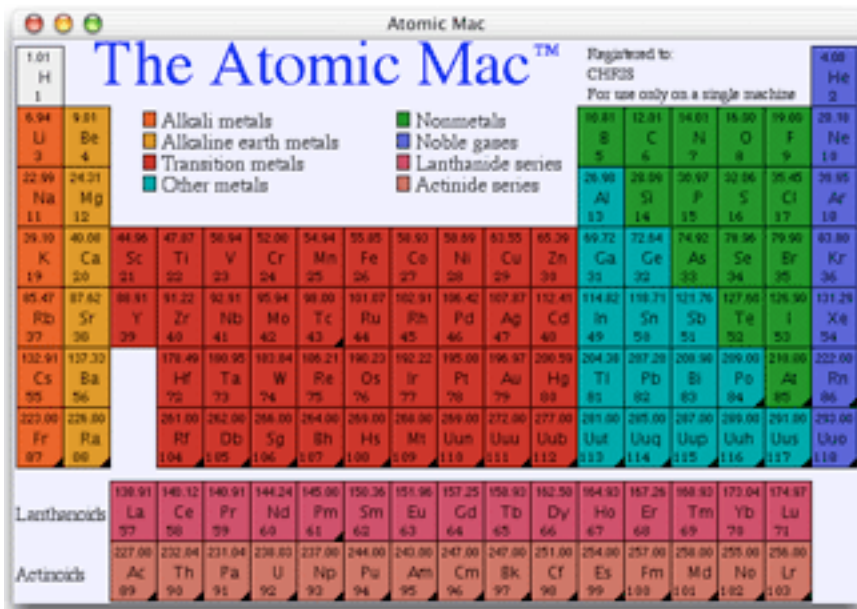


# The Atomic Mac™ Version 5.9.0

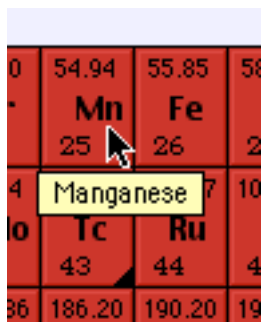
## Introduction

The Atomic Mac is a Periodic Table of the Elements for the Macintosh. It runs under both MacOS 9 and Mac OSX. The registration fee is only \$24.99. Until you register, you will only be able to look at data for a few selected elements.



When you first launch the Atomic Mac, you see a normal presentation of the periodic table of the elements.

If you place the cursor over an element for a few seconds, you'll see the name of the element pop up.



Clicking on one of the elements brings up a window that contains detailed information about that element. There are six different sets of detailed information you can display, selected from the tabs in the window.

They are:

**Physical View** - a list of physical properties, such as density, melting point, etc.



**Isotopes View** - a list of all isotopes for this element, showing the atomic mass, decay mode, half life, and percent natural abundance. If there are too many isotopes to fit in the window, then you can scroll down the list.

Parent	Daughter	Decay Mode	Half Life	Natural Abundance
Pb194	Tl194	E.C.	11 m	
Pb195	Tl195	E.C.	17 m	
Pb196	Tl196	E.C.	37 m	
Pb197	Tl197	E.C.	42 m	
Pb198	Tl198	E.C.	2.4 h	
Pb199	Tl199	E.C.	1.5 h	
Pb200	Tl200	E.C.	21.5 h	
Pb201	Tl201	E.C.	9.5 h	
Pb202	Tl202	E.C.	299803 y	
Pb203	Tl203	E.C.	2.14447 d	
Pb204	Pb204	Stable		1.48%
Pb205	Tl205	E.C.	2.99803e+07 y	
Pb206	Pb206	Stable		23.4%
Pb207	Pb207	Stable		22.6%
Pb208	Pb208	Stable		52.3%
Pb209	Bi209	Beta	3.3 h	
Pb210	Bi210	Beta	21.9855 y	
Pb211	Bi211	Beta	36.1 m	

□

## Isotope Detail View

Double clicking on an isotope will bring up the another window, with detailed information, such as the number of protons and neutrons, atomic mass, mass excess, binding energy, natural abundance, decay mode and half life, nuclear spin, magnetic moment, and alpha and beta radiation energies. (Not all information is available for all isotopes) In addition, possible parent nuclides are also listed, as well as the daughter product.

82 Lead 209 Information

82 **Pb** 209

Decay Tree

Gammas

**Number of Protons:** 82  
**Number of Neutrons:** 127  
**Atomic Mass:** 208.981 amu  
**Mass Excess:** -17.629 MeV  
**Binding Energy:** 1640.58 MeV  
**Natural Abundance:** Not naturally occurring  
**Decay Mode:** Beta  
**Half Life:** 5.5 h  
**Daughter Product:** Bismuth-209  
**Possible Parents:** Thallium-209, Polonium-215

**Nuclear Spin:** 9/2+  
**Magnetic Moment:** -1.4735 nm  
**Electric Moment:** -0.27 barns

**Alpha Radiation:** None or no data  
**Beta Radiation:** 644.200 keV  
**EC Radiation:** None or no data

□

## Gamma Rays

Clicking on the Gammas button will bring up a window listing all of the gamma rays that occur in at least 0.1% of transitions.

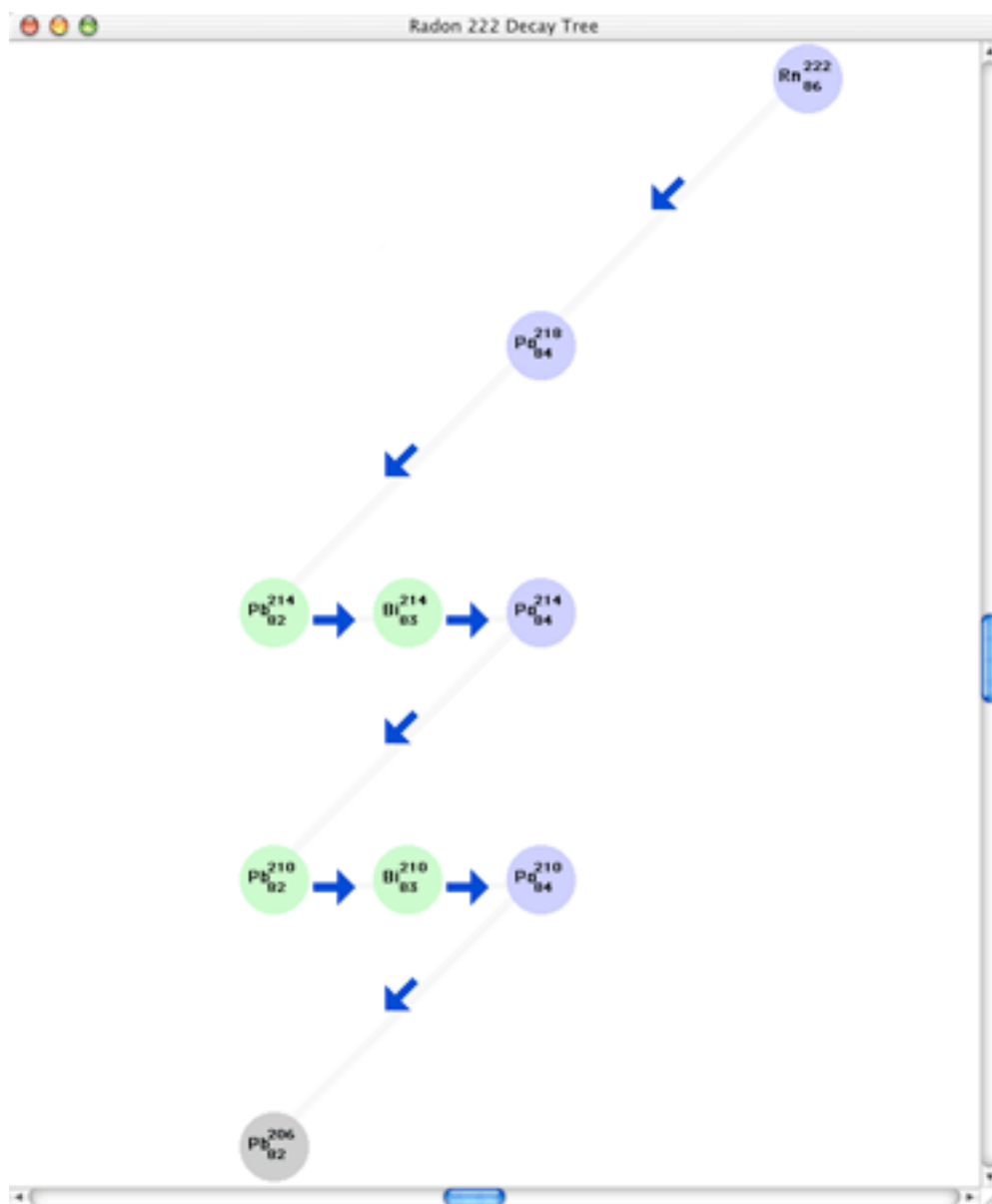
Palladium 101 Gamma Energies

46 **Pd** 101

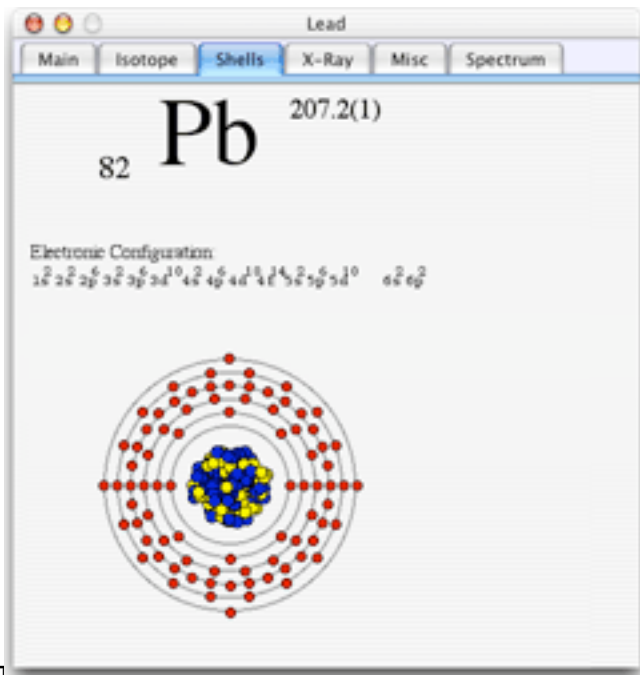
Energy	Percent
2.3767 keV	0.1629 %
2.49633 keV	4.311 %
2.88976 keV	2.689 %
3.2044 keV	0.2398 %
20.0738 keV	35.87 %
20.2161 keV	68.07 %
22.7166 keV	16.69 %
23.3122 keV	3.126 %
24.4713 keV	3.898 %
269.707 keV	6.432 %
296.284 keV	19.2 %
320.755 keV	0.5645 %
355.319 keV	0.2227 %
453.659 keV	0.6048 %
565.152 keV	0.2112 %
565.989 keV	3.437 %
590.461 keV	12.06 %
723.077 keV	0.288 %
723.914 keV	2.054 %
748.385 keV	6.4811 %

## Decay Tree

Clicking on the Decay Tree button will display the path taken by the nuclide as it and daughter products decay, until they become stable. This button is of course only visible for radioactive nuclides.



**Shells View** - a graphical display of the atom, showing the electron shells, along with the electronic configuration.



**X-Ray View** - A list of the K and L shell fluorescence energies, and K, L, M, and N shell binding energies. Clicking on the Photon Attenuation button will bring up a window showing the attenuation graph, while clicking on the Photon Attenuation Table button will bring up a tabular form of the same data. The information is based on the McMaster data. Clicking on the Photon Data button will bring up an interactive window, allow you to display the relevant data for any energy between 1 keV and 10 MeV.

Lead

Main Isotopes Shells **X-Ray** Misc Spectrum

82 **Pb** 207.2(1)

Photon Attenuation  
Photon Data...  
Photon Attenuation Table

**Fluorescence Emission Energies**

Ka1	74969.4 eV	0.1654 Å
Ka2	72804.2 eV	0.1703 Å
Kb1	84936.0 eV	0.1460 Å
La1	10551.5 eV	1.1750 Å
La2	10449.5 eV	1.1865 Å
Lb1	12613.7 eV	0.9829 Å
Lb2	12622.6 eV	0.9822 Å
Lg1	14764.4 eV	0.8398 Å

**Binding Energies**

K	88006.0 eV	0.1409 Å
L1	15860.0 eV	0.7817 Å
L2	15198.0 eV	0.8158 Å
L3	13035.0 eV	0.9512 Å
M1	3850.0 eV	3.2204 Å
M2	3554.0 eV	3.4886 Å
M3	3066.0 eV	4.0438 Å
M4	2586.0 eV	4.7944 Å
M5	2484.0 eV	4.9913 Å
N1	891.8 eV	13.9027 Å
N2	761.9 eV	16.2730 Å
N3	643.5 eV	19.2672 Å

**Misc View** - General information showing the name of the discoverer of the element, and where and when it was discovered. Interesting bits of information are also displayed. If you have any other interesting facts about an element, let us know, and we'll be glad to add them to a future version.

Lead

Main Isotope Shells X-Ray **Misc** Spectrum

82 **Pb** 207.2(1)

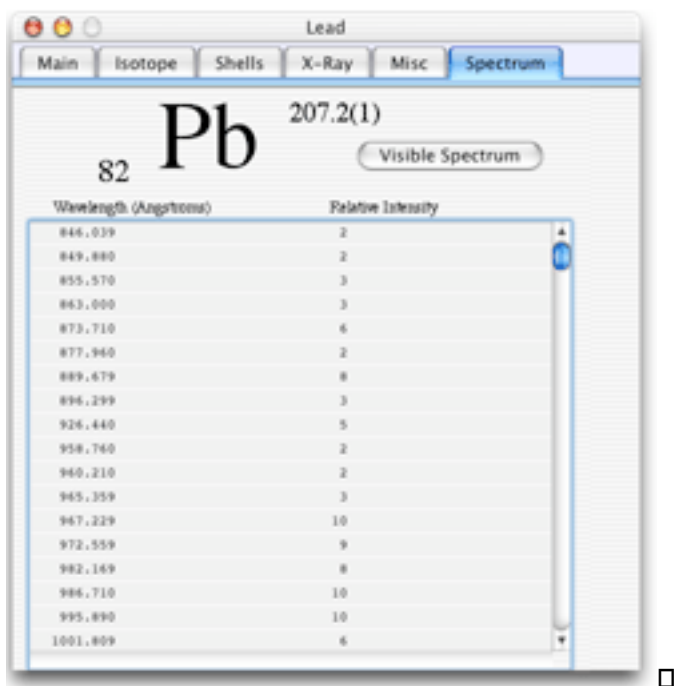
Discovered by: Known since ancient times  
Discovery Date:  
Discovery Location:  
Abundance in Solar System: 1.03e-08 %  
Abundance in Earth's Sea: 3e-05 mg/L  
Abundance in Earth's Crust: 14 mg/kg

**Facts about Lead**

Lead is a highly malleable, very soft, and ductile metal. It is used in alloys such as pewter and in electrical solder. Lead was used in ancient Roman plumbing systems, and even as recently as earlier this century, although it was phased out due to toxicity. Lead was also used in some paints, and used to be used as an anti-knock additive in gasoline. Lead is the final decay product of many heavy radioactive elements.

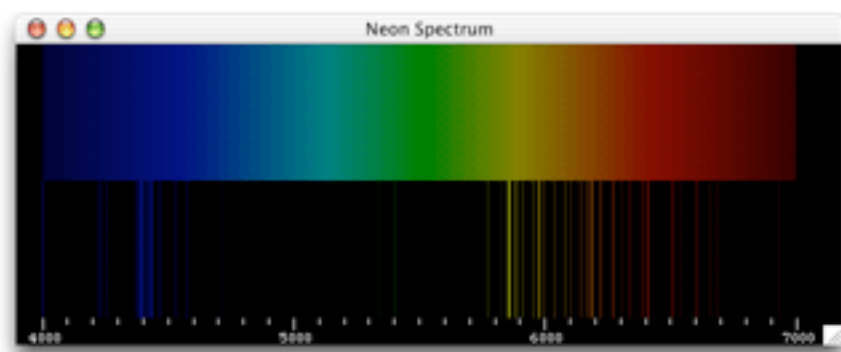
**Spectrum View** - A list of the wavelengths and relative intensities of the

optical spectra of an element, including visible, UV, and IR.



### Visible Spectrum Display

Clicking on the Visible Spectrum will bring up a window showing the visible line spectrum of the element, along with a complete (rainbow) spectrum for reference.



### Property View

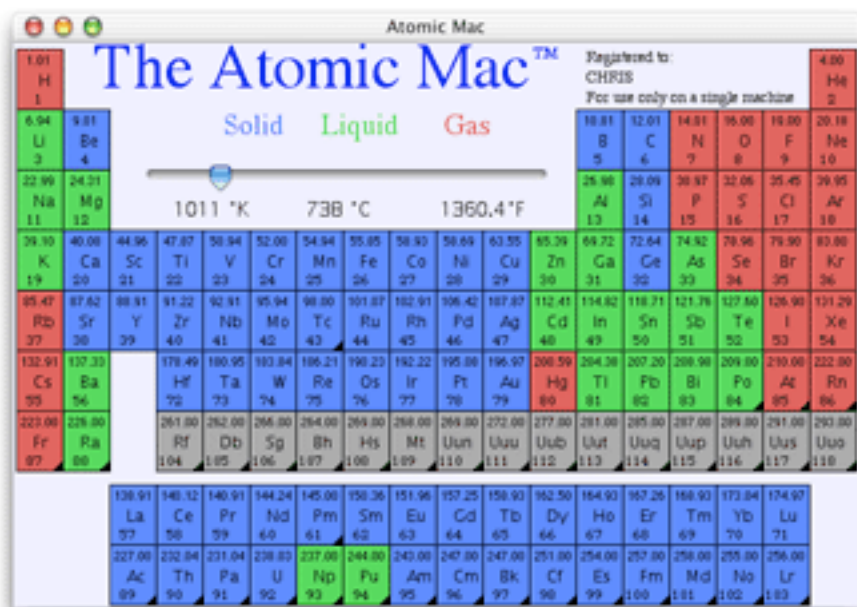
You can also alter the periodic table display to shade each element, by

several properties, which include:

Density  
Heat of Vaporization  
Heat of Fusion  
Specific Heat  
Thermal Conductivity  
Linear Expansion Coefficient  
Melting Point  
Boiling Point  
Atomic Radius  
Covalent Radius  
Magnetic Susceptibility  
Electrical Resistivity  
Electron Affinity  
Electric Dipole Polarizability  
State (gas, liquid, solid)  
Photoelectric Work Function  
Electronegativity  
Crystal Structure  
Abundance in Crust  
Abundance in Sea  
Abundance in Atmosphere  
Solar Abundance  
Number of Isotopes  
Number of Natural Isotopes  
Number of Stable Isotopes  
Atomic Mass  
Superconducting Critical Temperature

Below is a display with the view set to melting point. The elements with higher melting points are more red, those with lower melting points are more white. Elements for which there is no data (typically the man-made transuranic elements with extremely short half lives) are gray.





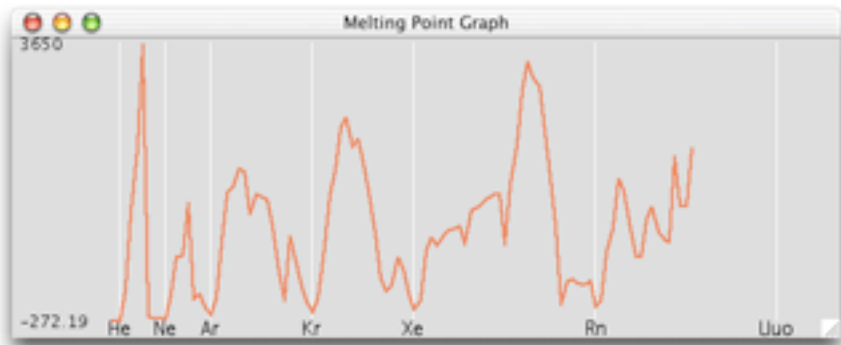
Also under the **View** menu is the **Molecular Weight Calculator**. Selecting this will display a text entry box just above the periodic table. You can enter a chemical formula into this box, and the molecular weight will be calculated for you. For example, entering H<sub>2</sub>O will compute the molecular weight of water. The text is case sensitive, so table salt must be entered as NaCl not NaCl or nacl.

You can enter parenthesis in your formula, such as (H<sub>2</sub>O)<sub>2</sub>

You can also enter in a hydrated compound using the • symbol (option 8 on your keyboard). An example: CuSO<sub>4</sub>•5H<sub>2</sub>O

## Graphing Properties

Also under the **View** menu is an option to graph the current view. Selecting this opens a window which shows a plot of the selected property against atomic number. The following picture shows a plot of the covalent radius:



Values of adjacent elements with known values are connected with a line. If an element is surrounded by two other elements with unknown values, its value appears as an isolated dot.

## Table Of Nuclides

By selecting **Table of Nuclides** from the **File** menu, you'll be presented with a large window showing all of the nuclides (isotopes) available. Clicking on one of them will bring up the window containing detailed information, such as nuclear spin, decay energies, etc. Here's a small portion of the table, the full table of course is huge, since The Atomic Mac has information regarding about 1600 nuclides!

		11 Li 3	11 Be 4	11 B 5	11 C 6
	10 He 2	10 Li 3	10 Be 4	10 B 5	10 C 6
	9 He 2	9 Li 3	9 Be 4	9 B 5	9 C 6
	8 He 2	8 Li 3	8 Be 4	8 B 5	
	7 He 2	7 Li 3	7 Be 4		
	6 H 1	6 He 2	6 Li 3	6 Be 4	
	5 H 1	5 He 2	5 Li 3		
	4 H 1	4 He 2	4 Li 3		
	3 H 1	3 He 2			
	2 H 1				
	1 H 1				

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You can always get the latest copy of The Atomic Mac from our web site, the URL is:

<http://www.blackcatsystems.com/software/atomic.html>

If you have Internet Config, or a recent version of MacOS, you can launch your web browser and automatically go to this page by selecting **Go To The Atomic Mac Website** from under the **Apple Menu**.

If you have suggestions for improving The Atomic Mac, please let us know!

You can send us email at [info@blackcatsystems.com](mailto:info@blackcatsystems.com)

Please take a look at the next chapter to learn how to register your copy of The Atomic Mac.

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The Atomic Mac is shareware. The price is only 24.99, allowing the use on a single computer. If you wish to run The Atomic Mac on multiple computers, you must obtain a license for each system, or the appropriate site license.

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When you buy and receive your registration code, select **Enter Registration...** from the **Edit** menu, and enter the code. If you register and don't get your registration code within a week, please send us an email at [atomic@blackcatsystems.com](mailto:atomic@blackcatsystems.com).

Thanks again for giving The Atomic Mac a try.

Black Cat Systems  
PO Box 2293  
Westminster, MD 21158

email: [info@blackcatsystems.com](mailto:info@blackcatsystems.com)  
Web: <http://www.blackcatsystems.com/software/atomic.html>

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City: \_\_\_\_\_ State/Province: \_\_\_\_\_

ZIP/Postal Code: \_\_\_\_\_ Country: \_\_\_\_\_

Email Address: \_\_\_\_\_

Macintosh Model: \_\_\_\_\_ System Version: \_\_\_\_\_

Enclosed, please find my check / money order / cash in the amount of \$\_\_\_\_\_

**Mail this form, along with payment, to:**

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Please make sure you include your email address when you buy online. That way we can send the registration code to you. If you do not send us a valid email address, we have no way to send you the code.

## Revision History

5.9.0:

Added additional ionization potential information

5.8.0:

Added photon data button in X-Ray element view to bring up interactive window to compute/display attenuation data.

5.7.0:

Added revised nuclear data

5.6.0:

Added gamma energies

5.5.1:

Fixed a bug with printing under OSX 10.2.

5.5.0:

Updated atomic mass values to latest IUPAC values.

5.4.0:

Can now zoom the main table window down to a small window.

5.3.0:

Added isotope data for abundance in universe and human body.  
Added ability to copy most windows to the clipboard for other use.  
Enhancements to the decay window.  
Some graphs are now log based for better display.  
Added/refined data for some nuclides.

5.2.1:

Misc Bug fixes.

5.2.0:

Added display of period, group, block, CAS Registry ID.

5.1.0:

Added window menu, showing list of available windows

5.0.2:

Error in U235 half life

Background of temperature slider not correct color.

5.0.1:

Fixed a bug that prevented the program from running under MacOS 8.1.

5.0.0:

Added pop-up names of elements and view value.

Added atmospheric abundance

Final release!

5.0.0 b2:

Third Carbon Release

Basically the full complement of features

5.0.0 b1:

Second Carbon Release

Added additional features from the 4.x versions.

5.0.0 b0:

Initial Carbon Release

Not all features implemented

4.6.1:

Fixed a bug where the name of the element would sometimes overwrite other information.

4.6.0:

Window locations (and in some cases size as well) are stored

Element name appears in main window when the cursor is over that element.

4.5.0:

Added Nuclides Table.

4.3.0:

Added data for atomic mass, mass excess, binding energy, and alpha and beta decay energies for most nuclides.

4.2.1:

Fixed a bug which could cause the element data window to not appear.

4.2.0:

Added NMR, magnetic moment, electric quadrupole moments.  
Added display of additional information to Isotope information.  
Added listing of possible parent nuclides.

4.1.0:

Added spectra information.

4.0.0:

Added table and graph of photon interaction data.  
Added number of isotopes, stable, natural to graphing.

3.8.0:

Added views for abundance in the Earth's crust and sea, and solar system.  
Added display of values in view mode.  
Added data for several elements.

3.7.3:

Corrected density for sodium.  
Added information for several elements.

3.7.2:

Fixed a bug that displayed a garbled registered user name.

3.7.1:

Compatibility modifications.

3.7.0:

Added graphing display.

3.6.1:

More improvements to the decay window.

3.6.0:

Improvements to the decay window.

3.5.8:

The main table now prints in color.

### 3.5.7:

Added beta particle energies for some isotopes.

Changed Lawrencium symbol to Lr.

Fixed a bug which could cause a crash on some systems when an element window was closed.

### 3.5.6:

Added beta particle energies for some isotopes.

Fixed some small bugs.

### 3.5.5:

Added alpha particle energies for some isotopes.

### 3.5.1:

Fixed a bug which did not allow selecting the last isotope when following a decay series.

Fixed a bug which could cause a crash if the element information window was closed, and you attempted to increment or decrement to another element.

Added some information for a few of the super-heavy elements.

### 3.5.0:

Added Covalent Radius, Electronegativity, and Crystal Structure views and data.

Added interesting facts about each element.

Color-coded each series.

Lots of improvements to the display windows.

### 3.1.2:

Left and right arrow keys change the temperature by 1 degree K when displaying the states of matter.

Fixed a bug which caused an erroneous half life to be displayed for stable isotopes.

### 3.1.1:

Modified Molecular Calculator to allow use of parenthesis and • symbol.

### 3.1.0:

Added display of state (gas, liquid, solid), and temperature control.

Added ability to shrink window to small size.

### 3.0.0:

Added several more categories of data  
Added Molecular Weight calculator  
Major changes to user interface

### 2.3.1:

Display and Human-Interface tweaks.

### 2.3.0:

Lots of GUI work.  
Ability to enter registration code directly into the program.  
Added several metastable isotopes.

### 2.2.0:

Added X-Ray information (fluorescence and binding energies).  
License files now used to register the program.

### 2.1.0:

Updated data for several elements.

### 2.0.0:

Updated to FAT, native on both 68K and PPC systems.

### 1.4.3:

Isotope display now always reverts to the first page when you change elements.  
(The version displayed in the program is 1.4.2, but check the Finder Info, it really is 1.4.3)

### 1.4.2:

Clicking on an element in the decay tree will jump to that element.

### 1.4.1:

Re-compiled for 68020 machines, some speed improvement  
Changed About... window, it looks a little nicer now, and doesn't beep at you.

### 1.4.0:

Misc cleanup

### 1.3.1:

Added several additional isotopes.  
Added Decay Tree window.

### 1.3.0:

Fixed bug which could cause crash upon launch on some systems.

### 1.2.2:

First Release.

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