Study Guide

AP Physics C **Mr. Butler**

Momentum, Impulse and Collisions

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

1. **Define momentum, state its unit, and recognize it as the fundamental quantity that describes motion.**

2. **Predict how a changing mass or velocity will affect an object's momentum and compare the momenta of objects of different mass and/or velocity, and compare the momentum and kinetic energy of two objects.**

3. **Use differentiation to relate the rate of change of an object's momentum to the net force acting on it and use integration to relate force and momentum change to the impulse imparted to an object.**

4. **State momentum conservation, use it to describe the transfer of motion, and recognize situations for which the law does not hold true.**

5. **Describe impulse, recognize it as the mechanism of momentum change and motion transfer, and relate it to an object's momentum change.**

6. **Know the relationship between impulse, momentum change, acceleration and velocity change and relate these to Newton's 2nd law.**

7. **Relate the area under an F vs t graph to the impulse imparted to an object during some time interval and describe the shape of the graph curve with respect to the interacting forces acting between objects during a two-body collision.**

8. **Apply the impulse-momentum principle and momentum conservation to determine the mass and or velocity of objects before and after a two-body collision.**

9. **Identify action-reaction forces during a collision, relate this to "recoil" and apply Newton's 3rd law to describe how these forces cause impulse and momentum changes.**

10. **Distinguish between *elastic* and *inelastic* collisions and for each, identify which quantities are conserved.**

11. **Distinguish between one-dimensional and two-dimensional linear momentum and use vector methods and momentum conservation to solve problems involving two-dimensional *elastic* and *inelastic* collisions.**

12. **Identify by inspection the location of the CM of a uniform, symmetrical object or system of particles and apply both calculus and non-calculus methods to determine the CM of uniform density objects and thin rods of non-uniform density.**

13. **Predict the motion of the CM for an extended body or system of particles for cases in which the net external force is zero and for cases where the net external force is not zero.**

14. **Use calculus methods in applying impulse-momentum principles to solve problems involving rocket propulsion.**

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