FREELY FALLLING OBJECT

جامعة الإمام عبدالرحمن بن فيصل
IMAM ABDULRAHMAN BIN FAISAL UNIVERSITY

Physics Department College of Sciences And Humanities – Jubail

Howra Abu Shaheen 2190001707@iau.edu.sa | Shoug Alsquor 2190002130@iau.edu.sa | Sara Almahri. 2200001693@iau.edu.sa

L.Hind Bagel | Dr.Ghadah Ameerah

INTRODUCTION :

Today, programming and modeling is a fun way and a basic skill that is easy and fast to solve problems, such as physical problems, and to convert scientific theoretical experiments into scientific modeling and simulation experiments that are useful in learning and developing education. We will perform a free fall acceleration experiment using Python language.

OBJECTIVE :

1/ Modeling and plotting a physical experiment using the Python programming language.

3/learn new things about Python and work on it.

TOOLS :

Libraries that were used:

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from IPython.display import Image
from IPython.display import YouTubeVideo
```

METHODOLOGY :

1- Use the pandas library to create a table

```
data = {'D(mm)': [11.95], 'r(mm)': [5.975]}
df1 = pd.DataFrame(data)

# Convert 'r(mm)' to 'r(m)' by dividing by 1000
df1['r(m)'] = df1['r(mm)'] / 1000
```

2- Calculate the data for the table called from the Excel file.

```
df = pd.read_csv('./HOOR/table.csv')

df['h(m)'] = df['h(cm)'] / 100


r_m_value = df1['r(m)'].values[0]


df['h-r(m)'] = df['h(m)'] - r_m_value

df['T(mes)'] = (df['T1(msec)'] + df['T2(msec)']) / 2

df['T(sec)'] = df['T(mes)'] / 1000

df['T^2(sec^2)'] = df['T(sec)'] ** 2
```

3- Plot data using the matplotlib & seaborn library.

```
plt.plot(df['h-r(m)'], df['T2(msec)'], marker='o', linestyle='-', color='blue')

plt.xlabel('h-r(m)')
plt.ylabel('T2(msec)')
plt.title('Plot of h-r(m) vs. T2')

plt.show()
sns.set()
```

4- Find the slope from the plotting, then found the value of gravitational acceleration from the slope.

```
x1 = 0.649
y1 = 0.14
x2 = 0.294
y2 = 0.6
s = (y2 - y1) / (x2 - x1)

print("\033[5;37m slope=  ",s)
```

```
a= 2
ss= -1.2957746478873238
g= (2/ss)
print("\033[5;37m gravity acceleration =  ",round(g,1))
```

METHODOLOGY :

5- Calculate the accuracy of the devices and the percentage of error.

```
g_exp= 9.1
g_th= 9.89
p_e = ((g_exp-g_th)/(g_th))*100

print("\033[5;36m E= ",round (p_e,1),"%")
```

```
print("\033[31m the experimental error for the followi

systematic_pe= "(+0.005 ,-0.005)"

print("\033[5;34m Smart time {} mes , micrometer perce
      .format(systematic_pe,systematic_pe))
```

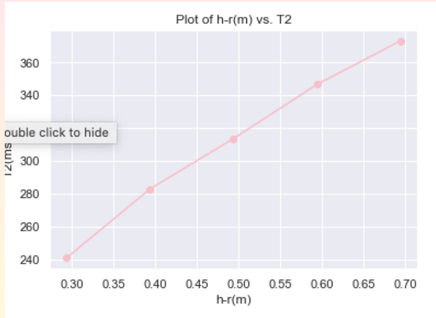
RESULT :

1.Data tables.

	D(mm)	r(mm)	r(m)
0	11.95	5.975	0.005975

	h(cm)	T1(msec)	T2(msec)	h(m)	h-r(m)	T(mes)	T(sec)	T^2(sec^2)
0	70	374.38	372.95	0.7	0.694025	373.665	0.373665	0.139626
1	60	345.03	346.44	0.6	0.594025	345.735	0.345735	0.119533
2	50	313.37	313.45	0.5	0.494025	313.410	0.313410	0.098226
3	40	280.48	282.80	0.4	0.394025	281.640	0.281640	0.079321
4	30	239.11	240.81	0.3	0.294025	239.960	0.239960	0.057581

2.The graph (plotting).



RESULT :

3. Calculated result.

```
slope=   -1.2957746478873238

gravity acceleration =   -1.5
E=  -8.0 %
```

DISCUSSION & SELF-LEARNING:

1- We faced while calling the file for images, videos, and excel, how to specify the file path, then we used this code to verify the right file path :

```
import os
os.getcwd()
```

2-We learned how to add image and a video from YouTube. this section can help explain the experience.

```
gif_path1 = './HOOR/Picture1.gif'
display(image1)
run=YouTubeVideo("z_sJ15feNGw")
run
```

3- we learned how to color the text so that the main heading is distinguished from the subtext for easier understanding and reading, we used ANSI Code in Python.

```
print("\033[1;31m  Freely Falling object video :  \n
```

Freely Falling object video :

CONCLUSIONS &REFFRENCES:

In the end, the results of the experiment, practically and mathematically, were completely identical to the results of applying the experiment in the Python program, and all goals were achieved.

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L.Hind Bagel

Dr.Ghadah Ameerah