Physics 121  Midterm Exam Review  Fall 2001  Instructor: John McGill

The exam will cover Chapters 1-5 from the text. You will be allowed one 8.5 x 11 inch sheet of notes to refer to during the exam. (You may write on both sides). You will also need a calculator for the exam. You will have the entire class period to complete the exam, (2:40 - 3:50 PM, Monday, Oct. 29, 2001).

The following topics may be helpful in guiding you as you study for the exam:

Chapter 1
Units and Conversions. You will need to know metric to metric conversions. Any English-metric conversion factors that you need will be provided.

Chapter 2 & 4
Know the definitions of:
- position- \( r \), displacement- \( \Delta r \), average velocity- \( \frac{\Delta r}{\Delta t} \), instantaneous velocity- \( \frac{dr}{dt} \), average speed- \( \frac{s}{\Delta t} \), instantaneous speed- \( |\frac{dr}{dt}| \), average acceleration- \( \frac{\Delta v}{\Delta t} \), instantaneous acceleration- \( \frac{dv}{dt} \).

Constant acceleration
\[
x = x_0 + v_{x_0}t + \frac{1}{2}a_xt^2 \\
y = y_0 + v_{y_0}t - \frac{1}{2}gt^2 \\
v_x^2 = v_{x_0}^2 + 2a_x(x-x_0) \\
v_y^2 = v_{y_0}^2 + 2a_y(y-y_0)
\]

Free fall - Projectile motion
Near the surface of the Earth acceleration is constant and has a magnitude of \( g = 9.8 m/s^2 \), and is directed toward the center of the Earth.
\[
x = x_0 + v_{x_0}t \\
y = y_0 + v_{y_0}t - \frac{1}{2}gt^2 \\
v_x = v_{x_0} = \text{constant} \\
v_y = v_{y_0} - gt \\
y-y_0 = \tan \theta_o(x-x_0) - \frac{1}{2}g(x-x_0)^2/(2v_{y_0}\cos \theta_o)^2) \\
R = v_{y_0}^2 \sin 2\theta_o/g, \quad H = v_{y_0}^2 \sin^2 \theta_o/2g \quad (\text{when the ground is flat and level with the starting point})
\]

Uniform Circular Motion
Motion around a circle or radius, \( r \), with constant speed, \( v = 2\pi/r \), \( T \) = period of revolution.
Centripetal (toward center) acceleration: \( a_c = \frac{v^2}{r} \)

Chapter 3
Vectors
Have magnitude and direction. Magnitude is always non-negative.

Unit vectors
have magnitude 1
\( \hat{i} \) +x direction, \( \hat{j} \) +y direction

Components
\[
\vec{V} = v_x \hat{i} + v_y \hat{j} \\
v_x = v \cos \theta, \quad v_y = v \sin \theta \\
\text{magnitude, } v = \sqrt{v_x^2 + v_y^2} \\
\theta = \tan^{-1}(v_y/v_x)
\]

Adding Vectors
\( \vec{C} = \vec{a} + \vec{b} \) implies: \( c_x = a_x + b_x \) and \( c_y = a_y + b_y \)

Chapter 5
Newton's First Law
When there are no external forces on a body, it moves with constant velocity.

Newton's Second Law
\[
\mathbf{F}_{\text{net}} = ma \quad (\text{The net force is equal to the mass times the acceleration.})
\]
\( \mathbf{F}_{\text{net}} \) is the vector sum of all of the individual forces acting on a body.
\( a \) is the acceleration of the body. \( m \) is the mass of the body.

Unit of Force
1 Newton = 1N = 1 kg m/s^2.