## Exercise 8.21 – Half-equations

**Q821-01** The conversion of iron (II) chloride to iron (III) chloride using chlorine gas, can be used to illustrate the definitions of the terms oxidation and reduction. Write an equation for this reaction and deduce what is oxidised and reduced by reference to both electron transfer and oxidation numbers.

**Q821-02** Given the reaction:

$$\_\_Mg + \_\_Cr^{3+} \longrightarrow \_\_Mg^{2+} + \_\_Cr$$

When the equation is correctly balanced using smallest whole numbers, the sum of the coefficients will be
- A. 10
- B. 7
- C. 5
- D. 4

**Q821-03** For the following reaction:

$$2Cu^+ \longrightarrow Cu + Cu^{2+}(aq)$$

a) State the oxidation number of each species.
b) Write a balanced half equation for the oxidation process.
c) Write a balanced half equation for the reduction process.

**Q821-04** One reaction occurring in the manufacture of bromine from sea water is:

$$Cl_2(g) + 2Br^-(aq) \longrightarrow 2Cl^-(aq) + Br_2(g)$$

Explain by reference to electrons, why the reaction is referred to as a redox reaction.

**Q821-05** Sodium thiosulphate is a reducing agent that can be used to determine iodine. The half equations for the reaction are:

$$2S_2O_3^{2-} \longrightarrow S_4O_6^{2-} + 2e$$
$$I_2 + 2e \longrightarrow 2I^-$$
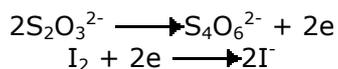
Construct the equation for the reaction of thiosulphate ions and iodine.

**Q821-06** Hydrogen peroxide acts as an oxidising agent, becoming hydroxide ions in the process, according to the following equation:

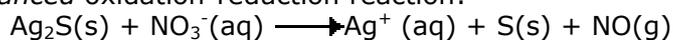$$H_2O_2 + 2e \longrightarrow 2OH^-$$
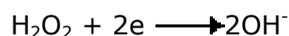
Show how hydrogen peroxide can be used to oxidise iodide ions using the equation in question 5.

**Q821-07** Hydrogen peroxide can oxidise iron (II) ions to iron (III) ions. Show the two half equations for the reduction of the hydrogen peroxide and the oxidation of the iron (II) ions and hence construct the equation for the reaction:

Q821-08 For the *unbalanced* oxidation-reduction reaction:
$$Ag_2S(s) + NO_3^-(aq) \longrightarrow Ag^+(aq) + S(s) + NO(g)$$
which takes place in an acidic solution, what is the balanced half-reaction for the process that involves reduction?

A. $Ag_2S(s) \longrightarrow 2Ag^+(aq) + S(s) + NO(g)$
B. $S^{2-}(aq) \longrightarrow S(s) + 2e$
C. $NO_3^-(aq) + 4H^+(aq) + 3e \longrightarrow NO(g) + 2H_2O(l)$
D. $NO_3^-(aq) + 2H^+(aq) + 2e \longrightarrow NO(g) + 2OH^-(aq)$

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Q821-09 One reaction occurring in the manufacture of bromine from sea water is:

$$Br_2(g) + SO_2(g) + 2H_2O(l) \longrightarrow 2HBr(g) + H_2SO_4(l)$$
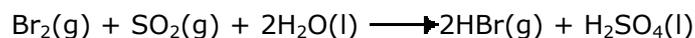
Use this reaction to construct the half equation for the process undergone by the bromine. Explain whether this change is oxidation or reduction?

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Q821-10 Tin (II) ions can be oxidised by acidified potassium permanganate (VII) solution according to the following *unbalanced* equation:

$$Sn^{2+} + MnO_4^- + H^+ \longrightarrow Sn^{4+} + Mn^{2+} + H_2O$$
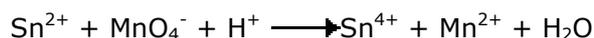
Identify the oxidising and reducing agents in the reaction, and balance the equation.

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