



MarvinJS goes to College

Drawing tool for MasteringChemistry

J Zane Barlow PhD, Product Manager

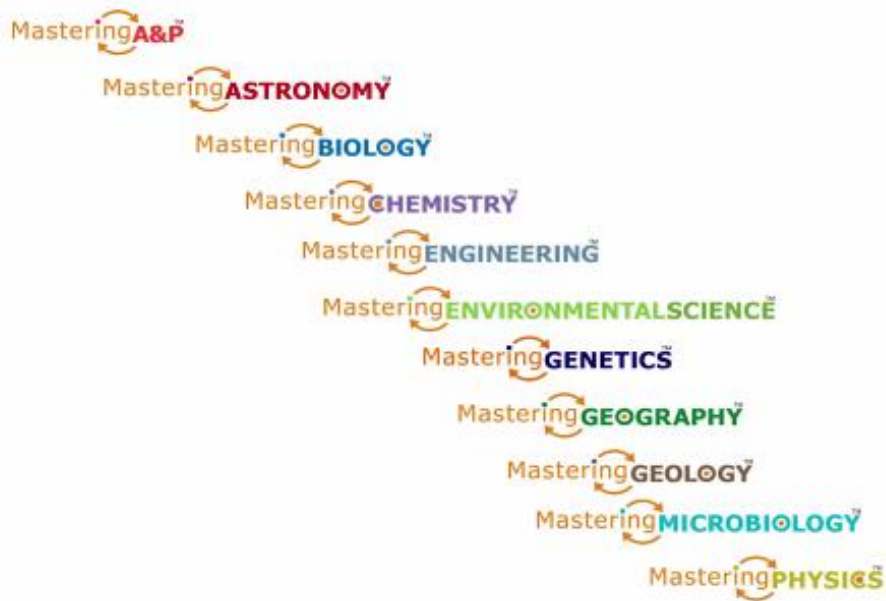
Margaret Trombley, Content Lead

Prasanth Buchi, Development Lead

Jeanne Zalesky, Editor in Chief

Pearson Education

**Mastering:
Over 1.7 million registrations**



**MasteringChemistry:
389,788 registrations**

The Power of Mastering

Evaluator: expressionOchemEvals

If compound in the response is

Compound Label:

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

```
<?xml version="1.0" ?>
<cml>
<MDocument>
```

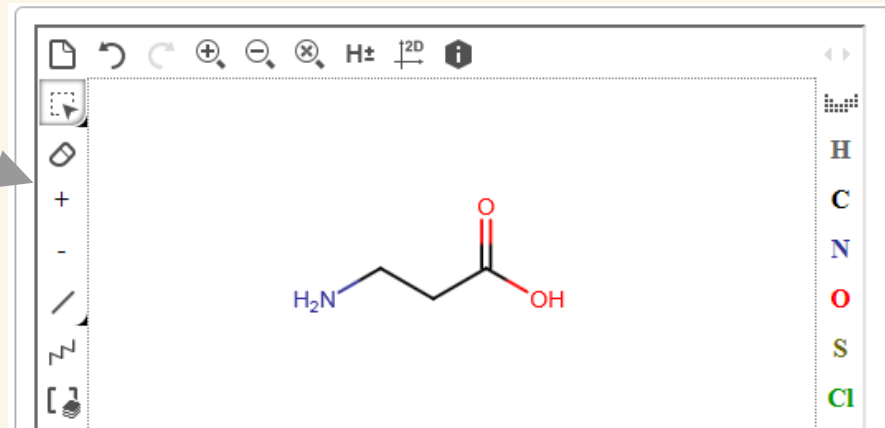
[add @eitherEnantiomer](#) check both enantiomers

[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 ($\text{CH}_3\text{CHNH}_2\text{COOH}$) contains a hydrogen atom, a methyl group, an amino group, and a carboxylic acid attached to a central carbon. Draw alanine.



Incorrect; Try Again

In amino acids such as alanine, an amino group (NH_2), a hydrogen atom, the remainder group (methyl in alanine), and a carboxylic acid group ($-\text{COOH}$) 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 this one atom.

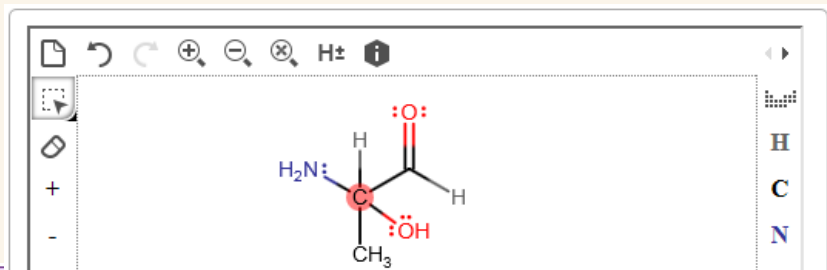
Using specific evaluators, authors can write targeted feedback geared toward specific student answers.

The Power of Mastering

Evaluator: expressionOchemEvalFormula

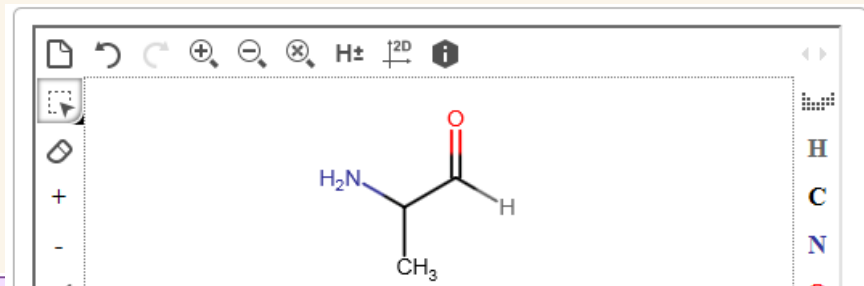
if the molecular formula

Feedback can also be authored for more general criteria



Incorrect; Try Again

Mastering has highlighted one or more atoms in your response that have an invalid valence. If Mastering has highlighted a shortcut group, you may need to expand the group to see the atoms with the invalid valences.



Incorrect; Try Again

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

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

Driving Learning

Draw the aldehyde produced from the oxidation of $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}(\text{CH}_3)_2\text{CH}_2\text{OH}$.

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

Hint 1. Identify processes associated with oxidation or reduction

Oxidation and reduction are defined as the loss and gain of electrons, respectively. In organic chemistry, it is common to associate redox reactions with the gain or loss of oxygen or hydrogen. Classify these processes as being associated with oxidation or reduction.

Drag the appropriate processes to their respective bins.

loss of hydrogen loss of oxygen gain of oxygen gain of hydrogen

Oxidation Reduction

reset help

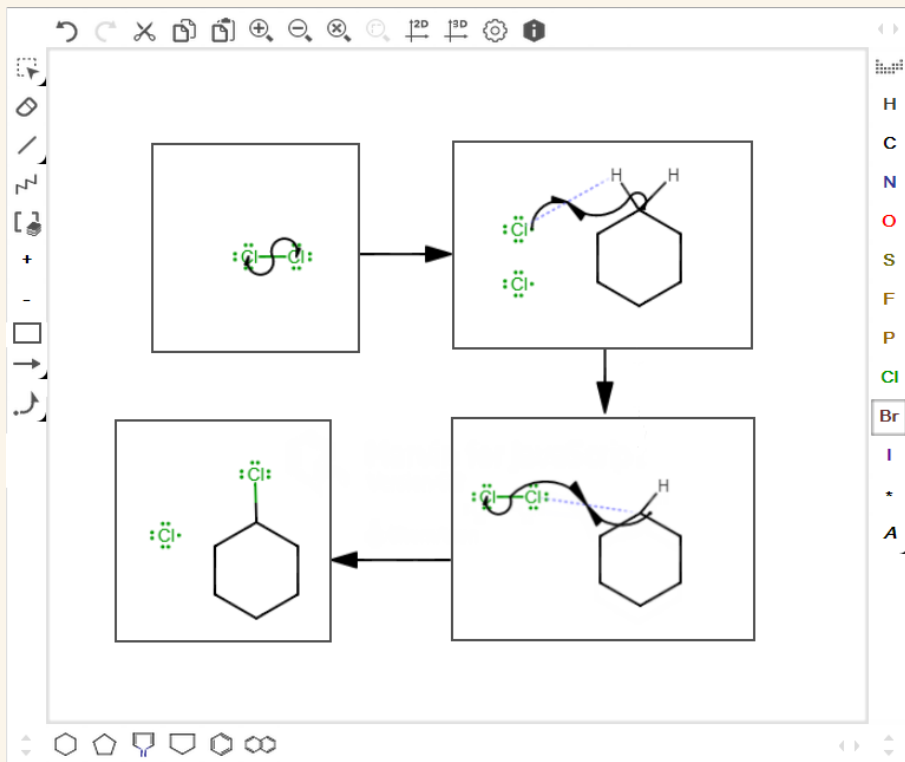
Submit

My Answers [Give Up](#)

Hint 2. Draw the alcohol that is oxidized [\(click to open\)](#)

Hint 3. Identify the general structure of an aldehyde [\(click to open\)](#)

Marvin for JavaScript



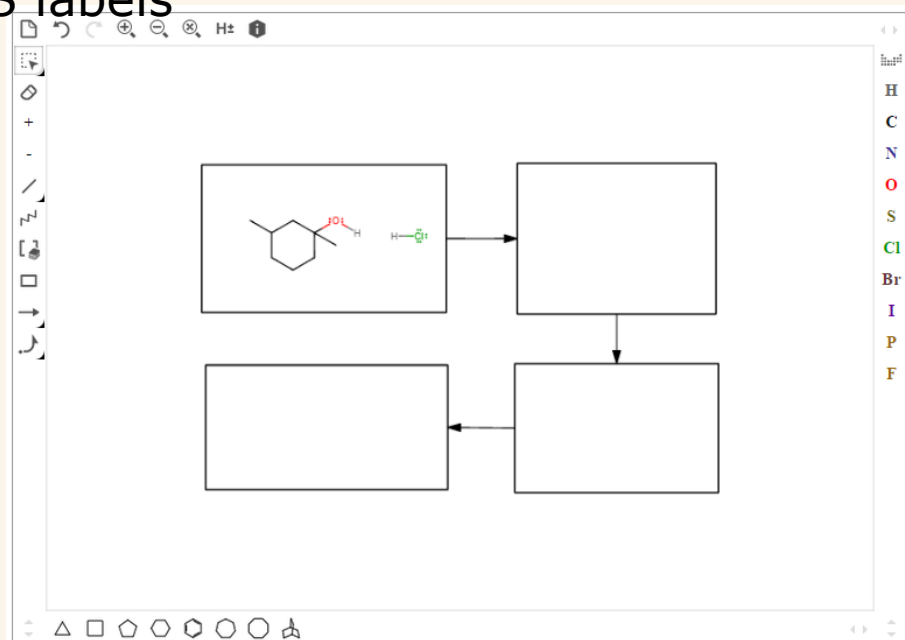
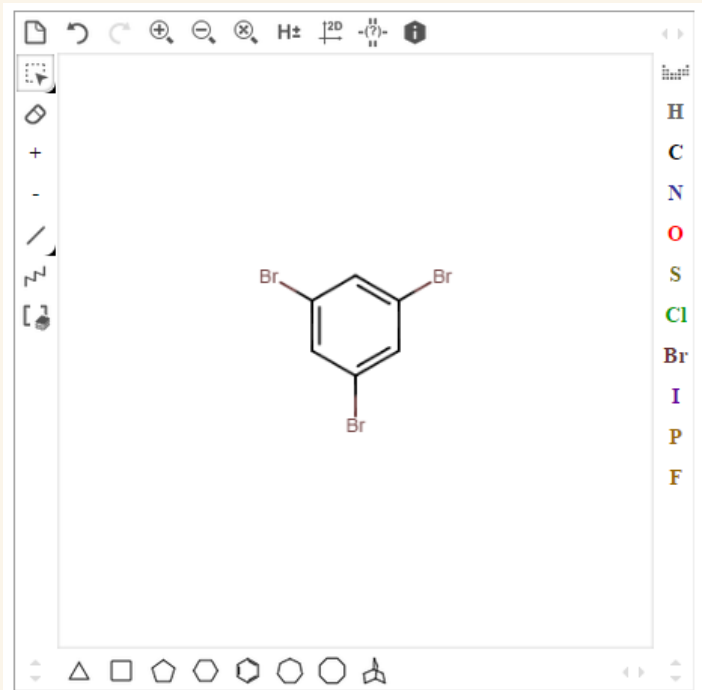
A user friendly tool for quick and convenient drawing of chemical structures and mechanisms.

Student benefits:

- New user friendly interface
- Mobile compatible
- Faster load times
- No JAVA!

Customized

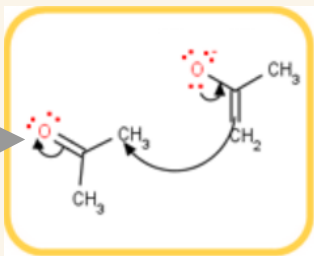
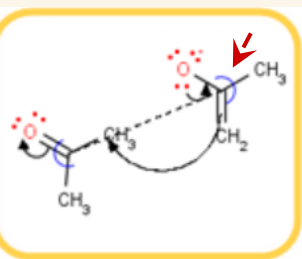
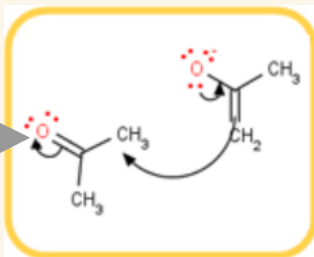
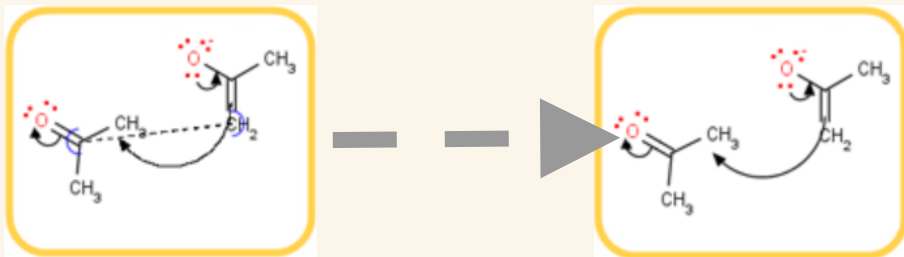
- Skeletal2D, Skeletal3D, Mechanism
- Ability to control showing:
 - Lone pairs
 - Valence errors
 - C and/or H
 - R,S labels



Toolbars specific to answer type

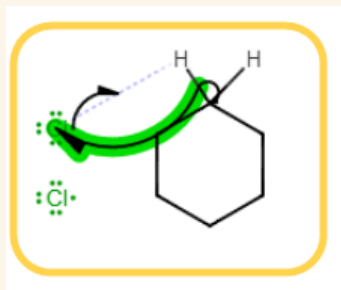
Usability: Challenge of drawing electron flows

In MarvinSketch:

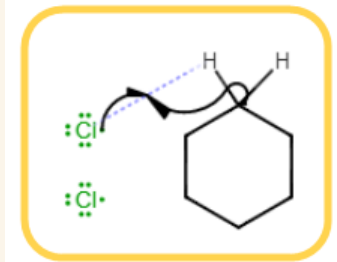
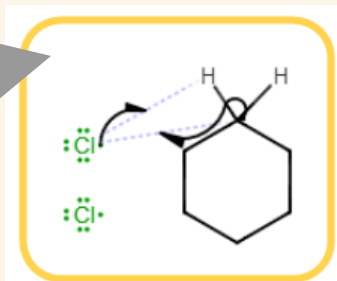


1. Subtle mouse movements radically alter the electron flow that's created
2. No consistent visual cues of what bond is created (difficult to determine why submission is wrong)
3. Students draw electron flow from atoms not electrons, which can lead to misconception

Improvements to Electron Flow in MarvinJS

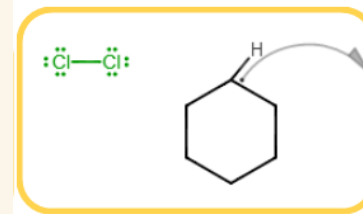
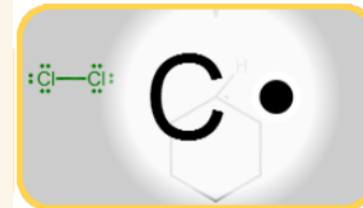
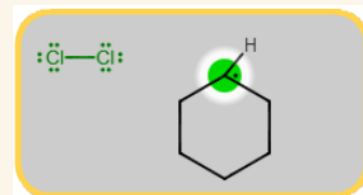


or



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

Dotted line maintains visual confirmation of bond.



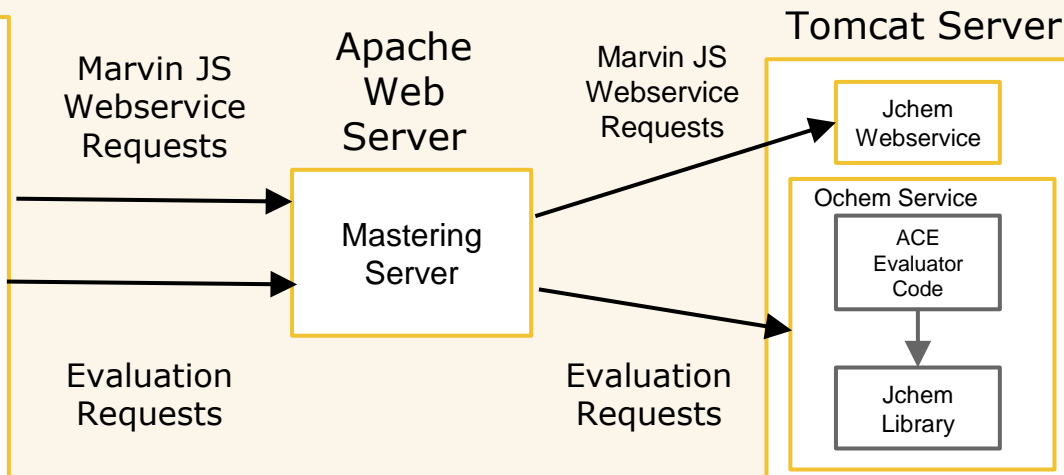
Students select electron(s) when showing flow.

Basic System Architecture - MarvinJS/Mastering

Marvin JS UI

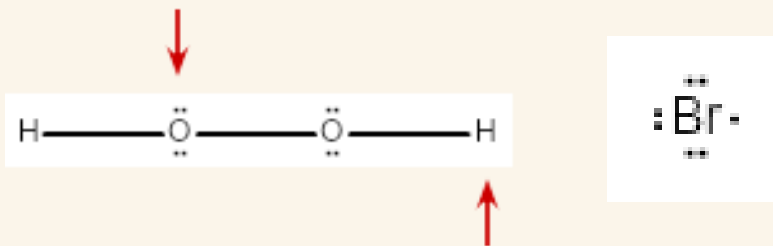
Draw the molecule on the canvas by choosing buttons from the Tools (for bonds), Atoms, and Advanced Template toolbars. The single bond is active by default.

Submit Hints My Answers Give Up Review Part



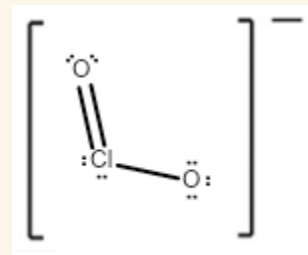
Next steps: Lewis drawing

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



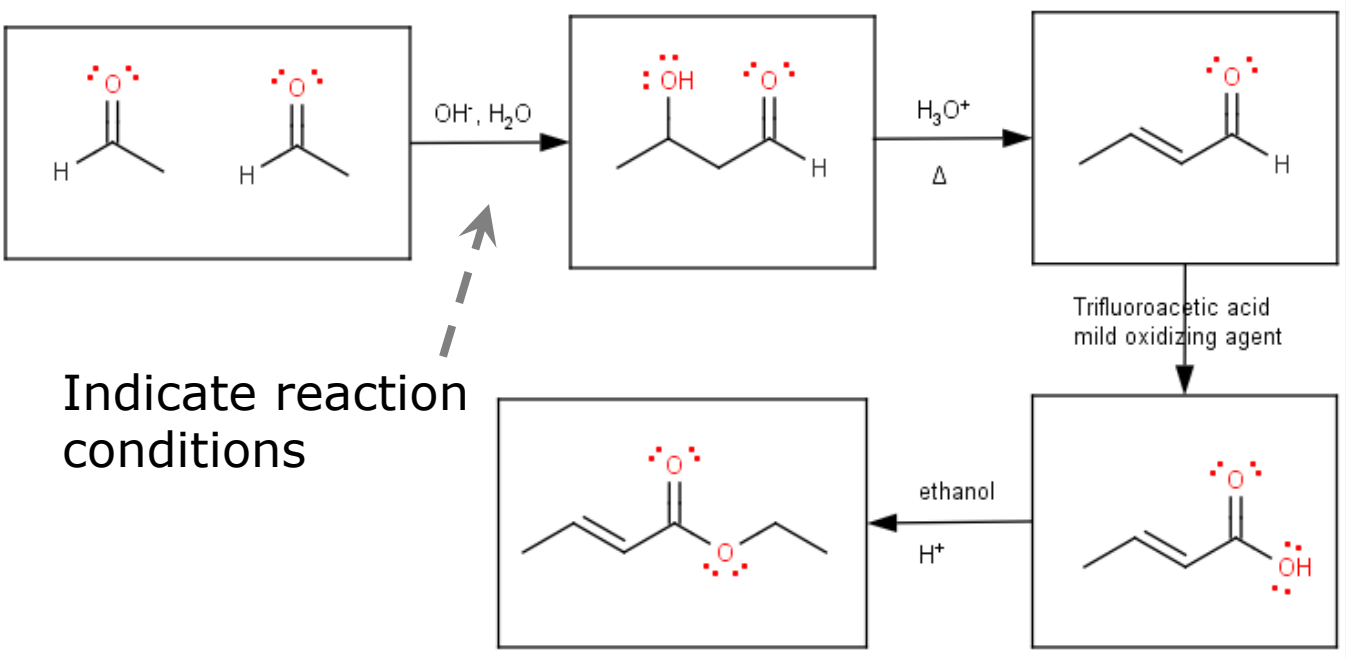
2 Hydrogen atoms manually added and graded

3 Brackets available for ionic species



Extend use of MarvinJS to all answer types in MasteringChemistry.

Next steps: Synthesis Problems



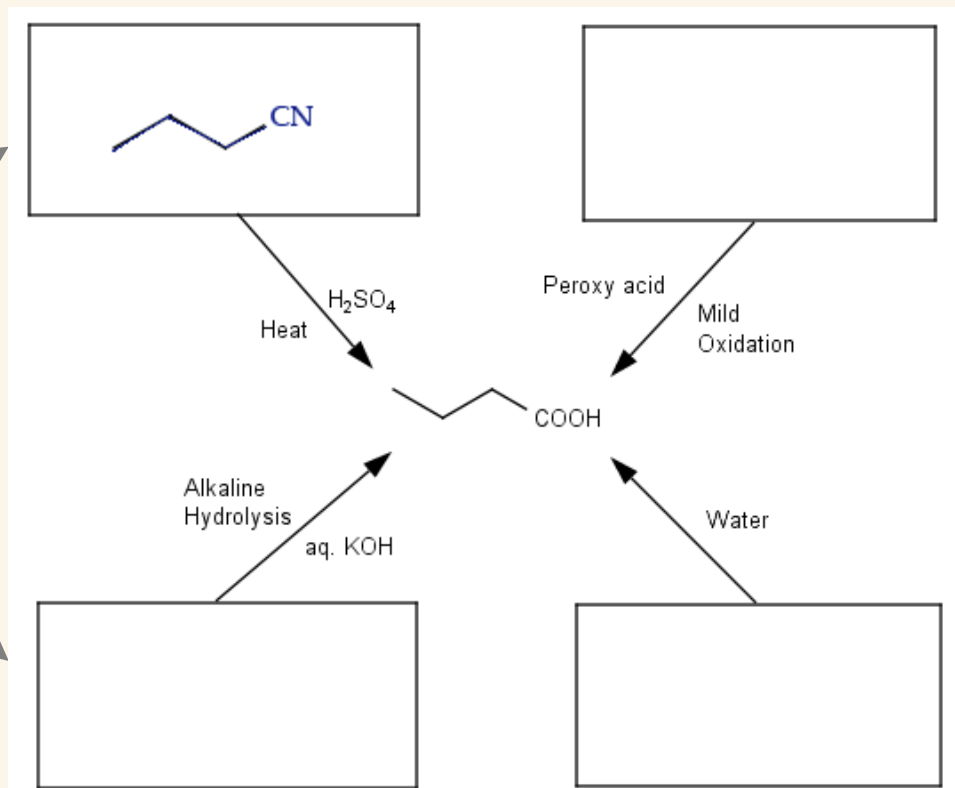
Indicate reaction conditions

Products of each step, rather than electron flow

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

Current Workaround: Synthesis maps

Students add precursors



Marvin for JavaScript

For more information, please contact
[J. Zane Barlow](mailto:zane.barlow@pearson.com) (zane.barlow@pearson.com)

