Dougherty Valley HS • AP Chemistry [Keep for Reference]

21 • Electrochemistry

**BLUFFER’S GUIDE**

1. Electrochemistry is all oxidation-reduction chemistry.

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**Oxidation**: loss of e; ox # increases

**Reduction**: gain of e; ox # decreases

*example*: Fe2+ + 2e → Fe(s) (reduction)

2. In a reaction, the

**oxidizing agent** gets **reduced**; the

**reducing agent** gets **oxidized**.

3. Balancing redox reactions:

**oxidation number method**

* assign ox #’s to every atom
* determine changes in ox #
* balance changes
* balance all atoms except H & O
* balance O’s (add H2O’s)
* balance H’s (add H+’s)
* adjust for basic solution if needed

**half-reaction method.**

* determine oxidation & reduction
* write two separate half-reactions
* balance all atoms except H & O
* balance O’s (add H2O’s)
* balance H’s (add H+’s)
* add e ‘s to more positive side
* balance e-‘s between half-reactions
* combine half-reactions
* adjust for basic solution if needed

4. Electricity can either **cause** a reaction (electrolysis, electrolytic cell) or can be **produced by** the reaction (Galvanic cell, electrochemical cell, Voltaic cell).

5. **Electrolysis / Electroplating**

coulomb (C) = an amount of charge

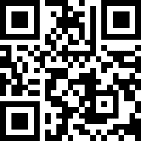
amp = current = charge per second

1 amp · 1 second = 1 Coulomb

1 C / amp·s

Faraday constant, F:

1 mole e- = 96,500 C



Neat online simulation/experiment   
for electrochem. I think it helps a lot!

<https://tinyurl.com/mssmkps9>

6. Electrolysis calculations begin with amp·s

*Example*:

How many moles of copper metal can be plated using a 10 amp circuit for 30 s?

10amp x 30s x 1C x 1 mol e- x 1 mol Ag =

1 amp·s 96500C 1 mol e-

= 3.1 x 10-3 mole Ag

7. Spontaneous redox reactions (unlike electrolysis/electroplating) can simply occur (as in the ornament lab) or can be separated so the oxidation and reduction occur in different containers (half-cells). In this way, the electrons must move through an outside wire (this is an electrochemical cell—a battery).

8. Every atom has a different “potential” to accept electrons… “reduction potential”

|  |  |
| --- | --- |
| Ag+(aq) + e¯ → Ag(s) | E° = +0.80 v |
| Cd2+(aq) + 2e¯ → Cd(s) | E° = 0.40 v |

These are measured by comparing every chemical to the same “standard half-cell.”

The reduction with the more positive E° value will occur as written; the other reaction will reverse (oxidation).

*Ex:*  2Ag+ + Cd  2Ag + Cd2+

The **difference** in the E° values is the voltage of a cell made using these two reactions.

*Ex:*  +0.80 v – (-0.40 v) = 1.20 volts

***NOTE that you do not multiply the Cd voltage by 2. Comparing every cell to the same standard cell accounts for this.***

9. Any change that drives the reaction forward will **increase** the cell’s voltage.

10. In ***all*** electrochemical cells:

**Oxidation** occurs at the **Anode**

**Reduction** occurs at the **Cathode**

**R-44**