

Homework 3

Due: Wednesday, November 13, 2024

Points: 100

This problem asks you to calculate the atomic weight of molecules.

The file “atomic_weights.txt” contains lines with three fields separated by tabs. The first field is the atomic weight, the second field is the symbol for the element, and the third field is the name of the element (which you can ignore for this problem).

We will proceed in stages, to make life easier. You should turn in only the final program, though.

1. Write a function to load the contents of the file into a dictionary. The key is to be the chemical symbol. The value is to be the atomic weight. As noted above, you can ignore the third field.
2. Now write a function that takes a chemical compound and breaks it into elements and numbers. The basic unit of a chemical formula is an element’s symbol followed by a number (1 or more digits); the chemical compound’s formula is a sequence of one or more units. For example, the chemical formula for ethanol, C_2H_5OH , is 2 C (carbon) atoms, 5 H (hydrogen) atoms, an oxygen atom, and another hydrogen atom; and the chemical formula for water, H_2O , is 2 H (hydrogen) atoms and an oxygen atom.

A good way to check your program is to have it print out each atom’s symbol and the number that follows it, if any.

Hint: Element symbols are either 1 or 2 letters. The first letter is *always* capitalized; if there is a second letter, it is *always* lower case. So “HO” is a hydrogen atom (H) and an oxygen atom (O), and “Ho” is the symbol for holmium. Similarly, “SN” is a sulfur atom (S) and a nitrogen atom (N), and “Sn” is the symbol for tin. Similarly, if no number follows an element’s name, treat it as 1.

3. Using the functions you wrote in the above two parts, write a program that reads in a chemical compound and prints its atomic weight. Your program is to continue reading input until the user types an end of file.

Your output is to look like this (input is in red).

```
Chemical composition? C2H5OH,  
The atomic weight of C2H5OH is 46.08  
Chemical composition? H2O,  
The atomic weight of H2O is 18.02  
Chemical composition? HO,  
The atomic weight of HO is 17.01  
Chemical composition? Ho,  
The atomic weight of Ho is 164.93  
Chemical composition? SN3,  
The atomic weight of SN3 is 74.1  
Chemical composition? Sn3,  
The atomic weight of Sn3 is 356.13  
Chemical composition? T,  
T: no such element  
Chemical composition? GpZx,  
Gp: no such element  
Zx: no such element  
Chemical composition? GpHeZx,  
Gp: no such element  
Zx: no such element  
Chemical composition? control-D
```

Call your program “compound.py”.