Lesson Title	Solution Chemistry
Length of Lesson	90 min
Created By	David Wilson
Subject	Chemistry
Grade Level	8-12
State Standards	4d,e
DOK Level	DOK 2, DOK 2
DOK Application	Explain, Describe
National Standards	K-12: Unifying Concepts and Processes
Graduate Research Element	Thermodynamics and solution chemistry are fundamental concepts that are used in all chemical research.

Student Learning Goal:

State Standards: (Chemistry)

4) Analyze the relationship between microscopic and macroscopic models of matter.

d. Explain the thermodynamics associated with physical and chemical concepts related to temperature, entropy, enthalpy, and heat energy. (DOK 2)

e. Describe and identify factors affecting the solution process, rates of reaction, and equilibrium. (DOK 2)

National Science Standards: (9-12)

Unifying Concepts and Processes:

As a result of activities in grades K-12, all students should develop understanding and abilities aligned with the following concepts and processes:

- Systems, order, and organization
- Evidence, models, and explanation
- Constancy, change, and measurement
- Evolution and equilibrium
- Form and function

Materials Needed (supplies, hand-outs, resources):

Be Careful and always read the Materials Safety Data Sheet (MSDS) written for chemicals you use. Federal Law requires the vendors of chemicals to provide MSDS sheets for all their chemicals

(All quantities specified here are for approximately one lab group.)

1) Sodium chloride

2) Copper(II) sulfate (powder)
3) Copper(II) sulfate (large crystals)
4) Potassium chloride
5) Calcium chloride
6) Test tubes (4 x 15 mL)
7) Spatulas
8) Full water bottle
9) Small rubber stopper (for test tubes)
10) Evaporation dish
11) Watch glass
12) Short stirring rod
13) Balance
14) 250 mL beaker
15) burner
16) ring stand
17) iron ring
18) wire gauze
19) filter paper
20) small funnel
21) beaker tongs
22) graduated cylinder
23) thermometer
24) test tube rack

Lesson Performance Task/Assessment:
Students will

- calculate the percent solubility of a compound
- investigate heats of solution
- investigate several factors affecting the rate of solubility of compounds

Lesson Relevance to Performance Task and Students:
Frankly, solution chemistry is typically a very boring subject with little interesting demonstrations and little-to-no labs. This lab serves as an introduction to the topic in the vein of inquiry activities, and serves to motivate the students in learning the subject. Additionally, it serves to give them some visual cues which they can apply to what they learn in lecture.

Anticipatory Set/Capture Interest:
This lab requires the entire class time. So, the anticipatory set was limited to a recitation of the learning objectives for this lab. The "capture" is the lab itself.

Guided Practice:
This lab serves as an introduction to the topic. The students will proceed with this lab before any guided practice. This is patterned after inquiry-style lessons. Guided practice will come in later lessons.

Independent Practice:
Completing the lab is the independent practice.

Remediation and/or Enrichment:
Remediation: Individual IEP.
Enrichment: These students will complete the final, "optional" section of the lab. This section introduces the students to an intimately related, yet much more advanced, topic: thermodynamics. For the students who complete this section, this enrichment will foreshadow Advanced Placement chemistry lessons they may have if they enter AP chemistry.

Check(s) for Understanding:
Students should be able to complete all the calculations involved in the lab, and explain the observations in paragraph form as part of the lab.

Closure:
The closure will be a discussion of the necessary calculations at the end of the lab. I expect this lab to require the entire class time. Any closure may be completed in the next class period.

Possible Alternate Subject Integrations:
None.

Teacher Notes:
Procedures for this lab were adapted from the following references. One refernce is a Youtube video.

Reference:

1) CHE-106 Lab Manual used at The University of Southern Mississippi; Woodruff, Frank and Howell, J. Emory. Chemical Principles in the Laboratory. The University of Southern Mississippi. 2000. {This particular lab was copyrighted in 1975.}
2) "Chemistry Lab – Solubility and Rate of Solution" Eastern Kentucky University. http://youtu.be/PpEyzhuz7K8