Physics Honors

Curriculum Guide

Dunmore School District

Dunmore, PA

Physics Honors

Prerequisite:

- Successful completion of Chemistry Honors, or Chemistry Academic, or Environmental Science

Physics Honors is an algebra-based physics course intended to introduce students to general physical science concepts. Assessment is generally limited to motion in one dimension, forces on macroscopic objects in simplified situations, mechanical forms of energy, collisions involving only two objects, uniform rotational kinematics, constant torque and equilibrium situations, wave pulses and standing waves, and direct current circuits with resistors only.

Dunmore School District
Curriculum Guide

Year-at-a-glance

Subject: Physics Honors	**Grade Level: 12**	**Date Completed: 1/23/2018**

1st Quarter

Topic	Resources	Standards
The Nature of Science, Scientific Tools and Skills	*Physics* Chapter 01	
Motion: Linear Kinematics	*Physics* Chapter 02	3.4.7.C, 3.4.12.C

2nd Quarter

Topic	Resources	Standards
Forces: Dynamics	*Physics* Chapter 04	3.4.10.C, 3.4.12.C
Energy: Work and Conservation of Energy	*Physics* Chapter 05	3.4.10.B, 3.4.10.C

3rd Quarter

Topic	Resources	Standards
Momentum and Collisions	*Physics* Chapter 07	3.4.10.B
Torque, Rotation, Circular Motion	*Physics* Chapters 05, 08	3.4.10.C, 3.4.12.C

4th Quarter

Topic	Resources	Standards
Periodic Motion and Waves	*Physics* Chapters 11,12	3.4.10.C, 3.4.12.C
Introduction to Electrical Circuits	*Physics* Chapters 16, 18,19	3.4.10.B, 3.4.10.C
Review and Final Exam		

General Topic	Anchor Descriptor PA Academic and Core Standards	Eligible Content, Essential Knowledge, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Translational Kinematics	**PA Academic Standards: Science** 3.4.7.C Describe the motion of an object based on its position, direction and speed. 3.4.12.C Analyze the principles of translational motion, velocity and acceleration as they relate to free fall and projectile motion. **PA Core Standards: Reading for Science and Technical Subjects, 6-12** 3.5 Reading Informational Text Students read, understand, and respond to informational text- with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence. **PA Core Standards: Writing for Science and Technical Subjects, 6-12** 3.6 Writing Students write for different purposes and audiences. Students write clear and focused	**Essential Knowledge/Skills:** **Vocabulary:** Position Displacement Distance Speed Velocity Acceleration Free Fall	**Approved textbook** *Physics* Chapter 02 **Constant Velocity Lab** **Inclined Plane Lab** **Egg Drop Part 1**	**Teacher prepared tests, quizzes, etc.** **Lab Reports and Worksheets** **Homework Assignments** **Online Resources (Optional)**	**30**

	text to convey a well-defined perspective and appropriate content.				

General Topic	Anchor Descriptor PA Academic and Core Standards	Eligible Content, Essential Knowledge, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Force Model Interactions between any two objects can cause changes in one or both of them.	**PA Academic Standards: Science** 3.4.10.C Know Newton's laws of motion (including inertia, action and reaction) and gravity and apply them to solve problems related to forces and mass. 3.4.12.C Describe inertia, motion, equilibrium, and action/reaction concepts through words, models and mathematical symbols. **PA Core Standards: Reading for Science and Technical Subjects, 6-12** 3.5 Reading Informational Text Students read, understand, and respond to informational text- with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence. **PA Core Standards: Writing for Science and Technical Subjects, 6-12** 3.6 Writing	**Essential Knowledge/Skills:** **The motion of an object is determined by the interactions between the object and any other objects in the system.** Construct an explanation for the motion of an object based on the interactions that occur between the object and other objects in the system. **Newton's Second Law provides a mathematical model that describes the relationship between the net force on an object, the mass of the object, and the acceleration of the object.** Plan and carry out investigations to show how the mathematical relationship of Newton's Second Law of motion	**Approved textbook** *Physics* Chapter 04 **Atwood Lab** **Friction Lab**	**Teacher prepared tests, quizzes, etc.** **Series available assessments online. (Optional)**	**30**

	Students write for different purposes and audiences. Students write clear and focused text to convey a well-defined perspective and appropriate content.	accurately predicts the relationship between the net force on objects, their mass, and the resulting change in motion. **Newton's Law of Universal Gravitation provides a mathematical model that describes and predicts the effects of gravitational forces acting between masses.** Use mathematical representations of Newton's Law of Gravitation to describe and predict the gravitational forces between objects. **Vocabulary:** Force System Velocity Acceleration Mass Net Force Gravitational forces Mathematical representation Newton's Law of Gravitation			

General Topic	Anchor Descriptor PA Academic and Core Standards	Eligible Content, Essential Knowledge, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Energy Model Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.	**PA Academic Standards: Science** 3.4.10.B Use Knowledge of conservation of energy and momentum to explain common phenomena 3.4.10.C Determine the efficiency of mechanical systems by applying mathematical formulas **PA Core Standards: Reading for Science and Technical Subjects, 6-12** 3.5 Reading Informational Text Students read, understand, and respond to informational text- with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence. **PA Core Standards: Writing for Science and Technical Subjects, 6-12** 3.6 Writing	**Essential Knowledge/Skills:** **The energy an object has within a system depends on the object's motion and interactions with other objects in that system.** Construct an explanation for the energy of an object has in a system based on the object's motion and the object's interaction with other objects in the system. **Any change in an object's energy is the result of interactions with other objects in a system or a transfer of energy between systems, changing in the total energy of the systems involved.** Develop and use a model to explain how an object's energy is transferred or transformed as objects	**Approved textbook** *Physics* Chapter 05 **Kinetic Energy, Potential Energy Lab** **Hooke's Law Lab** **Conservation of Energy Lab**	**Teacher prepared tests, quizzes, etc.** **Series available assessments online. (Optional)**	**30**

	Students write for different purposes and audiences. Students write clear and focused text to convey a well-defined perspective and appropriate content.	interact within a system. **Any energy gain or loss in a system will result in a corresponding energy loss or gain in another system.** Identify problems and suggest design solutions to optimize the energy transfer between objects or systems of objects. **Mathematical expressions for the kinetic and potential energy of objects allow for the concept of the conservation of energy to be used to describe and predict the behavior of objects in a system.** Construct mathematical models to show how energy is transformed and transferred within a system. **Vocabulary:** Kinetic energy Mechanical energy Potential energy Energy transfer			

		System Conservation of energy			

General Topic	Anchor Descriptor PA Academic and Core Standards	Eligible Content, Essential Knowledge, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Momentum Model Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.	**PA Academic Standards: Science** 3.4.10.B Use knowledge of conservation of energy and momentum to explain common phenomena **PA Core Standards: Reading for Science and Technical Subjects, 6-12** 3.5 Reading Informational Text Students read, understand, and respond to informational text- with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence. **PA Core Standards: Writing for Science and Technical Subjects, 6-12** 3.6 Writing Students write for different purposes and audiences. Students write clear and focused text to convey a well-defined perspective and appropriate content.	**Essential Knowledge/Skills:** **The transfer of energy through interactions of objects or systems of objects cause a change in the momentum of objects or systems of objects.** Generate and analyze data to support the claim that the total momentum of a closed system of objects is conserved. **For any system of interacting objects, the total momentum within the system changes due to transfer of momentum or energy into or out of the system.** Use mathematical representations to support the claim that the total momentum of a system of	**Approved textbook** *Physics* Chapter 07 **Egg Drop Part 2** **Collision and Impulse Lab** **Conservation of Momentum Lab**	**Teacher prepared tests, quizzes, etc.** **Online Resources (optional)**	**30**

		objects is conserved through the transfer of momentum between objects when there is no net force on the system. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. **Vocabulary:** Elastic collision Impulse Inelastic collision Momentum System			

General Topic	Anchor Descriptor PA Academic and Core Standards	Eligible Content, Essential Knowledge, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Rotational Mechanics	**PA Academic Standards: Science** 3.4.10.C Identify elements of simple machines in compound machines 3.4.12.C Analyze the principles of rotational motion to solve problems relating to angular momentum and torque. Interpret a model that illustrates circular motion and acceleration. Propose modifications to specific mechanical power systems that will improve their efficiency. **PA Core Standards: Reading for Science and Technical Subjects, 6-12** 3.5 Reading Informational Text Students read, understand, and respond to informational text- with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence. **PA Core Standards: Writing for Science and Technical Subjects**,	**Essential Knowledge/Skills:** **The basic laws of mechanics have an extension when equivalent principles are applied to rotation. Actual objects have dimensions and they require the expansion of the point particle model to consider the possibility of different points on an object having different states of motion and/or different velocities.** Apply scientific and engineering ideas to design, evaluate, and refine a device that reduces the force required to perform a mechanical task. **Vocabulary:** Rotational Displacement Rotational Velocity Rotational Acceleration Rotational Inertia Torque Mechanical Advantage Simple Machine Centripetal	**Approved textbook** *Physics* Chapters 05, 08 **Torque Lab** **Equilibrium Lab**	**Teacher prepared tests, quizzes, etc.** **Series available assessments online. (Optional)**	**20**

	6-12 3.6 Writing Students write for different purposes and audiences. Students write clear and focused text to convey a well-defined perspective and appropriate content.				

General Topic	Anchor Descriptor PA Academic and Core Standards	Eligible Content, Essential Knowledge, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Periodic Motion and Waves Waves are a repeating pattern of motion that transfers energy from place to place without overall displacement of matter.	**PA Academic Standards: Science** 3.4.10.C Describe sound effects and light effects. 3.4.12.C Evaluate wave properties of frequency, wavelength and speed as applied to sound and light through different media. **PA Core Standards: Reading for Science and Technical Subjects, 6-12** 3.5 Reading Informational Text Students read, understand, and respond to informational text- with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence. **PA Core Standards: Writing for Science and Technical Subjects, 6-12** 3.6 Writing Students write for different purposes and audiences. Students write clear and focused text to convey a well-defined perspective and appropriate	**Essential Knowledge/Skills:** **The speed of a wave in any medium is the product of the wave's frequency and wavelength.** Analyze and interpret data to support the claim that the speed of a wave in a medium is the product of the wave's frequency and the wave's wavelength. **Wave transmission, reflection, refraction, and/or absorption occurs when waves travel between two different mediums.** Construct explanations for the transmission, reflection, refraction and/or absorption of waves as they pass from one medium to another medium. **Wave transmission, reflection, refraction, and/or**	**Approved textbook** *Physics* Chapters 11,12 **Waves Lab**	**Teacher prepared tests, quizzes, etc.** **Series available assessments online. (Optional)**	**20**

	content.	**absorption occurs when waves travel between two different mediums.** Develop a claim and reasoning supported by evidence that describes the behavior of a wave as it passes from one medium to another medium. **Objects have natural frequencies and when they are forced to vibrate at a natural frequency they resonate with large vibrations.** Construct an explanation for the application of resonance in everyday phenomena (e.g., waves in a stretched string, speech, the design of all musical instruments). **Vocabulary:** Period Frequency Wave Wavelength Medium			

		Absorption Reflection Refraction Transmission Resonance Constructive interference Destructive interference Encode Superposition Electromagnetic wave Particle model Photon Wave model Pulses			

General Topic	Anchor Descriptor PA Academic and Core Standards	Eligible Content, Essential Knowledge, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Electricity and Magnetism (Optional)	**PA Academic Standards: Science** 3.4.10.B Explain resistance, current and electro-motive force (Ohm's Law). 3.4.10.C Identify the relationship of electricity and magnetism as two aspects of a single electromagnetic force. **PA Core Standards: Reading for Science and Technical Subjects, 6-12** 3.5 Reading Informational Text Students read, understand, and respond to informational text- with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence. **PA Core Standards: Writing for Science and Technical Subjects, 6-12** 3.6 Writing Students write for different purposes and audiences. Students write clear and focused text to convey a well-defined perspective and appropriate content.	**Essential Knowledge/Skills:** **Coulomb's Law provides a mathematical model that describes and predicts the effect of electrostatic forces acting between electrically charged objects** Use mathematical representations of Coulomb's Law to describe and predict the electrostatic forces between objects. **Vocabulary:** Electrostatic force Coulomb's Law Ohm's Law Electro-motive force Resistance Current Magnetic Induction Electromagnetic Force	**Approved textbook** *Physics* Chapters 16, 18,19 **Coulomb's Law Lab** **Ohm's Law Lab**	**Teacher prepared tests, quizzes, etc.** **Series available assessments online. (Optional)**	**10**

General Topic	Anchor Descriptor PA Academic and Core Standards	Eligible Content, Essential Knowledge, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Review and Final Exam					**10**

PA Core Standards:

Reading for Science and Technical Subjects, 6-12

3.5 Reading Informational Text
Students read, understand, and respond to informational text-with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence.

Grades 9-10

CC.3.5.9-10.A.
Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

CC.3.5.9-10.B.
Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

CC.3.5.9-10.C.
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CC.3.5.9-10.D.
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

CC.3.5.9-10.E.
Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

CC.3.5.9-10.F.
Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

CC.3.5.9-10.G.
Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

CC.3.5.9-10.H.
Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

CC.3.5.9-10.I.
Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

CC.3.5.9-10.J.
By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Grades 11-12

CC.3.5.11-12.A.
Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

CC.3.5.11-12.B.
Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

CC.3.5.11-12.C.
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

CC.3.5.11-12.D.
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

CC.3.5.11-12.E.
Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

CC.3.5.11-12.F.
Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

CC.3.5.11-12.G.
Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

CC.3.5.11-12.H.
Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

CC.3.5.11-12.I.
Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

CC.3.5.11-12.J.
By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently.

PA Core Standards:
Writing for Science and Technical Subjects, 6-12

3.6 Writing
Students write for different purposes and audiences. Students write clear and focused text to convey a well-defined perspective and appropriate content.

Grades 9-10

CC.3.6.9-10.A.
Write arguments focused on discipline-specific content.

- Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
- Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.
- Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- Provide a concluding statement or section that follows from or supports the argument presented.

CC.3.6.9-10B. *
Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.
- Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
- Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

- Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

CC.3.6.9-10.C.
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CC.3.6.9-10.D.
Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience

CC.3.6.9-10.E.
Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

CC.3.6.9-10.F.
Conduct short as well as more sustained research projects to answer a question (including a selfgenerated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

CC.3.6.9-10.G.
Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

CC.3.6.9-10.H.
Draw evidence from informational texts to support analysis, reflection, and research.

CC.3.6.9-10.I.
Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Grades 11-12

CC.3.6.11-12.A.
Write arguments focused on discipline-specific content.

- Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.
- Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- Provide a concluding statement or section that follows from or supports the argument presented.

CC.3.6.11-12. B *Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
- Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic)

CC.3.6.11-12.C.
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CC.3.6.11-12.D.
Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

CC.3.6.11-12.E.
Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

CC.3.6.11-12.F.
Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

CC.3.6.11-12.G.
Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

CC.3.6.11-12.H.
Draw evidence from informational texts to support analysis, reflection, and research.

CC.3.6.11-12.I.
Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.