

# TEACHING INTRODUCTORY CHEMISTRY ONLINE

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An Introductory Online Chemistry Course: From Conception to Implementation

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# HISTORY

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- **General college-wide expectation that online courses be developed in all areas of the Minnesota Transfer Curriculum (MnTC).**
- **Concern that if current faculty didn't develop online courses then an external hire may be made to do the job.**
- **Had an upcoming sabbatical and was looking for a project to do.**
- **Issues with Desire2Learn (D2L) had largely been ironed out and I was ready to learn how D2L may be used in my courses.**

# GOALS

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- **Course content to be delivered entirely online, with a single meeting for the final exam.**
- **Lab experience must be hands-on — no virtual labs.**
- **To the extent possible, the online lab experience should duplicate the seated lab experience.**
- **Most chemicals/supplies would be purchased at local grocery store.**
- **Remaining chemicals/supplies would be sold through the college bookstore in a shoebox-sized kit.**

# COURSE LAYOUT

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- Text: Introductory Chemistry, 4<sup>th</sup> ed, Nivaldo Tro
- Reading and Suggested End-of-Chapter Problems assigned from text
- Course content supplemented with short “lecture” modules on topics with which students typically have the most trouble
  - Screen recordings made on a tablet PC
  - Recorded, edited, and rendered using Camtasia Studio
  - Hosted on college website and linked through D2L
- ✓ QuickCheck worksheets with worked out solutions in PDF format and screen recordings rendered with Camtasia Studio

# COURSE LAYOUT

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- Homework quizzes for each chapter on MasteringChemistry
- Online office hours hosted from work or home using Adobe *Connect*
  - Tablet PC used to write on the screen
  - Webcam with audio
  - Screen sharing may be used to view a student's computer or take control of their computer (only with their permission) for troubleshooting purposes
  - Available for free at all MnSCU institutions subscribing to MetNet.
- Three midterm exams administered on D2L with a required meeting for the final exam on the Coon Rapids campus.

# LAB ACTIVITIES

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- **Introduction and Safety Lab**

- Students must pass D2L quiz with minimum score in order to access remaining labs in the course

- **Graphing and Prediction Lab**

- Students must determine the number of post-1982 pennies contained in a sealed vial (each student has a different number of pennies)

- **Measurement Lab**

- Student practice measurements, conversions, and significant figures
- Must determine the density of a given number post-1982 pennies and the density of a sucrose solution of a specified concentration (different for each student)

# LAB ACTIVITIES

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- **Freezing Point Depression Lab**
  - Go! Temp probe and Logger Lite used to observe the temperature lowering effect of different solutes on snow (or a crushed ice/water mixture)
- **Paper Chromatography of M&M's Lab**
  - Dyes extracted from candy coating and analyzed
- **Molecular Modeling Lab**
  - Students identify and draw Lewis structures of molecular models rendered as Jmol java applets
  - Molecular models generated using Chemsketch freeware

# LAB ACTIVITIES

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- **Electrolytes Lab**

- Homemade testing kit consisting of a 9-volt battery, battery clip, miniature Christmas light, and nails used to determine conductivity

- **Gases and More Lab**

- Baking soda and vinegar used to generate  $\text{CO}_2$  (endothermic), while hydrogen peroxide and yeast used to generate  $\text{O}_2$  (exothermic). Evaporative cooling of water also observed
- Gases tested with flaming/glowing splint, while temperatures monitored with Go! Temp probe and software

# LAB ACTIVITIES

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- **Baking Soda Volcano Reaction Lab**

- Concept of limiting reactants explored by holding vinegar mass constant and adding increasing masses of baking soda. Final mass measured to determine mass of  $\text{CO}_2$  produced.

- **Food Coloring Kinetics Lab**

- A blue food coloring solution is reacted with differing concentrations of bleach and used to determine the bleach concentration necessary to produce a reaction time of 60 s. Effect of temperature on rate also observed.

- **Red Cabbage Indicator Lab**

- An acid-base indicator is made using red cabbage juice and used to test a variety of household chemicals.

# MINI-DESIGN EXPERIMENTS

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- **Make hypothesis, design experiment, gather data, interpret data, make conclusions, report results**
- **Glow sticks**
  - First set of 3: One standard; Make one glow brighter and one glow dimmer
  - Second set of 3: One standard; Make one glow longer and one glow shorter
- **Topic of Choice**
  - Cleaning pennies — salt solution, vinegar, or mixture?
  - Bubbleology — change duration and size of bubbles?
  - Diffusion Rates of Food Coloring — affected by temperature or solutes?
  - Oobleck — “best” proportion of starch to water?
  - Surface Tension — which substances and how much break surface tension?

# SOFTWARE REFERENCED

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- Camtasia Studio 7.1.1
  - <http://www.techsmith.com/camtasia.asp> (\$77-179 educator pricing, fully functional 30-day free trial)
- MasteringChemistry
  - <http://www.masteringchemistry.com> (Pearson Education Online Homework System)
- Chems sketch 12.0 Freeware
  - <http://www.freechemsketch.com> (free to educators and students)
- Jmol
  - <http://www.jmol.org>
- Adobe Connect
  - <http://www.adobe.com/products/acrobatconnect> (education pricing available)

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