

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|---------------------------|---|--|---|--|
| EM.11.P.01 Physics | Electricity and Magnetism | Students shall understand the relationship between electric forces and electric fields. | Calculate electric force using Coulomb's law: | 342 understanding Coulomb's law | |
| EM.11.P.02 Physics | Electricity and Magnetism | Students shall understand the relationship between electric forces and electric fields. | Calculate electric field strength: | 404 the electric field | 89 understand and investigate electric and gravitational fields |
| EM.11.P.03 Physics | Electricity and Magnetism | Students shall understand the relationship between electric forces and electric fields. | Draw and interpret electric field lines | 342 electric forces are very strong 361 using magnetic forces 404 the electric field | 89 understand and investigate electric and gravitational fields |
| EM.12.P.01 Physics | Electricity and Magnetism | Students shall understand the relationship between electric energy and capacitance. | Calculate electrical potential energy | 303 understanding voltage 320 voltage in a series circuit 324 voltage in a parallel circuit 349 voltage and charge 351 voltage and capacitors | 58 measure voltage 60 measure voltage 64 investigating voltage drops 65 measure the voltage |
| EM.12.P.02 Physics | Electricity and Magnetism | Students shall understand the relationship between electric energy and capacitance. | Compute the electric potential for various charge distributions: | 303 understanding voltage 320 voltage in a series circuit 324 voltage in a parallel circuit 349 voltage and charge 351 voltage and capacitors | 58 measure voltage 60 measure voltage 64 investigating voltage drops 65 measure the voltage |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|---------------------------|---|--|--|--|
| EM.12.P.03 Physics | Electricity and Magnetism | Students shall understand the relationship between electric energy and capacitance. | Calculate the capacitance of various devices: | 350 how capacitors work 351 capacitors and current 351 charging a capacitor 352 measuring capacitance | 70 investigate capacitors 75 calculate charge stored in capacitor |
| EM.12.P.04 Physics | Electricity and Magnetism | Students shall understand the relationship between electric energy and capacitance. | Construct a circuit to produce a pre-determined value of an Ohm's law variable | 299 examples of electric circuits in nature 299 electric circuits 301 battery circuits 308 Ohm's law 318 series circuits 321 Ohm's law and voltage drops 323 parallel circuits 326 parallel circuits in homes | 57 build circuits 60 a circuit with a dimmer switch 62 investigate Ohm's law 63 use Ohm's law 65 investigate series circuits 65 build a circuit with three bulbs and a switch 66 investigate series circuits 67 Ohm's law and short circuits 68 investigate parallel circuits 69 construct a simple circuit 75 work with Ohm's law |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|---------------------------|--|--|--|--|
| EM.13.P.01 Physics | Electricity and Magnetism | Students shall understand how magnetism relates to induced and alternating currents. | Determine the strength of a magnetic field | 360 what is a magnet 362 magnetic fields 363 magnetic field lines 366 paramagnetic materials 366 diamagnetic materials 369 compass 370 how a compass works 374 magnets and MRI scanners 381 magnetic field of a wire | 77 investigate the strength of magnetic force 78 use a compass to investigate magnetic forces 79 investigate interactions of different materials with magnets 80 use a compass to detect magnetic force from electromagnet 81 compare electromagnet and permanent magnet 88 investigate magnetic fields 90 use magnetic fields to solve a puzzle |
| EM.13.P.02 Physics | Electricity and Magnetism | Students shall understand how magnetism relates to induced and alternating currents. | Use the first right-hand rule to find the direction of the force on the charge moving through a magnetic field | 364 electromagnets 364 right-hand rule 365 building an electromagnet 382 using coils to concentrate a magnetic field 387 electromagnetic induction explained | 82 investigate how a steel pin affects magnetic force created by a coil 85 investigate electromagnetic induction |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|---------------------------|--|---|---|---|
| EM.13.P.03 Physics | Electricity and Magnetism | Students shall understand how magnetism relates to induced and alternating currents. | Determine the magnitude and direction of the force on a current-carrying wire in a magnetic field | 364 electromagnets 364 right-hand rule 365 building an electromagnet 380 effect of current on a compass 382 using coils to concentrate a magnetic field 387 electromagnetic induction explained 522 electromagnetic waves | 82 investigate how a steel pin affects magnetic force created by a coil 85 investigate electromagnetic induction |
| EM.13.P.04 Physics | Electricity and Magnetism | Students shall understand how magnetism relates to induced and alternating currents. | Describe how the change in the number of magnetic field lines through a circuit loop affects the magnitude and direction of the induced current | 364 electromagnets 365 building an electromagnet 387 electromagnetic induction explained 388 Faraday's law of induction 389 how a generator works | 85 investigate electromagnetic induction 87 investigate how generators work |
| EM.13.P.05 Physics | Electricity and Magnetism | Students shall understand how magnetism relates to induced and alternating currents. | Calculate the induced electromagnetic field (emf) and current using Faraday's law of induction: | 388 Faraday's law of induction | |
| HT.07.P.01 Physics | Heat and Thermodynamics | Students shall understand the effects of thermal energy on particles and systems. | Perform specific heat capacity calculations: | 177 calories explained 178 specific heat explained 179 the heat equation | 32 investiate concept of specific heat |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | | Volume Two Investigation Manual Page | |
|-----------------------|----------------------------|---|--|---------------------------------|--|---|---|
| HT.07.P.02 Physics | Heat and Thermodynamics | Students shall understand the effects of thermal energy on particles and systems. | Perform calculations involving latent heat: | 177 178 179 | calories explained specific heat explained the heat equation | 32 | investiate concept of specific heat |
| HT.07.P.03 Physics | Heat and Thermodynamics | Students shall understand the effects of thermal energy on particles and systems. | Interpret the various sections of a heating curve diagram | 174 176 185 | interpreting a heating curve diagram flow of thermal energy is heat heat transfer is everywhere | | |
| HT.07.P.04 Physics | Heat and Thermodynamics | Students shall understand the effects of thermal energy on particles and systems. | Calculate heat energy of the different phase changes of a substance: | 177 179 | calories explained the heat equation | | |
| HT.08.P.01 Physics | Heat and Thermodynamics | Students shall apply the two laws of thermodynamics. | Describe how the first law of thermodynamics is a statement of energy conversion | 9 240 241 243 251 | basic forms of energy energy and systems energy exists in many different forms energy flow diagrams energy flow in natural systems | 45 46 47 57 | describe energy changes investigate energy flow in a system identify forms of energy in an experimental system draw energy flow diagram of the circuit |
| HT.08.P.02 Physics | Heat and Thermodynamics | Students shall apply the two laws of thermodynamics. | Calculate heat, work, and the change in internal energy by applying the first law of thermodynamics: | 94 101 | work and simple machines output work is always less than input work | 18 | compare and contrast input and output work |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|----------------------------|--|---|---|---|
| HT.08.P.03 Physics | Heat and Thermodynamics | Students shall apply the two laws of thermodynamics. | Calculate the efficiency of a heat engine by using the second law of thermodynamics: | 94 work and simple machines 101 output work is always less than input work 102 efficiency explained 246 efficiency explained 247 efficiency of a heat engine 248 efficiency of living things 334 efficiency of electric motors 334 efficiency of gasoline engine | 18 compare and contrast input and output work 45 calculate efficiency of the experimental system 45 graph efficiency vs. speed 45 investigate efficiency |
| HT.08.P.04 Physics | Heat and Thermodynamics | Students shall apply the two laws of thermodynamics. | Distinguish between entropy changes within systems and the entropy change for the universe as a whole | 94 work and simple machines 101 output work is always less than input work | 18 compare and contrast input and output work |
| MF.01.P.01 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Compare and contrast scalar and vector quantities | 110 compare and contrast scalars and vectors 111 force vectors 113 using a free-body diagram 115 finding resultant vector 136 working with velocity vector | 23 draw a free body diagram 23 use force vectors |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | | Volume Two Investigation Manual Page | |
|-----------------------|-------------------|---|---|---------------------------------|---|---|---|
| MF.01.P.02 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Solve problems involving constant and average velocity: | 18 | speed units | 3 | find the speed of the car |
| | | | | 19 | velocity defined | 7 | measure the speed |
| | | | | 40 | velocity defined | 9 | why did the speed change? |
| | | | | 56 | calculate speed from distance/time graph | 10 | find speed of car |
| | | | | 136 | speed vs. velocity | 21 | measure speed of car |
| | | | | 25 | calculate speed of car | 25 | calculate speed of car |
| | | | | 44 | experiment and find average speed | 44 | experiment and find average speed |
| | | | | 46 | measure speed of car | 46 | measure speed of car |
| MF.01.P.03 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Apply kinematic equations to calculate distance, time, or velocity under conditions of constant acceleration: | 32 | acceleration of sports cars | 11 | compare and contrast speed and acceleration |
| | | | | 32 | acceleration defined | 11 | find acceleration of car |
| | | | | 33 | calculating acceleration | 25 | calculate acceleration of car |
| | | | | 33 | acceleration and velocity | 25 | calculate acceleration of car |
| | | | | 40 | acceleration of falling objects | 28 | calculate acceleration |
| | | | | 149 | acceleration and circular motion | 28 | investigate acceleration on a ramp |
| MF.01.P.04 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Compare graphic representations of motion: | 46 | position vs. time graphs | 4 | position vs. time graph |
| | | | | 47 | position vs. time graph for accelerating motion | 11 | speed vs. time graph |
| | | | | 48 | speed vs. time graph | | |
| | | | | 49 | speed vs. time graph for accelerating motion | | |
| | | | | 51 | finding distance from a speed vs. time graph | | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|--|--|---|
| MF.01.P.05 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Calculate the components of a free falling object at various points in motion: | 39 calculations pertaining to free fall 39 effect of gravity on motion 52 acceleration shown through strobe photography 88 work and gravity 137 projectile explained 138 free fall component of a trajectory 402 gravitational field | 26 investigate projectile motion |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page | | |
|-----------------------|----------------------|---|--|---------------------------------|---|----|--------------------------------|
| MF.01.P.06 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Compare and contrast contact force (e.g., friction) and field forces (e.g., gravitational force) | 39 | calculations pertaining to free fall | 24 | investigate effect of friction |
| | | | | 39 | effect of gravity on motion | 26 | investigate projectile motion |
| | | | | 45 | effects of air resistance | | |
| | | | | 52 | acceleration shown through strobe photography | | |
| | | | | 88 | work and gravity | | |
| | | | | 94 | friction and machines | | |
| | | | | 101 | friction explained | | |
| | | | | 119 | friction explained | | |
| | | | | 119 | cause of friction | | |
| | | | | 120 | static and sliding friction | | |
| | | | | 122 | reducing friction | | |
| | | | | 123 | useful friction | | |
| | | | | 137 | projectile explained | | |
| | | | | 138 | free fall component of a trajectory | | |
| | | | | 402 | gravitational field | | |
| 418 | friction and damping | | | | | | |
| MF.01.P.07 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Draw free body diagrams of all forces acting upon an object | 111 | force vectors | 23 | draw a free body diagram |
| | | | | 112 | resolving vectors | 23 | use force vectors |
| | | | | 113 | using a free-body diagram | | |
| | | | | 115 | finding resultant vector | | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|--|---|---|
| MF.01.P.08 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Calculate the applied forces represented in a free body diagram | 112 resolving vectors | |
| MF.01.P.09 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Apply Newton's first law of motion to show balanced and unbalanced forces | 29 Newton's first law 36 balanced and unbalanced forces | 8 investigate Newton's first law of motion |
| MF.01.P.10 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Apply Newton's second law of motion to solve motion problems that involve constant forces: | 35 quantitative understanding of second law 35 Newton's second law 36 applying Newton's second law properly 37 using second law formula 424 Newton's second law and oscillators | 10 investigate Newton's second law of motion 23 Newton's second law of motion 25 apply Newton's second law of motion 29 apply Newton's second law of motion 95 Newton's 2nd law of motion and natural frequency |
| MF.01.P.11 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Apply Newton's third law of motion to explain action-reaction pairs | 52 action-reaction pairs 59 Newton's third law 60 sorting out force pairs 78 third law and rockets 117 Newton's third law and springs 128 the third law and physics of walls 158 Newton's third law and helicopters | 12 investigate Newton's 3rd law of motion 13 relate Newton's 3rd law of motion to car collisions |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|---|--|---|
| MF.01.P.12 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Calculate frictional forces (i.e., kinetic and static): | 45 effects of air resistance 94 friction and machines 101 friction explained 119 cause of friction 119 friction explained 120 static and sliding friction 122 reducing friction 123 useful friction 418 friction and damping | 24 investigate effect of friction |
| MF.01.P.13 Physics | Motion and Forces | Students shall understand one-dimensional motion. | Calculate the magnitude of the force of friction: | 45 effects of air resistance 94 friction and machines 101 friction explained 119 cause of friction 119 friction explained 120 static and sliding friction 122 reducing friction 123 useful friction 418 friction and damping | 24 investigate effect of friction |
| MF.02.P.01 Physics | Motion and Forces | Students shall understand two-dimensional motion. | Calculate the resultant vector of a moving object | 112 resolving vectors | |
| MF.02.P.02 Physics | Motion and Forces | Students shall understand two-dimensional motion. | Resolve two-dimensional vectors into their components: | 112 resolving vectors | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|--|--|---|
| MF.02.P.03 Physics | Motion and Forces | Students shall understand two-dimensional motion. | Calculate the magnitude and direction of a vector from its components: | 112 resolving vectors | |
| MF.02.P.04 Physics | Motion and Forces | Students shall understand two-dimensional motion. | Solve two-dimensional problems using balanced forces: | 29 mass and inertia 43 calculating weight from mass | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|--|---|--|
| MF.02.P.05 Physics | Motion and Forces | Students shall understand two-dimensional motion. | Solve two-dimensional problems using the Pythagorean Theorem or the quadratic formula: | 19 mathematical descriptions 26 interpreting distance/time graph 34 mathematical model of acceleration 35 Newton's second law equation 41 average speed equation 43 calculating weight 61 momentum equation 62 relating impulse and momentum conservation 68 kinetic energy formula 86 the work equation 89 the power equation 96 calculating mechanical advantage 118 Hooke's law equation 141 projectile motion problems 143 calculating angular speed 144 finding the circumference of a circle 145 linear speed equation 153 equation for law of universal gravitation 179 the heat equation 193 density formula | 11 find formula for acceleration 13 derive a formula 17 calculate mechanical advantage 17 derive a formula to use with ropes and pulleys 29 find a mathematical name for the steepness ratio 29 calculate the ratio 31 calculate temperature of mixture 69 calculate power used by the bulb 75 derive a formula to calculate the charge 76 calculate the number of electrons 99 calculate natural frequency and period 154 calculate gear ratio |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|---|--|---|
| | | | | 208 pressure and temperature relationship 308 equation for Ohm's law 342 equation for Coulomb's law 438 calculating wave speeds 439 equation for the speed of a wave 525 equation for the speed of light | |
| MF.02.P.06 Physics | Motion and Forces | Students shall understand two-dimensional motion. | Describe the path of a projectile as a parabola | 39 calculations pertaining to free fall 39 effect of gravity on motion 52 acceleration shown through strobe photography 88 work and gravity 137 projectile explained 138 free fall component of a trajectory 402 gravitational field | 26 investigate projectile motion |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|--|--|---|
| MF.02.P.07 Physics | Motion and Forces | Students shall understand two-dimensional motion. | Apply kinematic equations to solve problems involving projectile motion of an object launched at an angle: | 39 calculations pertaining to free fall 39 effect of gravity on motion 52 acceleration shown through strobe photography 88 work and gravity 137 projectile explained 138 free fall component of a trajectory 402 gravitational field | 26 investigate projectile motion |
| MF.02.P.08 Physics | Motion and Forces | Students shall understand two-dimensional motion. | Apply kinematic equations to solve problems involving projectile motion of an object launched with initial horizontal velocity | 39 calculations pertaining to free fall 39 effect of gravity on motion 52 acceleration shown through strobe photography 88 work and gravity 137 projectile explained 138 free fall component of a trajectory 402 gravitational field | 26 investigate projectile motion |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|---|---|---|
| MF.02.P.09 Physics | Motion and Forces | Students shall understand two-dimensional motion. | Calculate rotational motion with a constant force directed toward the center: | 143 angular speed formula 143 calculating angular speed 143 rotations and degrees 145 calculating linear speed for a rotating object 149 Newton's second law and circular motion | |
| MF.02.P.10 Physics | Motion and Forces | Students shall understand two-dimensional motion. | Solve problems in circular motion by using centripetal acceleration: | 147 centripetal force 148 centripetal force | |
| MF.03.P.01 Physics | Motion and Forces | Students shall understand the dynamics of rotational equilibrium. | Relate radians to degrees: | 143 calculating angular speed 143 rotations and degrees | |
| MF.03.P.02 Physics | Motion and Forces | Students shall understand the dynamics of rotational equilibrium. | Calculate the magnitude of torque on an object: | 124 torque causes objects to rotate 124 torque explained 124 comparing torque and force 125 torque is not work 125 calculating torque 126 solving problems with torque 127 rotational equilibrium | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|---|---------------------------------|--|
| MF.03.P.03 Physics | Motion and Forces | Students shall understand the dynamics of rotational equilibrium. | Calculate angular speed and angular acceleration: | 143 143 | calculating angular speed rotations and degrees |
| MF.03.P.04 Physics | Motion and Forces | Students shall understand the dynamics of rotational equilibrium. | Solve problems using kinematic equations for angular motion: | 127 | rotational equilibrium |
| MF.03.P.05 Physics | Motion and Forces | Students shall understand the dynamics of rotational equilibrium. | Solve problems involving tangential speed: | 127 | rotational equilibrium |
| MF.03.P.06 Physics | Motion and Forces | Students shall understand the dynamics of rotational equilibrium. | Solve problems involving tangential acceleration: | 127 | rotational equilibrium |
| MF.03.P.07 Physics | Motion and Forces | Students shall understand the dynamics of rotational equilibrium. | Calculate centripetal acceleration: | 143 145 147 148 149 | angular speed formula calculating linear speed for a rotating object centripetal force centripetal force Newton's second law and circular motion |
| MF.03.P.08 Physics | Motion and Forces | Students shall understand the dynamics of rotational equilibrium. | Apply Newton's universal law of gravitation to find the gravitational force between two masses: | 153 | Newton's law of universal gravitation explained |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|---|---|--|
| MF.04.P.01 Physics | Motion and Forces | Students shall understand the relationship between work and energy. | Calculate net work done by a constant net force: | 31 net force explained 37 net force and second law calculating 116 when net force is zero | 11 investigate net force 22 when net force is zero |
| MF.04.P.02 Physics | Motion and Forces | Students shall understand the relationship between work and energy. | Solve problems relating kinetic energy and potential energy to the work-energy theorem: | 67 calculating potential energy 68 calculating kinetic energy 68 potential to kinetic energy conversions 69 kinetic energy and stopping distance of a car 70 potential to kinetic energy conversions 117 potential and kinetic energy in a spring 249 mechanical systems and energy | 15 calculate potential energy of car 24 calculate kinetic energy of sled 47 calculate energy |
| MF.04.P.03 Physics | Motion and Forces | Students shall understand the relationship between work and energy. | Solve problems through the application of conservation of mechanical energy: | 67 potential energy explained 68 kinetic energy explained 70 law of conservation of energy 71 using energy conservation to solve problems 249 energy flow diagram for mechanical systems | 14 investigate exchange of energy in car and track system 15 apply law of energy conservation |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|---|---|---|
| MF.04.P.04 Physics | Motion and Forces | Students shall understand the relationship between work and energy. | Relate the concepts of time and energy to power | 89 calculating power 90 maximum power output of a person 244 power explained 245 three ways to look at power 250 power in human technology 252 power in natural systems 254 wave power 254 tidal power | |
| MF.04.P.05 Physics | Motion and Forces | Students shall understand the relationship between work and energy. | Prove the relationship of time, energy and power through problem solving: | 89 calculating power 90 maximum power output of a person 244 power explained 245 three ways to look at power 250 power in human technology 252 power in natural systems 254 wave power 254 tidal power | |
| MF.05.P.01 Physics | Motion and Forces | Students shall understand the law of conservation of momentum. | Describe changes in momentum in terms of force and time | 62 understanding impulse 76 impulse and practical problem solving | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|--|--|--|--|
| MF.05.P.02 Physics | Motion and Forces | Students shall understand the law of conservation of momentum. | Solve problems using the impulse-momentum theorem: | 62 understanding impulse 76 impulse and practical problem solving | |
| MF.05.P.03 Physics | Motion and Forces | Students shall understand the law of conservation of momentum. | Compare total momentum of two objects before and after they interact: | 63 law of conservation of momentum 64 using momentum conservation to solve problems 74 momentum and collisions 77 momentum and car safety | 13 apply the law of conservation of momentum |
| MF.05.P.04 Physics | Motion and Forces | Students shall understand the law of conservation of momentum. | Solve problems for perfectly inelastic and elastic collisions: | 63 law of conservation of momentum 64 using momentum conservation to solve problems 74 momentum and collisions 77 momentum and car safety | 13 apply the law of conservation of momentum |
| MF.06.P.01 Physics | Motion and Forces | Students shall understand the concepts of fluid mechanics. | Calibrate the applied buoyant force to determine if the object will sink or float: | 202 buoyancy explained | |
| MF.06.P.02 Physics | Motion and Forces | Students shall understand the concepts of fluid mechanics. | Apply Pascal's principle to an enclosed fluid system: | 204 pressure and fluids | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | | Volume Two Investigation Manual Page | |
|-----------------------|-------------------|---|--|---------------------------------|---|---|--|
| MF.06.P.03 Physics | Motion and Forces | Students shall understand the concepts of fluid mechanics. | Apply Bernoulli's equation to solve fluid-flow problems: | 205 205 | Bernoulli's principle Bernoulli's principle and fluids | 37 38 | investigate Bernoulli's principle applying Bernoulli's equation |
| MF.06.P.04 Physics | Motion and Forces | Students shall understand the concepts of fluid mechanics. | Use the ideal gas law to predict the properties of an ideal gas under different conditions | 207 | ideal gas law | | |
| NP.14.P.01 Physics | Nuclear Physics | Students shall understand the concepts of quantum mechanics as they apply to the atomic spectrum. | Calculate energy quanta using Planck's equation: | 231 233 | Planck's constant probability and quantum theory | | |
| NP.14.P.02 Physics | Nuclear Physics | Students shall understand the concepts of quantum mechanics as they apply to the atomic spectrum. | Calculate the de Broglie wavelength of matter: | 231 233 | Planck's constant probability and quantum theory | | |
| NP.14.P.03 Physics | Nuclear Physics | Students shall understand the concepts of quantum mechanics as they apply to the atomic spectrum. | Distinguish between classical ideas of measurement and Heisenberg's uncertainty principle | 232 | understanding the uncertainty principle | | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | | Volume Two Investigation Manual Page | |
|-----------------------|-------------------|---|--|---------------------------------|--|---|--|
| NP.14.P.04 Physics | Nuclear Physics | Students shall understand the concepts of quantum mechanics as they apply to the atomic spectrum. | Research emerging theories in physics, such as string theory | 280 284 | meaning of Einstein's formula theory of special relativity | 53 55 | explore the concept of relativity a thought experiment on Einstein's theories |
| NP.15.P.01 Physics | Nuclear Physics | Students shall understand the process of nuclear decay. | Calculate the binding energy of various nuclei | 269 270 | fusion reactions fission reactions | | |
| NP.15.P.02 Physics | Nuclear Physics | Students shall understand the process of nuclear decay. | Predict the products of nuclear decay | 267 268 | nuclear reactions explained nuclear reactions and energy | | |
| NP.15.P.03 Physics | Nuclear Physics | Students shall understand the process of nuclear decay. | Calculate the decay constant and the half-life of a radioactive substance | 221 222 270 | weak force explained radioactive decay radioactive materials | | |
| NS.16.P.01 Physics | Nature of Science | Students shall demonstrate an understanding that science is a way of knowing. | Describe why science is limited to natural explanations of how the world works | 4 4 19 23 | applying natural laws understanding natural laws mathematical models science helps us learn about natural world | | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|---|--------------|--|---|
| NS.16.P.02 Physics | Nature of Science | Students shall demonstrate an understanding that science is a way of knowing. | Compare and contrast the criteria for the formation of hypotheses, theories and laws | 8 | formulating a hypothesis | 6 form a hypothesis 30 state a hypothesis about the water's energy 94 state a hypothesis about period of pendulum 96 state a hypothesis about the natural frequency of the oscillator |
| NS.16.P.03 Physics | Nature of Science | Students shall demonstrate an understanding that science is a way of knowing. | Summarize the guidelines of science: -results are based on observations, evidence, and testing -hypotheses must be testable -understandings and/or conclusions may change -peer review and verification | 8 8 22 | scientific method formulating a hypothesis scientific method in action | 4 use photogate A to monitor repeatability 6 form a hypothesis 27 practice your technique until it is repeatable 30 state a hypothesis about the water's energy 94 state a hypothesis about period of pendulum 96 state a hypothesis about the natural frequency of the oscillator |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|--|---|---|---|
| NS.17.P.01 Physics | Nature of Science | Students shall safely design and conduct a scientific inquiry to solve valid problems. | Develop the appropriate procedures using controls and variables (dependent and independent) in scientific experimentation | 6 what is a variable 8 control and experimental variables 8 dependent variables 8 independent variables 16 graphs and dependent variables 16 graphs and independent variables 24 importance of changing one variable at a time in an experiment | 6 recognize and control variables 27 identify and control variables 94 investigate variables and how they affect the period of a pendulum |
| NS.17.P.02 Physics | Nature of Science | Students shall safely design and conduct a scientific inquiry to solve valid problems. | Research and apply appropriate safety precautions (ADE Guidelines) when designing and/or conducting scientific investigations | | 16 safety with simple machines 48 demonstrate safe lab practices 67 short circuits and lab safety 70 capacitor safety |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|--|---|---|---|
| NS.17.P.03 Physics | Nature of Science | Students shall safely design and conduct a scientific inquiry to solve valid problems. | Identify sources of bias that could affect experimental outcome | 6 what is a variable 8 cause and effect relationships 8 control and experimental variables 8 dependent variables 8 independent variables 16 graphs and dependent variables 16 graphs and independent variables 24 importance of changing one variable at a time in an experiment | 6 recognize and control variables 27 identify and control variables 94 investigate variables and how they affect the period of a pendulum |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | | Volume One Student Text Page | Volume Two Investigation Manual Page | |
|-----------------------|-------------------|--|---|-----|--|---|--|
| NS.17.P.04 Physics | Nature of Science | Students shall safely design and conduct a scientific inquiry to solve valid problems. | Gather and analyze data using appropriate summary statistics (e.g., percent yield, percent error) | 4 | what is analysis | 3 | car launching technique is a possible source of error |
| | | | | 10 | what is a model | 4 | car launching technique is a possible source of error |
| | | | | 11 | measurement | 4 | construct a graph |
| | | | | 12 | metric system | 11 | create a graph |
| | | | | 13 | measuring time | 15 | graph speed vs. height |
| | | | | 16 | constructing graphs | 20 | graph work done vs. deflection of rubber band |
| | | | | 16 | steps to follow for graph construction | 21 | graph speed vs. rubber band deflection |
| | | | | 25 | constructing a graph | 21 | how close is your prediction to the actual measurement? |
| | | | | 46 | motion graphs | 25 | graph friction vs. mass |
| | | | | 48 | motion graphs | 26 | spotting the landing point of the marble is tricky |
| | | | | 56 | analyze a speed/distance graph | 27 | graph launch angle vs. range |
| | | | | 112 | using a graph to find force vector components | 27 | marble launching technique is a possible source of error |
| | | | | 419 | harmonic motion graphs | 29 | graph acceleration vs. steepness ratio |
| | | | | 420 | finding the amplitude on a harmonic motion graph | 45 | make a graph of efficiency vs. speed |
| | | | | | | 47 | analyze the results |
| | | | | | | 50 | graph time vs. temperature |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|--------|------------------|---------------------------------|---------------------------------|--|
| | | | | | 52 construct a graph 71 find the average of the three times 75 graph current vs. time for the capacitor 86 graph voltage vs. speed 94 sketch harmonic motion graphs 154 analyze gear ratio data |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|--|--|---------------------------------|---|
| NS.17.P.05 Physics | Nature of Science | Students shall safely design and conduct a scientific inquiry to solve valid problems. | Formulate valid conclusions without bias | | <p>6 predict fastest car</p> <p>6 reflecting on the experiment</p> <p>7 construct explanations supported by evidence</p> <p>9 how do your observations support your answer?</p> <p>11 what experimental data support answer?</p> <p>15 predict speed of car</p> <p>21 predict speed of car</p> <p>30 predict temperature of mixture</p> <p>31 did result agree with hypothesis?</p> <p>45 predict how many bounces the car will make</p> <p>47 construct a reasonable explanation</p> <p>52 find a percentage</p> <p>60 propose a relationship between power and voltage</p> <p>96 make predictions about natural frequency</p> |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|--|---|---|---|
| NS.18.P.01 Physics | Nature of Science | Students shall demonstrate an understanding of historical trends in physics. | Recognize that theories are scientific explanations that require empirical data, verification and peer review | | 4 use photogate A to monitor repeatability 27 practice your technique until it is repeatable |
| NS.18.P.02 Physics | Nature of Science | Students shall demonstrate an understanding of historical trends in physics. | Research historical and current events in physics | 28 Newton and the history of physics 52 contributions of Harold Edgerton 52 history of high-speed photography 79 contributions of Robert Goddard 166 Robert Brown and Brownian motion | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|--|---|--|
| NS.19.P.01 Physics | Nature of Science | Students shall use mathematics, science equipment, and technology as tools to communicate and solve physics problems. | Use appropriate equipment and technology as tools for solving problems (e.g., balances, scales, calculators, probes, glassware, burners, computer software and hardware) | 11 measurement 12 metric system 13 measuring time 171 how a thermometer works 305 using a multimeter to measure current 307 using a multimeter to measure resistance | computer spreadsheets and graphing software can be used throughout the curriculum for data analysis and presentation 2 using timers and photogates 22 use spring scales 44 using a timer and photogates 46 using a timer and photogates 59 use a multimeter 61 using a multimeter to measure resistance 62 use a multimeter to measure current 63 use a multimeter to measure resistance of a pot 64 use a multimeter to measure voltage drop 65 use a multimeter to measure voltage 66 use a multimeter to measure current 74 use a multimeter to measure voltage 85 use a multimeter to measure voltage |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|--------|------------------|---------------------------------|---------------------------------|--|
| | | | | | <p>86 use a timer and photogate to measure speed of rotor</p> <p>93 use a timer and photogate to measure the period of a pendulum</p> <p>96 use a timer and photogate to measure the natural frequency of an oscillator</p> <p>150 using computer spreadsheets</p> |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page | | |
|-----------------------|-------------------|---|--|---|--|--|--|
| NS.19.P.02 Physics | Nature of Science | Students shall use mathematics, science equipment, and technology as tools to communicate and solve physics problems. | Manipulate scientific data using appropriate mathematical calculations, charts, tables, and graphs | 4 11 12 13 16 16 19 25 26 34 35 41 43 46 48 61 62 68 86 89 | what is analysis measurement metric system measuring time steps to follow for graph construction constructing graphs mathematical descriptions constructing a graph interpreting distance/time graph mathematical model of acceleration Newton's second law equation average speed equation calculating weight motion graphs motion graphs momentum equation relating impulse and momentum conservation kinetic energy formula the work equation the power equation | 1 1 4 6 6 7 8 9 10 11 11 13 13 15 15 17 17 18 19 20 | collect accurate, precise data with electronic timer construct a graph use a data table predict fastest car collect precise data constant force data table constant height data table speed data table find formula for acceleration create a graph derive a formula collision data table predict speed of car graph speed vs. height derive a formula to use with ropes and pulleys calculate mechanical advantage output and input work data table force vs. distance data table graph work done vs. deflection of rubber band |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page | | |
|-----------------------|--------|------------------|---------------------------------|---------------------------------|--|----|--|
| | | | | 96 | calculating mechanical advantage | 21 | graph speed vs. rubber band deflection |
| | | | | 112 | using a graph to find force vector components | 21 | predict speed of car |
| | | | | 118 | Hooke's law equation | 22 | force data table |
| | | | | 141 | projectile motion problems | 25 | graph friction vs. mass |
| | | | | 143 | calculating angular speed | 25 | rolling friction data table |
| | | | | 144 | finding the circumference of a circle | 27 | graph launch angle vs. range |
| | | | | 145 | linear speed equation | 27 | how can photogate ensure consistent results? |
| | | | | 153 | equation for law of universal gravitation | 29 | calculate the ratio |
| | | | | 179 | the heat equation | 29 | speed and height data table |
| | | | | 193 | density formula | 29 | find a mathematical name for the steepness ratio |
| | | | | 208 | pressure and temperature relationship | 29 | graph acceleration vs. steepness ratio |
| | | | | 308 | equation for Ohm's law | 30 | predict temperature of mixture |
| | | | | 342 | equation for Coulomb's law | 31 | calculate temperature of mixture |
| | | | | 419 | harmonic motion graphs | 45 | predict how many bounces the car will make |
| | | | | 420 | finding the amplitude on a harmonic motion graph | 45 | make a graph of efficiency vs. speed |
| | | | | 438 | calculating wave speeds | 50 | graph time vs. temperature |
| | | | | 439 | equation for the speed of a wave | 52 | construct a graph |
| | | | | 525 | equation for the speed of light | | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|--------|------------------|---------------------------------|---------------------------------|---|
| | | | | | 52 find a percentage |
| | | | | | 69 calculate power used by the bulb |
| | | | | | 71 find the average of the three times |
| | | | | | 75 derive a formula to calculate the charge |
| | | | | | 75 graph current vs. time for the capacitor |
| | | | | | 76 calculate the number of electrons |
| | | | | | 78 estimate the precision of measurements |
| | | | | | 86 graph voltage vs. speed |
| | | | | | 94 sketch harmonic motion graphs |
| | | | | | 96 make predictions about natural frequency |
| | | | | | 99 calculate natural frequency and period |
| | | | | | 154 calculate gear ratio |
| | | | | | 154 create a data table |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|--|---|---|
| NS.19.P.03 Physics | Nature of Science | Students shall use mathematics, science equipment, and technology as tools to communicate and solve physics problems. | Utilize technology to communicate research findings | 11 importance of units 11 communicating via measurement 11 measurement 12 metric system 13 measuring time | |
| NS.20.P.01 Physics | Nature of Science | Students shall describe the connections between pure and applied science. | Compare and contrast the connections between pure science and applied science as it relates to physics | 53 relationship between science and technology 78 rocket technology 79 new technologies 213 deep water submarine technology 235 technology and archaeology 273 how a smoke detector works 458 recording sound 532 applications of polarization | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|---|--------------------------------------|--|
| NS.20.P.02 Physics | Nature of Science | Students shall describe the connections between pure and applied science. | Give examples of scientific bias that affect outcomes of experimental results | 56 analyze a speed/distance graph | <p>3 car launching technique is a possible source of error</p> <p>4 car launching technique is a possible source of error</p> <p>6 reflecting on the experiment</p> <p>7 construct explanations supported by evidence</p> <p>9 how do your observations support your answer?</p> <p>11 what experimental data support answer?</p> <p>21 how close is your prediction to the actual measurement?</p> <p>26 spotting the landing point of the marble is tricky</p> <p>27 marble launching technique is a possible source of error</p> <p>47 construct a reasonable explanation</p> <p>47 analyze the results</p> <p>60 propose a relationship between power and voltage</p> <p>154 analyze gear ratio data</p> |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|---|--|---|---|
| NS.20.P.03 Physics | Nature of Science | Students shall describe the connections between pure and applied science. | Discuss why scientists should work within ethical parameters | 52 contributions of Harold Edgerton 79 contributions of Robert Goddard 218 contributions of John Dalton 219 contributions of Rutherford 219 contributions of J. J. Thomson 230 contributions of Bohr 231 Pauli's contributions 231 contributions of Schrödinger 232 contributions of Heisenberg | |
| NS.20.P.04 Physics | Nature of Science | Students shall describe the connections between pure and applied science. | Evaluate long-range plans concerning resource use and by-product disposal for environmental, economic, and political impact. | 72 energy usage and conservation | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|-------------------|--|--|---|---|
| NS.20.P.05 Physics | Nature of Science | Students shall describe the connections between pure and applied science. | Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology | 53 relationship between science and technology 78 rocket technology 79 new technologies 105 engineering design cycle in action 213 deep water submarine technology 235 technology and archaeology 273 how a smoke detector works 458 recording sound 532 applications of polarization | 47 suggest a design modification 87 measure voltage for each different generator 87 building different generators |
| NS.21.P.01 Physics | Nature of Science | Students shall describe various physics careers and the training required for the selected career. | Research and evaluate careers in physics using the following criteria: •educational requirements •salary •availability of jobs •working conditions | 53 science and photography 105 science and biomechanics 129 science and architecture 186 materials scientists 234 archaeologists 515 recording images | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | | Volume Two Investigation Manual Page | |
|-----------------------|------------------|--|--|---------------------------------|---|---|---|
| WO.09.P.01 Physics | Waves and Optics | Students shall distinguish between simple harmonic motion and waves. | Explain how force, velocity, and acceleration change as an object vibrates with simple harmonic motion | 414 | a pendulum's cycle | 92 | explore the meaning of amplitude |
| | | | | 414 | understanding a cycle | 92 | explore the meaning of cycle |
| | | | | 416 | frequency explained | 92 | explore harmonic motion using a pendulum |
| | | | | 416 | period is the time for one cycle | 93 | measure the period of a pendulum |
| | | | | 417 | frequency is the inverse of period | 94 | investigate harmonic motion with a pendulum |
| | | | | 418 | amplitude explained | | |
| | | | | 430 | identify period and frequency and cycle and amplitude | | |
| WO.09.P.02 Physics | Waves and Optics | Students shall distinguish between simple harmonic motion and waves. | Calculate the spring force using Hooke's law: | 118 | Hooke's law | | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|------------------|--|---|--|--|
| WO.09.P.03 Physics | Waves and Optics | Students shall distinguish between simple harmonic motion and waves. | Calculate the period and frequency of an object vibrating with a simple harmonic motion | 414 a pendulum's cycle 414 understanding a cycle 416 frequency explained 416 period is the time for one cycle 417 frequency is the inverse of period 418 amplitude explained 430 identify period and frequency and cycle and amplitude 437 frequency and amplitude and wavelength of waves 438 the speed of waves 461 wavelength of sound | 92 explore the meaning of amplitude 92 explore the meaning of cycle 92 explore harmonic motion using a pendulum 93 measure the period of a pendulum 94 investigate harmonic motion with a pendulum 101 investigate standing waves and frequency |
| WO.09.P.04 Physics | Waves and Optics | Students shall distinguish between simple harmonic motion and waves. | Differentiate between pulse and periodic waves | 440 standing waves on a vibrating string | 98 study waves on a string |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|------------------|--|---|--|--|
| WO.09.P.05 Physics | Waves and Optics | Students shall distinguish between simple harmonic motion and waves. | Relate energy and amplitude | 414 a pendulum's cycle 414 understanding a cycle 416 frequency explained 416 period is the time for one cycle 417 frequency is the inverse of period 418 amplitude explained 430 identify period and frequency and cycle and amplitude | 92 explore the meaning of amplitude 92 explore the meaning of cycle 92 explore harmonic motion using a pendulum 93 measure the period of a pendulum 94 investigate harmonic motion with a pendulum |
| WO.10.P.01 Physics | Waves and Optics | Students shall compare and contrast the law of reflection and the law of refraction. | Calculate the frequency and wavelength of electromagnetic radiation | 435 waves and technology 483 color and light 523 electromagnetic spectrum 524 wavelength and frequency of visible light 524 energy and color of light 536 the electromagnetic spectrum | 111 mixing primary colors of light 123 investigate visible light wavelengths 123 measure wavelengths of visible light using a spectrometer 123 how colors of light relate to frequency and wavelength |
| WO.10.P.02 Physics | Waves and Optics | Students shall compare and contrast the law of reflection and the law of refraction. | Apply the law of reflection for flat mirrors: | 499 mirrors reflect light 502 the law of reflection | 113 investigate law of reflection 113 use a mirror to observe reflected light 114 use results to derive law of reflection 120 using a mirror to reflect light |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|------------------|--|---|--|---|
| WO.10.P.03 Physics | Waves and Optics | Students shall compare and contrast the law of reflection and the law of refraction. | Describe the images formed by flat mirrors | 499 mirrors reflect light | 113 use a mirror to observe reflected light 120 using a mirror to reflect light |
| WO.10.P.04 Physics | Waves and Optics | Students shall compare and contrast the law of reflection and the law of refraction. | Calculate distances and focal lengths for curved mirrors: | 499 mirrors reflect light | 113 use a mirror to observe reflected light 120 using a mirror to reflect light |
| WO.10.P.05 Physics | Waves and Optics | Students shall compare and contrast the law of reflection and the law of refraction. | Draw ray diagrams to find the image distance and magnification for curved mirrors | 499 mirrors reflect light | 113 use a mirror to observe reflected light 120 using a mirror to reflect light |
| WO.10.P.06 Physics | Waves and Optics | Students shall compare and contrast the law of reflection and the law of refraction. | Solve problems using Snell's law: | 482 refraction of light 503 understanding refraction 504 angles of incidence and refraction 512 magnification | 114 use a prism to investigate light rays 115 investigate refraction 119 investigate lenses and magnification 121 investigate refraction of light 121 use a lens to refract light |
| WO.10.P.07 Physics | Waves and Optics | Students shall compare and contrast the law of reflection and the law of refraction. | Calculate the index of refraction through various media using the following equation: | 503 index of refraction | |

Correlation to Arkansas Science Curriculum Framework: Physical Systems

Physics: A First Course

Student Text and Investigation Manual

| Standard #: Strand | Grades | Content Standard | Student Learning Expectation | Volume One Student Text Page | Volume Two Investigation Manual Page |
|-----------------------|------------------|--|---|--|--|
| WO.10.P.08 Physics | Waves and Optics | Students shall compare and contrast the law of reflection and the law of refraction. | Use a ray diagram to find the position of an image produced by a lens | 502 drawing a ray diagram 508 ray diagram of an image in a mirror 509 focal point and focal length 510 ray diagram for a converging lens 511 the image formed by a lens 512 magnification | 113 construct ray diagrams 114 construct ray diagrams 114 use a prism to investigate light rays 117 find focal lengths of lenses 119 investigate lenses and magnification 121 use a lens to refract light |
| WO.10.P.09 Physics | Waves and Optics | Students shall compare and contrast the law of reflection and the law of refraction. | Solve problems using the thin-lens equation: | 499 converging and diverging lenses | |
| WO.10.P.10 Physics | Waves and Optics | Students shall compare and contrast the law of reflection and the law of refraction. | Calculate the magnification of lenses: | 512 magnification | 114 use a prism to investigate light rays 119 investigate lenses and magnification 121 use a lens to refract light |