

Polarity and Solubility Demonstrations: Dr. Leslie Pierce

Teacher's Guide

Goals

- To teach the basics of polarity and solubility of molecules
- To use different ways of teaching to enhance understanding

The Demonstrations

These demonstrations serve to help students visualize the effect of polarity on mutual solubility of liquids. Different models are used in order to explain these principles.

SAFETY

Wear goggles at all times when handling chemicals.

Materials for Each Group

- A petri dish
- 100 ml water with food coloring
- 100 ml isopropyl alcohol
- Test tube with rubber stopper
- Models:
 - Ball and stick models of water and alcohol
 - A jar with table-tennis balls for describing molecular motion
 - Computer modeling of molecules (on CD or Web)

Demonstration #1

Put some water with food coloring on the overhead projector.

Next to it, put some rubbing alcohol (isopropyl alcohol), so that the liquids are CLOSE TO EACH OTHER but DO NOT MIX. Watch what happens, and try to explain what you see.

1. The liquids reject each other
2. The alcohol evaporates before the water

Lecture Notes

Water is a polar substance?

"Like dissolves like."

Oil is non-polar, so it doesn't dissolve in water.

Alcohol evaporates faster than water so it feels cold.

Why does alcohol evaporate faster?

Watch the molecules in the jar: when they leave the liquid it means that they evaporate.

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Why don't the liquids mix?

Can we get them to mix?

It says on the bottle: 70% isopropyl alcohol. 70% in what?

The liquids do dissolve. If I shake them, they mix, because they are both polar. Their polarity is different, so they don't mix readily.

Demonstration #2

Put some water in a test tube, then put isopropyl alcohol on top.

Watch what happens, and try to explain.

Homework

Draw a ball and stick model of the water and isopropyl alcohol molecules.

You have three ways of approaching this:

1. Draw a dot diagram of the atoms and work it from there.
2. Use actual ball and stick models to draw the molecules.
3. Enter an Internet site where there are models of the molecules, rotate them and study the structure.

Teaching Tips From Dr. Pierce

If we show the kids different representations of the same idea, it will help them learn it.

The students don't see matter the same way the teachers do.

It is all very new. We have to help them construct an image of this.

References: Links

http://www.chem.vt.edu/RVGS/ACT/lab/Experiments/Exp_15-Polarity.html

A lab procedure on solubility and bonding.

<http://www.scienceteacherprogram.org/physics/Flomberg01.html>

A series of demonstrations to extend those shown by Dr. Pierce in the video.

References: Readings

Beall, H. Report on the WPI Conference "Demonstrations as a Teaching Tool in Chemistry: Pro and Con," *Journal of Chemical Education*, Vol. 73, No. 7, p: 641.

Furio, C. and Calatayud, M.L. (1996) "Difficulties With the Geometry and Polarity of Molecules: Beyond Misconceptions," *Journal of Chemical Education*, Vol. 73, No. 1, p: 36.

Sanger, M.J. and Badger II, S.M. (2001) "Using Computer-Based Visualization Strategies to Improve Students' Understanding of Molecular Polarity and Miscibility," *Journal of Chemical Education*, Vol. 78, No. 10, pp: 1412-1416.

Machado, C. (2001) "An Easy and Versatile Experiment to Demonstrate Solvent Polarity Using Solvatochromic Dyes," *Journal of Chemical Education*, Vol. 78, No. 5, pp: 649-651.

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