

Attach the assignment to your HW/Lab
Date: 9/07/22____
You name _____

ENGR 102 Section **Lab 3b**

DUE DATE: 9/14/2022

Team # (table) _____

ENGR 102 Sect #____ Lab 3b individual

22+4 points (may be converted to % for canvas)

Reading assignment:

Lecture Slides	L03a L03b week 3
zyBook chapters 3	Chapter 3

Attention!!

Use individual header for this submission. We will make ZyBook submission again this time. If you think that ZyBook is not getting your submission, please create a report with screenshots of your code and outputs and submit it on Canvas.

You may talk with others in lab about how to go about doing each of assignments. However, submission should be individual.

Deliverables.

Please complete the two activities as described below. Each activity is an individual assignment, but you may consult your teammates and others as you work. Please submit the following files to zyBooks.

- `using_input.py` [12 points]
- `calling_functions.py` [10 points]
- `e_challenge.py` (optional) [4 points]

Activity #1: Using input – individual [12 points]

Convert your program from Lab: Topic 2 Activity #1 to a new program that produces identical output. However, your new program should take in input from the user as appropriate, store values in variables, and output in the required format. Please name the program `using_input.py`.

Produce output for the following calculations:

- Use **Newton's Second Law** to calculate the net force applied to an object with a given mass in kg and a given acceleration in m/s^2 . Display the result with one (1) decimal place.
- Calculate the **wavelength** of x-rays scattering from a crystal lattice with a given distance between crystal layers in nm and a given scattering angle in degrees. Assume first order diffraction. Display the result with four (4) decimal places. (See **Bragg's Law** from before)
- Calculate how much Radon-222 is left given a time in days, an initial amount in g, and a half-life of 3.8 days. Display the result with two (2) decimal places. (See **radioactive decay** from before)
- Use the **Ideal Gas Law** to calculate the pressure of an ideal gas for a given number of moles, a given volume in m^3 , and a given temperature in K. Use a value of $8.314 \text{ m}^3\text{Pa/K}\cdot\text{mol}$ for the gas constant. Display the result with zero (0) decimal places.

Each part of your program should perform the following tasks:

- Print what the part of the program does to the screen.
- Prompt the user to enter required data from the keyboard. Include proper units in the prompt as shown in the example output below.
- Get the inputs from the user and store in appropriately named variables.

- Perform the necessary calculations.
- Output the result to the screen with proper labels and units.

Example output (using inputs **3** and **5.5**):

This program calculates the applied force given mass and acceleration

Please enter the mass (kg): **3**

Please enter the acceleration (m/s²): **5.5**

Force is 16.5 N

This program calculates the wavelength given distance and angle

Please enter the distance (nm): **0.025**

Please enter the angle (degrees): **25**

Wavelength is 0.0211 nm

You do **NOT** have to make your input text appear red and bold; it's only for the example above. Please see the tests on zyBooks for exact wording for the remaining parts. As always, please include descriptive comments in your code so that someone may follow your programming logic.

Activity #2: Calling functions – individual [10 points]

This program provides practice for writing programs to perform multiple complex calculations, and to give you practice with basic functions.

Starting with the template provided on zyBooks, write a program that calculates the area of several regular polygons when given a side length. Your program should take as input from the user a value for side length and calculate the following values:

- The area of an equilateral triangle
- The area of a square
- The area of a regular pentagon
- The area of a regular dodecagon (12 sides)

We're going to ignore units for this problem. The template provided contains the function `printresult()`. You do **NOT** need to modify the function in your code. Have your program calculate the area for each shape and call the function to generate the output according to the example shown below. Use two (2) decimal places for the side length and three (3) for the area. Name your program `calling_functions.py`.

Before you beginning coding, you should stop and think briefly about how you want to structure your program. This activity is a great way to practice calling the same function multiple times.

Example output (using input **1.25**):

```
Please enter the side length: 1.25
A triangle with side 1.25 has area 0.677
A square with side 1.25 has area 1.562
A pentagon with side 1.25 has area 2.688
A dodecagon with side 1.25 has area 17.494
```

Helpful Hint: When testing/debugging a program that requires input from the keyboard, it can be quite frustrating to have to retype the input every time you want to run the program. One technique for dealing with this problem is to simply “hard code” the variable values during the debugging process (assign variable values in the code rather than retrieving values from the keyboard), then add the code to retrieve the input from the keyboard after you are sure the code works.

Challenge Program (Optional 4 bonus points):

Using *only the commands we have covered in class so far*, write a program that asks a user for a number of digits, and prints the number e rounded to that many digits of precision. Do **NOT** use the `round()` function. Instead, get creative and think of another way!

Example output (using input **5**):

Please enter the number of digits of precision for e : **5**

The value of e to 5 digits is: 2.71828

If you complete this challenge correctly, you will receive 4 bonus points on this assignment. Please name your program `e_challenge.py` and submit to zyBooks.