

Problem Set 3.3

Electrolytic cell

1) The process of applying an electric current through a cell to produce a chemical change is called_____.

- | | | |
|-----------------|-----------------|----------------|
| 1. corrosion. | 2. ionization. | 3. hydrolysis. |
| 4. electrolysis | 5. voltaic cell | |

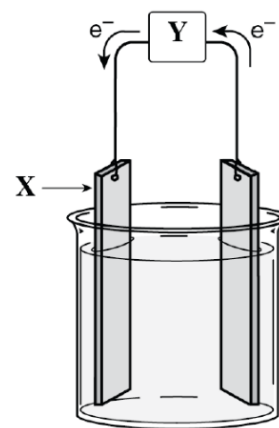
2) Which statement about electrolytic cell is correct?

1. negative ions move to the negative electrode.
2. positive ions move to the positive electrode.
3. negative ions move to the positive electrode.
4. positive ions move to the negative electrode.
5. Choice 3 and 4 are correct.

3) The diagram shown below represents an electrolytic cell:

Which of the following correctly describes the labelled parts X and Y of the cell?

- | X | Y |
|------------|--------------|
| 1. anode | voltmeter |
| 2. anode | power supply |
| 3. cathode | voltmeter |
| 4. cathode | power supply |
| 5. cathode | light bulb |



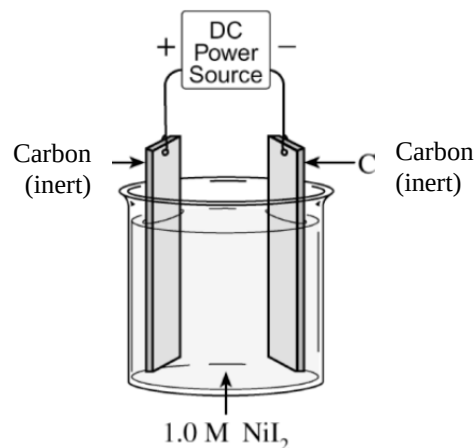
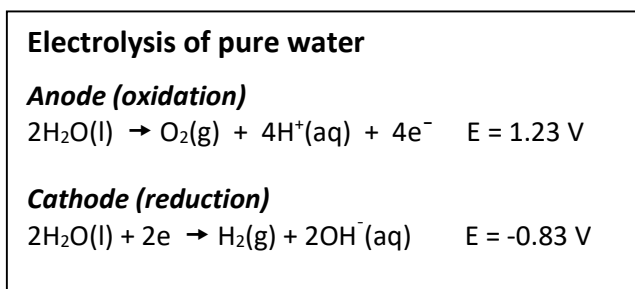
4) Consider the electrolysis of molten MgCl_2 using platinum electrodes. Which of the following half-reactions will occur at the cathode?

- | | |
|---|---|
| 1. $\text{Mg}^{2+} + 2\text{e}^- \rightarrow \text{Mg(s)}$ | 2. $\text{Cl}_2(\text{g}) + 2\text{e}^- \rightarrow 2\text{Cl}^-$ |
| 3. $\text{Mg(s)} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$ | 4. $\text{Pt}^{2+} + 2\text{e}^- \rightarrow \text{Pt}$ |
| 5. $2\text{Cl}^- \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^-$ | |

5) Which of the following is the anode half-cell reaction for the electrolysis of molten KBr ?

- | | | |
|--|---|---|
| 1. $\text{K}^+ + \text{e}^- \rightarrow \text{K(s)}$ | 2. $\text{K(s)} \rightarrow \text{K}^+ + \text{e}^-$ | 3. $2\text{Br}^- \rightarrow \text{Br}_2(\text{g}) + 2\text{e}^-$ |
| 4. $\text{H}_2\text{O} \rightarrow \frac{1}{2} \text{O}_2(\text{g}) + 2\text{H}^+ + 2\text{e}^-$ | 5. $\text{Pt} \rightarrow \text{Pt}^{2+} + 2\text{e}^-$ | |

Use the following diagram to answer questions 6 to 8.



6) What products would form at the anode and cathode as this cell operates?

	Anode	Cathode
1.	Cu^{2+}	Ni
2.	I_2	Ni
3.	Ni	I_2
4.	O_2	H_2/OH^-
5.	I_2	H_2/OH^-

7) What is the standard voltage (E°) for the cell?

- | | | | | |
|------------|------------|------------|------------|------------|
| 1. -1.36 V | 2. -2.06 V | 3. -0.25 V | 4. -1.48 V | 5. -0.78 V |
|------------|------------|------------|------------|------------|

8) In the above cell, if 1.0 M NiI_2 is replaced with molten NiI_2 , what products would form at the electrodes?

	Anode	Cathode
1.	Cu^{2+}	Ni
2.	I_2	Ni
3.	Ni	I_2
4.	O_2	H_2/OH^-
5.	I_2	H_2/OH^-

9) If a piece of nickel is to be gold-plated using an electrolytic process, which half-reaction occurs at the cathode?

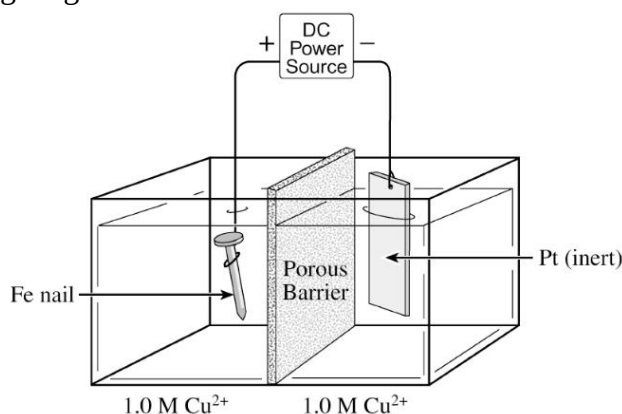
- | | | |
|---|--|---|
| 1. $\text{Ni}(\text{s}) \rightarrow \text{Ni}^{2+} + 2\text{e}^-$ | 2. $\text{Ni}^{2+} + 2\text{e}^- \rightarrow \text{Ni}$ | 3. $\text{Au} \rightarrow \text{Au}^{3+} + 3\text{e}^-$ |
| 4. $\text{Au}^{3+} + 3\text{e}^- \rightarrow \text{Au}$ | 5. $2\text{H}_2\text{O}(\text{l}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g}) + 2\text{OH}^-$ | |

10) Which statement is correct about the electrolysis of copper(II) sulfate solution using graphite electrodes?

- A colourless gas is produced at the negative electrode.
- The electrolyte does not change colour.
- The negative electrode decreases in mass.
- A colourless gas is produced at the positive electrode.
- none of these are correct.

- 11) A metallic object is electroplated with copper using a solution of copper(II) sulfate. Which statement is correct?
1. The positive electrode increases in mass.
 2. The concentration of Cu^{2+} ions in the solution decreases.
 3. Reduction occurs at the positive electrode.
 4. The reaction occurring at the negative electrode is $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu(s)}$
 5. all of these are correct.

12) Consider the following diagram:



Why would this cell fail to electroplate the Fe nail with copper?

1. The porous barrier prevents reaction.
 2. The Fe nail is the cathode.
 3. The Fe nail is the anode.
 4. The Pt is inert.
 5. all of these are correct.
- 13) A metal spoon is to be silver plated. The anode must be ____.
1. Zn(s)
 2. $\text{Zn}^{2+}(\text{aq})$
 3. Cr(s)
 4. $\text{Cr}^{2+}(\text{aq})$
 5. Ag(s)
- 14) Which of the following metal can be used to cathodically protect iron(Fe)?
1. Tin
 2. Zinc
 3. nikel
 4. Copper
 5. Silver
- 15) When copper is purified by electrolysis (Electrometallurgy):
- The positive electrode (anode) is __ (X) __. The negative (cathode) electrode is __ (Y) __.
- | X | Y |
|------------------|---------------|
| 1. impure copper | pure copper |
| 2. pure copper | impure copper |
| 3. graphite | graphite |
| 4. impure copper | impure copper |
| 5. pure copper | pure copper |