AP CHEMISTRY CHAPTER 18 PRACTICE TEST

1. How many coulombs of charge pass through a cell if 2.40 amperes of current are passed through the cell for 85.0 minutes?
2. 2.04 x 102 C
3. 0.133 C
4. 1.22 x 104 C
5. 2.12 x 103 C
6. 3.40 C
7. How many moles of chromium would be electroplated by passing a current of 5.2 amperes through a solution of Cr3+ for 45.0 minutes?
8. 0.048 mol
9. 2.9 mol
10. 0.15 mol
11. 6.9 mol
12. 0.073 mol
13. Which response contains all the following statements that are CORRECT, and no others?
14. In galvanic cells the flow of electrons is spontaneous
15. In electrolytic cells electrons flow in the external circuit (through the wire) from the anode to the cathode
16. In galvanic cells the cathode is the positive electrode
17. I
18. III
19. I and II
20. II and III
21. I, II, and III
22. A cell is constructed by immersing a strip of lead in a 1.0 M Pb(NO3)2 solution and a strip of silver in a 1.0 M AgNO3 solution. The circuit is completed b a wire and a salt bridge. As the cell operates, the strip of silver gains mass (only silver) and the concentration of silver ions in the solution around the silver strip decrease, while the strip of lead loses mass, and the concentration of lead ions increases in the solution around the lead strip. Which of the following represents the reaction that occurs at the cathode in this cell?
23. Pb2+ + 2e → Pb
24. Pb → Pb2+ + 2e
25. Ag+ + e → Ag
26. Ag → Ag+ + e
27. None of the above
28. Which of the following metals is most easily oxidized?
29. Cd
30. Cu
31. Fe
32. Ni
33. Zn
34. Which of the following describes the net reaction that occurs in the cell?

Cd|Cd2+ (1M) || Cu2+| Cu

1. Cu + Cd2+ → Cu2+ + Cd
2. Cu + Cd → Cu2+ + Cd2+
3. Cu2+ + Cd2+ → Cu + Cd
4. Cu2+ + Cd → Cu + Cd2+
5. 2Cu + Cd2+ → 2Cu+ + Cd
6. What is the numerical value for the standard potential for the following reaction?

2Cr3+ + 3Cu → 2Cr + 3Cu2+

1. -1.08 V
2. -0.40 V
3. 0.40 V
4. 1.08 V
5. 2.52 V
6. Calculate ΔGo for the following reaction.

3Hg2Cl2 + 2Cr → 2Cr3+ + 6Hg + 6Cl-

1. -1.12 x 103 kJ
2. -585 kJ
3. -361 kJ
4. 1.62 x 103 kJ
5. -1.78 x 103 kJ
6. What is the coefficient of H+ when the reaction below is balanced?

MnO4- + H+ + C2O42- → Mn2+ + CO2 + H2O

1. 16
2. 2
3. 8
4. 5
5. For the reaction below, pick the TRUE statement from the following

Cr2O72- + 14 H+ + 3S2- → 2Cr3+ + 3S + 7H2O

1. The S2- is reduced by Cr2O72-
2. The oxidation number of chromium changes from +7 to +3
3. The oxidation number of sulfur remains -2
4. The S2- is oxidized by Cr2O72-
5. The H+ oxidizes the S
6. Given the standard reduction potentials below, estimate the approximate value of the equilibrium constant for the following reaction

 Co2+ + 2e → Co Eo = -0.28 V

 Cd2+ + 2e → Cd Eo = -0.40 V

Cd + Co2+ → Cd2+ + Co

1. 10-4
2. 10-2
3. 104
4. 1016
5. 102
6. The reaction shown below was used in an electrolytic cell. The voltage measured for the cell was not equal to the calculated Eo for the cell. This discrepancy could be caused by which of the following?

2Fe3+ + Zn → Zn2+ + 2Fe2+

1. The anion in the anode compartment was chloride, instead of nitrate as in the cathode compartment.
2. One or more of the ion concentrations was not 1 M
3. Both of the solutions were at 25oC instead of 0oC
4. The solution in the salt bridge was Na2SO4 instead of KNO3
5. The anode and cathode were different sizes
6. Using the information below, determine the standard reduction potential for the following reaction: M3+ + 3e → M

2M + 3Zn2+ → 2M3+ + 3Zn Eo = 0.90 V

Zn2+ + 2e → Zn Eo = -0.76 V

1. 0.90 V
2. +1.66 V
3. 0.00 V
4. -0.62 V
5. -1.66 V

PROBLEMS

1. The diagram below shows a galvanic cell based on the reaction also given below. Assume that the temperature is 25oC

2Al + 3Zn2+ → 2Al3+ + 3Zn



The left side contains an Al electrode and Al3+, NO3- (1M)

The right side contains a Zn electrode and Zn2+, NO3- (1M)

1. The diagram includes a salt bridge that is filled with a saturated solution of KNO3. Describe what happens in the salt bridge as the cell operates.
2. Determine the value of the standard voltage, Eo, for the cell
3. Indicate whether the value of the standard free-energy change, ΔGo, for the cell reaction is positive, negative, or zero. Justify you answer.
4. If the concentration of Al(NO3)3 in the Al|Al3+ half-cell is lowered from 1.0 M to 0.01 M at 25oC, does the cell voltage increase, decrease, or remain the same? Justify your answer.
5. A galvanic cell is constructed using the substances indicated in the following two reduction half reactions.

Fe3+ + e → Fe2+ Eo = +0.77 V

MnO4- + 8H+ + 5e → Mn2+ + 4H2O Eo = +1.49 V

1. Calculate the value of the standard potential, Eo, for the spontaneous cell reaction
2. How many moles of electron are transferred when 1.0 mol of MnO4- is consumed in the overall cell reaction?
3. Calculate the value of the equilibrium constant for the cell reaction at 25oC. Explain what the magnitude of the equilibrium constant tells you about the extent of the reaction

ANSWERS

1. C
2. A
3. E
4. C
5. E
6. D
7. A
8. B
9. A
10. D
11. C
12. B
13. E

PROBLEMS

1 a. K+ goes to the Zn side and NO3- goes to the Al side

 b. 0.90 V

 c. – because ∆Go = -nFԐo

 d. Increase, the rxn will shift to restore Equilibrium

2a. 0 .72 V

 b. 5 moles of electrons

 c. K = 6.5 x 1060

Large K says forward reaction is favored.