CHEM 213 Fall 2008

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**Electrochemistry: Chemical Cells**

Introduction

Electrochemistry is the detailed study of electron transfer reactions. Electron transfer involves the loss of

electrons (oxidation) from one substance and the accompanying gain of electrons (reduction) by another

substance. Oxidation/reduction processes form one of the major classes of chemical reactions. In redox

reactions, electrons are transferred from one species to another. For example, in the following simple reaction:

Zn (s) + Cu2+(aq) 🡪 Zn2+ (aq) + Cu (s)

electrons are transferred from elemental metallic zinc to aqueous copper(II) ions. This is most easily seen if the overall reaction is written instead as two *half-reactions*, one for the oxidation and one for the reduction:

Zn (s) 🡪 Zn2+ (aq) + 2e- oxidation

Cu2+ (aq) + 2e- 🡪 Cu (s) reduction

Some substances are more easily reduced and some more easily oxidized. An activity series lists elements

in order of their increasing (re)activity toward oxidation. (See section 4.4 in BLB for reference.) A metal high on the list is more easily oxidized than one lower on the list. Additionally, a more active metal can "replace" a less active metal ion from solution.

Electrochemical or voltaic cells utilize the potential for electron transfer to produce voltage. The

components of an electrochemical cell include electrodes (anode and cathode), half-reaction components (usually solutions), a salt bridge, and a wire to connect the electrodes. A voltmeter is often used to measure the voltage produced by the cell.

In this part of the experiment, each lab group will construct an electrochemical cell containing either

zinc/copper, zinc/magnesium, or magnesium/copper under standard conditions or, for the zinc/copper cell, under nonstandard concentrations. You will record each cell’s potential (in V) and then compare the measured potential with its theoretical potential.

**Safety and Waste**

Goggles must be worn at all times. Waste that contains solids should be rinsed into waster beaker and

NOT poured down any drain. Solutions used in this experiment for the electrochemical cells are quite dilute and may be disposed of down the drain.

**Materials**

1 M copper(II) sulfate 1 M zinc sulfate 1 M magnesium sulfate

0.1 M copper(II) sulfate 0.1 M zinc sulfate

copper, magnesium, and copper electrode strips

salt bridges, volt meters, and appropriate glassware for cells

*Notes*

1. Note any and all changes observed for the metal and solution.

2. Observe the electrodes in the electrochemical cells for any changes.

**Report**

Your notebook should include all sections described in the "Introduction to Lab" document. In addition, address the following:

• Write balanced chemical equations for all reactions which occurred for all electrochemical cells. (Results)

• Calculate standard cell potentials (E0) for all electrochemical cells observed. (Results)

• Record the observed cell potential (E0) for all electrochemical cells observed. (Results)

• Calculate the % error of cell potential for each cell. (Results)