Using the Virtual Lab Authoring Tool

You can customize the Virtual Laboratory to meet your needs. The Authoring Tool guides you through the process of creating new assignments for your students. It is advisable to install both the Virtual Lab and the Authoring Tool on your hard drive before you begin. You do this by copying (dragging) the vladmin and vlab folders from the CD onto your hard drive.

Getting Started

The Virtual Lab simulates equilibrium reactions in water, so it needs to know the thermodynamic properties ($\Delta H°$, $S°$) of the chemical compounds involved in each reaction. From these properties, the simulation can determine the equilibrium constants and enthalpies of reaction. The authoring tool has a large set of reagents with predefined properties. For additional reagents, this information can usually be found in the back of chemistry textbooks or in the CRC handbook. The Virtual Lab simulation assumes all reactions reach equilibrium rapidly. Therefore, your problems can involve solubility, equilibrium, acid base and redox chemistry as well as thermochemistry, but problems using kinetics are not currently supported.

Although the properties of density and heat capacity are available in the Virtual Lab, as of yet they cannot be modified with the authoring tool. If you are interested in writing such a problem, we recommend contacting us at:info@chemcollective.org for assistance.

Before you begin working in the authoring tool, it's important to have an idea of what you want the homework problem to be. You can review sample problems in the curriculum section of the virtual lab CD or at http://www.chemcollective.com. We suggest you begin with a storyboard that includes a basic problem description, a list of chemicals you want in your stockroom, and what features of the Virtual Lab you want your students to be able to see (i.e., of identification of an unknown species is the objective of the problem, you'll want to disable the Species Viewer.)

When you're ready to start, you can begin my creating a new problem or modifying an existing one.

Editing an Existing Problem

If you already have an existing problem with the species and reactions that you'll be using, it may be easiest to simply modify that problem to fit your needs. To open a problem with the authoring tool, go to the File menu and choose "Open." This will open a dialogue box in which you can search for the file you want to open.

A very useful file is Default.xml, which can be found in the templates folder within your vladmin folder. Default.xml contains all of the species, reactions, and solutions used in the default stockroom of the Virtual Lab. Many problems can be created simply by deleting the reactions and species you don't need and editing the title and description. Alternatively, you can copy species and reactions from here into a new problem.

Creating a New Problem

To create a new problem, go to the File menu, and choose "New." This opens a dialog box with five tabs on the left side. You'll go through each tab in order.

General: Give text descriptions for your problem

Fill in all three boxes. The heading you give your problem in the *Title* field will be displayed in the heading bar of your problem in the Virtual Lab and will also be the name of the activity in the Homework Repository.

The *Short Description* field should contain a brief overview of the problem. This information will appear in the Load Homework dialog box the students use to select a problem.

Create a folder to save your files in; the default folder is "My Documents" on your computer.

Select Save As from the File menu, and save your problem as yourtitle.xml. (Note that the default saving location for the authoring tool is the "My Documents" folder. You can also create a different folder to hold your work and save to that location.)
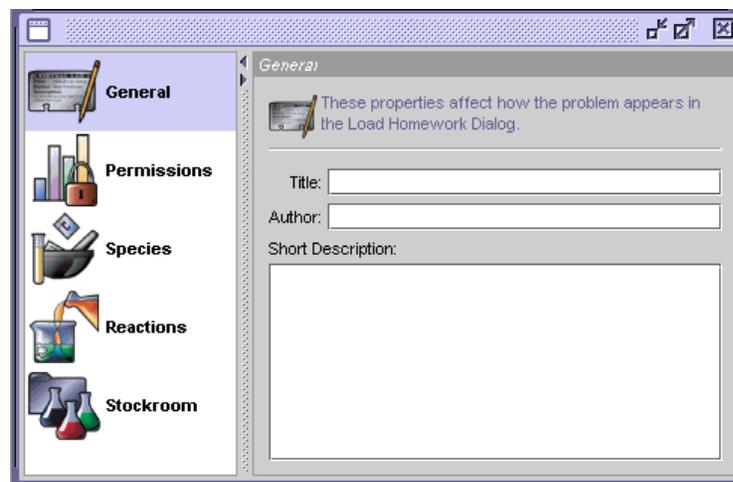
Permissions: Restrict use of certain properties and equipment in the Virtual Lab

Check a box to enable a viewer, and uncheck to disable it. These permissions specify the tools a student can use while they're working on your homework activity.

For example, if you want to design a pre-lab in which students practice laboratory technique, you can disable the Precise Transfer and Significant Figures modes. This forces students to perform the experiment in Realistc mode, which requires the use of proper glassware and chemical transfer techniques.
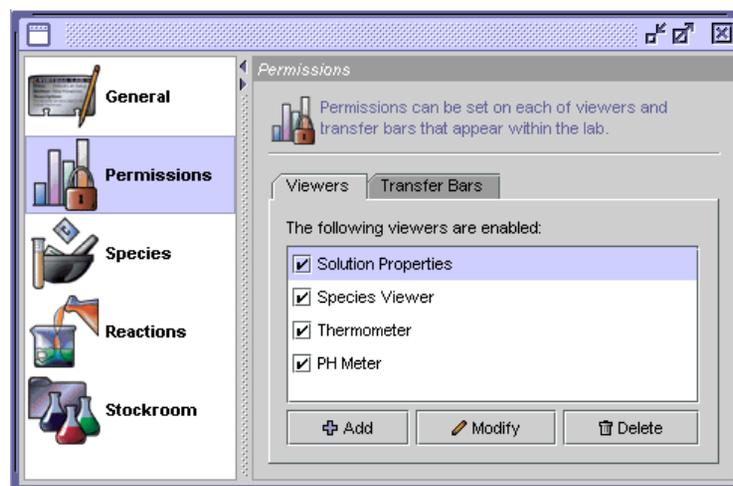
Species: Add/Edit species for use in your problem

The default stockroom, mentioned earlier, includes a large section of chemical reagents from which to choose. You can also add new species for your homework problem using the Species window.

When first opened, your activity will contain only the species for the water autoionization reaction. To add species from the default stockroom or another problem to your activity, choose "Open" from the file menu. In the open dialog box, choose "local problems" and navigate to where the desired file is located. The default stockroom can be accessed by opening the Templates folder from the vladmin folder. Double click on the file you want to copy from. To bring the species from another problem into your activity, select that species in the species dialog and choose copy from the edit menu. Then click into the species window of your activity and choose paste.

Note that when you copy and paste a reaction (a process described in the next section), the species related to that reaction are copied with it. For this reason, it is often best to copy entire reactions rather than individual chemical species.

To add new species, click the Add button. This opens a new window containing fields where you may enter information to create properties for a species. Enter the chemical symbol or formula of the species that you would like to add in the Species Name field. To enter a superscript or subscript, such as the "2" in H20, use standard HTML formatting (₂). For a "+" superscript, the HTML format is ⁺.

Next, click on the state field to choose from aqueous (aq), liquid (l), solid (s), and gas (g).

Enter the Enthalpy, Entropy, and Molecular Weight in their respective fields. The chemistry simulation depends on the values that you give for Enthalpy and Entropy, so please be sure that they are correct.

If you want to add color to the solutions, double click on the color field to choose from the color grid or enter a particular RGB or HSB combination.

The Next and Previous buttons at the bottom of the screen allow you to modify properties of other species without exiting the Add window.

To change information for an existing species, use the Modify button, which opens a window identical to the Add dialogue box.
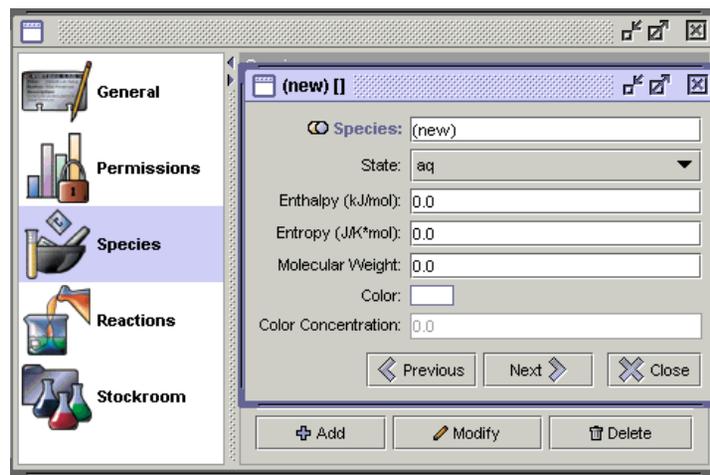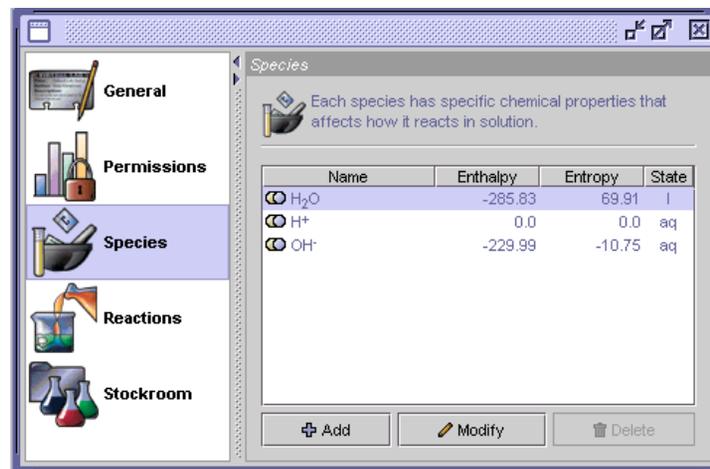
## Reactions: Edit reactions for use in your problem

In addition to adding species, you need to indicate all relevant reactions between these species.

Click on the Add button to open a window that allows you to input the chemical reaction. Use the dropdown menu to identify all the species involved in the reaction.

To designate which species are reactants and which are products, check the box in the product column to indicate that the species is a product. Leave the box empty (unchecked) to designate that the species is a reactant.

Enter the stoichiometric coefficient for each of the species in the second column. The Authoring Tool will not balance equations, so make sure you balance the equation when you enter it; the default coefficient is always 1.0.

At the top of the Add Reaction window, in the gray background, the reaction is shown. This updates as you edit.
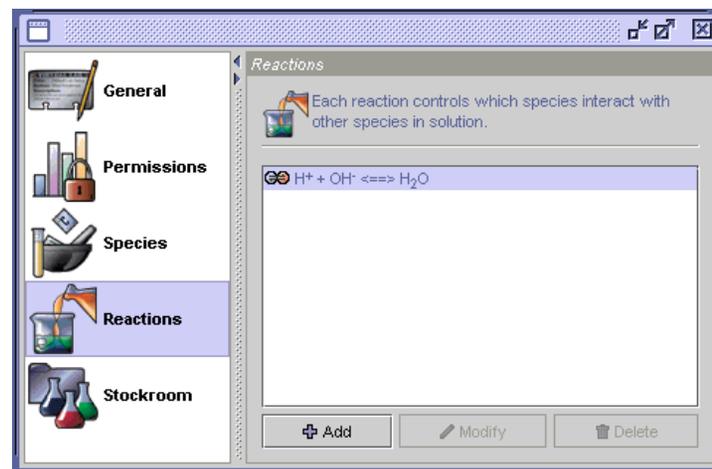
You can copy reactions from existing problems with the same method used to copy species. When a reaction is copied from one problem to another, the virtual lab authoring tool also copies all of the species related to that reaction. We suggest that copying reactions is the easiest way to transfer both reactions and species from existing problems into your activity.

Stockroom: Create or Modify solutions consisting of different species for use in your problem

In this tab, you'll create the stockrooms available to students when they begin this homework activity.

Click on the Add button, and choose Solution from the dropdown menu. This opens a window in which you name the solution, set its volume, and specify the type and amount (in moles) of the chemical species present in the solution. You also choose the type of container (flask, beaker, etc.)

Under "Add" in the Stockroom window, you can include a description of the activity by selecting New Problem Description and clicking the Modify button. This opens an HTML template into which you can type your description. A preview mode is available in the same window that shows your description as it will appear to the students.

Make sure to save any changes.
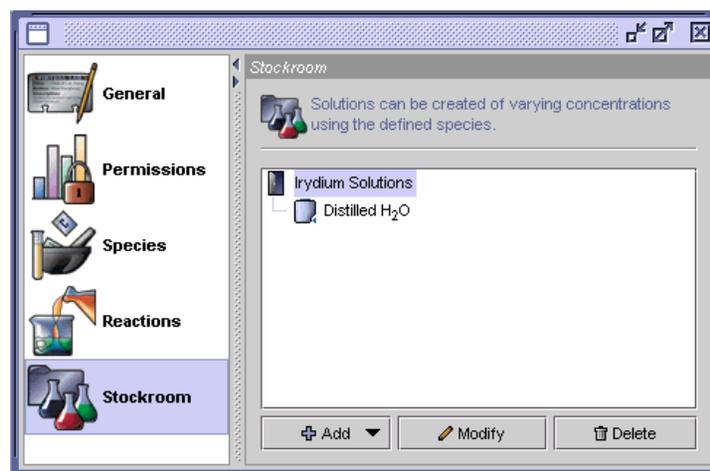
Previewing your work

Under the File menu, you can use Preview to view the stockroom and workbench as they will appear in the virtual lab; you can also test the problem to make sure it works properly. This step also prompts you to save the Virtual Lab problem you created.

Adding your new problem to the Virtual Lab

When you save your activity with a name such as "myprob", the authoring tool creates as file with a name myprob.xml and a directory with name myprob/ in which it writes a number of different files. To make your problem available from within the Virtual Lab, copy this file and folder (myprob.xml and myprob/) into the assignments folder of the Virtual Lab. (This is a subfolder in the location where you installed the Virtual Lab on your hard drive.) Then modify the problem index file (problemindex.xml) located in the VLab folder to include the file you just moved. The following template shows how to add a new problem to the problem file index:

```
<PROBLEM url="url address that contains your problem file (in this case assignments/myprob.xml)">
        <TITLE>your problem title</TITLE>
        <AUTHOR>author's name</AUTHOR>
        <DESCRIPTION>brief description of problem
        </DESCRIPTION>
</PROBLEM>
```

To make your problems appear inside a subdirectory in the Load Homework dialog, put your problem descriptions inside of a directory tag, as follows:

```
<DIRECTORY name="your directory name">
        <PROBLEM url=..>
                ...
        </PROBLEM>
        …
</DIRECTORY>
```

To test out your homework problem, open the Virtual Lab and go to the Load Homework dialog. Your homework problem will be displayed in the Local section.