# Web Unit Plan

**Title: Lights, Camera, Reaction!**

**Description:** Lights, Camera, Reaction! In a high school chemistry class, student film moguls have been hired to produce a video masterpiece featuring classic compounds whose chemistry lights up the screen!

## At a Glance

**Grade Level:** 9–10

**Subject sort (for Web site index):** Science

**Subject(s):** Chemistry

**Topics:** Chemical Reactions

**Higher-Ordering Thinking Skills:** Experimental Inquiry, Investigation

**Key Learnings:** Chemical Reactions (Combustion, Synthesis, Single Replacement, Double Displacement, Decomposition), Products of Chemical Reactions

**Time Needed:** 11 days, 45 minutes each day

**Background:** From the Classroom in Rosewell, New Mexico

## Unit Summary

First-year chemistry students learn the basics of chemical reactions, and then dig deeper to produce unique multimedia demonstrations that will be used in an educational instructional video for a cable channel. Microscaled investigations are presented, allowing students to study many reactions safely in a short period of time. Small groups of students are assigned one of five basic chemical changes (synthesis, decomposition, single displacement, double displacement, or combustion) to investigate further. After careful consideration, each student selects one reaction and microscaled demonstration that best illustrates the particular reaction, and develops a slideshow presentation that can be used in the final class video. As a final assessment, students are given a unique "recipe" for a set of reactants, and they are asked to identify the reaction type and the products that are likely to result.

## Curriculum-Framing Questions

- **Essential Question**
  What causes change?
- **Unit Questions**
  How do patterns allow us to predict chemical reactions and their products?
  How do chemical reactions affect everyday life?
- **Content Questions**
  What is a chemical reaction?
  How does chemical change occur?
  How can you tell if a change is chemical or physical?

## Assessment Processes

View how a variety of student-centered assessments are used in the Lights, Camera, Reaction! Unit Plan. These assessments help students and teachers set goals; monitor student progress; provide feedback; assess thinking, processes, performances, and products; and reflect on learning throughout the learning cycle.

## Instructional Procedures

### Prior to Instruction

Send the Using Projects brochure home to introduce parents to the projects students will complete during the upcoming year.

### Session 1: Assess Prior Knowledge

Introduce the project with the Essential Question, *What causes change?* Prepare a slideshow of various pictures that demonstrate physical change (such as fall colors, volcanoes erupting, fireworks, landfills, and so forth). Have students share evidence that change has taken place in the pictures. Lead the discussion so that students discern chemical changes versus physical changes. Conduct a demonstration of the Oscillating Reaction*. Ask students to write down an explanation for what they see taking place. As a pretest, ask students to spend 5 minutes writing answers to the following Content Questions:

- *What is a chemical reaction?*
- *How does chemical change occur?*
- *How can you tell if a change is chemical or physical?*

Ask the questions again at the end of this unit to measure new understanding.

### Session 2: Foundation Knowledge

Explain the fundamental features of chemical change, and describe how it differs from physical change. Use the many video downloads and slideshows listed in the resources section to deliver instruction on the five types of chemical reactions (synthesis, decomposition, single displacement, double displacement, and combustion) and the six signs that suggest chemical reactions have occurred (emission or absorption of heat, emission of light, formation of a solid, formation of a gas, color change, and odor).

Explain that in its most basic sense, a chemical reaction is an event in which atoms rearrange themselves and bind together in new ways. Sometimes, this involves a single substance, such as when three oxygen molecules rearrange their atoms to form two ozone molecules, or 2 $O_3$, or it can involve two or more substances, such as when an acid and a base combine to form salt and water as follows:

$HCl + NaOH \rightarrow NaCl + H_2O$

Explain that chemical reactions can either take in or give out energy when the atoms rearrange themselves. When oxygen is converted to ozone, it takes in the energy supplied by sunlight. When an acid reacts with a base resulting in salt and water, it gives out energy as heat. A reaction that takes in energy is *endothermic,* and a reaction that gives out energy is *exothermic*.

### Session 3: Explore

Set up stations in the classroom in which students complete a microscale investigation on each type of chemical reaction. Investigations and how to set them up can be found online at the University of Nebraska-Lincoln* Web site. Post reaction types, instructions, and safety guidelines. After students have completed each station, have students complete a summary for each investigation. Use the responses to the summary questions to gauge their understanding of chemical reactions. Discuss the Content and Unit Questions, *How can you tell if a change is*

*chemical or physical?* and *How do patterns allow us to predict chemical reactions and their products?*

### Session 4: Equations

Teach students about equations. Equations show:

- Reactants that enter into a reaction
- Products formed by the reaction
- Amounts of each substance used
- Each substance produced by the reaction

Make sure the preceding points are made, and provide many examples and opportunities for practice.

Allow time for students to learn more and practice their skills by interpreting, writing, and balancing equations in tutorials at SciLink NSTA*. Have students do their work in their science journals and check their journals frequently to assess their understanding.

### Session 5: Lights, Camera…

Introduce the scenario that a local cable channel would like to hire a group to produce an educational instructional video to air during National Chemistry Week (October). Explain that each group is assigned one of the reaction types. Each group then produces a student slideshow that is informative and keeps the attention of the audience. Assign advanced students to be "directors" and "producers" to compile all the group projects onto one DVD. Divide students into groups and assign one reaction type to each group (if the class is large, assign reaction types to more than one group). Using print and electronic sources, students study one reaction type and answer the following questions:

- *What are the features of the chemical reaction?*
- *How do patterns allow you to predict the reaction and its products?*
- *What variety of substances can be combined to result in the reaction?*
- *What are some everyday examples of the reaction?*
- *How do chemical reactions affect everyday life?*

Teach students how to develop their presentation from a plan. The reaction project instructions and checklist and slideshow rubric serve as guides.

### Sessions 6 through 9: Look Deeper

Have student groups research an everyday example of their type of chemical reaction and prepare a demonstration or experiment on the topic. Encourage students to explore topics that are relevant to their lives and impact society in some way (such as waste management, fireworks, and so forth). Students can use the University of Nebraska-Lincoln* Web site for interesting and safe microscaled examples of reaction types. After students deliberate about which example best illustrates a reaction type, have them submit a proposal that includes the following:

- Description of the microscale demonstration
- Rationale for the choice
- Preparation and material requirements
- Detailed procedures, including safety measures
- Citations

Provide work time for groups to proceed with implementation of their lab demonstration and to create their slideshow presentations. When the demonstrations are perfected, have students use a still or video camera to capture important parts of the process to hyperlink to their presentations.

### Session 10: Teach Others

Have students share their presentations. Presentations should last from 5 to 10 minutes with another 5 minutes reserved for fielding questions from the group. Assess students as they present their projects using the slideshow rubric.

### Session 11: Prove It

In preparation for assessment, students can learn more and hone their skills at this Five Reactions Practice* Web site. Ask students to write answers to the following questions, which were posed at the start of this unit of study:

- *What is a chemical reaction?*
- *How does chemical change occur?*
- *How can you tell if a change is chemical or physical?*

Administer the reaction quiz to test students' skills in recognizing reaction patterns and predicting the products of a chemical reaction. A key is provided.

Note: The unit Composting: Why Bother? is a good companion to this unit in which to explore chemical reactions as they pertain to society's waste management procedures.

## Prerequisite Skills

- Prior science courses involving discrete experiments

## Differentiated Instruction

### Special Needs Student

- Design specific slideshow templates
- Monitor progress with additional check-in dates and custom forms
- Select a reaction type that best fits the student's level
- Select specific Web sites for research
- Give the student extra time and individual instruction
- Shorten lab assignments
- Accept help from support personnel or volunteers
- Reduce the number of concepts needed to master
- Pair the student with a buddy

### Gifted/Talented Student

- Require the student to give more reaction type examples and compounds with formulas
- Require the presentation to be more in-depth and use additional technology
- Have the student study an independent topic or perform more complex experiments on a reaction type
- Have the student be a "director" or "producer" of the final DVD that compiles and edits all presentations into one format

### Nonnative Speaker

- Provide a slideshow template, example slideshow, and modified lab directions

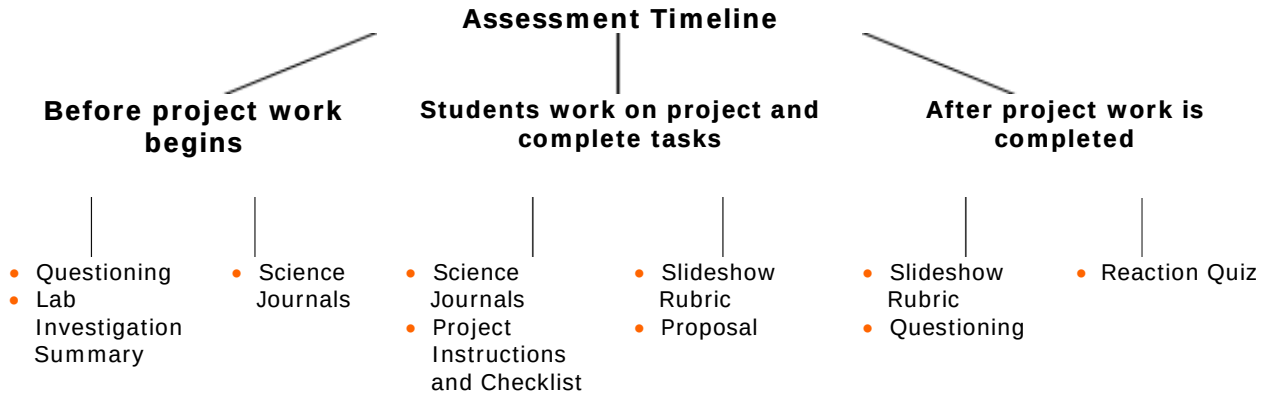
- Provide a first-language periodic table of the elements from the Internet
- Provide electronic translation devices
- Provide English/first language translation dictionaries
- Allow the student to study science concepts with an ESL assistant during supplemental instruction outside of class
- Pair the student with others during project work when the language load indicates a need, but require the student to complete visual parts of the project independently
- Allow the student to prepare materials in the student's first language and have it translated later

## Credits

Teresa Kelley participated in the Intel® Teach Program, which resulted in this idea for a classroom project. A team of teachers expanded the plan into the example you see here.

### THINGS YOU NEED (highlight box)

### Assessment Plan




Questioning is used at the beginning of the unit to assess prior knowledge as well as throughout to promote discussion and encourage higher-order thinking skills. The lab investigation summary sheet allows the teacher to assess understanding and interpretations of the concepts of the microscale investigations. Students keep science journals throughout the unit to document the scientific process for the investigations and to reflect on their work throughout the project. The teacher periodically checks the journals to ensure that students are on track and are developing their scientific inquiry skills. The project instructions and checklist provide guidelines for students as they develop their project and allow students to self-monitor their progress throughout the project. The slideshow rubric is used to self-assess the slideshows as well as for final assessment at the end of the project. During project work, students develop a proposal that assists in planning and setting a direction for their projects. After project work is complete, a final quiz assesses students' new knowledge and content understanding.

## Targeted Content Standards and Benchmarks

## Texas Essential Knowledge and Skills for Science

Knowledge and skills.

(1) Scientific processes. The student is expected to:

(A) demonstrate safe practices during field and laboratory investigations; and

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) Scientific processes. The student uses scientific methods during field and laboratory investigations. The student is expected to:

(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(B) collect data and make measurements with precision;

(C) express and manipulate chemical quantities using scientific conventions and mathematical procedures such as dimensional analysis, scientific notation, and significant figures;

(D) organize, analyze, evaluate, make inferences, and predict trends from data; and

(E) communicate valid conclusions.

(4) Science concepts. The student knows the characteristics of matter. The student is expected to:

(A) differentiate between physical and chemical properties of matter;

(B) analyze examples of solids, liquids, and gases to determine their compressibility, structure, motion of particles, shape, and volume;

(C) investigate and identify properties of mixtures and pure substances; and

(D) describe the physical and chemical characteristics of an element using the periodic table and make inferences about its chemical behavior.

(5) Science concepts. The student knows that energy transformations occur during physical or chemical changes in matter. The student is expected to:

(A) identify changes in matter, determine the nature of the change, and examine the forms of energy involved;

(B) identify and measure energy transformations and exchanges involved in chemical reactions; and

(C) measure the effects of the gain or loss of heat energy on the properties of solids, liquids, and gases.

(11) Science concepts. The student knows that balanced chemical equations are used to interpret and describe the interactions of matter. The student is expected to:

(A) identify common elements and compounds using scientific nomenclature;

(B) demonstrate the use of symbols, formulas, and equations in describing interactions of matter such as chemical and nuclear reactions; and

(C) explain and balance chemical and nuclear equations using number of atoms, masses, and charge.

## Student Objectives

Students will be able to:

- Recognize the components of a chemical reaction
- Analyze the products formed by a reaction
- Predict the products formed by a set of reactants

- Conduct laboratory investigations to develop and evaluate understanding of reaction types

## **Materials and Resources**:

### Printed Materials

- Ehrenkranz, D., and Mauch, J. J. (1993). *Chemistry in microscale: A set of microscale laboratory experiments with teacher guides, second edition*. Dubuque, IA: Kendall/Hunt Publishing Company.
- Waterman, E. L., and Thompson, S. (1995). *Small-scale chemistry laboratory manual: Teacher's edition*. Menlo Park, CA: Addison-Wesley Publishing Company.

### Supplies

- Microscale well plates
- Goggles
- Lab aprons
- Chemicals for microscale labs (appropriate for high school classrooms)
- Microscale thermometers
- Candles
- Appropriate chemical waste containers (do not put down the drain)
- Deionized or distilled water

### Internet Resources

- Lycée Faidherbe LILLE
  www.faidherbe.org/site/cours/dupuis/oscil.htm*
  Animation of oscillating reactions and other links and graphic explanations
- University of Nebraska—Lincoln
  http://dwb.unl.edu/Chemistry/MicroScale/MScale00.html*
  Series of links to microscale chemistry demonstrations
- Chemistry Based
  www.shsu.edu/~chm_tgc/sounds/sound.html*
  Library of instructional QuickTime videos
- University of Wisconsin
  http://genchem.chem.wisc.edu/demonstrations/Gen_Chem_Pages/04chemrxnpage/chemicalreactions.htm*
  High-level information pertaining to chemical reactions
- Nova
  www.pbs.org/wgbh/nova/kaboom*
  Visually stimulating site about the chemical reactions taking place in fireworks
- SciLinks
  www.chem.vt.edu/RVGS/ACT/notes/Types_of_Equations.html*
  Simple-to-understand site about balancing equations
- Chemistry ThinkQuest
  http://library.thinkquest.org/10429/text/balequa/balequa.htm*
  Easy-to-use site about balancing equations
- Dr. R. Rinehart
  www.mpcfaculty.net/ron_rinehart/1B/oscillat.htm*
  Explanation of how to conduct an oscillating clock reaction demonstration
- TrackStar
  http://trackstar.4teachers.org/trackstar/ts/viewTrack.do?number=191665*

Tutorial about chemical reactions and a self-assessment; just one of 51 resources made by teachers from TrackStar on the topic of chemical reactions

### Technology—Hardware

- Digital camera(s) to take pictures during experiments on reaction types included in presentations
- CD/DVD burner and player for final education instructional video for mock cable channel
- Computer to create documents for presentations and conduct research on the Internet
- Printer to print documents so they can be proofread and communicated to group members
- Projection system for instructional use during lessons that require discussing certain Web sites
- Scanner to scan documents and experiment information for group presentation
- Video camera for taping experiments and demonstrations to link to presentation on reaction type

### Technology—Software

- Camera or video image manipulation to process images for presentation
- Desktop publishing to create documents for presentations explaining experiments and demonstrations
- Encyclopedia on CD-ROM to research new vocabulary words and concepts
- Image processing to download videos and images from the Internet and/or presentations
- Internet Web browser to access the Internet for teacher lessons and for student research
- Multimedia for production of presentations and final DVD for mock cable company
- Web page editor as an option for students to use instead of multimedia slideshows
- Word processing to create documents for presentations