=|= Python Project Report =|=

Repository Name – Playing with Graph in Physics

Problem statement ,result and plot generated - Related to 4 topics 4 problems as follows:-

1. Under Kinematics , plotting displacement-time(X-T) graph and calculating average velocity ,total displacement and corresponding Velocity-Time(V-T) graph for initially plotted X-T graph .Observer may also see documentation of all plotted graph and he may also submit his analysis during observation in documentation.

Similarly I have plotted Velocity-time(V-T) graph and calculated average acceleration ,total displacement and corresponding acceleration-Time(A-T) graph for initially plotted V-T graph.

But here an extra Velocity-Time graph is drawn using data from a csv file(which contain 34 rows).In this csv file ,for replacing missing velocity in csv file we have used mean , meadian and mode of remaining velocities in file .The choice for choosing mean median and mode is upto user .if still there is an row having missing value of time then I have removed that row and then I have drawn V-t and A-t graph of given file and minimum ,maximum velocity ,total displacement ,average velocity ,average acceleration of given data in csv file. At last Observer may also see documentation of all plotted graph and he may also submit his analysis during observation in documentation

2. In Modern Physics, I have explored the Modern Physics domain and used the Matplotlib library to plot the graphs of some important concepts in the field of Radioactivity and X-Rays.

I used Numpy library to initialize values in an array for ploting the PieChart of occurence of Radioactive Element in earth's crust.

I have also collected the data and created a csv (Comma Seperated Values) file to store that data. Pandas library permits us to retrieve data from the csv file and analyze it accordingly.

I have gathered the information about the HalfLife, Isotopes, Energy and Natural Concentration, of some Radioactive Elements such as Uranium, Thorium, Radium and Polonium. My 6 plots are as follows:-

1. Pie Chart about the occurence of these elements in earth's crust.

2. Graphical Representation of Moseley Law of X-Rays.

3. Graph of Radioactive Decay Law.

4. Bar Graph of Energy of Radioactive Elements.

5. Scattered Graph of HalfLife of Elements.

6. Line Graph of Natural Concentrations of Elements.

3. I have drawn core and important graphs related to thermodynamics.

Line graph of Boyle law. Boyle's law, also called Mariotte's law, a relation concerning the compression and expansion of a gas at constant temperature. This empirical relation, formulated by the physicist Robert Boyle in 1662, states that the pressure (p) of a given quantity of gas varies inversely with its volume (v) at constant temperature; i.e., in equation form, pv = k, a constant.

Line graph of Charles law. Charles's law, a statement that the volume occupied by a fixed amount of gas is directly proportional to its absolute temperature, if the pressure remains constant.

Line graph of Avogadro's law. Avogadro's law, a statement that under the same conditions of temperature and pressure, equal volumes of different gases contain an equal number of molecules. This empirical relation can be derived from the kinetic theory of gases under the assumption of a perfect (ideal) gas. The law is approximately valid for real gases at sufficiently low pressures and high temperatures.

Line graph of Gay-Lussac's law. It is a gas law which states that the pressure exerted by a gas (of a given mass and kept at a constant volume) varies directly with the absolute temperature of the gas. In other words, the pressure exerted by a gas is proportional to the temperature of the gas when the mass is fixed and the volume is constant.

4. I have studied the gravitational field of earth and different concepts of our solar system such as different planets mass, radius, density and gravity. I used numpy library to create arrays on earth's gravitational field and on earth's radius and after that plot a curve graph.

I also collected the data on different fields of planets, different elements present on earth and to store them I created two csv files. After that I summarized all data with the help of panda library and plot four graphs and also plot a pie chart on them by using matplotlib library.

I plotted 6 graphs as follows:

Graph on earth's gravitational field vs different radii.

A graph of 4 subplots on gravity, mass, density, radius of different bodies of our solar system.

Pie chart on different elements present on earth.

Description of important libraries ❼

1. Numpy : (i)arrange()- The arange() function is used to get evenly spaced values within a given interval.
(ii) random.rand()- **creates an array of specified shape and fills it with random values**.

(iii) exp()-The np.exp() is a mathematical function used to find the exponential values of all the elements present in the input array.

(iv) array()-The array object in NumPy is called ndarray. We can create a NumPy ndarray object by using the array() function.

2. Pandas – (i) mean()-The mean() method returns a Series with the mean value of each column.

ii) median()-The median() method returns a Series with the median value of each column.

iii) mode()-The mode() method returns a Series with the mode value of each column.

iv) fillna()-The fillna() method replaces the NULL values with a specified value.

v) dropna()-The dropna() method removes the rows that contains NULL values.

vi) drop_duplicates()-method helps in removing duplicates from the data frame.

vii) loc[]-The loc property is used to access a group of rows and columns by label(s) or a boolean array.

viii) values()-The values property is used to get a Numpy representation of the DataFrame.

ix) read_csv()-A simple way to store big data sets is to use CSV files

x) DataFrame()-A Pandas DataFrame is a 2 dimensional data structure, like a 2 dimensional array, or a table with rows and columns.

3. Matplotlib :

i) plot()-The plot() function is used to draw points (markers) in a diagram.

ii) subplot()-Drawing multiple maps in the same figure is possible using matplotlib's *subplots*.

iii) pie()-With Pyplot, you can use the pie() function to draw pie charts:

iv) hist()-The hist() function will use an array of numbers to create a histogram, the array is sent into the function as an argument.

v) scatter()-The scatter() function plots one dot for each observation. It needs two arrays of the same length, one for the values of the x-axis, and one for values on the y-axis

vi) bar()-With Pyplot, you can use the bar() function to draw bar graphs

vii) title() , (viii)suptitle(), (ix) xlable(), (x)ylable(), (xi)show()

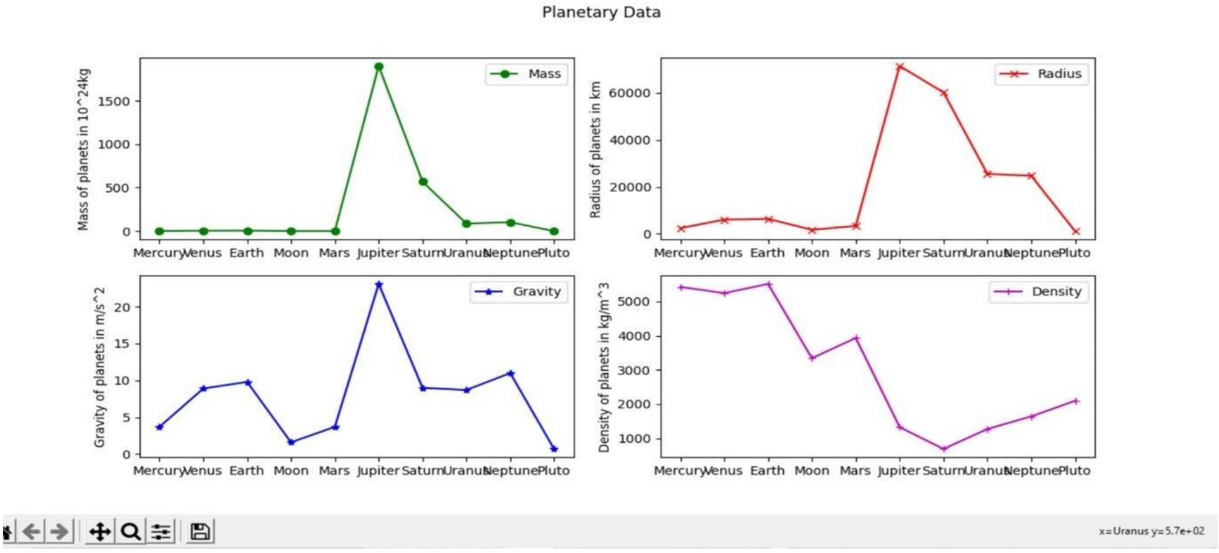
Other used python concepts in our project-:

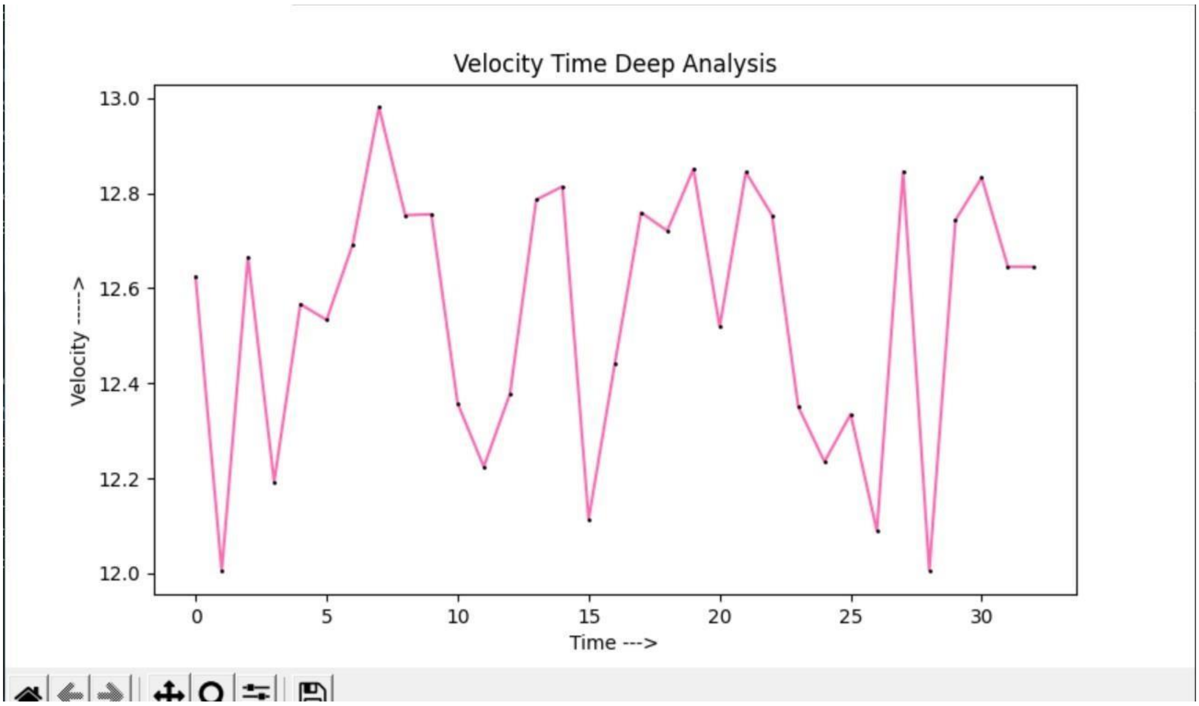
1. We have also used oops(including @classmethod , @staticmethod and hierarchical inheritance),

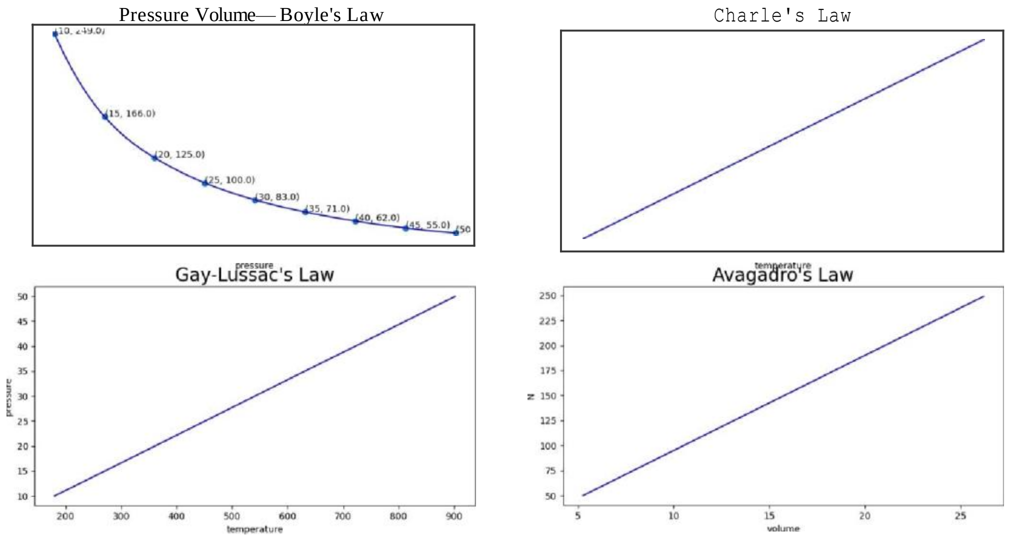
2. File Handling(in read and append modes)

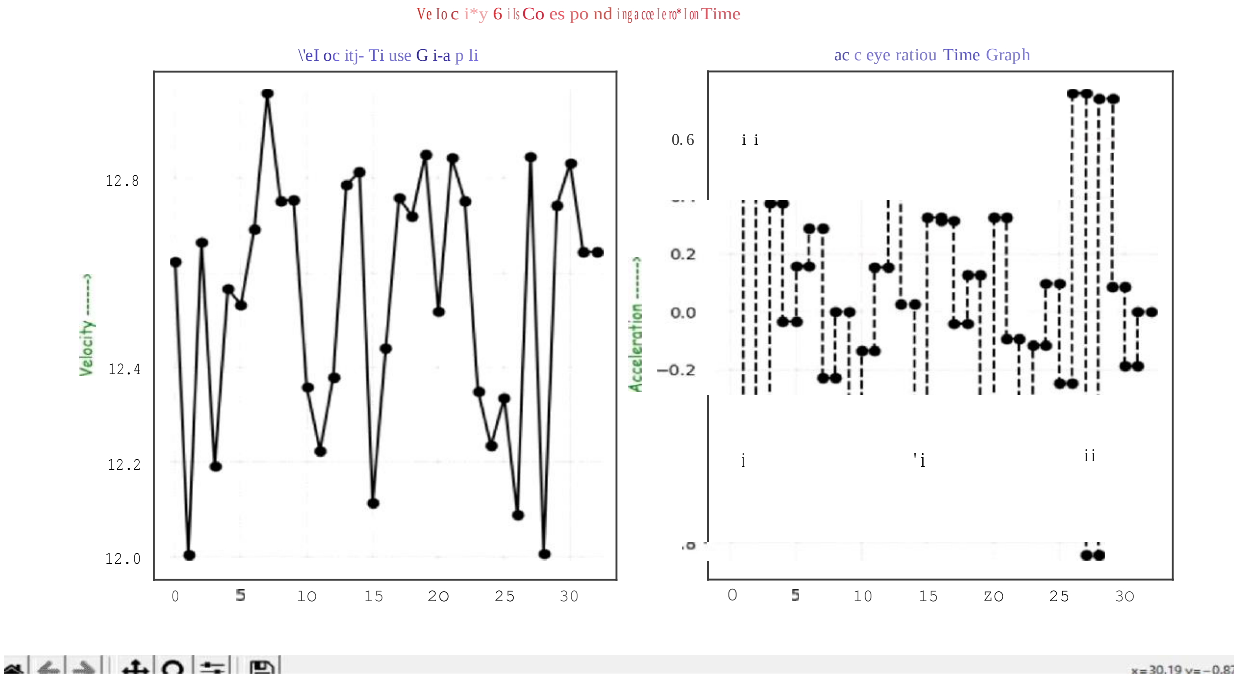
3. Used oops concepts and file handling to make project look more clear, made project files to be accessible in one file.

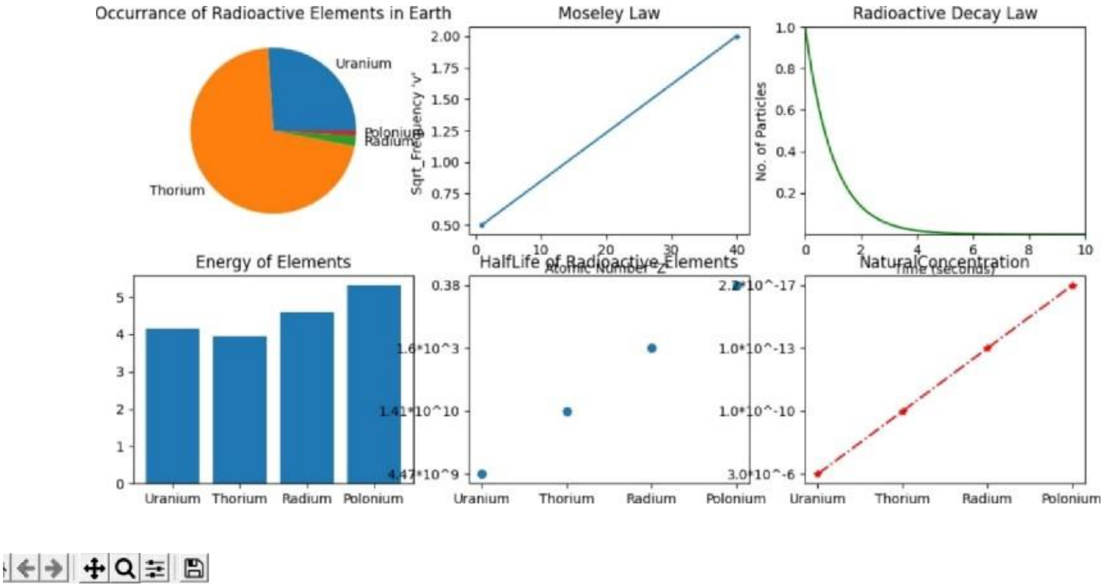
We have made project menu driven so that user can give input which graph he/she wants to see and taking input as a string/number that made project easier to run. Using file handling for reading text files which have important details of the graph. Open the main_file.py to execute the program.

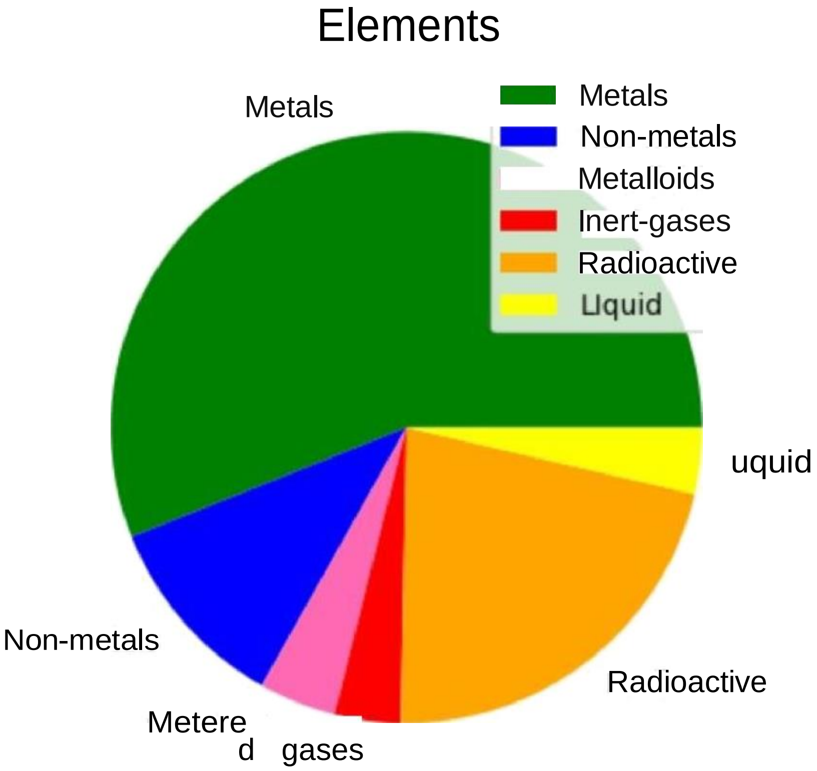





Pressure Volume— Boyle's Law
(10, 249.0)
(15, 166.0)
(20, 125.0)
(25, 100.0)
(30, 83.0)
(35, 71.0)
(40, 62.0)
(45, 55.0)
(50
pressure
Charle's Law
temperature
Gay-Lussac's Law
pressure
50
45
40
35
30
25
20
15
10
200
300
400
500
600
700
800
900
temperature
Avagadro's Law
N
250
225
200
175
150
125
100
75
50
5
10
15
20
25
volume


Ve lo c i*y 6 ils Co es po nd ing acce le ro*l on Time
\'eI oc itj- Ti use G i-a p li
ac c eye ratiou Time Graph
Velocity ------>
12.8
12.4
12.2
12.0
0
5
10
15
20
25
30
Acceleration ------>
0.6
0.2
0.0
−0.2
0
5
10
15
20
25
30
x=30.19 y=−0.87


Occurrance of Radioactive Elements in Earth
Uranium
Polonium
Radium
Thorium
Moseley Law
Sqrt_Frequency 'v'
Atomic Number 'Z'
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0
10
20
30
40
Radioactive Decay Law
No. of Particles
Time (seconds)
1.0
0.8
0.6
0.4
0.2
0
2
4
6
8
10
Energy of Elements
5
4
3
2
1
0
Uranium
Thorium
Radium
Polonium
HalfLife of Radioactive Elements
0.38
1.6*10^3
1.41*10^10
4.47*10^9
Uranium
Thorium
Radium
Polonium
NaturalConcentration
2.2*10^-17
1.0*10^-13
1.0*10^-10
3.0*10^-6
Uranium
Thorium
Radium
Polonium


Elements
Metals
Non-metals
Metalloids
Inert-gases
Radioactive
LIquid
Metals
uquid
Non-metals
Radioactive
Metere
d
gases