Mastering MarvinJS

Drawing tool for Mastering Chemistry

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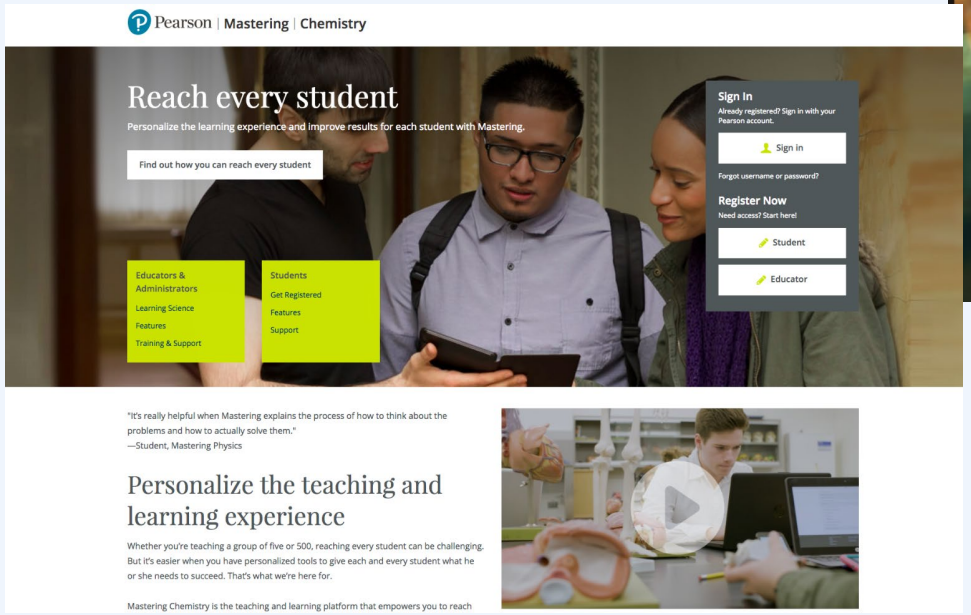
Mastering:

Over 2.9 million registrations across science and engineering



MasteringChemistry: 514,433 registrations

The Power of Mastering

Evaluator: expressionOchemEvalls

If any compound in the response is

Compound Label: NH3CH2CH2COOH

Compound: (double-click in the box below to edit with Marvin Sketch)

```
<?xml version="1.0" ?>
<cml>
<MDocument>
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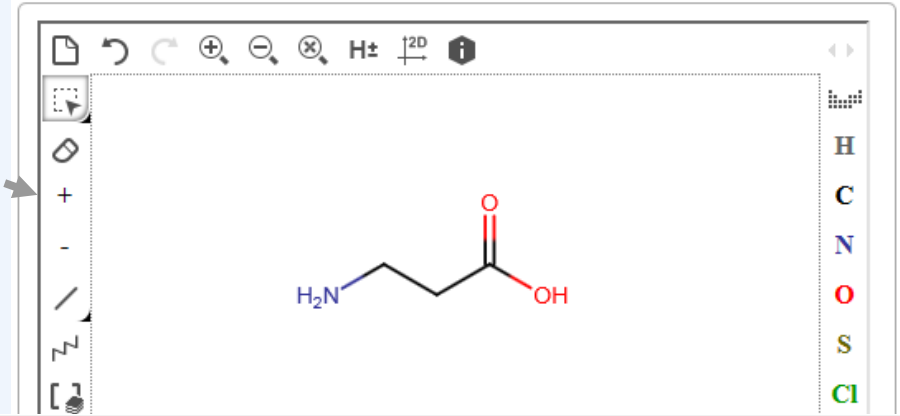
add @eitherEnantiomer check both enantiomers
add @resonanceStructures check for both resonance structures as well
add @sigmaNetworks check for identity of σ-bond networks only
add @eschewNormalization eschew normalization (aromatization and ylide standardization)

The structure of the amino acid alanine (CH_3CHNH_2COOH) contains a hydrogen atom, a methyl group, an amino group, and a carboxylic acid attached to a central carbon. Draw alanine.



Using specific evaluators, authors can write targeted feedback geared toward specific student answers.

Incorrect; Try Again

In amino acids such as alanine, an amino group ($-NH_2$), a hydrogen atom, the R group (methyl in alanine), and a carboxylic acid group ($-COOH$) are all bonded to a central carbon. Your structure should contain a methyl group. It may help to start with the central carbon atom and draw each group off of the one atom.

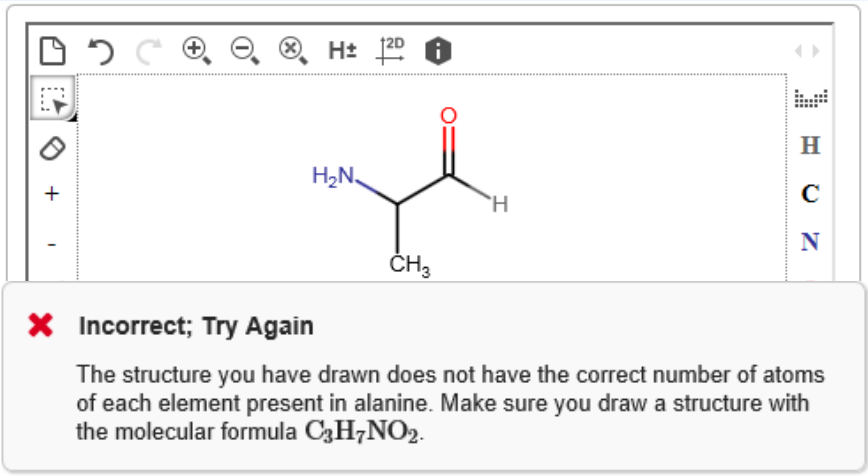
The Power of Mastering

Evaluator: expressionOchemEvalFormula

If: if the response has

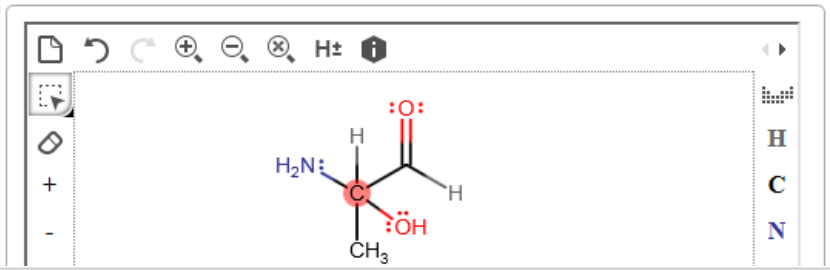
the molecular formula: C3H7NO2

Feedback can also be authored for more general criteria



Incorrect; Try Again

The structure you have drawn does not have the correct number of atoms of each element present in alanine. Make sure you draw a structure with the molecular formula $C_3H_7NO_2$.



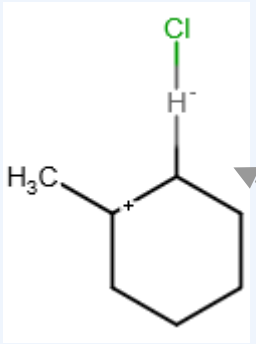
Incorrect; Try Again

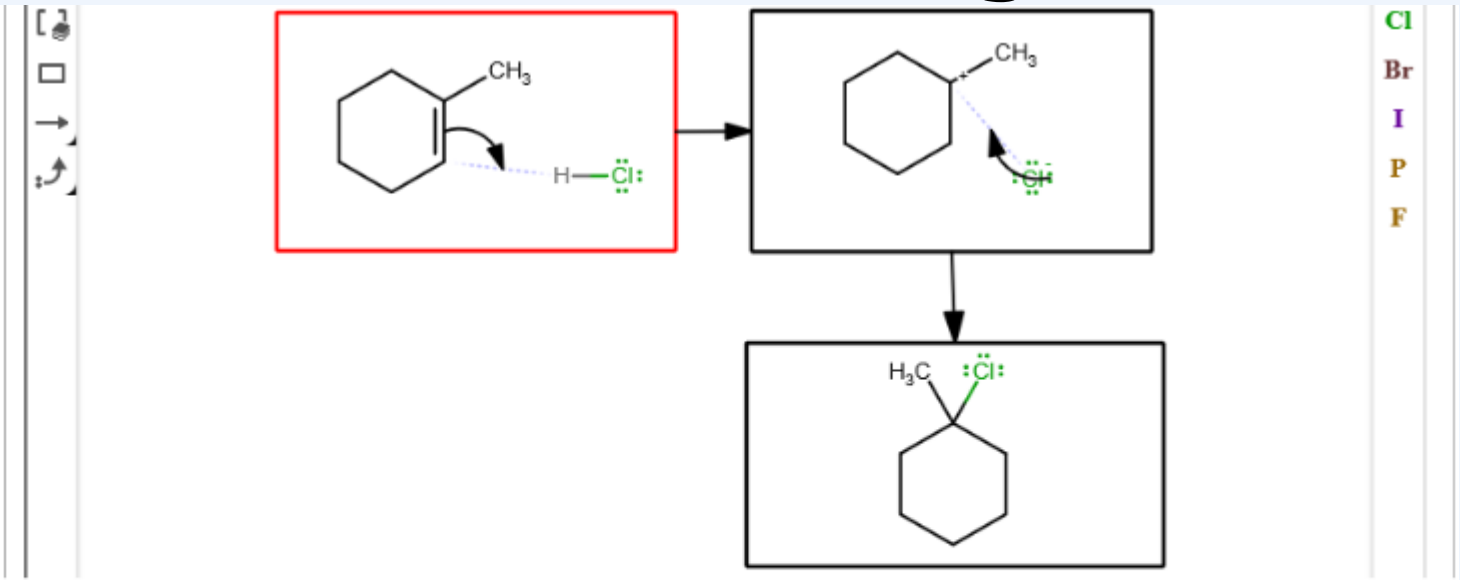
At least one of the atoms in your response has an invalid valence. If you don't see an atom highlighted in red, look for an atom that violates the octet rule, or try expanding your shortcut groups

And there is also system generated feedback for basic drawing issues.

The Power of Mastering

System generated prediction of structure based on curved arrow placement





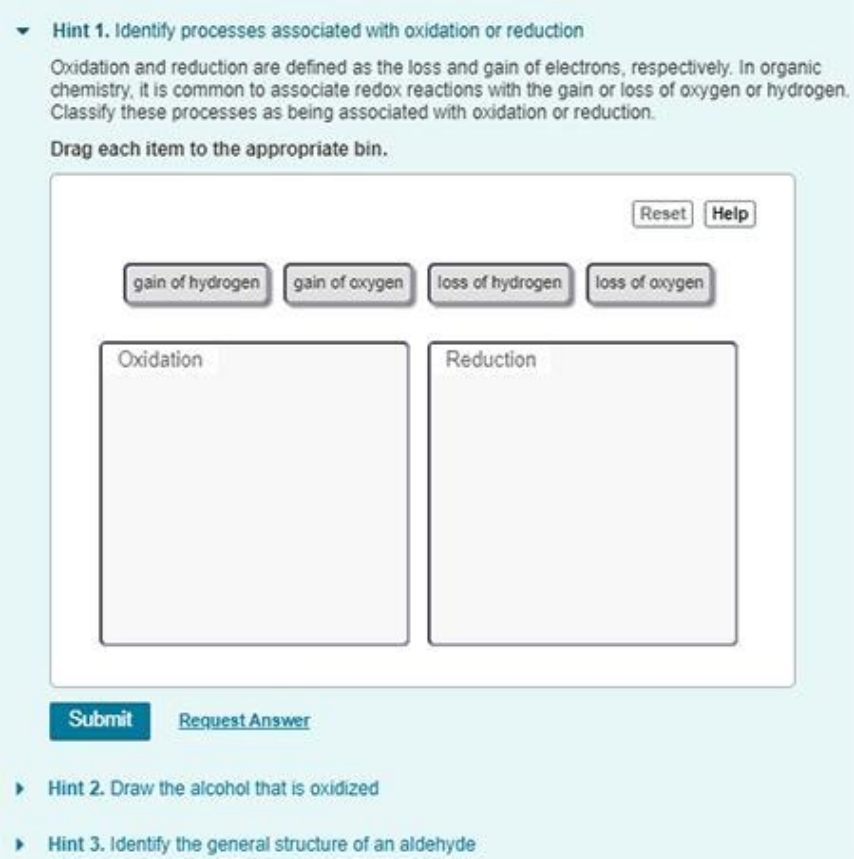
Incorrect; Try Again

Too many electrons are being shared with the highlighted atom, leading to products that have an atom with a total electron count more than the maximum.
When you draw any curved arrow, pay attention to the atoms contributing electrons. Select the Electron flow arrow from the toolbar on the left, and then click on a curved arrow to rotate through them. Any dotted-line indicates the atoms associated with the flow of electrons.
See the products Mastering has calculated from the electron-flow arrows in the highlighted stage.
Some of your electron-flow arrows are incorrect. If one of the boxes is colored red, the electron-flow arrows in that box probably do not lead to the compounds in the subsequent box.

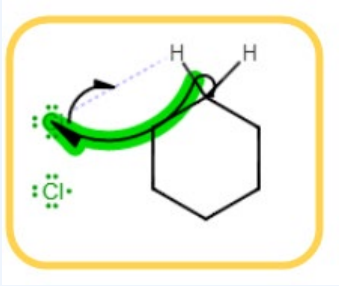
Scaffolded Learning

Draw the aldehyde produced from the oxidation of $CH_3CH_2CH_2C(CH_3)_2CH_2OH$.

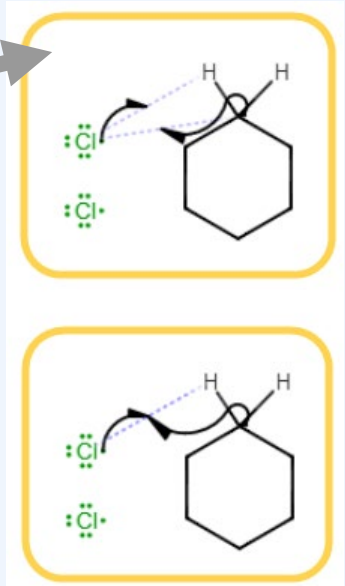
Hints step students through the problem. Socratic hints guide students much like instructor office hours.



Electron Flow Arrows

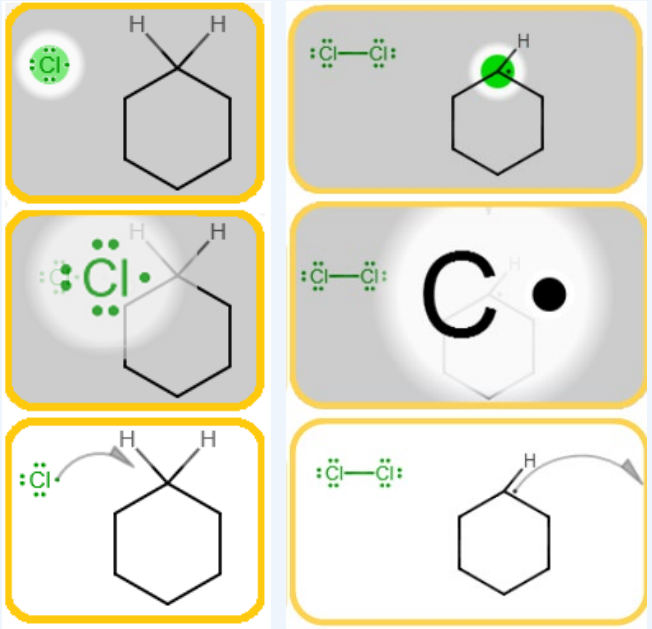


or



After drawing initial electron flow arrow, student clicks to specify the correct bond.

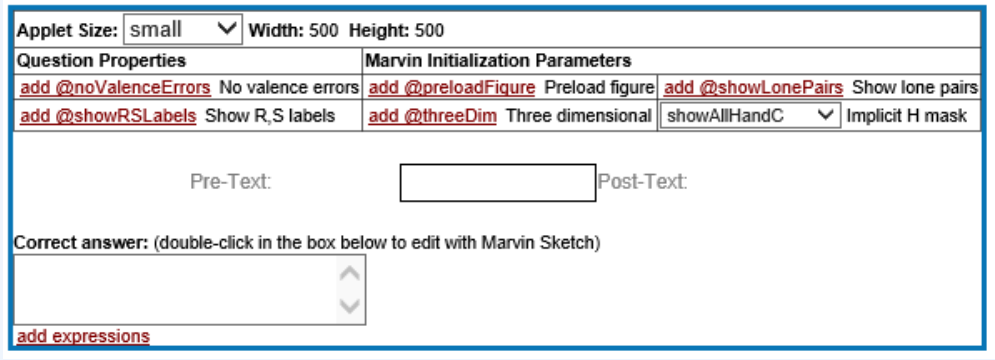
Dotted line maintains visual confirmation of bond.

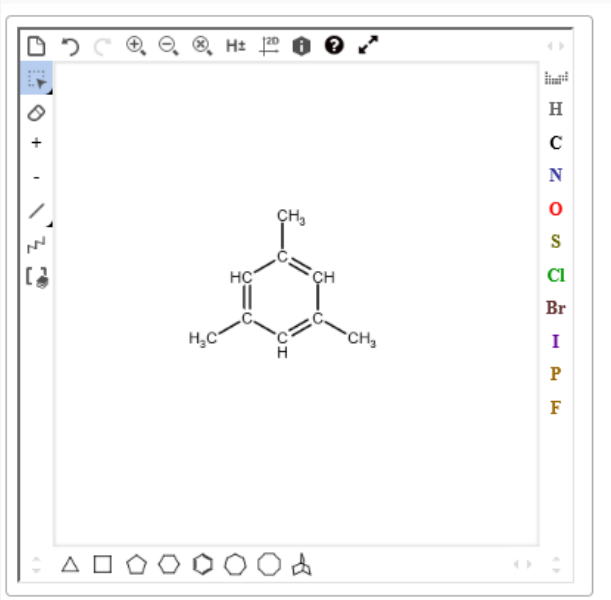


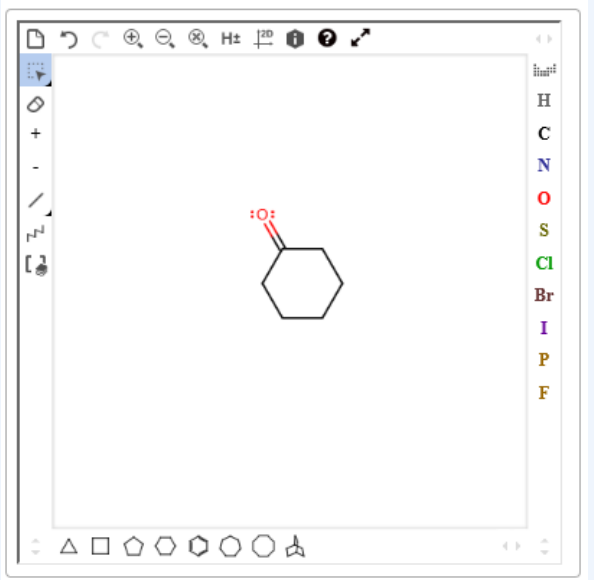
Students select electron(s) when showing flow.

Custom Display

- **Skeletal2D or Skeletal3D**
- Ability to control showing:
  - Lone pairs
  - Valence errors
  - C and/or H
  - R,S labels

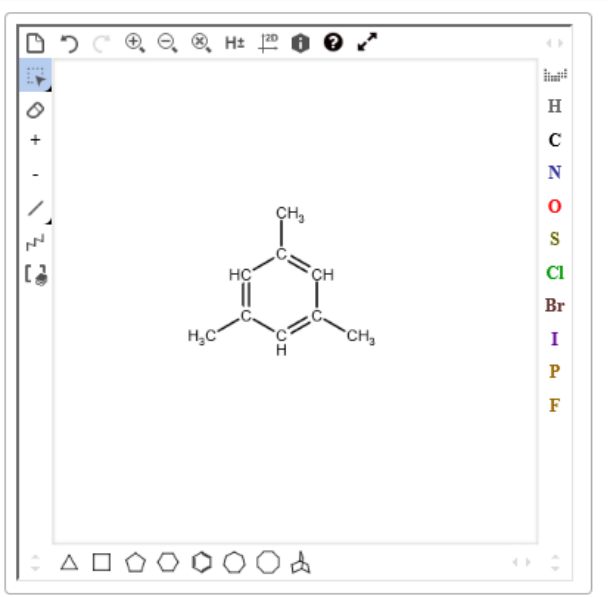


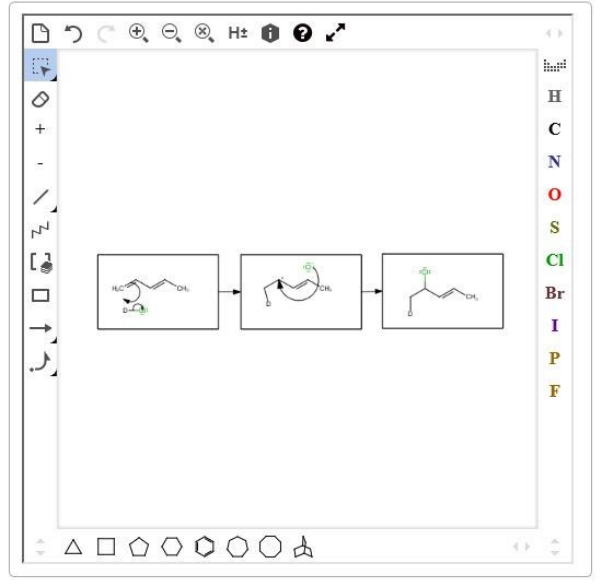




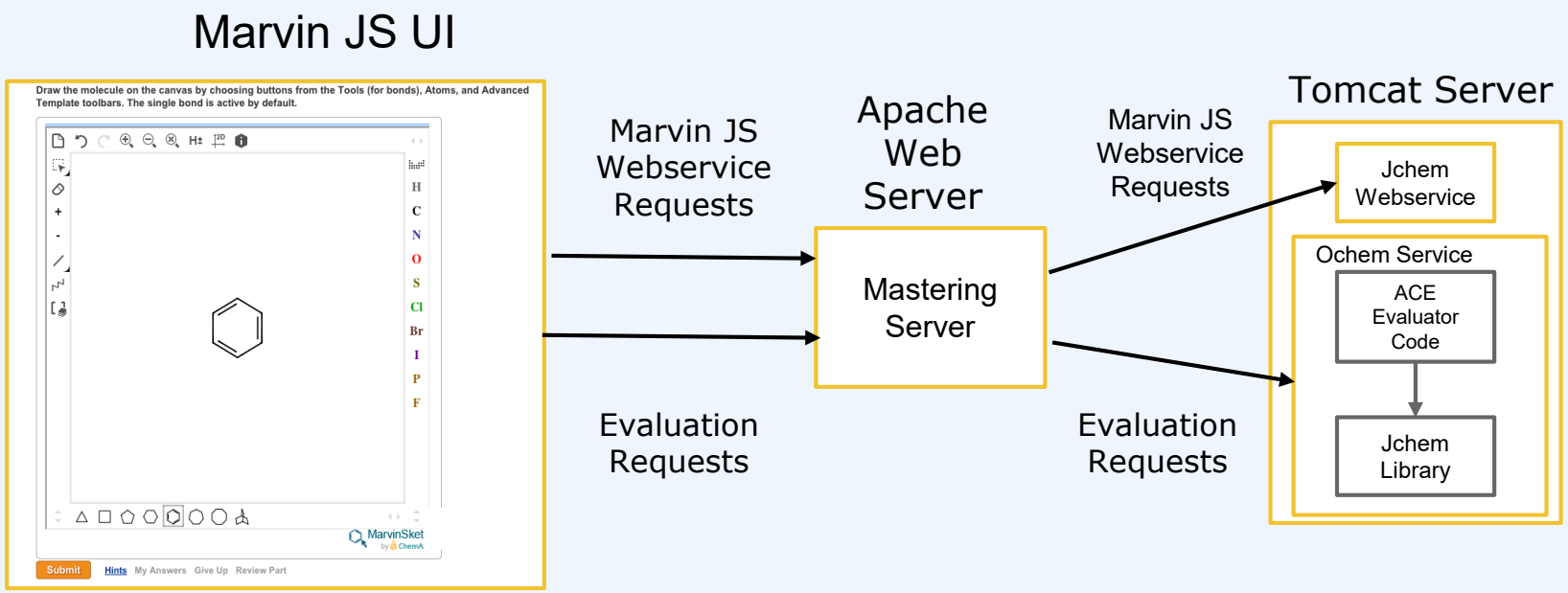
Custom Display

- **Skeletal2D, Skeletal3D, Mechanism**
- Toolbars adjust to each answer type





Basic System Architecture - MarvinJS/Mastering



Accessibility

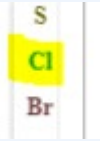
- WCAG 2.0 AA accessibility standards
- Not totally achieved, but ahead of our competitors
- Drawing tools like MarvinJS yield particular challenges

All user actions should be announced by a screen reader

Ensure every button has:

- Visible keyboard focus
- Associated alt text

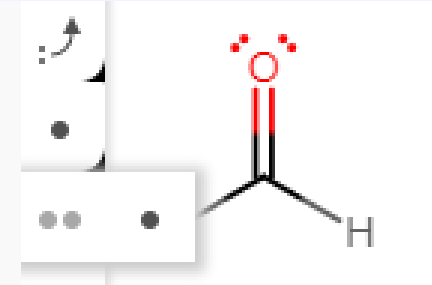
Use a darker green to meet the required contrast of 4.5:1

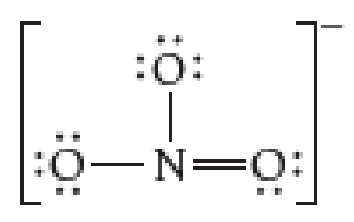


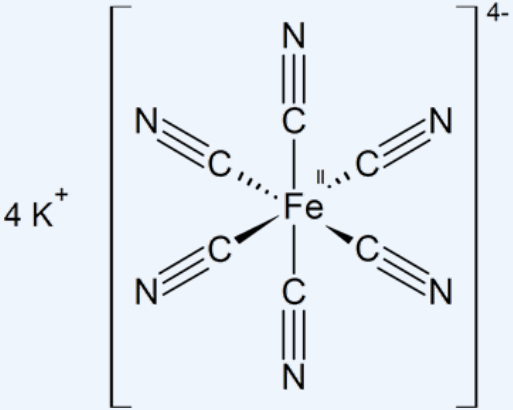
Improvements: Lewis drawing

1. Unpaired and lone-pairs of electrons manually added and graded

2. Brackets available for ionic species



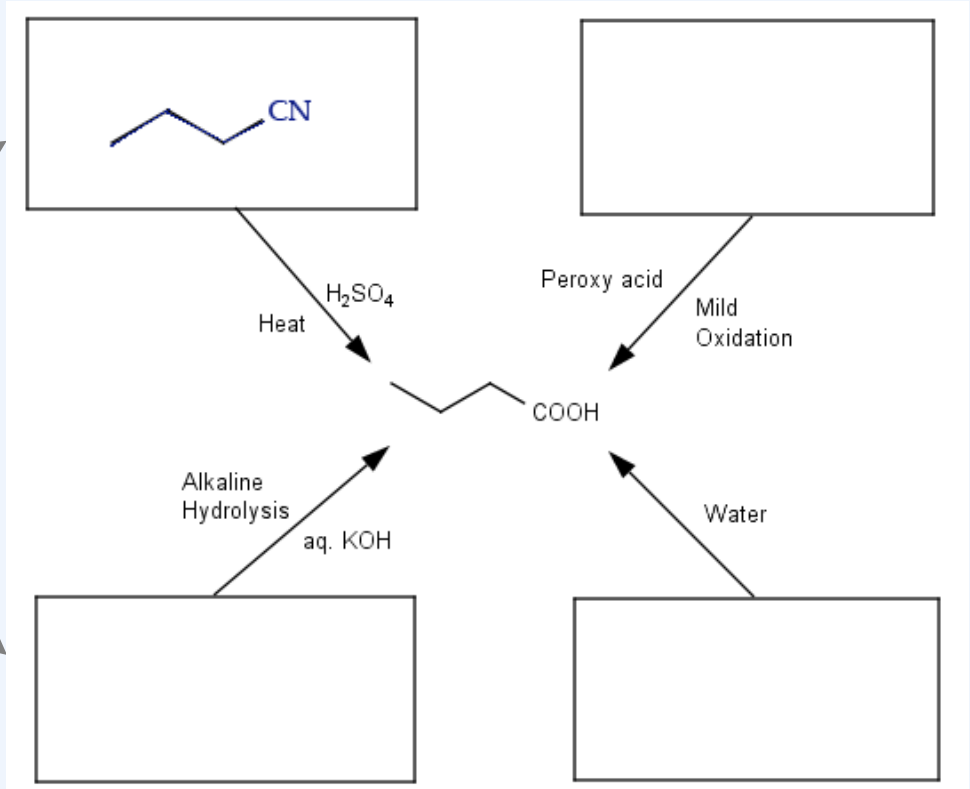




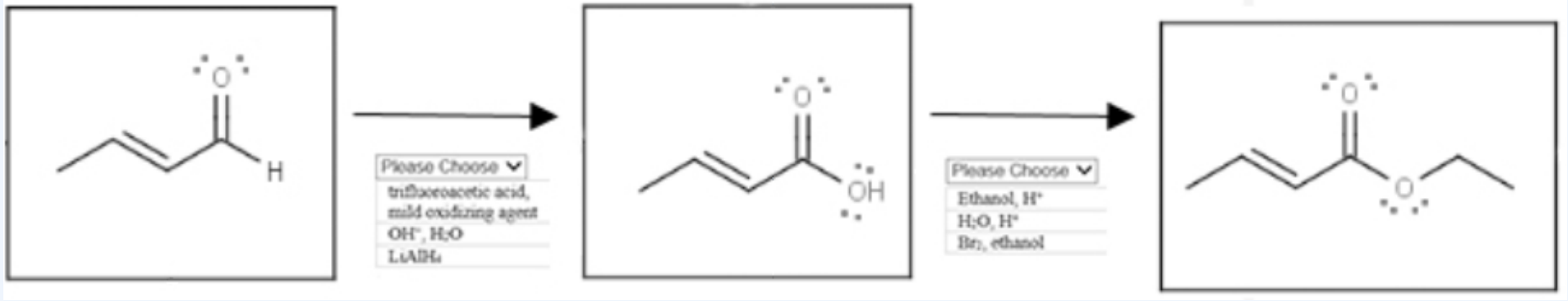
Extend use of MarvinJS to all answer types in MasteringChemistry.

Mastering Today: Synthesis maps

Students add precursors

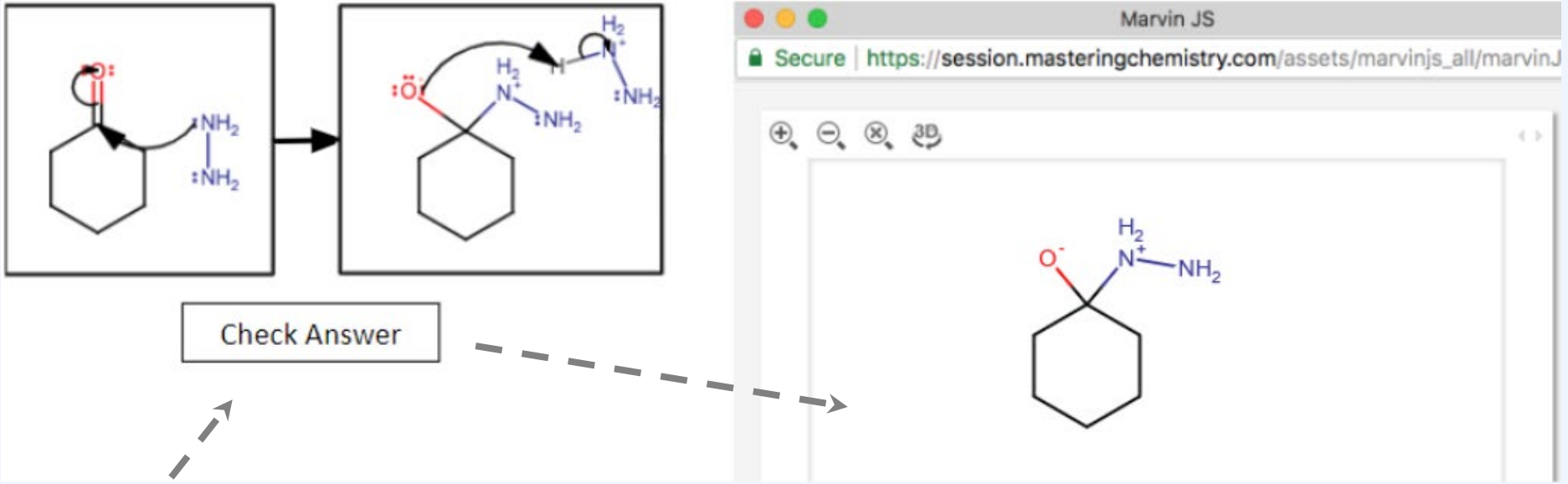


Mastering Tomorrow: Reagent Dropdown Menu



This answer type would enhance use in 2nd semester Organic Chemistry.

Mastering Tomorrow: Predictive Mechanism



Check steps as move through mechanism

This answer type would enhance use in 2nd semester Organic Chemistry.

Marvin for JavaScript

For more information, please contact
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