Physics Midterm Study Guide

Multiple Choice (35 Points)

Kinematics (11 Questions = 22% of the Exam)

- Understand the difference between scalar and vector and know examples of each.
- Be able to calculate distance and displacement given a scenario of a moving object.
- Be able to calculate speed and velocity given a scenario of a moving object.
- Be able to calculate the speed of an object given a position-time graph or the acceleration of an object given a velocity-time graph by using the slope.
- Be able to calculate the acceleration of an object using the constant acceleration equations and being given the initial velocity, final velocity, and time.
- Be able to identify the velocity-time graph of an object in free fall.
- Understand that the acceleration remains constant and speed changes for an object in free fall.
- Be able to calculate the maximum height or maximum speed of an object in free fall using the acceleration of gravity and the constant acceleration equations.
- Be able to calculate the time an object takes to hit the ground and horizontal distance it travels if horizontally off a height (parabolic motion cliff problem).
- Understand that the horizontal velocity remains constant while an object vertically accelerates during parabolic motion.
- Understand the optimum angle of 45° for an object launched at full parabolic motion to achieve the greatest horizontal displacement.

Dynamics (8 Questions = 26% of the Exam)

- Understand that mass if not affected by gravitational affects.
- Understand Newton's First Law (Law of Inertia) and inertia's sole dependence on mass.
- Understand Newton's First Law in that an object in equilibrium will stay in motion or stay at rest until a net force (not in equilibrium) acts upon that object.
- Be able to identify an object in equilibrium.
- Be able to identify the forces that need to be applied in order to establish equilibrium in an object given the forces acting on the objects.
- Be able to use Newton's Second Law ($a = F_{net} / m$) in order to calculate the acceleration of an object with a net force applied to it.
- Be able to use Newton's Second Law ($a = F_{net} / m$) in order to calculate the acceleration of an object with a multiple forces acting upon it.
- Understand Newton's Third Law and action-reaction forces being equal and opposite.

Uniform Circular Motion and Gravity (4 Questions = 8% of the Exam)

- Understand that the net force as well as the acceleration on an object is moving in circular motion is directed towards the center.
- Understand that the velocity of an object moving in circular motion is directed tangent to the curve.
- Be able to calculate the velocity of an object moving in circular motion given the mass, radius, and net force on the object.
- Understand that the gravitational force between any two objects with mass is equal and opposite to each other.

Work, Energy, and Power (6 Questions = 32% of the Exam)

- Be able to calculate the kinetic energy of a moving object.
- Be able to calculate the gravitational potential energy of an object.
- Be able to identify the point on a roller coaster that has the greatest gravitational potential energy, greatest kinetic energy, and greatest velocity.
- Understand how energy transfers through systems by identifying kinetic energy, gravitational potential energy, elastic potential energy, internal energy, etc.
- Understand that the total energy of a system is conserved or stays constant.
- Be able to calculate the maximum speed or initial height of an object using the full potential to full kinetic energy equation.
- Be able to calculate the power required to lift an object.

Momentum (4 Questions = 8% of the Exam)

- Be able to apply the Impulse-Momentum Theorem to calculate the average force or time to change the velocity of an object.
- Be able to calculate the momentum of an object.
- Be able to apply the Law of Conservation of Momentum to calculate the recoil velocity during an explosion.
- Be able to apply the Law of Conservation of Momentum and use a momentum table to calculate the velocity of an object after a collision.

General Questions (2 Questions = 4% of the Exam)

- Know the units of measurement and be able to derive the SI Units for each measurement.
- Be able to identify the graph of the relationship of two units of measurement by its equation.

Free Response (15 Points)

- Dynamics and Forces of Friction
- Gravitational Potential Energy vs. Height Graph
- Kinetic Energy and Speed