CURRICULUM SUGGESTIONS

TOPICS

Chemical Bonding	Quantum Mechanics	Chemical Formulas
Solids	Electron Configurations	Empirical Formulas
Crystal Structure	Orbital diagrams	Mole Relationships
Ionic Bonding	Magnetism	Nanoparticles

OVERVIEW

This material could be used to introduce empirical formulas, ionic bonding considerations, and stoichiometric relationships. Another possible focus is on the magnetic character of magnetite and an explanation of the spiking behavior of the ferrofluid. Explanations of magnetism hinge on electron configurations and thus to basic ideas from quantum mechanics. The surfactant employed provides an opportunity to discuss hydrophobic and hydrophyllic interactions. Ferrofluids make an important connection to nanotechnology, as the magnetic particles that are produced are typically on the order of 100 angstroms (10nm) in size. Particles in this range have a large surface-to-volume ratio that can in some cases dramatically influence their properties. In this case, the particles have a characteristic response to a magnet that leads them to be described as superparamagnetic.

SUGGESTIONS

Investigation 1-----Could be used to provide a laboratory framework within which to discuss electron configurations, orbital diagrams, and magnetic behavior.

Investigation 2-----Could be used to teach about ionic solids and crystal structure, which are often included in a unit on the phases of matter. The investigation also provides a means for determining empirical formulas.

Experiment 1-------Provides an opportunity to determine the stoichiometric mole ratio between reactants in units that deal with chemical formulas and stoichiometry. Extensions might include trying to synthesize ferrofluids using other transition metal ions such as manganese, cobalt and nickel.