Wyoming Department of Education
Required Virtual Education Course Syllabus

Washakie County School District No. 1

Program Name	Washakie #1 Online	Content Area	SC
Course ID	W03155G0.5022	Grade Level	10-12
Course Name	WOL-Physics-B	# of Credits	0.5 Total
SCED Code	03155G0.5022	Curriculum Type	K-12 Fuel Education

COURSE DESCRIPTION

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, laboratories, and related assessments, plus an online problem-solving book with 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-PS1-3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the macroscopic scale to infer the strength of electrical forces between particles.
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-PS2-3	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
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-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-PS4-3	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-PS4-4/ HS-ETS1-5	Evaluate the validity and reliability of claims in published materials.
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.

SCOPE AND SEQUENCE		
UNIT OUTLINE	STANDARD#	OUTCOMES OBJECTIVES STUDENT CENTERED GOALS
Semester 2 Unit 1: Momentum • Linear Momentum and Impulse • Law of Conservation of Momentum • Momentum in Collisions 1 • Momentum in Collisions 2 • Laboratory: Momentum 1 • Laboratory: Momentum 2 • Conservation of Angular Momentum	HS-PS2-2 HS-PS2-3	• Students explain situations where the net force is in equilibrium. Students identify the magnitude of opposing forces necessary for the net force to be zero. • Students conceptually define the law of conservation of momentum and use this definition to derive an equation. • Students apply the conservation of momentum equation to solve problems for elastic and inelastic collisions in one and two dimensions. • Students use free body diagrams to visually support the law of conservation of momentum • Through online examples, interactives, and explanations, students describe the concept of impulse and how it can be used to slow the momentum of an object. • Students apply this concept to a lunar lander and a batted baseball. Students experiment with how elastic and inelastic collisions can affect momentum. • Students summarize the history of gravitation, analyzing how Kepler's laws led to the Universal Law of Gravitation. • Students mathematically and conceptually explain the Universal Law of Gravitation. • Students calculate various values using the Universal Law of Gravitation. • Through online examples and explanation of an equation, students conceptually and mathematically describe Coulomb's law. • Students calculate forces using Coulomb's law.

SCOPE AND SEQUENCE		
UNIT OUTLINE	STANDARD#	OUTCOMES OBJECTIVES STUDENT CENTERED GOALS
Unit 2: Work • Work and Power • Direction of Force and Work • Laboratory: Work and Power • Machines and Mechanical Advantage • Laboratory: Simple and Compound Machines 1 • Laboratory: Simple and Compound Machines 2		• Students solve problems involving work and power, describing the relationship between work and the direction of force. • Students state that work is a form of energy transfer between two systems. • Students solve problems using the work equation and power equation. • Students solve problems involving the magnitude of force using trigonometry. • Students give examples of the mechanical transfer of energy. • Students compare and contrast simple and compound machines. • Students describe the mechanical advantages of machines. • Students calculate the mechanical advantages of machines. • Students compare and contrast effort force and resistance force. • Students define mechanical advantage. • Students solve problems involving mechanical advantage. • Students describe mechanical advantage in some machines. • Students experiment with simple machines. • Students calculate mechanical advantages of some machines. • Students define and calculate efficiency. • Students calculate the efficiency of some machines.
Unit 3: Energy • Types of Energy and Their Conversions • Kinetic and Potential Energy • Conservations of Energy 1 • Conservations of Energy 2 • Laboratory: Conservation of Energy 1 • Laboratory: Conservation of Energy 2 • Energy During Collisions	HS-PS3-1 HS-PS3-2 HS-PS3-3	• Students mathematically and conceptually explain energy conversion between potential and kinetic energy, including dropping a ball from a given height. • Students calculate values during energy conversions using the conservation of energy. • Students describe on the particle level how energy flows in and out of a system. • Students use the conservation of energy to calculate the specific heat of a metal during the transfer of energy from water to meta. • Students explain the concept of kinetic and potential energy. • Students use diagrams and equations to describe the potential energy of an object prior to free fall and kinetic energy during free fall; the potential and kinetic energy of a ball rolling down an inclined plane; and the potential and kinetic energy of a bow and arrow.

SCOPE AND SEQUENCE		
UNIT OUTLINE	STANDARD#	OUTCOMES OBJECTIVES STUDENT CENTERED GOALS
		• Students use molecular interaction diagrams to describe why the temperature of an object increases. • Students use diagrams to describe how electrical energy is stored between plates. Students use a diagram to explain how energy is created using electromagnetic induction. Students use the model of the atom with electron orbitals, to describe how different colors of light (emission spectra) are produced for different elements. • Students describe how an unstable nucleus produces energy through radioactive decay, fusion, or fission. • Students define kinetic, potential, mechanical, thermal, chemical, electrical, electromagnetic and nuclear energy. • Using diagrams and examples, students explain how energy transferred from one form to another. • Students explain the Law of Conservation of Energy with respect to energy conversions. • Students conduct an experiment to convert potential energy to kinetic energy for a ball rolling down an inclined plane.
Unit 4: Thermal Energy • Kinetic-Molecular Theory • Specific Heat • Laboratory: Specific Heat 1 • Laboratory: Specific Heat 2 • States of Matter • Heat During Change of Stat • First Law of Thermodynamics • Second Law of Thermodynamics and Entropy	HS-PS3-1 HS-PS3-2 HS-PS3-3 HS-PS3-4	• Students mathematically and conceptually explain energy conversion between potential and kinetic energy, including dropping a ball from a given height. • Students calculate values during energy conversions using the conservation of energy. • Students describe on the particle level how energy flows in and out of a system. • Students use the conservation of energy to calculate the specific heat of a metal during the transfer of energy from water to meta. • Students explain the concept of kinetic and potential energy. • Students use diagrams and equations to describe the potential energy of an object prior to free fall and kinetic energy during free fall; the potential and kinetic energy of a ball rolling down an inclined plane; and the potential and kinetic energy of a bow and arrow. • Students use molecular interaction diagrams to describe why the temperature of an object increases. • Students use diagrams to describe how electrical energy is stored between plates. Students use a diagram to explain how energy is created using electromagnetic induction. Students use the model of the atom with electron orbitals, to

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		describe how different colors of light (emission spectra) are produced for different elements. Students describe how an unstable nucleus produces energy through radioactive decay, fusion, or fission. • Students define kinetic, potential, mechanical, thermal, chemical, electrical, electromagnetic and nuclear energy. • Using diagrams and examples, students explain how energy transferred from one form to another. • Students explain the Law of Conservation of Energy with respect to energy conversions. • Students conduct an experiment to convert potential energy to kinetic energy for a ball rolling down an inclined plane. • Students explain how thermal energy is transferred through collisions on the particle level, resulting in an equilibrium temperature of the system. • Students conceptually and mathematically explain the second law of thermodynamics, including the definition of entropy. • Students apply the second law of thermodynamics by using a calorimeter to experimentally calculate the specific heat of metal samples.
Unit 5: Waves • Characteristics of Waves 1 • Characteristics of Waves 2 • Sound: Vibration and Waves • Qualities of Sound • Laboratory: Sound 1 • Laboratory: Sound 2	HS-PS4-1	• Through online interactives, examples, and explanations, students define different types of waves, such as seismic waves, sound waves, and electromagnetic radiation. • Students illustrate features of waves, such as frequency, wavelength, period, and amplitude. Students use then definitions as a basis for determining the relationship between frequency, wavelength, and speed of a wave. • Students use the relationship to calculate values of a wave.
Unit 6: Light • The Electromagnetic Spectrum • Diffraction and Interference • Reflection • Refraction • Mirrors • Lenses • Laboratory: Optics 1 • Laboratory: Optics 2 • Laboratory: Optics 3	HS-PS4-3 HS-PS4-4/ HS-ETS1-5 HS-PS4-5	• Using evidence from scientific studies, such as those focused on the photoelectric effect, students explain the wave-particle duality of electromagnetic radiation, citing the work of Einstein, Young, and Maxwell. • Students use the wave model of light to describe how the double slit pattern is possible. • Using real life examples, students explain the applications of different types of electromagnetic radiation in everyday life. • Students analyze a table of electromagnetic radiation to determine the amount of energy

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		associated with different types of electromagnetic radiation. • Students can evaluate the inferred effects of different types of electromagnetic radiation. • Students explain how the Doppler effect is used to calculate the age of the universe. • Students explain how diffraction is used in microscopy and how polarization is used in LCD displays. Students explain how the photoelectric effect is used in solar technologies and CCD devices.
Unit 7: Electric Forces • Static Electricity • Electric Force • Electric Fields • Laboratory: Electrostatics 1 • Laboratory: Electrostatics 2 • Electric Potential Difference	HS-PS1-3 HS-PS2-4 HS-PS3-2 HS-PS3-5	• Through online examples, interactives, and explanations, students describe the concept of impulse and how it can be used to slow the momentum of an object. • Students apply this concept to a lunar lander and a batted baseball. Students experiment with how elastic and inelastic collisions can affect momentum. • Students define conductors and insulators and identify examples of each. • Students categorize the molecular bonding and properties of conductors, semiconductors, and insulators. • Students describe how an electroscope works, including materials involved. • Using diagrams and examples, students explain how static electricity works and how pressure and temperature can separate charges. • Students summarize the history of gravitation, analyzing how Kepler's laws led to the Universal Law of Gravitation. • Students mathematically and conceptually explain the Universal Law of Gravitation. • Students calculate various values using the Universal Law of Gravitation. • Through online examples and explanation of an equation, students conceptually and mathematically describe Coulomb's law. • Students calculate forces using Coulomb's law. • Students explain the concept of kinetic and potential energy. • Students use diagrams and equations to describe the potential energy of an object prior to free fall and kinetic energy during free fall; the potential and kinetic energy of a ball rolling down an inclined plane; and the potential and kinetic energy of a bow and arrow. • Students use molecular interaction diagrams to describe why the temperature of an object increases.

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		• Students use diagrams to describe how electrical energy is stored between plates. Students use a diagram to explain how energy is created using electromagnetic induction. Students use the model of the atom with electron orbitals, to describe how different colors of light (emission spectra) are produced for different elements. Students describe how an unstable nucleus produces energy through radioactive decay, fusion, or fission. • Students explain how electric fields are formed objected charged through conduction and induction. • Students describe how a photocopier works using charged particles. Students use Faraday's Law and Coulomb's law to describe interactions between charged particles. • Using diagrams, students describe various magnetic fields, including the magnetic field produced from a solenoid and how magnets interact with each other and nonmagnetic objects. • Through online interactives and explanations, students analyze Faraday's experiments to illustrate how magnets produce electric current.
Unit 8: Currents and Circuits • Current and Circuits • Current Electric Forces • Series Circuits • Parallel Circuits • Combined Circuits • Laboratory: Circuits 1 • Laboratory: Circuits 2	HS-PS1-3	• Students define conductors and insulators and identify examples of each. • Students categorize the molecular bonding and properties of conductors, semiconductors, and insulators. • Students describe how an electroscope works, including materials involved. • Using diagrams and examples, students explain how static electricity works and how pressure and temperature can separate charges.
Unit 9: Magnetism • Magnets and Magnetic Fields • Forces in Magnetic Fields • Electromagnetic Induction • Laboratory: Magnetic Fields 1 • Laboratory: Magnetic Fields 2	HS-PS2-5 HS-PS3-2 HS-PS3-5	• Using diagrams, students describe various magnetic fields, including the magnetic field produced from a solenoid. • Students apply the right hand rule to determine the direction of a magnetic field produced. • Through online interactives and explanations, students analyze Faraday's experiments to illustrate how magnets produce electric current. • Students explain the concept of kinetic and potential energy. • Students use diagrams and equations to describe the potential energy of an object prior to free fall and kinetic energy during free fall; the potential and kinetic energy of a ball rolling down an inclined plane; and the potential and kinetic energy of a bow and arrow.

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		• Students use molecular interaction diagrams to describe why the temperature of an object increases. • Students use diagrams to describe how electrical energy is stored between plates. Students use a diagram to explain how energy is created using electromagnetic induction. Students use the model of the atom with electron orbitals, to describe how different colors of light (emission spectra) are produced for different elements. Students describe how an unstable nucleus produces energy through radioactive decay, fusion, or fission. • Students explain how electric fields are formed objected charged through conduction and induction. • Students describe how a photocopier works using charged particles. Students use Faraday's Law and Coulomb's law to describe interactions between charged particles. • Using diagrams, students describe various magnetic fields, including the magnetic field produced from a solenoid and how magnets interact with each other and nonmagnetic objects. • Through online interactives and explanations, students analyze Faraday's experiments to illustrate how magnets produce electric current.
Unit 10: Modern Physics • Atomic Spectra and Quantum Theory • The Nature of Light and the Photoelectric Effect • Relativity • Structure of the Nucleus • Radioactivity	HS-PS1-8 HS-PS3-2 HS-PS4-3 HS-PS4-5	• Through online diagrams, interactives, and explanations, students describe the particles of the nucleus including protons, neutrons, and quarks. Students use these particles to explain alpha, beta, and gamma radiation and how fission and fusion occur. • Students write chemical equations, noting where energy is released. • Students use real life examples such as the atomic bomb and nuclear power plants to show how the energy is used. • Students explain the concept of kinetic and potential energy. • Students use diagrams and equations to describe the potential energy of an object prior to free fall and kinetic energy during free fall; the potential and kinetic energy of a ball rolling down an inclined plane; and the potential and kinetic energy of a bow and arrow. • Using evidence from scientific studies, such as those focused on the photoelectric effect, students explain the wave-particle duality of

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		electromagnetic radiation, citing the work of Einstein, Young, and Maxwell. • Students use the wave model of light to describe how the double slit pattern is possible. • Students explain how the Doppler effect is used to calculate the age of the universe. • Students explain how diffraction is used in microscopy and how polarization is used in LCD displays. Students explain how the photoelectric effect is used in solar technologies and CCD devices. • Students use molecular interaction diagrams to describe why the temperature of an object increases. • Students use diagrams to describe how electrical energy is stored between plates. Students use a diagram to explain how energy is created using electromagnetic induction. Students use the model of the atom with electron orbitals, to describe how different colors of light (emission spectra) are produced for different elements. • Students describe how an unstable nucleus produces energy through radioactive decay, fusion, or fission.
Unit 11: Semester Review and Test • Semester Review • Semester Test		