

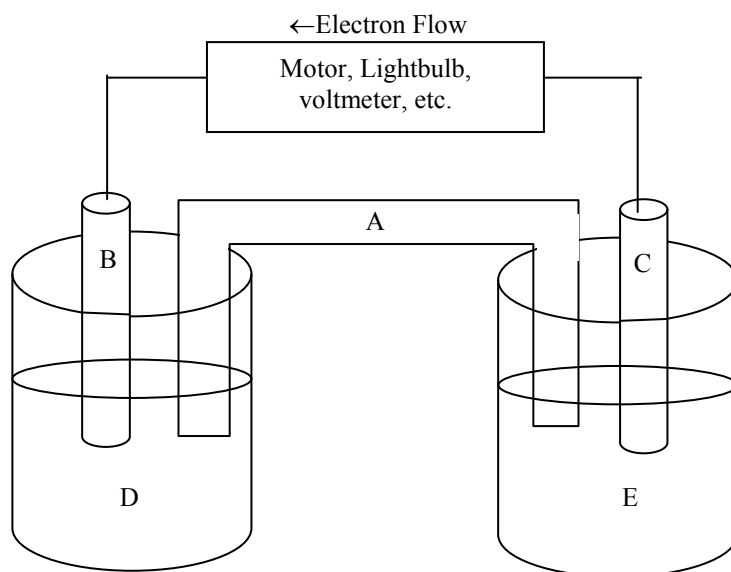
Honors Chemistry

Electrochemistry Problems

Name _____

Date _____ Period _____

The voltaic cell shown above is composed of the metals Nickel (Ni) and Calcium (Ca) and their nitrate salts. Assume both metals are 2^+ in their ionic state. Pay attention to the direction of electron flow. Answer the following questions using the letters indicated above. The same letter may be used more than once.



1. Salt bridge
2. Nickel electrode
3. Calcium nitrate solution
4. Calcium electrode
5. Nickel nitrate solution
6. Anode
7. Cathode
8. Electrode where oxidation occurs
9. Electrode where reduction occurs
10. KNO_3
11. Electrode that gets smaller with time
12. Solution that receives positive ions from the salt bridge

13. If the reduction potentials for Ni and Ca are -0.25V and -2.87V respectively, what is the voltage of the cell?

Write a condensed cell diagram for this reaction.

Write the oxidation half reaction for the cell.

Write the reduction half reaction for the cell.

For the following five questions identify the half reactions as either oxidized or reduced

14. $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + 1\text{e}^-$
15. $\text{Cu} \rightarrow \text{Cu}^{1+} + 1\text{e}^-$
16. $\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$
17. $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$
18. $2\text{N}^{3-} \rightarrow \text{N}_2 + 6\text{e}^-$

19. For the reaction
 $2\text{Mn}^{4+} + 3\text{Cl}_2 \rightarrow 2\text{Mn}^{7+} + 6\text{Cl}^-$
 which species is the reducing agent? Explain.

20. If you were going to use electrolysis to separate molten potassium chloride into its component elements, which element (K or Cl_2) would form at the anode and why?
21. Which statement is false
- Oxidation occurs at the anode in a galvanic cell.
 - Oxidation occurs at the anode in an electrolytic cell.
 - The anode is considered positive in a galvanic cell.
 - The anode is considered positive in an electrolytic cell.
22. If a student made a voltaic cell using aluminum and zinc electrodes and 1M nitrate solutions of those metals, which direction would the electrons flow? What is the cell potential of this system?
23. A baby's spoon with an area of 6.25cm^2 is plated with silver from AgNO_3 using a current of 2.00A for two hours and 25 minutes.
- If the current efficiency is 82.0%, how many grams of silver are plated?
 - What is the thickness of the silver plate formed? ($d = 10.5\text{g/cm}^3$)
24. Calcium metal can be obtained by the direct electrolysis of molten CaCl_2 , at a voltage of 3.2V.
- How many joules of electrical energy are required to obtain 12.0lb of calcium?
 - What is the cost of the electrical energy obtained in part a if electrical energy is sold at the rate of nine cents per kilowatt hour?
25. Who or what is SHE? What are "standard" conditions?
26. For the cell diagram $\text{Pt} | \text{Cl}_2, \text{ClO}_3^- || \text{O}_2, \text{H}_2\text{O} | \text{Pt}$ write the net ionic equation for the redox reaction that takes place in this galvanic cell.
27. Explain what is oxidized and what is reduced in a lead-acid battery. What are the advantages and disadvantages of this type of battery?
28. Look up the term "cathodic protection". What does it mean?
29. In a nickel-cadmium battery (Nicad), cadmium is oxidized to $\text{Cd}(\text{OH})_2$ at the anode, while Ni_2O_3 is reduced to $\text{Ni}(\text{OH})_2$ at the cathode. A portable CD player uses 0.175amp of current. How many grams of Cd and Ni_2O_3 are consumed when the CD player is used for an hour and a half?
30. Two half-cells are connected, one containing .620M $\text{Cu}(\text{NO}_3)_2$ and the other containing .950M $\text{Cu}(\text{NO}_3)_2$ (both with copper electrodes and a salt bridge connecting them). Explain whether or not there will be a potential and why, and if so, which direction the electrons will flow if a circuit is connected to this cell.