**Lesson Plan: Lecture 6**

**Stoichiometry and Reactions**

**Description**

In this lecture, students will continue to build their chemistry fundamentals. They will practice balancing equations and different types of chemical reactions. Finally, they will learn about biomimicry – an inspiration from nature to build new molecules and products.

**Prior to Lecture**

Required Readings:

* Anastas, Paul T.; Warner, John C.; “Green Chemistry: Theory and Practice”; Oxford University Press: Oxford, 1998, Chapter 7.

Optional/Supplemental Readings:

* Readings from Instructors Chemistry textbook are encouraged. The majority of the content found in this lecture is readily available in all chemistry textbooks, so we highly recommend that the instructor assign the textbook they are most familiar with teaching. The addition of more PowerPoint slides to the lecture is also encouraged.

Videos:

* [Balancing Equations Part 1](https://www.khanacademy.org/science/chemistry/chemical-reactions-stoichiome/balancing-chemical-equations/v/balancing-chemical-equations-introduction)
* [Balancing Equations Part 2](https://www.khanacademy.org/science/chemistry/chemical-reactions-stoichiome/balancing-chemical-equations/v/balancing-chemical-equation-with-substitution)
* [Balancing Equations Part 3](https://www.khanacademy.org/science/chemistry/chemical-reactions-stoichiome/balancing-chemical-equations/v/visually-understanding-balancing-chemical-equations)
* [Stoichiometry Example](https://www.youtube.com/watch?v=UL5k7_G0l_A&feature=youtu.be)
* [Types of Reactions](https://www.youtube.com/watch?v=eWQO3aTgFDg&feature=youtu.be)

**Topics to Cover in Lecture**

* Molecular Weight
  + What is it and how to calculate MW of molecules/compounds.
* Avogadro’s Number
  + Why it’s important.
  + Explain to students its importance for stoichiometry and other applications.
* Molar Mass
  + What is it?
  + Its applications in conversions.
  + Ensure students are comfortable with the topic since it will be required for more detailed calculations.
* Balancing Equations
* Stoichiometry and Calculations
* Reactions
  + Addition, elimination, replacement, and combustion.
  + Examples of organic named reactions.
* Lab vs. Nature
  + Explain how nature performs chemistry too. Discuss the ways nature performs chemistry and how Green Chemistry is striving to imitate nature.
* Green Chemistry Perspective
  + Discuss how Green Chemistry is changing the way reactions are performed.
  + Solvents, reagents, novel reactors.
  + Biomimicry.

**Class Exercise (optional exercises and labs):**

*Beyond Benign Reactions Lab*

Distinguishes between single replacement, double displacement, composition, and decomposition reactions. This class exercise discusses types of reactions and replaces traditional reactions involving chemicals such as lead (II) nitrate, barium chloride, and silver nitrate. This lab is designed to challenge students to identify types of chemical reactions and distinguish between those that use safer, less hazardous chemicals and those that are more dangerous. Students will make a choice as to which reaction they will perform using the 12 Principles of Green Chemistry. Students will ultimately learn the difference between composition, decomposition, single displacement, and double displacement reactions.

Download the lab directly from Beyond Benign here: <https://www.beyondbenign.org/lessons/reactions-lab/>

*Biomimicry Matching Game*

Students are introduced to biomimicry, an approach to innovation that derives inspiration from nature, through examples of technologies inspired by nature. Students are challenges to match the technology with the biological organism or phenomenon from which it was inspired.

Download the activity and image cards directly from Beyond Benign here: <https://www.beyondbenign.org/lessons/introduction-green-chemistry-biomimicry/>

*Stoichiometry Challenge*

This lab replaces a traditional aluminum to alum stoichiometry lab with a greener precipitation reaction of sodium carbonate and calcium chloride. It is used to demonstrate how stoichiometry works, showing that if concentrations and amounts of the starting materials are known that the theoretical yield can be calculated from a balanced chemical equation.

Download the lab directly from Beyond Benign here: <https://www.beyondbenign.org/lessons/stoichiometry-challenge/>

**Supplementary Materials**

* Brief Intro to Green Chemistry and Biomimicry
* Biomimicry Activity
* Empirical Formula
  + Available for download from Beyond Benign here: <https://www.beyondbenign.org/lessons/empirical-formula/>
* Vitamin C Clock Reaction
  + Available for download from Beyond Benign here: <https://www.beyondbenign.org/lessons/case-study-vitamin-c-clock-reaction/>