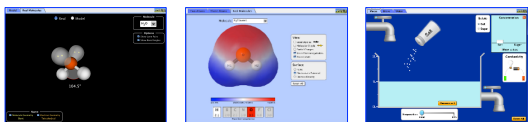


Using PhET Simulations for Chemistry Inquiry: Free research-based resources on the web



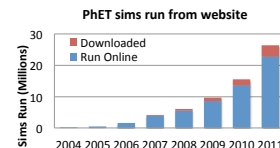
Julia Chamberlain and the PhET Team
phet.colorado.edu

Colorado Science Conference
Denver, CO - November 16, 2012

Overview



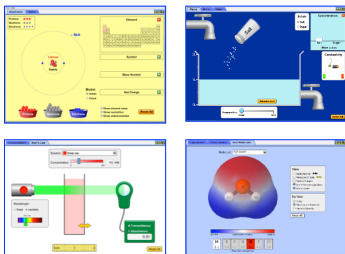
- New Chemistry Sims
 - Designed and researched to support productive inquiry
- Activities on the web for you to use – right away!
- PhET is *free* and here to stay
 - Growing user base
 - Funding for chemistry



What is PhET?



Suite of **120** interactive science sims – **38** in chemistry!



Your Turn



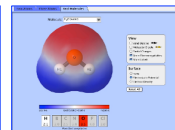
- How could you use PhET sims with your students?



Build an Atom



Molecule Polarity



Sugar and Salt Solutions



Broad Objectives



Accessible, Understandable, and Fun

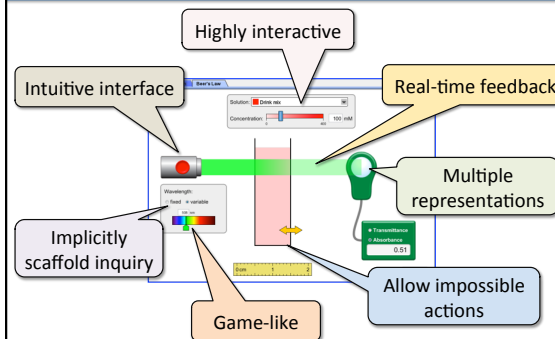
Connections to Everyday Life

Conceptual Learning

Engage in Exploration

Sense of Ownership

Designed to Support Inquiry



Where is PhET?



Use online
or download
(~270 MB)

<http://phet.colorado.edu>

Who is PhET?

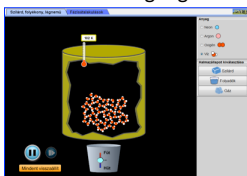


CU Boulder team of scientists, researchers,
programmers and educators

Who uses PhET?

Over **25 million** sims run in 2011, **35%** international!

Sims: 69 languages



Website: 27 languages



For Translators > PhET Translation Utility

How can PhET be free?

National Science Foundation



The Hewlett Foundation



The O'Donnell Foundation



The University of Colorado



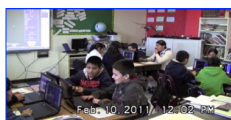
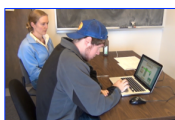
Carl Wieman & Sarah Gilbert



Corporate sponsors, schools, and individuals like you!

Research Based Design

- Extensive design feedback on each sim
 - Student interviews
 - Classroom studies
- Research on many sims shows what works
 - Students intuitively use controls
 - Students correctly interpret representations

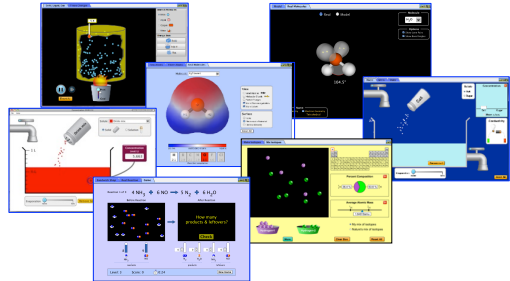


Explore the Sims

- Use the *Planning to Use PhET Sims* handout
 - Record your ideas!
- Need help with learning goals?
 - Check the *Writing Learning Goals* handout

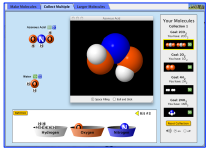


What Did You Find?

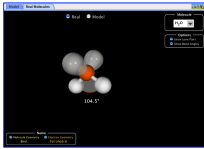


Activity Design

Build a Molecule



Molecule Shapes




What will students be doing and learning?

Tips for Sim Use

- Start with 5-10 minute open play
- Minimize or eliminate “sim-specific directions”
- Use open, investigative questions
- See PhET Guided Inquiry Strategies handout

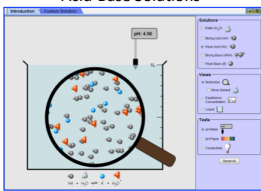
Set the acid concentration to 0.010 M...

Explore all the things that affect pH.



Using PhET Activities in Class

Acid-Base Solutions



Activity A

Select the strong acid solution. Dip the pH meter into the solution and record the pH.

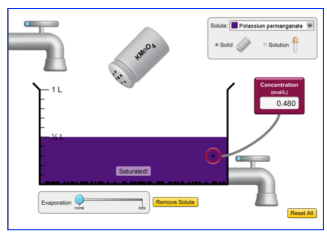
Activity B

Explore the sim with a partner. Investigate all of the factors that affect the pH of a solution.

For Teachers > Activity Submission Guide

Using PhET in a Lecture

How will evaporation affect the concentration?




A. Increase

B. Decrease

C. No change

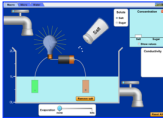
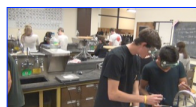
Concentration




Using PhET in Lab

Lab Test the conductivity of salt and sugar in water. Describe how concentration affects the conductivity of both solutions.

Sugar and Salt Solutions

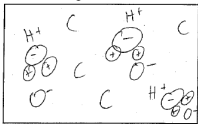



Sim Compare how salt and sugar behave in water. Describe how your observations help you explain the conductivity results.



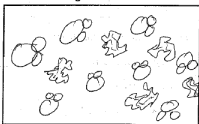
Assessment of PhET

Before Lab



Describe your picture:
Positive ions interacting w/
negative oxygen and negative
ions with positive hydrogen

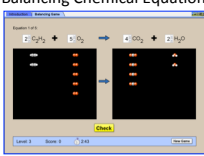
After Lab



Describe your picture:
The sugar stays together
as one molecule

Using PhET in Homework

Balancing Chemical Equations

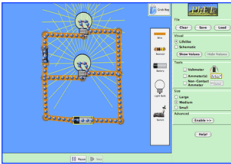


Comments

- Benjamin** Best score per level: 10/10
Some balances I had to think through a little more than others, but all in all not too hard. Made some minor errors on the way but fixed them easily.
Reply - Delete - Sun Apr 17, 2011 at 6:13 pm
- Zsuzsanna** Best score per level: 10/10
The illustrations of the molecules were a lot of help. There were also a lot of repeating patterns in balancing the different equations
Reply - Delete - Sun Apr 17, 2011 at 8:13 pm
- Ryan** Level 3 Best Time: 2:21
Level 3 Best Score: 10/10
It was a good teacher because it was very visual and easy to comprehend.
Reply - Delete - Sun Apr 17, 2011 at 9:01 pm
- Anna** Best score per level: 10/10
I read the pictures below the equations, the visual really helped me organize the balancing. Like Rono said a few took more time than others, but overall it wasn't too bad. I did all three levels twice, but after the first time it was quite easy.
Reply - Delete - Sun Apr 17, 2011 at 9:09 pm
- Kang** Level 3 best time: 2:56 Best score: 10/10
Illustrations made it a lot easier and I made some minor mistakes but was able to correct them.
Reply - Delete - Sun Apr 17, 2011 at 9:13 pm
- Margreger** Best score per level: 10/10
The pictures helped alot. I just kept getting caught with the issue of not simplifying it.
Reply - Delete - Sun Apr 17, 2011 at 9:22 pm
- Dani** Best Score Per Level: 10/10 and time from level 3: 3:48.
The figures were very helpful in trying to balance the equations. Another item that was helpful was the use of the different colors with being easy to identify what when where. After attempting a couple of times it wasn't all that hard.
Reply - Delete - Sun Apr 17, 2011 at 9:27 pm
- Phillip** Level 3 best time: 2:35 best score: 10/10
The different colors/sizes of each atom helps make the application much easier.
Reply - Delete - Sun Apr 17, 2011 at 9:30 pm

Flexible Use

Circuit Construction Kit (CCK)



CCK in grade school:
"What do you need to make the bulb light?"

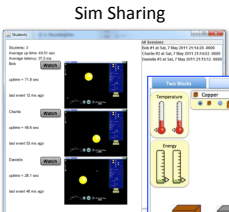
CCK in high school and college:
"Why does the light dim when you turn on the heater?"

More Resources

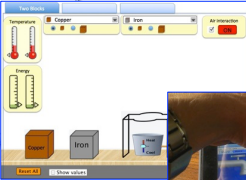
- Activity Design for PhET Simulations
- Helpful handouts (white pages)
 - Sample lesson plan for Sugar and Salts
 - Ideas for Activities from PhET Teaching Ideas
- Activity Database online
- Tips for Teachers for each sim

What's Next for PhET?

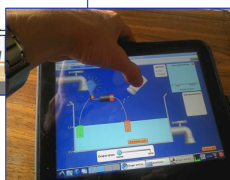
Sim Sharing



New Sims



Sims on Tablets



Thanks for your attention!

- Visit us on the web
 - <http://phet.colorado.edu>
 - Contribute a teaching activity
- Contact us
 - phethelp@colorado.edu
 - Suggest new sim topics
 - Report bugs
- Keep in touch!

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