Where's My Salt?

What Effects do Animations Have on Students' Understanding of the Dissolving of Ionic Compounds?

Available at: www.gvsu.edu/targetinquiry

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Rationale

* Many studies show that several misconceptions exist as students often misinterpret on the macroscopic scale what is happening on the particulate level. Particularly with the dissolving of ionic compounds

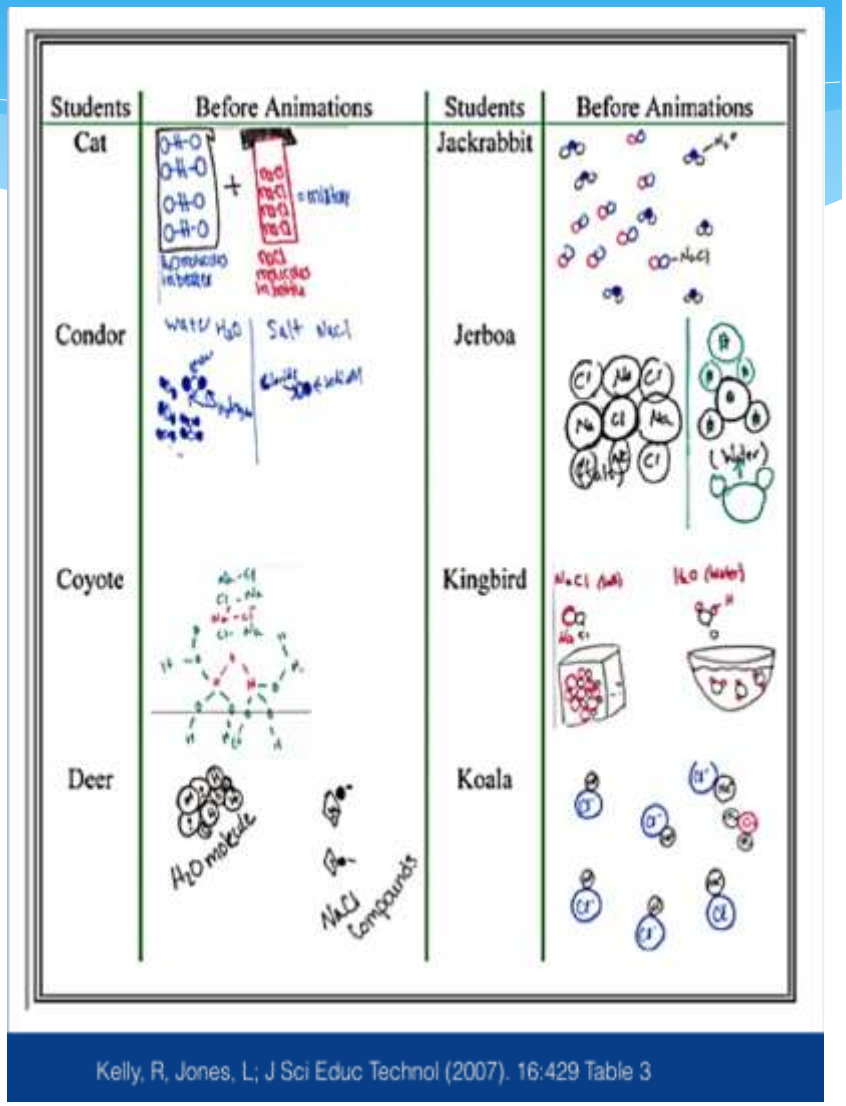
Misconceptions

* When asked, students' believed the name of the atom and ion of the element are the same. (Devetak, Vogrinc, & Glazar, 2009)

* In a study conducted by Kelly and Jones (2007), college students were asked to draw their explanation of the dissolving of sodium chloride in water from macroscopic and particular perspectives.

Misconceptions

- Solid sodium chloride made up of separate linear molecules
- No distinction was made between sodium and chlorine
- Students represented water as separate linear molecules



Kelly, R, Jones, L; J Sci Educ Technol (2007). 16:429 Table 3

Introduction

* By using this guided inquiry activity, the goal is to identify student misconceptions and then use animations to further their understanding of the relationship that exists between the macroscopic and particulate world.

Prelab Engagement Questions

* What do you know about table salt?
    a. What is its chemical name?
    b. What is its chemical formula?
    c. What substances is it composed of?

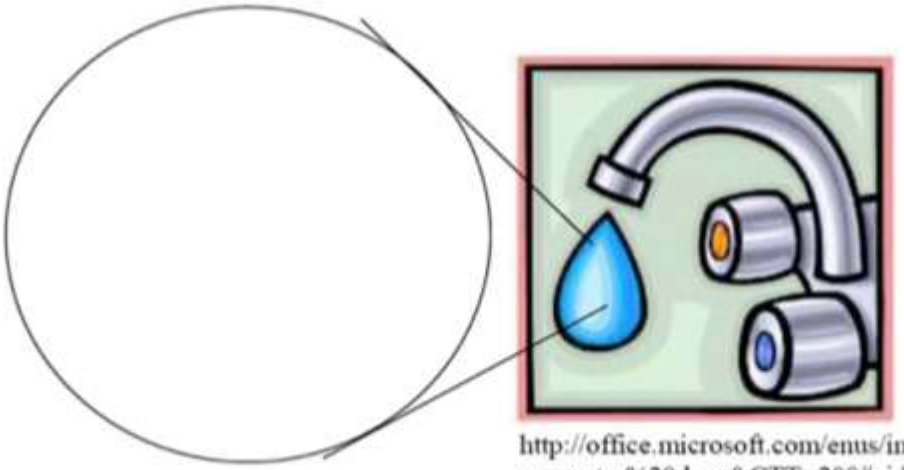
* If table salt is produced from sodium and chlorine,
    a. Why doesn't it burst into flames when sprinkled into water?
    b. Why is it safe to smell?

Predictions

PREDICTIONS

I. Where's my salt?

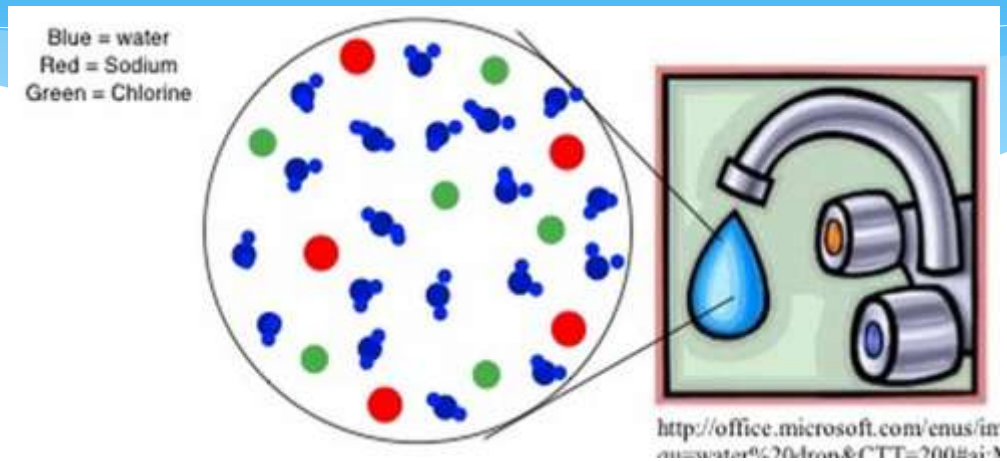
A small crystal of table salt, NaCl, is dissolved in tap water. Pretend you can see what the new salt solution looks like on a particulate level. Draw what you "see" in the diagram below. Be sure to provide a key for your drawing.

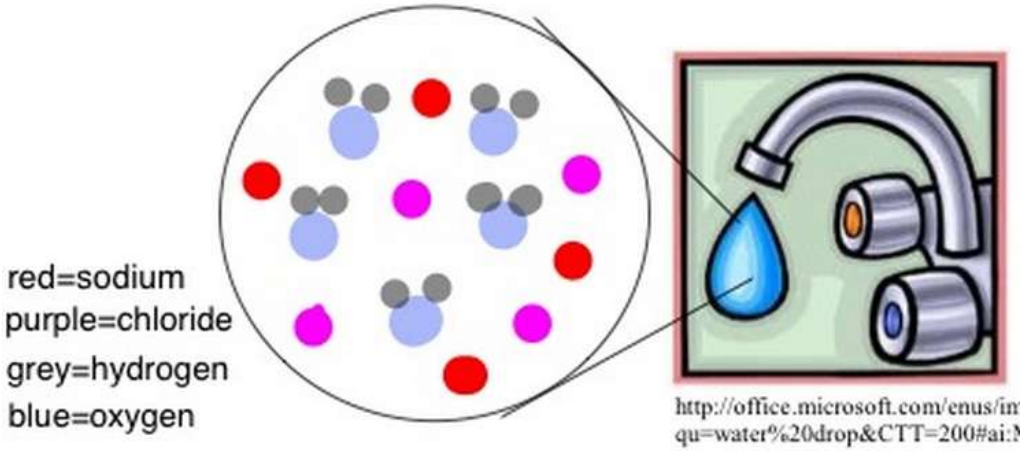


http://office.microsoft.com/enus/images/results.aspx?qu=water%20drop&CTT=200#ai:MC900233110

Prelab Results

- No distinction was made between atoms and ions or hydrogen and oxygen
- An uneven number of ions shown for the 1:1 ratio in NaCl
- No correct orientation showing how water molecules remove the Na ion and the Cl ion were shown





Predictions

* After students made their predictions they are asked to provide a word equation and a balanced chemical equation to explain the dissolving of sodium chloride in water.
* Students are then asked if the dissolving process is a physical or chemical change and if any change is associated with the water molecules in this process

Background Information

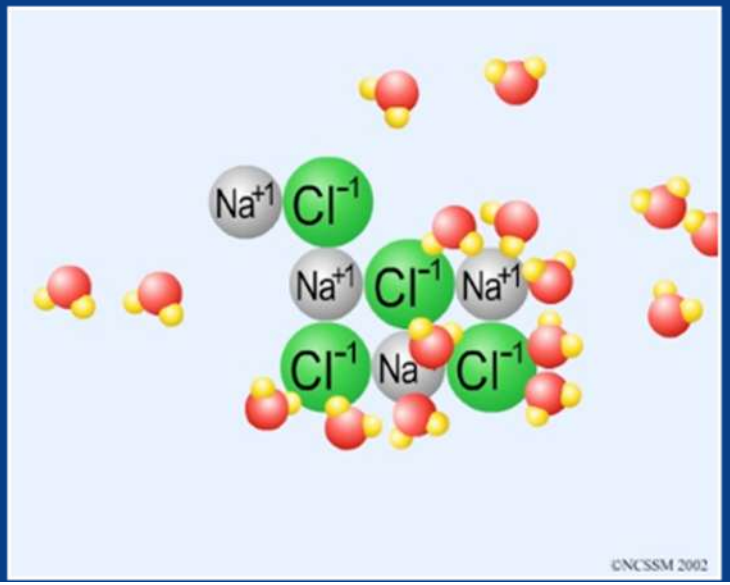
Atom/ion	Charge	Protons	Neutrons	Electrons
$^{23}_{11}Na$	0	11	12	11
Na^+	+1	11		10
$^{35}_{17}Cl$	0	17	18	17
Cl^-	-1	17		18

* In this section students are asked to list the similarities and differences between the atom and its ion as well as the chemical properties of sodium metal and chlorine gas.

The videos:

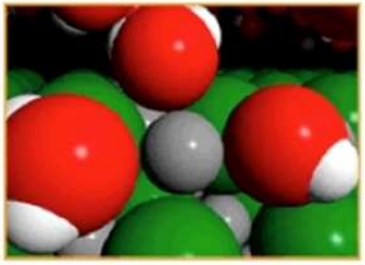
Reaction between Sodium metal and Chlorine
http://chemed.chem.purdue.edu/demos/main_pages/7.1.html (accessed January 2012)

NCSSM (2002). Dissolving NaCl Electrolyte. http://www.dlt.ncssm.edu/tiger/Flash/moles/Dissolving_NaCl-Electrolyte.html (accessed January 2012).



Takser, R. (n.d.) Website for *Chemical Principles 4th Edition*, W.H. Freeman. http://bcs.whfreeman.com/chemicalprinciples4e (accessed January 2012).

Figure 8.15: Are the water molecules oriented differently around the positive and negative ions when sodium chloride dissolves?
NaCl Dissolving



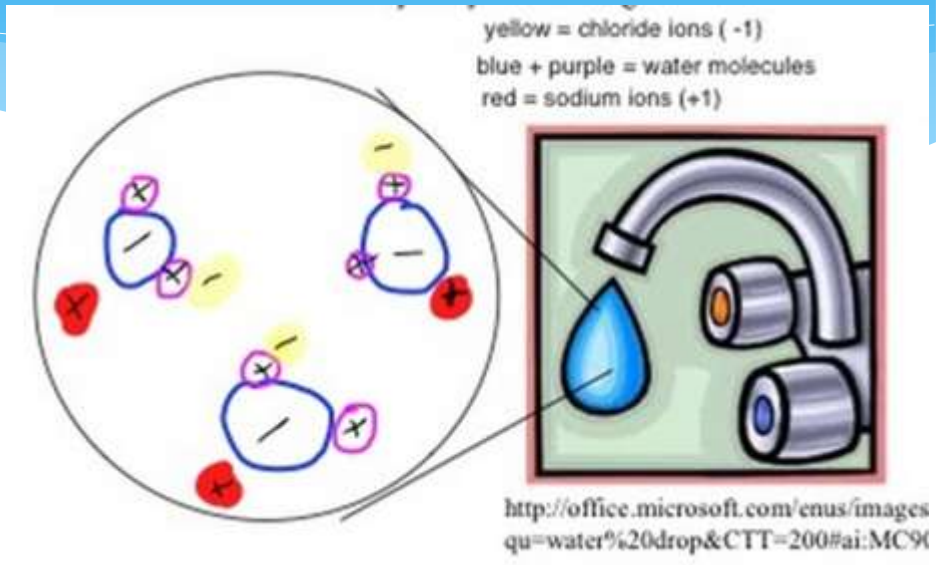
Results

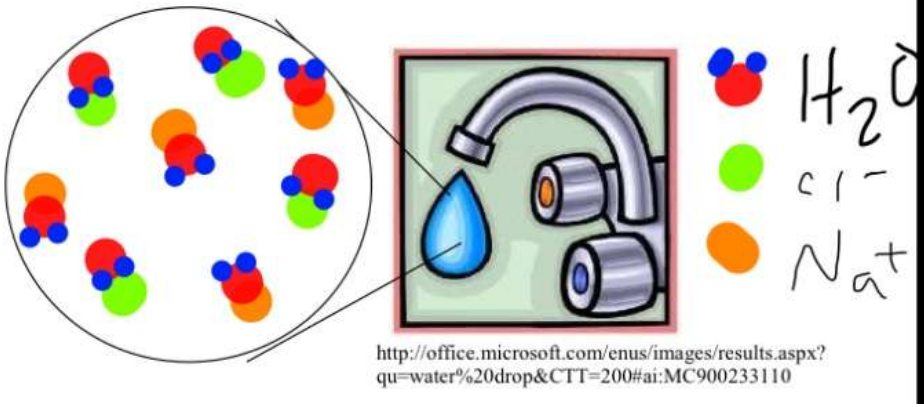
1. Is the NaCl broken up?
2. Are ions shown?
3. Is Na ion vs Na atom shown?
4. Is Cl ion vs Cl atom shown?
5. Is water shown?
6. Are multiple water molecules shown?
7. Is more than 1 water molecule shown bound to Na or Cl atom/ion?
8. Is water orientation shown correctly for Na ion/atom?
9. Is water orientation shown correctly for Cl ion/atom?
10. Is water H-O-H or H_2O?
11. Is the salt shown as a crystal, solid?
12. Are unbound water molecules shown?

Results

Post Video

- 56% students scores increased
- 21% showed no change
- 24% students scores decreased after having watched the videos
- 53% increased by 3 or more points
- N=34 students



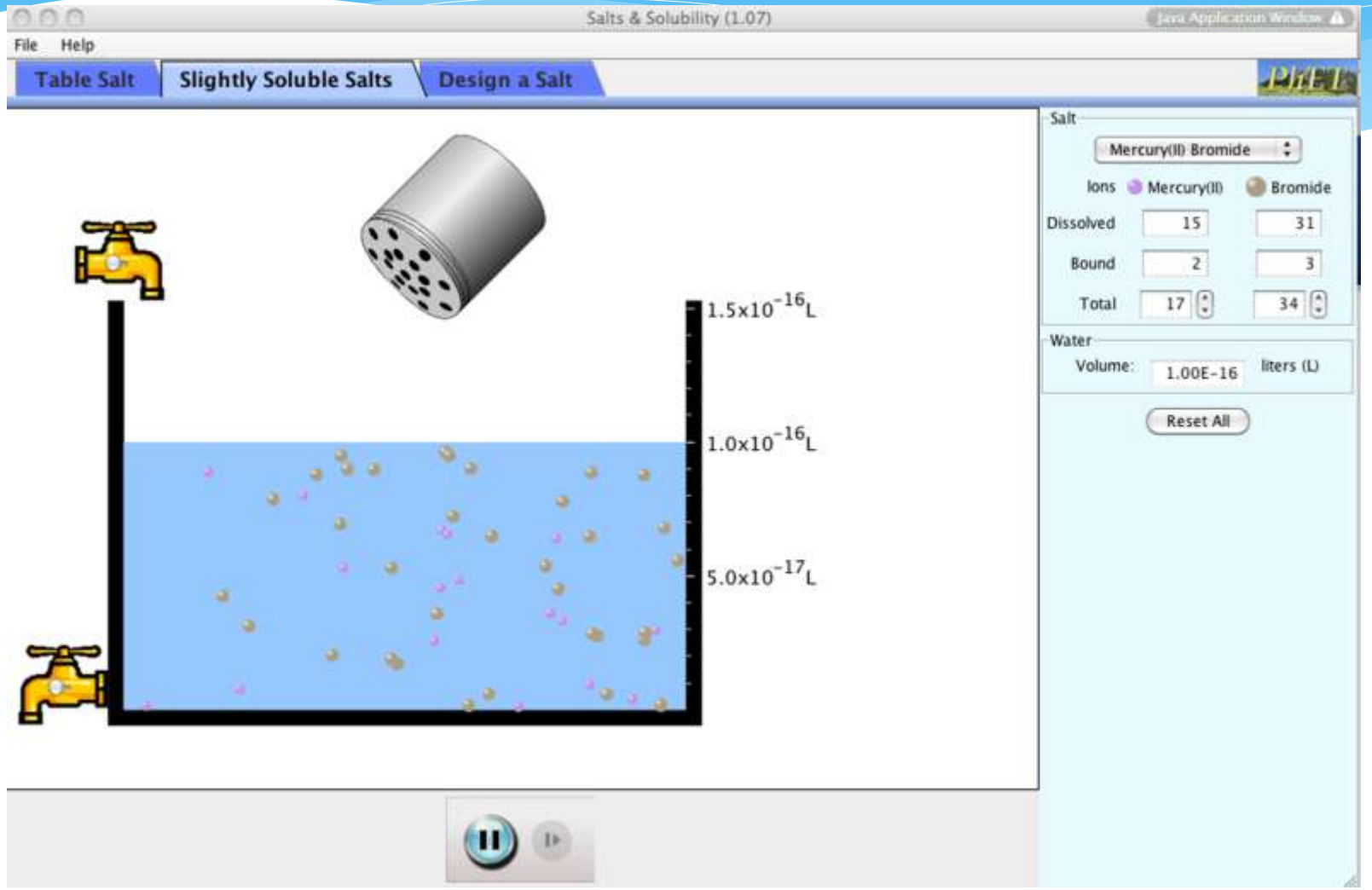


Going Further

* Students are asked to reflect on their prelab pictures and reflect on similarities and differences between the pre and post lab pictures.
* Write a chemical reaction that illustrates what you think will happen at the particulate level when the following ionic compounds dissolve in water
  a. $HgBr_2(s)$
  b. $Th_2S(s)$
  c. $Sr_3(PO_4)_2(s)$
  d. $MgO(s)$
* What are the total number of ions that a, b, d, and d dissociate into respectively?

Interactive Simulations

University of Colorado at Boulder



Acknowledgements

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