

# Using LON-CAPA For Pre-Lab Assignments in General Chemistry.

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## Background

Florida State has used its own in-house printed manual for general chemistry laboratory for many years.

The manual was revised and up-dated annually. Frustration with the process led Dr. Dillon to undertake the project of putting the manual on-line.

The printed manual contained printed "pre-lab" exercises for the students to complete before the lab. The exercises were designed to familiarize the student with concepts and calculations needed for the laboratory. They were turned in during the laboratory, graded by the teaching assistant, and returned the following week. Each student had the same exercise to do, and often it wasn't completed until the last minute as the lab started, sometimes by copying from another student.

## Motivation for On Line Lab Manual

- | Problems                      | Solutions         |
|-------------------------------|-------------------|
| • Size Limitation             | •Internet Links   |
| • Editing Delays              | •Instant Revision |
| • Book Shortages              | •Always Available |
| • Lack of Student Preparation | •No Crutch        |
| • Cost to Student             | •Decreased Cost   |

## Advantages to On Line Pre Lab

- Individualized Assignments
  - Students can help each other, but not copy
- Instant Feedback to Student
  - No waiting to learn if work is correct
- Multiple Tries
  - Build competency, learn from mistakes
- Encourage Earlier Preparation
  - Access blocked 30 min. prior to Lab
- Computer Grading
  - Lowers burden on TA's

## Useful LON-CAPA Features for Pre Labs

- Sophisticated Randomization Algorithms
  - numbers, string items, question foils
- Numerical Parameter Options
  - units, significant figures, tolerance, format
- Chemical Formulas and Structures
  - equation editor, JME editor, Jmol
- Graphing and Image Capabilities
  - gnuplot, random labeled images
- Integration With Other Programs
  - excel, Java applets, flash, web pages
- Individualized Help
  - discussion board for each problem

## Pre Lab Question Types

- Calculations Related to Lab Experiment
  - some simple, some complex, some guided
- Gathering Data and Information for Lab
  - web links to databases
  - prepared information sheets
- Graphing Data and Interpreting Graphs
  - introduction to excel
  - use of gnuplot for graphs
- Use of Images to "Simulate" the Experiment
  - random labeling of images

## Acknowledgements

- |                               |                                   |
|-------------------------------|-----------------------------------|
| • Coding and Trouble Shooting | • Funding                         |
| • HonKie Ng                   | • Dept of Physics, FSU            |
| • Guy Abenail                 | • Council for Instruction, FSU    |
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| • Brent Rastman               | • Michigan State Univ.            |
| • Ray Banchard                | • Simon Fraser Univ.              |

## Number of Problems Written

Course	No. of Lab Sessions	No. of Problems	No. of Parts
Chemistry I	12	47	168
Chemistry II	12	55	196
Total	24	102	364

## Some Example Problems

### Use of Excel Spreadsheets

<res/fsu/GeneralChemLib/Lab/Measurement/PVgraphs.problem>  
<res/fsu/GeneralChemLib/Lab/GraphingAndAnalysis/LinearRegression.problem>  
<res/fsu/GeneralChemLib/Lab/Equilibrium/MeasureK.problem>

### Use of GnuPlot

<res/fsu/GeneralChemLib/Lab/LeChatelier/TemperatureEffect.problem>  
<res/fsu/GeneralChemLib/Lab/Titration/TriproticTitrationA.problem>  
<res/fsu/GeneralChemLib/Lab/AtomicSpectra/ElementSpectra.problem>

### Use of Jmol

<res/fsu/GeneralChemLib/Lab/VSEPR/MultiatomicStructure.problem>  
<res/fsu/GeneralChemLib/Lab/VSEPR/TriatomicStructure.problem>

### Use of Random Labeled Images

<res/fsu/GeneralChemLib/Lab/VSEPR/FormalCharge.problem>  
<res/fsu/GeneralChemLib/Lab/VoltaicCell/CellDescrip.problem>  
<res/fsu/GeneralChemLib/Lab/Kinetics/ClockReaction.problem>  
<res/fsu/GeneralChemLib/Lab/PaperChromatography/DyeAnalysis.problem>  
<res/fsu/GeneralChemLib/Lab/HalogenReactions/ColorID.problem>  
<res/fsu/GeneralChemLib/Lab/InterMolForces/CO2PhaseDiagram.problem>  
<res/fsu/GeneralChemLib/Lab/InterMolForces/CO2TriplePtEst.problem>  
<res/fsu/GeneralChemLib/Lab/Density/VernierScale.problem>

### Supplying Other Data Or Worksheets For Laboratory

<res/fsu/GeneralChemLib/Lab/InterMolForces/LiquidProperties.problem>  
<res/fsu/GeneralChemLib/Lab/LimitingReagent/RxCalc.problem>  
<res/fsu/GeneralChemLib/Lab/ElementSpectra/ElementSpectra.problem>  
<res/fsu/GeneralChemLib/Lab/Density/Metals.problem> gives access to:  
<res/fsu/GeneralChemLib/Lab/Density/MetalDensities.pdf>  
<res/fsu/GeneralChemLib/Lab/WaterAnal/Dilution.problem> gives access to:  
<res/fsu/res/fsu/GeneralChemLib/Lab/WaterAnal/DilutionScheme.pdf>

### Explanations

<res/fsu/GeneralChemLib/Lab/PhosphateBuffer/PhosphateBuffers.htm>

### Lab Manual Web Sites

<http://www.chem.fsu.edu/chemlab/chm1045lmanual/index.html>  
<http://www.chem.fsu.edu/chemlab/chm1046lmanual/index.html>

Course	Sections	Students
Pilot Run—Fall 2006:		
CHEM-I (1050L—Honors)	6	~120
Full Scale—Spring 2007:		
CHEM-I (1045L)	40	~800
CHEM-II (1046L)	20	~480
CHEM-II (1051L—Honors)	2	~40

## TA Comments

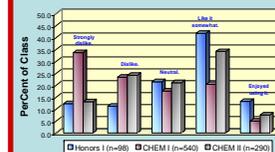
\*"...more inclined to learn the procedure and the concepts before coming to class than in past semesters in which a paper manual was used."

\*"...better grades and more clear lab reports than I have seen before."

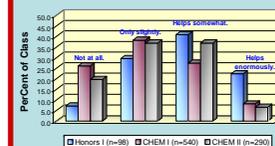
\*"...the students that complete the LON-CAPA exercises are particularly well prepared for class."

\*"...labs proceed in about half the time as previously."

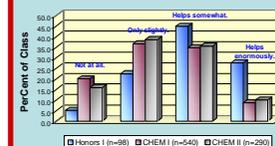
## How do you like using LON-CAPA?



## In general, did LON-CAPA help you feel more prepared for lab?



## In general, did LON-CAPA help you learn more about chemistry?



## Would you prefer LON-CAPA or written graded homework, where the graded homework is returned a week later?

