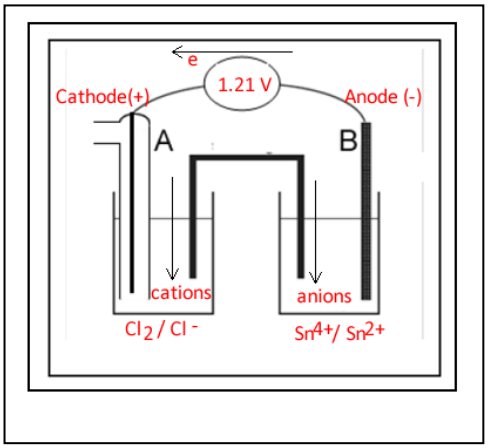
Redox reactions - revision Lesson 7a

1) A galvanic cell is formed using the following two half reactions at standard conditions.

$Sn^{4+}(aq) + 2e^- \rightleftharpoons Sn^{2+}(aq)$ $E^o = +0.15$

$Cl_2(g) + 2e^- \rightleftharpoons 2Cl^-(aq)$ $E^o = +1.36$



a) Using the template shown on the right label the:
i) contents of the half cell with electrode A
ii) contents of the half cell with electrode B
iii) the EMF of the cell
iv) the anode
v) the cathode
vi) the polarity of each electrode
vii) the direction of cation flow
viii) the direction of anion flow
ix) the direction of electron flow.

b) What are electrodes A and B made from? *Graphite or Pt*
What properties should these material have in order to be used as electrodes in this galvanic cell?
Must conduct electricity and be inert

c) Identify the chemical species that acts as the:
i) reductant - *Sn^{2+} ions*
ii) oxidant *Cl_2*

d) Identify the redox conjugate pairs in each half cell.
i) *Cl_2/Cl^-*

ii) *Sn^{4+} / Sn^{2+}*

d) Complete the sentences. A strong oxidant forms a *weak* conjugate reductant. A reductant will *give away* electrons to form its *conjugate* oxidant An oxidant will *accept* electrons to form its conjugate *reductant* In a half cell, the species donating electrons is the *reductant* which forms its *conjugate oxidant* . for example, Cu (donor) and Cu^{2+} (acceptor); Cu/Cu^{2+}.

e) The half cell on the right of the galvanic cell shown above is replaced with the hydrogen peroxide half cell shown below

$H_2O_2(aq) / H_2O(l)$ $E^o = +1.77$

i. Write a balanced half equation for the reaction occurring in the half cell on the right, occurring in an

a) acidic solution $H_2O_2(aq) + 2H^+(aq) + 2e \rightleftharpoons 2H_2O(l)$

b) alkaline solution $H_2O_2(aq) + 2e \rightleftharpoons 2OH^-(aq)$

iii. Explain how the pH of the solution in half cells A and B will change as the cell discharges if an

- acidified solution is used.

Half Cell A – $2Cl^-(aq) \rightarrow Cl_2(g) + 2e$ ---- *No change in pH*

Half cell B -- $H_2O_2(aq) + 2H^+(aq) + 2e \rightleftharpoons 2H_2O(l)$ *– pH will increase as* $[H^+]$ *decreases.*

- alkaline solution is used.

Half Cell A – $2Cl^-(aq) \rightarrow Cl_2(g) + 2e$ ---- *No change in pH*

Half cell B -- $H_2O_2(aq) + 2e \rightleftharpoons 2OH^-(aq)$ *– pH will increase as* $[OH^-]$ *increases.*

iv. On the diagram on the right, draw an appropriate electrode for half cell A and label the following:

i) the oxidant *Cl^- ions in half-cell A*

ii) the reductant *H_2O_2 in an acidified solution in half-cell B*

iii) the EMF of the cell

iv) the anode

v) the cathode

vi) the polarity of each electrode

vii) the direction of cation flow

viii) the direction of anion flow

ix) the direction of electron flow.