PRACTICE PROBLEMS FOR CHEM 103 HE2 SUMMER 05

1. Circle the correct answer(s); no work need be shown. In the following unbalanced reaction

$$K_2Cr_2O_7 + K_2C_2O_4 + H_2SO_4 = CO_2 + Cr_2(SO_4)_3 + K_2SO_4$$

No oxidation or reduction is taking place

Potassium is undergoing oxidation

Chromium is undergoing oxidation

Carbon is undergoing reduction

All the above

None of the above

2 Use the listed standard reduction potentials to determine the net spontaneous reaction under standard conditions and the standard cell potentials for the following systems: Fe^{2+} and $Br_2(aq)$; Ag^+ and Cu^{2+}. For ONE of the two cells make a sketch showing the essential components, including the anode, cathode, and direction of electron flow. E^o/V $Fe^{3+} + e = Fe^{2+}$, +0.77; $Br_2(aq) + 2e = 2Br^-(aq)$, +1.09

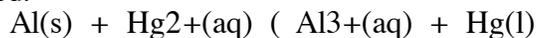 $Ag^+ + e = Ag$, 0.80; $Cu^{2+} + 2e = Cu$, +0.34

3. Which of the following changes does not indicate a reduction?
a. decrease in oxidation number
b. gain of electrons
c. electrons as reactants
d. reactant acting as a reducing agent
e. pure oxygen becoming oxide ion

ANSWER: d

4. When the reaction shown below is balanced, the coefficients are _____, and _____ electrons are transferred.
                    $Al(s) + Hg^{2+}(aq) (Al^{3+}(aq) + Hg(l)$
a. 1, 3, 1, and 3; 6
b. 2, 3, 2, and 3; 6
c. 3, 2, 3, and 2; 6
d. 2, 3, 2, and 3; 12
e. 3, 2, 3, and 2; 12
ANSWER: b
5. Two batteries have the same design, but are different sizes. The larger one will
        a. have a higher voltage.
        b. deliver the same current for a longer time.
        c. deliver a higher quantity of charge.
        d. display properties b and c.
        e. display properties a, b, and c.

        ANSWER: d

6. The value of Eocell for an aluminum-nickel electrochemical cell is +1.41 V at 25(C.
    Calculate the value of (G(for this cell under standard conditions.
a. -816 kJ
b. -680 kJ
c. -272 kJ
d. +403 kJ
e. +680 kJ

. 7. The value of Ecell at 25oC for the cell shown below is +1.27 V. What is the value of Eocell?

$$Cd(s) \mid Cd2+(aq), 2.0 \text{ M} \parallel Ag+(aq), 2.0 \text{ M} \mid Ag(s)$$

a. 1.57 V
b. 1.28 V
c. 1.26 V
d. 1.23 V
e. 0.97 V

8. A mass of 0.839 g of a divalent metal is plated out of a solution of the divalent metal ion. This takes 67.2 min at a current of 0.63 A. What is the metal? (Hint: find its atomic mass.)
    a. Cd
    b. Cu
    c. Hg
    d. Fe
    e. Mg
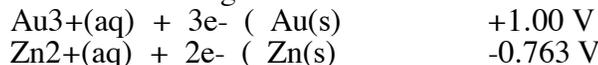
    ANSWER: b

9. Calculate the mass of cobalt that will be deposited when a current of 2.00 A is passed through a solution of $CoSO_4$ for 10.0 hours.
a. 6.11 (10-3 g
b. 0.366 g
c. 4.40 g
d. 8.72 g
e. 22.0 g

ANSWER: e

10. Refer to the following values of standard reduction potentials.
    Au3+(aq) + 3e- (Au(s)   +1.00 V
    Zn2+(aq) + 2e- (Zn(s)   -0.763 V
a. Write the balanced overall reaction for gold reacting with zinc(II) ion.
b. Calculate the value of Eocell for the reaction.
c. How many electrons are transferred in this reaction? Explain.
d. Calculate the value of (G(for this cell at 25(C.
e. Calculate the value of the equilibrium constant for this reaction at 25(C.
f. Is this reaction product-favored or reactant-favored? Explain how your answers in parts b, d, and e support this conclusion.

11. a. Briefly explain why aluminum is usually isolated from its ore by electrolysis, not by chemical reduction.
       b. Explain why this electrolysis has to be performed on a molten aluminum salt, not in aqueous solution.

AND FINALLY: A BUFFER PROBLEM

12. The Ka of carbonic acid is 4.2 x 10-7; you have 500.0 mL of a solution that is 0.0025 M in carbonic acid. What mass of NaHCO3 must you add to this solution to make a buffer of pH = 7.40.

AND A TITRATION PROBLEM

13, Calculate the pH at the equivalence point when 25.0 mL of 0.100 M acetic acid (Ka = 1.8 x 10-5) is titrated with 0.035 M Ca(OH)2 solution.