**Learning Target**: I can balance equations to show that mass and charge are conserved.

**Homework**: Hand in missing work.

---

As you enter... (Write down questions and answers)

Write the oxidation numbers above each element. Then write the oxidation and reduction half-reactions.

\[
\text{Oxidation half-reaction: } 2 \text{Cu}^+ + \text{Br}_2 \rightarrow 2 \text{CuBr}
\]

\[
\text{Reduction half-reaction: } \text{Br}_2 + 2e^- \rightarrow 2 \text{Br}^{-1}
\]

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**Reminder**: Quiz Wednesday (Vocab, Oxidation #, Half-Reactions)

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**Statement of Inquiry**: Energy allows for the movement of the parts of a system which is used to manipulate chemical reactions for scientific and technological uses.

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3rd period:
- More & more practice writing half-reactions! (45 min)
- Exit Tix (5 min)

---

**Tix out the door** (Don't forget your name.)

Write the half-reactions for the following reaction.
Identify which is oxidation and which is reduction.

\[
\text{Fe} + \text{Pb}^{+2} \rightarrow \text{Fe}^{+3} + \text{Pb}
\]
1. What is a redox reaction?
2. What is the difference between an oxidizing agent and a reducing agent?
3. Why would a salt and a compound made from sodium be classified as identical?
   Yes/No
4. What is the oxidation number of any atom in the following molecule?
   a. NaCl
   b. CaCO3
   c. FeCl3
   d. K2S
5. Determine the oxidation number of each element in each compound.
   a. Al2O3
   b. H2O
   c. H2S
   d. NaCl
6. Determine the oxidation numbers of each element in each redox reaction. (See the following approach.)
   a. Cl2 + H2O → HCl + HClO
   b. H2 + Cl2 → HCl
   c. Na + Cl → NaCl
7. If a substance is oxidized, does it lose or gain electrons?
8. Determine between a reducing agent and a reducing agent.
   a. H2 + Cl2 → 2HCl
   b. O2 + N2 → 2NO
9. Explain the difference between an oxidizing agent and a reducing agent.
   a. O2
   b. Cl2
10. Write the oxidation number above each element. Then, determine if each equation represents a redox reaction (circle yes or no).
   a. 2KClO3 → 2KCl + 3O2
   b. BaCl2 + 2KNO3 → Ba(NO3)2 + 2KCl
   c. HCl + NaOH → H2O + NaCl
   d. Mg + H2O → Mg(OH)2 + H2
   e. NH4NO3 → N2 + H2O

C) Balance the following redox reactions by the half-reaction method, rewriting the balanced equations below the given unbalanced equation. Show your work for each reaction and put coefficients in the spaces provided:

1) Cu + AgNO3 → Cu(NO3)2 + Ag

2) Fe + Pb(NO3)2 → Fe(NO3)2 + Pb

3) AgNO3 + Cr → Ag + Cr2(NO3)3

4) HNO3 + Li → LiNO3 + H2

5) Al + HNO3 → Al(NO3)3 + H2
Learning Target: I can compare and contrast hydrogen fuel cell vs electric powered vehicles in terms of electrochemistry.

Homework: Hand in missing work.

As you enter... (Write down questions and answers)

Balance the reaction using the half-reactions method

\[
2 \text{Mn}^{2+} + 2 \text{Cl}_2 \rightarrow 2 \text{MnCl}_4^{-}, \quad \text{loss of } e^- \rightarrow \text{oxidation}
\]

\[
2\left( \text{Mn}^{2+} \rightarrow \text{Mn}^{4+} + 2e^- \right), \quad \text{oxidation}
\]

\[
2\text{Cl}_2 + 4e^- \rightarrow 4\text{Cl}^-, \quad \text{reduction}
\]

Reminder: Quiz tomorrow (Vocab, Oxidation #, Half-Reactions)

**All assignments for 3rd mkg period due by Friday**

Statement of Inquiry: Energy allows for the movement of the parts of a system which is used to manipulate chemical reactions for scientific and technological uses.

3rd period:
- Article: Hydrogen Fuel Cell vs Electric Cars (45 min)

4th period:
- Make up period... You must do the following in order until completion:
  - Missing work on progress report
  - Electrochem classwork and homework
  - HW Extra Credit (aka Study sheet for quiz)
  - Exit Tix (5 min)

Tix out the door (Don't forget your name.)

Balance the equation by writing out the half-reactions and balancing the charge (# of electrons).

\[
\_\_\_ \text{Cr}^{+6} + \_\_\_ \text{Ag} \rightarrow \_\_\_ \text{Cr}^{+2} + \_\_\_ \text{Ag}^+
\]
Battery-powered electric cars and hydrogen fuel cell vehicles have both seen advances in their development, and one or both of these technologies may represent the future of "green" automobiles.

Both technologies offer a cleaner alternative to internal combustion engines, and both use electric motors powered by electrochemical devices. But what's the difference between them? For one, electric vehicles use energy stored in a battery, whereas fuel cell vehicles have stored fuel that reacts to produce energy.

### Hydrogen Fuel Cells (with hydrogen and oxygen electrodes)

- **Anode side (an oxidation reaction):**
  \[ 2H_2 \rightarrow 4H^+ + 4e^- \]
  **0.0 V**

- **Cathode side (a reduction reaction):**
  \[ O_2 + 4H^+ + 4e^- \rightarrow 2H_2O \]
  **+ 1.23 V**

**Net reaction (the "redox" reaction):**
\[ 2H_2 + O_2 \rightarrow 2H_2O \]
**Total= 1.23 V**

### Lithium ion battery half cell reactions

- **CoO_2 + Li^+ + e \leftrightarrow LiCoO_2**
  \[ \text{E}^0 = 1 \text{ V} \]

- **Li^+ + C_6+ + e \leftrightarrow LiC_6**
  \[ \text{E}^0 \sim -3 \text{ V} \]

**Overall reaction during discharge**
\[ \text{CoO}_2 + \text{LiC}_6 \rightarrow \text{LiCoO}_2 + \text{C}_6 \]
\[ E_{OC} = E_+ - E_- = 1 - (-3.01) = 4 \text{ V} \]
Learning Target: I can demonstrate my ability to write half-reactions and balance equations.

Homework: Hand in missing work

As you enter... (Write down questions and answers)

Balance the reaction using the half-reactions method

\[ \text{oxidation: } \quad \text{Fe} \rightarrow \text{Fe}^{3+} + 3e^- \\
\text{reduction: } \quad 3(\text{Ag}^+ + e^- \rightarrow \text{Ag}) \]

Reminder: You can retake a quiz. I am after school today and tmw.

**All assignments for 3rd mkg period due by Friday**

Statement of Inquiry: Energy allows for the movement of the parts of a system which is used to manipulate chemical reactions for scientific and technological uses.

### Agenda

- **3rd period:**
  - Quiz (30 min) **LAST GRADE FOR 3RD MKG PER**
  - HW Extra Credit (15 min)
  - [Review Quiz if time permits]

Tix out the door (Don't forget your name.)
Learning Target: I can test the cell potential of different metals to observe the properties of electrochemical cells.

Homework: Hand in missing work

As you enter... (Write down questions and answers)

Make two inferences about the properties of electrochemical cells based on the simulation.

Reminder: You can retake a quiz during lunch or after school.

**All assignments for 3rd mkg period due tomorrow**

Statement of Inquiry: Energy allows for the movement of the parts of a system which is used to manipulate chemical reactions for scientific and technological uses.

3rd/4th period:
- Review Quiz (15 min)
- Lab 21: Electrochemical Cells (60 min)

Lab notes...

- Correction: Green wire is positive (+) and blue wire is negative (-).
- Do not pour anything down the drain. There are labeled waste beakers.
- Be careful not to cross-contaminate pipettes.
- Clean up your area and rinse out your electrochemical cells.

Actual values:

Al = 0.6V  Cu = 0.1V  Fe = 0.3V
Pb = 0.4V  Zn = 1.0V

Tix out the door (Don't forget your name.)

1. What information does Table J give you?
2. According to Table J, what is the most active metal?
6) \[ \text{Na} + \text{H}_2\text{O} \rightarrow \text{NaOH} + \text{H}_2 \]

oxidation: \[ \text{Na} \rightarrow \text{Na}^{+1} + 1e^- \]

reduction: \[ 2\text{H}^{+1} + 2e^- \rightarrow \text{H}_2 \]

oxidized = Na

OA = H$_2$O

reduced = H$_2$O

RA = Na
Learning Target: I can describe the parts of voltaic and electrolytic cells.

Homework: Hand in missing work

As you enter... (Write down questions and answers)

Which ion is most easily reduced?
(1) Zn²⁺  (2) Mg²⁺  (3) Cu²⁺  (4) Co²⁺

When a voltaic cell operates, ions move through the
(1) anode  (2) cathode  (3) salt bridge  (4) external circuit

Reminder: Electrochemistry Exam Tuesday

Statement of Inquiry: Energy allows for the movement of the parts of a system which is used to manipulate chemical reactions for scientific and technological uses.

3rd period:
• Electrochemical Cells Stations (30 min)
• Voltaic Cells Intro (10 min)
• Exit Tix [5 min]

Tix out the door (Don't forget your name.)

Which statement describes where the oxidation and reduction half-reactions occur in an operating electrochemical cell?
(1) Oxidation and reduction both occur at the anode.
(2) Oxidation and reduction both occur at the cathode.
(3) Oxidation occurs at the anode, and reduction occurs at the cathode.
(4) Oxidation occurs at the cathode, and reduction occurs at the anode.