**Work through the ChemCAL module "*Electrochemistry*"**

1. Complete the table below by giving the name of each system and indicating whether stereoisomers of each complex are possible.

	species	name	stereoisomerism of complex
(a)	$[Co(NH_3)_5Cl]Cl_2$		
(a)	$[Fe(H_2O)_4Br_2]$		
(a)	$K[Ag(CN)_2]$		

2. How long must a current of 2.0 A be applied to a solution containing Au^{3+} to deposit 1.0 g of gold?

3. An electrochemical cell is composed of these two half cells (at 298 K):

$$Fe^{3+} + e^- \rightarrow Fe^{2+} \qquad E° = 0.77 \text{ V}$$
$$Sn^{2+} + 2e^- \rightarrow Sn \qquad E° = -0.13 \text{ V}$$
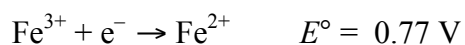
    (a) What reactions occur at the anode and at the cathode of the cell?
    (b) What is the overall cell reaction?
    (c) What is the standard voltage of this cell?
    (d) What is the equilibrium constant for this reaction?
    (e) What is the value of $\Delta G°$ for this reaction?
    (f) What is the voltage of the cell once equilibrium is reached?
    (g) If the concentration of the iron ions is maintained at 1 M but the concentration of Sn^{2+} is adjusted to 0.001 M, what is the voltage of the cell?

4. Nicotinamide adenine dinucleotide (NADH), a cofactor in many biochemical reactions, is a strong reducing agent in water solution:

$$NADH + H^+ \rightleftharpoons NAD^+ + 2H^+ + 2e^- \qquad E° = 0.527 \text{ V}$$

    Calculate the value of $E°'$ (reduction potential at the biological standard state of pH = 7.0) for this half cell at 298 K.

5. The pyruvate ion (Pv^-) is reduced to the lactate ion (PvH_2^-) at pH 7 in half cell below.

$$Pv^- + 2H^+ + 2e^- \rightleftharpoons PvH_2^- \qquad E°' = -0.185 \text{ V}$$
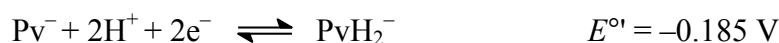
    Assume this half cell is combined with the NAD ion half cell of Q4 at pH 7.

    (a) What is the overall cell reaction?
    (b) What is the voltage of this cell at pH 7?

(c)   What is the equilibrium constant for this reaction at 298 K and pH 7?

(d)   What is the value of $\Delta G°$ for this reaction at 298 K?

(e)   Would the EMF of the cell increase, decrease or remain unchanged if:

(i)   the pH in the NAD ion half cell were reduced to 6.0?

(ii)   [NADH] were reduced to 0.1 M?

6.   Typical concentrations of Na^+ and K^+ in the intracellular and extracellular fluid are given below.

$[Na^+]$ 142 mM extracellular, 10 mM intracellular

$[K^+]$ 4 mM extracellular, 140 mM intracellular

Assuming that cell membrane has a much higher permeability to K^+ than all other ions, estimate the potential difference between the inside and the outside of the cell.