so it is being oxidized (loses an electron) and is acting as a reducing agent.
In the third reaction the oxidation state of bromine goes from 0 to -1 so it is being reduced (gains an electron) and it is acting as an oxidizing agent.

**iv.** The yellow-brown colour would be slightly less intense as the solution of iodine is being diluted. However as no reaction occurs the solution will remain yellow-brown and no precipitate will be formed.

**4. i.** Amount of $S_2O_3^{2-}$ in 20.0 $cm^3$ = (20.0/1000) x 1.00 x $10^{-2}$ = 2.00 x $10^{-4}$ mol
Since 2 mol of $S_2O_3^{2-}$ react with one mole of $I_2$
Amount of $I_2$ formed = ½ x 2.00 x $10^{-4}$ = 1.00 x $10^{-4}$ mol
Since one mole of $I_2$ is formed from one mole of $MnO_2$
Amount of $MnO_2$ produced = 1.00 x $10^{-4}$ mol
Since 2mol of $MnO_2$ are formed from one mole of $O_2$
Amount of $O_2$ present in 250 $cm^3$ of the lake water = ½ x 1.00 x $10^{-4}$ = 5.00 x $10^{-5}$ mol
Concentration of dissolved oxygen = (1000/250) x 5.00 x $10^{-5}$ = 2.00 x $10^{-4}$ mol $dm^{-3}$

**ii.** $M_r(O_2)$ = 32.0
Conc. of $O_2$ = (32.0 x 2.00 x $10^{-4}$) x $10^3$ mg $dm^{-3}$ = 6.40 mg $dm^{-3}$ = 6.40 ppm