Like Dissolves Like

To demonstrate that nonpolar solutes are better dissolved in nonpolar liquids.

Application

Solutions • Polarity • Solubility • Solvation • Van der Waals Forces

Theory

One of the factors that solvation is dependent upon is whether or not a solvent–solute combination is polar or not. When a molecule behaves as if one end is positively charged and the other negatively charged, the molecule is said to be polar. In general, if both the solute and solvent are polar, solvation occurs. If one is polar and the other is nonpolar, solvation usually does not occur. Solvation is the process during which the solute particles are surrounded by the solvent particles—forming a stable solution.

Nonpolar solute in nonpolar solvent solutions are also possible. Although solvation is possible, these types of solutions develop due to the van der Waals forces that exist between the two components. Van der Waals forces are weak forces between molecules. Nonpolar solute–solvent solutions develop slowly.

Materials

Graduated cylinder, 100-mL

PERC, (perchloroethane), 30 mL

Water, 30 mL

Hexane, 30 mL

Iodine, 1 g

Deflagrating spoon

Safety Precautions

Iodine reacts violently with reducing agents, sulfur, iron, alkali metals, metal powders and phosphorous. It is extremely irritating and corrosive to eyes, skin and respiratory tract. Inhalation of vapors or ingestion may be fatal. PERC and hexane may be irritating to eyes and tissue. Wear chemical splash goggles, chemical-resistant gloves and a chemical-resistant apron.

Demonstration

Place 30 mL PERC in a 100-mL graduated cylinder. Slowly add 30 mL water by pouring down the side of the cylinder to avoid mixing. Add 30 mL hexane in a similar fashion. Three layers of liquid should be visible.

Lower a deflagrating spoon filled with a few large crystals of iodine into the cylinder. Stir the spoon gently as you pass through each layer of liquid, allowing time for the iodine to dissolve. The nonpolar iodine will dissolve in the hexane and PERC because they are also nonpolar.

Disposal

Evaporate the solvents in a fume hood. Any remaining iodine crystals may be recycled.

Reference

Smoot, R. C., et al. *Merrill Chemistry;* Glencoe: New York, 1995; p 500.