
ALWAYS
LEARNING

Partnership to develop educational MarvinSketch

Pearson Education
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Jeanne Zalesky, Executive Editor, Chemistry

Seann Ives, Senior Developer

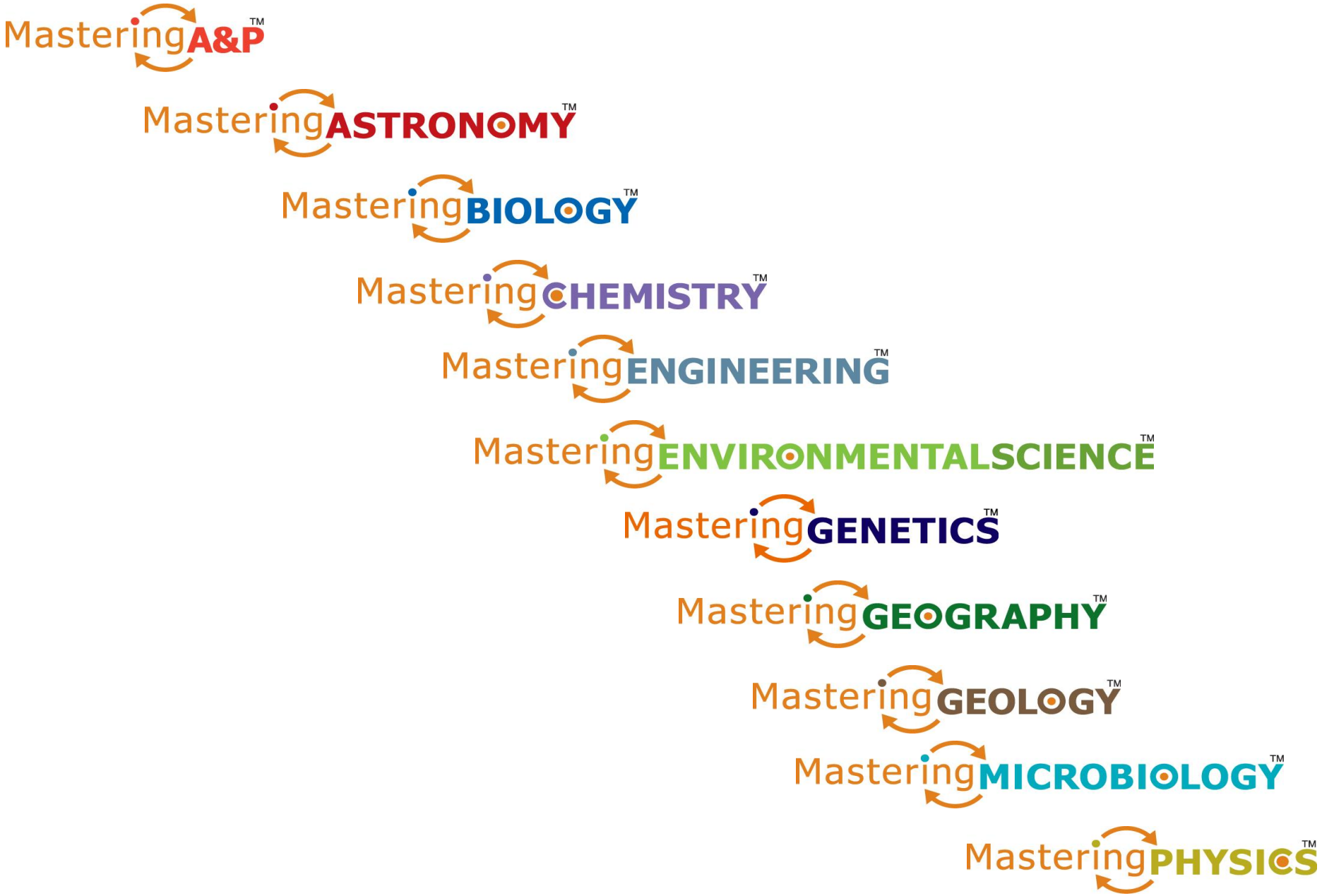
Laura Loiselle, Product Manager

Introduction

- Cross-functional development team consisting of marketing, software development, content development, and product development.
- Our presentation:
  - What are the market dynamics and drivers?
  - Developing the application
  - Validating the student experience

What are the market dynamics and drivers?

- Define market, users & size
- What is Mastering?
- Why build a new Mastering product versus adding to the existing Pearson platform?
  - Course management features
  - Gradebook
  - Proven sales and support record
  - Data/analytics for JIT teaching
  - Specific feedback/Socratic method


MasteringA&P™
MasteringASTRONOMY™
MasteringBIOLOGY™
MasteringCHEMISTRY™
MasteringENGINEERING™
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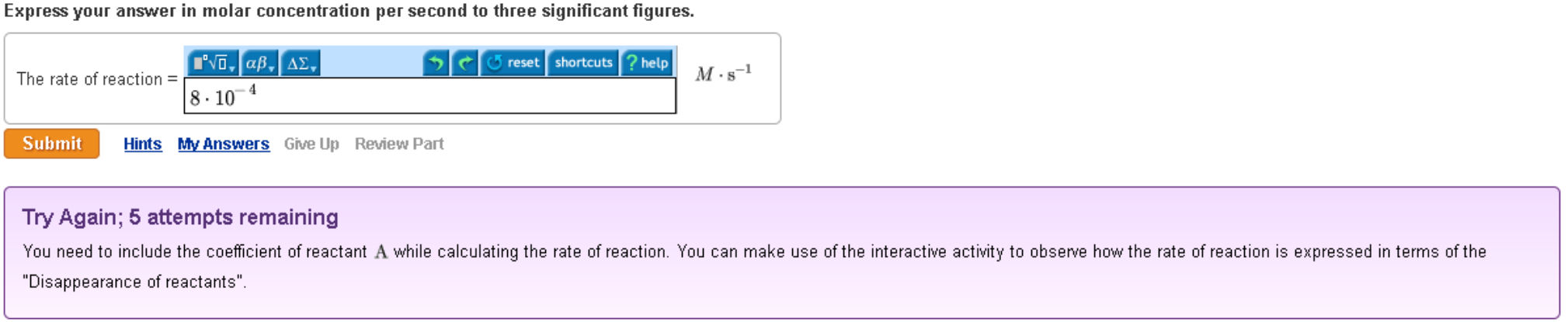
Individualized Coaching & Remediation

Answer-specific feedback



Mastering tutors students individually with feedback specific to their errors.

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Hints

Hint 1. How to approach the problem

First, identify how the rate of reaction can be expressed in terms of the disappearance of reactant A. To do this, you can use the interactive activity. Click on the "Disappearance of reactants" button to see how the rate of reaction can be expressed in terms of the disappearance of reactant A for the given reaction.

Now, determine the change in the concentration of reactant A ($\Delta[\mathrm{A}]$) during the given time interval t where t = 0 to 20 s by using the values of $[\mathrm{A}]$ given in the table. If $[\mathrm{A}]_{20}$ is the concentration of reactant A at t = 20 s, and $[\mathrm{A}]_0$ is the concentration of the reactant A at t = 0 s, then the change in concentration of reactant A is

$$\Delta[\mathrm{A}] = [\mathrm{A}]_{20} - [\mathrm{A}]_0$$

Once you know $\Delta[\mathrm{A}]$, t, and the expression for the rate of reaction in terms of A, you can calculate the rate of reaction.

Hint 2. Identify the expression for the rate of the reaction (click to open)

Hint 3. Calculate the change in the concentration of reactant A between t = 0 s and t = 20 s

What is the change in the concentration of reactant $\mathrm{A}(\Delta[\mathrm{A}])$ between t = 0 s and t = 20 s?

$$\Delta[\mathrm{A}] = [\mathrm{A}]_{20} - [\mathrm{A}]_0$$

The concentration of reactant A at t = 20 s ($[\mathrm{A}]_{20}$) is 0.0240 M and the concentration of the reactant A at $t = 0\ \mathrm{s}$ ($[\mathrm{A}]_0$) is 0.0400 M.

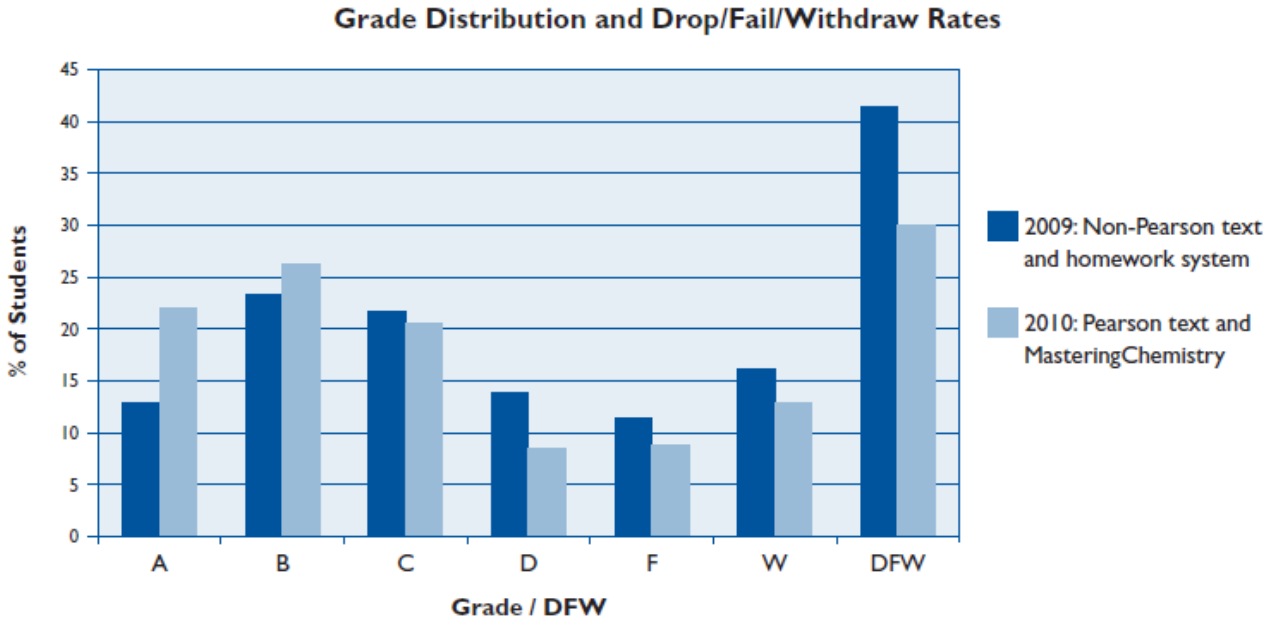
Express your answer in molar concentration to three significant figures.

$\Delta[\mathrm{A}] =$ [$\sqrt{\square}$] [$\alpha\beta$] [$\Delta\Sigma$] [reset] [shortcuts] [help] M

Submit My Answers Give Up

Optional hints allow students to pick only the help they need **when** they need it

Learning Gains



Results

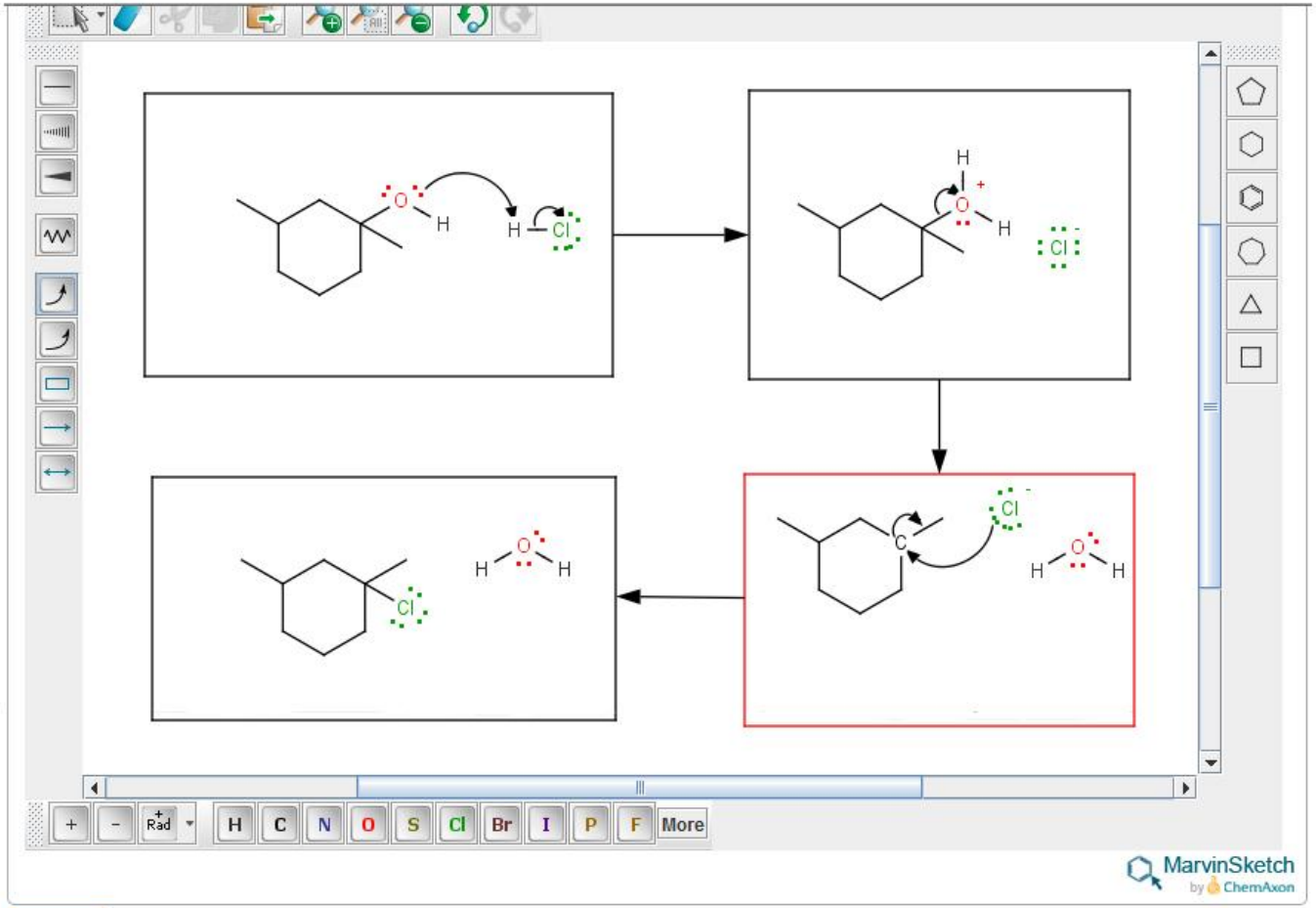
Students' course grade distribution shifted noticeably after we implemented MasteringChemistry. As shown in the chart below, we had a significant increase in the percentage of students earning an A or B, and far fewer Ds and Fs. The drop/fail/withdraw (DFW) rate fell dramatically from 41.6% pre-MasteringChemistry to 30.2% after MasteringChemistry.

Course Name CHE 105: General Chemistry

Credit Hours 3 credit hours/semester

Basic Course Information This is a traditional lecture/recitation course, serving approximately 2,000 students annually, mostly science, math, and engineering majors. Lab is taken concurrently, but as a separate course.

Submitted by Stephen Testa, University of Kentucky, KY

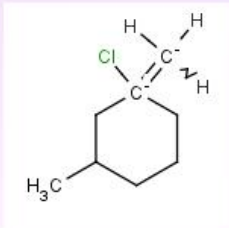


Submit Hints My Answers Give Up Review Part

Try Again

The electron-flow arrows in the highlighted step lead to products that have at least one atom with a total electron count more than the maximum. See the products calculated from the electron-flow arrows in the highlighted stage.

Interactive MarvinView



Origin of MasteringChemistry: Organic

- ACE Organic
  - Java web application on Tomcat and Oracle
  - Tight integration with JChem Base Java Class Libraries
  - Created by a Chemistry professor and a CS professor

Integrate that into MasteringChemistry

- Perl, uh oh
- JChem Web Services
  - New OchemEvaluationService endpoint
    - collects student submission & problem
    - iterates through problem until match
    - returns grade, feedback, errors
  - Extract ACE classes for Evaluation

Testing

- Web Service, Unit testing – Java's JUnit
- Integration Testing – Perl's Test::More
- Web Service, Functional testing (QA team) – soapUI

Performance

- 25k students this fall, 65k fall 2013
  - support 5% concurrently
- LoadUI against a quad core intel xeon @ 2.50GHz and 4gb ram, 32bit OS
- 1 evaluation, 200+/second, 10ms avg, no CPU hit
- 13 evaluations, 8/second, 100ms avg, 90% CPU
- Currently on a trio of the quad core machines which run all our services. Planned move to 2 dedicated OChem machines running 64bit OS 16 cores intel xeon @ 2.40GHz and 24gb ram

Challenges

- No Organic Chemists in Dev or QA
- Detangling our code from tomcat and axis2 and setting up version control/proper release process
- Keeping up with ACE changes
- Keeping up with MarvinSketch & JChem updates
  - currently v5.4.1.2
- Pearson enhancements

Validating the student experience

Step 1: Student user testing

8 Students, 1 hour individual Sessions

What we learned:

- Too many menu options to choose from
- Not all buttons and menu options are recognizable and used by students
- Arrangement of toolbars causes confusion and makes some buttons hard to find
- Drawing is not completely intuitive and requires a tutorial and practice to master

Validating the student experience

Step 2: Transition to an academic tool

What we changed:

- Remove menu options that make cheating easy
  - Save/Open
  - IUPAC Name
  - Find Structure Online
- Remove toolbar buttons and menu options that cause confusion
  - Single Up or Down Bond
  - Clear Desk
- Rearrange Toolbars to make buttons easier to find

Validating the student experience

Step 3: Training and support materials

What we created:

- How-To Tutorials with videos and practice questions
- Detailed help documentation specific to our implementation and how to use the drawing tool
- Troubleshooting guide for Java-related issues
- Instructor Guide: Tips for using MarvinSketch in your Classroom

Questions?