Using the *Periodic Table* and *SciTools* APPs

Concepts

- Exploring the types of information available in the *Periodic* APP
- Using the *Periodic* and *SciTools* APPs in to demonstrate the periodic trends of elements in a groups

Materials

- TI-84 Plus
- *Periodic* APP
- *SciTools* APP

Overview

There is a wealth of information about the elements and the *Periodic Table* available in the *Periodic* APP. This activity shows how the *Periodic* APP can be used to (1) get information about individual atoms, (2) highlight regions of the *Periodic Table*, and (3) graph periodic properties.

This is followed by an activity that uses the *Periodic* and *SciTools* APPs to demonstrate to students how Mendeleev predicted the properties of undiscovered elements.

Exploring the *Periodic* App

1. Press the [APPS] key on the TI-84 Plus calculator, and select *Periodic*.
2. Press the [WINDOW] key (for the softkey OPTIONS) (Figure 1).
   - The option HIGHLIGHT REGIONS is selected (Figure 2).
3. Press [Y=] to OK this selection.
4. Using the down arrow, scroll down [▼] through 2 more screen views (as shown in Figures 3 to 5) until you have highlighted HALOGENS.

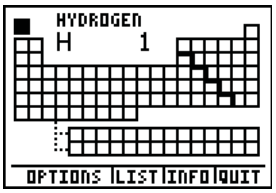

Figure 1

Figure 2

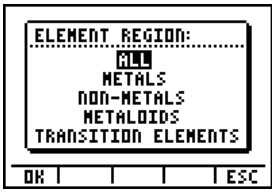

Figure 3

Figure 4

Figure 5

5. Press [Y=] to OK to select HALOGENS.
   - Notice that the halogens group is highlighted in the periodic table (Figure 6).

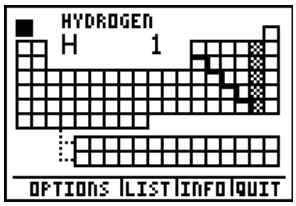

Figure 6

Expanded Periodic Table

Another interesting option is to view the expanded periodic table (Figure 7).

1. Select OPTIONS (press [WINDOW]).
2. Move the cursor down to SHOW EXPANDED TABLE and press the softkey OK ([Y=]).

Note: The ESC softkey ([GRAPH]) returns the program to the normal view of the periodic table.

3. Use any of the arrow keys ([◄][►][▲][▼]) to move through the table to the first element in the halogens group (fluorine—atomic number 9) (Figure 8).

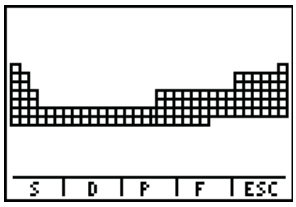

Figure 7

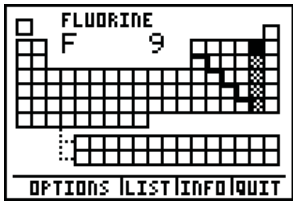

Figure 8

4. At this point, pressing the [ENTER] key and the down arrow keys gives you the screens shown Figures 9 to 11 with information for fluorine.

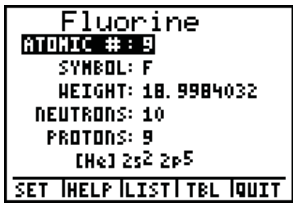

Figure 9

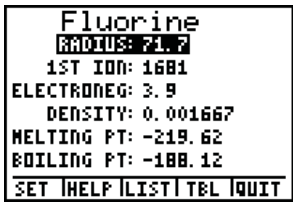

Figure 10

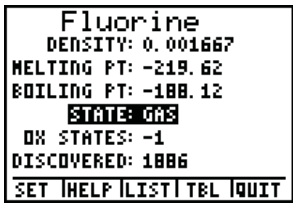

Figure 11

5. The softkey TBL (TRACE key) brings back the periodic table.

Listing Elements

1. Press LIST (ZOOM key) to get a list of the elements in order of atomic number (Figure 12).
2. Press ZOOM to SORT.
3. Then move the cursor down to NAME, and select OK (Figure 13).
   - This option will give the list in alphabetic order by name (Figure 14).

Figure 12

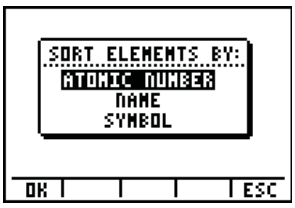

Figure 13

Figure 14

4. To move through the list quickly, enter the first letter of the desired element. For example, ALPHA Z highlights ZINC (Figure 15).
5. Pressing ENTER gives the information on the selected atom.

Figure 15

Graph Properties of Elements

1. Use the TRACE key to return to the table.
   - Select OPTIONS (WINDOW).
   - Select GRAPH PROPERTIES (Figure 16).

Figure 16

2. Among the graph properties, choose 1ST IONIZATION ENERGY (Figure 17).

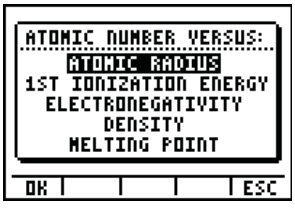

Figure 17

- Trace on the graph (→ using the [ZOOM] key) to find out which elements begin each repeating "period" of ionization energies (Figures 18 to 20).

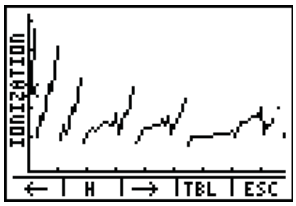

Figure 18

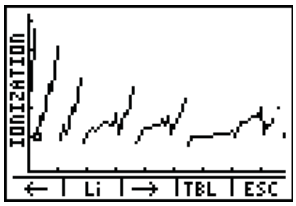

Figure 19

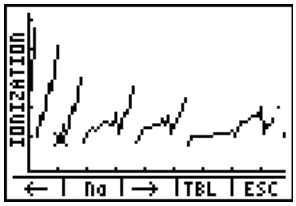

Figure 20

Discovering Eka-Silicon

Use the *Periodic Table* APP to fill in the following table.

Atomic Symbol	Atomic Number	Atomic Weight	Atomic Radius (pm)	Density (g/cm^3)
C	6			
Si	14			
Sn	50			

In 1871, Mendeleev had access to the data in the table above. In his periodic table, there was a missing element with atomic number 32. Using the known properties of C, Si, and Sn, he was able (without the benefit of a graphing calculator) to predict the properties of germanium (he called it eka-silicon) that had not been discovered at the time.

The *SciTools* APP will now be used to repeat Mendeleev's work by fitting this data to a linear regression line.

1. Exit the *Periodic* application using [2nd] [QUIT].
2. Press the [APPS] key, and select *SciTools*. Press [ENTER].
3. Select DATA/GRAPHS WIZARD by pressing [3] (Figure 21).
4. Press [Y=] to select the Data softkey. (Figure 22).
   - If necessary, use the arrow keys to move through the EDITOR to highlight the first element in list L1.

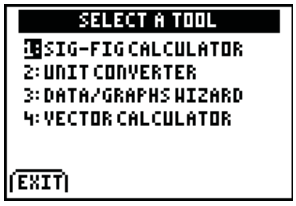

Figure 21

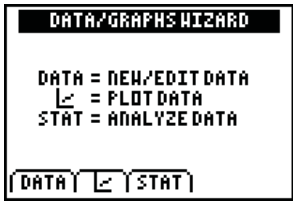

Figure 22

5. Enter the atomic numbers into L1, the atomic weights into L2, the atomic radii into L3, and the densities into L4 (Figure 23).
6. [2nd] [QUIT] returns the program to the DATA/ GRAPHS WIZARD screen.
7. Press [WINDOW] to select the Data softkey. (See Figure 22 above).

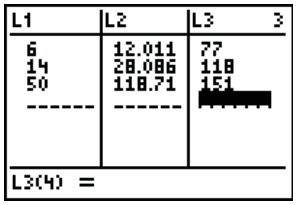

Figure 23

8. Press [Y=] for the scatterplot softkey. (Figure 24).

Figure 24

9. Choose L1 for the independent variable and L2 for the dependent variable (See Figures 25 and 26).

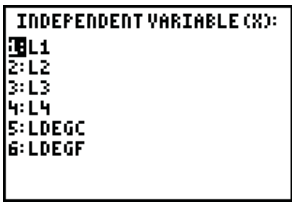

Figure 25

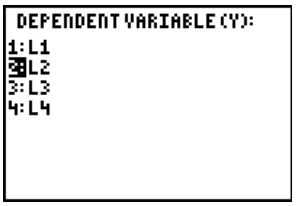

Figure 26

10. Pressing [2nd] [QUIT] brings up the CHOOSE A FIT menu (Figure 27).

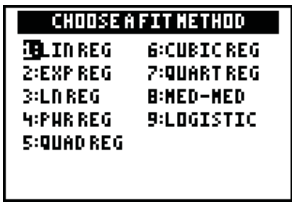

Figure 27

11. Press the [ENTER] key to select 1:LinReg.

12. Press [TRACE] to view the graph of the linear regression line (Figure 28).

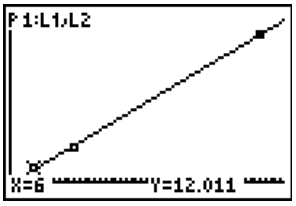

Figure 28

13. Next press the up arrow once to select tracing of the linear regression equation Y1 (Figure 29).

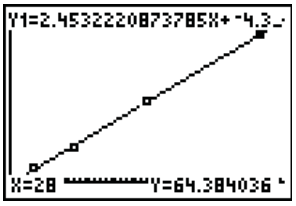

Figure 29

14. Enter the number 32, germanium (eka-silicon to Mendeleev) followed by [ENTER] to get the predicted atomic weight of the element with atomic number 32 (which is 74.2) (See Figure 30).
15. Press [2nd] [QUIT] to return to the DATA/GRAPHS WIZARD menu.
16. Repeat the previous steps, changing the dependent variable from L2 to L3. The predicted value in step 23 will now be the predicted atomic radius.
17. Repeat this process again with L4 to get the predicted density of eka-silicon.
18. Place the predicted values for atomic weight, atomic radius, and density in the following table.
19. Use the *Periodic Table* APP to get the actual values for germanium and to compare the predicted and actual values.

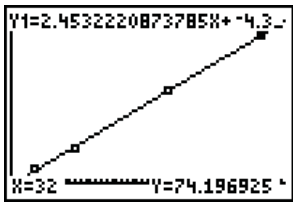

Figure 30

	Atomic Weight	Atomic Radius (pm)	Density (g/cm^3)
predicted			
actual			

Answers

Atomic Symbol	Atomic Number	Atomic Weight	Atomic Radius (pm)	Density (g/cm^3)
C	6	12.011	77	2.267
Si	14	28.0855	118	2.33
Sn	50	118.710	151	7.265

	Atomic Weight	Atomic Radius (pm)	Density (g/cm^3)
predicted	74.2	128	5.00
actual	72.61	128	5.323