CHE 112 Electrochemistry Additional Practice Problems

For questions 1 – 7, consider the following (unbalanced) equation:

$NO_2^-(aq) + Cr_2O_7^{2-}(aq) \rightarrow Cr^{3+}(aq) + NO_3^-(aq)$ (acidic solution)

1. What is the oxidation number of N in NO_2^-?

2. What is the oxidation number of Cr in $Cr_2O_7^{2-}$?

3. Which reactant is reduced? How did you decide?

4. Which reactant is the reducing agent? How did you decide?

5. Balance the reduction half reaction.

6. Balance the oxidation half reaction.

7. Write the overall balanced redox reaction.

For questions 8 – 14, consider the following (unbalanced) equation:

$Tl_2O_3(s) + NH_2OH(aq) \rightarrow TlOH(s) + N_2(g)$ (basic solution)

8. What is the oxidation number of Tl in Tl_2O_3?

9. What is the oxidation number of N in NH_2OH?

10. Which reactant is oxidized? How did you decide?

11. Which reactant is the oxidizing agent? How did you decide?

12. Balance the reduction half reaction.

13. Balance the oxidation half reaction.

14. Write the overall balance redox reaction.

For questions 15 – 21, consider the voltaic cell which uses the (unbalanced) reaction:

$Ag^{+}(aq) + Ni(s) \rightarrow Ag(s) + Ni^{2+}(aq)$

(It is best to sketch this cell as a help in answering the questions.)

15. Balance the cell reaction

16. Write the half reaction which occurs in the anode compartment.

17. Which electrode is the cathode?

18. Which electrode is designated the negative electrode?

19. Do electrons flow from Ni to Ag or from Ag to Ni?

20. To which compartment do the cations of the salt bridge migrate?

21. Refer to our online class Table of Standard Reduction Potentials and calculate the standard cell voltage.

For questions 22 – 24, consider the following unbalanced equation:

$F_2(g) + Cl^-(aq) \rightarrow F^-(aq) + Cl_2(g)$

22. Balance this equation.

23. Calculate the standard voltage for this reaction (use online class Table).

24. Is this reaction spontaneous? How did you decide?

For questions 25 – 26, use our online class Standard Reduction Potential Table.

25. Is zinc or aluminum a stronger reducing agent? How did you decide?

26. Is Br_2 or Cl_2 a stronger oxidizing agent? How did you decide?

For questions 27 – 29, consider the voltaic cell which uses the following reaction:

$4Fe^{2+}(aq) + O_2(g) + 4H^+(aq) \rightarrow 4Fe^{3+}(aq) + 2H_2O(l)$

27. Calculate the standard cell voltage.

28. What is the number of moles of electrons transferred in this equation ('n' in the Faraday equation)?

29. Calculate the voltage of this cell when $[Fe^{3+}] = 0.010$ M, $[Fe^{2+}] = 2.0$ M, pH in the cathode compartment is 4.00, and partial pressure of O_2 if 0.20 atm.

For questions 30 – 31, decide what the electrode reactions are when the given solutions are electrolyzed. Then write the balanced overall reaction.

30. A solution of $Cu(NO_3)_2$

31. A solution of KCl

32. A $NiSO_4$ solution is electrolyzed using a current of 9.50 A for 12.0 hours. What mass of Ni is plated out? First, write the relevant half reaction for the production of solid nickel.