Chemguide - answers

REDOX EQUATIONS under alkaline conditions

1. a) Don't forget to balance the iodines.

b)
$$MnO_4^- \longrightarrow MnO_2$$

 $MnO_4^- \longrightarrow MnO_2 + 2H_2O$
 $MnO_4^- + 4H^+ \longrightarrow MnO_2 + 2H_2O$
 $MnO_4^- + 4H^+ + 3e^- \longrightarrow MnO_2 + 2H_2O$
c) $MnO_4^- + 4H^+ + 4OH^- + 3e^- \longrightarrow MnO_2 + 2H_2O + 4OH^-$
 $MnO_4^- + 4H_2O + 3e^- \longrightarrow MnO_2 + 2H_2O + 4OH^-$
 $MnO_4^- + 2H_2O + 3e^- \longrightarrow MnO_2 + 4OH^-$
d) $2 \times (MnO_4^- + 2H_2O + 3e^- \longrightarrow MnO_2 + 4OH^-)$
 $3 \times (2l^- \longrightarrow l_2 + 2e^-)$
 $2MnO_4^- + 4H_2O + 6l^- \longrightarrow 2MnO_2 + 8OH^- + 3l_2$

2. You need to work out electron-half-equations for the two parts of the reaction, starting from the facts you know:

$$Ag(NH_3)_2^+$$
 \longrightarrow $Ag + NH_3$
RCHO \longrightarrow RCOO-

The first equation is simple to sort out.

$$Ag(NH_3)_2^+ + e^- \longrightarrow Ag + 2NH_3$$

Your thinking for the second equation goes through these stages:

Starting from what you know:

Add water to get the other oxygen you need:

Add hydrogen ions to balance the hydrogens:

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Add electrons to balance the charges:

And now convert it to alkaline conditions by adding enough hydroxide ions to both sides to neutralise the hydrogen ions.

RCHO +
$$H_2O$$
 + $3OH^ \longrightarrow$ RCOO⁻ + $3H^+$ + $3OH^-$ + $2e^-$ RCHO + $3OH^ \longrightarrow$ RCOO⁻ + $2H_2O$ + $2e^-$

Now you have got this final version of the half-reaction, you can combine it with the silver half-reaction.

If you got this right first time, well done! This is about as hard is it will get at this level.