Alchemist

Alchemist is a scientific program to demonstrate the filling of atomic shells in a graphical manner. The various shells are represented in two different window, one for demonstrating visually how the electrons fill, and the other, to show any atoms electron configuration.

The DemoOrbitals Window

The DemoOrbitals Window is the first of the two user windows. It displays the nucleus as a large purple sphere at the bottom of the screen. Placed above the nucleus are each of the shells in energy order, from 1s to 5p.

Each subshell is named to the left for easy reference. In each s subshell there are 2 electrons, each p subshell, 6 electrons, and each d subshell has 10 electrons. For demonstration purposes, each pair of electrons is sourrounded by an oval shape representing one orbital. Each orbital can hold two electrons, one with a spin of plus one-half, the other with a spin of negative one-half.

As the electrons fill in their respective orbitals, they appear as either a red or blue sphere. These represent the electrons of different spin. The electrons follow the determined path of filling according to the diagonal rule except for several elements which deviate from the norm. For demonstration purpose, it would be wise to, at first, avoid the atoms of #24: Chromium, #29: Copper, #41: Niobium and #46: Palladium. These specific atoms are irregular in their electron filling and you may show these later if you wish.

The FullOrbital Window

This window is much the same as the DemoOrbital window with the exception that its range it much greater. The FullOrbital window extends up to atoms of atomic number 116. This particular window may be helpful for determining the exact electron configuration of any existing element. Again, the subshells are named on the left and ghost images of electrons show where electrons will fill. There are no ovals showing individual orbitals, but the filling follows the same pattern as in DemoOrbitals.

Working the Program

There are three main buttons each user window:

- The Start Button
- The Refresh Button
- The Help! Button

The Start Button

This button will start the filling of the electrons according to the rules associated with electron filling. The button uses the number set in the Set Atom# and Delay menu, which will be explained later. To begin

the filling of shells, simply place the mouse over the button and depress. When you let go of the mouse button, the filling will begin. By pressing down the mouse button at any time during the filling process, you can speed up the filling process.

The Refresh Button

To refresh the screen and erase any previously drawn electron configurations, simply use this button. It is located directly below and to the left of the Start Button.

The Help! Button

The Help! Button brings you to a screen that gives a breif explanation as to the purpose of Alchemist, and also gives the key to the Atomic Display given after the filling of each atom's shells. By pressing the Okay button, you dismiss the window, and by choosing Detailed Info, you bring up this help screen.

The Menus

There are four menu items located at the top of your screen in the Chicago font. They are the following:

- File
- Edit
- Section
- Settings

The File Menu

The File menu is used for program instruction. Located under the File menu are two items: Print and Quit. Print will bring up a printing menu, and you can print the window to any attached printer. Quit exits the program and sends you back to the finder. You can invoke some menu items using Command Key Seqounces. The key sequence for Print is Command-P. for Quit use Command-Q.

The Edit Menu

The Edit menu will usually be dimmed during normal use of Alchemist. However, in dialog boxes where you can enter a value or name, you are allowed to copy, paste, cut, and clear as you would normally.

The Section Menu

To change from the DemoOrbitals window to the FullOrbitals window, use this menu and choose the window from under the menu. The window will switch and all electron configurations will apply to that window.

The Settings Menu

To set the atomic number and delay time, use the Settings menu.

Under the Settings menu there are two items:

- Set Atom # and Delay
- Enter Element

Set Atom # and Delay

This dialog box allows you to set the atomic number of the element to be modeled, and also the delay time between the electrons showing. To set the atomic number, simply type in the number in the first field. The delay time is set up in 60ths of a second. A value of 60 means you wait 1 second for each electron to show up. You can change this value to demonstrate the order in which electrons fill shells.

Enter Element

In this dialog box, you can enter the name of an element, or the symbol. You need not know the atomic number of the element. Type in the name or symbol (e.g. Cu, Copper or copper for the element #29: Copper) and Alchemist will determine the proper number for that element, and display the correct configuration of subshell arrangement. Setting the delay time remains the same as in the other dialog.

The Inner Workings

You must realize that what you see is only a model of a real atom. Different colors are used to differentiate between electrons of opposite spin, and are fixed in position above the nucleus. In reality, the electrons in an orbital make up an electron cloud, effectively occupying the space of a three dimensional object. The electrons are not draw to scale with the nucleus, and orbital enclosings are shown to convey a sense of visuality to an element. The filling of the shells appropriately simulates how electrons in elements fill according to current theory, and the exceptions are portrayed accurately. This program can prove useful in demonstrating a difficult process to visualize. Used as a teachers aid, it can help students to grasp the arcane methods of the atom, and all its wonders.

The Author

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Please contact me with any opinions, concerns, or suggestions about this program. Report any bugs or incompatibilities to any of the above addresses. I would like to make each of my programs as useful and user friendly as possible. Only your suggestions can help me to further develop useful and productive software.

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