Curriculum Map – Physics 2012 Rob Kania

**Semester 1**

**Quarter 1**

***Unit 1:***

**Scientific Method, Conversions, Significant Figures**

Students will be able to model all the steps of the scientific method as it pertains to solving problems. They will also be able to calculate conversion problems using dimensional analysis. Students will be able to understand the importance of uncertainty in measurement and how to classify and calculate with Significant Figures. ( 3 weeks)

Labs: Measurement and introduction CPO Lab

Assessment: Dimensional Analysis Quiz and Unit 1 Test with conversion problems and essays.

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| ***Unit 2:*****SCI.P.1 2010 - Motion and Forces** Collaboratively describe, test through experiments, explain and defend mathematical models of the motion of macroscopic objects in terms of Newton’s laws.

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| **SCI.P.1.1 2010** Using motion, maps, graphs and algebraic equations, describe, measure, and analyze constant acceleration motion in one dimension in terms of time and the vector quantities of displacement, velocity and acceleration. ( 3 weeks )Labs: Speed Labs from CPO, paper airplane labAssessment: Speed Quiz, Vector Quiz. Speed and Vector Test with Speed and Vector problems and essays.**SCI.P.1.2 2010** Using motion, maps, graphs and algebraic equations, describe, measure, and analyze constant acceleration motion in two dimensions in terms of time and the vector quantities of displacement, velocity and acceleration. Consider specifically projectile motion and uniform circular motion. ( 4 weeks )Labs: CPO labs on acceleration, marble launches and projectile motion, rocket lab.Assessment: Acceleration Quiz, Projectile motion quiz, Test with acceleration, projectile and circular motion problems and essays.**Quarter 2*****Unit 1:*****SCI.P.1 2010 - Motion and Forces** **SCI.P.1.3 2010** Describe the magnitude and direction of kinds of forces, including both contact forces and non-contact forces, those that act at a distance. Find the net force acting on an object using free-body diagrams and the addition of forces. Use Newton’s three laws to deductively analyze static and dynamic systems. ( 3 weeks)Labs: CPO labs on Force and FrictionAssessment: Force Quiz, Friction Quiz, Newton’s three laws quiz**SCI.P.1.4 2010** Use Newton’s Law of Universal Gravitation and the laws of motion to quantitatively analyze the motions of orbiting objects such as the moon, the planets and satellites (i.e., Kepler’s Third Law of Planetary Motion). (1 week)Labs: Gravitation lab CPOAssessment: Gravity Quiz and Unit 1 Test with Force, Friction, Newton’s Laws and Gravity problems and essays. |

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| ***Unit 2:Add*****SCI.P.2 2010 - Energy and Momentum** Collaboratively describe, test, explain and defend mathematical models of the motion of macroscopic objects in terms of energy, momentum and their conservation laws as developed using Newton’s three laws of motion.

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| **SCI.P.2.1 2010** Describe qualitatively and quantitatively the concepts of momentum, work, kinetic energy, potential energy and power. ( 3 weeks )Labs: CPO labs on Work and PowerAssessment: Work and Power Quiz**SCI.P.2.2 2010** Quantitatively predict changes in momentum using the impulse-momentum theorem and in kinetic energy using the work-energy theorem. ( 1 week )Labs: CPO labs on momentumAssessment: Momentum Quiz**SCI.P.2.3 2010** Analyze evidence that illustrates the Law of Conservation of Energy and the Law of Conservation of Momentum. Apply these laws to analyze elastic and completely inelastic collisions. (1 week )Labs: CPO energy labAssessment: Energy Quiz, Unit 2 test with Energy, Work and Power and Momentum questions and essays. |

**Quarter 3*****Unit 1:Add*****SCI.P.2 2010 - Energy and Momentum** **SCI.P.2.4 2010** Describe and quantify energy in its different mechanical forms (e.g., kinetic, gravitational potential, elastic potential) and recognize that these forms of energy can be transformed one into another and into non-mechanical forms of energy (e.g., thermal, chemical, nuclear and electromagnetic). ( 1 week )Lab: CPO Energy Conversion labAssessment: Energy Conversion Quiz |
| *Unit 2:Add***SCI.P.3 2010 - Temperature and Thermal Energy Transfer** Describe and distinguish the concepts of temperature and thermal energy. Use the kinetic-molecular theory to explain some thermal properties of gases and phase changes of solids, liquids and gases.

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| **SCI.P.3.1 2010** Describe temperature, thermal energy and thermal energy transfer in terms of the kinetic molecular model. Expand the concept of conservation of mechanical energy to include thermal energy. ( 1 week )Labs: CPO heat conversion lab**SCI.P.3.2 2010** Describe the kinetic molecular model, use it to derive the ideal gas law and show how it explains the relationship between the temperature of an object and the average kinetic energy of its molecules. ( 1 week )Labs: CPO kinetic energy labAssessment: Energy Conversion Quiz**SCI.P.3.3 2010** Use the kinetic theory to explain that the transfer of heat occurs during a change of state. ( 1 week )Labs: Specific heat and Heat of Fusion LabAssessment Heat quiz**SCI.P.3.4 2010** Use examples from everyday life to describe the transfer of thermal energy by conduction, convection and radiation. ( 1 week )Labs: Energy Conversion LabAssessment: Heat Transfer Quiz, Test with Energy Conversion, Heat and Heat Transfer Problems and Essays |

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| *Unit 3:***Add****SCI.P.4 2010 - Electricity and Magnetism** Understand the interplay of electricity and magnetism. Apply this understanding to electrostatic problems and basic electrical circuits.

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| **SCI.P.4.1 2010** Using Coulomb’s law, describe and determine the force on a stationary charge due to other stationary charges. Know that this force is many times greater than the gravitational force. ( 1 week )Labs: Static Charge lab**SCI.P.4.2 2010** Define electric field and describe the motion of a charged particle in a simple electric field. ( 1 week )Labs: CPO Electric Field Lab**SCI.P.4.3 2010** Describe electric potential energy and electric potential (i.e., voltage). Use voltage to explain the motion of electrical charges and the resulting electric currents in conductors. ( 1 week )Labs: Electric Circuit Lab CPOAssessment: Basic Electricity Quiz including static and electric fields.**SCI.P.4.4 2010** Explain and analyze simple arrangements of electrical components in series and parallel circuits in terms of current, resistance, voltage and power. Use Ohm’s and Kirchhoff’s laws to analyze circuits. ( 1 week )Labs: CPO Electricity LabAssessment: Series vs. Parallel Circuits Quiz**SCI.P.4.5 2010** Describe the magnetic forces and fields produced by and acting on moving charges and magnetic materials. ( 1 week )Labs: CPO Magnetic Field LabAssessment: Test with Electricity, series and parallel circuit and magnetism problems and essays. |

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| **Quarter 4***Unit 1:Add***SCI.P.5 2010 - Vibrations, Waves** Apply Newton’s laws and the concepts of kinetic and potential energy to describe and explain the motion of vibrating objects.

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| **SCI.P.5.1 2010** Identify properties of objects that vibrate by using Newton’s laws to describe and explain the vibrational motion resulting from restoring forces, such as Hooke’s Law in the case of spring or gravity in the case of a small amplitude pendulum. ( ½ week )Labs: CPO Pendulum lab**SCI.P.5.2 2010** Describe how vibrating objects can generate transverse and/or longitudinal waves so that energy is transmitted without the transfer of energy. Distinguish longitudinal waves from transverse waves. ( ½ week ) Labs: CPO Spring Labs**SCI.P.5.3 2010** Describe and analyze propagating waves in terms of their fundamental characteristics such as wave speed, wavelength, frequency or period, and amplitude. ( 1 week )Labs: CPO Wiggler Lab and Sound Waves LabAssessment: Quiz on Wave Mechanics**SCI.P.5.4 2010** Describe and explain the behavior of waves such as transmission, reflection, interference and polarizations. Qualitatively describe and explain the production and properties of standing waves. ( 1 week ) |

Labs: CPO Wave LabAssessments: Unit Test on Wave Mechanics with Wave, Pendulum and wave property problems and essays. |
| *Unit 2:Add***SCI.P.6 2010 - Light and Optics** Understand the geometric nature of light propagation and its wave nature as observed in the propagation of light through space and its interactions with and in matter.

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| **SCI.P.6.1 2010** Understand the geometric nature of light in reflection and refraction and in image formation by lenses and mirrors. Use that geometric nature to graphically predict the formation of images by lens and mirrors. ( 1 week )Labs: CPO Optics Lab**SCI.P.6.2 2010** Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Recognize that all these waves travel in a vacuum at the same speed. ( ½ week )Labs: CPO Spectrophotometer lab**SCI.P.6.3 2010** Understand that electromagnetic waves are produced by the acceleration of charged particles. Describe how electromagnetic waves interact with matter both as packets (i.e., photons) and as waves. Show qualitatively how wave theory helps explain polarization and diffraction. ( ½ week )Labs: CPO Wave interference labAssessment: Light and Optics quiz, Test with Light and Optics problems and essays. |

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| *Unit 3:Add***SCI.P.7 2010 - Modern Physics** Understand how our knowledge of physics has changed during the last hundred years, particularly in the areas of atomic and nuclear physics, quantum theory and relativity. Describe the structure of the atom and the reactions that occur in its nucleus.

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| **SCI.P.7.1 2010** Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses. Distinguish elements from isotopes. ( 1 week )Assessments: Isotope Quiz**SCI.P.7.2 2010** Explain that the stability of the nucleus, containing only positive or neutral particles, indicates the existence of a new force that is only evident within the nucleus, as it holds the particles together despite the strong repulsive electrical force. ( ½ week )Lab: CPO Atom Game**SCI.P.7.3 2010** Distinguish fission from fusion processes. Describe how the binding energies of protons and neutrons determine the stability and instability of nuclei. ( ½ week )Assessments: Fusion vs. Fission Quiz**SCI.P.7.4 2010** Describe qualitatively how nuclear reactions (i.e, fission and fusion) convert very small amounts of matter into large amounts of energy. ( ½ week )Labs: CPO Fusion Lab**SCI.P.7.5 2010** Understand that fission results from large, less stable nuclei decomposing to form smaller, more stable nuclei. Understand that fusion results from small nuclei at high temperatures and pressures combining to form larger, more stable nuclei and releasing thermonuclear energy. ( ½ week )Labs: Half Life LabAssessment: Radioactivity Quiz and Radioactivity test with nuclear reaction problems and essays. |

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