CHM 152
Exam III

Spring 2008
Dr. Doug Sawyer

Name _____

Question	Points
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.

1. The thermodynamic quantity that expresses the amount of disorder in a system is ...

a) enthalpy
b) internal energy
c) bond energy
d) entropy

2. Which is always positive when a spontaneous process occurs?

a) ΔS_{system} b) $\Delta S_{surroundings}$ c) $\Delta S_{universe}$ d) $\Delta H_{universe}$

3. Which reaction would have a positive value for ΔS^o?

a) $Ba(OH)_{2(s)} + CO_{2(g)} \rightarrow BaCO_{3(s)} + H_2O_{(l)}$
b) $N_{2(g)} + 3\ H_{2(g)} \rightarrow 2\ NH_{3(g)}$
c) $2\ SO_{3(g)} \rightarrow 2\ SO_{2(g)} + O_{2(g)}$
d) $AgNO_{3(aq)} + HCl_{(aq)} \rightarrow AgCl_{(s)} + HNO_{3(aq)}$

4. Which of the following has a ΔG_f^o value of 0?

a) $Co_{(s)}$ b) $PF_{3(g)}$ c) $HCo(PF_3)_{4(g)}$ d) $H_2O_{(l)}$

5. The electrode (surface) at which oxidation occurs is called the ..

a) oxidizing agent b) cathode c) anode d) reducing agent

6. What substance is oxidized in a Galvanic cell utilizing $Pb_{(s)}$ in $Pb^{2+}_{(aq)}$ and $Ni_{(s)}$ in $Ni^{2+}_{(aq)}$?

a) Pb b) Pb^{2+} c) Ni d) Ni^{2+}

7. Using the standard reduction potentials, determine which of the following could react with I^- to produce I_2.

a) Br_2 b) Mg c) Cu^{2+} d) Ni^{2+}

8. Predict the electrolysis product at the cathode: $MgS_{(aq)}$ → electrolysis

a) $Mg_{(s)}$ b) $H_{2(g)}$ c) $S_{(s)}$ d) $O_{2(g)}$

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 %
b) 67 %
c) 3.2 %
d) 2.0 %

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

a) Write the reaction (overall) for this Galvanic cell.
b) Calculate E^o_{cell} for the Galvanic cell.
c) Determine E_{cell} at 25 ^oC for the Galvanic cell when $[Pb^{2+}]$ = 1.50 M and $[Co^{2+}]$ = .0023 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 <u>to</u> the reaction system, or <u>by</u> 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:

$$2\ Ag^{+}_{(aq)} + 2\ Br^{-}_{(aq)} \rightarrow 2\ Ag_{(s)} + Br_{2(l)}$$

a) Calculate E^{o}_{cell} for a cell that utilizes this reaction.
b) Calculate ΔG^{o} for this reaction.
c) Calculate ΔH^{o} for this reaction at 25 ^{o}C, given $\Delta S^{o} = -72$ J/(mole · K).
Show your work.

12.(10) How many grams of Ca metal could be produced by the electrolysis of $CaBr_{2(l)}$ 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}Co nucleus

Alpha emission from a ^{226}Ra nucleus

Positron emission from a ^{75}Se nucleus

INFORMATION PAGE

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

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

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

$\Delta G = - nFE_{cell}$

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

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

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

constants

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

$F = 96485$ C/mole e^-

96485 C = 1 mole electrons

1 amp = 1 C/sec