Sample Worksheet

(Note: This is an example which can be modified depending on the educational level being targeted)

Vocabulary

Become familiar with the following terms:

Anode	Cathode	Reduction	Oxidation	Electrolyte
Electrolytic Cell	Voltage	Current	Metal	Semiconductor
Insulator	Potential	Potentiostat	Mobile Carriers	Electrons
Holes	Recombination	Conduction Band	Valence Band	Band-gap

Problems

1. Oxidation occurs at the ______________________.

2. Reduction occurs at the ______________________.

3. Balance the following equation:

$$H_2O\ (l) \rightarrow O_2(g) + H_2(g)$$

4. Write the two half-reactions for the above reaction:

   Oxidation Reaction: ____________________________________

   Reduction Reaction: ____________________________________

5. Calculate the Electrochemical Cell Potential for this reaction.

6. The value of the cell potential indicates that the reaction is:

   Spontaneous or NOT Spontaneous

7. Rank the following in order of increasing conductivity.

   Metals, Insulators, Semiconductors

8. Explain your answer from the question above.

9. How many grams of $Cu(NO_3)_2 \cdot 3H_2O$ are need to make 25.0 mL of a 0.040 M aqueous solution?

10. How many grams of $Fe(NO_3)_3 \cdot 9H_2O$ are need to make 50.0 mL of a 0.040 M aqueous solution?

Answers

1. Anode
2. Cathode
3. 2 $H_2O(l) \rightarrow O_2(g)$ + 2$H_2(g)$
4. Half Reactions
    a. Oxidation reaction: 2 $H_2O(\mathit{l}) \rightarrow O_2\mathit{(g)}$ + 4 H^+ *(aq)* + $4e^-$
    b. Reduction reaction: 4 H^+*(aq)* + 4 e^- $\rightarrow$ 2 H_2 *(g)*
5. $E^o_{cell} = E^o_{cathode} - E^o_{anode} = 0V - 1.23V = -1.23V$
6. Not spontaneous (*Could also have a ΔG calculation here*)
7. Insulators < Semiconductors < Metals
8. Insulators have a large band gap where the conduction band is separated from the valence band, which electrons cannot be promoted across thus producing no conductivity. Metals have conduction bands that overlap with valence bands and thus are not separated. Therefore there is not an energy gap or band gap allowing electrons to flow freely producing high conductivity. Semiconductors have conduction bands and valence bands that are separated but the band gap is not as large as with an insulator. Semiconductors can be doped to decrease the size of the band gap allowing electrons to be promoted across the band gap with some sort of applied energy. Thus the conductivity lies between that of an insulator and a metal.
9. MW=241.60 g/mol
   Answer: 0.24 g
10. MW= 404.00 g/mol
    Answer: 0.81 g