Solubility Class Activity: Al DeGennaro

Teacher's Guide

Goals

- To teach students about salt solubility in water
- To encourage all students to participate and to get involved

The Activity

In this activity, students learn about the solubilities of different salts. They use solubility charts to find out which salts will form precipitates in solution. The lesson plan allows students to be involved, either by completing worksheets, or by participating in a contest.

Materials

- $Fe(OH)_3$ saturated solution
- $Zn(NO_3)_2$ clear solution Solubility Worksheet
- Solubility charts.

Solubility Charts

http://www.austin.cc.tx.us/rvsmthsc/chem/chem-Solubili.html

http://www.phys.virginia.edu/education/outreach/8thgradesol/ConservMatterSolubility.htm

SAFETY

Wear goggles at all times when handling chemicals.

Handle solutions with care. Never hold bottle from top.

Lecture Notes

I have a saturated solution of a chemical. I would like to find ways to make it dissolve better: Heat the liquid, add more water to it.

That about covers it, since, if I stir it, will it dissolve better? No. Why not? Because it is already saturated.

Today we are going to talk about solubility and using reference.

I have two solutions here: zinc nitrate, which is completely dissolved, and ferric hydroxide, which does not dissolve very well.

It would be nice if people could know ahead of time if things will dissolve or not.

When you do your experiments with precipitates, you usually need things that can dissolve in water, and if you don't, you should change the experiment.

The other way is to have a chart in which there is a summary of about a hundred solubility tests, which tells you if they can be dissolved or not.

Take a look at the table (see Internet references at top of the page). There are several conditions: insoluble, nearly insoluble, (which means that they might be a little soluble under some conditions), slightly soluble, and soluble. And then, there are these materials which react with water, and for them, you cannot answer this question. And finally are those chemicals that you cannot separate from water by evaporating the water from it.

We are most interested in the soluble and the insoluble salts, and the ones which are between them.

What do all vertical and all horizontal entries in the solubility chart have in common? The ones going up and down make negative ions, and the ones going across make positive ions.

One way you could know about it is by trying out different substances and seeing if they dissolve.

Locate zinc nitrate. Is it soluble? Yes, so it fits what we know from real life. [Try out some more pairs.]

Are there any ions that always form soluble salts? Sodium, acetate, etc.

Are there any that are almost always insoluble?

Go to your lab tables and do your solubility worksheets.

Notice that I have a blank table of solubilities. I am going to give you all answers from memory. If I make a mistake, the person who finds the mistake and corrects it will receive a small prize [offer candy to students who are correct].

Teaching Tips From Mr. DeGennaro

The one thing that dawned on me is that kids don't like when you give them problems, which are essentially: "I know something that you don't know, and if you can't guess it, that's bad." This ought to be something that we are approaching together, and kids are a lot more receptive to that.

They don't mind the fact that you know things that they don't, but they just don't like the idea that I'm trying to trick them, that I'm giving them problems that are hard, and that they will have to come calling me. I don't like to create such a climate.

References: Links

http://dbhs.wvusd.k12.ca.us/Solutions/Solubility-Rules.html
A list of solubility rules similar to those used in video.

References: Readings

Aroti, A., and Leontidis, E. (2001) "Simultaneous Determination of the Ionization Constant and the Solubility of Sparingly Soluble Drug Substances. A Physical Chemistry Experiment," *Journal of Chemical Education,* Vol. 78, No. 6, pp: 786-788.

Raviolo, Andres. (2001) "Assessing Students' Conceptual Understanding of Solubility Equilibrium," *Journal of Chemical Education,* Vol. 78, No. 5, pp: 629-631.

Letcher, T. M., and Battino, R. (2001) "An Introduction to the Understanding of Solubility," *Journal of Chemical Education,* Vol. 78, No. 1, pp:103-121.

Brown, Pamela. (2001) "Understanding Solubility Through Excel Spreadsheets," *Journal of Chemical Education,* Vol. 78, No. 2, pp: 268-270.