Chapter 5: A Particle in Circular Motion; Universal Gravitation

1. Be able to describe uniform circular motion in words.
2. Be able to sketch qualitatively both velocity and acceleration vectors for an object undergoing uniform circular motion at any point on its path.
3. Be able to define the period for an object in uniform circular motion.
4. Be able to find the speed of an object in uniform circular motion given the radius of its path and the period of its motion.
5. Be able to calculate the magnitude and to determine the direction of the acceleration of an object undergoing uniform circular motion.
6. Be able to determine how a halving, a doubling or a tripling of the speed of an object in uniform circular motion affects its acceleration.
7. Be able to determine how a halving, a doubling, or a tripling of the radius of the path of an object in uniform circular motion affects its acceleration.
8. Be able to sketch a force diagram for an object in uniform or vertical circular motion. Examples of such objects are:
   (a) a tether ball moving in a horizontal circle
   (b) a person in the "Cajun Cliff Hanger" ride at an amusement park
   (c) a car on an unbanked turn
   (d) a car on a banked turn
   (e) a person on a Ferris Wheel ride
   (f) a ball on a string whirling in a vertical circle
   (g) a car going over the top of a hill
   (h) a car going through the bottom of a dip in the road
   (i) a person at the very top or very bottom of a looping roller coaster
   (j) a satellite in orbit
9. Be able to use Newton's Second Law to find the magnitude and direction of the net force for an object in uniform circular motion including objects at the top and bottom of their vertical circular motion.
10. Given the orbital radius and period, be able to find the strength of the gravitational field in which a satellite orbits.
11. Be able to state Newton's Law of Universal Gravitation.
12. Be able to state how the strength of a gravitational field of a planet depends 1) on the distance from the center of the planet and 2) on the planet's mass.
13. Be able to determine the speed and period of a satellite given its orbital radius.
14. Be able to determine the mass of an object given the speed and orbital radius of a satellite.

15. Be able to describe the orbit of a geosynchronous satellite in terms of its period, its orbital radius, and the location of all geosynchronous satellites.

16. Be able to use a spreadsheet containing orbital data for objects in the solar system to find the value of the strength of the gravitational field experienced by any orbiting object listed.

17. From a list of moons in the solar system, be able to select a set that could be used to determine how the strength of a planet's gravitational field depends on how far you are away from the planet.

18. From a list of moons in the solar system, be able to select a set that could be used to determine how the strength of a planet's gravitational field depends on the mass of the planet.

19. Be able to make plots that lead to linear relationships that show 1) how the strength of a gravitational field depends on the mass of the object the creates this field, and 2) how the strength of a gravitational field depends on the distance from the source of this field.