Course: Physics 1 *Course Code: 2003380*

SEMESTER 1
QUARTER 2
UNIT 4

TOPIC of STUDY: Newton's Laws of Motion and the Law of Gravity
STANDARDS: 10: Energy, 12: Motion
KEY LEARNING:
~Net force produces motion
~There are four fundamental forces that affect the Universe

RESOURCES COMMON CORE PACING GUIDE

VOCABULARY: action-reaction pair, weight, force, equilibrium, inertia, tension, Newton's Laws, coefficient of friction, friction, inclined plane, terminal velocity, centripetal, tangential, elliptical orbits, geocentric, heliocentric, Kepler's Law, Universal Gravitational constant

SUGGESTED LABS:
1. Force Lab (Spring Scales)
2. Motion on an Inclined plane
3. Torque
4. Activity – Make a Hanging Mobile

NGSSS	CONTENT	TARGETS
SC,912,P.12.3 Interpret and apply Newton's thee Laws of Motion. SC.912.P.12.7 Recognize that nothing travels faster than the speed of light in a vacuum which is the same for all observers no matter how they or the light source are moving	**CONCEPT:** Newton's Laws 1. Describe how force affects the motion of an object. 2. Explain the difference between mass and weight 3. Interpret and construct free-body diagrams. **ESSENTIAL QUESTIONS:** A. How do Force and mass affect acceleration? B. How can forces be represented using free-body diagrams? C. How do you investigate the total net force acting on an object when a force is acting at an angle? D. How do you investigate the total net force acting on an object when the object is moving on an inclined plane? E. How would you recognize an action-reaction pair? F. How does Newton's First Law affect us in our daily life? G. What are some of the benefits and the detractors of friction forces in our daily lives?	~Correctly explain given situations using Newton's Three Laws of Motion ~Draw correct free-body diagrams from a given situation and correctly label all identified forces ~Find the direction and magnitude of a Normal force ~On a free-body diagram construct any vertical or horizontal components necessary to completely describe the forces acting on an object ~Use a free-body diagram and Newton's 2nd Law to solve statics and dynamics problems ~Use coefficients of friction to calculate frictional forces ~Solve problems using Newton's 2nd Law with and without friction ~Solve force problems using Newton's Law when an object is on an inclined plane.

SC.912.P.10.10 Compare the magnitude and range of the four fundamental forces.	**CONCEPT:** Forces 1. There are four fundamental forces in nature: in order of strength…strong nuclear, weak nuclear, electromagnetic, and gravitational **ESSENTIAL QUESTIONS:** A. What do each of the fundamental forces do in nature?	~List the four fundamental forces in order of strength ~Describe a manifestation of each of the four fundamental forces
SC.912.P.12.4 Describe how that Gravitational force between two objects depends upon their masses and the distance between them.	**CONCEPT:** Newton's Law of Universal Gravitation 1. Newton's Law of Gravity accounts for various phenomena including satellite and planetary orbits, falling objects, and the tides. **ESSENTIAL QUESTIONS:** A. How does separation distance affect gravitational force? B. How does mass affect the gravitational force?	~Calculate the Gravitational force between two objects ~State how the Gravitational Force between two objects would be affected if the distance between the objects was doubled, cut in half, etc. ~State how the gravitational force between two objects would be affected if the masses of the objects was doubled, cut in half, etc.

SEMESTER 1
QUARTER 2
UNIT 5

TOPIC of STUDY: Circular Motion and Kepler's Laws
STANDARDS: 5: Earth in Space and Time, 10: Energy, 12: Motion
KEY LEARNING:
~Net force produces motion
~Circular motion is a result of velocity and acceleration that are perpendicular to each other

VOCABULARY: tangential velocity, centripetal, elliptical orbits, Kepler's Laws

SUGGESTED LABS:
1. Centripetal Force
2. Flying Pigs (Conical Pendulum)

NGSSS	CONTENT	TARGETS
SC.912.P.12.2 Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time	**CONCEPT: Circular Motion** 1. For an object to exhibit circular motion there must be an acceleration and a velocity that are at right angles to each other. 2. There is NO such thing as a Centrifugal force. **ESSENTIAL QUESTIONS:** A. How can an object moving at a constant speed be accelerating? B. How can circular motion and Newton's Law of Gravitation be used to investigate satellite motion?	~Solve problems using centripetal acceleration ~Solve problems using centripetal force ~Explain how the apparent existence of an outward (centrifugal) force in circular motion can be explained as inertia resisting the Centripetal force
SC.912.P.12.4 Describe how the gravitational force between two objects depends upon their masses and the distance between them SC.912.E.5.6 Develop logical connections through physical principles, including Kepler's and Newton's Laws about the relationships and the effects of Earth, Moon, and Sun on each other.	**CONCEPT: Kepler's Laws** 1. Application of Newton's Law of Universal Gravitation and Centripetal fore can be used to demonstrate Kepler's 3rd Law 2. Kepler's Laws work equally for natural or man-made satellites **ESSENTIAL QUESTIONS:** A. How can the orbits of planets be described? B. How can Kepler's 2nd Law be applied to the Physics of Sports	~Describe Kepler's Three Laws of Planetary Motion ~Use Kepler's Laws to relate the period of orbit to the radius of orbit for a satellite

SEMESTER 1
QUARTER 2
UNIT 6

TOPIC of STUDY: Work and Energy
STANDARDS: 10: Energy
KEY LEARNING:
~There is an important relationship between work and energy.
~Conservation of Energy is one of the fundamental Conservation Laws of Physics.
~Energy Conservation plays an important role in many of the applications of Physics

VOCABULARY: work, joule, potential energy, kinetic energy, mechanical energy, spring constant, conservation of energy, elastic potential energy, Work-Energy theorem, power, watt

SUGGESTED LABS:
1. Conservation of Energy
2. Amusement Park Physics

NGSSS	CONTENT	TARGETS
SC.912.P.10.3 Compare and contrast work and power qualitatively and quantitatively.	**CONCEPT: Work and Power** 1. Work is defined by a force acting on an object over a distance. 2. Work is a scalar quantity that can be positive or negative. 3. Power is the time rate of doing work 4. The net work on an object changes its kinetic energy. **ESSENTIAL QUESTIONS:** A. How is work defined in terms of force and distance? B. How is work in Physics different from work in ordinary life? C. How do you calculate work using forces applied at varying angles?	~Calculate the net work done on an object when many forces are applied to an object ~Calculate the power done when work is done on an object ~Explain the effect of machines on work and power ~Use the Work-Energy Theorem to solve problems
SC.912.P.10.1 Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.	**CONCEPT: Energy** 1. Kinetic energy is energy of motion and is a positive quantity 2. Kinetic energy depends upon the square of the velocity of an object 3. Gravitational Potential Energy depends upon a reference level and can be positive or negative. **ESSENTIAL QUESTIONS:** A. How are kinetic and potential energy different and how are they the same? B. How can you calculate an object's velocity using the relationships between potential and kinetic energies?	~Identify several forms of energy and identify changes in energy in different situations ~Distinguish between kinetic and potential energy ~Classify different forms of Potential energy ~Solve for the potential energy of an object (Gravitational PE and Elastic PE) ~Solve for the Kinetic energy of an object ~Use the Work-Energy Theorem to solve problems
.SC.912.P.10.2 Explore the Law of Conservation of Energy by differentiating among the open,	**CONCEPT: Conservation of Energy**	~Recognize the forms that conserved energy can take

closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.	1. Mechanical Energy is the sum of all of the Kinetic and Potential energies of a system. **ESSENTIAL QUESTIONS:** A. How does friction affect the conservation of energy? B. How can I find the final or initial Kinetic energy OR the final or initial Potential energy if three quantities are known?	~Solve problems using the Conservation of Mechanical Energy

SEMESTER 1
QUARTER 2
UNIT 7

TOPIC of STUDY: Impulse and Momentum
STANDARDS: 12: Motion
KEY LEARNING:
~Conservation of Momentum is one of the fundamental Conservation Laws in Physics
~Momentum is always conserved in a closed, isolated system
~The Conservation of Energy depends upon the type of collision between objects

VOCABULARY: impulse, momentum, closed system, elastic collision, inelastic collision

SUGGESTED LABS:
1. Impulse Egg Lab…Design a Landing Pad
2. Conservation of Energy Lab
3. Amusement Park Physics

NGSSS	CONTENT	TARGETS
SC.912.P.12.5 Apply the Law of Conservation of Momentum to interactions, such as collisions between objects.	**CONCEPT: Momentum and Impulse** 1. Compare the momentum of objects (the same object with different velocities and different moving objects). 2. Describe changes of momentum in terms of force and time. **ESSENTIAL QUESTIONS:** A. How is momentum related to Newton's Three Laws? B. How is impulse related to a change in momentum?	~Calculate the impulse applied to an object. ~Calculate the momentum and the change in momentum of an object. ~Use the Impulse-Momentum Theorem to solve problems.
SC.912.P.12.5 Apply the Law of Conservation of Momentum to interactions, such as collisions between objects.	**CONCEPT: Conservation of Momentum** 1. Compare the total momentum of two objects before and after they interact. 2. Compare conservation of momentum and conservation of energy in perfectly elastic collisions and in inelastic collisions. **ESSENTIAL QUESTIONS:** A. What are the similarities and differences of elastic and inelastic collisions? B. How can Conservation of Momentum be used to determine the behavior of two objects after a collision?	~State the Law of Conservation of Momentum. ~Use Conservation of Momentum to solve collision problems and to solve recoil problems. ~Determine the changes in Kinetic Energy during perfectly elastic collisions.