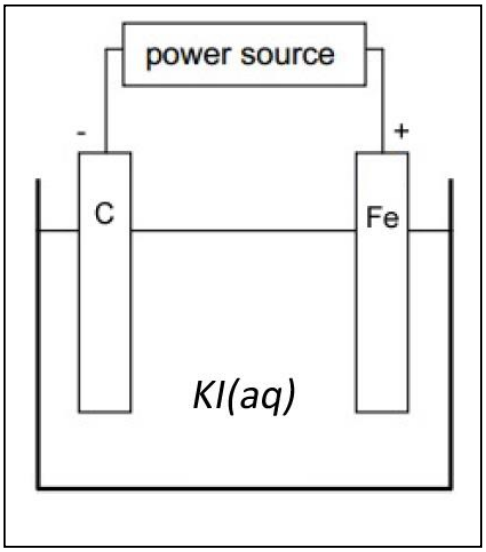
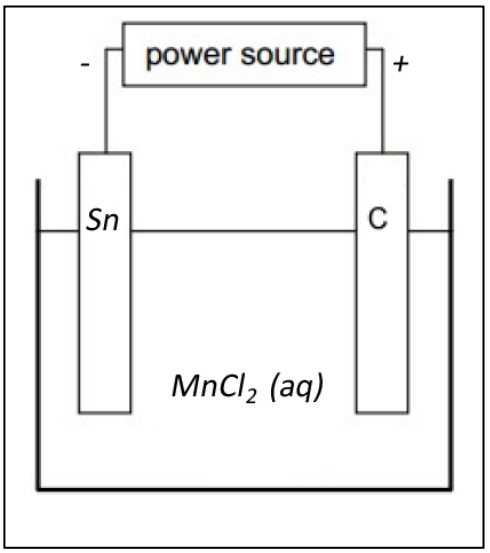
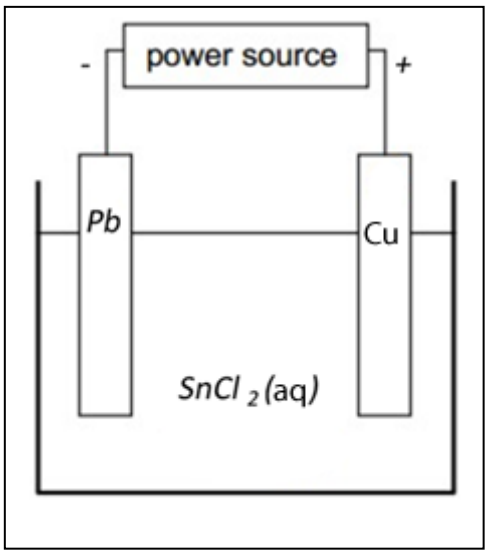
Revision 5

- Equilibrium and electrolytic cells.

1) Consider the diagram shown on the right of a set of electrolytic cells at SLC. For each cell:
    - Clearly label the cathode and anode
    - Give the products formed at each electrode immediately after the cell is turned on.
    - Write a balanced equation for the half reaction occurring at each electrode.







2) A gas cylinder of volume 20.0 L is filled with NH_3 gas at an initial temperature of 30.0 °C and pressure of 2.21 atm . Ammonia reacted according to the equation below until equilibrium was established.

$2NH_3\ (g) \rightleftarrows 3H_2(g) + N_2(g)\ \Delta H = +92$ kJ/mol

a) Calculate the mol of ammonia gas initially present in the cylinder.

b) After equilibrium was established the gas mixture was analysed and found to contain 0.400 mol of N_2 gas. Calculate the:

- The amount of mol of the following substances at equilibrium.
  NH_3

  H_2
- value of the K_c for the system at equilibrium
- Calculate the total number of mol of gas particles in the cylinder.
- calculate the total pressure exerted by the gas mixture at equilibrium

3) Carbonic acid dissolves in water to produce hydrogen ions and bicarbonate ions which play a vital role in buffering the blood from swings in pH. The reaction is shown below. At a given temperature the K_c for the reaction is 2.3×10^{-2} M.

$H_2CO_3\ (aq) \rightleftarrows H^+\ (aq) + HCO_3^-\ (aq)$

Calculate the pH of the solution, at this temperature, if the $[H_2CO_3]$ is 2.24×10^{-4} M

4) In an experiment, 2.0 mol of pure phosgene, $COCl_2$, is placed in a 2.0 L flask where the following reaction takes place.

$COCl_2(g) \rightleftarrows CO(g) + Cl_2(g)\ K_c = 2.10 \times 10^{-8}$ M

It can be assumed that, at equilibrium, the amount of unreacted $COCl_2$ is approximately equal to 2.0 mol.

a) Explain why this assumption is justified.

b) Calculate the amount, in mol, of Cl_2 (g) present at equilibrium. Give the answer to the right number of significant figures.

c) Jack was explaining to a fellow student how to go about solving b) above. " Assume we have negligible $COCl_2$ reacting and also assume that equal amounts of CO and Cl_2 are produced." Is this strictly correct? Explain