**Co-Curricular Project (5% of your final grade):**

*Free-fall in Daily Life, The Effects of Air Resistance, and Physics Beyond Newton*

This co-curricular activity is based on LaGuardia’s Core Competency Outcomes:

Inquiry and Problem Solving (written) asks students to seek and use disciplinary and cross-disciplinary content knowledge to address challenging issues, weighing evidence, and drawing conclusions through a process of synthesis and evaluation.

Global Learning (written) asks students to approach the world’s challenges and opportunities from multiple perspectives and engage with issues of diversity, identity, democracy, power, privilege, sustainability, and ethical action.

The co-curricular assignment in SCP 231 (General Physics I) will utilize the course objective that students should be able to “apply and adapt their knowledge through the direct application of physical principles learned in this course, or the methods of analysis used to solve basic problems acquired in this course” by having the students actively engage in a physics experiment that will be done outside of the classroom where they predict and analyze the results of a free-fall experiment. By doing this experiment and writing a paper, students will have a tangible example of free-fall. They must consider how to use the equations from class to obtain a result (the time the object is in the air as a function of height). They will also have to consider the effects of air resistance that lead to discrepancies in their calculations, and how air resistance depends on surface area. It will also satisfy the course objective “Contribute to the well-being of their community and the world at large” by having the students look at the contributions of other physicists besides Isaac Newton who come from diverse backgrounds and communities.

This project consisting of 4 parts will be uploaded to ePortfolio. After all four parts are completed, please combine them into one document that is uploaded to ePortfolio. The instructions for uploading can be found here: <https://eportfolio.laguardia.edu/documents/Tutorials/001_Resources_for_Students/001_Learn_the_Basics/004_Upload_Files_Documents_Images_Videos_and_Audio/004_Upload_Files_Documents_Images_Videos_and_Audio.pdf>

ePortfolio Resources can be found here: <https://eportfolio.laguardia.edu/>

**Part A: *Experimental- Free-Fall of Two Objects of Different Surface Areas***

(worth 20% of project grade)

Select two objects with different masses and surface areas. You should pick something with a “nice” shape so that you can calculate its surface area. Each object should have a surface area larger than 25 cm2. Your write-up should contain the following information:

-Measure the mass and calculate the surface area of each object. Include the dimensions you used to calculate this area.

-Measure the height that you will drop each object from. It should be higher than 1.5 m.

-Guess which object will fall faster.

-Using a stopwatch, record the time it takes each object to fall 10 times when dropped from the height you measured (it would be helpful to have a second person either drop the object or time its fall). The object should be dropped so that the surface area you calculated is perpendicular to the direction it is moving. Put into a table.

**Part B: *Free-Fall Analysis and Application to Daily Lives***

(worth 30% of project grade)

You will write a short paper where you address the following:

-Justify your guess from Part A. Why did you think the object you picked would take less time to fall?

-Was your guess correct? Why or why not?

-Take the average fall times of your 10 trials for each object.

-Calculate the time you would expect each object to fall using the kinematics equations. Discuss what information you used and what equation(s) you used to obtain the result.

-Compare your experimental and calculated values. Why do they differ? Justify and discuss (Hint: for the calculated values, what did you NOT account for)?

-Discuss another example of free fall that you have encountered in your daily life. How does air resistance play a role in this?

**Part C: *The Life and Times of Another Physicist (Besides Newton)***

(worth 30% of project grade)

The content from the class is dominated primarily by the works of Isaac Newton, who is attributed with founding classical mechanics. Pick a physicist from a different cultural background (preferably your own). Please use academic and scholarly resources. Cite these sources in the text- do NOT use direct quotes. Write everything in your own words. In a few paragraphs, discuss:

-The life of this physicist (early age, adulthood, a few personal details, where they lived and grew up).

-The major contribution(s) of this physicist to the field of physics, as well as any other fields.

-Any barriers this physicist faced over the course of their lifetimes. Did anything or anyone try to prevent them from working or hinder academic progress they were trying to make?

-Include a bibliography of your cited sources.

Sample list of physicists:

1. Angelita Castro Kelly
2. Bibha Chowdhuri
3. Carolyn Parker
4. Cecilia Payne-Gaposchkin
5. Chien Shiung-Wu
6. Donna Strickland
7. Ellen Ochoa
8. Émilie du Châtelet
9. Emmy Noether
10. Franklin Chang-Diaz
11. Galileo Galilei
12. George Carruthers
13. Haisako Koyama
14. Herman Branson
15. Isabelle Stone
16. Juan M. Maldacena
17. Kalpana Chawla
18. Katherine Johnson
19. Laura Bassi
20. Lev Landau
21. Lise Meitner
22. Luis Alvarez
23. Maria Goeppert-Mayer
24. Marie Curie
25. Mario J. Molina
26. Mazlan binti Othman
27. Toshiko Yuasa
28. Willie Hobbs Moore
29. Xie Xide

**Part D: *Free-Fall on Other Planets***

(worth 20% of project grade)

Look at your calculated free-fall times from Part B. Select any other planet in the solar system. Your write-up should contain the following information:

-Record this planet’s mass and radius.

-Calculate “g” for this planet.

-Assume that you drop your objects from Part B from the same height on this planet. Calculate how long they would take to hit the ground. Discuss what information you used and what equation(s) you used to obtain the result.

-Do your calculations from Part D differ from Part B? Why?

-Will your objects fall faster on the Earth or the planet you picked? Why?