A Correlation of

Pearson Physics
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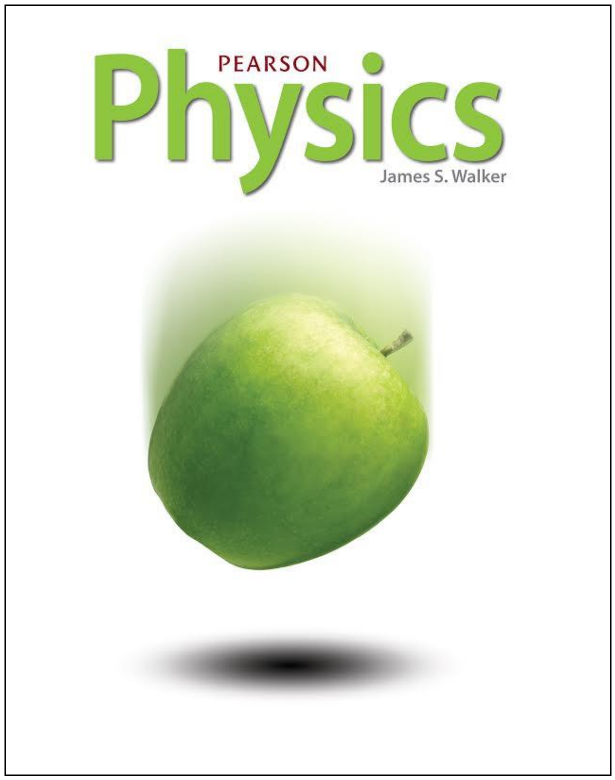

to the

Indiana Academic Standards for Science
Physics I and Physics II

Pearson

Introduction

This document demonstrates the alignment of ***Pearson Physics*** to the Indiana Academic Standards for Science. References are to the Student Edition and Teacher's Edition.

Pearson Physics offers a new path to mastery— a "concepts first" approach that supports a superior, step-by-step problem solving process.

Pearson Physics is the only high school program that blends conceptual development and quantitative problem solving. The conversational and engaging writing style, numerous and varied examples, annotated art program, and dual emphasis on concepts and math—together with MasteringPhysics®— deliver a superior program.

Pearson Physics Key Features:
Four distinct example types and their related Practice Problems build problem-solving skills for both math-based and conceptual-based problems.

- **Conceptual Examples** reinforce basic concepts and make connections to numerical calculations
- **Quick Examples** present short, simple calculations to aid in understanding a new equation
- **Active Examples** bridge the gap between examples and homework problems
- **Guided Examples** use detailed strategies and solutions to develop problem-solving skills and deepen student understanding of concepts

✓ The chapter-opening **Big Idea** statement outlines the chapter's overarching theme.
✓ The chapter-opening **Inquiry Lab** provides a simple exploratory activity that stimulates interest and provides a glimpse of the chapter concepts.
✓ The end-of-chapter **Physics Lab** provides an in-depth, full-page traditional lab activity that applies the concepts learned.

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Indiana Academic Standards for Science Physics I and Physics II	**Pearson Physics ©2014**
Science and Engineering Process Standards (SEPS)	
The Science and Engineering Process Standards are the processes and skills that students are expected to learn and be able to do within the context of the science content. The separation of the Science and Engineering Process Standards from the Content Standards is intentional; the separation of the standards explicitly shows that what students are doing while learning science is extremely important. The Process Standards reflect the way in which students are learning and doing science and are designed to work in tandem with the science content, resulting in robust instructional practice.	
SEPS.1 Posing questions (for science) and defining problems (for engineering) A practice of science is posing and refining questions that lead to descriptions and explanations of how the natural and designed world(s) work and these questions can be scientifically tested. Engineering questions clarify problems to determine criteria for possible solutions and identify constraints to solve problems about the designed world.	**SE/TE:** Inquiry Lab: 113, 151, 189, 267, 307, 385, 597 Physics Lab: 103, 258, 555 Physics & You: 35, 102, 141, 177, 217, 333, 520, 587, 665, 807 **TE Only:** Real World: 11, 390 Science & Engineering Practices: 314, 354, 426
SEPS.2 Developing and using models and tools A practice of both science and engineering is to use and construct conceptual models that illustrate ideas and explanations. Models are used to develop questions, predictions and explanations; analyze and identify flaws in systems; build and revise scientific explanations and proposed engineered systems; and communicate ideas. Measurements and observations are used to revise and improve models and designs. Models include, but are not limited to: diagrams, drawings, physical replicas, mathematical representations, analogies, and other technological models.	**SE/TE:** Inquiry Lab: 267, 597, 675, 745, 783, 817, 851, 883, 911, 949 Physics Lab: 36, 103, 142, 178, 218, 298, 444, 521, 627, 696, 842, 942, 969 Physics & You: 257 **TE Only:** Differentiated Instruction: 175 Science & Engineering Practices: 354, 752, 762

Indiana Academic Standards for Science Physics I and Physics II	**Pearson Physics ©2014**
Another practice of both science and engineering is to identify and correctly use tools to construct, obtain, and evaluate questions and problems. Utilize appropriate tools while identifying their limitations. Tools include, but are not limited to: pencil and paper, models, ruler, a protractor, a calculator, laboratory equipment, safety gear, a spreadsheet, experiment data collection software, and other technological tools.	**SE/TE:** Inquiry Lab: 73, 151, 189, 267, 307, 597 Physics Lab: 36, 64, 103, 142, 178, 218, 258, 298, 334, 376, 408, 444, 484, 521, 555, 588, 627, 666, 696, 736, 773, 808, 874, 904, 942 **TE Only:** Science & Engineering Practices: 55, 752, 762
SEPS.3 Constructing and performing investigations Scientists and engineers are constructing and performing investigations in the field or laboratory, working collaboratively as well as individually. Researching analogous problems in order to gain insight into possible solutions allows them to make conjectures about the form and meaning of the solution. A plan to a solution pathway is developed prior to constructing and performing investigations. Constructing investigations systematically encompasses identified variables and parameters generating quality data. While performing, scientists and engineers monitor and record progress. After performing, they evaluate to make changes to modify and repeat the investigation if necessary.	**SE/TE:** Inquiry Lab: 73, 151, 189, 229, 307, 817 Physics Lab: 36, 64, 103, 142, 178, 218, 258, 298, 334, 376, 408, 444, 484, 521, 555, 588, 627, 666, 696, 736, 773, 808, 874, 904, 942 **TE Only:** Science & Engineering Practices: 354, 441, 679, 752, 762

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SEPS.4 Analyzing and interpreting data Investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists and engineers use a range of tools to identify the significant features in the data. They identify sources of error in the investigations and calculate the degree of certainty in the results. Advances in science and engineering makes analysis of proposed solutions more efficient and effective. They analyze their results by continually asking themselves questions; possible questions may be, but are not limited to: "Does this make sense?" "Could my results be duplicated?" and/or "Does the design solve the problem with the given constraints?"	**SE/TE:** Inquiry Lab: 73, 151, 189, 229, 307, 817 Physics Lab: 36, 64, 103, 142, 178, 218, 258, 298, 334, 376, 408, 444, 484, 521, 555, 588, 627, 666, 696, 736, 773, 808, 874, 904, 942 **TE Only:** Science & Engineering Practices: 55, 354, 679, 752, 762
SEPS.5 Using mathematics and computational thinking In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; solving equations exactly or approximately; and recognizing, expressing, and applying quantitative relationships. Mathematical and computational approaches enable scientists and engineers to predict the behavior of systems and test the validity of such predictions. Scientists and engineers understand how mathematical ideas interconnect and build on one another to produce a coherent whole.	**SE/TE:** Inquiry Lab: 73 Physics Lab: 36, 64, 103, 142, 178, 218, 258, 298, 334, 376, 408, 444, 484, 521, 555, 588, 627, 666, 696, 736, 773, 808, 874, 904, 942 Physics & You: 257

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SEPS.6 Constructing explanations (for science) and designing solutions (for engineering) Scientists and engineers use their results from the investigation in constructing descriptions and explanations, citing the interpretation of data, connecting the investigation to how the natural and designed world(s) work. They construct or design logical coherent explanations or solutions of phenomena that incorporate their understanding of science and/or engineering or a model that represents it, and are consistent with the available evidence.	**SE/TE:** Inquiry Lab: 73, 113, 307, 343, 453, 529, 637, 783, 817, 851, 883, 911, 989 Physics Lab: 36, 64, 103, 142, 178, 218, 258, 298, 334, 376, 408, 444, 484, 521, 555, 588, 627, 666, 696, 736, 773, 808, 874, 904, 942 Physics & You: 63 **TE Only:** Science & Engineering Practices: 651
SEPS.7 Engaging in argument from evidence Scientists and engineers use reasoning and argument based on evidence to identify the best explanation for a natural phenomenon or the best solution to a design problem. Scientists and engineers use argumentation, the process by which evidence-based conclusions and solutions are reached, to listen to, compare, and evaluate competing ideas and methods based on merits. Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building data models, and using evidence to evaluate claims.	**SE/TE:** Inquiry Lab: 415 Physics & You: 141, 217, 297, 333, 375, 520, 554, 587, 735, 772, 968 **TE Only:** Scientific Literacy-Writing: 564A Scientific Literacy-STEM: 414A Teach-Writing: 910B

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SEPS.8 Obtaining, evaluating, and communicating information Scientists and engineers need to be communicating clearly and articulating the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations, as well as, orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs.	**SE/TE:** Assessment: 148 (#100-101), 186 (#121-123), 264 (#128), 412 (#90), 490 (#112-113), 526 (#109-110), 561 (#117), 814 (#100-101) Physics & You: 63, 102, 333, 520, 625, 807 **TE Only:** Scientific Literacy-Writing: 72A Scientific Literacy-STEM: 72A, 112A, 150A, 266A, 384A, 492A, 528A, 596A, 636A, 704A, 744A, 816A, 882A Teach-STEM: 2B

Indiana Academic Standards for Science Physics I and Physics II	**Pearson Physics ©2014**
Literacy in Science/Technical Subjects: Grades 11-12 (11-12 LST)	
The Indiana Academic Standards for Content Area Literacy (Science/Technical Subjects) indicate ways in which educators incorporate literacy skills into science at the 6-12 grade levels.	
LST.1: LEARNING OUTCOME FOR LITERACY IN SCIENCE/TECHNICAL SUBJECTS Read and comprehend science and technical texts independently and proficiently and write effectively for a variety of discipline-specific tasks, purposes, and audiences	
11-12.LST.1.1: Read and comprehend science and technical texts within a range of complexity appropriate for grades 11-CCR independently and proficiently by the end of grade 12.	Students are required to demonstrate reading comprehension of the text by completing Checking Concepts Exercise in each LessonCheck and Conceptual Questions in each end-of-chapter Assessment. The Assessment also contains a Read, Reason, and Respond passage and associated questions on a topic relevant to the chapter. For representative pages, please see **SE/TE:** 357, 374, 378, 382 **TE Only:** Scientific Literacy-Reading: 112A, 150A, 228A, 306A, 342A, 452A, 596A, 636A, 674A, 782A, 816A, 850A, 882A Teach-Reading: 266B, 384B, 414B, 948B
11-12.LST.1.2: Write routinely over a variety of time frames for a range of discipline-specific tasks, purposes, and audiences.	“Writing about Science” exercises in the chapter assessments and “Take It Further” activities on the “Physics & You” pages ask students to write brief explanations or extended reports on a variety of scientific topics and phenomena. **SE/TE:** Assessment: 148 (#100-101), 186 (#121-123), 264 (#128), 412 (#90), 490 (#112-113), 526 (#109-110), 561 (#117), 814 (#100-101) Physics & You: 63, 102, 177, 297, 333, 443, 520, 587, 626, 665, 695, 735, 772, 807, 873, 941 **TE Only:** Scientific Literacy-Writing: 73A, 188A, 266A, 384A, 414A, 492A, 782A, 882A

Indiana Academic Standards for Science Physics I and Physics II	Pearson Physics ©2014
LST.2: KEY IDEAS AND TEXTUAL SUPPORT (READING) Extract and construct meaning from science and technical texts using a variety of comprehension skills	
11-12.LST.2.1: 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.	"Writing about Science" exercises in the chapter assessments and "Take It Further" activities on the "Physics & You" pages require students to engage in outside research and cite textual evidence from science and technical texts. **SE/TE:** Assessment: 148 (#100-101), 186 (#121-123), 264 (#128), 412 (#90), 490 (#112-113), 526 (#109-110), 561 (#117), 814 (#100-101) Physics & You: 141, 217, 297, 333, 375, 520, 554, 587, 735, 772, 968 **TE Only:** Scientific Literacy-Reading: 112A, 150A, 228A, 306A, 342A, 452A, 596A, 636A, 674A, 782A, 816A, 850A, 882A Teach-Reading: 266B, 384B, 414B, 948B
11-12.LST.2.2: 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.	Questions within and at the end of each chapter require the student to demonstrate conceptual understanding of the ideas presented in each text section. For representative examples, see: **SE/TE:** Lesson Check: 81 (#13-14, 16), 91 (#37), 96 (#46), 101 (#55), 160 (#11-12), 169 (#26), 349 (#13), 374 (#49), 553 (#35, 37), 646 (#11), 717 (#11-12) Assessment: 105 (#64-67), 107 (#96, 107), 180 (#49-50), 183 (#94-95), 379 (#84-86), 380 (#100), 557 (#46) **TE Only:** Scientific Literacy-Writing: 72A Scientific Literacy-STEM: 72A, 112A, 150A, 266A, 384A, 492A, 528A, 596A, 636A, 704A, 744A, 816A, 882A Teach-STEM: 2B Scientific Literacy-Reading: 112A, 150A, 228A, 306A, 342A, 452A, 596A, 636A, 674A, 782A, 816A, 850A, 882A Teach-Reading: 266B, 384B, 414B, 948B

Indiana Academic Standards for Science Physics I and Physics II	Pearson Physics ©2014
11-12.LST.2.3: 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.	**SE/TE:** Inquiry Lab: 73, 151, 189, 229, 307, 817 Physics Lab: 36, 64, 103, 142, 178, 218, 258, 298, 334, 376, 408, 444, 484, 521, 555, 588, 627, 666, 696, 736, 773, 808, 874, 904, 942
LST.3: STRUCTURAL ELEMENTS AND ORGANIZATION (READING) Build understanding of science and technical texts, using knowledge of structural organization and author's purpose and message	
11-12.LST.3.1: 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.	Symbols, key terms, and other domain-specific words and phrases are used throughout the lessons and exercises. For representative examples, see: **SE/TE:** 8-9, 15, 76, 127, 152, 155, 158, 161, 167, 171, 343-345, 351, 358, 367, 537, 637, 641, 654, 676-677, 683, 706, 718, 719
11-12.LST.3.2: Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.	Each chapter of Pearson Physics opens with a Big Idea that motivates the study of the chapter's topic, and Key Questions are posed throughout the lessons to highlight important concepts. The Big Idea and Key Concepts are revisited in LessonCheck exercises within the chapter. See the progressions in Chapters 5 and 17 for examples: **SE/TE:** 150, 152, 155, 160, 596, 597, 601, 612, 618
11-12.LST.3.3: 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.	Connecting Ideas boxes in the margins throughout the text relate the explanations at hand to previous concepts or to upcoming lessons to help students put information in context. For representative examples, see: **SE/TE:** 132, 152, 235, 343, 385, 533, 473, 679, 766, 916 A statement at the beginning of each end-of-chapter Physics Lab connects the purpose of the experiment to the concepts discussed in the chapter. For representative examples, see: **SE/TE:** 36, 64, 103, 218, 298, 555

Indiana Academic Standards for Science Physics I and Physics II	**Pearson Physics ©2014**
LST.4: SYNTHESIS AND CONNECTION OF IDEAS (READING) Build understanding of science and technical texts by synthesizing and connecting ideas and evaluating specific claims	
11-12.LST.4.1: 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.	Graphics, graphs, charts and tables, photographs and drawings appear throughout the text as visual cues to support the learning and problem-solving process. The online MasteringPhysics platform **TE Only:** Scientific Literacy-Reading: 882A
11-12.LST.4.2: 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.	**SE/TE:** Inquiry Lab: 73, 151, 189, 229, 307, 817 Physics Lab: 36, 64, 103, 142, 178, 218, 258, 298, 334, 376, 408, 444, 484, 521, 555, 588, 627, 666, 696, 736, 773, 808, 874, 904, 942 **TE Only:** Science & Engineering Practices: 55, 354, 679, 752, 762
11-12.LST.4.3: 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.	**SE/TE:** Physics & You: 141, 217, 297, 333, 375, 520, 554, 587, 735, 772, 968 Inquiry Lab: 73, 151, 189, 229, 307, 817 Physics Lab: 36, 64, 103, 142, 178, 218, 258, 298, 334, 376, 408, 444, 484, 521, 555, 588, 627, 666, 696, 736, 773, 808, 874, 904, 942 **TE Only:** Science & Engineering Practices: 55, 354, 679, 752, 762
LST.5: WRITING GENRES (WRITING) Write for different purposes and to specific audiences or people	
11-12.LST.5.1: Write arguments focused on discipline-specific content.	**SE/TE:** Inquiry Lab: 415 Physics & You: 141, 217, 297, 333, 375, 520, 554, 587, 735, 772, 968 **TE Only:** Scientific Literacy-Writing: 564A Scientific Literacy-STEM: 414A Teach-Writing: 188B, 910B

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11-12.LST.5.2: Write informative texts, including scientific procedures/experiments or technical processes that include precise descriptions and conclusions drawn from data and research.	**SE/TE:** Inquiry Lab: 73, 113, 307, 343, 453, 529, 637, 783, 817, 851, 883, 911, 989 Physics Lab: 36, 64, 103, 142, 178, 218, 258, 298, 334, 376, 408, 444, 484, 521, 555, 588, 627, 666, 696, 736, 773, 808, 874, 904, 942 Physics & You: 63 **TE Only:** Science & Engineering Practices: 651
LST.6: THE WRITING PROCESS (WRITING) Produce coherent and legible documents by planning, drafting, revising, editing, and collaborating with others	
11-12.LST.6.1: Plan and develop; draft; revise using appropriate reference materials; rewrite; try a new approach, focusing on addressing what is most significant for a specific purpose and audience; and edit to produce and strengthen writing that is clear and coherent.	Opportunities to meet this standard occur as students engage in the "Writing About Science" exercises and "Physics & You/Take It Further" activities cited for standards 11-12.LST.1.2, 11-12.LST.5.1, and 11-12.LST.5.2 above.
11-12.LST.6.2: Use technology to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.	Opportunities to meet this standard occur as students engage in the "Writing About Science" exercises and "Physics & You/Take It Further" activities cited for standards 11-12.LST.1.2, 11-12.LST.5.1, and 11-12.LST.5.2 above.

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LST.7: THE RESEARCH PROCESS (WRITING) Build knowledge about the research process and the topic under study by conducting short or more sustained research	
11-12.LST.7.1: Conduct short as well as more sustained research assignments and tasks to answer a question (including a self-generated question), test a hypothesis, or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	Students have multiple opportunities to engage in research tasks of varying depth via the “Writing in Science” Assessment exercises and “Physics & You/Take it Further” activities at the end of each chapter. **SE/TE:** Assessment: 148 (#100-101), 186 (#121-123), 264 (#128), 412 (#90), 490 (#112-113), 526 (#109-110), 561 (#117), 814 (#100-101) Physics & You: 141, 217, 297, 333, 375, 520, 554, 587, 735, 772, 968 **TE Only:** Scientific Literacy-Reading: 112A, 150A, 228A, 306A, 342A, 452A, 596A, 636A, 674A, 782A, 816A, 850A, 882A Teach-Reading: 266B, 384B, 414B, 948B
11-12.LST.7.2: Gather relevant information from multiple types of authoritative sources, using advanced searches effectively; annotate sources; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; synthesize and 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 (e.g., *APA or CSE*).	Opportunities to meet this standard occur in the research assignments cited above for standard 11-12.LST.7.1.
11-12.LST.7.3: Draw evidence from informational texts to support analysis, reflection, and research.	Opportunities to meet this standard occur in the research assignments cited above for standard 11-12.LST.7.1.

Indiana Academic Standards for Science - Physics I	Pearson Physics ©2014
Content Standards - Indiana Physics I	
For the high school science courses, the content standards are organized around the core ideas in each particular course. Within each core idea are indicators which serve as the more detailed expectations within each of the content areas.	
Standard 1: Constant Velocity	
PI.1.1 Develop graphical, mathematical, and pictorial representations (e.g. a motion map) that describe the relationship between the clock reading (time) and position of an object moving at a uniform rate and apply those representations to qualitatively and quantitatively describe the motion of an object.	**SE/TE:** 54-56, 59-60 Practice Problems: 56 (#26), 60 (#37) Lesson Check: 57 (#29) Assessment: 68 (#82-83), 69 (#86, 110) Physics Lab: 64
PI.1.2 Describe the slope of the graphical representation of position vs. clock reading (time) in terms of the velocity of the object.	**SE/TE:** 55-56 Lesson Check: 57 (#32-34), 62 (#41)
PI.1.3 Rank the velocities of objects in a system based on the slope of a position vs. clock reading (time) graphical representation. Recognize that the magnitude of the slope representing a negative velocity can be greater than the magnitude of the slope representing a positive velocity.	**SE/TE:** Lesson Check: 57 (#30-31) Assessment: 68 (#78-80, 84)
PI.1.4 Describe the differences between the terms “distance,” “displacement,” “speed,” “velocity,” “average speed,” and “average velocity” and be able to calculate any of those values given an object moving at a single constant velocity or with different constant velocities over a given time interval.	**SE/TE:** 43-47, 48-50, 50-53 Practice Problems: 49 (#10-13) Lesson Check: 47 (#7-9), 53 (#22, 24-25) Assessment: 66 (#51-52, 57-59), 67 (#66-68, 70-73),68 (#81), 69 (#86-87, 102-105, 107, 109), 70(#112-113, 115-116, 119-122)

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Standard 2: Constant Acceleration	
PI.2.1 Develop graphical, mathematical, and pictorial representations (e.g. a motion map) that describe the relationship between the clock reading (time) and velocity of an object moving at a uniformly changing rate and apply those representations to qualitatively and quantitatively describe the motion of an object.	**SE/TE:** 56 Lesson Check: 57 (#30-31) Assessment: 68 (#80-81, 84)
PI.2.2 Describe the slope of the graphical representation of velocity vs. clock reading (time) in terms of the acceleration of the object.	**SE/TE:** 76-77
PI.2.3 Rank the accelerations of objects in a system based on the slope of a velocity vs. clock reading (time) graphical representation. Recognize that the magnitude of the slope representing a negative acceleration can be greater than the magnitude of the slope representing a positive acceleration.	**SE/TE:** 77-79, 82-83 Practice Problems: 79 (#7) Lesson Check: 81 (#14-15, 18), 83 (#22) Assessment: 105 (#68), 106 (#82), 107 (#94-97) Physics Lab: 103
PI.2.4 Given a graphical representation of the position, velocity, or acceleration vs. clock reading (time), be able to identify or sketch the shape of the other two graphs.	**SE/TE:** 92-94, 95 Practice Problems: 96 (#46, 50) Lesson Check: 91 (#41) Assessment: 105 (#69, 75-76) Physics Lab: 103
PI.2.5 Qualitatively and quantitatively apply the models of constant velocity and constant acceleration to determine the position or velocity of an object moving in free fall near the surface of the Earth.	**SE/TE:** 97-101 Lesson Check: 101 (#59, 60-62) Assessment: 107 (#105-112)
Standard 3: Forces	
PI.3.1 Understand Newton's first law of motion and describe the motion of an object in the absence of a net external force according to Newton's first law.	**SE/TE:** 151-152

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PI.3.2 Develop graphical and mathematical representations that describe the relationship among the inertial mass of an object, the total force applied, and the acceleration of an object in one dimension where one or more forces is applied to the object and apply those representations to qualitatively and quantitatively describe how a net external force changes the motion of an object.	**SE/TE:** 152-155, 156-157 Practice Problems: 155 (#1-2), 158 (#3-5) Lesson Check: 160 (#10, 12, 16-18) Assessment: 180 (#53-56), 181 (#58-60)
PI.3.3 Construct force diagrams using appropriately labeled vectors with magnitude, direction, and units to qualitatively and quantitatively analyze a scenario and make claims (i.e. develop arguments, justify assertions) about forces exerted on an object by other objects for different types of forces or components of forces.	**SE/TE:** 161-162, 163, 164, 166, 167-169 Lesson Check: 169 (#28) Assessment: 182 (#76-78)
PI.3.4 Understand Newton's third law of motion and describe the interaction of two objects using Newton's third law and the representation of action-reaction pairs of forces.	**SE/TE:** 158-159 Practice Problems: 159 (#6-8)
PI.3.5 Develop graphical and mathematical representations that describe the relationship between the gravitational mass of an object and the force due to gravity and apply those representations to qualitatively and quantitatively describe how changing the gravitational mass will affect the force due to gravity acting on the object.	**SE/TE:** 162-164, 165 Practice Problems: 164 (#19-20)
PI.3.6 Describe the slope of the force due to gravity vs. gravitational mass graphical representation in terms of gravitational field.	For supporting content, please see **SE/TE:** 312
PI.3.7 Explain that the equivalence of the inertial and gravitational masses leads to the observation that acceleration in free fall is independent of an object's mass.	**SE/TE:** 97-98

Indiana Academic Standards for Science - Physics I	**Pearson Physics ©2014**
Standard 4: Energy	
PI.4.1 Evaluate the translational kinetic, gravitational potential, and elastic potential energies in simple situations using the mathematical definitions of these quantities and mathematically relate the initial and final values of the translational kinetic, gravitational potential, and elastic potential energies in the absence of a net external force.	**SE/TE:** 197-198, 203-204, 205 Practice Problems: 199 (#17), 204 (#23) Lesson Check: 206 (#32, 35-36)
PI.4.2 Identify the forms of energy present in a scenario and recognize that the potential energy associated with a system of objects and is not stored in the object itself.	**SE/TE:** 202-203, 205
PI.4.3 Conceptually define “work” as the process of transferring of energy into or out of a system when an object is moved under the application of an external force and operationally define “work” as the area under a force vs. change in position curve.	**SE/TE:** 189-191, 192-193 Assessment: 224 (#122)
PI.4.4 For a force exerted in one or two dimensions, mathematically determine the amount of work done on a system by an unbalanced force over a change in position in one dimension.	**SE/TE:** 190-191, 192-193, 194-196 Practice Problems: 191 (#2-3), 193 (#4-5), 196 (#6-7) Lesson Check: 196 (#11-15)
PI.4.5 Understand and apply the principle of conservation of energy to determine the total mechanical energy stored in a closed system and mathematically show that the total mechanical energy of the system remains constant as long as no dissipative (i.e. non-conservative) forces are present.	**SE/TE:** 206-208 Lesson Check: 211 (#45)
PI.4.6 Develop and apply pictorial, mathematical or graphical representations to qualitatively and quantitatively predict changes in the mechanical energy (e.g. translational kinetic, gravitational, or elastic potential) of a system due to changes in position or speed of objects or non-conservative interactions within the system.	**SE/TE:** 208-210 Lesson Check: 211 (#44-46) Assessment: 222 (#101-106), 224 (#121), 225 (#140)

Indiana Academic Standards for Science - Physics I	Pearson Physics ©2014
Standard 5: Linear Momentum In One Dimension	
PI.5.1 For an object moving at constant rate, define linear momentum as the product of an object's mass and its velocity and be able to quantitatively determine the linear momentum of a single object.	**SE/TE:** 229-230, 231-233 Practice Problems: 230 (#1-3), 233 (#4-6) Lesson Check: 233 (#7-14) Assessment: 260
PI.5.2 Operationally define "impulse" as the area under a force vs. change in clock reading (time) curve and be able to determine the change in linear momentum of a system acted on by an external force. Predict the change in linear momentum of an object from the average force exerted on the object and time interval during which the force is exerted.	**SE/TE:** 234-238, 240 Practice Problems: 235 (#15-16), 236 (#17), 240 (#18-21) Lesson Check: 241 (#22-29) Assessment: 260-261
PI.5.3 Demonstrate that when two objects interact through a collision or separation that both the force experienced by each object and change in linear momentum of each object are equal and opposite, and as the mass of an object increases, the change in velocity of that object decreases.	**SE/TE:** 244-245 Practice Problems: 245 (#30, 32) Lesson Check: 247 (#39)
PI.5.4 Determine the individual and total linear momentum for a two-body system before and after an interaction (e.g. collision or separation) between the two objects and show that the total linear momentum of the system remains constant when no external force is applied consistent with Newton's third law.	**SE/TE:** 242-243
PI.5.5 Classify an interaction (e.g. collision or separation) between two objects as elastic or inelastic based on the change in linear kinetic energy of the system.	**SE/TE:** 248-253, 254-255
PI.5.6 Mathematically determine the center of mass of a system consisting of two or more masses. Given a system with no external forces applied, show that the linear momentum of the center of mass remains constant during any interaction between the masses.	**SE/TE:** 244-245, 292-293 Practice Problems: 245 (#31-32)

Indiana Academic Standards for Science - Physics I	Pearson Physics ©2014
Standard 6: Simple Harmonic Oscillating Systems	
PI.6.1 Develop graphical and mathematical representations that describe the relationship between the amount of stretch of a spring and the restoring force and apply those representations to qualitatively and quantitatively describe how changing the stretch or compression will affect the restoring force and vice versa, specifically for an ideal spring.	**SE/TE:** 165-166, 440-442 Practice Problems: 167 (#22) Lesson Check: 169 (#26, 29) Physics Lab: 444
PI.6.2 Describe the slope of the graphical representation of restoring force vs. change in length of an elastic material in terms of the elastic constant of the material, specifically for an ideal spring.	**SE/TE:** 441 Physics Lab: 444
PI.6.3 Develop graphical and mathematical representations which describe the relationship between the mass, elastic constant, and period of a simple horizontal mass-spring system and apply those representations to qualitatively and quantitatively describe how changing the mass or elastic constant will affect the period of the system for an ideal spring.	**SE/TE:** 440-441, 458-461 Practice Problems: 459 (#8-11), 461 (#12-13) Lesson Check: 461 (#19-21) Physics Lab: 444
PI.6.4 Develop graphical and mathematical representations which describe the relationship between the strength of gravity, length of string, and period of a simple mass-string (i.e. pendulum) system apply the those representations to qualitatively and quantitatively describe how changing the length of string or strength of gravity will affect the period of the system in the limit of small amplitudes.	**SE/TE:** 462-467 Practice Problems: (#464 (#22-24), 467 (#25-27) Lesson Check: 469 (#28-33)
PI.6.5 Explain the limit in which the amplitude does not affect the period of a simple mass-spring (i.e. permanent deformation) or mass-string (i.e. pendulum, small angles) harmonic oscillating system.	**SE/TE:** 460-461, 464 Lesson Check: 461 (#19-20) Assessment: 486 (#58)

Indiana Academic Standards for Science - Physics I	Pearson Physics ©2014
Standard 7: Mechanical Waves and Sound	
PI.7.1 Differentiate between transverse and longitudinal modes of oscillation for a mechanical wave traveling in one dimension.	**SE/TE:** 470-472 Practice Problems: 472 (#34-35)
PI.7.2 Understand that a mechanical wave requires a medium to transfer energy, unlike an electromagnetic wave, and that only the energy is transferred by the mechanical wave, not the mass of the medium.	**SE/TE:** 474
PI.7.3 Develop graphical and mathematical representations that describe the relationship between the frequency of a mechanical wave and the wavelength of the wave and apply those representations to qualitatively and quantitatively describe how changing the frequency of a mechanical wave affects the wavelength and vice versa.	**SE/TE:** 453-455, 473-474 Practice Problems: 474 (#36-38) Lesson Check: 475 (#42, 44) Assessment: 488 (#87-88, 90-92)
PI.7.4 Describe the slope of the graphical representation of wavelength vs. the inverse of the frequency in terms of the speed of the mechanical wave.	For supporting content, please see **SE/TE:** 473-474
PI.7.5 Apply the mechanical wave model to sound waves and qualitatively and quantitatively determine how the relative motion of a source and observer affects the frequency of a wave as described by the Doppler Effect.	**SE/TE:** 507-509, 510-511 Practice Problems: 510 (#36-38), 511 (#39-40) **TE Only:** Science & Engineering Practices: 508
PI.7.6 Qualitatively and quantitatively apply the principle of superposition to describe the interaction of two mechanical waves or pulses.	**SE/TE:** 476-477, 478 Practice Problems: 477 (#45-46) Lesson Check: 482 (#49) Assessment: 488 (#93-94, 99)
PI.7.7 Qualitatively describe the phenomena of both resonance frequencies and beat frequencies that arise from the interference of sound waves of slightly different frequency and define the beat frequency as the difference between the frequencies of two individual sound wave sources.	**SE/TE:** 468-469, 498-500 Practice Problems: 500 (#7-9) Lesson Check: 501 (#12-13, 17-18) Assessment: 523 (#64, 66)

Indiana Academic Standards for Science - Physics I	Pearson Physics ©2014
Standard 8: Simple Circuit Analysis	
PI.8.1 Develop graphical, mathematical, and pictorial representations that describe the relationship between length, cross-sectional area, and resistivity of an ohmic device and apply those representations to qualitatively and quantitatively describe how changing the composition, size, or shape of the device affect the resistance.	**SE/TE:** 750-753 Lesson Check: 757 (#12-13)
PI.8.2 Describe the slope of the graphical representation of resistance vs. the ratio of length to cross-sectional area in terms of the resistivity of the material.	For supporting content, please see **SE/TE:** 752
PI.8.3 Develop graphical and mathematical representations that describe the relationship between the amount of current passing through an ohmic device and the amount of voltage (i.e. EMF) applied across the device according to Ohm's Law and apply those representations to qualitatively and quantitatively describe how changing the current affects the voltage and vice versa.	**SE/TE:** 751, 764, 766-767 Practice Problems: 751 (#4-5), 769 (#35-37) Lesson Check: 757 (#13-14), 765 (#29-30) Physics Lab: 773 Assessment: 775 (#51) **TE Only:** Science & Engineering Practices: 752
PI.8.4 Describe the slope of the graphical representation of current vs. voltage or voltage vs. current in terms of the resistance of the device.	**SE/TE:** Physics Lab: 773 **TE Only:** Science & Engineering Practices: 752
PI.8.5 Qualitatively and quantitatively describe how changing the voltage or resistance of a simple series (i.e. loop) circuit affects the voltage, current, and power measurements of individual resistive devices and for the entire circuit.	**SE/TE:** 757-759, 764, 766-768 Practice Problems: 759 (#16-18), 766 (#33-34), 769 (#35-37) Lesson Check: 771 (#45-47) Assessment: 776 (#71), 777 (#105), 779 (#117) **TE Only:** Science & Engineering Practices: 762
PI.8.6 Qualitatively and quantitatively describe how changing the voltage or resistance of a simple parallel (i.e. ladder) circuit affects the voltage, current, and power measurements of individual resistive devices and for the entire circuit.	**SE/TE:** 759-761 Practice Problems: 762 (#19-21)

Indiana Academic Standards for Science - Physics I	**Pearson Physics ©2014**
PI.8.7 Apply conservation of energy concepts to the design of an experiment that will demonstrate the validity of Kirchhoff's loop rule ($\sum \Delta V = 0$) in a circuit with only a battery and resistors either in series or in, at most, one pair of parallel branches.	For supporting content, please see **SE/TE:** Assessment: 776 (#78, 83), 779 (#122, 124)
PI.8.8 Apply conservation of electric charge (i.e. Kirchhoff's junction rule) to the comparison of electric current in various segments of an electrical circuit with a single battery and resistors in series and in, at most, one parallel branch and predict how those values would change if configurations of the circuit are changed.	For supporting content, please see **SE/TE:** Assessment: 776 (#79, 83), 779 (#122, 124)
PI.8.9 Use a description or schematic diagram of an electrical circuit to calculate unknown values of current, voltage, or resistance in various components or branches of the circuit according to Ohm's Law, Kirchhoff's junction rule, and Kirchhoff's loop rule.	**SE/TE:** 758, 761, 763 Practice Problems: 759 (#16-18), 762 (#19, 21), 763 (#22-24) Lesson Check: 765 (#31-32) Assessment: 776-777 (#78, 83, 87), 779 (#122, 124)

Indiana Academic Standards for Science Physics II	**Pearson Physics ©2014**
Content Standards - Indiana Physics II	
For the high school science courses, the content standards are organized around the core ideas in each particular course. Within each core idea are indicators which serve as the more detailed expectations within each of the content areas.	
Standard 1: Energy and Momentum in Two Dimensions	
PII.1.1 For a system consisting of a single object with a net external force applied, qualitatively and quantitatively predict changes in its linear momentum using the impulse-momentum theorem and in its translational kinetic energy using the work-energy theorem.	**SE/TE:** 199-200, 235-236, 237, 239 Practice Problems: 201 (#19-20), 236 (#17), 240 (#18, 21) Lesson Check: 241 (#23)
PII.1.2 For a system consisting of a two objects with no net external forces applied, qualitatively and quantitatively analyze a two dimensional interaction (i.e. collision or separation) to show that the total linear momentum of the system remains constant.	**SE/TE:** 232, 252-253 Practice Problems: 233 (#6), 254 (#46-48) Lesson Check: 256 (#57)
PII.1.3 For a system consisting of two objects moving in two dimensions with no net external forces applied, apply the principles of conservation of linear momentum and of mechanical energy to quantitatively predict changes in the linear momentum, velocity, and kinetic energy after the interaction between the two objects.	**SE/TE:** 242-245, 248-253, 254-255 Practice Problems: 254 (#46-48) Lesson Check: 256 (#49-51, 57)
PII.1.4 Classify interactions between two objects moving in two dimensions as elastic, inelastic, and completely inelastic.	**SE/TE:** 248-453, 254-255 Lesson Check: 256 (#52, 54)

Indiana Academic Standards for Science Physics II	**Pearson Physics ©2014**
Standard 2: Temperature and Thermal Energy Transfer	
PII.2.1 Develop graphical and mathematical representations that describe the relationship among the temperature, thermal energy, and thermal energy transfer (i.e. heat) in the kinetic molecular theory and apply those representations to qualitatively and quantitatively describe how changing the temperature of a substance affects the motion of the molecules.	**SE/TE:** 344, 350-354, 354-356, 370-374, 385-388, 418, 422 Practice Problems: 352 (#18-19), 373 (#46) Lesson Check: 374 (#53-54, 56) Assessment: 380 (102-105)
PII.2.2 Describe the process of the transfer of thermal energy (i.e. heat) that occurs during the heating cycle of a substance from solid to gas and relate the changes in molecular motion to temperature changes that are observed.	**SE/TE:** 354-356, 370-374 Assessment: 380 (#99-100)
PII.2.3 Cite evidence from everyday life to describe the transfer of thermal energy by conduction, convection, and radiation.	**SE/TE:** 354-356 Assessment: 378 (#70-72, 112)
PII.2.4 Develop graphical and mathematical representations that describe the relationship among the volume, temperature, and number of molecules of an ideal gas in a closed system and the pressure exerted by the system and apply those representations to qualitatively and quantitatively describe how changing any of those variables affects the others.	**SE/TE:** 415-417, 417-419, 420-421, 422 Practice Problems: 417 (#1-3), 419 (#4-5), 421 (#6-7) Lesson Check: 423 (#13-18)
PII.2.5 Describe the slope of the graphical representation of pressure vs. the product of: the number of particles, temperature of the gas, and inverse of the volume of the gas in terms of the ideal gas constant.	For supporting content, please see: **SE/TE:** 418
PII.2.6 Using PV graphs, qualitatively and quantitatively determine how changes in the pressure, volume, or temperature of an ideal gas allow the gas to do work and classify the work as either done on or done by the gas.	**SE/TE:** 386-388, 393-394, 394-395, 398-399 Practice Problems: 388 (#1-3), 394 (#17-18), 396 (#19-20), 399 (#21-22) Lesson Check: 400 (#23-30) Assessment: 412 (#89)

Indiana Academic Standards for Science Physics II	**Pearson Physics ©2014**
Standard 3: Fluids	
PII.3.1 For a static, incompressible fluid, develop and apply graphical and mathematical representations that describe the relationship between the density and the pressure exerted at various positions in the fluid, and apply those representations to qualitatively and quantitatively describe how changing the depth or density affects the pressure.	**SE/TE:** 426-427 Practice Problems: 428 (#22-24)
PII.3.2 Qualitatively and quantitatively determine how the density of fluid or volume of fluid displaced is related to the force due to buoyancy acting on either a floating or submerged object as described by Archimedes' principle of buoyancy.	**SE/TE:** 431-434 Lesson Check: 434 (#28, 30-31)
PII.3.3 Develop and apply the principle of constant volume flow rate to determine the relationship between cross-sectional area of a pipe and the velocity of an incompressible fluid flowing through a pipe.	**SE/TE:** 435-436 Practice Problems: 436 (#37-38) Lesson Check: 439 (#44-46) Assessment: 448 (#88-90)
PII.3.4 Develop and apply Bernoulli's principle and continuity equations to predict changes in the speed and pressure of a moving incompressible fluid.	**SE/TE:** 435-438 Assessment: 448 (#91)
PII.3.5 Describe how a change in the pressure of as static fluid in an enclosed container is transmitted equally in all directions (Pascal's Principle) and apply Pascal's Principle to determine the mechanical advantage of a hydraulic system.	**SE/TE:** 430-431 Practice Problems: 431 (#25-26) Assessment: 448 (#82)

Indiana Academic Standards for Science Physics II	Pearson Physics ©2014
Standard 4: Electricity	
PII.4.1 Describe the methods of charging an object (i.e. contact, induction, and polarization) and apply the principle of conservation of charge to determine the charges on each object after charge is transferred between two objects by contact.	**SE/TE:** 678-681, 716-717 Lesson Check: 682 (#6-7) Assessment: 698 (#37-40, 50, 51), 702 (#102) **TE Only:** Science and Engineering Practices: 679
PII.4.2 For a single isolated charge, develop and apply graphical and mathematical representations that describe the relationship between the amount of charge, the distance from the charge and the strength of the electric field created by the charge and apply those representations to qualitatively and quantitatively describe how changing either the amount of charge or distance from the charge affects the strength of the electric field.	**SE/TE:** 705-708 Practice Problems: 708 (#13) Lesson Check: 717 (#10-11, 14-15) Inquiry Lab: 405
PII.4.3 Using Coulomb's law, pictorially and mathematically describe the force on a stationary charge due to other stationary charges. Understand that these forces are equal and opposite as described by Newton's third law and compare and contrast the strength of this force to the force due to gravity.	**SE/TE:** 683-688 Practice Problems: 688 (#12-14) Lesson Check: 689 (#19-22) Physics Lab: 696
PII.4.4 For a single isolated charge, develop graphical and mathematical representations that describe the relationship between the amount of charge, the distance from the charge and the electric potential created by the charge and apply those representations to qualitatively and quantitatively describe how changing either the amount of charge or distance from the charge affects the electric potential.	**SE/TE:** 708-709 Practice Problems: 709 (#4-5)
PII.4.5 Map electric fields and equipotential lines, showing the electric field lines are perpendicular to the equipotential lines, and draw conclusions about the motion of a charged particle either between or along equipotential lines due the electric field.	**SE/TE:** 713-714 Physics Lab: 736

Indiana Academic Standards for Science Physics II	Pearson Physics ©2014
PII.4.6 Distinguish between electric potential energy and electric potential (i.e. voltage).	**SE/TE:** 718-720, 720-723 Practice Problems: 720 (#18-19), 723 (#20-21) Physics Lab: 773
PII.4.7 Apply conservation of energy to determine changes in the electric potential energy, translational kinetic energy, and speed of a single charged object (i.e. a point particle) placed in a uniform electric field.	**SE/TE:** 723-724, 725-726 Practice Problems: 725 (#22-24), 726 (#25-27) Lesson Check: 727 (#33-35)
Standard 5: Simple and Complex Circuits	
PII.5.1 Relate the idea of electric potential energy to electric potential (i.e. voltage) in the context of electric circuits.	**SE/TE:** 748-751 Lesson Check: 757 (#9), 771 (#43)
PII.5.2 Develop graphical and mathematical representations that describe the relationship between the between the amount of current passing through an ohmic device and the amount of voltage (i.e. EMF) applied across the device according to Ohm's Law. Apply those representations to qualitatively and quantitatively describe how changing the current affects the voltage and vice versa for an ohmic device of known resistance.	**SE/TE:** 745-747, 751, 764 Practice Problems: 751 (#4-5), 757 (#13-14), 765 (#29-30), 769 (#35-37) Physics Lab: 773 **TE Only:** Science and Engineering Practices: 752
PII.5.3 Describe the slope of the graphical representation of current vs. voltage or voltage vs. current in terms of the resistance of the device.	**SE/TE:** Physics Lab: 773
PII.5.4 Define and describe a device as ohmic or non-ohmic based on the relationship between the current passing through the device and the voltage across the device based on the shape of the curve of a current vs. voltage or voltage vs. current graphical representation.	**SE/TE:** Physics Lab: 773
PII.5.5 Explain and analyze simple arrangements of electrical components in series and parallel DC circuits in terms of current, resistance, voltage and power. Use Ohm's and Kirchhoff's laws to analyze DC circuits.	**SE/TE:** 757-763, 765-768 Assessment: 775 (#67-68), 776 (#83, 87), 778 (#107-110, 112, 113)

Indiana Academic Standards for Science Physics II	Pearson Physics ©2014
Standard 6: Magnetism	
PII.6.1 Describe the magnetic properties of ferromagnetic, paramagnetic, and diamagnetic materials on a macroscopic scale and atomic scale.	For supporting content, please see **SE/TE:** 783-786, 788 Lesson Check: 788 (#8) Assessment: 810 (#47, 49)
PII.6.2 Develop and apply a mathematical representation that describes the relationship between the magnetic field created by a long straight wire carrying an electric current, the magnitude of the current, and the distance to the wire.	**SE/TE:** 789-791 Practice Problems: 791 (#9-10) Lesson Check: 795 (#15, 19, 20)
PII.6.3 Describe the motion of a charged or uncharged particle through a uniform magnetic field.	**SE/TE:** 798-801 Practice Problems: 802 (#28) Lesson Check: 806 (#38) Assessment: 811 (#76), 813 (#94, 99)
PII.6.4 Determine the magnitude of the magnetic force acting on a charged particle moving through a uniform magnetic field and apply the right hand rule to determine the direction of either the magnetic force or the magnetic field.	**SE/TE:** 796-797, 798 Practice Problems: 798 (#24), 801 (#26-27) Lesson Check: 806 (#40, 42) Assessment: 811 (#73-75), 812 (#80, 84, 86, 87, 89, 90), 813 (#93)
PII.6.5 Describe the practical uses of magnetism in motors, electronic devices, mass spectroscopy, MRIs, and other applications.	**SE/TE:** 801-802, 805 Assessment: 814 Physics & You: 807, 841
Standard 7: Electromagnetic Induction	
PII.7.1 Given the magnitude and direction of a uniform magnetic field, calculate the flux through a specified area in terms of the field magnitude and the size and orientation of the area with respect to the field.	**SE/TE:** 818-820 Practice Problems: 827 (#8, 11, 13)

Indiana Academic Standards for Science Physics II	**Pearson Physics ©2014**
PII.7.2 Develop graphical and mathematical representations that describe the relationship between the rate of change of magnetic flux and the amount of voltage induced in a simple loop circuit according to Faraday's Law of Induction and apply those representations to qualitatively and quantitatively describe how changing the voltage across the device affects the current through the device.	**SE/TE:** 821-822 Practice Problems: 822 (#4-6), 827 (#14-15) Physics Lab: 842
PII.7.3 Apply Ohm's Law, Faraday's Law, and Lenz's Law to determine the amount and direction of current induced by a changing magnetic flux in a loop of wire or simple loop circuit.	**SE/TE:** 823-826 Lesson Check: 827 (#13-16) Physics Lab: 842
Standard 8: Geometric Optics	
PII.8.1 Develop graphical, mathematical, and pictorial representations (e.g. ray diagrams) that describe the relationships between the focal length, the image distance and the object distance for planar, converging, and diverging mirrors and apply those representations to qualitatively and quantitatively describe how changing the object distance affects the image distance.	**SE/TE:** 570-571, 572-574, 575-576, 577-579, 581-582 Practice Problems: 574 (#9-10), 582 (#19-21), 583 (#22-23) Lesson Check: 574 (#13-16) Assessment: 591 (#51, 55-56), 593 (#87) Physics Lab: 588
PII.8.2 Develop graphical, mathematical, and pictorial representations (e.g. ray diagrams) that describe the relationship between the angles of incidence and refraction of monochromatic light passed between two different media and apply those representations to qualitatively and quantitatively describe how changing the angle of incidence affects the angle of refraction.	**SE/TE:** 599-600, 601-602 Practice Problems: 600 (#3-5), 603 (#6-8) Lesson Check: 605 (#14-16) Physics Lab: 627 Assessment: 629 (#56, 58, 62-65, 67-69), 633 (#114, 116)

Indiana Academic Standards for Science Physics II	**Pearson Physics ©2014**
PII.8.3 Develop graphical, mathematical, and pictorial representations (e.g. ray diagrams) that describe the relationships between the focal length, the image distance, and the object distance for both converging and diverging lenses and apply those representations to qualitatively and quantitatively describe how changing the object distance affects the image distance.	**SE/TE:** 612-617 Practice Problems: 618 (#31-34) Lesson Check: 618 (#40-43) Assessment: 631-632 (#84-100)
PII.8.4 Describe an image as real or virtual for both a curved mirror and lens system based on the position of the image relative to the optical device.	**SE/TE:** 577-580, 612-618, 619-622 Lesson Check: 586 (#30, 32), 618 (#37) Assessment: 591 (#62), 594 (#95), 631 (#92-93), 632 (#94, 113), 634 (#125)
Standard 9: Particle and Wave Nature of Light	
PII.9.1 Develop the relationship among frequency, wavelength, and energy for electromagnetic waves across the entire spectrum.	**SE/TE:** 536-538, 539-543 Practice Problems: 538 (#14-17) Assessment: 558 (#62-64)
PII.9.2 Explain how electromagnetic waves interact with matter both as particles (i.e. photons) and as waves and be able to apply the most appropriate model to any particular scenario.	**SE/TE:** 533, 536-538, 539-543 Practice Problems: 538 (#14-17)
PII.9.3 Develop graphical and mathematical representations that describe the relationship between the frequency of a photon and the kinetic energy of an electron emitted through the photoelectric effect and apply those representations to qualitatively and quantitatively describe how changing the frequency or intensity of light affect the current produced in the photoelectric effect.	**SE/TE:** 859-863 Practice Problems: 861 (#9-10), 802 (#11-13) Lesson Check: 863 (#22-23)
PII.9.4 Describe the slope of the graphical representation of the kinetic energy of a photoelectron vs. frequency in terms of Planck's constant.	**SE/TE:** 861-862, 861 (Figure 24.7) Practice Problems: 862 (#11-13)

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PII.9.5 Develop graphical and mathematical representations that describe the relationship between the wavelength of monochromatic light, spacing between slits, distance to screen, and interference pattern produced for a double-slit scenario and apply those representations to qualitatively and quantitatively describe how changing any of the independent variables affects the position of the bright fringes.	**SE/TE:** 637, 641-644, 644-645 Practice Problems: 644 (#4-5), 646 (#6-8) Lesson Check: 646 (#14-16) Assessment: 668 (#61, 64, 68), 669 (#71-74)
PII.9.6 Develop graphical and mathematical representations that describe the relationship between the angle between two polarizing filters and the intensity of light passed through the filters from an unpolarized light source and apply those representations to qualitatively and quantitatively describe how changing the angle between polarizing filters affects the intensity of light passing through both filters.	**SE/TE:** 545-548 Practice Problems: 547 (#27-29), 549 (#30-33) Lesson Check: 553 (#38-41) Assessment: 559 (#85-91), 560 (#92-95), 561 (#108) Physics Lab: 555
Standard 10: Modern Physics	
PII.10.1 Describe the Standard Model and explain the composition and decay of subatomic particles using the Standard Model and Feynman diagrams.	For supporting content, please see **SE/TE:** 936-940
PII.10.2 Explain the stability of the nucleus considering the electromagnetic repulsion in the nucleus and how forces govern binding energy and radioactive decay for different elements.	**SE/TE:** 914-916, 917-924 Lesson Check: 917 (#5)
PII.10.3 Qualitatively compare and contrast how particle interactions, fission, and fusion can convert matter into energy and energy into matter, and calculate the relative amounts of matter and energy in such processes.	**SE/TE:** 925-930 Practice Problems: 927 (#26)
PII.10.4 Apply the conservation of mass, conservation of charge, and conservation of linear momentum principles to describe the results of a radioactive particle undergoing either alpha or beta decay.	**SE/TE:** 920-923 Practice Problems: 921 (#10-12), 923 (#13-15)

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PII.10.5 Know and describe how a particle accelerator functions and how current high energy particle physics experiments are being used to develop the Standard Model.	**SE/TE:** Physics & You: 807