Information for Course Syllabus

Name of Course: Physics Honors

Grade Level:11-12

School: ORHS

Major Assignments: None

Field Trips: None

How can parents access instructional materials? Canvas

Physics Honors
2021-2022

Term 1

1D Kinematics	**PHYS.PS2.1** Investigate and evaluate the graphical and mathematical relationship (using either manual graphing or computers) of one-dimensional kinematic parameters (distance, displacement, speed, velocity, acceleration) with respect to an object's position, direction of motion, and time.
	PHYS.PS2.2 Algebraically solve problems involving constant velocity and constant acceleration in one-dimension.

Dynamics	**PHYS.PS2.4** Use free-body diagrams to illustrate the contact and non-contact forces acting on an object. Use the diagrams in combination with graphical or component-based vector analysis and with Newton's first and second laws to predict the position of the object on which the forces act in a constant net force scenario.
	PHYS.PS2.5 Gather evidence to defend the claim of Newton's first law of motion by explaining the effect that balanced forces have upon objects that are stationary or are moving at constant velocity.
	PHYS.PS2.7 Plan, conduct, and analyze the results of a controlled investigation to explore the validity of Newton's second law of motion in a system subject to a net unbalanced force, Fnet = ma or Fnet = Δp/Δt.
	PHYS.PS2.12 Use experimental evidence to demonstrate that air resistance is a velocity dependent drag force that leads to terminal velocity.
	PHYS.PS2.8 Use examples of forces between pairs of objects involving gravitation, electrostatic, friction, and normal forces to explain Newton's third law.

Uniform Circular Motion and Gravitation	**PHYS.PS2.3** Algebraically solve problems involving arc length, angular velocity, and angular acceleration. Relate quantities to tangential magnitudes of translational motion.
	PHYS.PS2.14 Plan and conduct an investigation to provide evidence that a constant force perpendicular to an object's motion is required for uniform circular motion (F = m v2 / r).
	PHYS.PS2.8 Use examples of forces between pairs of objects involving gravitation, electrostatic, friction, and normal forces to explain Newton's third law.
	PHYS.PS2.9 Use Newton's law of universal gravitation, $\boldsymbol{F}=G(m_1 m_2/\boldsymbol{r}^2)$, to calculate the gravitational forces, mass, or distance separating two objects with mass, given the information about the other quantities.

Physics Honors
2021-2022

Term 1

Work and Energy	**PHYS.PS3.1** Identify and calculate different types of energy and their transformations (thermal, kinetic, potential, including magnetic and electrical potential energies) from one form to another in a system.
	PHYS.PS3.3 Use the principle of energy conservation and mathematical representations to quantify the change in energy of one component of a system when the energy that flows in and out of the system and the change in energy of the other components is known.
	PHYS.PS3.6 Define power and solve problems involving the rate of energy production or consumption ($P = \Delta E/\Delta t$). Explain and predict changes in power consumption based on changes in energy demand or elapsed time. Investigate power consumption and power production systems in common use.
	PHYS.PS3.14 Recognize and communicate information about energy efficiency and/or inefficiency of machines used in everyday life.
	PHYS.PS3.15 Compare and contrast the process, design, and performance of numerous next-generation energy sources (hydropower, wind power, solar power, geothermal power, biomass power, etc.).

Momentum	**PHYS.PS2.6** Using experimental evidence and investigations, determine that Newton's second law of motion defines force as a change in momentum, $F = \Delta p/\Delta t$.
	PHYS.PS2.11 Develop and apply the impulse-momentum theorem along with scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on an object during a collision (e.g., helmet, seatbelt, parachute).
	PHYS.PS3.4 Assess the validity of the law of conservation of linear momentum ($p=mv$) by planning and constructing a controlled scientific investigation involving two objects moving in one-dimension.

Physics Honors
2021-2022

Term 2

Electrostatics	**PHYS.PS2.10** Describe and mathematically determine the electrostatic interaction between electrically charged particles using Coulomb's law, $\boldsymbol{F_e}=k_e(q_1q_2/\boldsymbol{r}^2)$. Compare and contrast Coulomb's law and gravitational force, notably with respect to distance.
	PHYS.PS2.8 Use examples of forces between pairs of objects involving gravitation, electrostatic, friction, and normal forces to explain Newton's third law.
	PHYS.PS3.8 Communicate scientific ideas to describe how forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space. Explain how energy is contained within the field and how the energy changes when the objects generating and interacting with the field change their relative positions.
	PHYS.PS3.9 Describe, compare, and diagrammatically represent both electric and magnetic fields. Qualitatively predict the motion of a charged particle in each type of field, but avoid situations where the two types of fields are combined in the same region of space. Restrict magnetic fields to those that are parallel or perpendicular to the path of a charged particle.

Current and Circuits	**PHYS.PS3.11** Investigate Ohm's law (I=V/R) by conducting an experiment to determine the relationships between current and voltage, current and resistance, and voltage and resistance.
	PHYS.PS3.10 Develop a model of a resistor circuit or capacitor circuit and use it to illustrate the behavior of electrons, electrical charge, and energy transfer.
	PHYS.PS3.12 Apply the law of conservation of energy and charge to assess the validity of Kirchhoff's loop and junction rules when algebraically solving problems involving multi-loop circuits.
	PHYS.PS3.13 Predict the energy stored by a capacitor and how charge flows among capacitors connected in series or parallel.

Magnetism	**PHYS.PS3.8** Communicate scientific ideas to describe how forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space. Explain how energy is contained within the field and how the energy changes when the objects generating and interacting with the field change their relative positions.
	PHYS.PS3.9 Describe, compare, and diagrammatically represent both electric and magnetic fields. Qualitatively predict the motion of a charged particle in each type of field, but avoid situations where the two types of fields are combined in the same region of space. Restrict magnetic fields to those that are parallel or perpendicular to the path of a charged particle.

Physics Honors
2021-2022

Term 2

Simple Harmonic Motion	**PHYS.PS2.6** Using experimental evidence and investigations, determine that Newton's second law of motion defines force as a change in momentum, $F = \Delta p/\Delta t$.
	PHYS.PS2.7 Plan, conduct, and analyze the results of a controlled investigation to explore the validity of Newton's second law of motion in a system subject to a net unbalanced force, $F_{net} = ma$ or $F_{net} = \Delta p/\Delta t$.
	PHYS.PS3.3 Use the principle of energy conservation and mathematical representations to quantify the change in energy of one component of a system when the energy that flows in and out of the system and the change in energy of the other components is known.
	PHYS.PS4.1 Know wave parameters (i.e., velocity, period, amplitude, frequency, angular frequency) as well as how these quantities are defined in the cases of longitudinal and transverse waves.

Waves and Sound	**PHYS.PS4.1** Know wave parameters (i.e., velocity, period, amplitude, frequency, angular frequency) as well as how these quantities are defined in the cases of longitudinal and transverse waves.
	PHYS.PS4.2 Describe parameters of a medium that affect the propagation of a sound wave through it.
	PHYS.PS4.3 Understand that the reflection, refraction, and transmission of waves at an interface between two media can be modeled on the basis of characteristics of specific wave parameters and parameters of the medium.
	PHYS.PS4.4 Communicate scientific and technical information about how the principle of superposition explains the resonance and harmonic phenomena in air columns and on strings and common sound devices.

Review and Final Exam