This is ACA # 29. It is OK to use your textbook, but if you can answers the questions without it that is OK too.

I recommend you print out this page and bring it to class. Click here to show a set of five ACA29 student responses, randomly selected from all of the student responses thus far, in a new window.

John , here are your responses to the ACA and the Expert's response.

1. Determine the species oxidized and the species reduced in each of the following reactions.

a) $3Cu + 8H^+ + 2NO_3^- \text{----> } 2NO + 4H_2O + 3Cu^{2+}$

$Cu + 2e^- \rightarrow Cu^{2+}$
$NO_3^- \rightarrow 2NO + 2e^-$
$8H^+ \rightarrow 4H_2O$

formula of the species oxidized Cu 31%

Copper metal, Cu, is oxidized to Cu^{2+} . Since the oxidation number for copper increases from 0 in Cu to +2 in Cu^{2+} copper is oxidized.

formula of the species reduced NO3^- 19% NO_3 25%

Nitrate ion, NO_3^-, is reduced to NO. Since the oxidation number for nitrogen in NO_3^- decreases from +5 to +2 in NO NO_3^- is reduced. Also notice the number of oxygen atoms around the nitrogen in NO_3^- is reduced from three to one in NO.

b) $H_2O(l) + 5VO^{2+}(aq) + MnO_4^-(aq) \text{----> } 5VO_2^+(aq) + Mn^{2+}(aq) + 2H^+(aq)$

formula of the species oxidized VO^2+ 31% 31% VO 19% MnO_4^- 6% Mn

Vanadium (II) oxide, VO^{2+}, is oxidized to vanadium(III) oxide VO_2^+. Since the oxidation number for vanadium increases from +2 in VO^{2+} to +3 in VO_2^+ then VO^{2+} is oxidized. Also notice the number of oxygen atoms on VO^{2+} increases from 1 to 2 in VO_2^+.

formula of the species reduced MnO4^- 25% Mn 19% Mn^{2+} 13% VO^{2+} 13%

Permanganate ion, MnO_4^-, is reduced to Mn^{2+}. Since the oxidation number for manganese in MnO_4^- decreases from +7 to +2 in Mn^{2+}, MnO_4^- is reduced. Also notice the number of oxygen atoms around the manganese in MnO_4^- is reduced from four to zero in Mn^{2+}.

c) $I^- + H_2O + 2MnO_4^- \longrightarrow 2MnO_2 + IO_3^- + 2OH^-$

I 13% IO_3^- 13%
MnO_2 19%

formula of the species oxidized I^- 25%

Iodide ion, I^-, is oxidized to iodate ion IO_3^-. Since the oxidation number for iodine increases from -1 in I^- to +5 in IO_3^- then I^- is oxidized. Also notice the number of oxygen atoms on I^- from 0 to 3 in IO_3^-.

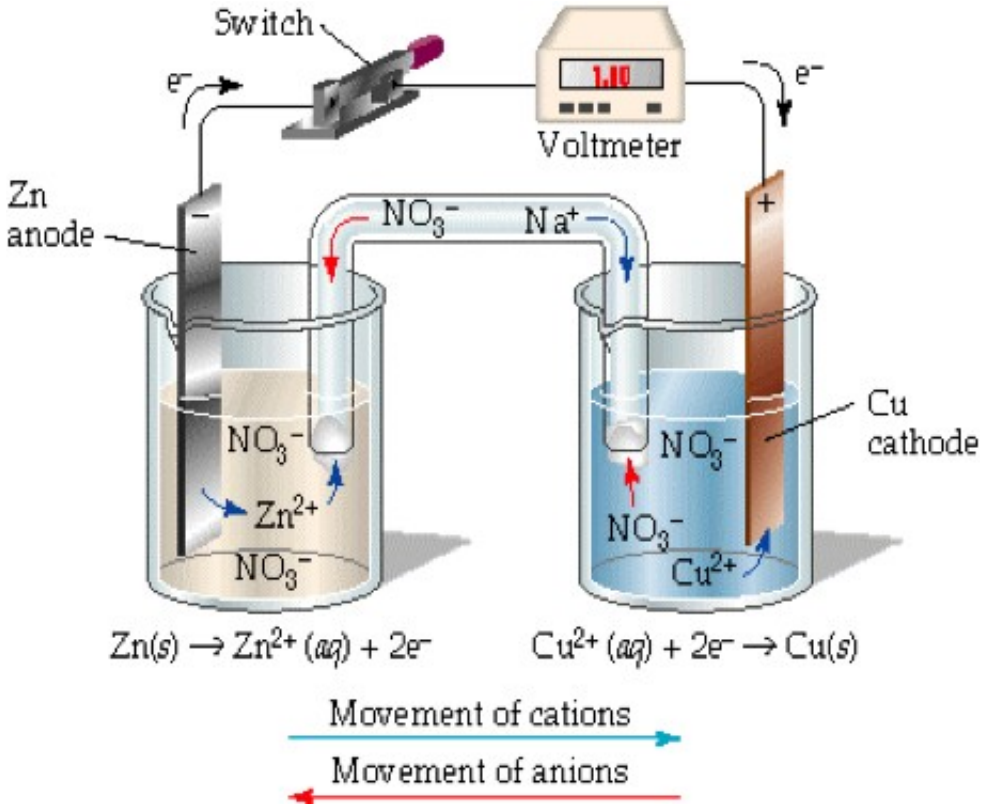
H_2O 18% I^- 25%
MnO 13% MnO_2 6%

formula of the species reduced MnO4^- 19%

Permanganate ion, MnO_4^-, is reduced to MnO_2. Since the oxidation number for manganese in MnO_4^- decreases from +7 to +4 in MnO_2, MnO_4^- is reduced. Also notice the number of oxygen atoms around the manganese in MnO_4^- is reduced from four to two in MnO_2.

2) The Figure below shows an electrochemical cell for the reaction between Zn(s) and Cu^{2+}. The beaker on the left is called the anode compartment. The anode compartment consists of the anode, the metal strip suspended in the aqueous solution of zinc(ii) nitrate. The beaker on the right is called the cathode compartment. The cathode compartment consists of the cathode, the metal strip suspended in the aqueous solution of copper (II) nitrate. The salt bridege is the inverted U-tube that connects the anode compartment and cathode compartment. Using the information in the Figure answer the following questions.

$Cu^{2+} + Zn \rightarrow Zn^{2+} + Cu$



a) The oxidation half-reaction for this electrochemical cell is Zn --> Zn^2+ +2e^-

Zn(s) ---> Zn^{2+}(aq) + $2e^-$ 62.5%

18% $Cu^{2+} + 2e^- \rightarrow Cu$
6% Zn
6% NO_3

b) The reduction half-reaction for this electrochemical cell is Cu^2+ + 2e^- --> Cu

$2e^-$ + Cu^{2+}(aq) ----> Cu(s) 62.5%

c) The metal strip, in the anode compartment is a piece of Zn 75%

The metal strip (also called an electrode) in the anode compartment is called the anode and is Zn metal.

d) The cation in the anode compartment is Zn^2+ 62% 25% Zn

The cation in the anode compartment is Zn^{2+}(aq).

e) The anion in the anode compartment is NO3^- 98% NO_3 6% Zn^{2+} 6%

The anion in the anode compartment is NO_3^-(aq).

f) The metal strip, in the cathode compartment is a piece of Cu 75%

The metal strip (also called an electrode) in the cathode compartment is called the cathode and is Cu metal.

g) The cation in the cathode compartment is Cu^2+ 68% 25° Copper/Cu

The cation in the cathode compartment is $Cu^{2+}(aq)$.

h) The anion in the cathode compartment is NO3^- 81% 19% NO_3

The anion in the cathode compartment is $NO_3^-(aq)$.

i) The cation in the salt bridge is Na^+ 81% 19% sodium/Na

The cation in the salt bridge is $Na^+(aq)$.

j) The anion in the salt bridge is NO3^- 94% 6% NO_3

The anion in the cathode compartment is $NO_3^-(aq)$.

k) In the external circuit which direction are the electrons flowing? from anode to cathode 68% 6% left 6% right 6% to anode comp

The electrons are flowing from the anode (the negative electrode) to the cathode (the positive electrode).

l) The cations in the salt bridge are flowing towards the cathode 38%

The cations in the salt bridge are flowing towards the cathode compartment where the number of cations is reduced when Cu^{2+} is reduced to Cu.

m) The anions in the salt bridge are flowing towards the anode 19% left 12%

The anions in the salt bridge are flowing towards the anode compartment where the number of anions must increase as the Zn is oxidized to Zn^{2+}.

3. Is there anything about the questions that you feel you do not understand? List your concerns/questions.

nothing

4. If there is one question you would like to have answered in lecture, what would that question be?

nothing

the whole ACA confused me!