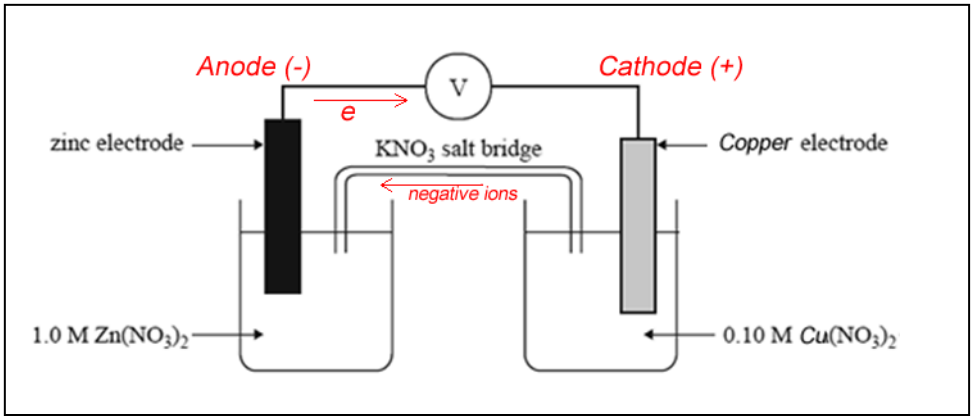
Friday Worksheet **Name: ……..**

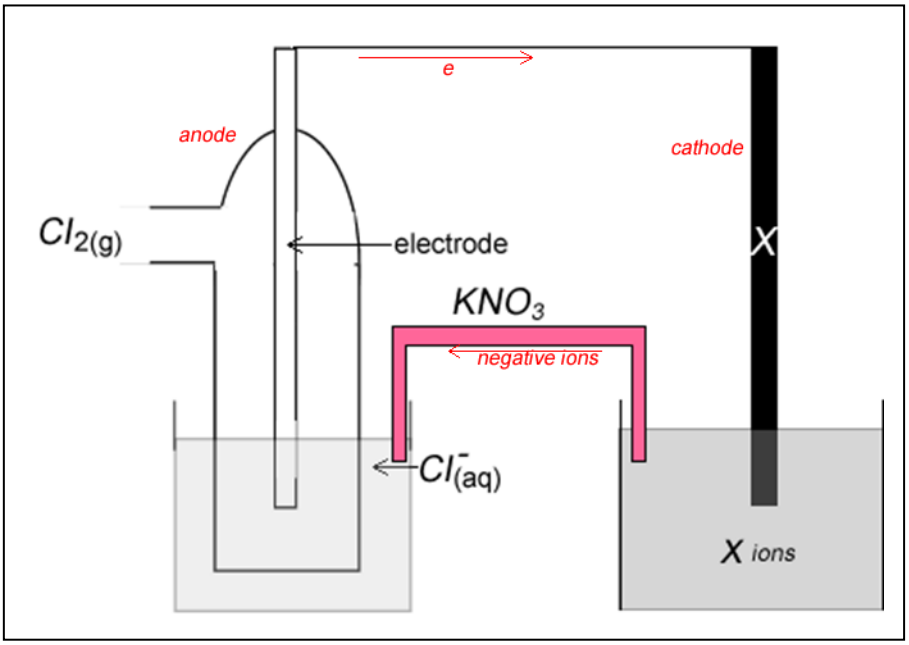
Galvanic cells worksheet 1



1) Above is a galvanic cell. Label the following.
   a) Direction of electron flow.
   b) The anode
   c) The cathode
   d) Direction of anion movement
   e) The polarity of the electrodes

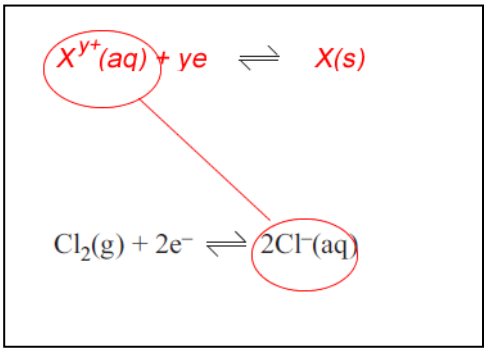
2) Indicate the maximum theoretical voltage that can be generated by the cell and describe the conditions under which this voltage is achievable.
   1.10 V
   Standard condition (25 ^{o}C and 1.00 M concentrations)
3) What happens to the concentration of zinc ions in the solution surrounding the zinc electrode?
   Increases according the equation below
   $Zn(s) \Rightarrow Zn^{2+}(aq) + 2e$
4) Write the equation for the reaction taking place at the anode and for the reaction taking place at the cathode.
   $Cu^{2+}(aq) + 2e \Rightarrow Cu(s)$
   Note- single arrows are used and not equilibrium arrows (<=>)
5) Write the overall equation
   $Zn(s) + Cu^{2+}(aq) \Rightarrow Cu(s) + Zn^{2+}(aq)$

6) The galvanic cell shown below was set up using a Cl_2 /Cl^- half cell and a half cell made from an unknown metal electrode and a solution containing the metal ions.



a) What is an appropriate material for the electrode in the Cl_2/Cl^- half cell?
Carbon or platinum. Any material that conducts electricity and does not take part in the reaction is acceptable.

b) As the cell discharged the mass of electrode X increased. Identify the strongest oxidant present and give a reason.



In order for a reaction to occur where X metal is formed, Cl^- must be a stronger reductant than X (s).

X ions must be above Cl_2 in the E_o table, as shown on the left.

c) On the diagram above label the following
   a. Direction of electron flow
   b. Direction of anion flow
   c. The anode
   d. The cathode.

d) After discharging 9409 C of electricity it was found that 0.0325 mol of metal X was deposited on the electrode made of metal X.
   a. Calculate the mol of electrons that flowed in order to deposit 0.0325 mol of X.
   9409 / 96500 = 0.0975

b. Give the

i. reduction half equation

$X^{3+}(aq) + 3e \Rightarrow X(s)$

We know the charge is 3+ because it takes 0.0975 mol of electrons to deposit 0.0325 mol of X. A ratio of 3 mol of electron to one mol of metal.

ii. oxidation half equation

$2Cl^{-}(aq) \Rightarrow Cl_2(g) + 2e$

c. Give the overall equation for the galvanic cell.

$2X^{3+}(aq) + 6Cl^{-}(aq) \Rightarrow 3Cl_2(g) + 2X(s)$