3Wyoming Department of Education Required Virtual Education Course Syllabus

Niobrara County School District # 1

Program Name	Wyoming Virtual Academy	Content Area	SC
Course ID	D-SCI-403BV2-K	Grade Level	9-12
Course Name	Summit Physics - Semester 2	# of Credits	0.5
SCED Code	03151E0.5022	Curriculum Type	K12 Inc

COURSE DESCRIPTION

Generally offered first semester. This course provides a comprehensive survey of all key areas: physical systems, measurement, kinematics, dynamics, momentum, energy, thermodynamics, waves, electricity, and magnetism, and introduces students to modern physics topics such as quantum theory and the atomic nucleus. The course gives students a solid basis to move on to more advanced courses later in their academic careers. The program consists of online instruction and related assessments, plus an associated problem-solving book and instructions for conducting hands-on laboratory experiments at home. K12 lab kits contain all lab materials that cannot easily be found in the home.

WYOMING CONTENT AND PERFORMANCE STANDARDS

STANDARD#	BENCHMARK (Standard/Indicator) Use the Standards and Benchmarks as Spreadsheets
HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
HS-PS2-4	Use mathematical representations to predict the gravitational and/or electrostatic forces between objects using Newton's Law of Gravitation and/or Coulomb's Law, respectively.
HS-PS2-5	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of materials.
HS-PS3-1	Create or apply a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy
HS-PS3-4	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system.
HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

HS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
HS-PS4-2	Evaluate the advantages and disadvantages of using digital transmission and storage of information.
HS-PS4-3	Evaluate evidence behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.
HS-PS4-5	Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

SCOPE AND SEQUENCE

UNIT OUTLINE	STANDARD#	OUTCOMES OBJECTIVES/STUDENT CENTERED GOALS
Unit 1: Momentum Lesson 1: Semester Introduction	0	Describe the major topics that you will explore in this semester of this course.
Unit 1: Momentum Lesson 2: Linear Momentum and Impulse	0	Explain the momentum-impulse theorem. Solve problems using the equation for momentum. Interpret force-time graphs. Compare and contrast momentum and impulse.
Unit 1: Momentum Lesson 3: Law of Conservation of Momentum	0	State the law of conservation of momentum. Relate Newton's third law to momentum. State that momentum conservation can only be analyzed for a closed system. Discuss momentum in terms of Newton's third law of motion.
Unit 1: Momentum Lesson 4: Momentum in Collisions	0	Mathematically model two-body collisions. Apply the law of conservation of momentum to collisions. Solve problems involving

		collisions with momentum changes.
Unit 1: Momentum Lesson 5: Laboratory: Momentum 1 Lesson 6: Discuss: Momentum	0	Solve problems using the equation for momentum. Interpret force-time graphs. Experiment with linear momentum and collisions.
Unit 1: Momentum Lesson 7: Laboratory: Momentum 2	0	Solve problems using the equation for momentum. Interpret force-time graphs. Experiment with linear momentum and collisions.
Unit 1: Momentum Lesson 8: Conservation of Angular Momentum	0	State the law of the conservation of angular momentum. Define angular momentum. Relate changes in angular momentum to torque. State the law of conservation of angular momentum.
Unit 1: Momentum Lesson 9: Your Choice	0	00000
Unit 1: Momentum Lesson 10: Unit Test	HS-PS2-2	00000
Unit 2: Work Lesson 1: Work and Power	0	Solve problems involving work. Solve problems involving power. Define work. Describe the relationship between work and the direction of force. State that work is a form of energy transfer between two systems. Solve problems using the work equation. Define power. Solve problems using the power equation.

Unit 2: Work Lesson 2: Direction of Force and Work	0	Describe the relationship between work and the direction of force. Solve problems involving the magnitude of force using trigonometry. Give examples of the mechanical transfer of energy.
Unit 2: Work Lesson 3: Laboratory: Work and Power Lesson 4: Discuss: Work and Power	0	Conduct experiments in work and power.
Unit 2: Work Lesson 5: Machines and Mechanical Advantage	0	Compare and contrast simple and compound machines. Describe the mechanical advantages of machines. Calculate the mechanical advantages of machines. Compare and contrast effort force and resistance force. Define mechanical advantage. Solve problems involving mechanical advantage. Describe mechanical advantage in some machines.
Unit 2: Work Lesson 6: Laboratory: Simple and Compound Machines 1	0	Experiment with simple machines. Calculate mechanical advantages of some machines. Define and calculate efficiency. Calculate the efficiency of some machines.
Unit 2: Work Lesson 7: Laboratory: Simple and Compound Machines 2	0	Experiment with simple machines. Calculate mechanical advantages of some machines. Define and calculate efficiency. Calculate the efficiency of some machines.
Unit 2: Work Lesson 8: Your Choice	0	00000
Unit 2: Work Lesson 9: Unit Test	HS-ETS1-4	00000

Unit 3: Energy Lesson 1: Types of Energy and Their Conversions	0	Analyze the transfer of energy between systems or within systems. Describe major advances in the historical development of the concept of energy. Describe a closed system in terms of its total energy. Give examples of the types of energy.
Unit 3: Energy Lesson 2: Kinetic and Potential Energy	0	Compare and contrast kinetic and potential energy. Solve problems involving kinetic and potential energy. Describe various types of potential energy. Explain the work-energy theorem.
Unit 3: Energy Lesson 3: Conservation of Energy 1	0	Solve problems involving conservation of energy. State and give examples of the law of conservation of energy.
Unit 3: Energy Lesson 4: Conservation of Energy 2	0	Relate the law of conservation of energy to mechanical systems. Solve problems involving changes of mechanical energy.
Unit 3: Energy Lesson 5: Laboratory: Conservation of Energy 1	0	Solve problems involving conservation of energy. Observe transformations between potential and kinetic energy in a system. Experiment with energy changes in a mechanical system. Solve problems involving energy and work.
Unit 3: Energy Lesson 6: Laboratory: Conservation of Energy 2	0	Solve problems involving conservation of energy. Observe transformations between potential and kinetic energy in a system. Experiment with energy changes in a mechanical system. Solve problems involving energy and work.

Unit 3: Energy Lesson 7: Energy During Collisions	0	Solve problems involving elastic and inelastic collisions by applying the law of conservation of energy. Compare and contrast elastic and inelastic collisions. Compare and contrast momentum and energy during collisions and state the laws governing collisions.
Unit 3: Energy Lesson 8: Your Choice	0	00000
Unit 3: Energy Lesson 9: Unit Test	HS-PS3-1, HS-PS3-2, HS-PS3-3	00000
Unit 4: Thermal Energy Lesson 1: Kinetic-Molecular Theory	0	Describe how the kinetic-molecular system explains thermal energy and heat transfer. Define thermodynamics. Discuss the history of heat as a concept of physics, including a discussion of the caloric theory. Compare and contrast thermal energy and heat. Explain that heat flow is a form of energy transfer. Compare and contrast thermal energy and temperature.
Unit 4: Thermal Energy Lesson 2: Specific Heat	0	Solve problems involving specific heat. Define an object's specific heat (heat capacity). Write and explain the equation for the calculation of specific heat.
Unit 4: Thermal Energy Lesson 3: Laboratory: Specific Heat 1	0	Set up experiments in specific heat. Collect data involving specific heat. Use the equation for the calculation of specific heat.
Unit 4: Thermal Energy Lesson 4: Laboratory: Specific Heat 2	0	Set up experiments in specific heat. Collect data involving specific heat.

		Use the equation for the calculation of specific heat.
Unit 4: Thermal Energy Lesson 5: States of Matter	0	Relate a substance's state of matter in terms of kinetic energy and intermolecular forces. State and give examples of the states of matter. Describe plasma as a state of matter that contains ions or free electrons or both.
Unit 4: Thermal Energy Lesson 6: Heat During Change of State	0	Calculate thermal energy changes during change of state. Compare and contrast heat of fusion and heat of vaporization. Solve problems involving heating from solid, to liquid, to gas.
Unit 4: Thermal EnergyLesson 7: First Law of Thermodynamics	0	Explain the first and second laws of thermodynamics.Explain that thermal energy can be increased in a system by adding thermal energy or doing work on the system.Discuss the first law of thermodynamics.Give examples of converting heat energy to mechanical energy.Define a heat engine and describe the operation of one.Relate the law of conservation of energy to heat engines.
Unit 4: Thermal Energy Lesson 8: Second Law of Thermodynamics and Entropy	0	Explain the first and second laws of thermodynamics. Describe Carnot's contribution to the modern understanding of entropy. Define entropy and give examples of increasing and decreasing entropy in systems. Explain the second law of thermodynamics.
Unit 4: Thermal Energy Lesson 9: Your Choice	0	00000

Unit 4: Thermal Energy Lesson 10: Unit Test	HS-PS3-1, HS-PS3-2, HS-PS3-3, HS-PS3-4, HS-ETS1-1	00000
Unit 5: Waves Lesson 1: Characteristics of Waves 1	0	Describe and illustrate the characteristics of waves. Compare, contrast, and identify transverse and longitudinal waves. Explain that waves carry energy from one place to another. Give examples of the importance of waves in daily life. Describe the importance of waves in phenomena like earthquakes.
Unit 5: Waves Lesson 2: Characteristics of Waves 2	0	Solve problems involving the wavelength, frequency, and velocity of waves. Compare and contrast period, frequency, and amplitude. Describe and recognize interference, diffraction, refraction, and polarization.
Unit 5: Waves Lesson 3: Sound: Vibration and Waves	0	Explain that the speed of a sound wave depends on the medium though which it moves. Discuss sound as a wave phenomenon. Describe sound as a longitudinal wave. Give examples showing that sound begins with a vibrating source. Explain that the speed of a sound wave depends on the medium through which it moves. Solve problems involving the speed of sound.
Unit 5: Waves Lesson 4: Qualities of Sound	0	Compare and contrast loudness and pitch. Define decibel and give examples of the decibel levels of common sounds. Describe the physics of sound production by a musical instrument.

		Explain the Doppler effect and give examples of it, using sound in everyday life.
Unit 5: Waves Lesson 5: Laboratory: Sound 1	0	Describe sound as a longitudinal wave. Give examples showing that sound begins with a vibrating source. Explain that the speed of a sound wave depends on the medium through which it moves. Study examples showing that sound begins with a vibrating source. Demonstrate that the speed of a sound wave depends on the medium through which it moves.
Unit 5: Waves Lesson 6: Laboratory: Sound 2	0	Describe sound as a longitudinal wave. Give examples showing that sound begins with a vibrating source. Explain that the speed of a sound wave depends on the medium through which it moves. Study examples showing that sound begins with a vibrating source. Demonstrate that the speed of a sound wave depends on the medium through which it moves.
Unit 5: Waves Lesson 7: Your Choice	0	00000
Unit 5: Waves Lesson 8: Unit Test	HS-PS4-1, HS-PS4-3	00000
Unit 6: Light Lesson 1: The Electromagnetic Spectrum	0	Define electromagnetic spectrum and give its boundaries in wavelength and frequency. Characterize the types of electromagnetic radiation. Explain how scientists determined the speed of light.

		Give examples of the sources of light.
Unit 6: Light Lesson 2: Diffraction and Interference	0	Compare and contrast diffraction and interference. Interpret a double-slit interference diagram. Explain the Doppler effect and give examples of it for light.
Unit 6: Light Lesson 3: Reflection	0	Compare and contrast reflection and refraction of waves. Give examples of everyday reflection of light. Interpret diagrams showing total internal reflection. Calculate critical angles.
Unit 6: Light Lesson 4: Refraction	0	Give examples of everyday refraction of light. Interpret diagrams showing refraction. Interpret diagrams and solve problems involving Snell's law and index of refraction. Explain a rainbow.
Unit 6: Light Lesson 5: Mirrors	0	Interpret and create diagrams involving a plane mirror. Interpret and create diagrams involving concave mirrors. Interpret and create diagrams involving convex mirrors. Compare and contrast real and virtual images.
Unit 6: Light Lesson 6: Lenses	0	Interpret and create diagrams involving concave and convex mirrors and lenses. Interpret and create diagrams involving convex lenses. Interpret and create diagrams involving concave lenses. Explain a human eye in

		terms of the physics of lenses.
Unit 6: Light Lesson 7: Laboratory: Optics 1	0	Conduct experiments with light. Conduct experiments with mirrors. Conduct experiments with lenses.
Unit 6: Light Lesson 8: Laboratory: Optics 2	0	Conduct experiments with light. Conduct experiments with mirrors. Conduct experiments with lenses.
Unit 6: Light Lesson 9: Laboratory: Optics 3	0	Conduct experiments with light. Conduct experiments with mirrors. Conduct experiments with lenses.
Unit 6: Light Lesson 10: Your Choice	0	00000
Unit 6: Light Lesson 11: Unit Test	HS-PS4-1, HS-PS4-3, HS-PS4-5	00000
Unit 7: Electric Forces Lesson 1: Static Electricity	0	Explain charged objects in terms of the distribution of electric charges. Give everyday examples of charged objects. Interpret diagrams of charged objects. Compare and contrast conductors and insulators.
Unit 7: Electric Forces Lesson 2: Electric Force	0	olve problems of electric force, electric potential, and electric fields. Define a coulomb and give examples of everyday electric forces in coulombs. Solve problems involving Coulomb's law and state that it involves electric force. Observe and explain the action of electric forces between charged objects. Compare and contrast conduction and induction of an electric charge.

Unit 7: Electric Forces Lesson 3: Electric Fields	0	Solve problems of electric force, electric potential, and electric fields. Solve problems involving calculation of electric fields. Explain that a charged particle creates an electric field. State the importance of a test charge. Explain that an electric field is a vector quantity.
Unit 7: Electric Forces Lesson 4: Laboratory: Electrostatics 1 Lesson 5: Discuss: Electrostatics	0	Conduct experiments in static electricity.
Unit 7: Electric Forces Lesson 6: Laboratory: Electrostatics 2	0	Conduct experiments in static electricity.
Unit 7: Electric Forces Lesson 7: Electric Potential	0	Solve problems of electric force, electric potential, and electric fields. Solve problems involving potential difference. Define electric potential difference and state that its unit is the volt. Determine the potential difference between two points in an electric field. Solve problems involving electric potential difference.
Unit 7: Electric Forces Lesson 8: Your Choice	0	00000
Unit 7: Electric Forces Lesson 9: Unit Test	HS-PS2-4, HS-PS3-5	00000
Unit 8: Currents and Circuits Lesson 1: Currents and Circuits	0	Solve problems involving electric current. Compare and contrast an electric current and an electric circuit. Define an ampere. Define and calculate electric power using watts and kilowatts. Relate electric power to aspects of everyday life.
Unit 8: Currents and Circuits Lesson 2: Current Electric Forces	0	Draw and analyze a simple circuit diagram. Explain the functions of batteries, wires, resistors, potentiometers, and capacitors.

		Draw and interpret complex circuit diagrams.
Unit 8: Currents and Circuits Lesson 3: Series Circuits	0	Solve problems involving voltage in series, parallel, and combined circuits. Predict the behavior of light bulbs in series and parallel circuits. Draw and analyze series circuit diagrams. Solve problems involving voltage in a series circuit.
Unit 8: Currents and Circuits Lesson 4: Parallel Circuits	0	Solve problems involving voltage in series, parallel, and combined circuits. Draw and analyze parallel circuit diagrams. Solve problems involving voltage in a parallel circuit.
Unit 8: Currents and Circuits Lesson 5: Combined Circuits	0	Solve problems involving voltage in series, parallel, and combined circuits. Draw and analyze circuit diagrams combining series and parallel circuits. Explain the importance of special circuits, specifically a voltage divider circuit and an RC circuit. Solve problems involving voltage in a combined circuit.
Unit 8: Currents and Circuits Lesson 6: Laboratory: Circuits 1	0	Conduct experiments with series and parallel circuits. Conduct experiments with series circuits. Conduct experiments with parallel circuits. Calculate and obtain voltages in series and parallel circuits.
Unit 8: Currents and Circuits Lesson 7: Laboratory: Circuits 2	0	Conduct experiments with series and parallel circuits. Conduct experiments with series circuits. Conduct experiments with parallel circuits. Calculate and obtain voltages in series and parallel circuits.

Unit 8: Currents and Circuits Lesson 8: Your Choice	0	00000
Unit 8: Currents and Circuits Lesson 9: Unit Test	HS-PS2-6, HS-PS3-2	00000
Unit 9: Magnetism Lesson 1: Magnets and Magnetic Fields	0	Explain that a magnetic field is a vector field around a magnet. Explain the atomic basis of magnetism. Discuss naturally occurring and common magnets. Discuss the properties of a bar magnet. Define magnetic flux as proportional to the strength of a magnetic field.
Unit 9: Magnetism Lesson 2: Forces in Magnetic Fields	0	Determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil. Calculate the force due to the application of a magnetic field.
Unit 9: Magnetism Lesson 3: Electromagnetic Induction	0	Describe magnetic induction and solve problems involving magnetic induction. Solve problems involving induced electromagnetic force. Define and give examples of electromagnetic induction. Describe electromagnetic induction and solve problems involving electromagnetic induction. Explain that electromotive force is not a force but an increase in electric potential. Solve problems involving induced electromotive force.
Unit 9: Magnetism Lesson 4: Laboratory: Magnetic Fields 1	0	Conduct experiments with electromagnetism. Conduct experiments with magnetism.
Unit 9: Magnetism Lesson 5: Laboratory: Magnetic Fields 2	0	Conduct experiments with electromagnetism. Conduct experiments with magnetism.

Unit 9: Magnetism Lesson 6: Your Choice	0	00000
Unit 9: Magnetism Lesson 7: Unit Test	HS-PS2-4, HS-PS2-5, HS-PS2-6, HS-PS3-5	00000
Unit 10: Modern Physics Lesson 1: Atomic Spectra and Quantum Theory	0	Explain how the quantum model of the atom accounts for emission and absorption spectra. Define and explain an emission and an absorption spectrum. Describe the Bohr model of the atom. Discuss the quantum model of the atom.
Unit 10: Modern Physics Lesson 2: The Nature of Light and the Photoelectric Effect	0	Support the argument for the wave and particle nature of light. Describe the photoelectric effect and state its use in modern technology. Discuss Einstein's explanation of the photoelectric effect.
Unit 10: Modern Physics Lesson 3: Relativity	0	Explain the importance of the theory of relativity to modern physics. Describe and give an example of relativity. Describe Einstein's contribution to the theory of relativity.
Unit 10: Modern Physics Lesson 4: Structure of the Nucleus	0	Describe the forces that are involved in nuclear structure. Discuss the particles that make up the nucleus of an atom. Explain ongoing worldwide research into the structure and forces of the nucleus.
Unit 10: Modern Physics Lesson 5: Radioactivity	0	List the types of radiation that may exit an atomic nucleus. Tell how radiation research has resulted in solutions to practical problems of everyday life. Contrast nuclear fusion with nuclear fission.

		Discuss the importance of knowledge about radioactivity to studies of the past.
Unit 10: Modern Physics Lesson 6: Your Choice	HS-PS1-8, HS-PS2-6, HS-PS4-2, HS-PS4-5, HS-ETS1-4	00000
Unit 10: Modern Physics Lesson 7: Unit Test	0	00000
Unit 11: Semester Review and Test Lesson 1: Semester Review	0	00000
Unit 11: Semester Review and Test Lesson 2: Your Choice	0	00000
Unit 11: Semester Review and Test Lesson 3: Your Choice	0	00000
Unit 11: Semester Review and Test Lesson 4: Semester Test	0	00000