

Wyoming 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-403AV2-K	Grade Level	9-12
Course Name	Summit Physics - Semester 1	# of Credits	0.5
SCED Code	03151E0.5012	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-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-PS2-3	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.
N.Q.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.*
N.Q.2	Define appropriate quantities for the purpose of descriptive modeling.*
N.Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.*

SCOPE AND SEQUENCE

UNIT OUTLINE	STANDARD#	OUTCOMES OBJECTIVES/STUDENT CENTERED GOALS
Unit 1: Introduction to Physics Lesson 1: Semester Introduction	0	Describe the major topics of physics that you will explore in this course.

<p>Unit 1: Introduction to Physics Lesson 2: The History of Physics</p>	<p>0</p>	<p>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.</p>
<p>Unit 1: Introduction to Physics Lesson 3: Physics and Society</p>	<p>0</p>	<p>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.</p>
<p>Unit 1: Introduction to Physics Lesson 4: Physics and Science</p>	<p>0</p>	<p>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.</p>
<p>Unit 1: Introduction to Physics Lesson 5: Physical Systems and Models</p>	<p>0</p>	<p>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.</p>
<p>Unit 1: Introduction to Physics Lesson 6: Your Choice</p>	<p>N.Q.1</p>	<p>00000</p>

<p>Unit 2: Physical Units and Measurement Lesson 1: The Metric System: History and Use</p>	0	<p>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.</p>
<p>Unit 2: Physical Units and Measurement Lesson 2: The Metric System: Base Units Lesson 3: Discuss: Meet and Greet</p>	0	<p>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.</p>
<p>Unit 2: Physical Units and Measurement Lesson 4: The Metric System: Derived Units</p>	0	<p>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.</p>
<p>Unit 2: Physical Units and Measurement Lesson 5: Your Choice</p>	0	00000
<p>Unit 2: Physical Units and Measurement Lesson 6: Measurement and Scientific Notation</p>	0	<p>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.</p>
<p>Unit 2: Physical Units and Measurement Lesson 7: Conversion Techniques</p>	0	<p>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.</p>

Unit 2: Physical Units and Measurement Lesson 8: Significant Figures	0	<p>Solve problems using conversion factors and significant figures.</p> <p>State the six rules of determining significant figures.</p> <p>Relate measurement and significant figures.</p> <p>Define significant figures.</p> <p>State the six rules for determining significant figures.</p> <p>Solve problems involving significant figures.</p>
Unit 2: Physical Units and Measurement Lesson 9: Laboratory: Measurement and Significant Figures 1 Lesson 10: Discuss: Measurement and Significant Figures	0	<p>Use various devices to make measurements in metric base units.</p> <p>Distinguish between precision and accuracy.</p> <p>Distinguish between base units and derived units.</p>
Unit 2: Physical Units and Measurement Lesson 11: Laboratory: Measurement and Significant Figures 2	0	<p>Use various devices to make measurements in metric base units.</p> <p>Distinguish between precision and accuracy.</p> <p>Distinguish between base units and derived units.</p>
Unit 2: Physical Units and Measurement Lesson 12: Your Choice	0	00000
Unit 2: Physical Units and Measurement Lesson 13: Unit Test	N.Q.1, N.Q.2, N.Q.3	00000
Unit 3: Graphing and Problem Solving Lesson 1: Graphing Physical Data	0	<p>Develop graphs that are correctly labeled.</p> <p>Create graphs that plot data correctly.</p> <p>Distinguish between a dependent variable and an independent variable.</p> <p>Create a number of different kinds of graphs given different sets of data.</p> <p>Define chart junk and be able to identify examples of it.</p>
Unit 3: Graphing and Problem Solving Lesson 2: Graphs and Data Relationships	0	<p>Analyze and interpret various kinds of graphs.</p> <p>Observe and identify relationships between variables using graphed data.</p> <p>Interpret data that result in linear, inverse, and quadratic graph lines.</p> <p>Observe graphs with errors and correct the errors.</p>
Unit 3: Graphing and Problem Solving Lesson 3: Laboratory: Creating and Interpreting Graphs 1	0	<p>Develop graphs that are correctly labeled.</p> <p>Create graphs that plot data correctly.</p> <p>Plot data that result in linear and nonlinear functions.</p>

Unit 3: Graphing and Problem Solving Lesson 4: Laboratory: Creating and Interpreting Graphs 2	0	Develop graphs that are correctly labeled. Create graphs that plot data correctly. Plot data that result in linear and nonlinear functions.
Unit 3: Graphing and Problem Solving Lesson 5: Your Choice	0	00000
Unit 3: Graphing and Problem Solving Lesson 6: Problem Solving Strategies: Units	0	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.
Unit 3: Graphing and Problem Solving Lesson 7: Problem Solving Strategies: Estimation	0	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 3: Graphing and Problem Solving Lesson 8: Your Choice	0	00000
Unit 3: Graphing and Problem Solving Lesson 9: Unit Test	N.Q.1, N.Q.2, N.Q.3	00000
Unit 4: Kinematics Lesson 1: Rotation and Translation	0	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.
Unit 4: Kinematics Lesson 2: Frame of Reference	0	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.
Unit 4: Kinematics Lesson 3: Speed and Velocity	0	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.

<p>Unit 4: Kinematics Lesson 4: Position-Time and Velocity-Time Graphs</p>	0	<p>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.</p>
<p>Unit 4: Kinematics Lesson 5: Laboratory: Kinematics 1</p>	0	<p>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.</p>
<p>Unit 4: Kinematics Lesson 6: Laboratory: Kinematics 2</p>	0	<p>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.</p>
<p>Unit 4: Kinematics Lesson 7: Acceleration</p>	0	<p>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 $a = 0$. Show positive acceleration and negative acceleration graphically.</p>
<p>Unit 4: Kinematics Lesson 8: Acceleration and Displacement</p>	0	<p>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.</p>

Unit 4: Kinematics Lesson 9: Laboratory: Acceleration 1	0	Determine the average acceleration and instantaneous acceleration of a body given a velocity-time graph. Solve problems involving velocity, acceleration, and time. Solve problems involving acceleration due to gravity.
Unit 4: Kinematics Lesson 10: Laboratory: Acceleration 2	0	Determine the average acceleration and instantaneous acceleration of a body given a velocity-time graph. Solve problems involving velocity, acceleration, and time. Solve problems involving acceleration due to gravity.
Unit 4: Kinematics Lesson 11: Your Choice	0	00000
Unit 4: Kinematics Lesson 12: Unit Test	HS-PS2-1, HS-PS2-4	00000
Unit 5: Forces Lesson 1: Forces	0	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.
Unit 5: Forces Lesson 2: Inertia and Newton's First Law	0	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.
Unit 5: Forces Lesson 3: Newton's Second Law	0	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.
Unit 5: Forces Lesson 4: Mass and Weight	0	Solve problems involving mass, weight, and gravitational forces. Compare and contrast mass and weight.
Unit 5: Forces Lesson 5: Laboratory: Newton's Laws of Motion 1	0	Apply Newton's second law to bodies moving in various physical systems. Determine the effect of balanced and unbalanced forces on a body.
Unit 5: Forces Lesson 6: Laboratory: Newton's Laws of Motion 2	0	Apply Newton's second law to bodies moving in various physical systems. Determine the effect of balanced and unbalanced forces on a body.

Unit 5: Forces Lesson 7: Newton's Third Law		0	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.
Unit 5: Forces Lesson 8: Your Choice		0	00000
Unit 5: Forces Lesson 9: Unit Test	HS-PS2-1, HS-PS2-3, HS-PS2-4.		00000
Unit 6: Net Forces and Vectors Lesson 1: The Net Forces Problem		0	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.
Unit 6: Net Forces and Vectors Lesson 2: Resolving Vectors		0	Resolve single vectors into component vectors. Solve problems involving the resolution of vectors.
Unit 6: Net Forces and Vectors Lesson 3: Adding Vectors		0	Add vectors trigonometrically. Solve problems involving the addition of vectors in one dimension. Solve problems involving the addition of vectors in two dimensions.
Unit 6: Net Forces and Vectors Lesson 4: Laboratory: Working with Vectors Lesson 5: Discuss: Working with Vectors		0	Calculate the components of a vector. Add vectors analytically.
Unit 6: Net Forces and Vectors Lesson 6: Net Forces at Equilibrium		0	Discuss the application of an equilibrant force and its effect. Solve problems involving the application of an equilibrant.
Unit 6: Net Forces and Vectors Lesson 7: Free Fall and Equilibrium		0	Define free fall. Solve net force problems involving free fall.
Unit 6: Net Forces and Vectors Lesson 8: Calculating Net Force 1		0	Define and create a free body diagram. Solve net force problems using free body diagrams.
Unit 6: Net Forces and Vectors Lesson 9: Calculating Net Force 2		0	Solve net force problems using free body diagrams.
Unit 6: Net Forces and Vectors Lesson 10: Friction		0	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.

Unit 6: Net Forces and Vectors Lesson 11: Laboratory: Net Force 1		0	Solve net force problems involving an inclined plane. Solve net force problems involving the coefficient of friction.
Unit 6: Net Forces and Vectors Lesson 12: Laboratory: Net Force 2		0	Solve net force problems involving an inclined plane. Solve net force problems involving the coefficient of friction.
Unit 6: Net Forces and Vectors Lesson 13: Your Choice		0	00000
Unit 6: Net Forces and Vectors Lesson 14: Unit Test	HS-PS2-3		00000
Unit 7: Motion in Two Dimensions Lesson 1: Projectile Motion		0	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.
Unit 7: Motion in Two Dimensions Lesson 2: Uniform Circular Motion		0	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.
Unit 7: Motion in Two Dimensions Lesson 3: Laboratory: Motion in Two Dimensions 1		0	Solve problems involving uniform circular motion.
Unit 7: Motion in Two Dimensions Lesson 4: Laboratory: Motion in Two Dimensions 2		0	Solve problems involving projectile motion.
Unit 7: Motion in Two Dimensions Lesson 5: Laboratory: Motion in Two Dimensions 3		0	Solve problems involving projectile motion. Solve problems involving uniform circular motion.

<p>Unit 7: Motion in Two Dimensions Lesson 6: Angular Displacement and Torque</p>	0	<p>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.</p>
<p>Unit 7: Motion in Two Dimensions Lesson 7: Simple Harmonic Motion: Springs</p>	0	<p>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.</p>
<p>Unit 7: Motion in Two Dimensions Lesson 8: Simple Harmonic Motion: Pendulums</p>	0	<p>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.</p>
<p>Unit 7: Motion in Two Dimensions Lesson 9: Laboratory: Harmonic Motion 1</p>	0	<p>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.</p>
<p>Unit 7: Motion in Two Dimensions Lesson 10: Laboratory: Harmonic Motion 2</p>	0	<p>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.</p>
<p>Unit 7: Motion in Two Dimensions Lesson 11: Your Choice</p>	0	00000

Unit 7: Motion in Two Dimensions Lesson 12: Unit Test	HS-PS4-1	00000
Unit 8: Gravitation Lesson 1: History of Gravitation	0	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.
Unit 8: Gravitation Lesson 2: Laboratory: Kepler's Laws Lesson 3: Discuss: Kepler's Laws	0	Solve problems involving an orbiting object in space.
Unit 8: Gravitation Lesson 4: Universal Gravitation	0	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.
Unit 8: Gravitation Lesson 5: Einstein and the Gravitational Field	0	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 8: Gravitation Lesson 6: Your Choice	0	00000
Unit 8: Gravitation Lesson 7: Unit Test	HS- PS2-1, HS-PS2-4, HS-PS4-1	00000
Unit 9: Physics and Scientific Inquiry Lesson 1: Physics Inquiry: Inductive Reasoning	0	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.
Unit 9: Physics and Scientific Inquiry Lesson 2: Physics Inquiry: Questions and Hypotheses	0	List some scientific processes and methods. Discuss the importance of the scientific method. 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. Distinguish between a hypothesis and a theory.

		Write hypotheses as if-then statements.
Unit 9: Physics and Scientific Inquiry Lesson 3: Physics Inquiry: Experimentation	0	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.
Unit 9: Physics and Scientific Inquiry Lesson 4: Your Choice	0	00000
Unit 9: Physics and Scientific Inquiry Lesson 5: Physics Inquiry: Data Collection and Analysis	0	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.
Unit 9: Physics and Scientific Inquiry Lesson 6: Physics Inquiry: Conclusions and Communicating	0	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.
Unit 9: Physics and Scientific Inquiry Lesson 7: Your Choice	0	00000
Unit 9: Physics and Scientific Inquiry Lesson 8: Unit Test	HS-ETS1-4	00000

Unit 10: Semester Review and Test Lesson 1: Semester Review	0	00000
Unit 10: Semester Review and Test Lesson 2: Your Choice	0	00000
Unit 10: Semester Review and Test Lesson 3: Your Choice	0	00000
Unit 10: Semester Review and Test Lesson 4: Semester Test	0	00000