Physics 2A Lecture Final Review

1. ***MOTION IN 1-D***
   a) Understand the terms and concepts required to describe the motion of a particle moving in one dimension.
   b) Know how to use the kinematic equations to describe the motion of an object moving with constant acceleration
   c) Know how to use the graphs of x vs. t, v vs. t , and a vs. t to find the position, velocity, and acceleration of a particle moving with constant or non-constant acceleration.
   d) Know how to apply the kinematic equations to object in free-fall motion.
   e) Understand and know how to define the following terms:
      - Position
      - Displacement
      - Average velocity
      - Instantaneous velocity
      - Average speed
      - Average acceleration
      - Instantaneous acceleration
      - Free-fall Motion
      - Acceleration of gravity
2. ***VECTORS***
   a) What is a vector quantity?
   b) What is a scalar quantity?
   c) Know how to add vectors graphically (geometrically) and using component method.
   d) What are unit vectors? What are they used for?
   e) Know how to calculate displacement, velocity (average), and acceleration (average) vectors.
   f) How do you draw the velocity vector given the path of the particle?
   g) Vector properties (equality of vectors, commutative law, associative law, vector subtraction, negative of a vector, scalar multiplication)
   h) Scalar component of a vector.
   i) Vector components of a vector.
   j) Magnitude and direction of a vector.
   k) Know how to sketch vectors graphically.

3. ***MOTION IN 2-D***
   a) Motion in 2D can be analyzed by treating the x and y motion separately. The two motions are independent, each with constant acceleration.
   b) Kinematic equations can be used to describe motion in 2-D since it's motion with constant acceleration.
   c) Calculate the maximum height of a projectile.
   d) Calculate the range of a projectile. What is the maximum range?
   e) What is the path(trajectory) of a projectile moving in 2-D?
   f) What is uniform circular motion (UCM)?
   g) What is the magnitude and direction of the acceleration of a particle moving in UCM?
   h) What equations can I use to calculate radial (centripetal) acceleration?
   i) What is the circumference of a circle?

4. ***NEWTON'S LAWS OF MOTION (VERY IMPORTANT!!!!!!)***

a) Make sure you're able to write down Newton's 3 laws of motion and be able to explain conceptually and practically each one of them.
b) Know how to apply Newton's Laws of Motion to describe the motion of a system in equilibrium or moving with constant acceleration. See " STEPS IN USING NEWTON'S LAWS OF MOTION" on notes on homepage.
c) ALWAYS define your system when applying Newton's Laws.
d) Define a convenient SYSTEM and use a convenient coordinate system to apply Newton's Laws.
e) ALWAYS draw a FREE-BODY diagram when applying Newton's Laws making sure to include ALL external forces acting on system !!!!!
f) Newton's Laws fail when applied to particles moving near the speed of light and when applied to the subatomic scale.
g) What is an inertial reference frame?
h) What are the 4 fundamental forces of nature?
i) Give examples of different types of forces.
j) Know how to apply Newton's Laws to a system moving in Uniform Circular Motion.
k) Kinetic and static frictional forces.
l) Coefficients of friction.
m) What is the maximum value of static frictional force? How can you calculate it?
n) Is there a maximum value of kinetic frictional force?
o) Understand and know how to define the following terms:
    - Equilibrium
    - Conditions for equilibrium
    - Net (resultant) force
    - External forces
    - Internal forces
    - System
    - Free-Body Diagram (very important)
    - Mass
    - Inertia
    - Weight
    - Apparent weight

5. ***WORK***

a) Know the definition of the scalar (dot) product.
b) Know how to compute the scalar product.
c) Definition of work $W = \vec{F} \bullet \vec{s}$
d) Work is a scalar quantity NOT a vector quantity.
e) What is the physical interpretation of work?
f) Know how to compute the work done by a constant force.
g) Know how to compute work graphically using the graph of F vs. x.
h) How do you compute the net work on a system?
i) What does negative work mean?
j) What is the work done by the spring force?
k) Know what kinetic energy is and how to compute it.
l) Understand the meaning and how to use the Work-KE Theorem.
m) Work is measure of transferring energy into/out of a system due to a force doing work on system.
n) What is power? What does power measure? Explain.
o) What equations can you use to computer power?

p) What do we mean by net power delivered to an object (system)?
q) What is the spring force equation?
r) What is the physical meaning of the spring constant?
s) What is the work done by the spring force for a giving displacement?

6. POTENTIAL ENERGY AND CONSERVATION OF ENERGY

a) Conceptually understand and be able to explain potential energy (PE) and conservative forces.
b) What is the relation between PE and work done by a conservative forces?
c) What does conservation of mechanical energy (COME) mean?
d) When is the mechanical energy of a system conserved?
e) Remember to always define the SYSTEM when applying conservation of mechanical energy.
f) Remember to take into account the PE functions associated with all conservative forces acting on system when applying conservation of mechanical energy. Ex. U = mgy or U = (1/2)kx^2.
p) Understand and know how to define the following terms:
    - Potential energy (gravitational and elastic)
    - Conservative forces
    - Isolated system
    - Mechanical Energy
    - Conservation of Mechanical Energy

7. ***MOMENTUM***

a) What is the definition of momentum.
b) Momentum is a vector quantity.
c) What is N2L in terms of momentum?
d) A rapid change in momentum requires a large net force and a gradual change in momentum requires a small net force.
e) Why is momentum important?
f) When is the momentum of a system conserved?
g) ALWAYS define a SYSTEM when applying conservation of linear momentum.
q) What is an elastic, inelastic, and perfectly inelastic collision?

8. ROTATIONAL MOTION

a) What is the angular displacement, angular speed, and angular acceleration of a rotating body about a fixed axis of rotation.
b) Know how to apply the rotational equations of motion for constant α to describe the rotational motion of a body.
c) What are the SI units of the rotational quantities?
d) How do you relate linear and angular quantities?
e) What is torque and how do you compute it?
f) Understand how to use N2L for rotational motion $\sum \tau_{ext} = I\alpha$.
r) Understand and know how to define the following terms:
    - Angular displacement
    - Angular velocity
    - Angular acceleration
    - Tangential and radial components of acceleration
    - Moment of inertia
    - Rotational KE

9. ***ANGULAR MOMENTUM***

a) What is the definition of angular momentum?
b) How do calculate the magnitude and direction of angular momentum?
c) What is the angular momentum of a particle moving in a straight line? Why does it have an angular momentum since its moving in a straight line?
d) N2L for rotational motion in terms of angular momentum is $\sum \vec{\tau}_{ext} = \frac{\Delta \vec{L}_{sys}}{\Delta t}$
e) When is the angular momentum of a system conserved?