Unit 8 Plan: ***Universal Gravitation***
Physics1 Honors @ PalmHarborUniversityHigh

Day	Date	Topic	Assignments Due / Schedule
1-2		Models of the Universe Kepler's Laws **CW #1:** 1,2,3,4 page174	Read Section 7.1, pages 171-175 Finish In-class problems
3		Universal gravitation In-class worksheet and notes	**HW#1:** (p. 191) 54,55,56
4		Ellipse Lab	Read Section 7.2;
5		Section 7.2 Notes and Problems	**HW#2** (p. 192) : 71,72,73,84
6		Apple and Moon Video	**HW#3**: (p. 190-191) 24,26,27,28,30,31,32,36,38,40,42,43,46--50
7		Review	
8		Unit Test	

***Note**: Homework is due on the day following the assignment, unless otherwise noted.*

Objectives / **Essential Learnings**: (key terms in **bold**)

1. Aristotle, Eratosthenes, Ptolemy, Copernicus, Galileo, Brahe, Kepler, Newton, and Hubble. Know what their major contribution was to the study of the "universe"
2. Be able to discuss Kepler's contributions to our understanding of the motion in the heavens.
3. List **Kepler's laws** and be able to solve for an orbital period and an orbital radius.
4. Explain Newton's idea that the moon, like an apple, falls toward the earth.
5. Explain why the moon does not fall into the earth, or the planets into the sun.
6. State **Newton's law of universal gravitation**.
7. Explain the significance of an **inverse-square law**.
8. Understand that gravitational force is proportional to the product of both masses and the inverse square of the distance between the centers of spherical bodies.
9. Distinguish between **g (the acceleration due to gravity**) and **G (the universal gravitational constant)**
10. State the method used by Cavendish to measure G and understand the results of knowing G.
11. Describe a **gravitational field**. Understand that all bodies have gravitational fields surrounding them that can be represented by a collection of vectors representing the force per unit mass at all locations.
12. Describe what is meant by **gravitational field strength.**
13. Explain why an astronaut in earth orbit seems **weightless** even though there is a gravitational force on the astronaut.
14. Recognize that the motion of satellites in circular orbits about Earth can be understood using equations of uniform circular motion; solve problems involving orbital velocity and period.
15. Describe how the speed of a satellite changes for different portions of an **elliptical orbit**.

$$\left(\frac{T_a}{T_b}\right)^2 = \left(\frac{r_a}{r_b}\right)^3 \qquad F = G\frac{m_1 m_2}{r^2} \qquad g = G\frac{M}{r^2} \quad \text{(gravitational field strength)}$$

$$v = \sqrt{\frac{GM}{r}} \quad \text{(orbital velocity)} \qquad T = 2\pi\sqrt{\frac{r^3}{GM}} \quad \text{(orbital period)}$$

$G = 6.67 \times 10^{-11}\ Nm^2/kg^2$ $M_E = 5.98 \times 10^{24}\ kg$

$r_E = 6.38 \times 10^{6}\ m$