

Correlation to Missouri Science Expectations, Grade 9 - 11
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
1.1.A.a Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Objects, and the materials they are made of, have properties that can be used to describe and classify them	Measure the volume and mass of regular and irregular objects and calculate their respective densities	280	measuring volume of liquids	116	mass and volume measurements
				280	measuring volume of solids	117	measuring volume
				281	volume and mass contrasted	124	build a density column
				291	density explained	212	investigate density changes in the oceans as the cause of ocean layering
				295	relationship between mass volume and density		
				296	density of liquid water vs. ice		
1.1.A.b Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Objects, and the materials they are made of, have properties that can be used to describe and classify them	Identify pure substances by their physical and chemical properties	278	mixtures can be separated by physical means	114	separating a homogeneous mixture
				283	atoms and molecules	132	atomic number determines what element that atom is
				311	all matter is formed from atoms	132	comparing atoms
				311	all matter is formed from atoms	137	importance of atomic number
				315	atoms of same element have same atomic number	141	compare and contrast elements and compounds

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1.1.A.c Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Objects, and the materials they are made of, have properties that can be used to describe and classify them	Classify a substance as being made up of one kind of atom (element) or compound when given the molecular formula or structural formula (or electron dot diagram) for the substance	330 336 338 339 344 349	Lewis dot diagrams writing a chemical formula summary of chemical formula writing rules naming compounds calculating formula mass calculate the formula mass	143 143 145	name chemical compounds predict chemical formulas determine empirical formula
1.1.B.a Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Properties of mixtures depend upon the concentrations, properties and interactions of particles	Classify solutions as dilute, concentrated, saturated	407 407 412 412 413 414 415	solute and solvent defined definitions of solution and solute and solvent effect of nature of solvent on solubility effect of temperature on solubility temperature-solubility graphs effect of temperature on solubility of gasses saturated and supersaturated solutions	170 172	solubility and temperature investigate solubility of sugar

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1.1.B.b Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Properties of mixtures depend upon the concentrations, properties and interactions of particles	Compare and contrast the properties of acidic, basic, and neutral solutions	417 417 417 417 418 418 419 419 420 420 421 421	H and OH ions properties of acids acids and bases compared/contrasted define and compare acids and bases properties of bases strong vs. weak acids strong vs. weak bases weak and strong acids and bases pH and pH scale defining and determining pH table of pH of common substances pH of substances you use or consume	176 181 184	investigate acids and bases testing pH of tap water samples determining pH of water as carbon dioxide dissolves
1.1.B.c Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Properties of mixtures depend upon the concentrations, properties and interactions of particles	Predict the effect of the properties of the solvent or solute on the solubility of a substance	403 409 412	why water is a nearly universal solvent polar solutes solubility value	181 181	water quality testing water quality testing

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1.1.D.a Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Physical changes in states of matter due to thermal changes in materials can be explained by moving particles	Using the kinetic theory model, explain the changes that occur in the distance between atoms/molecules and temperature of a substance as energy is absorbed or released during a phase change	284 406 451 452 498	changes of state hydrogen bonding and the gaseous state of water increasing temperature means increasing motion of molecules molecular motion increases when temperature increases phases changes in the atmosphere	119 119 119 119 203 204 204	investigate melting and create a graph adding heat energy to melt an ice cube create a temperature vs. time graph of phase change energy and phase changes investigate the temperature/time curves as water is cooled through a phase change to ice investigating latent heat and thermal buffering compare the shape of the water line and the ice line on the temperature/time graph
1.1.D.b Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Physical changes in states of matter due to thermal changes in materials can be explained by moving particles	Predict the effect of a temperature change on the properties of a material	454 460 461	temperature and thermal energy and heat thermal equilibrium thermal conductivity explained	188	relationship between heat and temperature

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1.1.D.c Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Physical changes in states of matter due to thermal changes in materials can be explained by moving particles	Predict the effect of pressure changes on the properties of a material	300	what is pressure?	194	building a compression chamber to observe changes in atm pressure
						196	correcting your barometer's readings for the effects of temperature on a gas
1.1.E.a Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	The atomic model describes the electrically neutral atom	Describe the atom as having a dense, positive nucleus surrounded by a cloud of negative electrons	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
				388	showing valence electrons in a diagram	136	model stable and neutral atoms
						137	build atomic models
						140	find the number of electrons in outermost level
						140	review subatomic particles

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1.1.E.b Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	The atomic model describes the electrically neutral atom	Calculate the number of protons, neutrons, and electrons of an element (or isotopes) given its atomic mass (or mass number) and atomic number	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
1.1.E.c Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	The atomic model describes the electrically neutral atom	Describe the information provided by the atomic number and the mass number (i.e. electrical charge, chemical stability)	311 311 316 318	protons/neutrons/electrons location/size/charge of subatomic particles isotopes explained proton/electron attraction	132 133 133 133 136 136 137 140	building atom models protons and neutrons location of electrons in atom exploring isotopes model stable and neutral atoms understanding isotopes build atomic models review subatomic particles

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1.1.F.a Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	The periodic table organizes the elements according to their atomic structure and chemical reactivity	Explain the structure of the periodic table in terms of the elements with common properties and repeating properties	320 321 321 329 330 332 335	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 periodic table and oxidation numbers	133 136 141 142	using the periodic table building and studying the periodic table build model of Na and Cl atoms and explain why they bond to form a molecule arrangement of electrons and groups of elements
1.1.F.b Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	The periodic table organizes the elements according to their atomic structure and chemical reactivity	Compare and contrast the common properties of metals, nonmetals, metalloids, and noble gases and their location on the periodic table	332	metals nonmetals and metalloids		
1.1.F.c Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	The periodic table organizes the elements according to their atomic structure and chemical reactivity	Predict the properties of elements and the bonds that may result between elements using the periodic table	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	141 143	modeling a chemical bond ionic compounds

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1.1.G.a Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Properties of objects and states of matter can change chemically and/or physically	Distinguish between physical and chemical changes in matter	294 353 355 372 457	development of Kevlar brand fiber physical and chemical changes and digestion physical and chemical changes in tire recycling determine if changes are chemical or physical engineers use specific heat of substances to design better products	146	investigate and observe chemical and physical changes in the lab

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1.1.H.a Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties	Describe how the valence electron configuration determines how atoms interact and may bond	321 324 324 329 330 332 335 335 336 338 339	groups of elements and valence shells use the periodic table to predict chemical formulas which element is more likely to combine with other elements? periodic table columns and valence electrons bonding and periodic table position periodic table and electronegativities periodic table and oxidation numbers chemical bonding and the periodic table writing a chemical formula summary of chemical formula writing rules naming compounds	136 141 141 141 142 143 143 145	ions build model of Na and Cl atoms and explain why they bond to form a molecule when an atom ionizes modeling a chemical bond arrangement of electrons and groups of elements name chemical compounds predict chemical formulas determine empirical formula
1.1.H.b Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties	Predict the reaction rates of different substances based on their properties	422	acids and bases and enzymes in digestion		

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1.1.H.c Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties	Compare and contrast the types of chemical bonds	330 331 332 409 410	ionic bonds covalent bonds distinguishing between ionic and covalent bonds dissolving an ionic compound solute dissolution depends on chemical bonds	143 143	classify ionic compounds ionic compounds

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1.1.H.d Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties	Identify the consequences of different types of reactions to humans and human activity	361	chemical reactions in living systems	138	nuclear reactions
				378	combustion reactions	160	how do you simulate nuclear decay?
				378	consumer chemistry	161	research pros and cons of uses for radioactive elements
				379	hydrogen-powered cars and the environment	162	investigating combustion reactions
				379	research fuel cells	163	too much CO ₂
				379	research environmental impact of fuel cells	163	research how trees offset accumulation of CO ₂
				381	MRE ration heater reaction	163	research how trees offset accumulation of CO ₂
				388	nuclear vs chemical reactions	182	investigate effect of acid rain on microorganisms
				393	carbon dating	201	research the causes of ozone in the lower atmosphere
				393	radioisotopes in science and medicine		
				395	chemistry of the atmosphere		
				395	fossil fuels		
				395	chemistry of the atmosphere		
				397	carbon reactions		
				400	problems caused by airborne pollutants		
				400	research pros and cons of nuclear technology		
				436	effect of excess nitrates on environment		

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				437	acid rain explained		
				438	chemical reactions and the formation of acid rain		
				448	research the issue of acid rain		
1.1.1.a Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Mass is conserved during any physical or chemical change	Compare the mass of the reactants to the mass of the products in a chemical reaction or physical change as support for the Law of Conservation of Mass	363	history of law of conservation of mass	150	investigate conservation of mass in effervescent tablet reaction
1.1.1.b Properties and Principles of Matter and Energy	Changes in properties and states of matter provide evidence of the atomic theory of matter	Mass is conserved during any physical or chemical change	Recognize whether the number of atoms of the reactants and products in a chemical equation are balanced	371	which of the equations is balanced?	149	balance these equations

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1.2.A.a Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Forms of energy have a source, a means of transfer (work and heat) and a receiver	Differentiate between thermal energy, heat, and temperature	453 454 454 455 456 456 458 459 460 461	comparing temperature in Fahrenheit and Celsius scales changes in temperature are directly related to changes in energy temperature and thermal energy and heat examples of flow of heat definition of specific heat specific heat water's specific heat helps regulate Earth's temperature heat equation thermal equilibrium conduction and convection and radiation	119 186 188 188 188 205	investigate temperature and energy transfer in melting process develop a way to convert between Fahrenheit and Celsius temperature scales investigate the increase of temperature of water as thermal energy is added investigate heating water with an immersion heater relationship between heat and temperature investigating how the high specific heat of water helps regulate Earth's temperature
1.2.A.b Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Forms of energy have a source, a means of transfer (work and heat) and a receiver	Recognize chemical energy as the energy stored in the bonds between atoms in compounds	381 382	exothermic reactions and MREs endothermic reactions and cold packs	158 158	investigate energy changes in chemical reactions measure energy changes in 3 different reactions

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1.2.A.c Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Forms of energy have a source, a means of transfer (work and heat) and a receiver	Describe the relationship among wavelength, energy, and frequency as illustrated by the electromagnetic spectrum	237 242 479	visible light and the electromagnetic spectrum color and frequency of light waves ultraviolet and infrared light	105 134 265	explore relationship between color and wavelength investigating visible light with a spectrometer an element's spectral lines correspond to specific wavelengths of light
1.2.A.d Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Forms of energy have a source, a means of transfer (work and heat) and a receiver	Describe sources and common uses of different forms of energy	91 91 91 623 626	following an energy transformation understand basic forms of energy energy conversions energy from the sun harnessing the sun's energy	38 39 39	explore energy transformations make an energy flow chart identify type of energy involved

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1.2.A.e Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Forms of energy have a source, a means of transfer (work and heat) and a receiver	Identify and evaluate advantages/disadvantages of using various sources of energy for human activity	172 391 391 400 414 438 560 627 627	generating electric power nuclear vs. fossil fuels impact of nuclear energy reducing pollution environmental impact of electrical generating facilities impact of using fossil fuels description of geothermal energy using photovoltaic cells the efficiency of photovoltaic cells	52 262 262	the cost of using electrical appliances solar energy can be used to generate electricity without producing pollution determine the efficiency of a photovoltaic cell
1.2.A.f Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Forms of energy have a source, a means of transfer (work and heat) and a receiver	Describe the effect of different frequencies of electromagnetic waves on the Earth and living organisms	237 479 479	visible light and the electromagnetic spectrum ultraviolet and infrared light ultraviolet and infrared light	134	investigating visible light with a spectrometer

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1.2.A.g Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Forms of energy have a source, a means of transfer (work and heat) and a receiver	Interpret examples of heat transfer as convection, conduction, or radiation	461 462 462 463 463 464 465 465 482 493	thermal conductivity explained densely packed solids are good conductors of heat heat transfer through air warming hands over candle convection currents and weather convection currents in water solid road surface emits radiation transfer of heat by radiation global warming and heat transfer by radiation apply knowledge of heat transfer to different situations	192	investigate convection in liquids
1.2.B.a Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Mechanical energy comes from the motion and/or position of an object	Relate kinetic energy to an object's mass and its velocity	91 537	following an energy transformation potential energy transformed to kinetic energy causes earthquakes	38	identify potential/kinetic energy conversions

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1.2.B.b Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Mechanical energy comes from the motion and/or position of an object	Relate an object's gravitational potential energy to its weight and height relative to the surface of the earth	91 537	following an energy transformation potential energy transformed to kinetic energy causes earthquakes	38	identify potential/kinetic energy conversions
1.2.B.c Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Mechanical energy comes from the motion and/or position of an object	Distinguish between examples of kinetic and potential energy with a system	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
1.2.C.a Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Electromagnetic energy from the sun is a major source of energy on Earth	Identify stars as producers of electromagnetic energy	638 639 640	the life cycle of stars description and illustration of the life cycle of stars elements formed by nuclear fusion in stars	255	observe and describe the appearance of the moon and Jupiter and its moons

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1.2.C.b Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Electromagnetic energy from the sun is a major source of energy on Earth	Describe how electromagnetic energy is transferred through space as electromagnetic waves	195 234 480 626	waves transmit energy electrons and energy levels and light emission energy and radiation relationships the sun's energy reaches Earth in the form of electromagnetic waves	134 265	what does atomic structure have to do with light and color? an element's spectral lines correspond to specific wavelengths of light
1.2.D.a Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Chemical reactions involve changes in the bonding of atoms with the release or absorption of energy	Describe evidence of energy transfer and transformations that occur during exothermic and endothermic chemical reactions	381 382	exothermic reactions and MREs endothermic reactions and cold packs	158 158	measure energy changes in 3 different reactions investigate energy changes in chemical reactions
1.2.E.a Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Nuclear energy is a major source of energy throughout the universe	Describe how changes in the nucleus of an atom during a nuclear reaction result in the emission of radiation	387 388 623	fusion and fission explained nuclear vs chemical reactions nuclear fusion and the sun	138 138 160 160	fusion and fission nuclear reactions radioactive decay how do you simulate nuclear decay?

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1.2.E.b Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Nuclear energy is a major source of energy throughout the universe	Identify the role of nuclear energy as it serves as a source of energy for the Earth, stars, and human activity	387 393 393 400 623 638 639 640 640 640	fusion and fission explained carbon dating radioisotopes in science and medicine research pros and cons of nuclear technology nuclear fusion and the sun the life cycle of stars description and illustration of the life cycle of stars birth of elements death of massive stars elements formed by nuclear fusion in stars	138 161 255	fusion and fission research pros and cons of uses for radioactive elements observe and describe the appearance of the moon and Jupiter and its moons
1.2.F.a Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Energy can change from one form to another within and between systems but the total amount remains the same	Describe the transformations that occur as energy changes from kinetic to potential within a system	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

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1.2.F.b Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Energy can change from one form to another within and between systems but the total amount remains the same	Compare the efficiency of simple machines	85 85 97 97	efficiency explained efficiency and bicycles find the efficiency of a machine calculate work output from efficiency data	191	find efficiency of water heater
1.2.F.c Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Energy can change from one form to another within and between systems but the total amount remains the same	Classify the different forms of energy that can be observed as energy is transferred and transformed with a system when given a scenario	91 91 91 623 626	following an energy transformation understand basic forms of energy energy conversions energy from the sun harnessing the sun's energy	38 39 39	explore energy transformations make an energy flow chart identify type of energy involved
1.2.F.d Properties and Principles of Matter and Energy	Energy has a source, can be transferred, and transformed into various forms but is conserved between and within systems	Energy can change from one form to another within and between systems but the total amount remains the same	Explain how energy can be transferred or transformed between and within systems as the total amount of energy remains constant	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

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2.1.A.a Properties and Principles of Force and Motion	The motion of an object is described by its change in position relative to another object or point	The motion of an object is described as a change in position, direction, and speed relative to another object (frame of reference)	Represent and analyze the motion of an object graphically	29 30 37 37	position vs. time graph discussion position vs. time graphs speed vs. time graphs speed vs. time graph discussion	12 13 15 15 15	model the car's motion graphically make a position vs. time graph make a speed vs. time graph changes in motion can be represented graphically make a speed vs. time graph
2.1.A.b Properties and Principles of Force and Motion	The motion of an object is described by its change in position relative to another object or point	The motion of an object is described as a change in position, direction, and speed relative to another object (frame of reference)	Analyze the speed of two objects in terms of distance and time	15 32	compare and contrast speed and velocity average speed discussed	8	calculating speed
2.1.A.c Properties and Principles of Force and Motion	The motion of an object is described by its change in position relative to another object or point	The motion of an object is described as a change in position, direction, and speed relative to another object (frame of reference)	Calculate the speed of objects	14 20 20 24 32 42	how to calculate speed find speed of bumblebee calculate speed of car accurate speed measurements average speed vs. instantaneous calculate speed from distance/time graph	9 10 12 14 17 36	collect data and calculate speed of car calculate speed of the car find speed of car at different positions calculate speed of car at two places on the ramp caclulate speed of car find speed of marble

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2.1.B.a Properties and Principles of Force and Motion	The motion of an object is described by its change in position relative to another object or point	An object that is accelerating is speeding up, slowing down, or changing direction	Measure and analyze an object's motion in terms of speed, velocity and acceleration	14 20 20 24 30 32 32 33 35 36 41 42 49 53	how to calculate speed find speed of bumblebee calculate speed of car accurate speed measurements position vs. time graphs average speed vs. instantaneous average speed discussed understanding acceleration how to calculate acceleration examples of acceleration find acceleration of car calculate speed from distance/time graph link between force and acceleration acceleration due to gravity	8 9 10 12 13 14 14 14 17 17 36	calculating speed collect data and calculate speed of car calculate speed of the car find speed of car at different positions make a position vs. time graph calculate acceleration of car on ramp acceleration is the rate at which speed changes calculate speed of car at two places on the ramp explore 2nd law and acceleration caclulate speed of car find speed of marble
2.1.B.b Properties and Principles of Force and Motion	The motion of an object is described by its change in position relative to another object or point	An object that is accelerating is speeding up, slowing down, or changing direction	Calculate the acceleration of an object	35 41 49 53	how to calculate acceleration find acceleration of car link between force and acceleration acceleration due to gravity	14 17	calculate acceleration of car on ramp explore 2nd law and acceleration

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2.1.C.a Properties and Principles of Force and Motion	The motion of an object is described by its change in position relative to another object or point	Momentum depends on the mass of the object and the velocity with which it is traveling	Compare the momentum of two objects in terms of mass and velocity	60	law of conservation of momentum		
2.1.C.b Properties and Principles of Force and Motion	The motion of an object is described by its change in position relative to another object or point	Momentum depends on the mass of the object and the velocity with which it is traveling	Explain that the total momentum remains constant within a system	60	law of conservation of momentum		
2.2.A.a Properties and Principles of Force and Motion	Forces affect motion	Forces are classified as either contact forces (pushes, pulls, friction, buoyancy) or non-contact forces (gravity, magnetism) that can be described in terms of direction and magnitude	Identify and describe the forces acting on an object	45 46 48 49 51 69	Newton's first law summarized force has potential to change motion Newton's first law in detail force is related to acceleration balanced and unbalanced forces newtons and pounds	16 19 24	unbalanced forces and acceleration of car find correct relationship between force mass and acceleration measure force in newtons

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2.2.B.a Properties and Principles of Force and Motion	Forces affect motion	Every object exerts a gravitational force on every other object	Describe gravity as an attractive force among all objects	52 52 54 55 606	gravity depends on mass the effect of gravity 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
2.2.B.b Properties and Principles of Force and Motion	Forces affect motion	Every object exerts a gravitational force on every other object	Compare and describe the gravitational forces between two objects in terms of their masses and the distances between them	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
2.2.B.c Properties and Principles of Force and Motion	Forces affect motion	Every object exerts a gravitational force on every other object	Describe weight in terms of the force of a planet's or moon's gravity acting on a given mass	47 53	weight vs. mass how to calculate weight	20	weight vs. mass
2.2.B.d Properties and Principles of Force and Motion	Forces affect motion	Every object exerts a gravitational force on every other object	Recognize that free-falling bodies accelerate at a constant rate (neglecting friction) due to gravity	52	the effect of gravity	20	investigate effect of gravity on motion

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
2.2.C.a Properties and Principles of Force and Motion	Forces affect motion	Magnetic forces are related to electrical forces as different aspects of a single electromagnetic force	Recognize that changing magnetic fields can produce electrical current and electric currents can produce magnetic forces	164 166 166 171	what is an electromagnet? building an electromagnet increased current vs. strength of magnetic field electromagnetic induction explained	66 67 73 73	build an electromagnet find out what happens to strength of electromagnet when current is increased exploring electric generators use magnetic induction to create an electric field
2.2.C.b Properties and Principles of Force and Motion	Forces affect motion	Magnetic forces are related to electrical forces as different aspects of a single electromagnetic force	Predict the effects of an electromagnetic force on the motion of objects (attract or repel)	159 163 531 531	magnetism explained understanding magnetic fields interesting magnetic patterns on sea floor magnetic polarity of Earth	62 64 66	describing forces that magnets exert on each other testing materials to see if they are affected by magnets compare electromagnets and permanent magnets
2.2.D.a Properties and Principles of Force and Motion	Forces affect motion	The interaction of mass and forces can be explained by Newton's Laws of Motion that are used to predict changes in motion	Recognize that inertia is a property of matter that can be described as an object's tendency to resist a change in motion and is dependent upon the object's mass	45 48	Newton's first law summarized Newton's first law in detail		
2.2.D.b Properties and Principles of Force and Motion	Forces affect motion	The interaction of mass and forces can be explained by Newton's Laws of Motion that are used to predict changes in motion	Describe the effect of a change in mass of an object on the inertia of that object (Newton's First Law of Motion)	45 48	Newton's first law summarized Newton's first law in detail	14	exploring acceleration on a ramp

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
2.2.D.c Properties and Principles of Force and Motion	Forces affect motion	The interaction of mass and forces can be explained by Newton's Laws of Motion that are used to predict changes in motion	Using information about the mass and acceleration of two objects, compare the forces required to move them	45 49 64	Newton's second law summarized Newton's second law in detail solving problems using $f=ma$	16 19	thinking about force discover 2nd law of motion
2.2.D.d Properties and Principles of Force and Motion	Forces affect motion	The interaction of mass and forces can be explained by Newton's Laws of Motion that are used to predict changes in motion	Identify forces acting on a falling object and the factors that affect the rate of fall (i.e., mass, volume, shape, or type of material from which the object is made)	52	the effect of gravity	20	investigate effect of gravity on motion
2.2.D.e Properties and Principles of Force and Motion	Forces affect motion	The interaction of mass and forces can be explained by Newton's Laws of Motion that are used to predict changes in motion	Determine the overall effect (i.e., direction and magnitude) of forces acting on an object at the same time (i.e., net force)	51	net force explained		
2.2.D.f Properties and Principles of Force and Motion	Forces affect motion	The interaction of mass and forces can be explained by Newton's Laws of Motion that are used to predict changes in motion	Predict and explain the effect of a change in force and/or mass on the motion of an object (Newton's Second Law of Motion)	45 49 64	Newton's second law summarized Newton's second law in detail solving problems using $f=ma$	16 19	thinking about force discover 2nd law of motion

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2.2.D.g Properties and Principles of Force and Motion	Forces affect motion	The interaction of mass and forces can be explained by Newton's Laws of Motion that are used to predict changes in motion	Analyze action/reaction forces acting between two objects (e.g., handball hits concrete wall, shotgun firing) and describe their magnitude and direction	45 59	Newton's third law summarized Newton's third law in detail	22 23	car and ramp and Newton's 3rd law using 3rd law to explain common phenomena
2.2.D.h Properties and Principles of Force and Motion	Forces affect motion	The interaction of mass and forces can be explained by Newton's Laws of Motion that are used to predict changes in motion	Predict the change in motion of one object when it is acted upon by the equal and opposite force of another object (i.e., action/reaction forces)	45 59	Newton's third law summarized Newton's third law in detail	22 23	car and ramp and Newton's 3rd law using 3rd law to explain common phenomena
2.2.E.b Properties and Principles of Force and Motion	Forces affect motion	Perpendicular forces act independently of each other	Describe the force(s) acting on a projectile on the Earth	52	the effect of gravity	20	investigate effect of gravity on motion
2.2.E.c Properties and Principles of Force and Motion	Forces affect motion	Perpendicular forces act independently of each other	Predict the path of an object when the forces directing it in a given direction change	46 49 51	force has potential to change motion force is related to acceleration balanced and unbalanced forces	16 19	unbalanced forces and acceleration of car find correct relationship between force mass and acceleration

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2.2.F.a Properties and Principles of Force and Motion	Forces affect motion	Simple machines affect the forces applied to an object and/or direction of movement as work is done	Describe the relationships between work, applied net force and the distance an object moves	69 71 71 78 78 79 79 79 80 84 96	how to calculate mechanical advantage pliers as an example of a lever how a lever works design a toothbrush set up a lever with MA greater than 1 analyze block and tackle analyze pulleys with different numbers of supporting strings calculate mechanical advantage analyze wheelbarrow work input and output decide whether or not work is done	25 27 27 30 31 31	discover mechanical advantage of ropes and pulleys changing force and distance on a lever set up a lever that has mechanical advantage exploring force and distance with ropes and pulleys work output vs. work input work = force X distance
2.2.F.b Properties and Principles of Force and Motion	Forces affect motion	Simple machines affect the forces applied to an object and/or direction of movement as work is done	Describe the effect of work on an object's kinetic and potential energy	87	concept of energy as stored work		

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2.2.F.c Properties and Principles of Force and Motion	Forces affect motion	Simple machines affect the forces applied to an object and/or direction of movement as work is done	Explain how the efficiency of machines can be expressed as a ratio of work output to work input	84 85 85 97 97	work input and output efficiency explained efficiency and bicycles find the efficiency of a machine calculate work output from efficiency data	31 191	work output vs. work input find efficiency of water heater
2.2.F.d Properties and Principles of Force and Motion	Forces affect motion	Simple machines affect the forces applied to an object and/or direction of movement as work is done	Describe power in terms of work and time	86 86 97 97 97 138	how to calculate power power explained calculate power calculate power of two different machines analyze power of motor how to calculate electrical power	191 263	power of an immersion heater calculate the power output of a photovoltaic cell

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
2.2.F.e Properties and Principles of Force and Motion	Forces affect motion	Simple machines affect the forces applied to an object and/or direction of movement as work is done	Analyze and describe the relationship among work, power, and efficiency	83	how to calculate work	31	calculate work done on block
				85	efficiency explained	31	work = force X distance
				85	efficiency and bicycles	191	find efficiency of water heater
				86	how to calculate power	191	calculating work input and work output
				86	power explained	191	power of an immersion heater
				96	calculate work done	263	calculate the power output of a photovoltaic cell
				96	decide whether or not work is done		
				97	find the efficiency of a machine		
				97	calculate work output from efficiency data		
				97	calculate work accomplished by a motor		
				97	compare different amounts of work done		
				97	calculate power		
				97	calculate power of two different machines		
				97	analyze power of motor		
138	how to calculate electrical power						

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5.1.B.a Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems have common components and unique structures	The hydrosphere is composed of water and other materials	Recognize the importance of water as a solvent in the environment as it relates to karst topography, acid rain, and water pollution	411	effects of PCB's in Great Lakes	178	actions to take to improve water quality
				433	water quality standards	178	predict the quality of surface water to be tested and justify your answer
				433	The Clean Water Act		
				434	importance of water analysis		
				435	water quality testing	179	address what you can do to maintain or improve the water quality at the test site
				436	water quality testing		
				437	acid rain		
				437	acid rain explained	182	investigate effect of acid rain on microorganisms
				437	effects of acid rain on natural environments	182	the effects of acid rain on organisms in aquatic environments
				437	effects of acid rain on the soil		
				439	illustration of acid rain formation		
				443	impact of increased CO2 on oceans		
				444	pollution and the ocean food chain		
				445	pollution and the ocean food chain		
				448	research the issue of acid rain		
				471	nitrogen cycle		
				482	changes to the oceans due to increasing global temperatures		

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
				568	how urban sprawl changes local climate		
5.1.C.a Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems have common components and unique structures	The atmosphere is composed of a mixture of gases, including water vapor, and minute particles	Relate the composition of gases and temperature of the layers of the atmosphere to cloud formation and transmission of radiation	440 471 480 481 481 485 498 501 559	oceans in the water cycle composition of Earth's atmosphere distribution of incoming solar radiation Earth's "energy budget" greenhouse effect and greenhouse gasses Earth's internal energy phase changes in the atmosphere and dewpoint forms of precipitation volcanoes and water vapor	185 198 202 217	effect of ocean on carbon dioxide levels in the atmosphere detecting ozone which is a protective atmosphere gas against high energy radiation investigate the temperature effects of greenhouse gases finding relative humidity
5.1.C.b Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems have common components and unique structures	The atmosphere is composed of a mixture of gases, including water vapor, and minute particles	Describe the causes and consequences of observed and predicted changes in the ozone layer	481 481 485 615	greenhouse conditions on Earth greenhouse effect and greenhouse gasses research the density of Venus' and Mars' atmospheres greenhouse conditions on Venus	185 202	effect of ocean on carbon dioxide levels in the atmosphere investigate the temperature effects of greenhouse gases

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
5.1.D.a Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems have common components and unique structures	Climate is a description of average weather conditions in a given area over time	Provide evidence (e.g., melting glaciers, fossils, desertification) that supports theories of climate change due to natural phenomena and/or human interactions	481 483 508 528	global warming global temperature changing over time causes and effects of the El Nino Southern Oscillation Earth's surface is changing		

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
5.1.D.b Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems have common components and unique structures	Climate is a description of average weather conditions in a given area over time	Explain how climate and weather patterns in a particular region are affected by factors such as proximity to large bodies of water or ice/ocean currents, latitude, altitude, prevailing wind currents, and amount of solar radiation	485 493 494 495 496 497 502 502 503 503 504 508 510 511	Earth's internal energy convection currents in the atmosphere the Coriolis effect global wind patterns descriptions of ocean currents and their effects on climate water in the atmosphere affects weather patterns effects of moving air masses cold fronts warm fronts jet streams rotation of air masses due to Coriolis effect causes and effects of the El Nino Southern Oscillation different types of deserts and how they are formed how tropical rainforests are formed	207 213 215 223	research how large bodies of water affect climate exploring how temperature-dependent layering creates currents understanding the Atlantic gyre research a particular biome

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
5.2.A.a Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	The Earth's materials and surface features are changed through a variety of external processes	Explain the external processes (i.e., weathering, erosion, deposition of sediment) that result in the formation and modification of landforms	528	predicting what Earth might look like in 50 million years	230	predicting plate movement over 50 million years and the resultant land features
				533	activity of Earth's crust at plate boundaries	240	estimating the effects of meteor impacts on Earth
				534	land features resulting from divergent plate boundaries	241	identifying which geologic features on Earth were caused by meteors
				534	balance of creating and consuming Earth's crust		
				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		
				555	formation of Hawaiian Islands due to volcanic activity		
				558	volcanoes shape the Earth		
				562	constructive and destructive processes		
				562	constructive and destructive processes		

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
				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		
				565	formation of soil		
				566	effect of glaciers on land		
				576	the rock cycle		
				576	the rock cycle		
5.2.B.a Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates	Describe the internal source of energy on Earth that results in uneven heating of the mantle (i.e., decay of radioactive isotopes)	485	Earth's internal energy		
				525	formation of Earth's layers		
				526	description of Earth's layers		
				552	formation of magma in Earth's mantle		
5.2.B.b Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates	Illustrate and explain the convection currents that result from the uneven heating inside the mantle	525	formation of Earth's layers		
				526	description of Earth's layers		
				552	formation of magma in Earth's mantle		

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5.2.B.c Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates	Describe how the energy of an earthquake travels as seismic waves and provides evidence for the layers of the geosphere	537	conversion of energy in rocks causes seismic waves		
				537	earthquakes and plate tectonics		
				537	causes and descriptions of earthquakes		
				538	seismic waves		
				539	earthquakes rating scales		
				552	formation of magma in Earth's mantle		
				552	geologic basis for volcanic eruptions		
				553	where volcanic activity occurs		
				555	geologic basis for shield volcanoes		
				556	geologic basis for stratovolcanoes		
				557	geologic bases for cinder cone volcanoes		

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5.2.B.d Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates	Relate the densities of the materials found in continental and oceanic plates to the processes that result in each type of plate boundary	528 532 533 534 535 536	definition of plate tectonics theory of plate tectonics describing plate boundaries divergent plate boundaries convergent plate boundaries transform plate boundaries	229	identifying tectonic plates and plate boundaries

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5.2.B.e Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates	Describe the effects of the movement of crustal plates (i.e., earthquakes, sea floor spreading, mountain building, volcanic eruptions) at a given location on the planet	530	sea-floor spreading and mid-ocean ridges	228	listing which kind of plate boundary is associated with each geologic feature
				531	magnetic patterns on the sea floor	229	identifying tectonic plates and plate boundaries
				533	describing plate boundaries	236	understanding the Volcanic Explosivity Index
				534	divergent plate boundaries	237	finding a pattern of volcanoes related to the locations of plate boundaries
				535	convergent plate boundaries		
				536	transform plate boundaries		
				551	structure of a volcano		
				554	types and shapes of volcanoes		
				554	figure showing structure of different types of volcanoes		
				555	formation of shield volcanoes due to hot spots		
				555	shield volcanoes		
				556	formation of stratovolcanoes due to subduction		
				556	stratovolcanoes		

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5.2.B.f Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates	Articulate the processes involved in the Theory of Plate Tectonics and describe evidence that supports that theory	528 532	definition of plate tectonics theory of plate tectonics		
5.2.D.a Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	Changes in the Earth over time can be inferred through rock and fossil evidence	Use data from relative dating techniques (e.g., correlation of fossils and rock sequences, presence of intrusions and faults) to infer geologic history	523 524 566	faunal succession table and description of the geologic time scale ice ages		

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5.2.F.a Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	Constantly changing properties of the atmosphere occur in patterns which are described as weather	Predict the weather at a designated location using weather maps (including map legends) and/or weather data (e.g., temperature, barometric pressure, cloud cover and type, wind speed and direction, precipitation)	451	thermometers	186	accurately measuring temperature using thermometers		
				452	thermometers				
				473	definition of atmospheric pressure			194	construct and use an aneroid barometer
				474	measuring atmospheric pressure with barometers			207	research how large bodies of water affect climate
				475	how atmospheric pressure changes with altitude			215	understanding the Atlantic gyre
				476	graph showing atmospheric pressure vs. altitude			217	finding relative humidity
				480	transfer of energy in and out of Earth's atmosphere			218	using Doppler radar images to detect and track storms
				485	computer modeling to predict greenhouse effects			219	use radar to detect a tornado
				495	global wind patterns			220	using radar to track a hurricane
				496	descriptions of ocean currents and their effects on climate				
				497	factors which influence the weather				
				497	slings psychrometer				
				498	phase changes in the atmosphere and dewpoint				
				499	cloud formation				
				501	forms of precipitation				
				502	cold fronts				

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				502	effects of moving air masses		
				503	warm fronts		
				503	jet streams		
				505	description of thunderstorms		
				506	description of hurricanes		
				507	description of tornadoes		

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5.2.F.b Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	Constantly changing properties of the atmosphere occur in patterns which are described as weather	Discover and evaluate patterns and relationships in the causes of weather phenomena and regional climates	492 495 497 497 499 502 502 503 503 505 506 507 508 509 510 511	Earth's tilt causes seasons global wind patterns water in the atmosphere affects weather patterns factors which influence the weather cloud formation cold fronts effects of moving air masses warm fronts jet streams description of thunderstorms description of hurricanes description of tornadoes causes and effects of the El Nino Southern Oscillation descriptions and distribution of desert biomes different types of deserts and how they are formed descriptions and distribution of tropical rainforest biomes	209 219 220 223	investigating factors which cause the seasons use radar to detect a tornado using radar to track a hurricane research a particular biome

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				511	how tropical rainforests are formed		
				518	create a model to explain why Earth has seasons		
5.2.G.a Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	The geosphere, hydrosphere and atmosphere are continually interacting through processes that transfer energy and Earth materials	Explain how global wind and ocean currents are produced on the Earth's surface	495 496 502 502 503 503	global wind patterns descriptions of ocean currents and their effects on climate effects of moving air masses cold fronts warm fronts jet streams	207 215	research how large bodies of water affect climate understanding the Atlantic gyre
5.2.G.b Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Earth's systems interact with one another as they undergo change by common processes	The geosphere, hydrosphere and atmosphere are continually interacting through processes that transfer energy and Earth materials	Describe the effects of natural phenomena (i.e., burning organic material, volcanic eruptions, lightning) on the properties of the atmosphere	480 481 481 481 485 485 615	distribution of incoming solar radiation greenhouse conditions on Earth Earth's "energy budget" greenhouse effect and greenhouse gasses research the density of Venus' and Mars' atmospheres Earth's internal energy greenhouse conditions on Venus	185 202	effect of ocean on carbon dioxide levels in the atmosphere investigate the temperature effects of greenhouse gases

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5.3.A.a Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Human activity is dependent upon and affects Earth's resources and systems	Earth's materials are limited natural resources that are affected by human activity	Distinguish between renewable and nonrenewable energy resources	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
				443	impact of increased CO2 in oceans		
				479	effects of CFC's on the ozone layer		
				482	effects of burning fossil fuels		
				515	permafrost		

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5.3.A.b Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Human activity is dependent upon and affects Earth's resources and systems	Earth's materials are limited natural resources that are affected by human activity	Recognize the finite availability of fresh water for use by living organisms	411	effects of PCB's in Great Lakes	178	actions to take to improve water quality
				433	water quality standards	178	predict the quality of surface water to be tested and justify your answer
				433	The Clean Water Act		
				434	importance of water analysis		
				435	water quality testing	179	address what you can do to maintain or improve the water quality at the test site
				436	water quality testing		
				437	effects of acid rain on natural environments	182	the effects of acid rain on organisms in aquatic environments
				437	acid rain		
				439	illustration of acid rain formation		
				440	oceans in the water cycle		
				443	impact of increased CO2 on oceans		
				444	pollution and the ocean food chain		
				445	pollution and the ocean food chain		
				471	nitrogen cycle		
				482	changes to the oceans due to increasing global temperatures		
				559	volcanoes and water vapor		
				568	how urban sprawl changes local climate		

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5.3.A.c Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Human activity is dependent upon and affects Earth's resources and systems	Earth's materials are limited natural resources that are affected by human activity	Identify human activities that adversely affect the composition of the atmosphere, hydrosphere, or geosphere	414	effect of electrical generating facilities on dissolved oxygen in water	178	actions to take to improve water quality
				437	effects of acid rain on the soil	178	predict the quality of surface water to be tested and justify your answer
				437	effects of acid rain on natural environments		
				439	illustration of acid rain formation		
				443	impact of increased CO ₂ in oceans		
				471	nitrogen cycle		
				479	effects of CFC's on the ozone layer		
				482	effects of burning fossil fuels		
				482	changes to the oceans due to increasing global temperatures		
				515	permafrost		
				568	how urban sprawl changes local climate		

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
5.3.A.d Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Human activity is dependent upon and affects Earth's resources and systems	Earth's materials are limited natural resources that are affected by human activity	When given a scenario describing how the composition of the atmosphere, hydrosphere, or geosphere is altered, predict the effect of that change on the other sphere	414 437 437 439 443 471 479 482 482 515 568	effect of electrical generating facilities on dissolved oxygen in water effects of acid rain on the soil effects of acid rain on natural environments illustration of acid rain formation impact of increased CO2 in oceans nitrogen cycle effects of CFC's on the ozone layer effects of burning fossil fuels changes to the oceans due to increasing global temperatures permafrost how urban sprawl changes local climate	178 178	actions to take to improve water quality predict the quality of surface water to be tested and justify your answer
5.3.A.e Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Human activity is dependent upon and affects Earth's resources and systems	Earth's materials are limited natural resources that are affected by human activity	Recognize how the geomorphology of Missouri affects the development of land use		featured in ancillary component		featured in ancillary component

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
5.3.A.f Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Human activity is dependent upon and affects Earth's resources and systems	Earth's materials are limited natural resources that are affected by human activity	Recognize the limited availability of major mineral deposits in the United States due to human use (e.g., lead, petroleum, coal, copper, zinc, iron, gravel, aluminum)	570 571 572	properties of minerals common minerals Mohs hardness scale		
5.3.A.g Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere and Hydrosphere)	Human activity is dependent upon and affects Earth's resources and systems	Earth's materials are limited natural resources that are affected by human activity	Recognize the economic, political, social, and ethical constraints associated with obtaining and using natural resources	364 432 433 435 437 448 542 560	petroleum water cycle and conservation wise use of water water usage and quality acid rain explained research the issue of acid rain using seismic waves for oil and gas exploration mineral deposits and diamonds	163 163 164 178 179 180 180 182	consider a vehicle's fuel economy can trees compensate for manmade CO2 from vehicles and industry? perform water quality tests wise use of water supply maintaining water supply quality save water for houseplants perform water quality tests investigate effect of acid rain on microorganisms

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
6.1.A.a Composition and Structure of the Universe and the Motion of Objects within It	The universe has observable properties and structure	The Earth, Sun, and Moon are part of a larger system that includes other planets and smaller celestial bodies	Describe the position and motion of the Sun-Earth solar system within the Universe	613 614	explanation and illustration of the solar system relative sizes and distances within the solar system	258 259 260	setting up a scale model of the solar system determining scale distances for the planets determining scale sizes of the planets
6.1.B.a Composition and Structure of the Universe and the Motion of Objects within It	The universe has observable properties and structure	The Earth has a composition and location that is suitable to sustain life	Explain how Earth's environmental characteristics and location in the Universe (e.g., atmosphere, temperature, orbital path, magnetic field, mass-gravity, location in solar system) provide a life-supporting environment	472 612 612 613 613 614 615 619 620 641	comparison of Earth's atmosphere to other planets orbits of planets around the sun Johannes Kepler Kepler's elliptically shaped orbits explanation and illustration of the solar system relative sizes and distances within the solar system what makes Earth capable of supporting life asteroids and comets meteors and meteorites and the Kuiper Belt the existence of other planetary systems	256 258 259 260	simulate an object in orbit and investigate how orbital period varies within distance setting up a scale model of the solar system determining scale distances for the planets determining scale sizes of the planets

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
6.1.C.a Composition and Structure of the Universe and the Motion of Objects within It	The universe has observable properties and structure	Most of the information we know about the universe comes from the electromagnetic spectrum	Identify information that the electromagnetic spectrum provides about the stars and the universe (e.g. chemical composition, temperature, age of stars, location of black holes, motion of celestial bodies)	594 595 596 597 598 634 639 640 648 649	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 death of small to medium stars results in white dwarfs and planetary nebula and black dwarfs death of massive stars results in supernovas and neutron stars and black holes evidence for the Big Bang theory evidence for the Big Bang theory	264 264 268	using spectroscopy to analyze the light emitted by stars and identify most common elements understand why spectroscopy is an important tool of astronomers measuring apparent brightness to calculate the distance to stars and galaxies

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
6.1.C.b Composition and Structure of the Universe and the Motion of Objects within It	The universe has observable properties and structure	Most of the information we know about the universe comes from the electromagnetic spectrum	Evaluate the advantages/disadvantages of using different tools (e.g., spectroscope, different types of telescopes, probes) to gather information about the universe	594 595 596 597 598 634	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	264 268	understand why spectroscopy is an important tool of astronomers measuring apparent brightness to calculate the distance to stars and galaxies

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
6.2.C.a Composition and Structure of the Universe and the Motion of Objects within It	Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces	The regular and predictable motions of the Earth and moon relative to the sun explain natural phenomena on Earth such as the day, the month, the year, shadows, moon phases, eclipses, tides, and seasons	Relate units of time (i.e., day, month, year) to the regular and predictable motion of the Earth and moon	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		

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
6.2.C.b Composition and Structure of the Universe and the Motion of Objects within It	Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces	The regular and predictable motions of the Earth and moon relative to the sun explain natural phenomena on Earth such as the day, the month, the year, shadows, moon phases, eclipses, tides, and seasons	Explain seasonal phenomena (i.e., weather, length of day, temperature, intensity of sunlight) as a consequence of Earth's axial tilt as it rotates and Earth's orbital position as it revolves around the sun	492 518	Earth's tilt causes seasons create a model to explain why Earth has seasons	209	investigating factors which cause the seasons

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
6.2.C.c Composition and Structure of the Universe and the Motion of Objects within It	Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces	The regular and predictable motions of the Earth and moon relative to the sun explain natural phenomena on Earth such as the day, the month, the year, shadows, moon phases, eclipses, tides, and seasons	Provide evidence that can be observed from Earth that supports the fact that Earth rotates on its axis and revolves around the sun	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		
				585	Earth's rotation and patterns of day and night	211	investigating how Earth's tilt affects the sun's intensity
				587	axial tilt causes the seasons	238	why studying the moon's surface is useful for understanding Earth
				588	solar eclipses		
				588	lunar eclipses		
				589	solar eclipses	248	building a sundial to keep track of daily time based on the cycles between Earth and the sun
				589	solar eclipses		
				601	identify seasons	250	modeling the lunar cycle
				607	properties of the moon	251	constructing a lunar calendar
				608	the moon as a satellite of Earth		
				609	the moon's effect on tides on Earth	256	simulate an object in orbit and investigate how orbital period varies within distance
				610	the Earth-moon system		
				611	giant impact theory		
				612	orbits of planets around the sun		
				612	Johannes Kepler		
				613	Kepler's elliptically shaped orbits		

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
				619	asteroids and comets		
				620	meteors and meteorites and the Kuiper Belt		
6.2.C.d Composition and Structure of the Universe and the Motion of Objects within It	Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces	The regular and predictable motions of the Earth and moon relative to the sun explain natural phenomena on Earth such as the day, the month, the year, shadows, moon phases, eclipses, tides, and seasons	Predict the moon rise/set times, phases of the moon, and/or eclipses using information describing the relative position of the moon with respect to the Earth and sun	584	the lunar cycle	238	why studying the moon's surface is useful for understanding Earth
				588	lunar eclipses		
				589	solar eclipses	250	modeling the lunar cycle
				607	properties of the moon	251	constructing a lunar calendar
				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		
6.2.C.e Composition and Structure of the Universe and the Motion of Objects within It	Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces	The regular and predictable motions of the Earth and moon relative to the sun explain natural phenomena on Earth such as the day, the month, the year, shadows, moon phases, eclipses, tides, and seasons	Explain how the gravitational forces due to the relative positions of the Earth, moon and sun determine the height and frequency of tides (assess only high and low)	584	the lunar cycle	238	why studying the moon's surface is useful for understanding Earth
				588	lunar eclipses		
				589	solar eclipses	250	modeling the lunar cycle
				607	properties of the moon	251	constructing a lunar calendar
				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		

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6.2.D.a Composition and Structure of the Universe and the Motion of Objects within It	Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces	Gravity is a force of attraction between objects in the solar system that governs their motion	Explain orbital motions of moons around planets and planets around the sun as the result of gravitational forces between those objects	612 612 613 616 617 618 619 620 621	orbits of planets around the sun Johannes Kepler Kepler's elliptically shaped orbits classifying the planets classifying the planets comparing properties of the planets asteroids and comets meteors and meteorites and the Kuiper Belt is Pluto a planet	256	simulate an object in orbit and investigate how orbital period varies within distance

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
7.1.A.a Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation	Formulate testable questions and hypotheses	10	the research question and hypothesis	6	how do we ask questions and get answers from nature?
				429	why haven't we run out of water	170	devise hypothesis and explain
				434	what is in your tap water		
				437	what is acid rain	170	which method will give fastest dissolving rate?
				441	why are oceans salty	182	formulate hypothesis
				451	what is temperature	208	formulate a hypothesis about why the seasons occur
				456	asking questions pertaining to specific heat and heat flow		
				472	why is Earth's atmosphere different from other planets		
				473	why do ears pop		
				492	why does Earth have seasons		
				501	how does rain form		
				509	how do animals survive in the desert		
				515	what is a carbon sink		
				530	proving hypotheses for sea-floor spreading		
				534	why doesn't Earth get bigger and bigger		
				580	form a hypothesis (#7)		
				588	what causes eclipses		

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				621	is Pluto a planet		

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7.1.A.b Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation	Analyzing an experiment, identify the components (i.e., independent variable, dependent variables, control of constants, multiple trials) and explain their importance to the design of a valid experiment	11	control and experimental variables	7	doing a controlled experiment
				26	independent and dependent variables	21	determine effect of increasing mass
				28	identifying cause and effect relationships	21	choose independent and dependent variables for graph
				41	identify cause and effect	27	recognize variables
				438	what causes acid rain	190	effect of changing mass on data
				456	determining effect of changing mass on temperature changes	190	effect of changing mass on collected data
				460	thermal equilibrium	197	identifying relationships between air pressure and weather
				497	factors that shape the weather	206	identifying relationship between percent of Earth covered in water and temperature range
				608	relationship between orbital speed and distance between two objects	211	determining whether distance from light source or axial tilt plays a more significant role in causing the seasons
						224	sequencing events
						235	concluding which conditions affect the timing and duration and intensity of an earthquake based on observation

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
						241 justify which scenario was most likely 256 investigation discovering relationship between orbital speed and distance	

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
7.1.A.c Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation	Design and conduct a valid experiment	7	experimentation begins with a question	7	design your own experiment
				9	steps in the scientific method	7	compare results with hypothesis
				10	forming a hypothesis	7	perform your own experiment
				12	writing lab procedures	9	design three experiments using car and ramp
				19	design your own experiment	9	design three experiments and choose equipment
				19	design your own experiment	9	conduct three experiments with appropriate equipment
				42	devise an experiment	9	design three experiments and choose equipment
				288	find the thickness of a single card	10	selecting ramp and photogates
				448	describe steps you would take to determine whether pH affects frog population	10	conduct car/ramp experiment
						12	select equipment and set up experiment
						16	decide how to vary the force on the car for this experiment
						16	investigate Newton's 2nd law
						26	what variables can be changed?
						30	rigging block and tackle

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						34	investigate motion on a rollercoaster
						75	plan three experiments to determine which variable affects the period of a pendulum
						75	perform self-designed experiment
						75	design pendulum experiment
						93	decision trees and the advantage of doing multiple trials
						145	carry out procedure and select equipment
						145	plan a procedure and select necessary equipment
						151	design experiment to find out if mass is conserved
						151	select materials from list
						151	plan procedures and select materials
						170	what three factors influence dissolving rate?
						170	which factor will produce fastest dissolving rate?
						170	write a procedure
						182	simulating the effect of acid rain on daphnia

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
						188	conducting investigation of efficiency of immersion heater
						193	conducting experiments on heat transfer
						194	design and construct an aneroid barometer
						196	writing a procedure for constructing a pointer for an aneroid barometer
						205	investigating how specific heat of water regulates Earth's temperature
						209	measuring the intensity of light using an electric meter and solar cell and light bulb
						214	develop a procedure to create an underwater spring
						233	identifying how the earthquake model represents an earthquake
						237	develop a research plan for studying volcanoes
						252	identifying the parts of a refracting telescope and making observations of the moon's surface

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7.1.A.d Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation	Recognize that sometimes it is not possible, for practical or ethical reasons, to control some conditions	11 26	control and experimental variables independent and dependent variables	7 21 27 190 211	doing a controlled experiment choose independent and dependent variables for graph recognize variables effect of changing mass on collected data determining whether distance from light source or axial tilt plays a more significant role in causing the seasons
7.1.A.e Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation	Acknowledge that some scientific explanations cannot be tested using the standard experimental “scientific method” due to the limits of the laboratory environment, resources, and/or technologies	448 602	forming a hypothesis and testing through experimentation (#5) identify question, hypothesis, procedure, and results (#1)	7	variables in an experiment

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7.1.A.f Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation	Acknowledge that there is no fixed procedure called “the scientific method”, but that some investigations involve systematic observations, carefully collected, relevant evidence, logical reasoning, and some imagination	34 45 54 105 107 312 313 321 324 332 393 528 529 529 612 648	Aristotle vs. Newton Newton’s Laws of Motion Newton and the force of gravity Benjamin Franklin Charles-Augustin Coulomb contributions of Fermi development of atomic theory contributions of Mendeleev research and create a poster to illustrate development of atomic model plate tectonic history contributions of Marie and Pierre Curie development of plate tectonic theory continental drift theory history continental drift theory changing ideas about the solar system development of Big Bang theory	130	investigate Rutherford’s gold foil experiment

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
7.1.A.g Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation	Evaluate the design of an experiment and make suggestions for reasonable improvements	28 41 438 456 460 497 608	identifying cause and effect relationships identify cause and effect what causes acid rain determining effect of changing mass on temperature changes thermal equilibrium factors that shape the weather relationship between orbital speed and distance between two objects	21 157 190 197 197 206 224 235 241 256	determine effect of increasing mass add new rules to list based on findings effect of changing mass on data identifying relationships between air pressure and weather evaluating your aneroid barometer design identifying relationship between percent of Earth covered in water and temperature range sequencing events concluding which conditions affect the timing and duration and intensity of an earthquake based on observation justify which scenario was most likely investigation discovering relationship between orbital speed and distance

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7.1.B.a Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations	Make qualitative and quantitative observations using the appropriate senses, tools and equipment to gather data	5	make measurements with precision	5	measuring metric and english lengths
				5	measuring distance	5	making measurements with precision
				435	making observations and asking questions	6	measure time
				486	observing an aurora	7	measure and record variables
				630	what evidence was used to predict the existence of the Kuiper Belt?	14	record three different time intervals
				630	use the data to answer the questions	16	measure force
						17	measure the force
				652	analysis with a spectrometer (#4)	17	measure the force
						25	collect force data
						25	measure and record the force
						27	write down the number of weights you use
						30	measure height difference
						36	make precise height measurements
						44	measure voltage
						46	measure current
						48	measure resistance
						63	making measurements with precision
						75	make precise length measurements

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						87	measure wavelength
						116	measure mass
						117	measure volume
						146	record detailed observations
						150	record data as you perform experiment
						176	measure pH
						182	observing daphnia and recording movements and behavior
						186	measure temperature
						199	collecting Schönbein strips for detecting ozone
						202	collecting data of temperature and sensations
						206	collecting temperature and time data
						210	collecting qualitative data of light intensity at scale distance from the sun
						217	collecting wet and dry bulb temperature readings
						243	recording observations of crystal growing
						251	recording the changes in the moon over a month

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7.1.B.b Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations	Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second	3 6 78 280 280 453 585 586	time measurement scientists use metric units use and understand mass measurements measuring volume of liquids measuring volume of solids comparing temperature in Fahrenheit and Celsius scales understanding time measurement in years clocks and the division of time	12 16 116 117 186 249	make metric length measurement understand and use units of force measuring mass measuring volume develop a way to convert between Fahrenheit and Celsius temperature scales calibrating a sundial

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7.1.B.c Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations	Determine the appropriate tools and techniques to collect, analyze and interpret data	5 288	measuring distance find the thickness of a single card	5 6 9 9 9 10 12 16 30 44 46 48 87 116 117 145 145	measuring metric and english lengths measure time design three experiments and choose equipment conduct three experiments with appropriate equipment design three experiments and choose equipment selecting ramp and photogates select equipment and set up experiment measure force rigging block and tackle measure voltage measure current measure resistance measure wavelength measure mass measure volume plan a procedure and select necessary equipment carry out procedure and select equipment

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
						151 select materials from list 151 plan procedures and select materials 186 measure temperature 194 design and construct an aneroid barometer 209 measuring the intensity of light using an electric meter and solar cell and light bulb 252 identifying the parts of a refracting telescope and making observations of the moon's surface	

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7.1.B.d Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations	Judge whether measurements and computation of quantities are reasonable	11	controlling variables in experiments	7	what variables should be controlled?
				19	did you run a controlled experiment?	11	calculate % error
				20	what factors could explain the variability in their data?	15	interpret a speed vs. time graph
				24	interpretations of patterns in data	76	calculate % error
				27	reading a graph	129	control the height of the liquid
				78	analyze lever diagram	151	does your experiment agree with law of conservation of mass?
				476	atmospheric pressure at various altitudes graph	169	why was plain water tested?
				485	what percentage comes from this source? (problem 4)	169	what does the word control mean?
				543	determining distance to an epicenter	197	calculating error between your barometer and a commercial barometer
				547	what explains the difference in density? (#5)	199	importance of good record keeping in order to avoid error
				605	how big is Earth?	217	determining relationship between temperature of the atmosphere and relative humidity
				645	apparent brightness vs. distance graph	218	interpreting Doppler radar images
				651	use the diagram to answer the questions (#2)	231	evaluating your completed bathymetric map
				651	arrange the items in the table (#3)		
				651	use the diagram to answer the questions (#4)		

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
						237	finding a pattern of volcanoes on a bathymetric map
						247	evaluate your ability to interpret rock formations
7.1.B.e Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations	Calculate the range, average/mean, percent and ratios for sets of data	547 618	average density (#5) average distance from the sun	21 129 171	think about percent change find average velocity average dissolving rate
7.1.B.f Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations	Recognize that observation is biased by the experiences and knowledge of the observer	110 142 448	study appliance labels and instructions create pamphlet on utility's energy saver programs study claims made by bottled water companies	76 162 163 181	analyze watch manufacturer's claims inferences from promotional materials for vehicles evaluating choice of favorite car study water filtration device claims

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7.1.C.a Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Evidence is used to formulate explanations	Use quantitative and qualitative data to construct reasonable explanations (conclusions)	19	which group did the best experiment?	18	evaluate graphs as to whether or not they show relationships between variables
				28	identifying cause and effect relationships	21	evaluate percent change for data collected
				41	identify cause and effect	21	determine effect of increasing mass
				438	what causes acid rain	21	construct reasonable explanation based on data
				456	determining effect of changing mass on temperature changes	35	study data and determine importance of height on speed of marble
				460	thermal equilibrium	45	analyze data and explain a rule
				497	factors that shape the weather	75	evaluate statistical significance
				608	relationship between orbital speed and distance between two objects	157	add new rules to list based on findings
						171	evaluate method based on data
						190	effect of changing mass on data
						197	evaluating your aneroid barometer design
						197	identifying relationships between air pressure and weather
						200	evaluating your qualitative ozone strips

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
						206 identifying relationship between percent of Earth covered in water and temperature range 224 sequencing events 235 concluding which conditions affect the timing and duration and intensity of an earthquake based on observation 241 justify which scenario was most likely 256 investigation discovering relationship between orbital speed and distance	

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
7.1.C.b Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Evidence is used to formulate explanations	Analyze experimental data to determine patterns, relationship, perspectives and credibility (e.g., predict/extrapolate data, explain the relationship between the independent and dependent variable)	24	making a graph	13	graph distance vs. time
				24	interpretations of patterns in data	15	interpret a speed vs. time graph
				26	creating graphs	15	construct a quantitative graphical model
				27	reading a graph	25	create a mathematical model
				41	make a graph	27	find math rule for lever equilibrium
				42	interpreting distance/time graph	28	derive a math formula
				78	analyze lever diagram	37	organize data into a graph of speed vs. height
				459	heat equation	51	graph voltage vs. current
				476	atmospheric pressure at various altitudes graph	121	graph mass vs. volume
				645	inverse square law	147	organize observations into a category table
				645	apparent brightness vs. distance graph	185	constructing a graph of drops of acid vs pH
				651	use the diagram to answer the questions (#2)	187	construct a graphical model
				651	arrange the items in the table (#3)	187	find equation for trend line
				651	use the diagram to answer the questions (#4)	189	construct a temperature vs. time graph
						197	constructing a graph from atmospheric pressure data
						203	graphing water and ice temperature readings

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
						206 constructing a graph of time vs. temperature 217 determining relationship between temperature of the atmosphere and relative humidity 218 interpreting Doppler radar images 237 finding a pattern of volcanoes on a bathymetric map 257 inverse square law 268 discovering the mathematical relationship between apparent brightness and distance	

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
7.1.C.c Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Evidence is used to formulate explanations	Identify the possible effects of measurement and calculation errors on the validity and reliability of data	11	controlling variables in experiments	7	what variables should be controlled?
				19	did you run a controlled experiment?	11	calculate % error
				20	what factors could explain the variability in their data?	76	calculate % error
				485	what percentage comes from this source? (problem 4)	129	control the height of the liquid
				543	determining distance to an epicenter	151	does your experiment agree with law of conservation of mass?
				547	what explains the difference in density? (#5)	169	why was plain water tested?
				605	how big is Earth?	169	what does the word control mean?
						197	calculating error between your barometer and a commercial barometer
						199	importance of good record keeping in order to avoid error
						231	evaluating your completed bathymetric map
						247	evaluate your ability to interpret rock formations

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
7.1.D.a Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry includes evaluation of explanations (hypotheses, laws, theories) in light of scientific principles (understandings)	Make predictions supported by scientific knowledge and explanations	20 24 42	how will speed change? predicting speed from a graph predict the speed of a car	76 121 156 201 204 239 242	use data to predict best string length for a pendulum clock use graph to predict mass of six objects make predictions about solubility predicting areas with high ozone concentration based on your data predicting what would happen if you place your ice/water test tube into a hot cup or a cold cup estimating the number of meteor collisions on Earth during the last 3.5 billion years predicting the results of the crystal-growing experiment

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
7.1.D.b Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry includes evaluation of explanations (hypotheses, laws, theories) in light of scientific principles (understandings)	Analyze whether evidence supports proposed explanations (hypotheses, laws, theories)			151 171	do the data support the hypothesis what was happening at molecular level?

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
7.1.D.c Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	Scientific inquiry includes evaluation of explanations (hypotheses, laws, theories) in light of scientific principles (understandings)	Evaluate the reasonableness of an explanation (conclusions)	19	which group did the best experiment?	6 7 9 18 21 21 27 34 35 43 45 75 75 151	predict which car will move fastest test the effect of one other variable devise a hypothesis evaluate graphs as to whether or not they show relationships between variables evaluate percent change for data collected construct reasonable explanation based on data think about the variables where does the marble move the fastest? study data and determine importance of height on speed of marble how did A and B tapes acquire different charge? analyze data and explain a rule investigate variables that affect the period of a pendulum evaluate statistical significance explain how hypothesis compares to results

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
						151 perform the experiment you designed 170 devise hypothesis and explain 171 evaluate method based on data 200 evaluating your qualitative ozone strips 208 testing hypothesis of why seasons occur against your observations in the investigation	

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
7.1.E.a Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	The nature of science relies upon communication of results and justification of explanations	Communicate the procedures and results of investigations and explanations through: oral presentations, drawings and maps, data tables, graphs, equations, and writings	20 27	explain your reasoning how to read a graph		vocabulary is presented in context of investigations students are encouraged to keep a lab notebook 9 present conclusions to the class 9 reporting on an experiment 13 make a distance vs. time graph 15 discuss and test ideas with your group 19 explain how you arrived at your answer 29 discuss what you learned about gears 37 describe the flow of energy based on experimental graph 39 give a brief presentation to the class 41 drawing and interpreting circuit diagrams 47 discuss an explanation with your group 47 present and defend an explanation 78 reading harmonic motion data tables and graphs

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
						129 explain your answer and justify 145 present findings to the class 145 present findings and methods used 151 present results to the class 179 create water quality report 181 write paragraph to explain results 183 write summary of findings 183 writing up a lab report	
7.1.E.b Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	The nature of science relies upon communication of results and justification of explanations	Communicate and defend a scientific argument			179 create water quality report 181 write paragraph to explain results 183 write summary of findings	

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
7.1.E.c Scientific Inquiry	Science understanding is developed through the use of science process skills and scientific knowledge in combination with scientific investigation, reasoning, and critical thinking	The nature of science relies upon communication of results and justification of explanations	Explain the importance of the public presentation of scientific work and supporting evidence to the scientific community	58	Newton on a skateboard	39	study energy transformations in daily life scenarios
				78	describe a problem that would be solved by an engineer	163	evaluating choice of favorite car
				120	circuits in your house	179	researching and preparing for a field trip to test surface water
				320	the quests of alchemists	198	contributions of Schönbein
				391	scientific discovery and the atomic age	201	suggesting ways that ozone concentrations could be reduced
				452	balloons expands or contracts due to thermal expansion	204	connecting the latent heat investigation to Earth
				454	temperature vs. thermal energy for a cup or pot of soup	218	understanding Doppler radar
				461	understanding thermal energy through cocoa example		
				465	examples of reflectors and absorbers		
				473	why do ears pop		
				476	atmospheric pressure in Denver		
				490	using the North Star to estimate your latitude		
				509	how do animals survive in the desert		
				536	analogy of plate movements		
				583	history of calendars		

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
				585	counting the days in a year		
				586	the history of clocks and the division of time		
				589	ancient beliefs about solar eclipses		
				594	history of the telescope		
8.1.C.a Impact of Science, Technology and Human Activity	The nature of technology is advanced by and can advance science as it seeks to apply scientific knowledge in ways that meet human needs	Technological solutions to problems often have drawbacks as well as benefits	Identify and evaluate the environmental costs and benefits of scientific or technological solutions to a given problem	333	problems with disposing of plastics	163	too much CO ₂
				355	recycling tires	163	research how trees offset accumulation of CO ₂
				356	recycling discarded tires	163	research how trees offset accumulation of CO ₂
				379	hydrogen-powered cars and the environment	182	investigate effect of acid rain on microorganisms
				379	research fuel cells	201	research the causes of ozone in the lower atmosphere
				379	research environmental impact of fuel cells		
				392	storage of nuclear waste		
				395	fossil fuels		
				400	problems caused by airborne pollutants		
				436	effect of excess nitrates on environment		
				437	acid rain explained		
				448	research the issue of acid rain		

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
8.2.A.a Impact of Science, Technology and Human Activity	A historical perspective of scientific explanations helps to improve understanding of the nature of science and how science knowledge and technology evolve over time	People from various cultures, races, and of different gender have contributed to the scientific discoveries and the invention of technological innovations	Recognize that contributions to science have not been limited to the work of one particular group, but instead have been made by a diverse group of scientists representing various cultures, races, and gender	34 45 54 105 107 312 312 320 321 321 332 363 370 391 393 393 393 457	Aristotle vs. Newton Newton's Laws of Motion Newton and the force of gravity Benjamin Franklin Charles-Augustin Coulomb contributions of Fermi Dalton's contributions the quests of alchemists Mendeleev's periodic table contributions of Mendeleev Linus Pauling and electronegativities Antoine Lavoisier research Lavoisier's contributions scientific discovery and the atomic age accomplishments of Marie Curie Marie and Pierre Curie contributions of Marie and Pierre Curie Joseph Black	198	contributions of Schönbein

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
				583	history of calendars		
				585	counting the days in a year		
				586	the history of clocks and the division of time		
				589	ancient beliefs about solar eclipses		
				594	history of the telescope		

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
8.2.B.a Impact of Science, Technology and Human Activity	A historical perspective of scientific explanations helps to improve understanding of the nature of science and how science knowledge and technology evolve over time	Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity	Identify and describe how explanations (hypotheses, laws, theories) explaining scientific phenomena have changed over time as a result of new evidence	34 45 54 105 107 312 313 321 324 332 393 528 529 529 612 648	Aristotle vs. Newton Newton's Laws of Motion Newton and the force of gravity Benjamin Franklin Charles-Augustin Coulomb contributions of Fermi development of atomic theory contributions of Mendeleev research and create a poster to illustrate development of atomic model plate tectonic history contributions of Marie and Pierre Curie development of plate tectonic theory continental drift theory continental drift theory history changing ideas about the solar system development of Big Bang theory	130	investigate Rutherford's gold foil experiment

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
8.2.B.b Impact of Science, Technology and Human Activity	A historical perspective of scientific explanations helps to improve understanding of the nature of science and how science knowledge and technology evolve over time	Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity	Identify and analyze current theories that are being questioned and compare them to new theories that have emerged to challenge the older ones	34 45 54 105 107 312 313 321 324 332 393 528 529 529 612 648	Aristotle vs. Newton Newton's Laws of Motion Newton and the force of gravity Benjamin Franklin Charles-Augustin Coulomb contributions of Fermi development of atomic theory contributions of Mendeleev research and create a poster to illustrate development of atomic model plate tectonic history contributions of Marie and Pierre Curie development of plate tectonic theory continental drift theory history continental drift theory changing ideas about the solar system development of Big Bang theory	130	investigate Rutherford's gold foil experiment

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
				648	evidence for the Big Bang theory		
				649	evidence for the Big Bang theory		
8.3.B.a Impact of Science, Technology and Human Activity	Science is a human endeavor	Social, political, economic, ethical, and environmental forces strongly influence and are influenced by the direction of progress of science and technology	Recognize the role funding and promotion by political and social groups has on scientific research	400	clean air act of 1970		
				429	governments managing water resources		
				448	is acid rain a problem in your community?		
				448	what is the history of your community's water supply and treatment		
				448	how is the government addressing the problem of acid rain?		
				479	London Agreement of 1991		
				483	should governments enforce changes for lowering greenhouse gas levels		

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
8.3.B.b Impact of Science, Technology and Human Activity	Science is a human endeavor	Social, political, economic, ethical, and environmental forces strongly influence and are influenced by the direction of progress of science and technology	Analyze and evaluate the social, political, economic, ethical, and environmental factors affecting science and technology	73 433 439 483 530 538 544 597 599	relationship between science and technology the clean water act catalytic converters and scrubbing reduce acid rain hydrogen powered cars using echo sounders to map the sea floor what we can learn from seismographs understanding earthquakes allows engineers to design safer buildings using satellite technology space shuttle	70	using engineering design cycle

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8.3.B.c Impact of Science, Technology and Human Activity	Science is a human endeavor	Social, political, economic, ethical, and environmental forces strongly influence and are influenced by the direction of progress of science and technology	Identify and describe major scientific and technological challenges to society and their ramifications for public policy	172 364 368 379 379 379 391 391 395 400 400 414 414 432 433 435 436 437	generating electric power petroleum limiting reactants hydrogen-powered cars and the environment research environmental impact of fuel cells research fuel cells nuclear vs. fossil fuels impact of nuclear energy fossil fuels reducing pollution problems caused by airborne pollutants environmental impact of electrical generating facilities effect of electrical generating facilities on dissolved oxygen in water water cycle and conservation wise use of water water usage and quality effect of excess nitrates on environment acid rain explained	52 163 163 163 163 163 163 163 163 163 164 178 179 180 180 182 201	the cost of using electrical appliances research how trees offset accumulation of CO ₂ economic impact of end- product of combustion reaction too much CO ₂ consider a vehicle's fuel economy can trees compensate for manmade CO ₂ from vehicles and industry? research how trees offset accumulation of CO ₂ perform water quality tests wise use of water supply maintaining water supply quality perform water quality tests save water for houseplants investigate effect of acid rain on microorganisms research the causes of ozone in the lower atmosphere

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				438	impact of using fossil fuels	262	solar energy can be used to generate electricity without producing pollution
				448	research the issue of acid rain		
				560	description of geothermal energy	262	determine the efficiency of a photovoltaic cell
				627	the efficiency of photovoltaic cells		
				627	using photovoltaic cells		

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8.3.B.d Impact of Science, Technology and Human Activity	Science is a human endeavor	Social, political, economic, ethical, and environmental forces strongly influence and are influenced by the direction of progress of science and technology	Recognize that the gender, ethnicity, and culture of scientists often influence the questions asked and/or the methods used in scientific research and may limit or advance science knowledge and/or technology	73 320 391 473 504 583 585 586 589 594 648	impact of Da Vinci's work the quests of alchemists scientific discovery and the atomic age why do ears pop meteorologists use atmospheric pressure data to understand movement of weather systems history of calendars counting the days in a year the history of clocks and the division of time ancient beliefs about solar eclipses history of the telescope evidence for Big Bang theory	6 198 215	asking questions and learning about natural world contributions of Schönbein the food paradox of the oceans

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Standard #: Standard	Objective	Concept	Expectations	student text pg	detail	investigation pg	detail
8.3.C.a Impact of Science, Technology and Human Activity	Science is a human endeavor	Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent	Identify and evaluate the need for informed consent in experimentation	320 391 583 585 586 589 594	the quests of alchemists scientific discovery and the atomic age history of calendars counting the days in a year the history of clocks and the division of time ancient beliefs about solar eclipses history of the telescope	198	contributions of Schönbein

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8.3.C.b Impact of Science, Technology and Human Activity	Science is a human endeavor	Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent	Identify the ethical issues involved in experimentation (i.e., risks to organisms or environment)	34 73 395 443 479 482 496 511 542 545 568	Newton's research impacted mathematics impact of technology impact of industrial revolution impact of carbon dioxide on life in the oceans scientists detect loss of ozone in atmosphere effects of global warming discovered tracking ocean currents trees and global climate studying seismic waves leads to information used in oil and gas exploration predicting tsunamis urban sprawl		

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8.3.C.c Impact of Science, Technology and Human Activity	Science is a human endeavor	Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent	Identify and evaluate the role of models as an ethical alternative to direct experimentation	23	why make models?	13	graph distance vs. time
				24	making a graph	15	construct a quantitative graphical model
				24	what is a scientific model?	37	organize data into a graph of speed vs. height
				24	scientific models	51	graph voltage vs. current
				26	creating graphs	121	graph mass vs. volume
				41	make a graph	147	organize observations into a category table
				485	computer modeling to predict greenhouse effects	151	does your experiment agree with law of conservation of mass?
				485	computer modeling to predict greenhouse effects	185	constructing a graph of drops of acid vs pH
				494	modeling air currents	187	construct a graphical model
				518	create a model (#1)	189	construct a temperature vs. time graph
				524	model of Earth's history	197	constructing a graph from atmospheric pressure data
				533	modeling plate boundaries	202	modeling the effect of greenhouse gases on Earth's temperature
				576	rock cycle model	203	graphing water and ice temperature readings
				614	solar system modeling	206	constructing a graph of time vs. temperature
				624	model of the sun's anatomy		

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						212 modeling underwater rivers and waterfalls and springs 231 evaluating your completed bathymetric map 232 construct a model that simulates an earthquake 247 evaluate your ability to interpret rock formations 258 setting up a scale model of the solar system	
8.3.D.a Impact of Science, Technology and Human Activity	Science is a human endeavor	Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible	Evaluate a given source for its scientific credibility (e.g., articles in new periodical quoting an “eye witness”, a scientist speaking within or outside his/her area of expertise)	110 142 448	study appliance labels and instructions create pamphlet on utility’s energy saver programs study claims made by bottled water companies	76 162 181	analyze watch manufacturer’s claims inferences from promotional materials for vehicles study water filtration device claims
8.3.D.b Impact of Science, Technology and Human Activity	Science is a human endeavor	Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible	Explain why accurate record-keeping, openness, and replication are essential for maintaining an investigator’s credibility with other scientists and society	110 142 448	study appliance labels and instructions create pamphlet on utility’s energy saver programs study claims made by bottled water companies	76 162 181	analyze watch manufacturer’s claims inferences from promotional materials for vehicles study water filtration device claims