



Science Objectives

- Students will observe at the molecular level what makes a substance an acid or a base in water.
- Students will observe at the molecular level the difference between strong and weak acids and bases.

Vocabulary

- acid
- base
- dissociation
- ion
- ionization
- strong acid/base
- weak acid/base

About the Lesson




- This lesson features simulations of a strong acid (HCl), a weak acid (HF), a strong base (NaOH), and a weak base (NH_3) dissolving in water. Students will observe the changes that occur at the molecular level.
- As a result, students will have a better understanding of:
 - What makes a substance an acid or a base.
 - What makes an acid or base strong or weak.

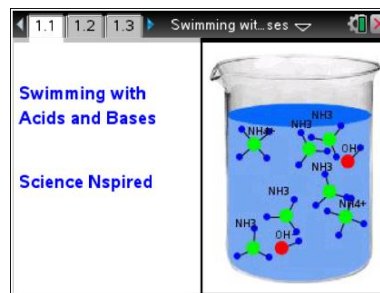


TI-Nspire™ Navigator™

- Send out the *Swimming_with_Acids_and_Bases.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies:  TI-Nspire™ CX Handhelds,  TI-Nspire™ Apps for iPad®,  TI-Nspire™ Software



Tech Tips:

- This activity includes class captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

Lesson Files:

Student Activity

- *Swimming_with_Acids_and_Bases_Student.doc*
- *Swimming_with_Acids_and_Bases_Student.pdf*

TI-Nspire document

- *Swimming_with_Acids_and_Bases.tns*



Discussion Points and Possible Answers



TI-Nspire Navigator Opportunities

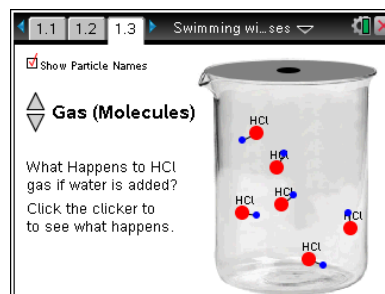
TI-Nspire Navigator can be used to make screen shots to follow student progress. A visual check can be made to see which students are successful and which are struggling.

Use Quick Poll on any page with a question to check for understanding during the course of the activity. For students using iPad or those teachers without the TI-Nspire Navigator, the questions are set up in in Self-Check. Teachers with TI-Nspire Navigator should change questions to Exam mode for assessment and to discuss using the Review Workspace after the file is collected. On any question page select the Teacher Tool Palette. Then select Question Properties. Change the Document Type from Self-Check to Exam. Then send the file to the students.

Allow students to read the background information on the student activity sheet.

Move to pages 1.2 and 1.3.

1. Have students read the instructions on page 1.2 for controlling the simulation on page 1.3. The up and down arrows at the top left controls the addition (and removal) of water.



Move to page 1.4.

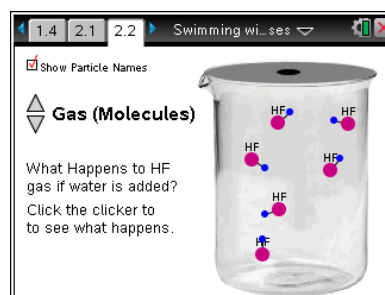
Have students answer question 1 on the handheld, the activity sheet, or both.

- Q1. When added to water, gaseous HCl _____.

Answer: D. completely ionizes into H^+ and Cl^- ions

Move to pages 2.1 and 2.2.

2. Have students run the second simulation with gaseous HF.





Move to page 2.3.

Have students answer question 2 on the handheld, the activity sheet, or both.

Q2. When added to water, gaseous HF _____.

Answer: C. partially ionizes into H^+ and F^- ions

Move to pages 3.1 and 3.2.

3. Have students run the third simulation with solid NaOH.

Move to page 3.3.

Have students answer question 3 on the handheld, the activity sheet, or both.

Q3. When added to water, solid NaOH _____.

Answer: D. completely ionizes into Na^+ and OH^- ions

Move to pages 4.1 and 4.2.

4. Have students run the fourth simulation with gaseous NH_3 .

Move to page 4.3.

Have students answer question 4 on either the handheld, on the activity sheet, or both.

Q4. When added to water, gaseous NH_3 _____.

Answer: C. partially ionizes into NH_4^+ and OH^- ions

Move to pages 5.1 – 5.4.

Have students answer questions 5 - 8 on either the handheld, on the activity sheet, or both.

Q5. HCl and HF are acids because they _____ in water.

Answer: A. produce H^+ ions



Q6. NaOH and NH_3 are bases because they _____ in water.

Answer: B. produce OH^- ions

Q7. HCl and NaOH are “strong” because they _____ in water.

Answer: D. completely ionize

Q8. HF and NH_3 are “weak” because they _____ in water.

Answer: C. partially ionize



TI-Nspire Navigator Opportunities

Make a student a Live Presenter and have the student demonstrate for the whole class each of the simulations. Ask the students what they see. Point out that the gas molecules move throughout the volume, whereas the solid, NaOH, does not. In both cases, however, the ions move throughout the water. They should also see that with a weak acid or a weak base only a very small number of molecules dissociate. Those few numbers of H^+ or OH^- ions still make the solution acidic or basic. If students answer the questions within the .tns file, the files can be collected at the end of class and graded electronically and added to the Portfolio.

Wrap Up

When students are finished with the activity, retrieve the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Review Workspace.

Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved by TI-Nspire Navigator. The TI-Nspire Navigator Review Workspace can be utilized to give students immediate feedback on their assessment.
- Summative assessment will consist of questions/problems on the chapter test, inquiry project, performance assessment, or an application/elaborate activity.