Physics 1

Algebra-Based First Year Physics Course.

The main goal of this course is to provide students with a clear and logical presentation of the principles of physics. They will engage in the methods used by physicists to explain and predict the fundamental functions and basic concepts of the physical world both descriptively and mathematically.

The topics of study will include:

- Scientific methods of experimentation.
- Review of mathematic concepts, processes and applications.
- Analysis and application of vectors and the addition of multiple vectors.
- Analysis and application of the Newtonian Laws of Motion to include linear, free fall, two-dimensional, circular, and projectile motions.
- Conserved quantities including energy and momentum.
- Analysis of rotational and circular motion utilizing torque and angular momentum.
- Newton's Universal Law of Gravity and orbital motion.
- Simple Harmonic Motion (repetitive vibrations)

The fundamentals will be introduced through classroom discussions, lectures, guided inquiry activities and exploratory labs. There is a strong emphasis on problem solving as well as application of the principles to real world examples.

Course Information:

Frequency & Duration: Daily for 42 minutes; 6 periods per week (includes 1 lab period)

Text: *Physics: Cutnell and Johnson, 2001; Physics 5th edition: Arthur Beiser, 1992*

(Both of the listed text books are used primarily as a reference guide or supplemental materials for guided practice of prediction calculations.)

Lab materials are written by the instructor.

Content: Scientific Data **Duration:** August (3 weeks)

Essential Question:	How do scientists use a universal system of measurement units to ensure international collaboration?
Skills:	• Utilize the International System of Units to evaluate the size and scale of various objects and measurements, including distance, time, and mass. • Construct an English measurement to metric measurement conversion table. • Explain how the behavior of matter and energy follow predictable patterns that are defined by laws. • Analyze experimental data through graphical analysis.
Instructional/Engagement Activities	
Assessment:	• Utilize the International System of Units to evaluate the size and scale of various objects and measurements, including distance, time, and mass. • Students will explain how the behavior of matter and energy follow predictable patterns that are defined by laws. • Analyze experimental data through graphical analysis.
Resources / Activities:	Development of conversion table from scratch. Various assignments as independent practice. Quizzes and tests. Measurements Lab
Standards:	3.2.10.B6. PATTERNS, SCALE MODELS, CONSTANCY/ CHANGE: Explain how the behavior of matter and energy follow predictable patterns that are defined by laws.

Comments:

Content: Mathematics Review **Duration:** September (3 weeks)

Essential Question:	How do scientists use math to ensure international collaboration?
Skills:	• Utilize common mathematical processes and applications to reach a common conclusion. • Explain how the behavior of mathematical applications follow predictable patterns. • Analyze experimental data through graphical analysis. • Utilize trigonometric functions to make predictions using right triangle properties.
Instructional/Engagement Activities	
Assessment:	• Utilize common mathematics processes and applications to reach a common conclusion. • Explain how the behavior of mathematical applications follow predictable patterns. • Analyze experimental data through graphical analysis. • Utilize trigonometric functions to make predictions using right triangle properties.
Resources / Activities:	Development of mathematical processes and applications. Various assignments as independent practice. Quizzes and tests. Define trigonometric functions Lab
Standards:	3.2.10.B6. PATTERNS, SCALE MODELS, CONSTANCY/ CHANGE: Explain how the behavior of matter and energy follow predictable patterns that are defined by laws.

Comments:

Content: Vectors **Duration:** October (4 weeks)

Essential Question:	How do scientists use math to ensure international collaboration?
Skills:	• Utilize common mathematics processes and applications to reach a common conclusion. • Explain how the behavior of mathematical applications follow predictable patterns. • Define and use the properties of vectors to make predictions when combining multiple vectors. • Utilize trigonometric functions to make predictions using right triangle properties to add vectors. • Use trigonometric function to make predictions of unknown values of vectors. • Use mathematical processes to make predictions of unknown variables using vectors.
Instructional/Engagement Activities	
Assessment:	• Utilize common mathematics processes and applications to reach a common conclusion. • Explain how the behavior of mathematical applications follow predictable patterns. • Define the properties of a vector. • Use the properties of vectors to combine multiple vectors. • Combine multiple vectors to determine a resultant vector with the correct properties. • Utilize trigonometric functions to make predictions using right triangle properties. • Use the properties of vectors to combine multiple vectors that do not form a right triangle.
Resources / Activities:	Define properties of vectors and determine the process of vector addition. Web page: pHet simulation – vector addition Various assignments as independent practice. Quizzes and tests. Vector addition Lab
Standards:	3.2.10.B6. PATTERNS, SCALE MODELS, CONSTANCY/ CHANGE: Explain how the behavior of matter and energy follow predictable patterns that are defined by laws.

Content: Laws of Motion and Translation **Duration:** November–March (16 weeks)

Essential Question:	How can the motion of an object be described in a measurable and quantitative way? What causes the motion of an object to change?
Skills:	• Analyze the relationships among the net force, mass, acceleration using Newton's Second Law of Motion. • Use Newton's Third Law to explain the forces as interactions between bodies. • Use force and mass to explain the translational motion of objects. • Use Newton's Laws of Motion and to describe and predict the motion of objects including: ▪ Projectile Motion ▪ Translational Motion • Compare and contrast motions of objects using forces.
Instructional/Engagement Activities	
Assessment:	• Students will use Newton's Second Law of Motion to analyze the relationship between the net force on a body, its mass, and its acceleration. • Students will use Newton's Third Law to explain the forces as interactions between bodies. • Students will use force and mass to explain the translational motion of objects. • Students will use Newton's Laws of Motion and to describe and predict the motion of objects including: ▪ Projectile Motion ▪ Translational Motion ▪ Atwood Machines • Students will compare and contrast motions of objects using forces.
Resources / Activities:	Various assignments as independent practice. Quizzes and tests *Labs*: Match graph game Uniform Motion Lab Accelerated Motion Lab Free Fall Lab Projectile Motion Lab Force and Tension Accelerated Cart Lab Friction lab Centripetal force lab

Standards:	3.2.10.B1. Analyze the relationships among the net forces acting on a body, the **mass** of the body, and the resulting acceleration using Newton's Second Law of Motion. Use Newton's Third Law to explain forces as interactions between bodies. 3.2.P .B1. Use force and **mass** to explain translational motion or simple harmonic motion of objects. 3.2.P .B6. PATTERNS, SCALE MODELS, CONSTANCY/CHANGE Use Newton's laws of motion and gravitation to describe and predict the motion of objects ranging from atoms to the galaxies. 3.2.12.B6. CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws

Comments: This period of time is lengthy, however, the focus of this content is the heart of physics and its understanding. This area of content will be broken up into four sub-content units. Namely, linear motion (horizontal and vertical), two dimensional motion, Newton's laws, and uniform circular motion.

Content: Work, Energy, and Power **Duration:** March-April (5 weeks)

Essential Question:	How can the motion of an object be described in a measurable and quantitative way? What causes the motion of an object to change?
Skills:	• Explain how the overall energy flowing through a system remains constant. • Describe the Work-Energy Theorem • Explain the relationships between work and power. • Explain how energy flowing through an open system can be lost. • Demonstrate how the law of conservation of energy provides an alternate approach to predict and describe the motion of objects. • Describe the law of conservation of energy and use it to analyze closed frictionless systems. • Compare and contrast motions of objects using forces and conservation laws.
Instructional/Engagement Activities	
Assessment:	• Students will explain how the overall energy flowing through a system remains constant. • Students will describe the Work-Energy Theorem • Students will explain the relationships between work and power. • Students will explain how energy flowing through an open system can be lost. • Students will demonstrate how the law of conservation of energy provides an alternate approach to predict and describe the motion of objects. • Students will describe the law of conservation of energy and use it to analyze closed frictionless systems. • Students will compare and contrast motions of objects using forces and conservation laws.
Resources / Activities:	Holt Physics p. 167-199 Conservation of Energy (Ramp) Lab Energy of a cart lab Collision lab
Standards:	3.2.10.B2. Explain how the overall energy flowing through a system remains constant. Describe the work- energy theorem. Explain the relationships between work and power. 3.2.P.B2. Explain the translation and simple harmonic motion of objects using conservation of energy and conservation of momentum. 3.2.12.B2. Explain how energy flowing through an open **system** can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternate approaches to predict and describe the motion of objects. 3.2.C.B3. Describe the law of conservation of energy. 3.2.12.B6.

Comments: