

SRPSD Physics 30 Rubrics

Student-Directed Study

PH30-SDS1 Create and carry out a plan to explore one or more topics of personal interest relevant to Physics 30 in depth.

Beginning (1)	Approaching (2)	Proficiency (3)	Mastery (4)
I can identify a personally relevant or interesting topic and develop a proposal for a scientific investigation, or a plan for an experiment, using the scientific method.	I can assemble a product demonstrating an understanding of a Physics 30 related topic of interest.	I can demonstrate a deep understanding of my topic.	I can use my deep understanding to show how my topic impacts myself, society, and/or the scientific community.

Modern Physics

PH30-MP1 Analyze the importance of relativistic principles and quantum mechanics in our world.

Beginning (1)	Approaching (2)	Proficiency (3)	Mastery (4)
I can identify differences between Newtonian mechanics, Quantum mechanics, and special relativity. I can identify the limitations of Newton's Laws of motion in relativistic and quantum situations.	I can explain phenomenon related to quantum mechanics including the quantum nature of light, photoelectric effect, and wave-particle phenomenon. I can use Planck's constant to determine the energy of a photon.	I can explain phenomenon related to special relativity including relativistic space and time (i.e. twin paradox and length contraction) I can describe the current scientific thinking regarding weak nuclear force.	I can explain and discuss the ongoing debates in physics relative to quantum mechanics (e.g. collapse, pilot wave, many worlds and Copenhagen).

PH30-MP2 Assess the effects of radioactivity and nuclear technology on society and the environment.

Beginning (1)	Approaching (2)	Proficiency (3)	Mastery (4)
I can compare the characteristics of alpha, beta, and gamma radiation. I can identify natural and man-made sources of radiation.	I can differentiate between controlled and uncontrolled fission reactions and can identify uses for both. I can use Einstein's equation and the idea of Conservation of Mass-Energy to determine the amount of energy released from a nuclear reaction.	I can describe the process of nuclear fusion and can identify difficulties related to using it as an energy source. I can describe the current scientific thinking regarding strong nuclear force. I can explain the concept of half-life including simple calculations.	I can analyze societal and environmental impacts of nuclear technologies and the implications for long and short term exposure to radiation.

Forces and Motion

PH30-FM1 Analyze motion in one- and two-dimensions, including uniform motion, uniformly accelerated motion, circular motion, and projectile motion.

Beginning (1)	Approaching (2)	Proficiency (3)	Mastery (4)
I can define uniform motion, acceleration motion, projectile motion and circular motion. I can provide examples of objects that undergo different types of motion.	I can solve problems involving uniform motion including uniform circular motion.	I can solve problems involving all types of motion, including vectors, when manipulation is not required. I can explain the motion of an object based on initial conditions (i.e. circular motion, projectile motion).	I can solve problems involving all types of motion, including vectors, when manipulation is required. I can design and carry out an experiment, following the scientific method, on an object that undergoes accelerated or circular motion. I can critique the realism of objects in motion from popular culture.

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PH30-FM2 Analyze the effects of forces on objects undergoing uniform motion, uniformly accelerated motion and circular motion.

Beginning (1)	Approaching (2)	Proficiency (3)	Mastery (4)
I can state Newton's 3 laws of motion.	I can use Newton's 3 Laws of motion to describe the motion of objects. I can describe how inertia affects the motion of objects. I can draw free-body simple diagrams to represent the forces acting on an object. I can determine net force using Newton's Second Law of motion.	I can solve problems involving force, mass and acceleration using Free-body diagrams and Newton's Second Law of Motion. I can describe how balanced and unbalanced forces affect the motion of objects, including projectile and circular motion.	I can solve problems involving force, mass and acceleration using Free-body diagrams and Newton's Second Law of Motion in two dimensions. I can design and carry out an experiment to investigate the effect of changing mass and force on the acceleration of an object and describe the effect friction has on my overall results.

Conservation Laws

PH30-CO1 Investigate the nature of mechanical energy and efficiency in mechanical systems, including the law of conservation of energy.

Beginning (1)	Approaching (2)	Proficiency (3)	Mastery (4)
I can define work, power, kinetic energy, potential energy and total mechanical energy.	I can identify situations where positive and negative work takes place. I can calculate the work and power done on an object.	I can perform calculations for kinetic and potential energy. I can perform work calculations to determine the change in energy for an object. I can identify reasons that Total Mechanical Energy fails in the world around me. I can provide examples of elastic and inelastic collisions in the world around me.	I can explain the law of conservation of energy and how it applies to various situations. I can use the law of conservation of energy to determine all variables for a given situation. Investigate and explain the efficiency of everyday objects.

PH30-CO2 Analyze the motion of objects and interactions between objects using momentum concepts, including the law of conservation of momentum.

Beginning (1)	Approaching (2)	Proficiency (3)	Mastery (4)
I can provide examples of objects experiencing impulse or momentum.	I can determine the momentum of an object when given its mass and a velocity. I can determine the impulse of an object when given a force and change in time.	I can solve problems involving momentum, impulse and law of conservations of momentum. I can provide examples of how momentum is conserved in the world around me.	I can conduct an experiment to determine conservation of momentum in elastic and inelastic collisions. I can analyze applications of the law of conservations of momentum.

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Fields

PH30-FI1 Investigate gravitational fields and their interactions with matter.

Beginning (1)	Approaching (2)	Proficiency (3)	Mastery (4)
<p>I can distinguish between weight and mass.</p> <p>I can determine the weight of an object.</p> <p>I can identify where gravitational field strength would be stronger.</p>	<p>I can determine gravitational field strength and force of gravity that acts on objects.</p> <p>I can describe how gravitational field strength changes with elevation.</p> <p>I can identify the 4 fundamental interactions.</p>	<p>I can use Newton's Law of Gravitation to solve for any variable.</p> <p>I can define microgravity and provide examples of where it exists.</p> <p>I can describe why gravity is one of the four fundamental interactions.</p>	<p>I can explain phenomenon that relate to gravitational fields (i.e. dark matter, gravitational waves).</p>

PH30-FI2 Investigate electric and magnetic fields and their interactions with matter.

Beginning (1)	Approaching (2) ↔ Proficiency (3)	Mastery (4)
<p>I can identify where electric and magnetic fields exist.</p> <p>I can determine the direction of electron flow from a simple circuit diagram.</p>	<p>I can use Coulomb's Law to determine the electric force between two charges.</p> <p>I can describe and determine electric field strength at varying distances.</p>	<p>I can describe (draw) electric and magnetic field lines for various scenarios.</p> <p>I can use the left and right hand rules to determine the direction of a magnetic field.</p> <p>I can manipulate equations for electric field strength and force to solve for any variable.</p> <p>I can describe the current scientific thinking regarding electromagnetic force.</p>
		<p>I understand the relationship between electric and magnetic fields and their application to technology.</p> <p>I can explain phenomenon related to electric and magnetic fields (i.e. earth's magnetic field, solar flares, auroras, particle accelerators, changes in animal migrations and other health concerns)</p>