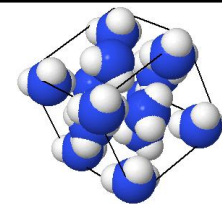


Embedding Technology to Enhance Chemistry Learning

Mark D. McClain*, Jeffrey W. Whitacre *Department of Science & Mathematics*

Dara E. Fraley, Philip J. Schanely, Donald S. Humphreys *Center for Teaching & Learning*

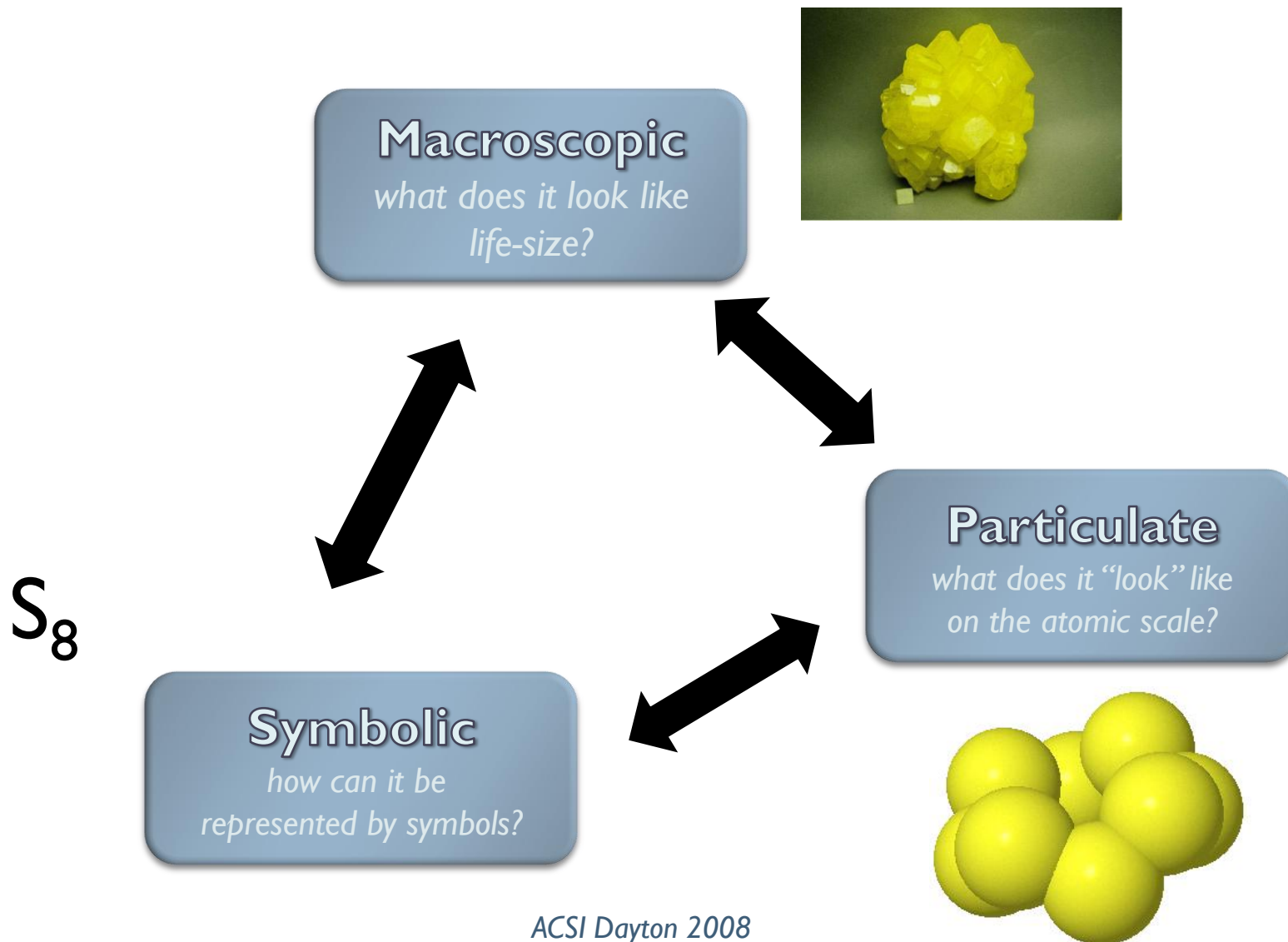
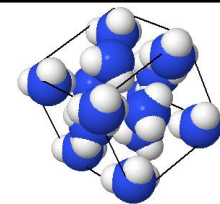
Where we're going today...



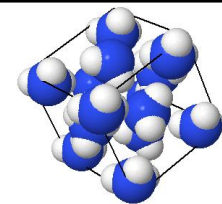
- ▶ **Growth opportunity**
 - ▶ Frustration with learning gap
 - ▶ Burgeoning enrollment
 - ▶ Synergy with new teaching/learning center
- ▶ **Solution**
 - ▶ Development resources
 - ▶ Learning Modules
 - ▶ Content specific tools
- ▶ **Assessments**
- ▶ **Questions**



Three worlds



Hosting Web Resources



CEDARVILLE
university

[Accessibility](#) | [Help](#)

Build Teach **Student View**

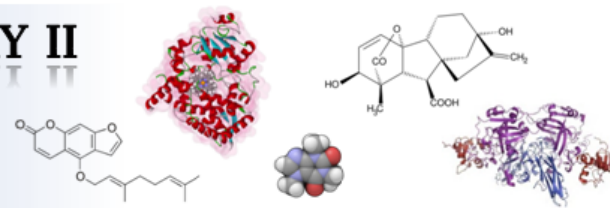
2008SP_CHEM_1120 Gen Chemistry II - Section_LEC

Your location: [Home Page](#)



GENERAL CHEMISTRY II

Dr. Mark McClain
Spring 2008



[Chapter 13](#)

Intermolecular Forces, Liquids, and Solids

[CHEM1110-2007 Review](#)

Detailed Class Schedules
Key Terms, Equations, Memory Lists
Lecture Slides
Study Questions

[Chapter 14](#)

Solutions and Their Behavior

[Chapter 15](#)

Principles of Reactivity: Chemical Kinetics

[Chapter 16](#)

Principles of Reactivity: Chemical Equilibrium

[Chapter 17](#)

Chemistry of Acids & Bases

[Chapter 18](#)

Other Aspects of Aqueous Equilibria

[Chapter 19](#)

Entropy and Free Energy

[Chapter 20](#)

Electron Transfer Reactions

[Chapters 21 & 22](#)

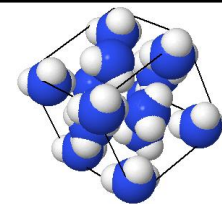
Descriptive Chemistry of the Elements

[Final Exam Study Stuff](#)

[Chapter 23](#)

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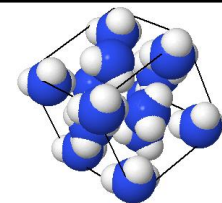
Tool Box



- ▶ Flash Cards—[sample](#)
- ▶ Equilibrium Learning Module
- ▶ Structure visualization with Jmol (an open-source Java viewer for chemical structures in 3D.
<http://www.jmol.org/>)

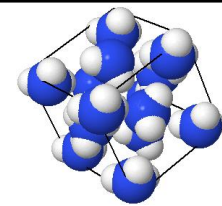


Jmol



- ▶ Free, open-source Java applet
- ▶ Cross-platform
- ▶ Browser tolerant (IE, Mozilla, others)
- ▶ Multiple input formats
 - ▶ .cif crystallographic information file
 - ▶ .mol MDL structure
 - ▶ .pdb protein data bank
 - ▶ .xyz Xmol file
- ▶ Structure sources
 - ▶ http://wiki.jmol.org/index.php/Websites_Using_Jmol
 - ▶ Naval Research Lab (<http://cst-www.nrl.navy.mil/lattice/>)
 - ▶ Protein Data Bank (<http://www.pdb.org/pdb/home/home.do>)
46K + proteins

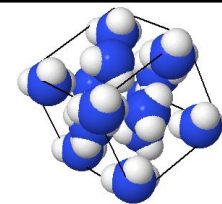
Homemade Jmol pages



- ▶ <C:\docs\genchem\jmol>



Applet demos



- ▶ Kinetic Molecular Theory of gases

<http://mc2.cchem.berkeley.edu/Java/molecules/index.html>

- ▶ Show temperature and mass effect on molecular velocity

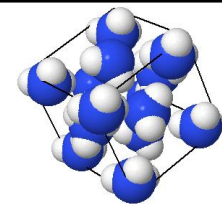
Red

Temperature: 6 K
Mass: 2 amu
Number: 20
Internal Pressure:

Blue

Temperature: 273 K
Mass: 2 amu
Number: 20
Internal Pressure:

For Fixed Pressure | About... | Reset Containers | Remove Barrier



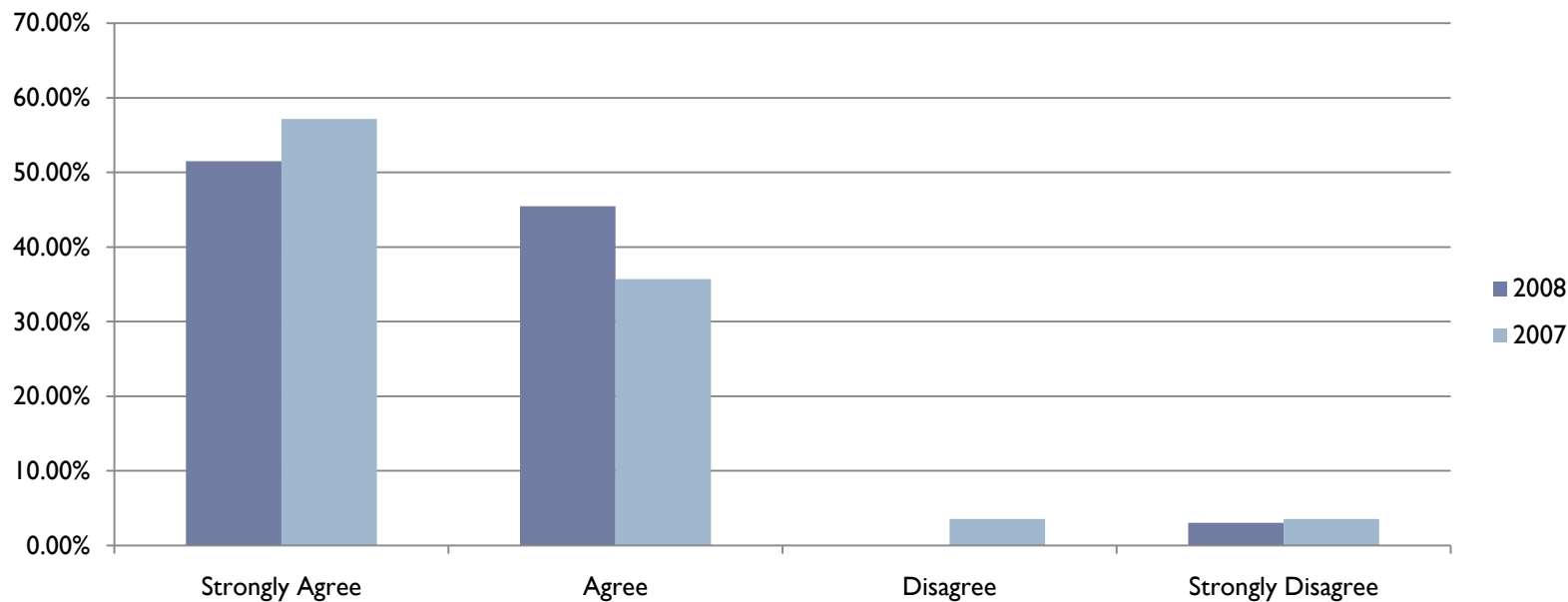
Assessment—Equilibrium Evaluation Survey

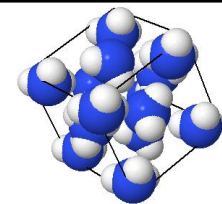
▶ Do students use the tools?

▶ 2008—54%

▶ 2007—42%

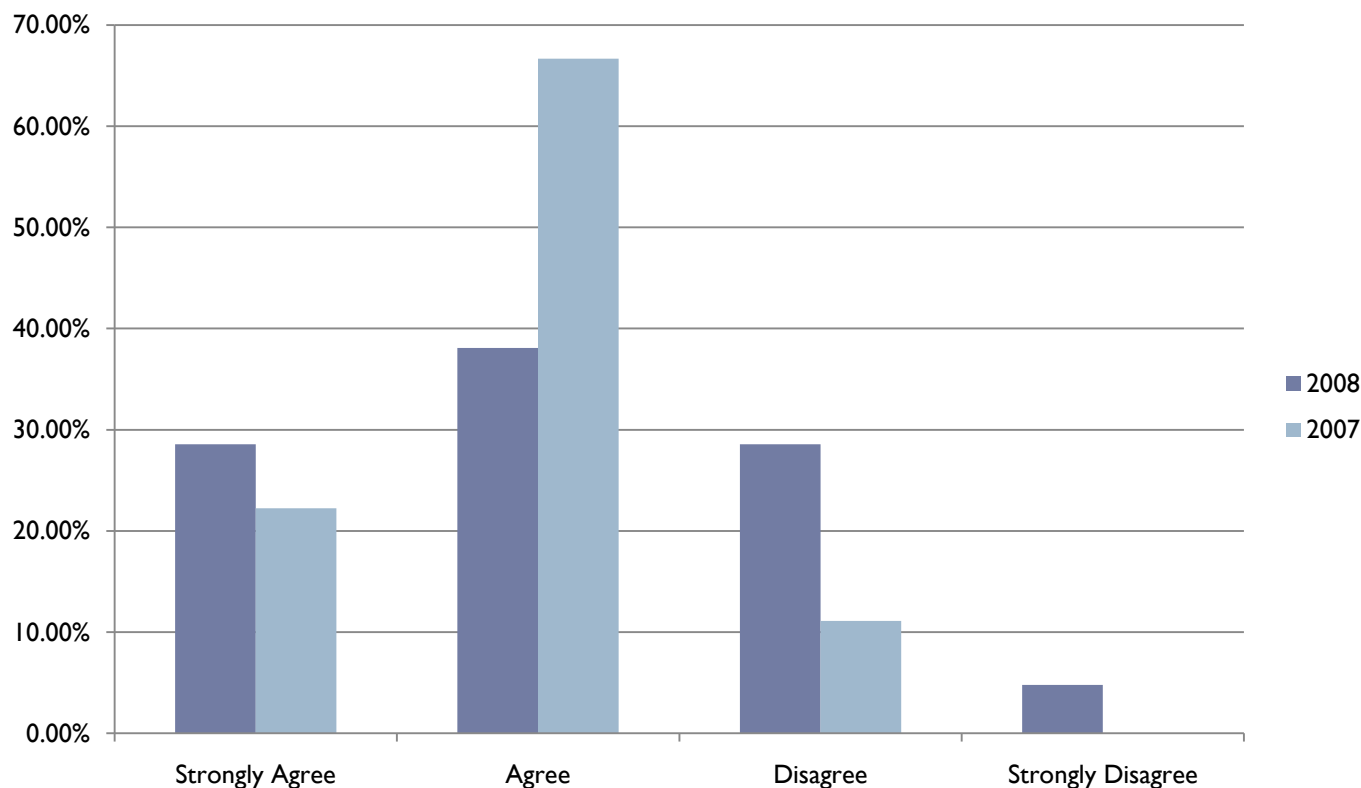
▶ Was LM easy to use?



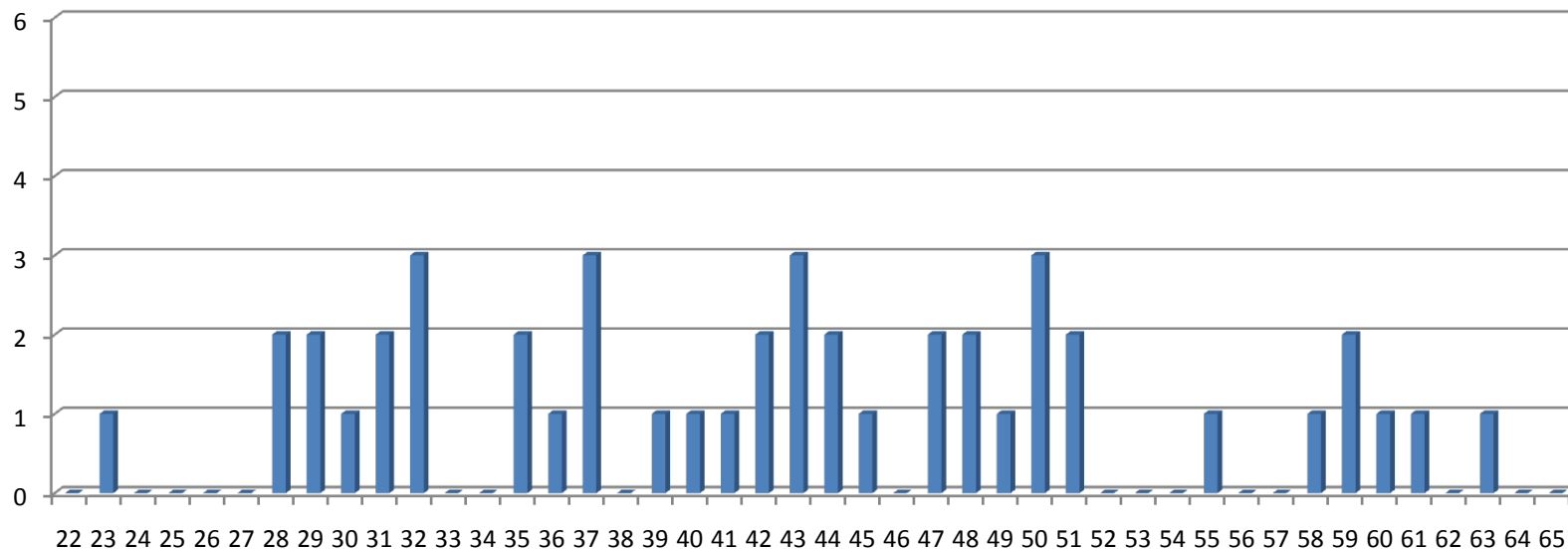
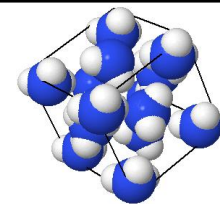


Assessment—Equilibrium Evaluation Survey

- ▶ Do students who had trouble with equilibrium understand it better after using the LM?



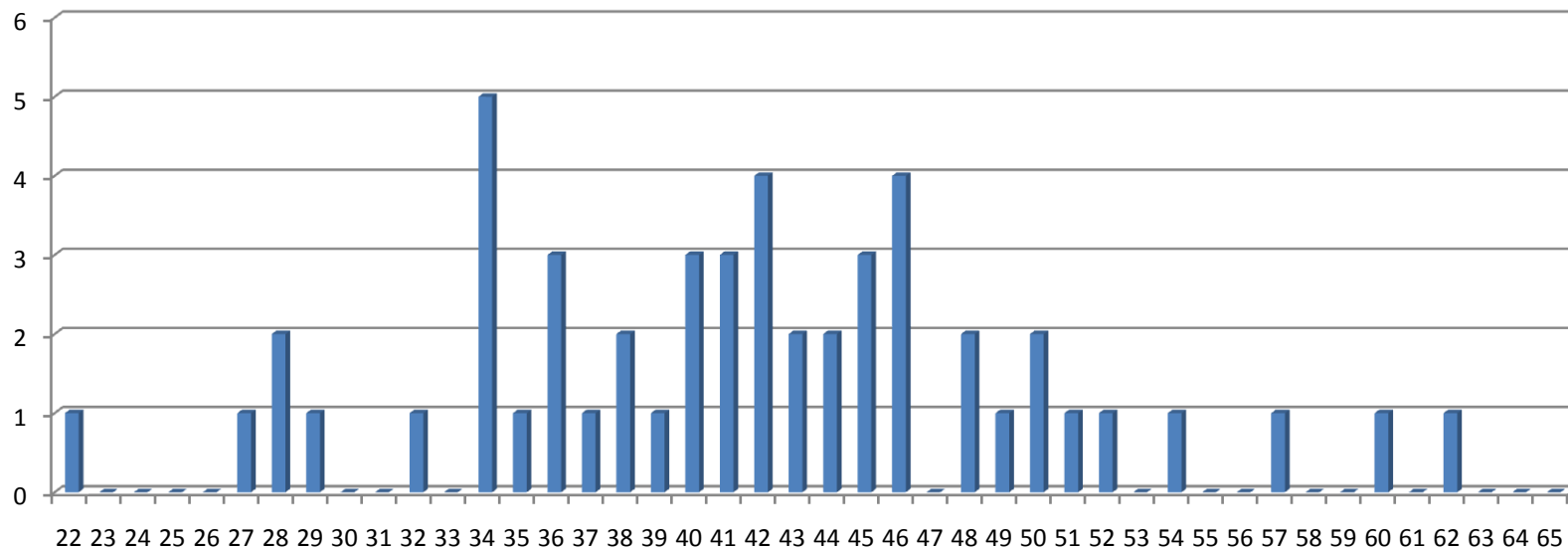
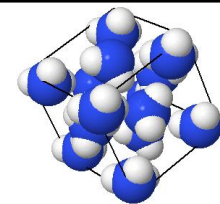
ACS Exam results 2005



ACS stats
Median = 36
Mean = 36.19

CU 2005 stats
Median = 43 (70th percentile)
Mean = 42.53
n = 45 students

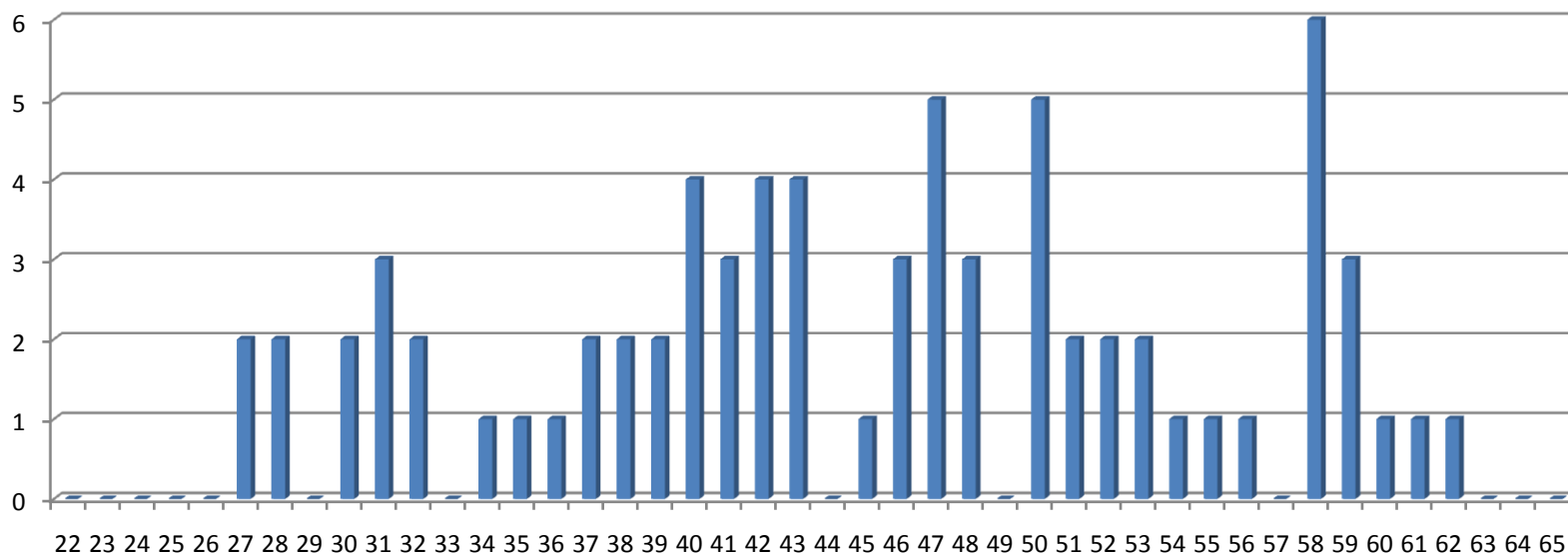
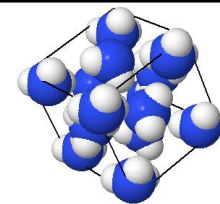
ACS Exam results 2006



ACS stats
Median = 36
Mean = 36.19

CU 2006 stats
Median = 42 (68th percentile)
Mean = 41.49
n = 51 students

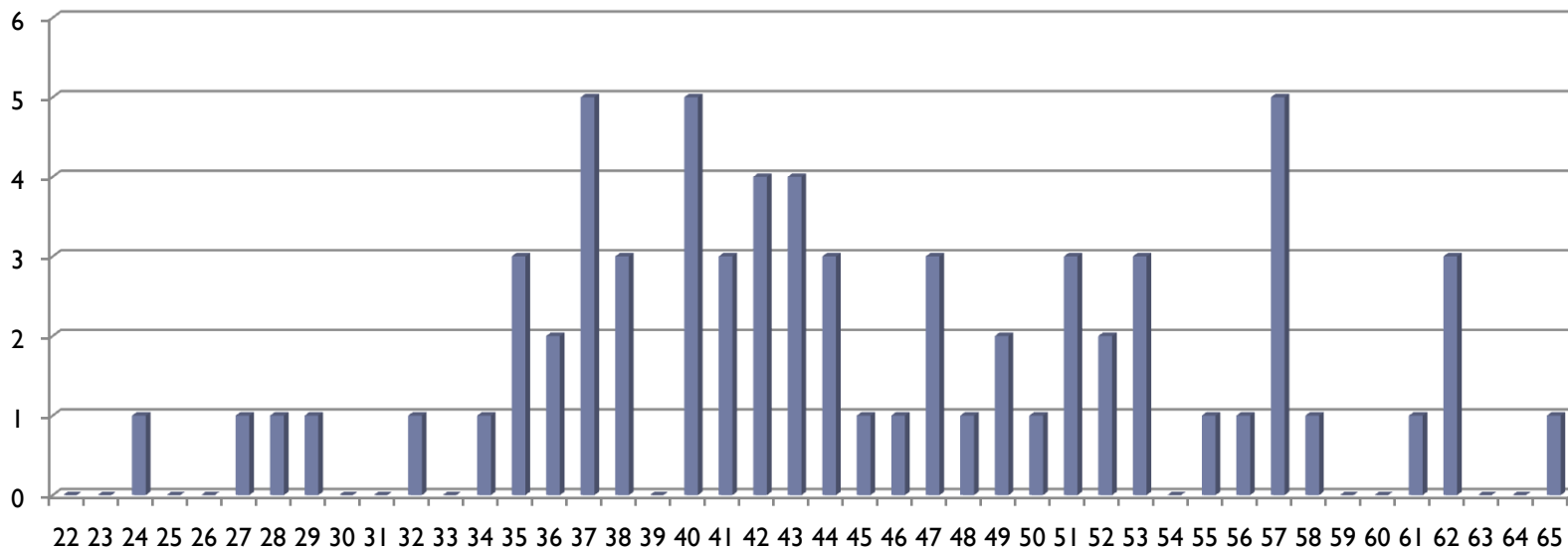
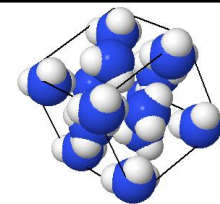
ACS Exam results 2007



ACS stats
Median = 36
Mean = 36.19

CU 2007 stats
Median = 46 (76th percentile)
Mean = 44.93
n = 73 students

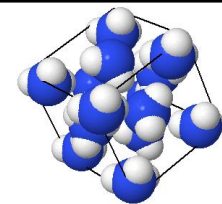
ACS Exam results 2008



ACS stats
Median = 36
Mean = 36.19

CU 2008 stats
Median = 43 (70th percentile)
Mean = 44.93
n = 68 students

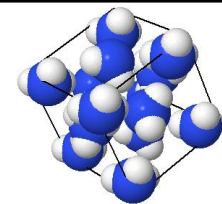
What's the bottom line?



- ▶ If you build it, they will probably come
- ▶ Engage peers in the development
- ▶ Extending the classroom via technology doesn't have to break the bank (or exhaust the teacher)



Questions / comments?



mcclain@cedarville.edu

http://www.cedarville.edu/academics/sciencemath/mcclain/mdm_www.htm