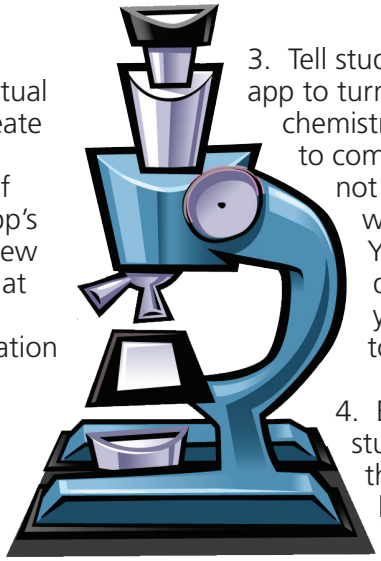
VIRTUAL CHEMISTRY

Teacher's Guide

This activity builds on the free *goREACT* app developed by the Museum of Science and Industry, Chicago, which is available in the Science section of **STEM Mobile Labs**.



goREACT allows students to explore the Periodic Table of elements and conduct virtual experiments by combining elements to create different compounds. Students can touch any element to learn its name and some of its properties and uses. By touching the app's menu icon, they can choose a Standard View of the Periodic Table or an Atomic View that shows the atomic mass of each element. Students can also learn about the organization of the Periodic Table by selecting Help + Information in the menu, then touching the contents icon and selecting The Periodic Table.

To create their own compounds, students double-tap elements to place them in the app's Reaction Area, where the elements can form any of nearly 300 compounds. In most cases, when they place an element in the Reaction Area, the app will guide them through choices that yield one of these pre-loaded compounds, and then explain how the compound is used with a photo or video. Students can also select Featured Reactions in the menu and explore compounds important for personal care products, household products, automobiles, the environment, and technology.

1. Begin by distributing copies of the activity sheet to your students. If they have not installed **STEM Mobile Labs** already, have them scan the QR code on the sheet or use their app store's search feature to download and install **STEM Mobile Labs** onto a smartphone or tablet.

2. Have students open the Science section of **STEM Mobile Labs** and take a moment to review the free apps listed there. (Note: The selection of apps is slightly different for Apple and Android devices.) Discuss how these apps offer a hands-on approach to learning different branches of science by turning a mobile device into an observatory, a seismograph, a field research tool, etc.

3. Tell students that they will be using the *goREACT* app to turn their mobile devices into virtual chemistry labs. Divide students into small groups to complete the activity, grouping those who do not have a smartphone or tablet with those who do, so that everyone can participate. You should also ask students about their data plans and have them use the app on your school's Wi-Fi network, if necessary, to avoid unexpected charges.

4. Explain how the app works and help students become familiar with it by having them create some simple compounds they know already, such as sodium chloride (NaCl), carbon monoxide (CO), and carbon dioxide (CO_2). Then have students experiment to create compounds using five of the most common elements on Earth and five more compounds using any elements they wish. Direct students to record the results of their experiments on the activity sheet, since the app does not store these results.

5. When they have completed the activity, have students share their discoveries in a class discussion. Compare notes to find out which elements students used most often in creating compounds, and discuss why these elements play a leading part in chemical reactions. Then have students work independently to research and report on one of the compounds created by their group, using the Wikipedia Dictionary of Chemical Formulas at http://en.wikipedia.org/wiki/Dictionary_of_chemical_formulas.

6. To extend the learning, you and your students can explore other examples of how mobile technology is providing new ways to learn science and new tools for scientific research. For a start, try searching "citizen science" at your device's app store to discover some of the many ways wireless technology is being used to collect scientific data from around the world.

VIRTUAL CHEMISTRY

Reproducible Master

Scientists used to need formal laboratories to conduct experiments. Now, with mobile technology, anyone can conduct experiments and collect data with a smartphone or tablet, and share their discoveries with scientists around the world.

PART ONE Download **STEM Mobile Labs** to your mobile device using the QR code on this activity sheet or the search feature at your app store. Touch the Science door on the **STEM Mobile Labs** homescreen to explore some of the best free apps available for learning about different branches of science. Talk about how these apps turn a smartphone or tablet into a scientific tool, allowing you to explore space, track earthquakes, and even send data to marine biologists working to protect our oceans.

PART TWO Now use **STEM Mobile Labs** to download the free *goREACT* app, which allows you to conduct virtual chemistry experiments on a smartphone or tablet by combining elements from the Periodic Table to create different compounds.

- Begin by creating some compounds you probably know already, such as sodium chloride (NaCl), carbon monoxide (CO), and carbon dioxide (CO_2). You will find that the app tells you the name of the compound and something about it. You will also see that the app sometimes gives you clues about which element to add next. These clues will guide you to one of the nearly 300 compounds in the app's database, but you can try any combination of elements you want.

First Element	Elements Added	Compound	How It's Used/What It Does
Nitrogen			
Oxygen			
Hydrogen			
Carbon			
Iron			

- Experiment with the *goREACT* virtual laboratory by creating ten different chemical compounds. Start with compounds based on five of the most common elements on Earth — nitrogen, oxygen, hydrogen, carbon, and iron — then create five more compounds using different elements. Record the results of your experiments in the chart, then share your results in a class discussion. Compare notes to find out which elements you and your classmates used most often to create compounds. Why do these elements seem to play a leading part in chemical reactions?

PART THREE Find out more about one of the compounds your group created with the *goREACT* app.

Use your mobile device web browser or a computer to look up the compound at the Wikipedia Dictionary of Chemical Formulas (http://en.wikipedia.org/wiki/Dictionary_of_ chemical_formulas). Prepare a short oral report on the compound you selected — its history, properties, and uses.

NOTE: Standard data rates apply. If necessary, download and use these apps on a Wi-Fi network to avoid unexpected charges.

The Wireless Foundation

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