CHAPTER 18 SAMPLE PROBLEMS

Sample Problem 1: Potassium dichromate is a bright orange compound that can be reduced to a blue-violet solution of Cr3+ ions. Under certain conditions K2Cr2O7 reacts with ethanol (C2H5OH) as follows:

H+(aq) + Cr2O72-(aq) + C2H5OH → Cr3+(aq) + CO2(g) + H2O(l)

Balance this reaction using the ½ reaction method

Sample problem 2: Silver is sometimes found in nature as large nuggets; more often it is found mixed with other metals and their ores. An aqueous solution containing cyanide ion is often used to extract silver using the following reaction that occurs in basic solution:

Ag(s) + CN-(aq) + O2(g) → Ag(CN)2-(aq) + H2O(l)

Balance this reaction using the ½ reaction method

Sample problem 3

1. Consider a galvanic cell based on the reaction

Al3+(aq) + Mg(s) → Al(s) + Mg2+(aq)

Give the balanced cell reaction and calculate ξo for the cell

1. Consider a galvanic cell based on the reaction

MnO4-(aq) + H+(aq) + ClO3-(aq) → ClO4-(aq) + Mn2+(aq) + H2O(l)

Give the balanced cell reaction and calculate ξo for the cell

Sample problem 4

Describe completely the galvanic cell based on the following half-reactions under standard conditions:

Ag+ + e- → Ag ξo = 0.80 V

Fe3+ + e- → Fe2+ ξo = 0.77 V

Sample problem 5

Using the data in Table 18.1, calculate ΔGo for the reaction

Cu2+(aq) + Fe(s) → Cu(s) + Fe2+(aq)

Is this reaction spontaneous?

Sample problem 6

Using the data from Table 18.1, predict whether 1 M HNO3 will dissolve gold metal to form a 1 M Au3+ solution

Sample problem 7

For the cell reaction

2Al(s) + 3Mn2+(aq) → 2Al3+(aq) + 3Mn(s) ξocell = 0.48 V

predict whether ξcell is larger or smaller than ξocell  for the following cases

[Al3+] = 2.0 M, [Mn2+] = 1.0 M

[Al3+] = 1.0 M, [Mn2+] = 3.0 M

Sample problem 8

Determine the direction of electron flow and designate the anode and cathode for the cell represented in Fig 18.10 (page 854)

Sample problem 9

Describe the cell based on the following half reactions

VO22+ + 2H+ + e- → VO2+ + H2O ξo = 1.00 V

 Zn2+ + 2e- → Zn ξo = -0.76 V

Where

T = 25oC

[VO22+] = 2.0 M

[H+] = 0.50 M

[VO2+] =1.0 x 10-2 M

[Zn2+] = 0.10 M

Sample problem 10

For the oxidation-reduction reaction

S4O62-(aq) + Cr2+(aq) → Cr3+(aq) + S2O32-(aq)

The appropriate half reactions are

S4O62- + 2e- → 2S2O32- ξo = 0.17 V

Cr3+ + e- → Cr2+ ξo = -0.50 V

Balance the redox, and calculate ξo, and K (at 25oC)

Sample problem 11

How long must a current of 5.00 A be applied to a solution of Ag+ to produce 10.5 g of silver metal?

Sample problem 12

How many g of copper can be plated when a current of 10.0 A is passed through a solution of Cu2+ for 30 minutes?

Sample problem 13

An acidic solution contains the ions Ce4+, VO22+, and Fe3+. Using the ξo values listed in Table 17.1, give the order of oxidizing ability of these species and predict which will be reduced at the cathode of an electrolytic cell at the lowest voltage.