Study Guide

AP Physics C **Mr. Butler**

Newton's Laws of Motion

The student should know or be able to do the following:

1. **State and describe Newton's 1st, 2nd, and 3rd laws both in words and equations and state the important features of each law.**
2. **Distinguish between conditions of *Static* and *Dynamic* equilibrium and describe why Newton's 1st law governs both conditions.**
3. **Identify the *Fundamental forces of nature*, state their relative strength, range over which they act and identify the fundamental mediating or "carrying" particle particular to each fundamental force.**
4. **Describe the Standard Model of particle physics and explain how it is organized, state the basic similarities and differences in the particle types and be able to identify and classify some of the major fundamental particles in terms type, charge, mass and spin.**
5. **Correctly identify which of Newton's laws governs a given physical situation.**
6. **Apply Newton's laws to determine if an object is in equilibrium.**
7. **Distinguish between an object's *state of motion* and its *change in state of motion* and relate these to the cause-effect relationship produced by a net force.**
8. **Describe inertia and state how it is measured.**
9. **Know the units of mass and force in both *the SI* and English systems and use these units to make force and mass conversions.**
10. **Distinguish between *mass* and *weight* and know which is an inherent property of an object and why.**
11. **Describe the relationship between *mass* and *weight* and use it to calculate the weight of an object and the value of *g* at different locations.**
12. **Distinguish between *gravitational mass* and *inertial mass* and describe how their non-equivalence would affect the value of *g* for bodies of different mass.**
13. **Distinguish between *inertial and non-inertial* reference frames and use these to account for motion which does not obey Newton's 1st and 2nd laws.**
14. **Calculate the net/resultant force from a system of forces using the component method of vector addition.**
15. **Draw a correct and complete free-body diagram for a force system and apply Newton's laws to predict the magnitude and direction of the net force and acceleration on the body.**
16. **Determine the magnitude and direction of the missing force in a force system that causes a given acceleration.**
17. **Correctly identify the cause-effect relationship on an object's acceleration due to a changing force or mass by applying appropriate equations or by interpreting graphs.**
18. **Correctly identify action-reaction force pairs acting between a given set of objects.**

19. **Use calculus methods and unit vectors to derive a force function from position, velocity, and acceleration functions and apply initial conditions to calculate position, velocity, acceleration, or force expressed in unit vector notation.**

20. **Apply Newton's laws and Galileo's kinematic equations to solve motion problems involving force, mass, acceleration, and the direction of motion of a body.**

NOTE: Review diagrams, graphs, worksheets, applets/films, and handout materials.