

**Prentice Hall Conceptual Physics (Hewitt) © 2009**  
**Correlated to:**  
**The Revised Washington State Science Standards, (12/14/2008)**  
**(Grades 9-12)**

<b>REVISED WASHINGTON STATE SCIENCE STANDARDS DECEMBER 14, 2008</b>	<b>PRENTICE HALL CONCEPTUAL PHYSICS (HEWITT) © 2009</b>
EALR 1: Systems (SYS)	
Core Content: Predictability and Feedback	
In prior grades, students learned how to simplify and analyze complex situations by thinking about them as systems. In grades 9-12, students learn to construct more sophisticated system models, including the concept of feedback. Students are expected to determine whether or not systems analysis will be helpful in a given situation and if so, to describe the system, including subsystems, boundaries, flows, and feedbacks. The next step is to use the system as a dynamic model to predict changes. Students are also expected to recognize that even the most sophisticated models may not accurately predict how the real world functions. This deep understanding of systems and ability to use systems analysis is an essential tool both for scientific inquiry and for technological design.	
Content Standards	
Students know that:	
9-12 SYSA -Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system.	<b>SE/TE:</b> 415, 416, 417, 419, 441-443, 453, 454, 460-461, 479, 480, 481, 501-503, 612, 613, 614, 615, 672, 673, 674, 730-731, 750
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physics; Virtual Physics Labs: Forces, Newton's Third Law, Conservation of Momentum
9-12 SYSB -Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible.	<b>SE/TE:</b> 14-16, 19-22, 69-72, 135-136
	<b>TR:</b> Lab Manual: Labs 4, 5, 24, 25
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Linear Motion and Momentum; Virtual Physics Labs: Forces, Newton's First Law, Newton's Second Law, Newton's Third Law, Conservation of Momentum
9-12 SYSC -In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible.	<b>SE/TE:</b> 324-247, 335, 345, 436, 493, 533, 767, 768, 772-775
	<b>TR:</b> Lab Manual: Labs 47, 48

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9-12 SYSD -Systems can be changing or in equilibrium.	<b>SE/TE:</b> 12, 13, 15, 16, 18, 19, 188-204, 410, 454
	<b>TR:</b> Lab Manual: Labs 2, 24, 25, 49, 56, 58
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM: Virtual Physics Lab: Forces, Conservation of Momentum
Performance Expectations	
Students are expected to:	
Give examples of a positive feedback system and explain its regulatory mechanism (e.g., global warming causes Earth's ice caps to melt, reflecting less energy to space, increasing temperatures). Give examples of a negative feedback system and explain its regulatory mechanism (e.g., when a human body overheats, it produces sweat that cools the body by evaporation).	<b>SE/TE:</b> 415, 416, 417, 419, 441-443, 453, 454, 460-461, 479, 480, 481, 501-503, 612, 613, 614, 615, 672, 673, 674, 730-731, 750
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physics; Virtual Physics Labs: Forces, Newton's Third Law, Conservation of Momentum
Determine if a systems approach will be helpful in answering a question or solving a problem. Represent the system with a diagram specifying components, boundaries, flows, and feedbacks. Describe relevant subsystems and the larger system that contains the system being analyzed. Determine how the system functions with respect to other systems.	<b>SE/TE:</b> 14-16, 19-22, 69-72, 135-136
	<b>TR:</b> Lab Manual: Labs 4, 5, 24, 25

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Create a simplified model of a complex system. Trace the possible consequences of a change in one part of the system and explain how the simplified model may not be adequate to reliably predict consequences.	<b>SE/TE:</b> 324-247, 335, 345, 436, 493, 533, 767, 768, 772-775
	<b>TR:</b> Lab Manual: Labs 47, 48
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physics; Virtual Physics Labs: Solid Structure Model
Analyze whether or not a system (e.g., population) is changing or in equilibrium. Determine whether a state of equilibrium is static or dynamic (i.e., inflows equal outflows).	<b>SE/TE:</b> 12, 13, 15, 16, 18, 19, 188-204, 410, 454
	<b>TR:</b> Lab Manual: Labs 2, 24, 25, 49, 56, 58
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM: Virtual Physics Lab: Forces, Newton's First Law, Newton's Second Law, Newton's Third Law, Conservation of Momentum

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EALR 2: Inquiry (INQ)	
Core Content: Conducting Analyses and Thinking Logically	
<p>In prior grades, students learned to revise questions so they can be answered scientifically. In grades 9-12, students extend and refine their understanding of the nature of inquiry and their ability to formulate questions, propose hypotheses, and design, conduct, and report on investigations. Refinement includes an increased understanding of the kinds of questions that scientists ask and how the results reflect the research methods and the criteria that scientific arguments are judged by. Increased abilities include competence in using mathematics, a closer connection between student-planned investigations and existing knowledge, reflecting increased knowledge and improvements in communication and collaboration, and participation in a community of learners.</p>	
Content Standards	
Students know that:	
9-12 INQA -Question -Scientists generate and evaluate questions to investigate the natural world.	<b>SE/TE:</b> xx, 2, 4, 12, 28, 46, 55, 68, 75, 76, 86, 88, 97, 106, 109, 124, 132, 144, 147, 170, 173, 179, 188, 190, 200, 212, 215, 232, 253, 262, 267, 282, 302, 324, 326, 344, 352, 362, 364, 369, 382, 387, 406, 409, 419, 430, 433, 435, 436, 450, 455, 468, 471, 478, 490, 494, 514, 532, 539, 544, 554, 559, 563, 578, 581, 590, 602, 615, 622, 627, 632, 644, 655, 664, 680, 702, 720, 725, 740, 766, 782, 808
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs; Virtual Physics Labs: Forces, Newton's First Law, Measuring Speed, Graphing Motion, Inclined to Roll, Acceleration of Gravity, Gravity and Projectile Motion, Newton's Second Law, Acceleration and Friction, Newton's Third Law, Conservations of Momentum, Energy Conversions, Centripetal Motion, Rotational Inertia, Universal Gravitation, Gravitational Interactions, Satellite Motion, Rutherford and the Nucleus, Solid Structure Model, Density and Buoyancy, Pressure and Volume of a Gas, Specific Heat of Metals, Phase Changes, Light investigation, Color in Light, Reflection and Refraction of Light, Lenses, Diffraction and Interference, The Effect of Electrical Field on Moving Charges, Capacitors, Electric Current, Series and Parallel Circuits, The Effect of a Magnetic Field on Moving Charges, Photoelectric Effect; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science

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9-12 INQB -Investigate -Scientific progress requires the use of various methods appropriate for answering different kinds of research questions, a thoughtful plan for gathering data needed to answer the question, and care in collecting, analyzing, and displaying the data.	<b>SE/TE:</b> xx, 2, 12, 28, 46, 55, 68, 75, 76, 86, 88, 97, 106, 109, 124, 132, 144, 147, 170, 173, 179, 188, 190, 200, 212, 215, 232, 253, 262, 267, 282, 302, 324, 326, 344, 352, 362, 364, 369, 382, 387, 406, 409, 419, 430, 433, 435, 436, 450, 455, 468, 471, 478, 490, 494, 514, 532, 539, 544, 554, 559, 563, 578, 581, 590, 602, 615, 622, 627, 632, 644, 655, 664, 680, 702, 720, 725, 740, 766, 782, 808
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9-12 INQC -Explain -Conclusions must be logical, based on evidence, and consistent with prior established knowledge.	<b>SE/TE:</b> xx, 2, 12, 28, 46, 55, 68, 75, 76, 86, 88, 97, 106, 109, 124, 132, 144, 147, 170, 173, 179, 188, 190, 200, 212, 215, 232, 253, 262, 267, 282, 302, 324, 326, 344, 352, 362, 364, 369, 382, 387, 406, 409, 419, 430, 433, 435, 436, 450, 455, 468, 471, 478, 490, 494, 514, 532, 539, 544, 554, 559, 563, 578, 581, 590, 602, 615, 622, 627, 632, 644, 655, 664, 680, 702, 720, 725, 740, 766, 782, 808

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9-12 INQD -Communicate Clearly -The methods and procedures that scientists use to obtain evidence must be clearly reported to enhance opportunities for further investigation.	<b>SE/TE:</b> xx, 2, 12, 28, 46, 55, 68, 75, 76, 86, 88, 97, 106, 109, 124, 132, 144, 147, 170, 173, 179, 188, 190, 200, 212, 215, 232, 253, 262, 267, 282, 302, 324, 326, 344, 352, 362, 364, 369, 382, 387, 406, 409, 419, 430, 433, 435, 436, 450, 455, 468, 471, 478, 490, 494, 514, 532, 539, 544, 554, 559, 563, 578, 581, 590, 602, 615, 622, 627, 632, 644, 655, 664, 680, 702, 720, 725, 740, 766, 782, 808

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9-12 INQE -Model -The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable predictions.	<b>SE/TE:</b> 3, 5, 282, 308, 232-234, 324-327, 335, 345, 436, 493, 533, 767, 768, 772-775, 906
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs; Virtual Physics Labs: Solid Structure Model; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science
9-12 INQF -Communicate -Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light.	<b>SE/TE:</b> 3, 5, 232-234, 282, 308, 906
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs; Virtual Physics Labs: Solid Structure Model; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science
9-12 INQG -Intellectual Honesty -Public communication among scientists is an essential aspect of research. Scientists evaluate the validity of one another's investigations, check the reliability of results, and explain inconsistencies in findings	<b>SE/TE:</b> 2, 3

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9-12 INQH -Intellectual Honesty -Scientists carefully evaluate sources of information for reliability before using that information. When referring to the ideas or findings of others, they cite their sources of information.	<b>SE/TE:</b> 2, 3
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs; Virtual Physics Labs Rutherford and the Nucleus, Solid Structure Model; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science
Performance Expectations	
Students are expected to:	
Generate and evaluate a question that can be answered through a scientific investigation. Critique questions generated by others and explain whether or not the questions are scientific.	<b>SE/TE:</b> xx, 2, 4, 12, 28, 46, 55, 68, 75, 76, 86, 88, 97, 106, 109, 124, 132, 144, 147, 170, 173, 179, 188, 190, 200, 212, 215, 232, 253, 262, 267, 282, 302, 324, 326, 344, 352, 362, 364, 369, 382, 387, 406, 409, 419, 430, 433, 435, 436, 450, 455, 468, 471, 478, 490, 494, 514, 532, 539, 544, 554, 559, 563, 578, 581, 590, 602, 615, 622, 627, 632, 644, 655, 664, 680, 702, 720, 725, 740, 766, 782, 808



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Plan and conduct a scientific investigation, choosing a method appropriate to the question being asked. Collect, analyze, and display data using calculators, computers, or other technical devices when available.	<b>SE/TE:</b> xx, 2, 12, 28, 46, 55, 68, 75, 76, 86, 88, 97, 106, 109, 124, 132, 144, 147, 170, 173, 179, 188, 190, 200, 212, 215, 232, 253, 262, 267, 282, 302, 324, 326, 344, 352, 362, 364, 369, 382, 387, 406, 409, 419, 430, 433, 435, 436, 450, 455, 468, 471, 478, 490, 494, 514, 532, 539, 544, 554, 559, 563, 578, 581, 590, 602, 615, 622, 627, 632, 644, 655, 664, 680, 702, 720, 725, 740, 766, 782, 808

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<p>Draw conclusions supported by evidence from the investigation and consistent with established scientific knowledge. Analyze alternative explanations and decide which best fits the data.</p>	<p><b>SE/TE:</b> xx, 2, 12, 28, 46, 55, 68, 75, 76, 86, 88, 97, 106, 109, 124, 132, 144, 147, 170, 173, 179, 188, 190, 200, 212, 215, 232, 253, 262, 267, 282, 302, 324, 326, 344, 352, 362, 364, 369, 382, 387, 406, 409, 419, 430, 433, 435, 436, 450, 455, 468, 471, 478, 490, 494, 514, 532, 539, 544, 554, 559, 563, 578, 581, 590, 602, 615, 622, 627, 632, 644, 655, 664, 680, 702, 720, 725, 740, 766, 782, 808</p>

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Write a detailed laboratory report that includes: the question that motivated the study, a justification for the kind of investigation chosen, hypotheses (if any), a description of what was done, a summary of data in tables and graphs, and a conclusion, based on the evidence, that responds to the question.	<b>SE/TE:</b> xx, 2, 12, 28, 46, 55, 68, 75, 76, 86, 88, 97, 106, 109, 124, 132, 144, 147, 170, 173, 179, 188, 190, 200, 212, 215, 232, 253, 262, 267, 282, 302, 324, 326, 344, 352, 362, 364, 369, 382, 387, 406, 409, 419, 430, 433, 435, 436, 450, 455, 468, 471, 478, 490, 494, 514, 532, 539, 544, 554, 559, 563, 578, 581, 590, 602, 615, 622, 627, 632, 644, 655, 664, 680, 702, 720, 725, 740, 766, 782, 808

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Formulate one or more hypotheses based on a model or theory of a causal relationship. Demonstrate creativity and critical thinking to formulate and evaluate the hypotheses.	<b>SE/TE:</b> 3, 5, 282, 308, 232-234, 324-327, 335, 345, 436, 493, 533, 767, 768, 772-775, 906
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Evaluate an investigation to determine if it was a valid means of answering the question, and whether or not the results were reliable. Describe the development of a scientific theory that illustrates logical reasoning, creativity, testing, revision, and replacement of prior ideas in light of new evidence.	<b>SE/TE:</b> xx, 2, 12, 28, 46, 55, 68, 75, 76, 86, 88, 97, 106, 109, 124, 132, 144, 147, 170, 173, 179, 188, 190, 200, 212, 215, 232, 253, 262, 267, 282, 302, 324, 326, 344, 352, 362, 364, 369, 382, 387, 406, 409, 419, 430, 433, 435, 436, 450, 455, 468, 471, 478, 490, 494, 514, 532, 539, 544, 554, 559, 563, 578, 581, 590, 602, 615, 622, 627, 632, 644, 655, 664, 680, 702, 720, 725, 740, 766, 782, 808

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<p>Participate in a scientific discussion about their own investigations and those performed by others. Respond to questions and criticisms, and if appropriate, revise explanations based on these discussions.</p>	<p><b>SE/TE:</b> 2, 3</p>
	<p><b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs; Virtual Physics Labs: Forces, Newton's First Law, Measuring Speed, Graphing Motion, Inclined to Roll, Acceleration of Gravity, Gravity and Projectile Motion, Newton's Second Law, Acceleration and Friction, Newton's Third Law, Conservations of Momentum, Energy Conversions, Centripetal Motion, Rotational Inertia, Universal Gravitation, Gravitational Interactions, Satellite Motion, Rutherford and the Nucleus, Solid Structure Model, Density and Buoyancy, Pressure and Volume of a Gas, Specific Heat of Metals, Phase Changes, Light investigation, Color in Light, Reflection and Refraction of Light, Lenses, Diffraction and Interference, The Effect of Electrical Field on Moving Charges, Capacitors, Electric Current, Series and Parallel Circuits, The Effect of a Magnetic Field on Moving Charges, Photoelectric Effect; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science</p>

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Provide appropriate citations for all ideas, findings, and information used in any and all written reports. Explain the consequences for failure to provide appropriate citations.	<b>SE/TE:</b> 2, 3
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs; Virtual Physics Labs; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science
EALR 3: Application (APP)	
Core Content: Science, Technology, and Society	
In prior grades, students learn to work with other members of a team to apply the full process of technological design and relevant science concepts to solve problems. In grades 9-12, students apply what they have learned to address societal issues and cultural differences. Students learn that science and technology are interdependent, that science and technology influence society, and that society influences science and technology. Students continue to increase their abilities to work with other students and to use mathematics and information technologies (when available) to solve problems. They transfer insights from those increased abilities to considering local, regional, and global issues. These insights and capabilities will help prepare students to solve societal and personal problems in future years.	
Content Standards	
Students know that:	
9-12 APPA -Science affects society and cultures by influencing the way many people think about themselves, others, and the environment. Society also affects science by its prevailing views about what is important to study, and by deciding what research will be funded.	<b>SE/TE:</b> 163, 204, 236, 248, 275, 4811, 526, 648, 727, 756
	<b>TR:</b> Lab Manual: Lab 60
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science
9-12 APPB -The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions.	<b>SE/TE:</b> 5, 90, 248, 275, 292, 476, 481, 518, 526, 611, 673, 709, 727, 729, 745, 751, 793, 817
	<b>TR:</b> Lab Manual: Lab 60

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	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science; Virtual Physics Labs: Capacitors
9-12 APPC -Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a mode or other representation of the final design.	<b>SE/TE:</b> 2
	<b>TR:</b> Lab Manual: Lab 60
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science; Virtual Physics Labs: Rutherford and the Nucleus, Solid Structure Model
9-12 APPD -The ability to solve problems is greatly enhanced by use of mathematics and information technologies.	<b>SE/TE:</b> 1, 89, 135, 191, 239, 289, 348, 412, 414, 418, 496, 536, 650
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science; Virtual Physics Labs: Forces, Newton's First Law, Newton's Second Law, Newton's Third Law
9-12 APPE -Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended others not.	<b>SE/TE:</b> 5, 90, 248, 275, 292, 476, 481, 518, 526, 611, 673, 709, 727, 729, 745, 751, 793, 817
	<b>TR:</b> Lab Manual: Lab 31, 60
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science
9-12 APPF -It is important for all citizens to apply science and technology to critical issues that influence society.	<b>SE/TE:</b> 163, 204, 236, 248, 275, 481, 526, 648, 727, 756
	<b>TR:</b> Lab Manual: Lab 60

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	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science
Performance Expectations	
Students are expected to:	
Describe ways that scientific ideas have influenced society or the development of differing cultures. List questions that scientists investigate that are stimulated by the needs of society (e.g., medical research, global climate change).	<b>SE/TE:</b> 163, 204, 236, 248, 275, 4811, 526, 648, 727, 756
	<b>TR:</b> Lab Manual: Lab 60
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science
Work collaboratively with other students to generate ideas for solving a problem. Identify criteria and constraints, research the problem, and generate several possible solutions.	<b>SE/TE:</b> 5, 90, 248, 275, 292, 476, 481, 518, 526, 611, 673, 709, 727, 729, 745, 751, 793, 817
	<b>TR:</b> Lab Manual: Lab 60



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	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science; Virtual Physics Labs: Forces, Newton’s First Law, Measuring Speed, Graphing Motion, Inclined to Roll, Acceleration of Gravity, Gravity and Projectile Motion, Newton’s Second Law, Acceleration and Friction, Newton’s Third Law, Conservations of Momentum, Energy Conversions, Centripetal Motion, Rotational Inertia, Universal Gravitation, Gravitational Interactions, Satellite Motion, Rutherford and the Nucleus, Solid Structure Model, Density and Buoyancy, Pressure and Volume of a Gas, Specific Heat of Metals, Phase Changes, Light investigation, Color in Light, Reflection and Refraction of Light, Lenses, Diffraction and Interference, The Effect of Electrical Field on Moving Charges, Capacitors, Electric Current, Series and Parallel Circuits, The Effect of a Magnetic Field on Moving Charges, Photoelectric Effect;
Choose the best solution for a problem, create a model or drawing of the final design, and devise a way to test it. Redesign the solution, if necessary, then present it to peers.	<b>SE/TE:</b> 2
	<b>TR:</b> Lab Manual: Lab 60
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science; Virtual Physics Labs: Rutherford and the Nucleus, Solid Structure Model
Use proportional reasoning, functions, graphing, and estimation to solve problems. Use computers, probes, and software when available to collect, display, and analyze data.	<b>SE/TE:</b> 1, 89, 135, 191, 239, 289, 348, 412, 414, 418, 496, 536, 650
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science; Virtual Physics Labs: Forces, Newton’s First Law, Newton’s Second Law, Newton’s Third Law

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Analyze a societal issue that may be addressed through science and/or technology. Compare alternative solutions by considering trade-offs and unintended consequences (e.g., removing dams to increase salmon spawning).	<b>SE/TE:</b> 163, 204, 236, 248, 275, 481, 526, 648, 727, 756
	<b>TR:</b> Lab Manual: Lab 31, 60
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science
Critically analyze scientific information in current events to make personal choices, or to inform public-policy decisions.	<b>SE/TE:</b> 163, 204, 236, 248, 275, 481, 526, 648, 727, 756
	<b>TR:</b> Lab Manual: Lab 60
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Introduction to Conceptual Physical Science
EALR 4: Physical Science	
Big Idea: Force and Motion (PS1)	
Core Content: Newton's Laws	
In prior grades, students learned to measure, record, and calculate the average speed of objects, and to tabulate and graph the results. In grades 9-11, students learn to apply Newton's Laws of Motion and Gravity both conceptually and quantitatively. Students are able to calculate average speed, velocity, and acceleration. Students also develop an understanding of forces due to gravitational and electrical attraction. These fundamental concepts enable students to understand the forces that govern the observable world and provide a foundation for a full course in physics.	
Content Standards	
Students know that:	
9-11 PS1A -Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction.	<b>SE/TE:</b> 50, 51, 59, 61-67, 70-71, 72, 73, 74, 77, 96, 97, 219, 234, 235, 236
	<b>TR:</b> Lab Manual: Labs 8, 9
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Linear Motion; Virtual Physics Labs: Measuring Speed

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9-11 PS1B -Average acceleration is defined as a change in velocity with respect to time. Acceleration indicates a change in speed and/or a change in direction.	<b>SE/TE:</b> 51-52, 53-55, 56, 57, 59, 61-67, 73-77, 86, 87, 88, 93, 95-97, 110, 111, 114
	<b>TR:</b> Lab Manual: Labs, 10, 11, 12, 13, 18, 19, 20, 34
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 1; Virtual Physics Labs: Acceleration of Gravity, Acceleration and Friction; Conceptual Physics Alive DVD: Linear Motion
9-11 PS1C -An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's 1st Law of Motion, the =Law of Inertia)	<b>SE/TE:</b> 30-32, 33-34, 36-39, 40-45
	<b>TR:</b> Lab Manual: Labs 6, 7, 12, 41
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 2; Virtual Physics Labs: Newton's First Law, Graphing Motion; Conceptual Physics Alive DVD: Newton's 1 <sup>st</sup> Law
9-11 PS1D -A net force will cause an object to accelerate or change direction. A less massive object will speed up more quickly than a more massive object subjected to the same force. (Newton's 2nd Law of Motion, $F=ma$ )	<b>SE/TE:</b> 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98-105
	<b>TR:</b> Lab Manual: Labs 10,11, 12, 13, 19, 20
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab2; Virtual Physics Labs: Graphing Motion, Acceleration of Gravity, Newton's 2 <sup>nd</sup> Law, Acceleration and Friction; Conceptual Physics Alive DVD: Newton's 2 <sup>nd</sup> Law
9-11 PS1E -Whenever one object exerts a force on another object, a force of equal magnitude is exerted on the first object in the opposite direction. (Newton's 3rd Law of Motion)	<b>SE/TE:</b> 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117-123
	<b>TR:</b> Lab Manual: Labs 12, 14, 15, 21, 22, 33, 35

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	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Graphing Motion, Newton's 3 <sup>rd</sup> Law, Conservation of Momentum; Probeware Labs: Labs 2, 6; Conceptual Physics Alive DVD: Newton's 3 <sup>rd</sup> Law
9-11 PS1F -Gravitation is a universal attractive force by which objects with mass attract one another. The gravitational force between two objects is proportional to their masses and inversely proportional to the square of the distance between the objects. (Newton's Law of Universal Gravitation)	<b>SE/TE:</b> 237-239, 255-261, 648-650
	<b>TR:</b> Lab Manual: Labs 43, 44, 45, 46
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Satellite Motion, Gravitational Interactions, Universal Gravitation; Conceptual Physics Alive DVD: Gravity I, Gravity II
9-11 PS1G -Electrical force is a force of nature, independent of gravity that exists between charged objects. Opposite charges attract while like charges repel.	<b>SE/TE:</b> 645, 646, 647, 648, 649, 650, 652, 653, 654, 655, 656, 657, 658-663
	<b>TR:</b> Lab Manual: Labs 89, 90, 98
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 15; Conceptual Physics Alive DVD: Electrostatics
9-11 PS1H -Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces.	<b>SE/TE:</b> 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 703, 704, 705, 706, 707, 709, 710, 711, 712, 720, 721, 722, 723, 724, 72, 726, 727, 728, 729, 730, 731, 732, 733, 741, 742, 743, 744, 745, 746, 747-752
	<b>TR:</b> Lab Manual: Labs 90, 91, 92, 93, 94, 95, 96, 97, 99

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	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 15; Virtual Physics Labs: The Effect of an Electric Field on Moving Charges, Capacitors, Electric Current, Series and Parallel Circuits, The Effect of a Magnetic Field on Moving Charges; Conceptual Physics Alive DVD: Electric Current, Magnetism and Induction
Performance Expectations	
Students are expected to:	
Calculate the average velocity of a moving object, given the object's change in position and time. ( $v = \frac{x_2 - x_1}{t_2 - t_1}$ ) Explain how two objects moving at the same speed can have different velocities.	<b>SE/TE:</b> 50, 51, 59, 61-67, 70-71, 72, 73, 74, 77, 96, 97, 219, 234, 235, 236
	<b>TR:</b> Lab Manual: Labs 8, 9
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Linear Motion; Virtual Physics Labs: Measuring Speed
Calculate the average acceleration of an object, given the object's change in velocity with respect to time. ( $a = \frac{v_2 - v_1}{t_2 - t_1}$ ) Explain how an object moving at constant speed can be accelerating.	<b>SE/TE:</b> 51-52, 53-55, 56, 57, 59, 61-67, 73-77, 86, 87, 88, 93, 95-97, 110, 111, 114
	<b>TR:</b> Lab Manual: Labs, 10, 11, 12, 13, 18, 19, 20, 34
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 1; Virtual Physics Labs: Acceleration of Gravity, Acceleration and Friction; Conceptual Physics Alive DVD: Linear Motion
Given specific scenarios, compare the motion of an object acted on by balanced forces with the motion of an object acted on by unbalanced forces.	<b>SE/TE:</b> 30-32, 33-34, 36-39, 40-45
	<b>TR:</b> Lab Manual: Labs 6, 7, 12, 41

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	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 2; Virtual Physics Labs: Newton's First Law, Graphing Motion; Conceptual Physics Alive DVD: Newton's 1 <sup>st</sup> Law
Predict how objects of different masses will accelerate when subject to the same force. Calculate the acceleration of an object, given the object's mass and the net force on the object, using Newton's 2nd law of Motion ( $F=ma$ ).	<b>SE/TE:</b> 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98-105
	<b>TR:</b> Lab Manual: Labs 10,11, 12, 13, 19, 20
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab2; Virtual Physics Labs: Graphing Motion, Acceleration of Gravity, Newton's 2 <sup>nd</sup> Law, Acceleration and Friction; Conceptual Physics Alive DVD: Newton's 2 <sup>nd</sup> Law
Illustrate with everyday examples that for every action there is an equal and opposite reaction (e.g., a person exerts the same force on the Earth as the Earth exerts on the person).	<b>SE/TE:</b> 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117-123
	<b>TR:</b> Lab Manual: Labs 12, 14, 15, 21, 22, 33, 35
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Graphing Motion, Newton's 3 <sup>rd</sup> Law, Conservation of Momentum; Probeware Labs: Labs 2, 6; Conceptual Physics Alive DVD: Newton's 3 <sup>rd</sup> Law
Predict how the gravitational force between two bodies would differ for bodies of different masses or different distances apart. Explain how the weight of an object can change while its mass remains constant.	<b>SE/TE:</b> 237-239, 255-261, 648-650
	<b>TR:</b> Lab Manual: Labs 43, 44, 45, 46
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Satellite Motion, Gravitational Interactions, Universal Gravitation; Conceptual Physics Alive DVD: Gravity I, Gravity II

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Predict whether two charged objects will attract or repel each other, and explain why.	<b>SE/TE:</b> 645, 646, 647, 648, 649, 650, 652, 653, 654, 655, 656, 657, 658-663
	<b>TR:</b> Lab Manual: Labs 89, 90, 98
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 15; Conceptual Physics Alive DVD: Electrostatics
Demonstrate and explain that an electric current flowing in a wire will create a magnetic field around the wire (i.e., electromagnetic effect). Demonstrate and explain that moving a magnet near a wire will cause an electric current to flow in the wire (i.e., the generator effect).	<b>SE/TE:</b> 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 703, 704, 705, 706, 707, 709, 710, 711, 712, 720, 721, 722, 723, 724, 72, 726, 727, 728, 729, 730, 731, 732, 733, 741, 742, 743, 744, 745, 746, 747-752
	<b>TR:</b> Lab Manual: Labs 90, 91, 92, 93, 94, 95, 96, 97, 99
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 15; Virtual Physics Labs: The Effect of an Electric Field on Moving Charges, Capacitors, Electric Current, Series and Parallel Circuits, The Effect of a Magnetic Field on Moving Charges; Conceptual Physics Alive DVD: Electric Current, Magnetism and Induction

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EALR 4: Physical Science	
Big Idea: Matter: Properties and Change (PS2)	
Core Content: Chemical Reactions	
<p>In prior years, students learned the basic concepts behind the atomic nature of matter. In grades 9-11, students learn about chemical reactions, starting with the structure of an atom. They learn that the Periodic Table groups elements with similar physical and chemical properties. With grounding in atomic structure, students learn about the formation of molecules and ions, compounds and solutions, and the details of a few common chemical reactions. They also learn about nuclear reactions and the distinction between fusion and fission. These concepts about the fundamental properties of matter will help students understand chemical reactions that are important in modern society and lay the groundwork for both chemistry and life science.</p>	
Content Standards	
Students know that:	
<p>9-11 PS2A -Atoms are composed of protons, neutrons, and electrons. The nucleus of an atom takes up very little of the atom's volume but makes up almost all of the mass. The nucleus contains protons and neutrons, which are much more massive than the electrons surrounding the nucleus. Protons have a positive charge, electrons are negative in charge, and neutrons have no net charge.</p>	<p><b>SE/TE:</b> 327, 331, 332, 333, 334, 335, 338-343, 774, 775, 783, 784</p>
	<p><b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Rutherford and the Nucleus; Conceptual Physics Alive DVD: Atoms</p>
<p>9-11 PS2B -Atoms of the same element have the same number of protons. The number and arrangement of electrons determines how the atom interacts with other atoms to form molecules and ionic compounds.</p>	<p><b>SE/TE:</b> 325, 326, 327, 328, 329, 333, 338-343, 774, 775</p>
	<p><b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Atoms; Virtual Physics Labs: Rutherford and the Nucleus</p>
<p>9-11 PS2C -When elements are listed in order according to the number of protons, repeating patterns of physical and chemical properties identify families of elements with similar properties. This Periodic Table is a consequence of the repeating pattern of outermost electrons.</p>	<p><b>SE/TE:</b> 335, 336</p>



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	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Atoms; Virtual Physics Labs: Rutherford and the Nucleus
9-11 PS2D -Ions are produced when atoms or molecules lose or gain electrons, thereby gaining a positive or negative electrical charge. Ions of opposite charge are attracted to each other, forming ionic bonds. Chemical formulas for ionic compounds represent the proportion of ion of each element in the ionic array.	<b>SE/TE:</b> 331, 334, 335, 646, 788
	<b>TR:</b> Lab Manual, Lab 75
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM
9-11 PS2E -Compounds are composed of two or more elements bonded together in a fixed proportion by sharing electrons between atoms, forming covalent bonds. Such compounds consist of well-defined molecules. Formulas of covalent compounds represent the types and number of atoms of each element in each molecule.	<b>SE/TE:</b> 330, 331, 334
	<b>TR:</b> Lab Manual: Lab 48
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM
9-11 PS2F -All forms of life are composed of large molecules that contain carbon. Carbon atoms bond to one another and other elements by sharing, forming covalent bonds. Stable molecules of carbon have four covalent bonds per carbon atom.	<b>SE/TE:</b> 331, 334
	<b>TR:</b> Lab Manual, Lab 48
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM
9-11 PS2G -Chemical reactions change the arrangement of atoms in the molecules of substances. Chemical reactions release or acquire energy from their surroundings and result in the formation of new substances.	<b>SE/TE:</b> 160, 334

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	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM
9-11 PS2H -Solutions are mixtures in which particles of one substance are evenly distributed through another substance. Liquids are limited in the amount of dissolved solid or gas that they can contain. Aqueous solutions can be described by relative quantities of the dissolved substances and acidity or alkalinity (pH).	<b>SE/TE:</b> 458
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Phase Changes; Conceptual Physics Alive DVD: Heat: Change of State
9-11 PS2I -The rate of a physical or chemical change may be affected by factors such as temperature, surface area, and pressure.	<b>SE/TE:</b> 337, 450-461
	<b>TR:</b> Lab Manual: Labs 54, 61, 63
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Labs 10, 11, 12; Virtual Physics Labs: Phase Changes; Conceptual Physics Alive DVD: Heat: Change of State
9-11 PS2J -The number of neutrons in the nucleus of an atom determines the isotope of the element. Radioactive isotopes are unstable and emit particles and/or radiation. Though the timing of a single nuclear decay is unpredictable, a large group of nuclei decay at a predictable rate, making it possible to estimate the age of materials that contain radioactive isotopes.	<b>SE/TE:</b> 333, 338-343, 784, 785, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801
	<b>TR:</b> Lab Manual: Labs 102, 103
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Radioactivity
9-11 PS2K -Nuclear reactions convert matter into energy, releasing large amounts of energy compared with chemical reactions. Fission is the splitting of a large nucleus into smaller pieces. Fusion is the joining of nuclei and is the process that generates energy in the Sun and other stars.	<b>SE/TE:</b> 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825-829

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	<b>TR:</b> Lab Manual: Lab 104
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Fission and Fusion
Performance Expectations	
Students are expected to:	
Describe the relative charges, masses, and locations of the protons, neutrons, and electrons in an atom of an element.	<b>SE/TE:</b> 327, 331, 332, 333, 334, 335, 338-343, 774, 775, 783, 784
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Rutherford and the Nucleus; Conceptual Physics Alive DVD: Atoms
Given the number and arrangement of electrons in the outermost shell of an atom, predict the chemical properties of the element.	<b>SE/TE:</b> 325, 326, 327, 328, 329, 333, 338-343, 774, 775
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Atoms; Virtual Physics Labs: Rutherford and the Nucleus
Given the number of protons, identify the element using a Periodic Table. Explain the arrangement of the elements on the Periodic Table, including the significant relationships among elements in a given column or row.	<b>SE/TE:</b> 335, 336
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Atoms; Virtual Physics Labs: Rutherford and the Nucleus
Explain how ions and ionic bonds are formed (e.g., sodium atoms lose an electron and chlorine atoms gain an electron, then the charged ions are attracted to each other and form bonds). Explain the meaning of a chemical formula for an ionic array (e.g., NaCl).	<b>SE/TE:</b> 331, 334, 335, 646, 788
	<b>TR:</b> Lab Manual, Lab 75
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM

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Give examples to illustrate that molecules are groups of two or more atoms bonded together (e.g., a molecule of water is formed when one oxygen atom shares electrons with two hydrogen atoms). Explain the meaning of a chemical formula for a molecule (e.g., CH <sub>4</sub> or H <sub>2</sub> O).	<b>SE/TE:</b> 330, 331, 334
	<b>TR:</b> Lab Manual: Lab 48
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM
Demonstrate how carbon atoms form four covalent bonds to make large molecules. Identify the functions of these molecules (e.g., plant and animal tissue, polymers, sources of food and nutrition, fossil fuels).	<b>SE/TE:</b> 160, 331, 334
	<b>TR:</b> Lab Manual, Lab 48
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM
Describe at least three chemical reactions of particular importance to humans (e.g., burning of fossil fuels, photosynthesis, rusting of metals). Use a chemical equation to illustrate how the atoms in molecules are arranged before and after a reaction. Give examples of chemical reactions that either release or acquire energy and result in the formation of new substances (e.g., burning of fossil fuels releases large amounts of energy in the form of heat).	<b>SE/TE:</b> 160, 334
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM
Give examples of common solutions. Explain the differences among the processes of dissolving, melting, and reacting. Predict the result of adding increased amounts of a substance to an aqueous solution, in concentration and pH.	<b>SE/TE:</b> 458
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Phase Changes; Conceptual Physics Alive DVD: Heat: Change of State

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Predict the effect of a change in temperature, surface area, pressure, on the rate of a given physical or chemical change.	<b>SE/TE:</b> 337, 450-461
	<b>TR:</b> Lab Manual: Labs 54, 61, 63
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Labs 10, 11, 12; Virtual Physics Labs: Phase Changes; Conceptual Physics Alive DVD: Heat: Change of State
Given the atomic number and atomic mass number of an isotope, students draw and label a model of the isotope's atomic structure (number of protons, neutrons and electrons). Given data from a sample, use a decay curve for a radioactive isotope to find the age of the sample. Explain how the decay curve is derived.	<b>SE/TE:</b> 333, 338-343, 784, 785, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801
	<b>TR:</b> Lab Manual: Labs 102, 103
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Radioactivity
Distinguish between nuclear fusion and nuclear fission by describing how each process transforms elements present before the reaction into elements present after the reaction.	<b>SE/TE:</b> 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825-829
	<b>TR:</b> Lab Manual: Lab 104
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Conceptual Physics Alive DVD: Fission and Fusion

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EALR 4: Physical Science	
Big Idea: Energy: Transfer, Transformation, and Conservation (PS3)	
Core Content: Transformation and Conservation of Energy	
In prior grades, students learned to apply the concept of –energy in various settings. In grades 9-11, students learn fundamental concepts of energy, including the Law of Conservation of Energy—that the total amount of energy in a closed system is constant. Other key concepts include gravitational potential and kinetic energy, how waves transfer energy, the nature of sound and the electromagnetic spectrum. Energy concepts are essential for understanding all of the domains of science, from the ways that organisms get energy from their environment, to the energy that drives weather systems and volcanoes.	
Content Standards	
Students know that:	
9-11 PS3A -Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system is constant and can neither be created nor destroyed. (Conservation of Energy)	<b>SE/TE:</b> 153-154, 155-157, 164-169, 409, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 451, 452, 453, 454, 455, 456, 457, 458-460, 470, 471, 472, 474, 475, 476, 477, 479, 669, 670, 671
	<b>TR:</b> Lab Manual: Labs 28, 29, 30, 31, 32, 42, 60, 61, 62, 63, 65
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Energy Conversions, Phase Changes; Probeware Labs: Labs 8, 12; Conceptual Physics Alive DVD: Energy
9-11 PS3B -Kinetic energy is the energy of motion. The kinetic energy of an object is defined by the equation: $E_k = \frac{1}{2} mv^2$	<b>SE/TE:</b> 147, 150, 151, 152, 164-169, 269-270, 407, 408, 411, 412, 413, 414, 451
	<b>TR:</b> Lab Manual: Lab 26
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 7; Conceptual Physics Alive DVD: Energy; Virtual Physics Labs: Energy Conversions
9-11 PS3C -Gravitational potential energy is due to the separation of mutually attracting masses. Transformations can occur between gravitational potential energy and kinetic energy, but the total amount of energy remains constant.	<b>SE/TE:</b> 147, 148, 149, 153-154, 155-157, 158-159, 164-169, 669, 670

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	<b>TR:</b> Lab Manual: Labs 28, 29, 32, 42, 65
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 12; Virtual Physics Labs: Energy Conversions; Conceptual Physics Alive DVD: Energy
9-11 PS3D -Waves (including sound, seismic, light, and water waves) transfer energy when they interact with matter. Waves can have different wavelengths, frequencies, amplitudes, and travel at different speeds.	<b>SE/TE:</b> 491-494, 495-496, 497, 498-499, 500-503, 504-506, 507-513, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 527-531, 533, 534, 535, 537, 538, 539, 540, 51, 544, 545, 546, 572-573, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 603-610, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636
	<b>TR:</b> Lab Manual: Labs 70, 71, 72, 73, 74, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Labs 13, 14; Virtual Physics Lab: Light and Investigation, Color in Light, Reflection and Refraction of Light, Lenses, Diffraction and Interference; Conceptual Physics Alive DVD: Vibrations and Sound I and II, Light Waves, Light and Color, Reflection and Refraction
9-11 PS3E -Electromagnetic waves differ from physical waves because they do not require a medium and they all travel at the same speed in a vacuum. This is the maximum speed that any object or wave can travel. Forms of electromagnetic waves include X-rays, ultraviolet, visible light, infrared, and radio.	<b>SE/TE:</b> 536, 537, 538, 539, 542, 543, 555, 556, 557, 558, 559, 753, 754, 755
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Light Investigation

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Performance Expectations	
Students are expected to:	
Describe a situation in which energy is transferred from one place to another, and explain how energy is conserved. Describe a situation in which energy is transformed from one form to another and explain how energy is conserved.	<b>SE/TE:</b> 153-154, 155-157, 164-169, 409, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 451, 452, 453, 454, 455, 456, 457, 458-460, 470, 471, 472, 474, 475, 476, 477, 479, 669, 670, 671
	<b>TR:</b> Lab Manual: Labs 28, 29, 30, 31, 32, 42, 60, 61, 62, 63, 65
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Energy Conversions, Phase Changes; Probeware Labs: Labs 8, 12; Conceptual Physics Alive DVD: Energy
Calculate the kinetic energy of an object, given the object's mass and velocity.	<b>SE/TE:</b> 147, 150, 151, 152, 164-169, 269-270, 407, 408, 411, 412, 413, 414, 451
	<b>TR:</b> Lab Manual: Lab 26
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 7; Conceptual Physics Alive DVD: Energy; Virtual Physics Labs: Energy Conversions
Give an example in which gravitational potential energy and kinetic energy are changed from one to the other (e.g., a child on a swing illustrates the alternating transformation of kinetic and gravitational potential energy).	<b>SE/TE:</b> 147, 148, 149, 153-154, 155-157, 158-159, 164-169, 669, 670
	<b>TR:</b> Lab Manual: Labs 28, 29, 32, 42, 65
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Lab 12; Virtual Physics Labs: Energy Conversions; Conceptual Physics Alive DVD: Energy



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Demonstrate how energy can be transmitted by sending waves along a spring or rope. Characterize physical waves by frequency, wavelength, amplitude, and speed. Apply these properties to the pitch and volume of sound waves, and to the wavelength and magnitude of water waves.	<b>SE/TE:</b> 491-494, 495-496, 497, 498-499, 500-503, 504-506, 507-513, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 527-531, 533, 534, 535, 537, 538, 539, 540, 51, 544, 545, 546, 572-573, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 603-610, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636
	<b>TR:</b> Lab Manual: Labs 70, 71, 72, 73, 74, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Probeware Labs: Labs 13, 14; Virtual Physics Lab: Light and Investigation, Color in Light, Reflection and Refraction of Light, Lenses, Diffraction and Interference; Conceptual Physics Alive DVD: Vibrations and Sound I and II, Light Waves, Light and Color, Reflection and Refraction
Illustrate the electromagnetic spectrum with a labeled diagram, showing how regions of the spectrum differ regarding wavelength, frequency, and energy, and how they are used (e.g., infrared in heat lamps, microwaves for heating foods, X-rays for medical imaging).	<b>SE/TE:</b> 536, 537, 538, 539, 542, 543, 555, 556, 557, 558, 559, 753, 754, 755
	<b>TECH:</b> Teacher Express CD ROM; Exam View Express CD ROM; Student Express CD ROM; Virtual Physics Labs: Light Investigation