

CHG 8191L
Electrochemical Engineering
Winter 2016

Professor: Dr. Elena Baranova

February 10, 2016

DATE DUE: February 24, 2016 before the lecture at 8:30 am

Assignment 2

Problem 1

The kinetics of an electrochemical reaction are described by the Butler-Volmer equation with the parameters $\alpha_a = \alpha_c = 0.5$ and $j_0 = 20 \text{ mA/cm}^2$

- a) Determine the error in using the Tafel approximation for overpotentials of 1 mV and 100 mV
- b) Repeat Part a) for the linear approximation

Problem 2

Overpotential measurements at 25 °C for copper dissolution in well-stirred electrolyte yielded the following results:

$j \text{ (mA/cm}^2\text{)}$	1.2	2.4	4.8	9.7	20	40	60	200	2000
$\eta \text{ (mV)}$	1.5	3.0	6.0	9.0	18	30	36	60	104

Determine j_0 and α_a

Problem 3

An SCE (saturated calomel electrode) is placed near an inert electrode where hydrogen is evolving from pH 5 electrolyte. At 25 °C the following potentials are measured with a voltmeter connected between the reference electrode and cathode:

$j \text{ (mA/cm}^2\text{)}$	10	1	0.3	0.1
$E_{\text{meas}} \text{ (V)}$	-0.91	-0.79	-0.71	-0.66

- a) Calculate the cathodic overpotential for each measurement
- b) Estimate j_0 and α_a from these measurements

Problem 4

The I-V curves for three different fuel cells are given below. Calculate (approximately) the activation overpotential and ohmic drop for each fuel cell.

