Wyoming Department of Education
Required Virtual Education Course Syllabus

2201000 - Washakie County School District No. 1

Program Name	Washakie #1 Online	Content Area	SC
Course ID	W03155G0.5012	Grade Level	10-12
Course Name	WOL-Physics-A	# of Credits	0.5 Total
SCED Code	03155G0.5012	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 and instructions for conducting hands-on laboratory experiments at home. 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-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
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-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
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
COURSE OUTLINE: **Semester 1** Unit 1: Introduction to Physics • Semester Introduction • The History of Physics • Physics and Society • Physics and Science • Physical Systems and Models		Students will: • Describe the major topics of physics that you will explore in this course. • Explain how physics has been an interest of people since ancient times. • Describe the contributions of ancient scientists of diverse societies to knowledge of physics. • Discuss how the Renaissance revitalized the study of physics in Europe. • Compare and contrast the contributions of Galileo and Newton to physics knowledge. • Discuss contributions of scientists in the 1700s and 1800s to physics. • Define modern physics. • Describe the importance of physics to modern society. • Cite examples of some of the most important areas of physics research. • Understand that scientific knowledge is a crucial way of viewing the world. • Cite everyday examples of how physics research has contributed to quality of life. • Discuss the relationship between government and modern physics research. • List some careers in which a knowledge of physics is exceptionally important. • Explain how the principles of the scientific method apply to physics. • Explain that the physical world can be understood in terms of a small set of universal laws. • Discuss how physics informs research in all the other sciences. • Describe why it is important for all scientists, including physicists, to communicate their findings openly. • Recognize the limits and usefulness of models in physics. • Explain that physicists represent reality by defining usefully simplified model systems they can describe and analyze. • Define a physical system. • State why the variables of any physical system must be controlled during experimentation. • Compare and contrast physics laws, hypotheses, and theories.
Unit 2: Physical Units and Measurement • The Metric System: History and Use • The Metric System: Base Units • The Metric System: Derived Units • Measurement and Scientific Notation • Conversion Techniques • Significant Figures • Lab: Measurement and Significant Figures 1		Students will: • Explain the powers of 10 as the basis for the metric system. • Describe the origin and history of the metric system. • Distinguish between metric units and units in other systems. • Explain why physicists report results in the metric system.

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• Lab: Measurement and Significant Figures 2		• Discuss base and derived units and the importance of the metric system. • Define a base unit as it applies to the metric system. • List each of the base units of the metric system. • Discuss changes in the standards for metric base measures over time. • State one example in physics for each of the base units of the metric system. • Discuss base and derived units and the importance of the metric system. • Explain that any physical quantity can be expressed in terms of a small number of fundamental quantities. • Distinguish between the base units and derived units in some physics examples. • Compare and contrast accuracy and precision. • Determine how to calculate experimental error. • Read the scale on various scientific instruments. • Explain the importance of using scientific notation. • Use scientific notation in solving problems. • Solve problems using conversion factors and significant figures. • Define conversion factor. • State the importance of conversion factors in scientific calculations. • Solve problems using conversion factors. • Define dimensional analysis. • Solve problems using dimensional analysis. • Solve problems using conversion factors and significant figures. • State the six rules of determining significant figures. • Relate measurement and significant figures. Define significant figures. • State the six rules for determining significant figures. • Solve problems involving significant figures. • Use various devices to make measurements in metric base units. • Distinguish between precision and accuracy. • Distinguish between base units and derived units.
Unit 3: Graphing and Problem Solving • Graphing Physical Data • Graphs and Data Relationships • Lab: Creating and Interpreting Graphs 1 • Lab: Creating and Interpreting Graphs 2 • Problem Solving Strategies: Units • Problem Solving Strategies: Estimation		Students will: • Develop graphs that are correctly labeled. Create graphs that plot data correctly. • Distinguish between a dependent variable and an independent variable. • Create a number of different kinds of graphs given different sets of data. • Define chart junk and be able to identify examples of it. • Analyze and interpret various kinds of graphs. Observe and identify relationships between variables using graphed data. • Interpret data that result in linear, inverse, and quadratic graph lines.

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		• Observe graphs with errors and correct the errors. • Plot data that result in linear and nonlinear functions. • Describe the importance of handling units correctly while problem solving. • Demonstrate the importance of working with units in physics problem solving. • Solve problems that require manipulating units correctly. • Use estimation in solving physics problems. Demonstrate the importance of estimating in physics problem solving. • Solve problems that require estimating. • View problems, estimate, and then check if estimations are correct.
Unit 4: Kinematics • Rotation and Translation • Frame of Reference • Speed and Velocity • Position-Time and Velocity-Time Graphs • Lab: Kinematics 1 • Lab: Kinematics 2 • Acceleration • Acceleration and Displacement • Lab: Acceleration 1 • Lab: Acceleration 2	HS-PS2-1	Students will: • Compare and contrast rotation and translation. • Explain what physicists mean when they use the term body. • Identify instances of rotational motion. • Identify instances of translational motion. • Compare and contrast scalar and vector. Define frame of reference. • Explain the importance of coordinate systems for understanding motion. • Compare and contrast reference point, distance, and direction. • Visualize displacement as a change in position. • Solve kinematic problems involving velocity and acceleration. • Distinguish between instantaneous velocity and average velocity. • Determine the average velocity of a moving body. • Define speed as distance an object travels over time. • Solve problems involving speed. • Compare and contrast speed and velocity. • Create and interpret velocity-time graphs. • Create and interpret position-time graphs. • State the importance of slope in a position-time graph. • Compare instantaneous velocity and average velocity of a body given a graph of its movement. • Solve kinematic problems involving velocity and acceleration. • Determine the average velocity of a moving body. • Create and interpret velocity-time graphs. • Compare and contrast speed and velocity. • Create and interpret position-time graphs. • Compare and contrast instantaneous acceleration and average acceleration. • Determine the average acceleration and instantaneous acceleration of a body given a velocity-time graph. • Describe the velocity of a body when a = 0.

Scope and Sequence		
UNIT OUTLINE	STANDARD #	OUTCOMES OBJECTIVES STUDENT CENTERED GOALS
		• Show positive acceleration and negative acceleration graphically. • Solve problems involving velocity, acceleration, and time. • Describe instances of acceleration due to gravity. • Interpret velocity-time graphs involving motion and gravity. • Solve problems involving acceleration due to gravity.
Unit 5: Forces • Forces • Inertia and Newton's First Law • Newton's Second Law • Mass and Weight • Lab: Newton's Laws of Motion 1 • Lab: Newton's Laws of Motion 2 • Newton's Third Law	HS-PS2-1 HS-PS2-2 HS-PS2-3 HS-PS2-4	Students will: • Identify and describe various kinds of forces. • Distinguish between kinematics and dynamics. • Describe a force as a push or pull. • Discuss forces encountered in daily life. • State Newton's first law of motion. • Define inertia. • Discuss the history of the development of Newton's laws of motion. • Describe the motion of a stationary and a moving object acted upon by balanced forces. • Define Newton's second law conceptually and mathematically. • State Newton's second law of motion. • Solve problems involving Newton's second law of motion. • Define the unit of force as a newton. • List some everyday forces and estimate the force in newtons. • Solve problems involving mass, weight, and gravitational forces. • Compare and contrast mass and weight. • Apply Newton's second law to bodies moving in various physical systems. • Determine the effect of balanced and unbalanced forces on a body. • Identify pairs of forces acting between two objects. • State Newton's third law of motion. • Recognize everyday examples of Newton's third law of motion. • Determine the magnitude and direction of the acting force when the magnitude and direction of the reacting force is known. • Conduct their own experiment, gathering data for position and velocity at various masses. Students analyze the relationship between mass and position and mass and velocity, proving the relationship • Explain situations where the net force is in equilibrium. Students identify the magnitude of opposing forces necessary for the net force to be zero. • 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

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		problems for elastic and inelastic collisions in one and two dimensions. • Use free body diagrams to visually support the law of conservation of momentum.
Unit 6: Net Forces and Vectors • The Net Forces Problem • Resolving Vectors • Adding Vectors • Lab: Working with Vectors • Net Forces at Equilibrium • Free Fall and Equilibrium • Calculating Net Force I • Calculating Net Force II • Friction • Lab: Net Force 1 • Lab: Net Force 2	HS-PS2-2 HS-PS2-3	Students will: • Explain situations where the net force is in equilibrium. Students identify the magnitude of opposing forces necessary for the net force to be zero. • Describe the effect of forces on a body. • Describe how positive net force causes a body to accelerate. • Understand the need for a mathematical way to describe the effect of forces on a body. • Resolve single vectors into component vectors. • Solve problems involving the resolution of vectors. • Add vectors trigonometrically. • Solve problems involving the addition of vectors in one dimension. • Solve problems involving the addition of vectors in two dimensions. • Calculate the components of a vector. • Add vectors analytically. • Discuss the application of an equilibrant force and its effect. • Solve problems involving the application of an equilibrant. • Define free fall. • Solve net force problems involving free fall. • Define and create a free body diagram. • Solve net force problems using free body diagrams. • Define friction and give examples from daily life. • Compare and contrast kinetic and static friction. • Use the coefficient of friction to solve surface friction problems. • Solve net force problems involving an inclined plane. • Solve net force problems involving the coefficient of friction. • 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. • 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. • Apply this concept to a lunar lander and a batted baseball. • Students experiment with how elastic and inelastic collisions can affect momentum.

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UNIT OUTLINE	STANDARD #	OUTCOMES OBJECTIVES STUDENT CENTERED GOALS
Unit 7: Motion in Two Dimensions • Projectile Motion • Uniform Circular Motion • Lab: Motion in Two Dimensions 1 • Lab: Motion in Two Dimensions 2 • Lab: Motion in Two Dimensions 3 • Angular Displacement and Torque • Simple Harmonic Motion: Springs • Simple Harmonic Motion: Pendulum • Lab: Harmonic Motion 1 • Lab: Harmonic Motion 2	HS-PS4-1	Students will: • Recognize that the vertical and horizontal velocities of a projectile are independent. • Solve problems involving projectile motion. • Give examples of projectile motion in daily life, citing the importance of frame of reference. • Graphically show the path of a body projected horizontally and at an angle. • Solve problems in uniform circular motion. Define uniform circular motion (UCM). • Interpret a diagram of a body undergoing UCM. • Describe how centripetal acceleration relates to the object's velocity and the radius of the circle. • Explain that force applied perpendicular to an object's direction of motion changes the direction. • Identify the forces that cause centripetal acceleration. • Explain centrifugal force and why it's a fictitious force. • Solve problems involving projectile motion. • Discuss angular momentum and recognize its occurrence in everyday life. • Define angular displacement. • Explain situations in daily life when circular motion must be stopped or started. • Define torque. • Interpret diagrams that show the application of force on a lever arm. • Create and interpret graphs of acceleration, velocity, and displacement of spring movement. • Define and cite examples of simple harmonic motion. • Define period and amplitude in the context of diagrams of oscillating springs. • Solve problems involving simple harmonic motion. • Create and interpret graphs of acceleration, velocity, and displacement of a pendulum. • Solve problems involving the period of a pendulum. • Discuss some aspects of the history of the pendulum in physics. • Define period and amplitude in the context of diagrams of a pendulum. • Define and cite examples of simple harmonic motion. • Define period and amplitude in the context of diagrams of pendulums and oscillating springs. • Create and interpret graphs of displacement of a pendulum and a spring. • Solve problems involving the periods of a pendulum and spring.
Unit 8: Gravitation • History of Gravitation • Lab: Keplar's Laws • Universal Gravitation • Einstein and the Gravitational Field	HS-PS2-1 HS-PS2-4 HS-PS4-1	Students will: • Summarize the history of gravitation, analyzing how Kepler's laws led to the Universal Law of Gravitation. • Mathematically and conceptually explain the Universal Law of Gravitation.

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UNIT OUTLINE	STANDARD #	OUTCOMES OBJECTIVES STUDENT CENTERED GOALS
		• 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. • Compare and contrast Newtonian and Einsteinian concepts of gravity. • Define gravity and gravitation. • Cite the contributions of Kepler, Newton, and Cavendish to the understanding of gravity. • Discuss the contribution of Einstein to knowledge of gravity. • Solve problems involving an orbiting object in space. • Define and explain universal gravitation. • Solve problems using Newton's inverse square law. • Use Kepler's third law to calculate the period of a planet. • Describe and draw representations of a gravitational field. • Define a field. Knowing the force and the mass of a body, calculate the strength of a field. • Explain Einstein's description of gravity.
Unit 9: Physics and Scientific Inquiry • Physics Inquiry: Inductive Reasoning • Physics Inquiry: Questions and Hypotheses • Physics Inquiry: Experimentation • Physics Inquiry: Data Collection and Analysis • Physics Inquiry: Conclusions and Communicating	HS-ETS1-4	Students will: • Compare and contrast inductive and deductive reasoning. • Explain how inductive reasoning forms the basis for physics research. • Explain how physicists form explanations using logic and evidence. • Recognize that our modern knowledge of physics is cumulative. • Describe how inductive reasoning is important in the study of physics. • List some scientific processes and methods. • Discuss the importance of the scientific method. • Distinguish between a hypothesis and a theory. • Write hypotheses as "if-then" statements. • Describe the importance of question formation in physics research. • Explain what factors go into formulating a good research question. • List some scientific processes and methods. • Discuss the importance of the scientific method. • Describe and identify variables in physics experiments. • Compare and contrast dependent and independent variables. • Identify sources of experimental error during experiments. • Discuss how statistical variability means that many trial runs are necessary in an experiment.

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		• Study instances of errors in both mathematical and graphical data presentation. • List some scientific processes and methods. • Discuss the importance of the scientific method. • Study instances of data presentation and point out sources of error. • Tell how some graphs can be misleading for interpreting data. • Given a data set, interpret the data correctly. • List some scientific processes and methods. • Discuss the importance of the scientific method. • Describe the importance of forming a conclusion to a scientific investigation. • State the importance of communicating the results and conclusion of a scientific investigation. • State some of the ways that physicists communicate their findings.
Semester Review and Test		