ChemPrep:
Self-paced OWL Preparation for
General Chemistry and Organic Chemistry

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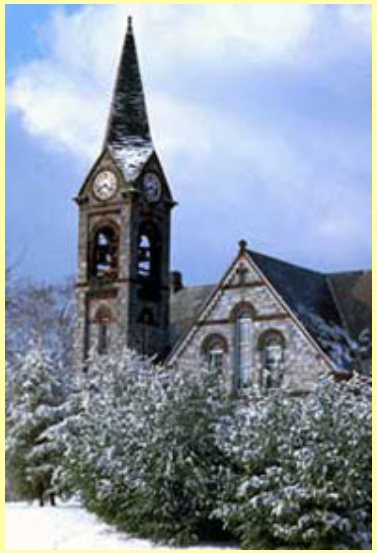
University of Massachusetts Contributors:
Beatrice Botch, Roberta Day, William Vining,
Stephen Hixson, Peter Samal, David Hart

Evaluators: Kenneth Rath and Alan Peterfreund

UMass Amherst



ChemPrep - Motivation

Help students ***succeed*** in General and Organic Chemistry

Improve preparedness
Build skills

Fill in gaps

Review concepts

Build confidence

ChemPrep - General and Organic

- OWL based Courses
- 24 hour access
- Self-paced
- Self-contained (no textbook)
- Non-credit
- Taken before semester begins
- Time: ~ 20 hours GenChem
  ~ 10 hours OChem
- For skill building and review

OWL Chemistry

- Mastery Learning System
- Extensive database
- Questions - Parameterized for numerical and chemical systems
- Feedback - Complete and Parameterized
- Interactive Modules - Simulations, Tutors, Exercises
- Chemical drawing and visualization tools
- Message system

Topics

General Chemistry

1. Intro to OWL
2. Structure of Matter
3. Nomenclature
4. Dimensional analysis, metric units, significant figures, exponents and roots
5. Mole/mass conversions
6. Chemical Reactions
7. Algebra, Temperature, Density, Graphs and Logs

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Organic Chemistry

1. Intro to OWL
2. Electronic Structure of Atoms
3. Lewis Structures
4. Geometry and Polarity
5. Bonding and Resonance
6. Structural Formulas
7. Alkanes & Functional Groups
8. Acids and Bases

Pilot Study

- Invitation via email using Pre-registration lists
- Taken prior to start of semester
  - January 2004 for Spring class
  - July-August 2004 for Fall classes
- S04: General Chemistry 1
  - Organic Chemistry 1
- F04: Nursing, GenChem1, and Honors GenChem
  - Organic1 and Honors Organic
- Surveys in prep and subsequent courses
- Free of charge
- Voluntary

Completion Rate

	Students	SignedUp	Users(>50%)	Percent
Nursing F04	180	62	16	9%
General S04	373	83	28	8%
General F04	658	203	61	9%
GHonors F04	115	52	26	23%
OChem S04	179	53	19	11%
OChem F04	308	112	42	14%
OHonors F04	78	41	22	28%

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Pilot Study Profile

User – completed 50% or more

Nonuser – Did not sign up

Users:

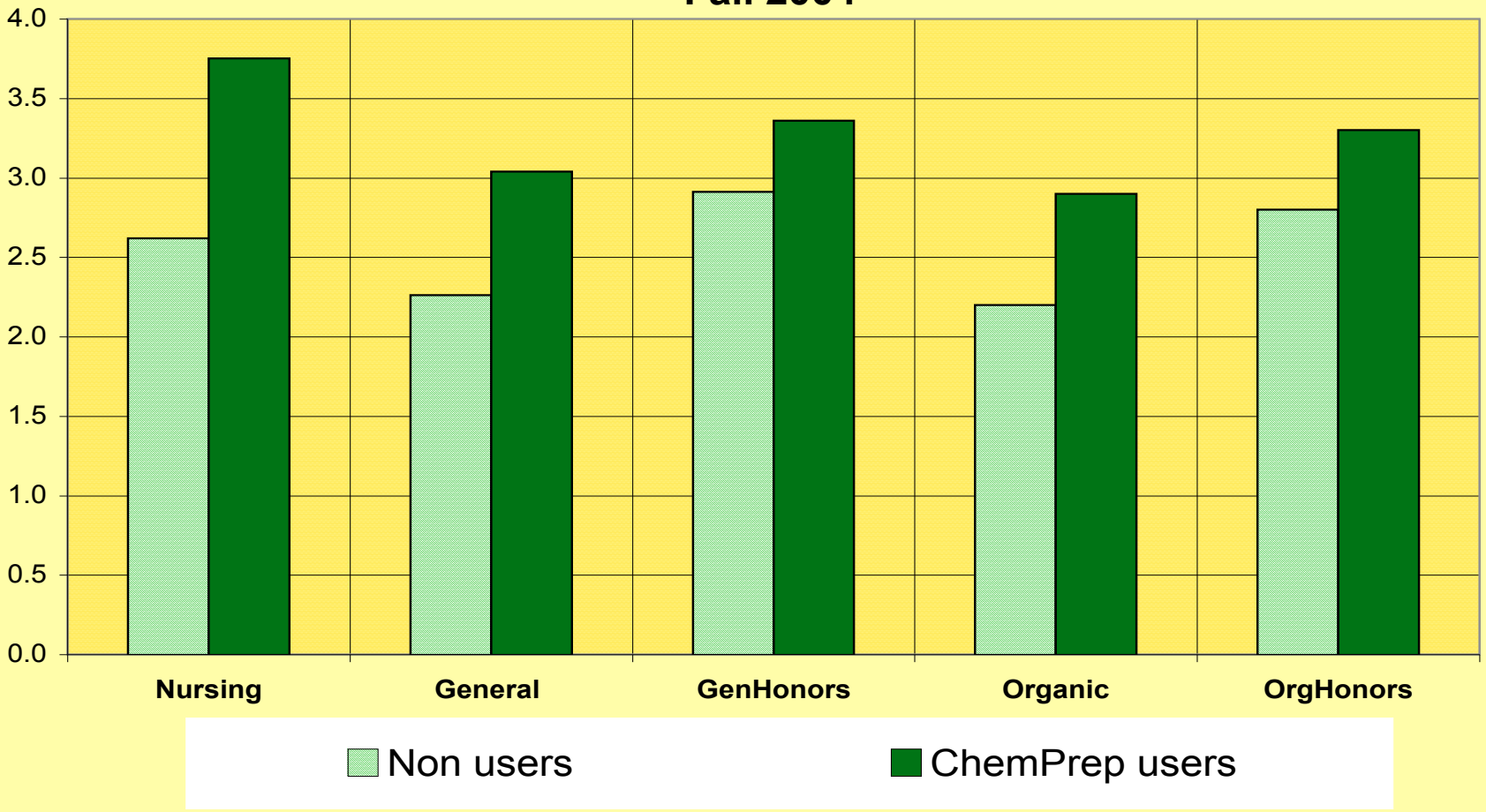
15–20% more women

Somewhat more predisposed to using technology

No other notable differences

Average Grade

Fall 2004



The Burning Question

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  SAT Math UMass Math Placement Algebra
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- Compared ***Effect Size*** of variables between prep and non-users

Effect Size

$$ES = \frac{(\text{Avg Score User} - \text{Avg Score NonUser})}{\text{Standard Deviation Total}}$$

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$ES < 0$	Users weaker than NonUsers
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Look for $ES \sim \pm 0.3$ or better

NursF04 GenS04 GenF04 GHonF04 OrgS04 OrgF04

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- **Improvement is beyond what would be predicted from self-selection** (except OChem Honors)


Questions to Address

- **How can we get students who really need a preparatory course to complete it ?**
- What is best way to reach high school, transfer, and returning students ?
- Will we see similar results at other schools ?
- Does the curriculum meet the needs of potential users ?

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Acknowledgements

University of Massachusetts
Presidents Office Grant

Peterfreund Associates

When **chlorine gas** and **water** react according to the following equation, **hydrochloric acid** and **chloric acid ($HClO_3$)** are formed.

3 Cl_2 (g) + 3 H_2O (l) ⟶ 5 HCl (aq) + $HClO_3$ (aq)

How many moles of **hydrochloric acid** will be formed upon the complete reaction of **0.478** moles **chlorine gas** with excess **water**?

[ ] moles **hydrochloric acid**

Feedback:

The balanced chemical equation for the reaction is needed to get the mole ratio conversion factor:

3 Cl_2 (g) + 3 H_2O (l) ⟶ 5 HCl (aq) + $HClO_3$ (aq)

GIVEN: **0.478** mol **Cl_2** WANTED: mol **HCl**

PATH: mol **Cl_2** —(**5 mol HCl / 3 mol Cl_2**)→ mol **HCl**

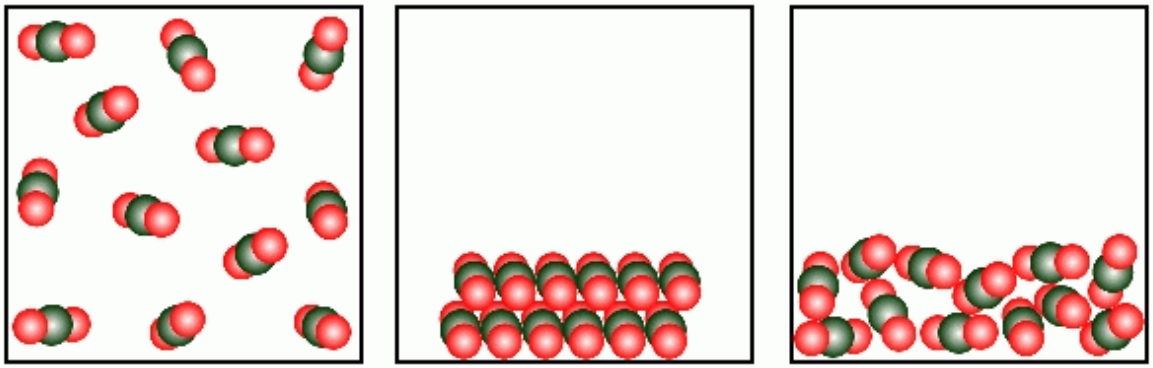
$$0.478 \text{ mol } Cl_2 \times \frac{5 \text{ mol HCl}}{3 \text{ mol } Cl_2} = 0.797 \text{ mol HCl}$$

University of Massachusetts ONLINE WEB-BASED LEARNING

OWL Example - States of Matter

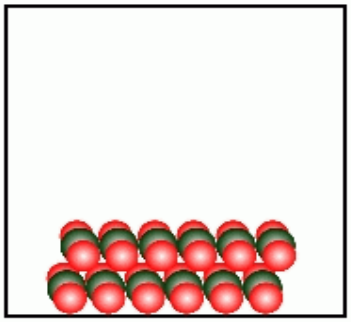
Chemical Formulas | Scientific Notation | Periodic Table | Tables

The following illustrations represent different states of the substance **carbon dioxide**, CO_2, at the particulate level. Classify each as solid, liquid, or gas:

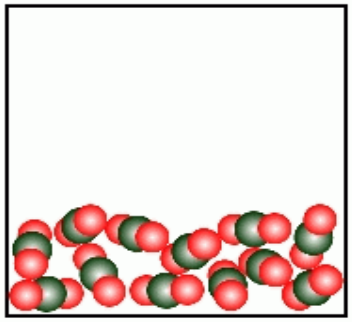


CHECK ANSWER

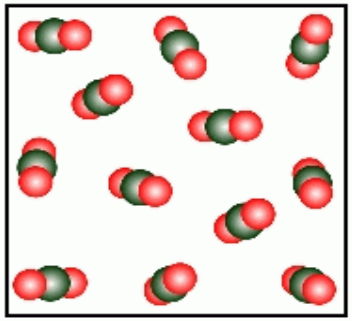
Feedback:



solid - Particles in a solid are held in place by attractive forces, and are often found in closely packed, well-ordered arrays. The particles vibrate, but remain in fixed positions relative to each other. A solid has a fixed volume and a definite shape.



liquid - Particles in a liquid are only loosely held together by attractive forces, so that they are able to move relative to each other. A liquid has a definite volume, but assumes the shape of the bottom of its container.



gas - In a gas, attractive forces are not strong enough to hold the particles together, so they are not in contact and move randomly throughout the container. A gas fills its container completely and assumes its shape and volume.