



Classroom Teacher Preparation

Chemistry 5: Acids and Bases

Please use the following to prepare for the next SfS lesson.

Description:

In this lesson, students determine the pH values of acids and bases using common household liquids, a universal acid-base indicator from red cabbage juice, and pH strips. Students then investigate what happens when they add an acid and/or a base to a solution and learn about a chemical reaction between acids and bases. Long classes also discuss why certain solutions resist a pH change.

Lesson Objectives – SWBAT (“Students Will Be Able To...”):

5th-8th

- Distinguish between acids and bases by using an acid-base indicator
- Define the pH range for acids and bases

Disciplinary Core Idea (DCI)

PS1 Matter and Its Interactions - PS1.A Structure of Matter

- (3rd-5th) Because matter exists as particles that are too small to see, matter is always conserved even if it seems to disappear. Measurements of a variety of observable properties can be used to identify particular materials.
- (6th-8th) The fact that matter is composed of atoms and molecules can be used to explain the properties of substances, diversity of materials, states of matter, phase changes, and conservation of matter.

PS1 Matter and Its Interactions - PS1.B Chemical Reactions

- (3rd-5th) Chemical reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.
- (6th-8th) Reacting substances rearrange to form different molecules, but the number of atoms is conserved. Some reactions release energy and others absorb energy.

Science & Engineering Practice (SEP)

Analyzing and Interpreting Data

- (3rd-5th) Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.
- (6th-8th) Analyze and interpret data to provide evidence for phenomena.

Crosscutting Concept (CCC)

Energy and Matter: Flows, Cycles, and Conservation

- (3rd-5th) Matter is made of particles.
- (6th-8th) Matter is conserved because atoms are conserved in physical and chemical processes.



Preparation:

Prior to this lesson, students should know that all matter is made of atoms (and that groups of atoms are called molecules), and that charged atoms and molecules are called ions. In addition, students should understand what a solution is.

Room Set Up for Activities:

Students will work in pairs or groups of 3 to test the pH of various household compounds. Access to a sink would be very helpful for getting the water and for disposing of the used solutions. The instructors will also need a flat surface to prepare fresh solutions and sets of materials for the groups.

Safety:

Ammonia is corrosive and has a strong odor; students should not get it on their skin or inhale the fumes. Students will be wearing safety goggles and gloves at all times and ammonia solution will be diluted for the experiment to reduce the risks.

Related Modules:

This lesson may be taught as part of a sequence or group of related modules on **Chemistry**. Other modules in this sequence include:

Chemistry 2: Chemical Identification - Students investigate the physical and chemical properties of six similar-looking—but chemically different—substances, and use these observations to attempt to identify the substances.

Chemistry 3: Polymer Investigation - Students create cross-linked polymers and investigate their polymer's behavior.

Chemistry 10: Vitamin C Experiment - Students predict and then measure the amount of vitamin C in selected drinks by counting the number of drops needed for a color change of an indicator solution (a titration).

For other module sequences and groups, look here: www.sciencefromscientists.org/sequences

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state: www.sciencefromscientists.org/standards/

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson by using cabbage juice to dye hard-boiled eggs and to determine the pH of an egg shell.

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

- Colorful Chemistry of Acids and Bases (video, 11:25): <https://www.youtube.com/watch?v=Ko5iDMYzwWE>
- Sci Guys: Acid-Base Indicators (video, 6:22): <https://www.youtube.com/watch?v=l18K2upEHLc>
- Neutralization Reaction - How to treat a bee sting? (video, 3:35): <https://www.youtube.com/watch?v=rznlgkRcZZE>

