

Homework Assignment #2

GE 1501

Cornerstone of Engineering 1

CRN: 16504

Monday, Wednesday, Thursday from 10:35 AM - 11:35 AM

429 Dana Research Center

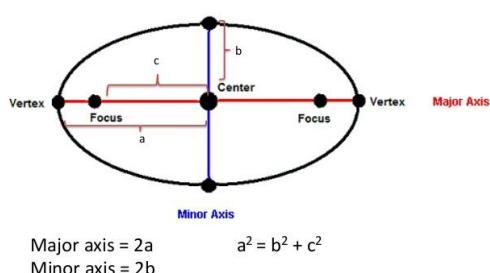
Monday, September 18, 2017

Jordan Lian

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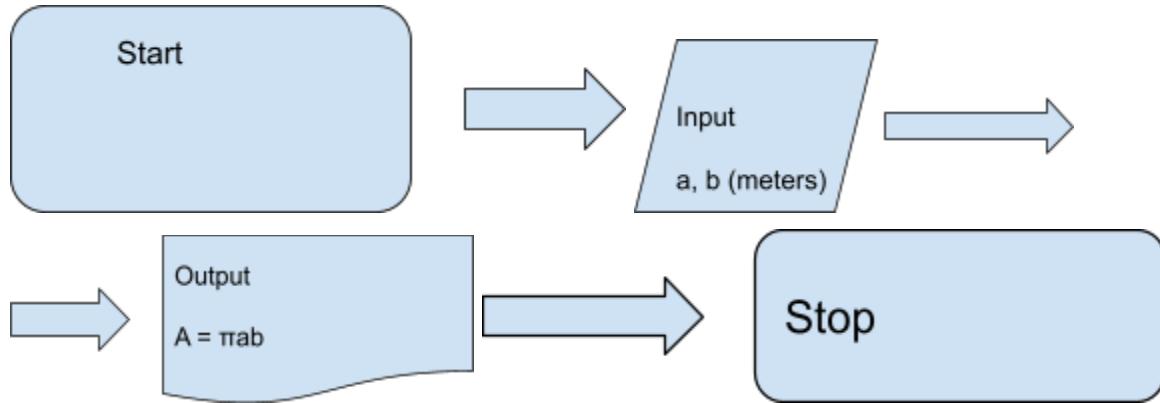
Parts of an ellipse



AMINO ACID	
Nonpolar, aliphatic R groups	Glycine Alanine Valine
	<chem>H2N-C(=O)-CH3</chem> <chem>H2N-C(=O)-CH2-CH3</chem> <chem>H2N-C(=O)-CH2-CH2-CH3</chem>
	<chem>H2N-C(=O)-CH2-CH2-CH2-CH3</chem> <chem>H2N-C(=O)-CH2-CH2-CH2-CH2-CH3</chem> <chem>H2N-C(=O)-CH2-CH2-CH2-CH2-CH2-CH3</chem>
	Isoleucine Leucine Methionine
Polar, uncharged R groups	Serine Threonine Cysteine
	<chem>H2N-C(=O)-CH2-CH2-OH</chem> <chem>H2N-C(=O)-CH2-CH2-OH</chem> <chem>H2N-C(=O)-CH2-CH2-SH</chem>
	<chem>H2N-C(=O)-CH2-CH2-CH2-OH</chem> <chem>H2N-C(=O)-CH2-CH2-CH2-CH2-OH</chem>
	Proline Asparagine Glutamine
Positively charged R groups	Lysine Arginine Histidine
	<chem>H2N-C(=O)-NH2</chem> <chem>H2N-C(=O)-NH2</chem> <chem>H2N-C(=O)-NH-C(=O)-NH2</chem>
Negatively charged R groups	Aspartate Glutamate
	<chem>H2N-C(=O)-CH2-COO-</chem> <chem>H2N-C(=O)-CH2-COO-</chem>
Nonpolar, aromatic R groups	Phenylalanine Tyrosine Tryptophan
	<chem>H2N-C(=O)-C6H5</chem> <chem>H2N-C(=O)-C6H4-OH</chem> <chem>H2N-C(=O)-C6H2-NH-C6H5</chem>

Area of an Ellipse

Pseudocode/Flowchart



Test by Hand Calculation

a = 2.5 m
b = 4 m
A = πab
A = $(\pi)(2.5 \text{ m})(4 \text{ m}) = 10\pi \text{ m}^2$
A = 31.416 m^2

Program Source .cpp File

```
/* This program computes the area A of an ellipse with semiaxes a and b
User will input values a and b in meters */
```

```
//library files
#include <cmath>
#include <iostream>
#include <iomanip> //set precision to 3 decimal places
using namespace std; //cin cout

#define PI 3.1415

int main(void)
```

```
{  
    //declare local variables  
    double a; //semiaxis a  
    double b; //semiaxis b  
    double A; //area  
  
    //1. User inputs  
    cout << "Please enter values for the semiaxes a and b (m) of an ellipse to compute the  
area A (m^2) --> ";  
    cin >> a >> b; //user inputs  
  
    //2. Calculate Area  
    A = PI * a * b; //area of an ellipse  
  
    //3. Output  
    cout << setprecision(3) << fixed ; //set 3 decimal places  
    cout << "\nThe value of a is " << a;  
    cout << "\nThe value of b is " << b;  
    cout << "\nThe calculated area = " << A << " m^2\n";  
  
    system("pause"); //hold dos window in DEV  
    return 0;  
}  
//end of main
```

Screenshot of Output

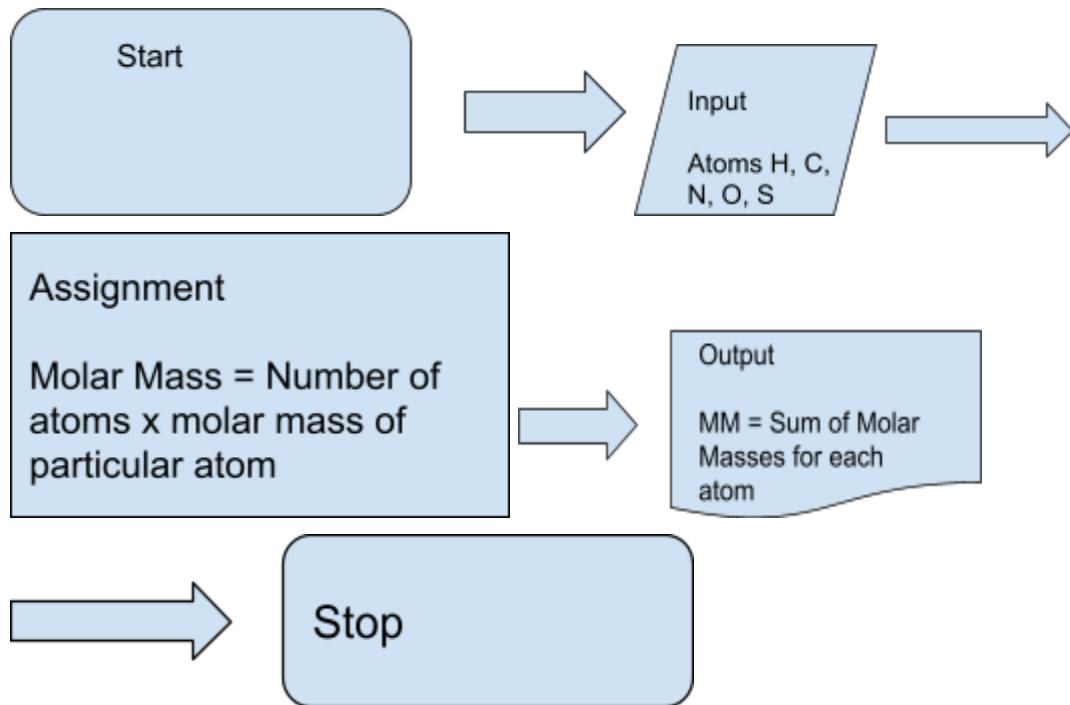
A screenshot of a Windows desktop environment. In the center, there is a terminal window titled "D:\VGE 1501\HW #2 - Area of an Ellipse.exe". The window contains the following text:

```
Please enter values for the semiaxes a and b (m) of an ellipse to compute the area A (m^2) --> 2.5
4
The value of a is 2.500
The value of b is 4.000
The calculated area = 31.416 m^2
Press any key to continue . . .
```

The desktop taskbar at the bottom shows various pinned icons, including File Explorer, Edge, and Spotify. The system tray indicates the date and time as 9/18/2017, 9:14 AM.

Amino Acids - Total Molar Mass

Pseudocode/Flowchart



Test by Hand Calculation

Alanine: 7 atoms H + 3 atoms C + 1 atom N + 2 atoms O + 0 atoms S

$$(7 \times 1.00794 \text{ g/mol}) + (3 \times 12.011 \text{ g/mol}) + (1 \times 14.00674 \text{ g/mol}) + (2 \times 15.9994 \text{ g/mol}) + (0 \times 32.066 \text{ g/mol}) = 89.09412 \text{ g/mol} > \mathbf{89.094 \text{ g/mol}}$$

Arginine: 15 atoms H + 6 atoms C + 4 atom N + 2 atoms O + 0 atoms S

$$(15 \times 1.00794 \text{ g/mol}) + (6 \times 12.011 \text{ g/mol}) + (4 \times 14.00674 \text{ g/mol}) + (2 \times 15.9994 \text{ g/mol}) + (0 \times 32.066 \text{ g/mol}) = 175.21086 \text{ g/mol} > \mathbf{175.211 \text{ g/mol}}$$

Program Source .cpp File

```
// This program computes the molar mass of amino acids in grams/mole (g/mol) with atoms of  
Hydrogen, Carbon, Nitrogen, Oxygen, Sulfur
```

```
//library files
```

```

#include <cmath>
#include <iostream>
#include <iomanip> //set precision to 3 decimal places
using namespace std; //cin cout

#define H 1.00794
#define C 12.011
#define N 14.00674
#define O 15.9994
#define S 32.066

int main(void)
{
    //declare local variables
    int h; //atoms of hydrogen
    int c; //atoms of carbon
    int n; //atoms of nitrogen
    int o; //atoms of oxygen
    int s; //atoms of sulfur
    double MM; //total molar mass (g/mol)

    //1. User inputs
    cout << "Please enter the number of atoms of each of the five elements (Hydrogen, Carbon, Nitrogen, Oxygen, Sulfur) for an amino acid below. ";

    cout << "\n\nHow many hydrogen atoms? ";
    cin >> h;

    cout << "How many carbon atoms? ";
    cin >> c;

    cout << "How many nitrogen atoms? ";
    cin >> n;

    cout << "How many oxygen atoms? ";
    cin >> o;

    cout << "How many sulfur atoms? ";
    cin >> s; //user inputs

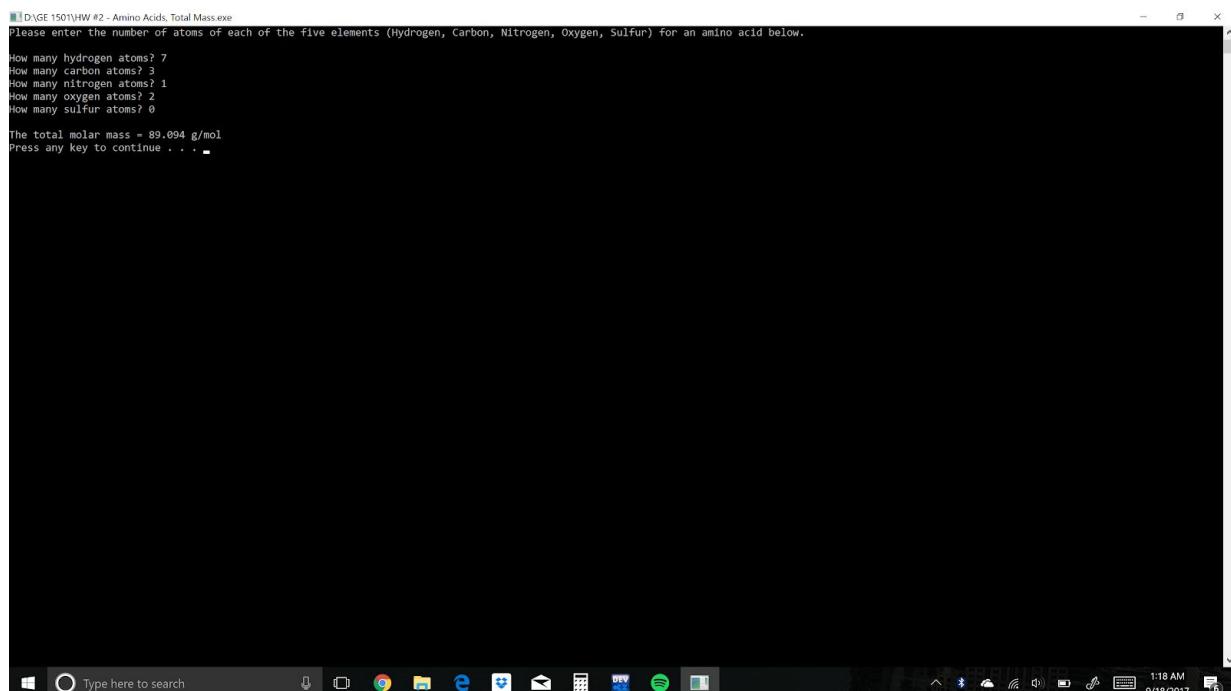
    //2. Define sum of the molar masses
    MM = h*H + c*C + n*N + o*O + s*S; //sum of the molar masses

```

```
//3. Output
cout << setprecision(3) << fixed ; //set 3 decimal places
cout << "\nThe total molar mass = " << MM << " g/mol\n";
system("pause"); //hold dos window in DEV
return 0;

} //end of main
```

Screenshots of Output



Alanine

D:\VGE 150\HW #2 - Amino Acids, Total Mass.exe
Please enter the number of atoms of each of the five elements (Hydrogen, Carbon, Nitrogen, Oxygen, Sulfur) for an amino acid below.

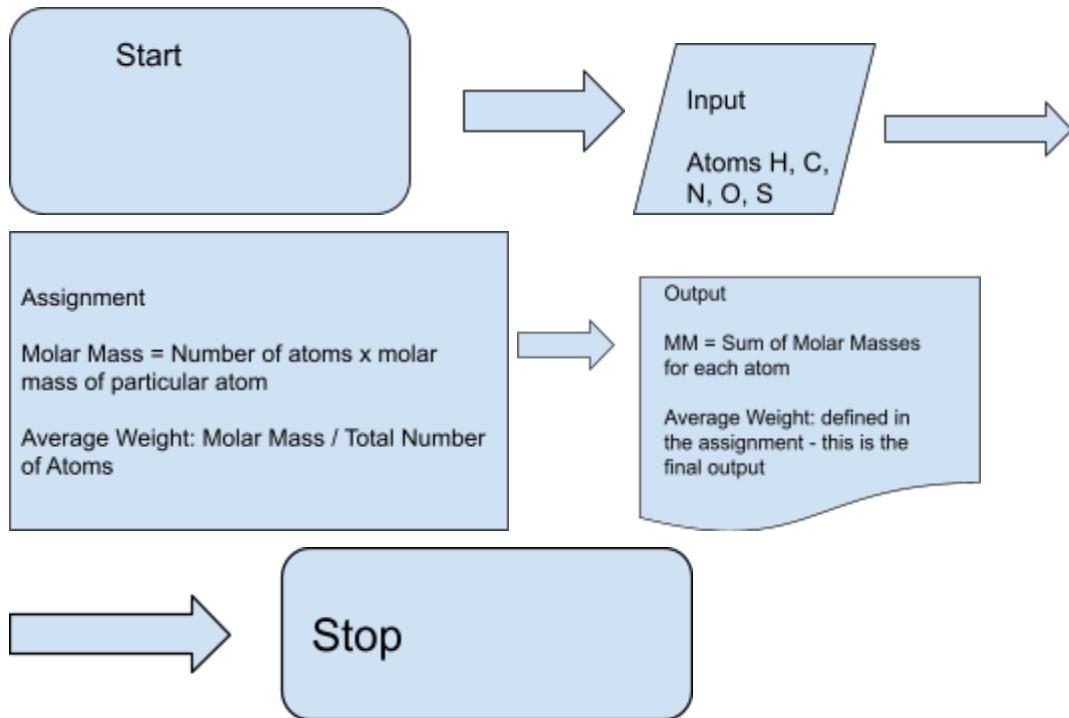
How many hydrogen atoms? 15
How many carbon atoms? 6
How many nitrogen atoms? 4
How many oxygen atoms? 2
How many sulfur atoms? 0

The total molar mass = 175.211 g/mol
Press any key to continue . . .

Arginine

Amino Acids - Average Weight per Atom

Pseudocode/Flowchart



Test by Hand Calculation

Cysteine:

- Atoms: 7 atoms H + 3 atoms C + 1 atom N + 2 atoms O + 1 atom S = 14 atoms
- Molar Mass: $(7 \times 1.00794 \text{ g/mol}) + (3 \times 12.011 \text{ g/mol}) + (1 \times 14.00674 \text{ g/mol}) + (2 \times 15.9994 \text{ g/mol}) + (1 \times 32.066 \text{ g/mol}) = 121.16012 \text{ g/mol}$
- Average Weight per Atom: $(121.16012 \text{ g/mol}) / 14 = 8.654 \text{ g/mol}$

Lysine:

- Atoms: 15 atoms H + 6 atoms C + 2 atom N + 2 atoms O + 0 atom S = 25 atoms
- Molar Mass: $(15 \times 1.00794 \text{ g/mol}) + (6 \times 12.011 \text{ g/mol}) + (2 \times 14.00674 \text{ g/mol}) + (2 \times 15.9994 \text{ g/mol}) + (0 \times 32.066 \text{ g/mol}) = 147.19738 \text{ g/mol}$
- Average Weight per Atom: $(147.19738 \text{ g/mol}) / 25 = 5.888 \text{ g/mol}$

Program Source .cpp File

```
// This program computes the average weight per atom in an amino acid (g/mol) with atoms of
Hydrogen, Carbon, Nitrogen, Oxygen, Sulfur

//library files
#include <cmath>
#include <iostream>
#include <iomanip> //set precision to 3 decimal places
using namespace std; //cin cout

#define H 1.00794
#define C 12.011
#define N 14.00674
#define O 15.9994
#define S 32.066

int main(void)
{
    //declare local variables
    int h; //atoms of hydrogen
    int c; //atoms of carbon
    int n; //atoms of nitrogen
    int o; //atoms of oxygen
    int s; //atoms of sulfur
    double AW; //average weight per atom (g/mol)

    //1. User inputs
    cout << "Please enter the number of atoms of each of the five elements (Hydrogen,
Carbon, Nitrogen, Oxygen, Sulfur) for an amino acid below. ";

    cout << "\n\nHow many hydrogen atoms? ";
    cin >> h;

    cout << "How many carbon atoms? ";
    cin >> c;

    cout << "How many nitrogen atoms? ";
    cin >> n;

    cout << "How many oxygen atoms? ";
    cin >> o;
```

```

cout << "How many sulfur atoms? ";
cin >> s; //user inputs

//2. Define the average weight
AW = (h*H + c*C + n*N + o*O + s*S) / (h + c + n + o + s); //average weight

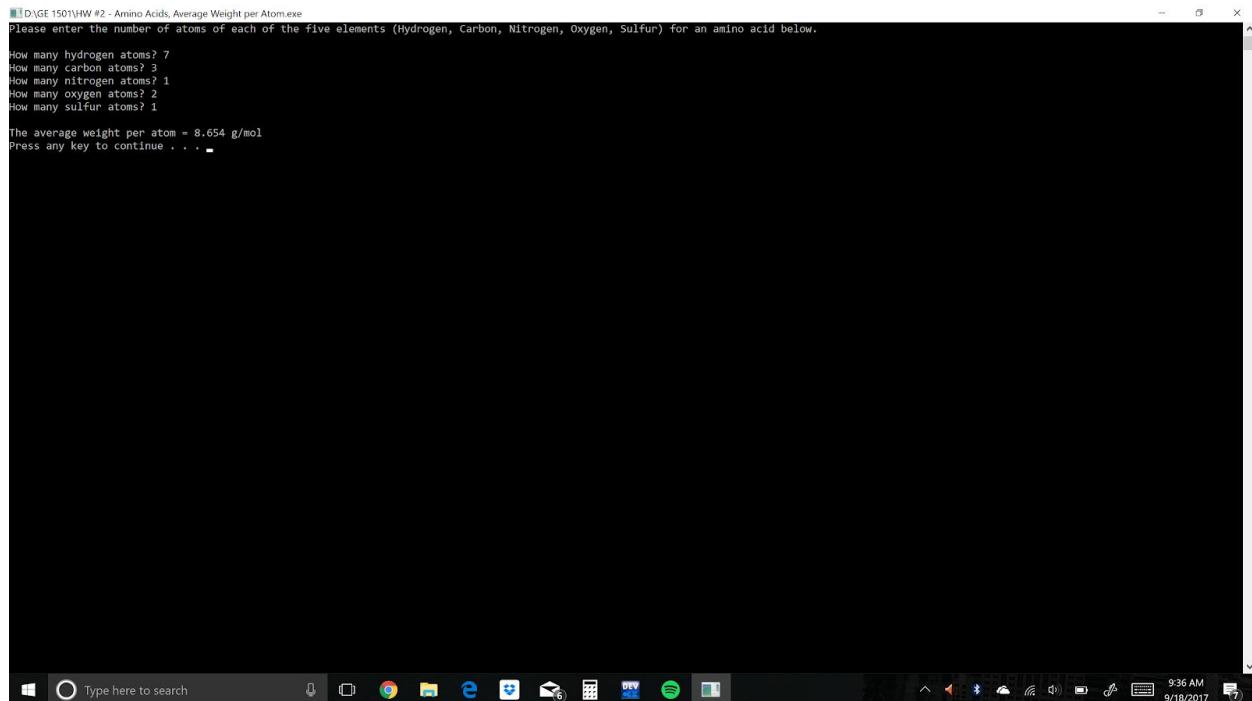
//3. Output
cout << setprecision(3) << fixed ; //set 3 decimal places
cout << "\nThe average weight per atom = " << AW << " g/mol\n";

system("pause"); //hold dos window in DEV
return 0;

} //end of main

```

Screenshots of Output



```

D:\GE 150\HW #2 - Amino Acids, Average Weight per Atom.exe
Please enter the number of atoms of each of the five elements (Hydrogen, Carbon, Nitrogen, Oxygen, Sulfur) for an amino acid below.

How many hydrogen atoms? 7
How many carbon atoms? 3
How many nitrogen atoms? 1
How many oxygen atoms? 2
How many sulfur atoms? 1

The average weight per atom = 8.654 g/mol
Press any key to continue . . .

```

Cysteine

```
D:\VGE 150\HW #2 - Amino Acids, Average Weight per Atom.exe
Please enter the number of atoms of each of the five elements (Hydrogen, Carbon, Nitrogen, Oxygen, Sulfur) for an amino acid below.

How many hydrogen atoms? 15
How many carbon atoms? 6
How many nitrogen atoms? 2
How many oxygen atoms? 2
How many sulfur atoms? 0

The average weight per atom = 5.888 g/mol
Press any key to continue . . .

Windows Type here to search 9:37 AM 9/18/2017
```

Lysine