Lesson Title	Halloween Chemistry
Length of Lesson	30 minutes
Created By	Erin Anderson
Subject	Chemistry
Grade Level	9-12
State Standards	7a, b, c, d, g
DOK Level	II
DOK Application	Compare Relate, Predict
National Standards	9-12 B. Physical Science
Graduate Research Element	Single displacement, double displacement, synthesis, decomposition and combustion reactions occur all the time. In bay water chemistry, the displacement reactions control the geochemistry of porewaters. These reactions are often facilitated by microbial action, which is believed to be essential to pyrite formation.

Student Learning Goal: All chemical reactions can be categorized into 5 general types: synthesis, decomposition, single displacement, double displacement and combustion.

State Standards: 7. Interpret chemical change in terms of chemical reactions.
a. Write an equation in sentence form (word equation) when given a chemical equation.
b. Balance a simple chemical equation by inspection when given the formulas or names of all reactants and products.
c. Classify simple equations as to type: single displacement, double displacement, synthesis and decomposition.
d. Complete chemical equations when given reactants for reactions, such as synthesis, decomposition, single displacement, and double displacement.
f. Use the activity series to predict single displacement reactions and write equations of these reactions.
g. Predict products of simple synthesis and decomposition reactions.

National Standards: B. Physical Science: Chemical Reactions

- Chemical reactions occur all around us, for example: in health care, cooking, cosmetics, and automobiles. Complex chemical reactions involving carbon-based molecules take place constantly in every cell in our bodies.
- Chemical reactions may release or consume energy. Some reactions, such as the burning of fossil fuels, release large amounts of energy by losing heat and emitting light. Light can initiate many chemical reactions, such as photosynthesis and the evolution of urban smog.

- A large number of important reactions involve the transfer of either electrons (oxidation/ reduction reactions) or hydrogen ions (acid/base reactions) between reacting ions, molecules or atoms. In other reactions, chemical bonds are broken by heat or light to form very reactive radicals with electrons ready to form new bonds. Radical reactions control many processes such as the presence of ozone and greenhouse gases in the atmosphere, burning and processing of fossil fuels, the formation of polymers, and explosions.

Materials Needed (supplies, hand-outs, resources): Isopropyl Alcohol, blue water jug, grill lighter, long metal stick (or a stick that is not flammable), 50-100 ml of 30% hydrogen peroxide (H_2O_2) solution, saturated potassium iodide (KI) solution, liquid dishwashing detergent, food coloring, 500 mL graduated cylinder, Nylon synthesis kit from this website: http://www.hometrainingtools.com/nylon-synthesis-rope-trick-kit/p/KT-ISNYLON/, 1 g Potassium Chlorate, 1 test tube, 1 stand for the test tube, Thongs, 1 gummy bear, 30 ml HCl, 3 pieces of mossy zinc, 1 balloon, 1 bottle, 30 g lead nitrate, 30 g potassium iodide, large plastic hollow jack-o-lantern

Lesson Performance Task/Assessment: Teacher's Notes (at bottom of page) contains directions for each demo. Reaction demo sheet (with answers and without) are included in supplemental material. For each demo, the type of reaction and the compounds that are being reacted will be revealed. Students must finish the equation based on the type of reaction.

Lesson Relevance to Performance Task and Students: Students ability to correctly write equations will demonstrate their understanding of the 6 types of reactions: synthesis, decomposition, combustion, single replacement, double replacement.

Anticipatory Set/Capture Interest: Halloween science experiments. Let's start off with a combustion reaction with the blue ghost demonstration.
Procedure:

- Wet inside of blue water jug with isopropyl alcohol.
- Tape a match to the end of a yard stick and carefully insert match inside jug. Alcohol will quickly burn in a decomposition reaction.
- Simply turn the jug over to pour out water.

Guided Practice:

1. Can you predict the product side of the equation if you know the reactants and the type of equation?
2. How is a decomposition reaction different from a synthesis reaction?
3. Explain why some types of reactions are more violent than others.

Independent Practice: Students will be given an equation sheet with only the reactants written out. After each reaction, students must determine the product side of the equation, write the product side, and correctly balance the entire equation.

Remediation and/or Enrichment: All IEP's will be supported. For remediation, students will work together to figure out what goes on the product side of each equation. The teacher will be available for questions and help with balancing equations. For enrichment, students will work alone to determine what goes on the product side of the equation. They will be asked to think of different types of reactions that occur in everyday life (i.e. combustion of sucrose for ATP synthesis).

Check(s) for Understanding:

- Why was the synthesis reaction different from the combustion reaction?
- Was more energy released in a combustion reaction or a double recombination reaction?
- Which reaction was most energetic?
- Which reaction was your favorite?

Closure: Students will turn in worksheet for a daily grade. The reactions will be discussed, so students know the correct answers.

Possible Alternate Subject Integrations: Physics, History

Teacher Notes:

Decomposition Reaction

Elephant Toothpaste Materials

- 50-100 ml of 30% hydrogen peroxide (H_2O_2) solution
- saturated potassium iodide (KI) solution
- liquid dishwashing detergent
- food coloring
- 500 mL graduated cylinder

Procedure

- Put on gloves and safety glasses. The iodine from the reaction may stain surfaces so you might want to cover your workspace with an open garbage bag or a layer of paper towels.
- Pour ~50 mL of 30% hydrogen peroxide solution into the graduated cylinder.
- Squirt in a little dishwashing detergent and swirl it around.

- You can place 5-10 drops of food coloring along the wall of the cylinder to make the foam resemble striped toothpaste.
- Add ~10 mL of potassium iodide solution. Do not lean over the cylinder when you do this, as the reaction is very vigorous and you may get splashed or possibly burned by steam.

Do reaction underneath a hollowed out plastic pumpkin without the bottom!

Synthesis

Nylon Synthesis

Procedure included in Nylon synthesis kit, which can be ordered from the website below. Briefly introduce the concept of polymers with this demonstration!

http://www.hometrainingtools.com/nylon-synthesis-rope-trick-kit/p/KT-ISNYLON/

Combustion

Gummy Bear Sacrifice

- 1 g potassium chlorate
- 1 test tube
- 1 stand for the test tube
- thongs
- 1 gummy bear

Procedure:

- Melt potassium chlorate with burner.
- When potassium chlorate is melted, drop gummy bear inside test tube. Screaming and light will be produced from the combustion reaction. Carbon, water, diatomic oxygen will be produced.

Single Recombination

Hydrogen Gas Production

- 30 ml HCl
- 3 pieces of mossy zinc
- 1 balloon
- 1 bottle

Procedure:

- Have balloon ready to cap bottle.
- Pour in 30 ml of HCl inside bottle.
- Have student drop in mossy zinc pieces.
- Quickly cap bottle with balloon. Balloon fills with hydrogen gas. Explode balloon with lighter.

Lighting a balloon filled with hydrogen gas is what happened to the Hindenberg. Don't

try this at home.

Double Recombination:
Color Changing Powder
$2\ KI + Pb(NO_3)_2$ ----------> $PbI_2 + 2\ K(NO_3)$

Procedure:

- If crystallized, grind into powders.
- Equal amounts go into test tube.
- Swirl and color will change.

No water needed. The outsides of the crystals react. White potassium nitrate and yellow lead iodide.