

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.1.01 Integrated Chemistry - Physics	Standard 1: Principles of Integrated Chemistry – Physics	Structure and Properties of Matter	Understand and explain that atoms have a positive nucleus (consisting of relatively massive positive protons and neutral neutrons) surrounded by negative electrons, some of which may be lost, gained, or shared when interacting with other atoms.	311	protons/neutrons/electrons	132	building atom models
				311	location/size/charge of subatomic particles	133	protons and neutrons
				318	proton/electron attraction	133	location of electrons in atom
				324	use the periodic table to predict chemical formulas	136	ions
				324	which element is more likely to combine with other elements?	136	model stable and neutral atoms
				335	chemical bonding and the periodic table	137	build atomic models
				388	showing valence electrons in a diagram	140	find the number of electrons in outermost level
						140	review subatomic particles
						141	whan an atom ionizes
						141	modeling a chemical bond

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

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CP.1.02 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Structure and Properties of Matter	Realize that and explain how a neutral atom's atomic number and mass number can be used to determine the number of protons, neutrons, and electrons that make up an atom.	315 315 316 322 322 322 322	atomic number discussed atoms of same element have same atomic number mass number discussed atomic number on the periodic table chemical symbols and element names atomic mass on the periodic table mass number on the periodic table	132 133 133 133 136 136 137	atomic number determines what element that atom is identify atomic number identify mass number identify element symbol and name mass number atomic number importance of atomic number
CP.1.03 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Structure and Properties of Matter	Understand, and give examples to show, that isotopes of the same element have the same numbers of protons and electrons but differ in the numbers of neutrons.	316	isotopes explained	133 136	exploring isotopes understanding isotopes

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.1.04 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Structure and Properties of Matter	Know and explain that physical properties can be used to differentiate among pure substances, solutions, and heterogeneous mixtures.	278	mixtures can be separated by physical means	114	separating a homogeneous mixture
				291	density is independent of amount of substance		
				292	elasticity is a physical property of matter		
				292	hardness is a physical property of matter		
				293	brittleness is a physical property of matter		
				294	tensile strength is a physical property of matter		
				294	malleability is a physical property of matter		
CP.1.05 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Changes in Matter	Distinguish among chemical and physical changes in matter by identifying characteristics of these changes.	294	development of Kevlar brand fiber	146	investigate and observe chemical and physical changes in the lab
				353	physical and chemical changes and digestion		
				355	physical and chemical changes in tire recycling		
				372	determine if changes are chemical or physical		
				457	engineers use specific heat of substances to design better products		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

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CP.1.06 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Changes in Matter	Understand and explain how an atom can acquire an unbalanced electrical charge by gaining or losing electrons.	324 324 335	use the periodic table to predict chemical formulas which element is more likely to combine with other elements? chemical bonding and the periodic table	136 141 141	ions whan an atom ionizes modeling a chemical bond
CP.1.07 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Changes in Matter	Identify the substances gaining and losing electrons in simple oxidation-reduction reactions.	388	showing valence electrons in a diagram	136 140 141 143	ions find the number of electrons in outermost level whan an atom ionizes ionic compounds
CP.1.08 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Changes in Matter	Know and explain that the nucleus of a radioactive isotope is unstable and may spontaneously decay, emitting particles and/or electromagnetic radiation.	387 623	fusion and fission explained nuclear fusion and the sun	138 160	fusion and fission radioactive decay
CP.1.09 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Changes in Matter	Show how the predictability of the nuclei decay rate allows radioactivity to be used for estimating the age of materials that contain radioactive substances.	393 393 400	carbon dating radioisotopes in science and medicine research pros and cons of nuclear technology	160 161	radioactive decay research pros and cons of uses for radioactive elements

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

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CP.1.10 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Changes in Matter	Understand that the Periodic Table is a listing of elements arranged by increasing atomic number, and use it to predict whether a selected atom would gain, lose, or share electrons as it interacts with other selected atoms.	320 321 321 329 330 332 332 335	groups of elements groups of elements and valence shells studying the periodic table periodic table columns and valence electrons bonding and periodic table position periodic table and electronegativities metals nonmetals and metalloids periodic table and oxidation numbers	133 136 136 141 141 142	using the periodic table ions building and studying the periodic table build model of Na and Cl atoms and explain why they bond to form a molecule whan an atom ionizes arrangement of electrons and groups of elements

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.1.11 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Changes in Matter	Understand and give examples to show that an enormous variety of biological, chemical, and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules.	354	chemical reactions and digestion	157	predict the products of double displacement reactions
				354	new substances are formed when a chemical change occurs	162	investigating combustion reactions
				357	combustion reaction	162	carbon reactions and the environment
				361	chemical reactions in living systems	162	structure of fossil fuels
				361	heartburn reaction	162	importance of fossil fuels
				364	carbon chains		
				378	combustion reactions		
				378	consumer chemistry		
				381	MRE ration heater reaction		
				394	photosynthesis and carbon reactions		
				395	chemistry of the atmosphere		
				395	chemistry of the atmosphere		
				395	fossil fuels and carbon reactions		
				397	carbon reactions		
				438	chemical reactions and the formation of acid rain		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

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CP.1.12 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Changes in Matter	Realize and explain that because mass is conserved in chemical reactions, balanced chemical equations must be used to show that atoms are conserved.	363 371	history of law of conservation of mass which of the equations is balanced?	149 150	balance these equations investigate conservation of mass in effervescent tablet reaction

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

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CP.1.13 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Changes in Matter	Explain that the rate of reactions among atoms and molecules depends on how often they encounter one another, which is in turn affected by the concentrations, pressures, and temperatures of the reacting materials.	361	chemical reactions in living systems	156	predict products in a double displacement reaction
				364	formation of petroleum is a very slow chemical reaction	162	investigating combustion reactions
				378	combustion reactions	170	design experiments to explore dissolving rate
				378	consumer chemistry	175	solubility and pressure
				381	MRE ration heater reaction	181	water quality testing
				395	chemistry of the atmosphere	181	water quality testing
				395	chemistry of the atmosphere		
				397	carbon reactions		
				403	why water is a nearly universal solvent		
				409	polar solutes		
				412	solubility value		
				414	effect of pressure on solubility of gasses		
				414	pressure and the solubility of gases		
				416	SCUBA diving and effects of pressure on gasses in the bloodstream		
				422	acids and bases and enzymes in digestion		
				438	chemical reactions and the formation of acid rain		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

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CP.1.14 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Changes in Matter	Understand and explain that catalysts are highly effective in encouraging the interaction of other atoms and molecules.	364 422	formation of petroleum is a very slow chemical reaction acids and bases and enzymes in digestion	156	predict products in a double displacement reaction
CP.1.15 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Energy Transformations	Understand and explain that whenever the amount of energy in one place or form diminishes, the amount in other places or forms increases by the same amount.	84 85 88 90 91 92 92 93 96 96	work input and output some input work is converted to heat potential and kinetic energy explained conservation of energy explained energy conversions where does "spent" energy go? energy transformations and conservation different forms of energy described explain the "lost" energy prove that energy is conserved	31 36 37 38 38	work output vs. work input energy conservation and the roller coaster investigating conservation of energy with rollercoaster explore energy transformations conservation of energy and energy transformations

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.1.16 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Energy Transformations	Explain that heat energy in a material consists of the disordered motions of its atoms or molecules.	284 451 451 452 498	changes of state increasing temperature means increasing motion of molecules temperature is a measure of average kinetic energy molecular motion increases when temperature increases phases changes in the atmosphere	119 119	energy and phase changes adding heat energy to melt an ice cube
CP.1.17 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Energy Transformations	Know and explain that transformations of energy usually transform some energy into the form of heat, which dissipates by radiation or conduction into cooler surroundings.	454 455 460 461 461	changes in temperature are directly related to changes in energy examples of flow of heat thermal equilibrium conduction and convection and radiation thermal conductivity explained	119 188 188	investigate temperature and energy transfer in melting process investigate heating water with an immersion heater investigate the increase of temperature of water as thermal energy is added
CP.1.18 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Energy Transformations	Recognize and describe the heat transfer associated with a chemical reaction or a phase change as either exothermic or endothermic, and understand the significance of the distinction.	381 382	exothermic reactions and MREs endothermic reactions and cold packs	147 158 158	feel the heat generated by chemical reaction measure energy changes in 3 different reactions investigate energy changes in chemical reactions

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

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CP.1.19 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Energy Transformations	Understand and explain that the energy released whenever heavy nuclei split or light nuclei combine is roughly a million times greater than the energy absorbed or released in a chemical reaction. (E=mc ²)	387 623	fusion and fission explained nuclear fusion and the sun	138	fusion and fission
CP.1.20 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Energy Transformations	Realize and explain that the energy in a system* is the sum of both potential energy and kinetic energy.	91 537	following an energy transformation potential energy transformed to kinetic energy causes earthquakes	36 38	energy conservation and the roller coaster identify potential/kinetic energy conversions
CP.1.21 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Motion	Understand and explain that the change in motion of an object (acceleration) is proportional to the net force applied to the object and inversely proportional to the object's mass.	33 45 49 51 64	understanding acceleration Newton's second law summarized Newton's second law in detail net force explained solving problems using f=ma	14 16 19	acceleration is the rate at which speed changes thinking about force discover 2nd law of motion

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.1.22 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Motion	Recognize and explain that whenever one object exerts a force on another, an equal and opposite force is exerted back on it by the other object.	45	Newton's third law summarized	22	car and ramp and Newton's 3rd law
				59	Newton's third law in detail	23	using 3rd law to explain common phenomena

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

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CP.1.23 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Motion	Understand and explain that the motion of an object is described by its position, velocity, and acceleration.	14	how to calculate speed	8	calculating speed
				15	compare and contrast speed and velocity	9	collect data and calculate speed of car
				20	calculate speed of car	10	calculate speed of the car
				20	find speed of bumblebee	12	model the car's motion graphically
				24	accurate speed measurements	12	find speed of car at different positions
				29	position vs. time graph discussion	12	calculate speed of moving car
				30	position vs. time graphs	13	make a position vs. time graph
				32	average speed discussed	14	calculate speed of car at two places on the ramp
				32	average speed vs. instantaneous	14	acceleration is the rate at which speed changes
				36	examples of acceleration	15	make a speed vs. time graph
				37	speed vs. time graphs	15	make a speed vs. time graph
				37	speed vs. time graph discussion	15	changes in motion can be represented graphically
				42	calculate speed from distance/time graph	17	calculate speed of car
				52	the effect of gravity	20	investigate effect of gravity on motion
				56	friction explained	21	effect of friction on the car
				64	research effect of friction on human joints	36	find speed of marble

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.1.24 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Motion	Recognize and explain that waves are described by their velocity, wavelength, frequency or period, and amplitude.	179	what is a cycle?	83	find speed of a wave
				182	concept of frequency explained	86	adjust frequency of a standing wave
				182	concept of period explained	90	what is sound and how do we hear it?
				192	analyze systems to find cycle/period/frequency	105	explore relationship between color and wavelength
				219	frequency of sound and pitch	265	an element's spectral lines correspond to specific wavelengths of light
				221	importance of wavelength of sound waves		
				242	color and frequency of light waves		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.1.25 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Motion	Understand and explain that waves can superpose on one another, bend around corners, reflect off surfaces, be absorbed by materials they enter, and change direction when entering a new material.	197	transverse and longitudinal waves	82	study wave pulses on elastic cord
				201	waves and reflection	84	make different types of waves in a ripple tank
				201	reflection in water waves and light waves	85	observing reflection in water waves
				201	waves and refraction	87	investigating resonance
				201	waves and absorption	88	natural frequency and resonance of standing waves on a string
				202	refraction and eyeglasses	95	interference and sound waves
				204	resonance explained	95	investigate interference with sound waves
				205	standing waves on a string	96	investigating sound resonance
				206	constructive and destructive interference	101	examine light through diffraction grating
				210	can wave interference sink a ship?	102	polarization of water waves
				210	natural frequency of a building and earthquakes	102	polarization of a spring wave
				223	interference of sound waves	103	polarization of light
				225	consonance and dissonance and beats	106	tracing incident and reflected rays
				240	polarization of light	107	investigate how light interacts with mirrors
				258	forming images with lenses	108	tracing incident and refracted rays
				258	refraction in optical systems		
261	refraction and lenses						

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
				263	index of refraction	108	investigate how light interacts with a prism
				263	index of refraction	108	explore refraction with lenses
				273	find the angle of reflection	108	explore refraction with a prism
				480	absorption and emission	110	finding focal point and focal length of a lens
				538	body waves	111	plotting images formed when light is refracted by a lens
						253	using a retractive telescope
CP.1.26 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Motion	Realize and explain that all motion is relative to whatever frame of reference is chosen, for there is no absolute motionless frame from which to judge all motion.	13	speed is relative		
				18	what is the speed of an object that is standing still?		
				25	conceptual models of motion		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

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CP.1.27 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Forces of Nature	Recognize and describe that gravitational force is an attraction between masses and that the strength of the force is proportional to the masses and decreases rapidly as the square of the distance between the masses increases.	52 52 54 55 106 106 606	gravity depends on mass the effect of gravity Newton's law of universal gravitation calculating gravitational force between objects electrical forces electrical force is incredibly strong! Newton's law of universal gravitation	20 257	investigate effect of gravity on motion relating the relationship between orbital speed and distance to the equation of universal gravitation
CP.1.28 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Forces of Nature	Realize and explain that electromagnetic forces acting within and between atoms are vastly stronger than the gravitational forces acting between atoms.	389 389 389	strong nuclear force forces in the nucleus electromagnetic force	136	strong force

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.1.29 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Forces of Nature	Understand and explain that at the atomic level, electric forces between oppositely charged electrons and protons hold atoms and molecules together and thus, are involved in all chemical reactions.	324 324 335 389 389 389	use the periodic table to predict chemical formulas which element is more likely to combine with other elements? chemical bonding and the periodic table strong nuclear force forces in the nucleus electromagnetic force	136 136 141 141	strong force ions when an atom ionizes modeling a chemical bond
CP.1.30 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Forces of Nature	Understand and explain that in materials, there are usually equal proportions of positive and negative charges, making the materials as a whole electrically neutral.	311 311 318	protons/neutrons/electrons location/size/charge of subatomic particles proton/electron attraction	132 133 133 136 137 140	building atom models protons and neutrons location of electrons in atom model stable and neutral atoms build atomic models review subatomic particles

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.1.31 Integrated Chemistry- Physics	Standard 1: Principles of Integrated Chemistry – Physics	Forces of Nature	Realize and explain that moving electric charges produce magnetic forces, and moving magnets produce electric forces.	164 166 166 168 170 171	what is an electromagnet? building an electromagnet increased current vs. strength of magnetic field how electric motors work dissecting an electric motor electromagnetic induction explained	66 67 68 73 73	build an electromagnet find out what happens to strength of electromagnet when current is increased investigate how an electric motor works exploring electric generators use magnetic induction to create an electric field
CP.2.01 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Explain that Antoine Lavoisier invented a whole new field of science based on a theory of materials, physical laws, and quantitative methods, with the conservation of matter at its core.	312 321 332 363 363 393 393 457	Dalton's contributions Mendeleev's periodic table Linus Pauling and electronegativities history of law of conservation of mass Antoine Lavoisier accomplishments of Marie Curie Marie and Pierre Curie Joseph Black	150	investigate conservation of mass in effervescent tablet reaction

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

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CP.2.02 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Describe how Lavoisier's system for naming substances and describing their reactions contributed to the rapid growth of chemistry by enabling scientists everywhere to share their findings about chemical reactions with one another without ambiguity.	312 321 332 336 338 339 363 393 393 457	Dalton's contributions Mendeleev's periodic table Linus Pauling and electronegativities writing a chemical formula summary of chemical formula writing rules naming compounds Antoine Lavoisier accomplishments of Marie Curie Marie and Pierre Curie Joseph Black	143 143 145	name chemical compounds predict chemical formulas determine empirical formula
CP.2.03 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Explain that John Dalton's modernization of the ancient Greek ideas of element, atom, compound, and molecule strengthened the new chemistry by providing physical explanations for reactions that could be expressed in quantitative terms.	311 311 313 324	all matter is formed from atoms all matter is formed from atoms development of atomic theory research and create a poster to illustrate development of atomic model	130 132	investigate Rutherford's gold foil experiment comparing atoms

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.2.04 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Explain that Isaac Newton created a unified view of force and motion in which motion everywhere in the universe can be explained by the same few rules. Note that his mathematical analysis of gravitational force and motion showed that planetary orbits...	34 45 45 54 55 73 86 105 107 115 131 160 455	Aristotle vs. Newton Newton's Laws of Motion Newton's Principia Newton and the force of gravity Newton and the apple legend Leonardo DaVinci James Watt Benjamin Franklin Charles-Augustin Coulomb Volta's batteries Georg Ohm's work with circuits Faraday's contributions contributions of Joule		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.2.05 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Describe that Newton's system was based on the concepts of mass, force, and acceleration, his three laws of motion relating them, and a physical law stating that the force of gravity between any two objects in the universe...	34 45 48 50 52 54 54 55 105 107 599 606	Aristotle vs. Newton Newton's Laws of Motion Newton's laws explained and applied Newton's second law applied gravity depends on mass Newton's law of universal gravitation Newton and the force of gravity calculating gravitational force between objects Benjamin Franklin Charles-Augustin Coulomb Newton's first law of motion and the space shuttle Newton's law of universal gravitation	16 20 257	2nd law force and motion with car and ramp relating the relationship between orbital speed and distance to the equation of universal gravitation

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.2.06 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Explain that the Newtonian model made it possible to account for such diverse phenomena as tides, the orbits of the planets and moons, the motion of falling objects, and Earth's equatorial bulge.	52 52 54 55 606	the effect of gravity gravity depends on mass Newton's law of universal gravitation calculating gravitational force between objects Newton's law of universal gravitation	20 257	investigate effect of gravity on motion relating the relationship between orbital speed and distance to the equation of universal gravitation
CP.2.07 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Describe that among the surprising ideas of Albert Einstein's special relativity is that nothing can travel faster than the speed of light, which is the same for all observers no matter how they or the light source happen to be moving.		featured in ancillary component		featured in ancillary component
CP.2.08 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Explain that the special theory of relativity is best known for stating that any form of energy has mass, and that matter itself is a form of energy. ($E=mc^2$)		featured in ancillary component		featured in ancillary component

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.2.09 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Describe that general relativity theory pictures Newton's gravitational force as a distortion of space and time.	52 54 55 606	gravity depends on mass Newton's law of universal gravitation calculating gravitational force between objects Newton's law of universal gravitation	257	relating the relationship between orbital speed and distance to the equation of universal gravitation
CP.2.10 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Explain that Marie and Pierre Curie made radium available to researchers all over the world, increasing the study of radioactivity and leading to the realization that one kind of atom may change into another kind, and so must be made up of smaller parts.	312 393	contributions of Fermi contributions of Marie and Pierre Curie		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
CP.2.11 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Explain that Rutherford and his colleagues discovered that the heavy radioactive element uranium spontaneously splits itself into a slightly lighter nucleus and a very light helium nucleus.	313 324	development of atomic theory research and create a poster to illustrate development of atomic model	130	investigate Rutherford's gold foil experiment
CP.2.12 Integrated Chemistry- Physics	Standard 2: Historical Perspectives of Integrated Chemistry – Physics		Describe that later, Austrian and German scientists showed that when uranium is struck by neutrons, it splits into two nearly equal parts plus one or two extra neutrons.	387 623	fusion and fission explained nuclear fusion and the sun	138	fusion and fission

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.01 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	The Universe	Understand and discuss the nebular theory concerning the formation of solar systems. Include in the discussion the roles of planetesimals and protoplanets.	611 612 621 641 643 647	historical theories of the origin of the moon historical theories about the solar system historical theories of which objects were planets how the solar system was formed the structure of the Milky Way Galaxy the Big Bang theory of the origin of the universe		
ES.1.02 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	The Universe	Differentiate between the different types of stars found on the Hertzsprung-Russell Diagram. Compare and contrast the evolution of stars of different masses. Understand and discuss the basics of the fusion processes that are the source of energy of stars.	387 623 638 639 639 640 640	fusion and fission explained nuclear fusion and the sun the life cycle of stars death of small to medium stars results in white dwarfs and planetary nebula and black dwarfs description and illustration of the life cycle of stars death of massive stars results in supernovas and neutron stars and black holes elements formed by nuclear fusion in stars	138 255 264	fusion and fission observe and describe the appearance of the moon and Jupiter and its moons using spectroscopy to analyze the light emitted by stars and identify most common elements

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.03 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	The Universe	Compare and contrast the differences in size, temperature, and age between our sun and other stars.	615 622 624 625 635 637	classifying the planets descriptions of the sun and comparisons to other stars features and diagram of the sun features and emissions of the sun size of the sun compare to other stars H-R diagrams comparing temperature and brightness of stars		
ES.1.04 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	The Universe	Describe Hubble's law. Identify and understand that the "Big Bang" theory is the most widely accepted theory explaining the formation of the universe.	591 611 612 621 633 642 647 652	characteristics of the universe historical theories of the origin of the moon historical theories about the solar system historical theories of which objects were planets what is a star? what is a galaxy? the Big Bang theory of the origin of the universe research and describe astronomical objects		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.05 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	The Universe	Understand and explain the relationship between planetary systems, stars, multiple-star systems, star clusters, galaxies, and galactic groups in the universe.	591	characteristics of the universe	251	tracking the moon's phases in the night sky
				612	orbits of planets around the sun	256	simulate an object in orbit and investigate how orbital period varies within distance
				612	Johannes Kepler		
				613	Kepler's elliptically shaped orbits	258	setting up a scale model of the solar system
				613	explanation and illustration of the solar system	259	determining scale distances for the planets
				614	relative sizes and distances within the solar system	260	determining scale sizes of the planets
				616	classifying the planets	268	calculating the distance to stars and galaxies using apparent brightness and absolute brightness
				617	classifying the planets		
				618	comparing properties of the planets		
				619	asteroids and comets		
				620	meteors and meteorites and the Kuiper Belt		
				621	is Pluto a planet		
				622	descriptions of the sun and comparisons to other stars		
				633	the appearance of constellations in the night sky		
				633	what is a star?		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
				635	differences in colors of stars is related to their temperatures		
				635	size of the sun compare to other stars		
				636	brightness of stars' appearance		
				637	H-R diagrams comparing temperature and brightness of stars		
				642	what is a galaxy?		
				643	the appearance of the disk of the Milky Way in the night sky		
				652	research and describe astronomical objects		
ES.1.06 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	The Universe	Discuss how manned and unmanned space vehicles can be used to increase our knowledge and understanding of the universe.	594	history of the telescope	264	understand why spectroscopy is an important tool of astronomers
				595	types and uses of telescopes		
				596	types and uses of telescopes	268	measuring apparent brightness to calculate the distance to stars and galaxies
				597	satellites as tools of astronomy		
				598	spacecraft as tools of astronomy		
				599	how the space shuttle works		
				634	the use of spectroscopy to analyze stars		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.07 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	The Universe	Describe the characteristics and motions of the various kinds of objects in our solar system, including planets, satellites, comets, and asteroids. Explain that Kepler's laws determine the orbits of the planets.	612	orbits of planets around the sun	256	simulate an object in orbit and investigate how orbital period varies within distance
				612	Johannes Kepler		
				613	Kepler's elliptically shaped orbits		
				616	classifying the planets		
				617	classifying the planets		
				618	comparing properties of the planets		
				619	asteroids and comets		
				620	meteors and meteorites and the Kuiper Belt		
				621	is Pluto a planet		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.08 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	The Universe	Discuss the role of sophisticated technology, such as telescopes, computers, space probes, and particle accelerators, in making computer simulations and mathematical models in order to form a scientific account of the universe.	592 593 594 595 596 597 598 634 648 649	calculating and using light years light years and time history of the telescope types and uses of telescopes types and uses of telescopes satellites as tools of astronomy spacecraft as tools of astronomy the use of spectroscopy to analyze stars evidence for the Big Bang theory evidence for the Big Bang theory	264 268	understand why spectroscopy is an important tool of astronomers measuring apparent brightness to calculate the distance to stars and galaxies
ES.1.09 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	The Universe	Recognize and explain that the concept of conservation of energy is at the heart of advances in fields as diverse as the study of nuclear particles and the study of the origin of the universe.	88 90 92 93 96	potential and kinetic energy explained conservation of energy explained energy transformations and conservation different forms of energy described prove that energy is conserved	37 38	investigating conservation of energy with rollercoaster conservation of energy and energy transformations

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.10 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Recognize and describe that earth sciences address planet-wide interacting systems, including the oceans, the air, the solid earth, and life on Earth, as well as interactions with the Solar System.	439	illustration of acid rain formation		
				440	oceans as part of the hydrosphere		
				471	description of Earth's atmosphere		
				472	effect of life on Earth's atmosphere		
				477	layers of the atmosphere		
				478	layers of the atmosphere		
				482	changes to the oceans due to increasing global temperatures		
				568	how urban sprawl changes local climate		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.11 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Examine the structure, composition, and function of Earth's atmosphere. Include the role of living organisms in the cycling of atmospheric gases.	440	oceans as part of the hydrosphere	185	effect of ocean on carbon dioxide levels in the atmosphere
				451	thermometers	186	accurately measuring temperature using thermometers
				452	thermometers	194	construct and use an aneroid barometer
				471	description of Earth's atmosphere	198	detecting ozone which is a protective atmosphere gas against high energy radiation
				471	composition of Earth's atmosphere	202	investigate the temperature effects of greenhouse gases
				472	effect of life on Earth's atmosphere	218	using Doppler radar images to detect and track storms
				474	measuring atmospheric pressure with barometers		
				477	layers of the atmosphere		
				478	layers of the atmosphere		
				481	greenhouse effect and greenhouse gasses		
				481	greenhouse conditions on Earth		
				485	research the density of Venus' and Mars' atmospheres		
				495	global wind patterns		
				497	sling psychrometer		
				502	cold fronts		
				502	effects of moving air masses		
				503	jet streams		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
				503	warm fronts		
				615	greenhouse conditions on Venus		
ES.1.12 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Describe the role of photosynthetic plants in changing Earth's atmosphere.	364	carbon chains	52	the cost of using electrical appliances
				391	impact of nuclear energy	162	carbon reactions and the environment
				400	reducing pollution	178	actions to take to improve water quality
				437	effects of acid rain on natural environments		
				471	nitrogen cycle		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.13 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Explain the importance of heat transfer between and within the atmosphere, land masses, and oceans.	480	distribution of incoming solar radiation	185	effect of ocean on carbon dioxide levels in the atmosphere
				481	greenhouse conditions on Earth	185	effect of ocean on carbon dioxide levels in the atmosphere
				481	Earth's "energy budget"	202	investigate the temperature effects of greenhouse gases
				481	greenhouse effect and greenhouse gasses	202	investigate the temperature effects of greenhouse gases
				481	greenhouse effect and greenhouse gasses	209	investigating factors which cause the seasons
				485	research the density of Venus' and Mars' atmospheres	213	exploring how temperature-dependent layering creates currents
				492	Earth's tilt causes seasons		
				493	convection currents in the atmosphere		
				518	create a model to explain why Earth has seasons		
				615	greenhouse conditions on Venus		
ES.1.14 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Understand and explain the role of differential heating and the role of Earth's rotation on the movement of air around the planet.	495	global wind patterns		
				502	effects of moving air masses		
				502	cold fronts		
				503	warm fronts		
				503	jet streams		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.15 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Understand and describe the origin, life cycle, behavior, and prediction of weather systems.	451	thermometers	185	effect of ocean on carbon dioxide levels in the atmosphere
				452	thermometers	186	accurately measuring temperature using thermometers
				471	composition of Earth's atmosphere	194	construct and use an aneroid barometer
				473	definition of atmospheric pressure	198	detecting ozone which is a protective atmosphere gas against high energy radiation
				474	measuring atmospheric pressure with barometers	202	investigate the temperature effects of greenhouse gases
				475	how atmospheric pressure changes with altitude	207	research how large bodies of water affect climate
				476	graph showing atmospheric pressure vs. altitude	207	research how large bodies of water affect climate
				480	distribution of incoming solar radiation	209	investigating factors which cause the seasons
				480	transfer of energy in and out of Earth's atmosphere	213	exploring how temperature-dependent layering creates currents
				481	Earth's "energy budget"	215	understanding the Atlantic gyre
				481	greenhouse effect and greenhouse gasses	217	finding relative humidity
				481	greenhouse conditions on Earth		
				483	global temperature changing over time		
				485	Earth's internal energy		
				485	research the density of Venus' and Mars' atmospheres		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
				485	computer modeling to predict greenhouse effects	218	using Doppler radar images to detect and track storms
				491	Earth's temperature varies with latitude	219	use radar to detect a tornado
				492	Earth's tilt causes seasons	219	describe what safety precautions the National Weather Service recommends for tornado conditions
				493	convection currents in the atmosphere		
				494	the Coriolis effect		
				495	global wind patterns	220	using radar to track a hurricane
				496	descriptions of ocean currents and their effects on climate	223	research a particular biome
				496	effects of the Gulf Stream on climate of Great Britain		
				497	factors which influence the weather		
				497	sling psychrometer		
				497	water in the atmosphere affects weather patterns		
				498	phase changes in the atmosphere and dewpoint		
				499	cloud formation		
				501	forms of precipitation		
				502	effects of moving air masses		
				502	cold fronts		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
				503	jet streams		
				503	warm fronts		
				504	rotation of air masses due to Coriolis effect		
				505	description of thunderstorms		
				506	description of hurricanes		
				507	description of tornadoes		
				508	causes and effects of the El Nino Southern Oscillation		
				509	descriptions and distribution of desert biomes		
				510	effect of cold ocean currents on formation of fog desserts		
				510	different types of deserts and how they are formed		
				511	effect of warm ocean currents on formation of tropical rainforest		
				511	descriptions and distribution of tropical rainforest biomes		
				511	how tropical rainforests are formed		
				513	effect of large bodies of water on climate		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
				515	alpine tundra occurs at high altitudes		
				518	create a model to explain why Earth has seasons		
				518	write an action plan to stay safe during a tornado		
				528	Earth's surface is changing		
				615	greenhouse conditions on Venus		
ES.1.16 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Investigate the causes of severe weather, and propose appropriate safety measures that can be taken in the event of severe weather.	518	write an action plan to stay safe during a tornado	219	describe what safety precautions the National Weather Service recommends for tornado conditions
ES.1.17 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Describe the development and dynamics of climatic changes over time, such as the cycles of glaciation.	480	transfer of energy in and out of Earth's atmosphere		
				483	global temperature changing over time		
				528	Earth's surface is changing		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.18 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Demonstrate the possible effects of atmospheric changes brought on by things such as acid rain, smoke, volcanic dust, greenhouse gases, and ozone depletion.	414	effect of electrical generating facilities on dissolved oxygen in water	178	predict the quality of surface water to be tested and justify your answer
				437	acid rain explained		
				439	illustration of acid rain formation	182	investigate effect of acid rain on microorganisms
				443	impact of increased CO2 in oceans		
				448	research the issue of acid rain		
				479	effects of CFC's on the ozone layer		
				481	greenhouse conditions on Earth		
				482	effects of burning fossil fuels		
				482	changes to the oceans due to increasing global temperatures		
				485	research the density of Venus' and Mars' atmospheres		
				515	permafrost		
				568	how urban sprawl changes local climate		
				615	greenhouse conditions on Venus		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.19 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Identify and discuss the effects of gravity on the waters of Earth. Include both the flow of streams and the movement of tides.	491	the effects of Earth's rotation on daytime heating and nighttime cooling	208	developing a hypothesis about why the seasons occur
				492	Earth's tilt causes seasons	210	investigating how the distance of Earth from the sun affects its intensity
				584	the lunar cycle	211	investigating how Earth's tilt affects the sun's intensity
				585	Earth's rotation and patterns of day and night	238	why studying the moon's surface is useful for understanding Earth
				587	axial tilt causes the seasons	248	building a sundial to keep track of daily time based on the cycles between Earth and the sun
				588	lunar eclipses	250	modeling the lunar cycle
				588	solar eclipses	251	constructing a lunar calendar
				589	solar eclipses		
				589	solar eclipses		
				601	identify seasons		
				607	properties of the moon		
				608	the moon as a satellite of Earth		
				609	the moon's effect on tides on Earth		
				610	the Earth-moon system		
				611	giant impact theory		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.20 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Describe the relationship among ground water, surface water, and glacial systems.	440 441 442 559 564	oceans in the water cycle sources of salts in the ocean composition of seawater volcanoes and water vapor landforms shaped by water	212	investigate how the ocean's salinity affects its density
ES.1.21 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Identify the various processes that are involved in the water cycle.	440 559	oceans in the water cycle volcanoes and water vapor		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.22 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Earth	Compare the properties of rocks and minerals and their uses.	522	relative dating	225	determining the relative ages of rock formations
				523	interpreting rock formations	226	sequencing events in a geologic cross-section
				562	constructive and destructive processes	242	understanding how igneous rocks are formed and growing crystals to investigate their formation
				565	formation of soil	244	understanding how sedimentary rocks are formed and creating sedimentary deposits to investigate them
				569	studying moon rocks on Earth		
				570	properties of minerals	246	understanding and investigating how metamorphic rocks are formed
				571	common minerals		
				572	Mohs hardness scale		
				573	formation of igneous and sedimentary and metamorphic rocks	247	interpreting how different rock formations were formed
				575	identifying igneous and sedimentary and metamorphic rocks		
				576	the rock cycle		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.23 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Processes that Shape Earth	Explain motions, transformations, and locations of materials in Earth's lithosphere and interior. For example, describe the movement of the plates that make up Earth's crust of and the resulting formation of..	510	using maps to identify mountain ranges	228	listing which kind of plate boundary is associated with each geologic feature
				525	formation of Earth's layers	229	identifying tectonic plates and plate boundaries
				526	description of Earth's layers	229	using a globe to identify mountain ranges
				528	predicting what Earth might look like in 50 million years	230	predicting plate movement over 50 million years and the resultant land features
				528	definition of plate tectonics	236	understanding the Volcanic Explosivity Index
				530	sea-floor spreading and mid-ocean ridges	237	finding a pattern of volcanoes related to the locations of plate boundaries
				531	magnetic patterns on the sea floor	240	estimating the effects of meteor impacts on Earth
				532	theory of plate tectonics	241	identifying which geologic features on Earth were caused by meteors
				533	describing plate boundaries		
				533	activity of Earth's crust at plate boundaries		
				534	divergent plate boundaries		
				534	land features resulting from divergent plate boundaries		
				534	balance of creating and consuming Earth's crust		
				535	resulting land features from subduction		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
				535	convergent plate boundaries		
				536	land features resulting from transform plate boundaries		
				536	transform plate boundaries		
				537	causes and descriptions of earthquakes		
				539	earthquakes rating scales		
				547	predict separation of North America and Europe in 75 million years		
				548	predict effects of divergent plate boundaries on Great Rift Valley		
				551	structure of a volcano		
				552	formation of magma in Earth's mantle		
				553	using a map to identify volcanoes		
				554	types and shapes of volcanoes		
				554	figure showing structure of different types of volcanoes		
				555	formation of Hawaiian Islands due to volcanic activity		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
				555	formation of shield volcanoes due to hot spots		
				555	shield volcanoes		
				556	formation of stratovolcanoes due to subduction		
				556	stratovolcanoes		
				558	volcanoes shape the Earth		
				562	constructive and destructive processes		
				563	mountain-building		
				563	constructive process of mountain building		
				564	the destructive process of erosion		
				564	changes in land features due to erosion		
				565	wind erosion		
				566	effect of glaciers on land		
				576	the rock cycle		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.24 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Processes that Shape Earth	Understand and discuss continental drift, sea-floor spreading, and plate tectonics. Include evidence that supports the movement of the plates such as magnetic stripes on the ocean floor...	528	definition of plate tectonics	228	listing which kind of plate boundary is associated with each geologic feature
				530	sea-floor spreading and mid-ocean ridges	229	identifying tectonic plates and plate boundaries
				531	magnetic patterns on the sea floor		
				532	theory of plate tectonics		
				533	describing plate boundaries		
				534	divergent plate boundaries		
				535	convergent plate boundaries		
				536	transform plate boundaries		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.25 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Processes that Shape Earth	Investigate and discuss the origin of various landforms, such as mountains and rivers, and how they affect and are affected by human activities.	441	the five major oceans	229	using a globe to identify mountain ranges
				447	name the five big oceans on Earth	230	predicting plate movement over 50 million years and the resultant land features
				510	using maps to identify mountain ranges		
				528	predicting what Earth might look like in 50 million years		
				534	land features resulting from divergent plate boundaries		
				535	resulting land features from subduction		
				536	land features resulting from transform plate boundaries		
				547	predict separation of North America and Europe in 75 million years		
				548	predict effects of divergent plate boundaries on Great Rift Valley		
				553	using a map to identify volcanoes		
				563	mountain-building		
				564	changes in land features due to erosion		
				566	effect of glaciers on land		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
				568	environmental impact of urban sprawl		
ES.1.26 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Processes that Shape Earth	Differentiate among the processes of weathering, erosion, transportation of materials, deposition, and soil formation.	562	constructive and destructive processes	242	understanding how igneous rocks are formed and growing crystals to investigate their formation
				565	formation of soil		
				573	formation of igneous and sedimentary and metamorphic rocks	244	understanding how sedimentary rocks are formed and creating sedimentary deposits to investigate them
				575	identifying igneous and sedimentary and metamorphic rocks		
				576	the rock cycle	246	understanding and investigating how metamorphic rocks are formed
						247	interpreting how different rock formations were formed

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.27 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Processes that Shape Earth	Illustrate the various processes that are involved in the rock cycle and discuss how the total amount of material stays the same through formation, weathering, sedimentation, and reformation.	510	using maps to identify mountain ranges	229	using a globe to identify mountain ranges
				533	activity of Earth's crust at plate boundaries	242	understanding how igneous rocks are formed and growing crystals to investigate their formation
				534	balance of creating and consuming Earth's crust		
				553	using a map to identify volcanoes	244	understanding how sedimentary rocks are formed and creating sedimentary deposits to investigate them
				562	constructive and destructive processes		
				573	formation of igneous and sedimentary and metamorphic rocks	246	understanding and investigating how metamorphic rocks are formed
				575	identifying igneous and sedimentary and metamorphic rocks	247	interpreting how different rock formations were formed
				576	the rock cycle		
ES.1.28 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Processes that Shape Earth	Discuss geologic evidence, including fossils and radioactive dating, in relation to Earth's past.	521	origin of fossils	225	determining the relative ages of rock formations
				522	relative dating		
				523	interpreting rock formations	226	sequencing events in a geologic cross-section
				523	faunal succession		
				524	table and description of the geologic time scale		
				566	ice ages		
				569	studying moon rocks on Earth		

Correlation to Indiana's Science Academic Standards
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Course	Standard	Topic	Objective	student text pg	detail	investigation pg	detail
ES.1.29 Earth and Space Science I	Standard 1: Principles of Earth and Space Science	Processes that Shape Earth	Recognize and explain that in geologic change, the present arises from the materials of the past in ways that can be explained according to the same physical and chemical laws.	524	table and description of the geologic time scale		
				533	activity of Earth's crust at plate boundaries		
				534	balance of creating and consuming Earth's crust		
				562	constructive and destructive processes		
				566	ice ages		
				576	the rock cycle		