Experiment 32
Galvanic Cells, the Nernst Equation

Oxidation-Reduction reactions - involves the transfer of electrons.

Galvanic cell
- Spontaneous transfer of electrons
- half cell with electrodes connected with a salt bridge
- Anode is the electrode where oxidation occurs -negative electrode (black).
- Cathode is the electrode where reduction occurs -positive electrode (red).

Cell potential - tendency of two metals to oxidize or reduce.
- Cell potentials are measured using the voltmeter (potentiometer).
- Voltmeter measures, $E_{\text{cell}}$, the difference between the reduction potential of the two redox couples.

Waste
- Put all waste in the container labeled for your experiment.
- Return electrodes clean to the reagent tray. They can be reused.

Experiment
- Work in pairs.
- Check-out voltmeter, 50mL volumetric flask, 20 mL beakers and 6 well plates.
- Get an unknown for Part C. **There will be no unknown for Part A.**

Part A.
Objectives:
- Make galvanic cells of different combination using the four solutions in Figure 32.3.
- Determine the relative reduction potential
- Rank in the decreasing order the reduction potential of the redox couples.

Procedure:
#1
- Obtain 4-20 mL beakers and fill them to the 15 mL mark with the solutions.
- Electrode must be polished and tarnish free. Steel wool is available and rinse oxides off with water. Dry the electrodes with paper towel.
- Do not touch electrodes once hooked to the voltmeter.
- **Make Ferrous sulfate solution by dissolving .54g in 20 mL of water.**
#2
- Prepare a new salt bridge for each cell. It is important that the filter paper is completely wetted with the KNO$_3$
#3
- Voltmeter settings
  - **Direct** current Voltage
#6
- Skip this part. No unknown for Part A.
Part B
Objective:
- Determine the effect of concentration on cell potential.

Procedure
- Do this part in the hood. NH$_3$ and Na$_2$S are noxious chemicals and need to be used with ventilation.

Part C.
Objective:
- Determine the effect of concentration on cell potential

Procedure
- Review technique pages of your lab book for volumetric measurement.
- Polish electrode again, if necessary.
- You might have to set voltmeter to mV setting if available.
- The dilution concentrations are modified to give you better results.

#1
- Check-out 3-50 mL volumetric flask, 5 mL volumetric pipet and green pump.
- MODIFICATION:
  Half fill a small test tube with 1.0 M Cu(NO$_3$)$_2$. The first dilution (0.1 M) will be prepared by pipetting the 5.0 mL of 1.0 M Cu(NO$_3$) into a 50 mL volumetric flask. Mix the solutions well before going on to the next dilution.

Pipet 5.0 mL of 1.0 M Cu(NO$_3$)

5.0 mL  5.0 mL

50 mL volumetric flask

10$^{-1}$M  10$^{-2}$M  10$^{-3}$ M

- The dilutions can be shared by 4 groups. **Please note that the copper solutions prepared for the dilution is Cu(NO$_3$)$_2$ and not CuSO$_4$ as shown in the picture.**

#2. Use 1.0 M Zn(NO$_3$)$_2$ for your reference half cell.

#5 Get your unknown from the stockroom.