

CHM 152  
Exam III

Spring 2008  
Dr. Doug Sawyer

Name \_\_\_\_\_

<u>Question</u>	<u>Points</u>
1 - 9	45
10	16
11	14
12	10
13	15
total	100

The back pages contain a periodic chart, a table of standard reduction potentials, and some equations and constants. These pages may be detached.



8. Predict the electrolysis product at the cathode:  $\text{MgS}_{(\text{aq})} \rightarrow$  electrolysis

a)  $\text{Mg}_{(\text{s})}$

b)  $\text{H}_{2(\text{g})}$

c)  $\text{S}_{(\text{s})}$

d)  $\text{O}_{2(\text{g})}$

9. An unstable nucleus has a half-life of 32.0 minutes. Calculate the percent of original nuclei remaining after 3.0 hours.

a) 98.0 %

c) 3.2 %

b) 67 %

d) 2.0 %

10.(16) Consider the Galvanic cell with a cobalt electrode immersed in 1.0 M  $\text{Co}^{2+}_{(\text{aq})}$  and a lead electrode immersed in 1.0 M  $\text{Pb}^{2+}_{(\text{aq})}$ .

a) Write the reaction (overall) for this Galvanic cell.

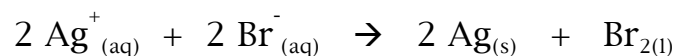
b) Calculate  $E^{\circ}_{\text{cell}}$  for the Galvanic cell.

c) Determine  $E_{\text{cell}}$  at 25 °C for the Galvanic cell when  $[\text{Pb}^{2+}] = 1.50 \text{ M}$  and  $[\text{Co}^{2+}] = .0023 \text{ M}$ .

d) If one mole of each reactant reacts under the conditions given in part (c), then how much work (in kJ) is theoretically performed? Is the work done to the reaction system, or by the reaction system?

Show your work.

11.(14) Photosensitive glass will darken when exposed to light. One type of photosensitive glass is darkened by the production of silver metal:



- Calculate  $E^\circ_{\text{cell}}$  for a cell that utilizes this reaction.
- Calculate  $\Delta G^\circ$  for this reaction.
- Calculate  $\Delta H^\circ$  for this reaction at 25 °C, given  $\Delta S^\circ = -72 \text{ J}/(\text{mole} \cdot \text{K})$ .  
Show your work.

12.(10) How many grams of Ca metal could be produced by the electrolysis of  $\text{CaBr}_{2(\text{l})}$  using a current of 30.0 amps for 10.0 hours? Show your work.

13.(15) Show a balanced nuclear equation for each of the following.

Beta emission from a  $^{58}\text{Co}$  nucleus

Alpha emission from a  $^{226}\text{Ra}$  nucleus

Positron emission from a  $^{75}\text{Se}$  nucleus

## INFORMATION PAGE

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G = \Delta G^\circ + (RT) \ln Q$$

$$\Delta G^\circ = - (RT) \ln K$$

$$\Delta G = - nFE_{\text{cell}}$$

$$E_{\text{cell}} = E^\circ_{\text{cell}} - (RT/nF) \ln Q$$

$$E_{\text{cell}} = E^\circ_{\text{cell}} - (0.0592/n) \log Q$$

$$E^\circ_{\text{cell}} = (RT/nF) \ln K$$

### constants

$$R = 0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mole} \cdot \text{K}} = 8.314 \frac{\text{J}}{\text{mole} \cdot \text{K}}$$

$$F = 96485 \text{ C/mole } e^-$$

$$96485 \text{ C} = 1 \text{ mole electrons}$$

$$1 \text{ amp} = 1 \text{ C/sec}$$