



FALL 2020 FACULTY ONLINE  
TEACHING EXTRAVAGANZA



# TEACHING A CHEMISTRY LABORATORY COURSE EFFECTIVELY AND ECONOMICALLY

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# A CHEMISTRY LABORATORY COURSE

- Provides hands-on experience to investigate real-world applications of theory
- Teaches the proper use of equipment and glassware

# TEACHING A CHEMISTRY LABORATORY COURSE ONLINE

- An online chemistry lab class is challenging
- Students won't get a chance to perform experiments using chemicals and instruments
- Delivery of the concepts as in an actual experiment is important
- Virtual lab applications with in-built experiments are available

# VIRTUAL LAB APPLICATIONS

- Closely resemble the actual lab environment
- Allow use of glassware and equipment in a virtual lab environment
- Guide through analysis of data
- Allow the students to repeat the experiments as many times as they want
- Provide in-built pre- and post-lab questions

# PROBLEMS WITH CURRENT VIRTUAL LAB APPLICATIONS

- Cost
  - High due to low number of students
- Requirement of a reliable Internet connection
- Limited flexibility for changing the experiments

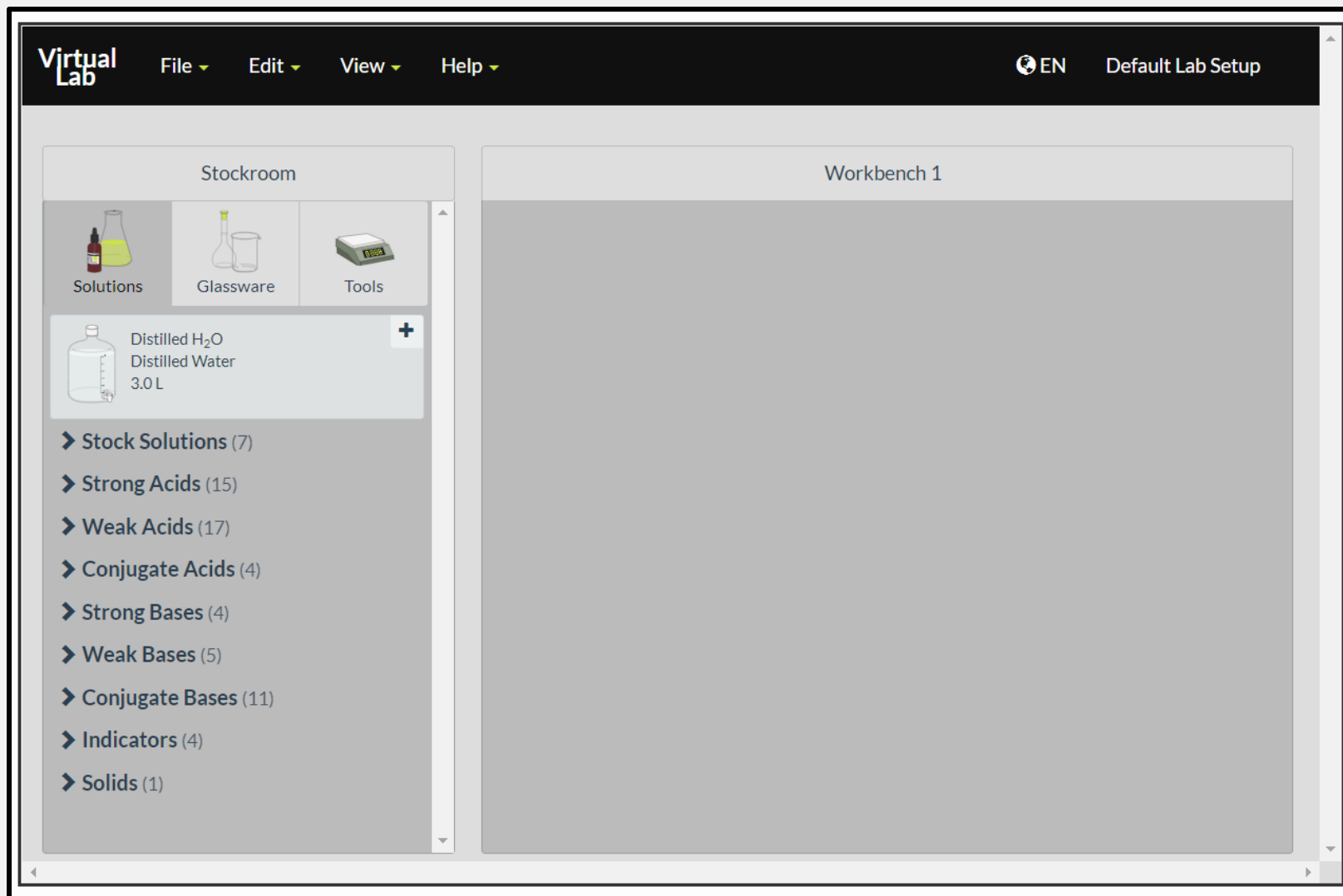
# ECONOMICAL OPTIONS

- Free online virtual lab platforms
- Free molecular modeling software
- Simple experiments that can be done using household items

# FREE ONLINE VIRTUAL LAB PLATFORMS

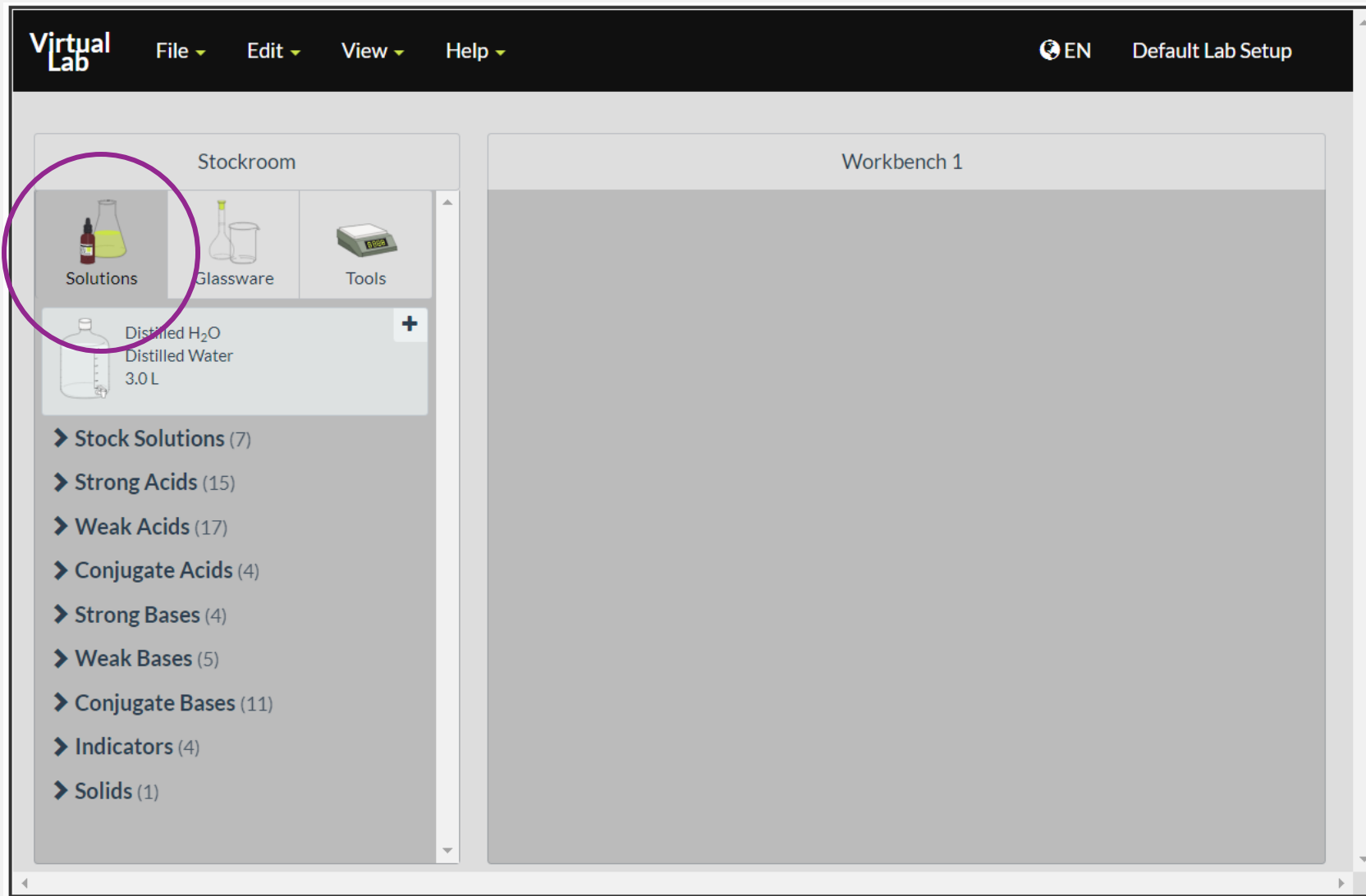
- ChemCollective Virtual Labs
  - Hosted by ChemCollective online resources for teaching and learning chemistry
  - A project in the National Science Digital Library
- Allow designing our own experiments using the available resources

# THE CHEMCOLLECTIVE VIRTUAL LAB INTERFACE

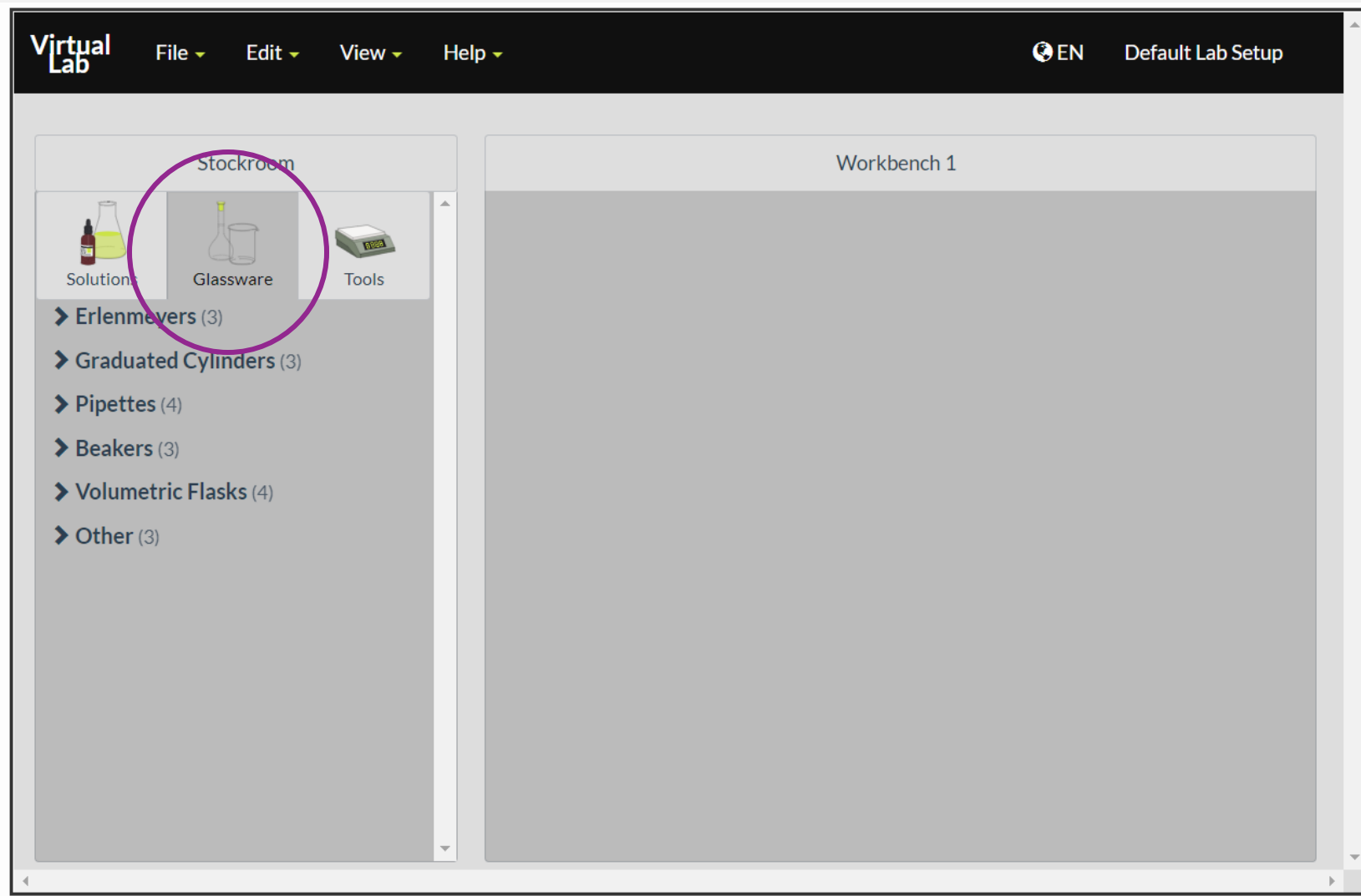




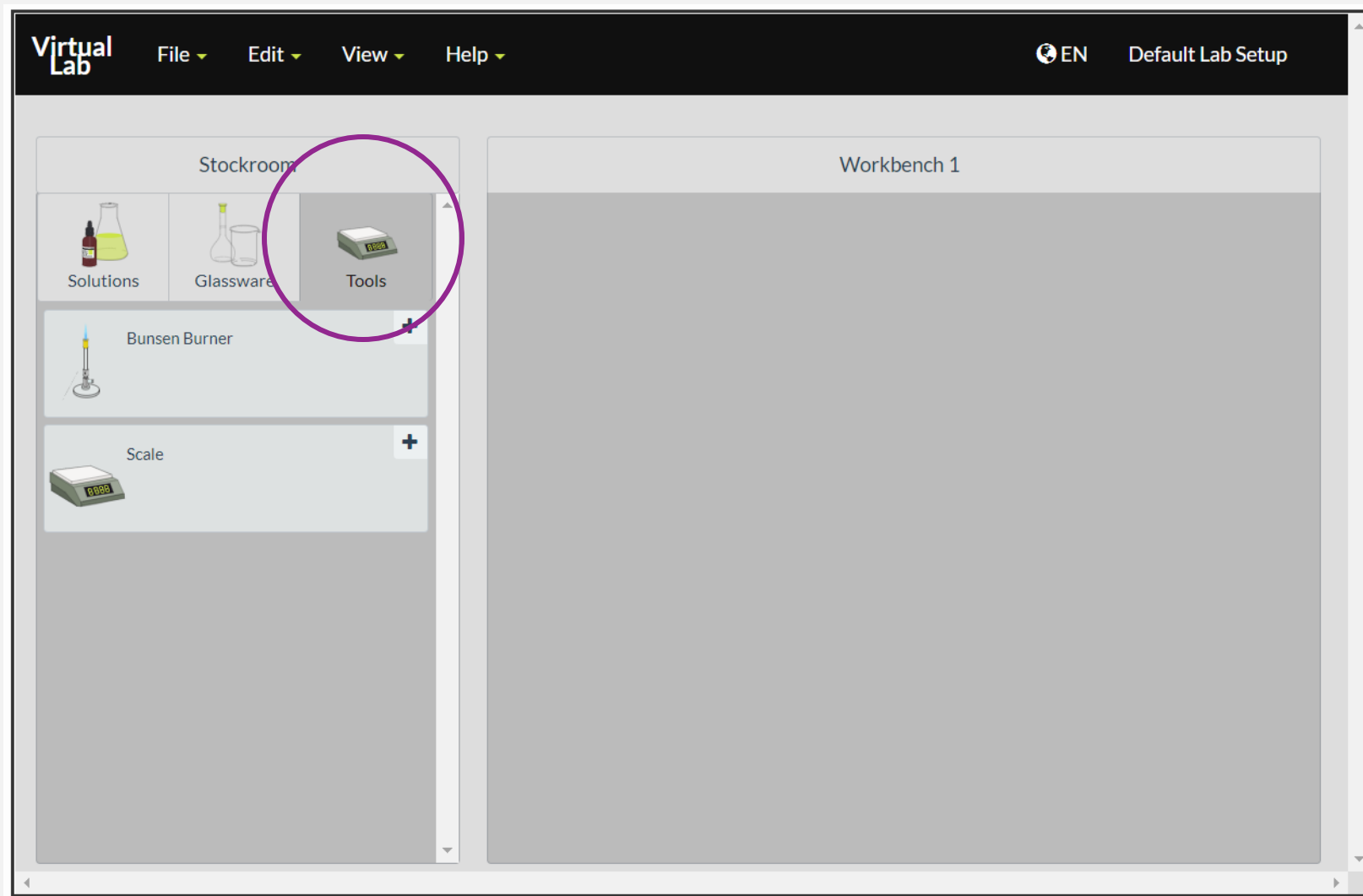
# THE CHEMCOLLECTIVE VIRTUAL LAB INTERFACE



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# THE CHEMCOLLECTIVE VIRTUAL LAB INTERFACE

The screenshot displays the Virtual Lab interface, which is divided into two main sections: the Stockroom and the Workbench.

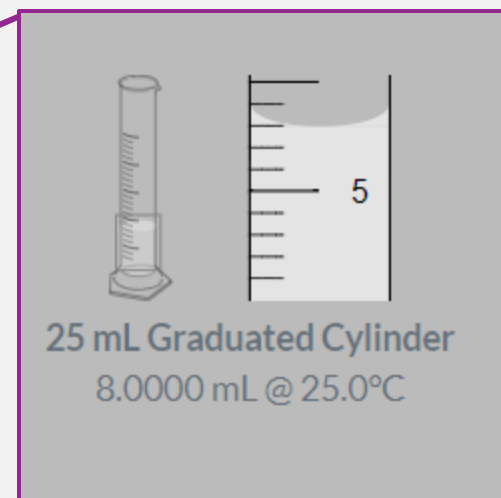
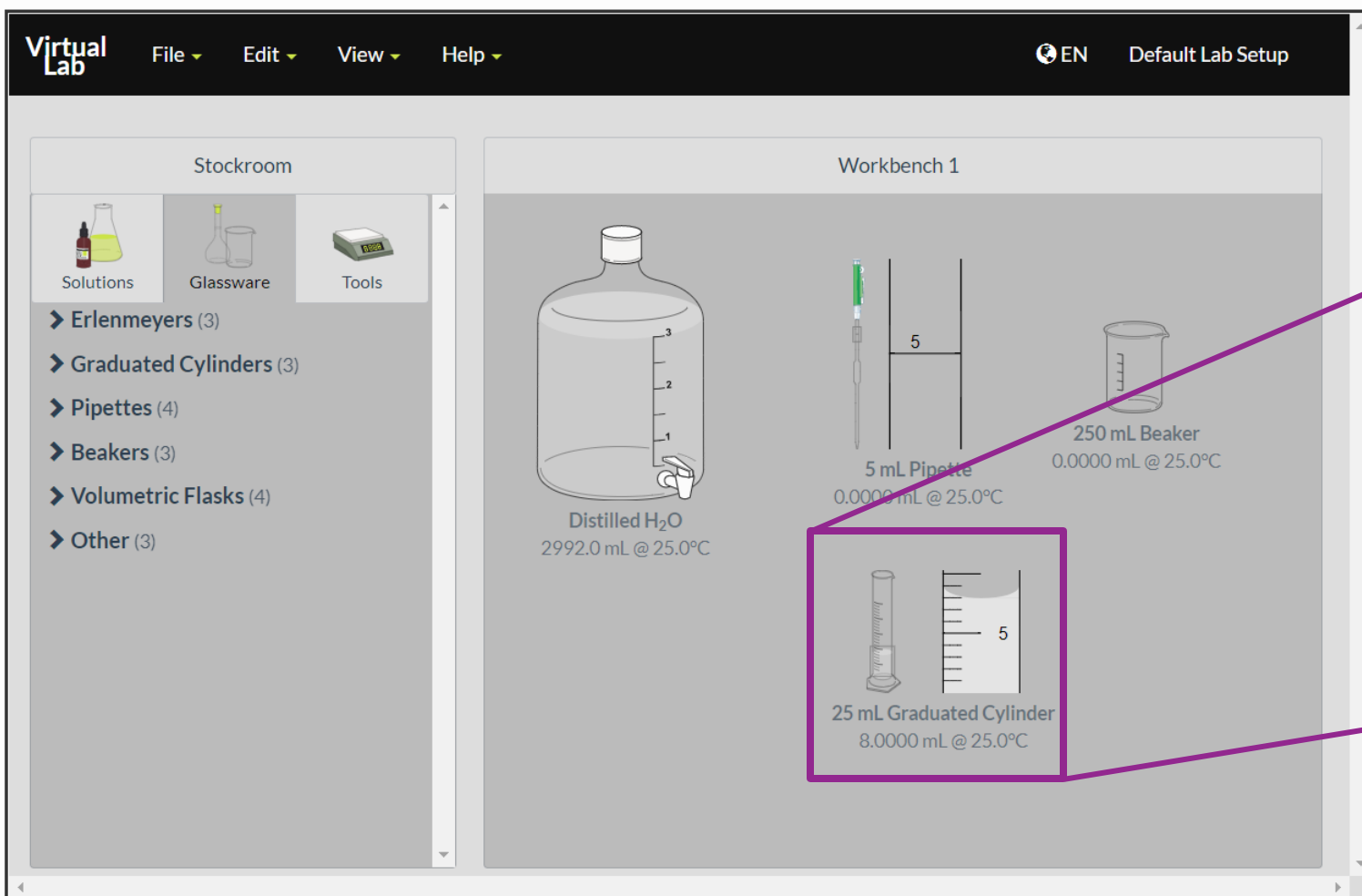
**Stockroom:** This section is located on the left side of the interface. It features a menu bar at the top with "File", "Edit", "View", and "Help" options. Below the menu bar, there are three tabs: "Solutions", "Glassware", and "Tools". Under the "Glassware" tab, there is a list of items with expandable arrows:

- ▶ Erlenmeyers (3)
- ▶ Graduated Cylinders (3)
- ▶ Pipettes (4)
- ▶ Beakers (3)
- ▶ Volumetric Flasks (4)
- ▶ Other (3)

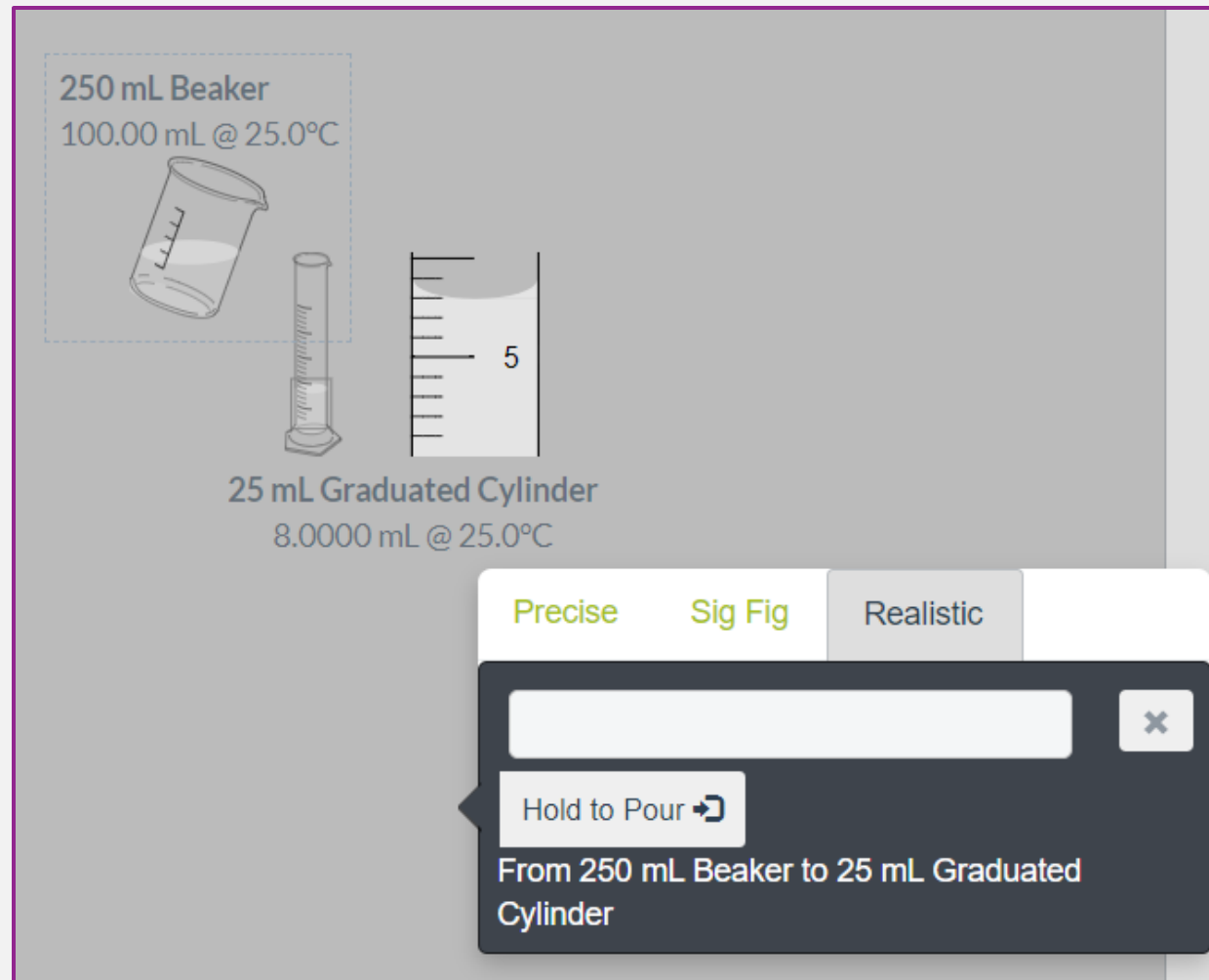
**Workbench 1:** This section is located on the right side of the interface. It contains four items:

- Distilled H<sub>2</sub>O:** A large bottle with a tap, containing 2992.0 mL @ 25.0°C.
- 5 mL Pipette:** A pipette with a volume of 0.0000 mL @ 25.0°C.
- 250 mL Beaker:** A beaker with a volume of 0.0000 mL @ 25.0°C.
- 25 mL Graduated Cylinder:** A graduated cylinder with a volume of 8.0000 mL @ 25.0°C.

# THE CHEMCOLLECTIVE VIRTUAL LAB INTERFACE

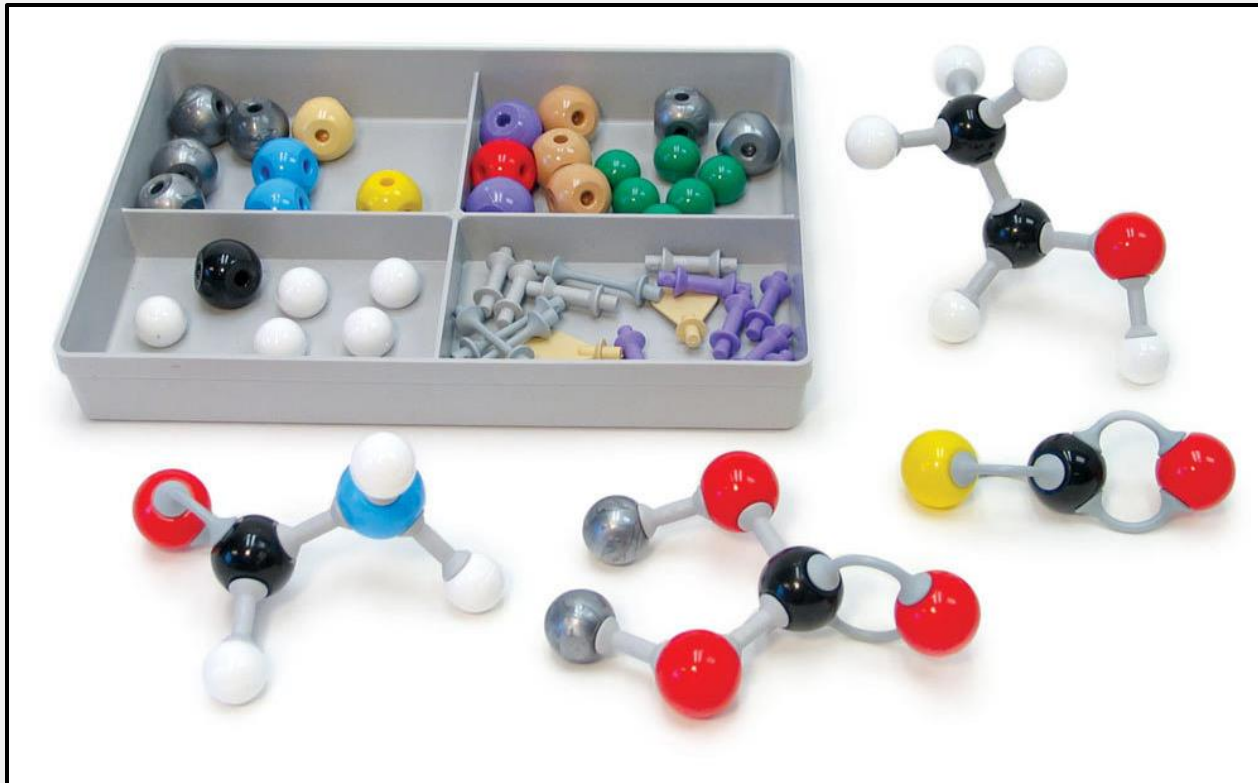


# THE CHEMCOLLECTIVE VIRTUAL LAB INTERFACE



# VISUALIZING MOLECULAR STRUCTURE

- Usually use molecular model kits



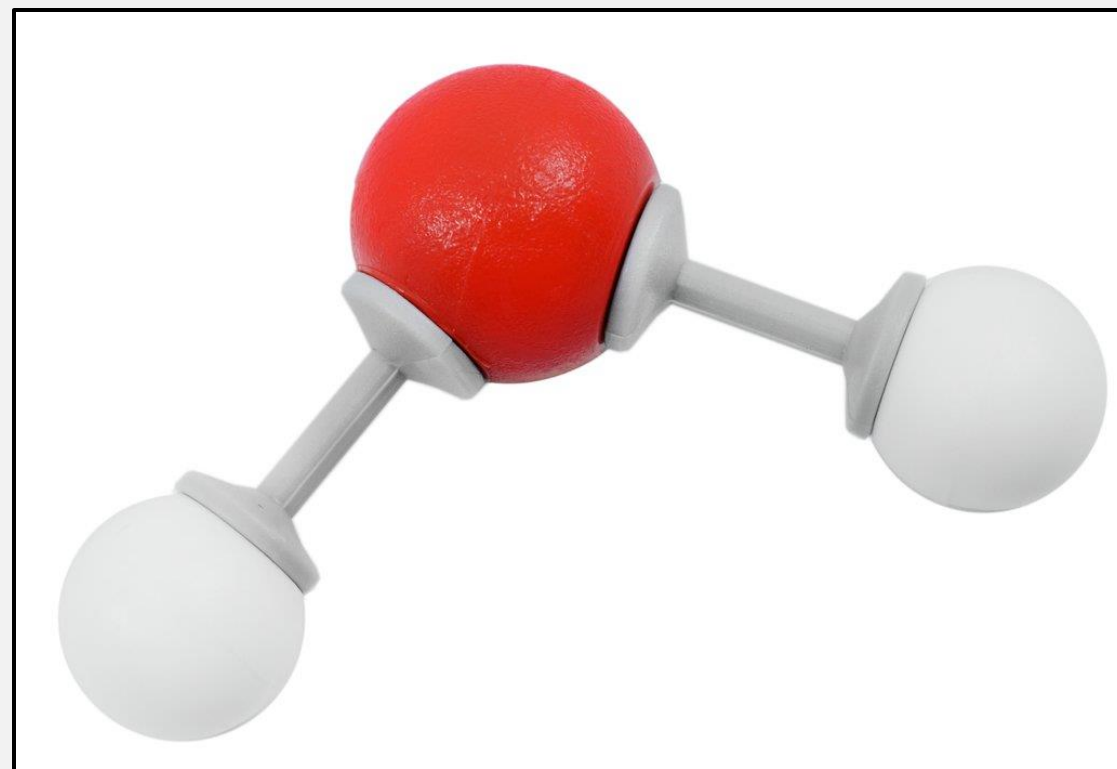
<https://www.teachersource.com/product/molymod-molecular-model-sets>

# MOLECULAR MODEL KIT

## Water molecule



<https://www.amazon.com/H2O-Molecule-Model-Set-Molecular/dp/B07MKLNRL4>



<https://www.hbarsci.com/products/chmolh2o>

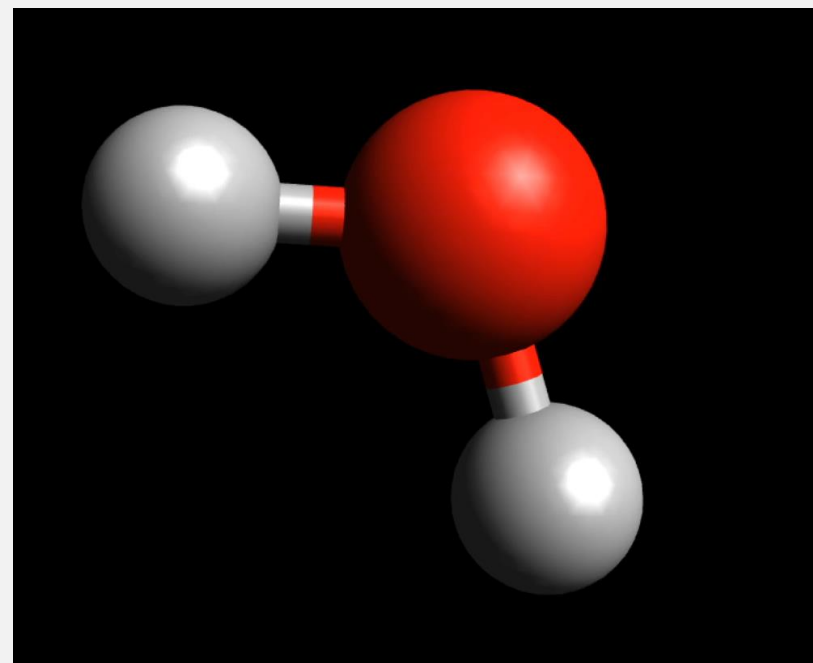
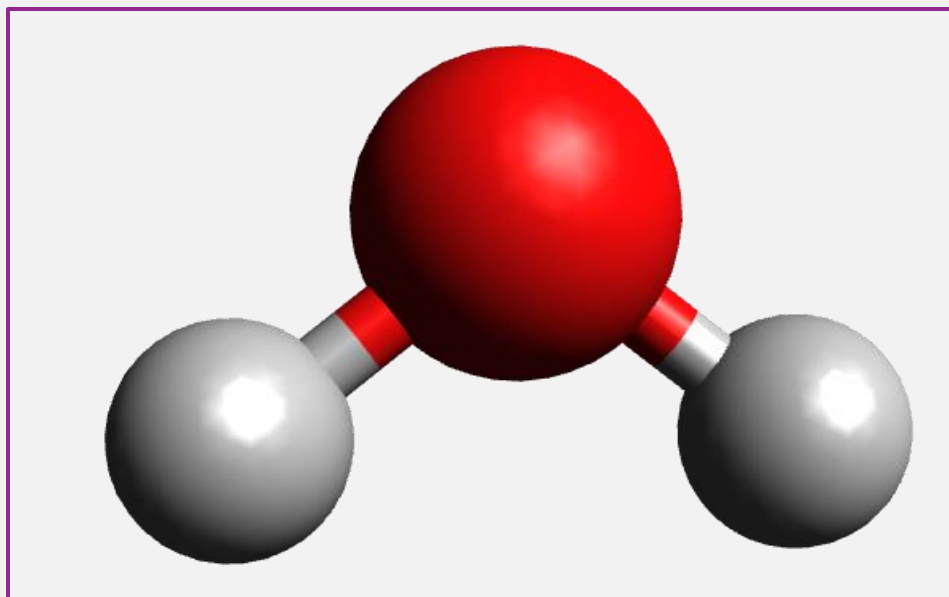


# FREE ONLINE MOLECULAR MODELING SOFTWARE

- ChemDoodle and Molview/Avogadro
- Helps visualizing molecular structures

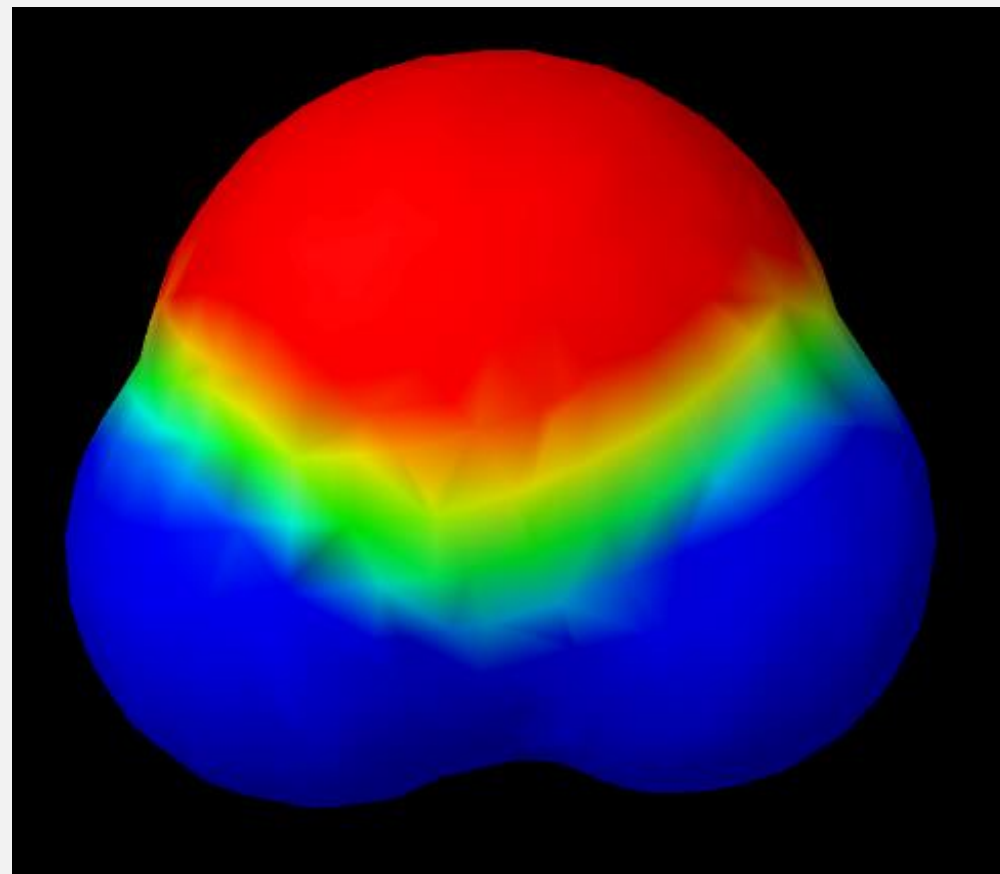
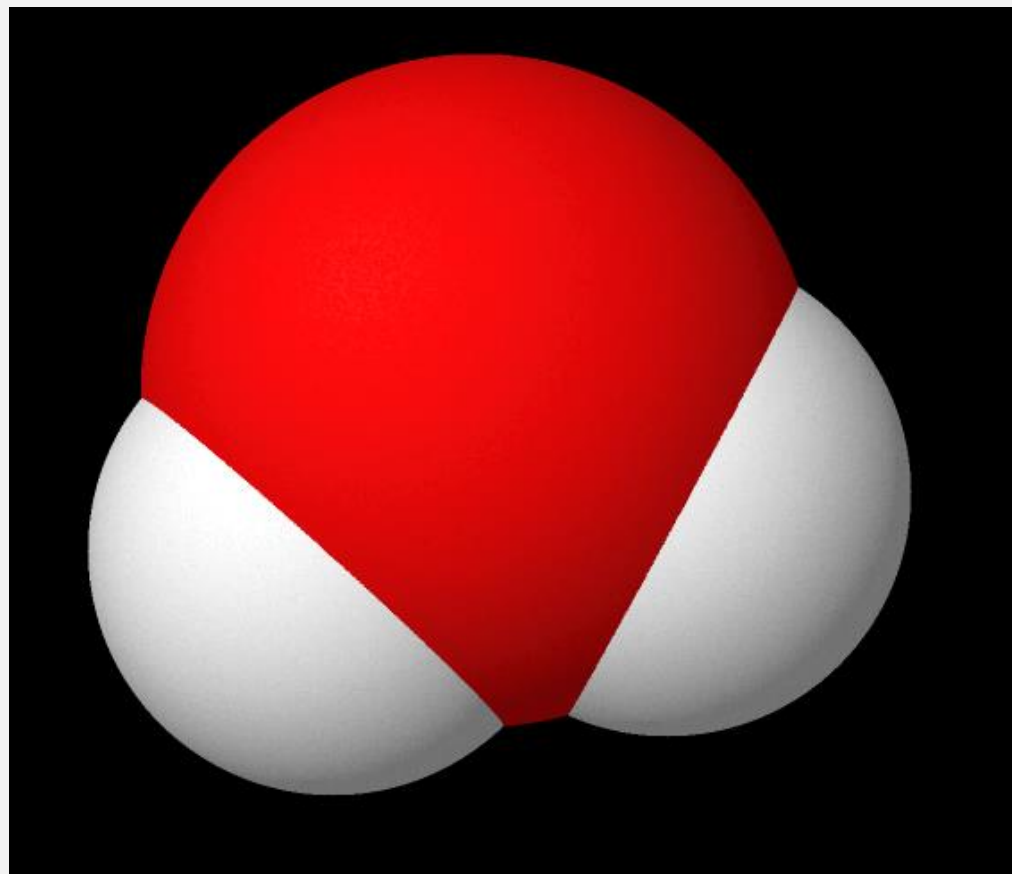
# MOLECULAR MODELING SOFTWARE

Water molecule



# MOLECULAR MODELING SOFTWARE

Water molecule – different representations/properties



# DESIGNING SIMPLE EXPERIMENTS

- There are simple experiments that can be done using household items
- Explore chemistry applied in day-to-day life
- Deliver the same concept as an actual experiment
- Allow analysis of data qualitatively and quantitatively

# DESIGNING A SIMPLE EXPERIMENT

- E.g.: An experiment to demonstrate acids and bases
  - Acids – vinegar, lime juice
  - Base – baking soda, soap water, bleach
  - Indicator – red cabbage juice (extract)

# DESIGNING A SIMPLE EXPERIMENT



# ONLINE CHEMISTRY LABORATORY COURSE

- These options have both pros and cons
  - Molecular modeling software – allows detailed visualization of molecular structures
  - Students do not get experiences on proper handling of chemicals and equipment
- However, can be designed to offer an exciting learning experience economically and effectively

Thank You..!