



## Classroom Teacher Preparation

### Chemistry 5: Introduction to Acids and Bases

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

#### Description:

In this lesson, students will be introduced to the Arrhenius theory of acids and bases (acids dissociate into  $H^+$  and bases into  $OH^-$ ). They will learn that pH gives us a measure of the concentration of  $H^+$  in solution, and they will use a universal indicator and pH strips to test the pH of various common household liquids.

**Note:** The background information provided by this lesson is largely the same as the background info in C06: Acid-Base Titration, but the activity in this lesson aimed at 4<sup>th</sup>-6<sup>th</sup> grade students.

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

3<sup>rd</sup>-6<sup>th</sup>

- The pH scale runs from 0-14 and is a measure of the acidity or basicity of a solution
- Water, with a pH of 7, is neutral
- Acids have a  $pH < 7$  and bases have a  $pH > 7$
- Many common liquids are either acidic or basic

#### Preparation:

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

#### Vocabulary:

Introduce these terms:

- Molecule – a group of atoms chemically bonded together as a compound ( $H_2O$ ) or in elemental form ( $O_2$ )
- Ion – a charged atom or molecule
- Solution – a liquid mixture in which a compound is dissolved and uniformly distributed

These terms will be defined in lesson:

- Acid – a chemical compound which, in water, dissociates (splits) into  $H^+$  and another ion
- Base – a chemical compound which, in water, dissociates (splits) into  $OH^-$  and another ion
- Concentration – the number of molecules per volume of solution of a given compound
- pH – a scale from 0 to 14 which is used to describe how acidic or basic a solution is
- pH indicator – a compound which changes color depending on the pH of the solution
- Neutralize – to bring the pH of a solution to 7.0

#### 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.

## 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 4: Separation of Substances* - Students design and implement a multi-step purification process for a mixture of rice, sand, and iron.

For other module sequences and groups, look here: [www.sciencefromscientists.org/sequences](http://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:

<http://www.sciencefromscientists.org/standards/>

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

## Classroom Post and Activities:

A link to the Follow Up Student activity can be found in the Classroom Post on our website at [sciencefromscientists.org/cohorts](http://sciencefromscientists.org/cohorts). Use the name of your school/cohort and password to log in. *The activity uses red cabbage juice to dye hard-boiled eggs blue.*

## Additional Resources:

- PBS Kids Kitchen Chemistry Virtual Experiments: <http://pbskids.org/zoom/games/kitchenchemistry/virtual-start.html>
- Sci Guys: Acid-Base Indicators (video, 6:22): <https://www.youtube.com/watch?v=I18K2upEHLc>
- SciShow, “Acid, Poop, and Barf: Vultures' Secret Weapons” (video, 3:47): <https://www.youtube.com/watch?v=ieBhJICxnt8>