

Physical Science CR

State Standard Number	State Standard Area/Description	Unit Name	Course Topic Description
C	Chemistry		
C.1	Students shall demonstrate an understanding of matter's composition and structure.		
C.1.PS.1	Compare and contrast chemical and physical properties of matter, including but not limited to flammability, reactivity, density, buoyancy, viscosity, melting point and boiling point	Matter, Energy and Change Energy in Motion	Characteristic Properties of Matter Properties of Fluids Other Properties of Fluids
C.1.PS.2	Compare and contrast chemical and physical changes, including but not limited to rusting, burning, evaporation, boiling and dehydration	Matter, Energy and Change	Physical and Chemical Changes
C.1.PS.3	Discuss and model the relative size and placement of sub-atomic particles	Elements, Compounds and Mixtures	Characterizing the Atom The Wave Mechanical Model of the Atom
C.1.PS.4	Illustrate the placement of electrons in the first twenty elements using energy levels and orbitals	Elements, Compounds and Mixtures	Tutorial: It's All About the Electrons
C.1.PS.5	Distinguish among atoms, ions, and isotopes	Elements, Compounds and Mixtures	Tutorial: Chemistry's Elemental Concepts
C.1.PS.6	Model the valence electrons using electron dot structures (Lewis electron dot structures)	Elements, Compounds and Mixtures	Tutorial: It's All About the Electrons
C.1.PS.7	Explain the role of valence electrons in determining chemical properties	Elements, Compounds and Mixtures	Tutorial: It's All About the Electrons
C.1.PS.8	Explain the role of valence electrons in forming chemical bonds	Elements, Compounds and Mixtures	Tutorial: It's All About the Electrons
C.1.PS.9	Model bonding:		

Physical Science CR

C.1.PS.9.a	ionic	Elements, Compounds and Mixtures	Ionic Bonds
C.1.PS.9.b	covalent	Elements, Compounds and Mixtures	Covalent Bonds
C.1.PS.9.c	metallic		
C.1.PS.10	Identify commonly used polyatomic ions	Elements, Compounds and Mixtures	Ionic Bonds
C.1.PS.11	Write formulas for ionic and covalent compounds	Chemical Reactions	Chemical Symbols in Reaction Equations
C.1.PS.12	Name ionic and covalent compounds		
C.1.PS.13	Identify the mole and amu (atomic mass unit) as units of measurement in chemistry		

Physical Science CR

C.1.PS.14	Calculate the molar mass of compounds based on average atomic mass.		
C.2	Students shall demonstrate an understanding of the role of energy in chemistry.		
C.2.PS.1	Identify the kinetic theory throughout the phases of matter	Matter, Energy and Change	Kinetic Theory of Matter
C.2.PS.2	Create and label heat versus temperature graphs (heating curves):		
C.2.PS.2.a	solid		
C.2.PS.2.b	liquid		
C.2.PS.2.c	gas		
C.2.PS.2.d	triple point		

Physical Science CR

C.2.PS.2.e	heat of fusion		
C.2.PS.2.f	heat of vaporization		
C.2.PS.3	Relate thermal expansion to the kinetic theory	Matter, Energy and Change	Kinetic Theory of Matter
C.2.PS.4	Compare and contrast Boyle's law and Charles' law	Matter, Energy and Change	Kinetic Theory of Matter
C.2.PS.5	Compare and contrast endothermic and exothermic reactions as energy is transferred	Chemical Reactions	Energy Gains and Losses
C.2.PS.6	Distinguish between nuclear fission and nuclear fusion	Chemical Reactions	Tutorial: Nuclear Reactions

Physical Science CR

C.2.PS.7	Compare and contrast the emissions produced by radioactive decay:		
C.2.PS.7.a	alpha particles		
C.2.PS.7.b	beta particles		
C.2.PS.7.c	gamma rays		
C.3	Students shall compare and contrast chemical reactions.		
C.3.PS.1	Identify and write balanced chemical equations:		

Physical Science CR

C.3.PS.1.a	decomposition reaction	Chemical Reactions	Tutorial: Types of Reactions Tutorial: Balancing Chemical Equations
C.3.PS.1.b	synthesis reaction	Chemical Reactions	Tutorial: Types of Reactions Tutorial: Balancing Chemical Equations
C.3.PS.1.c	single displacement reaction	Chemical Reactions	Tutorial: Types of Reactions Tutorial: Balancing Chemical Equations
C.3.PS.1.d	double displacement reaction	Chemical Reactions	Tutorial: Types of Reactions Tutorial: Balancing Chemical Equations
C.3.PS.1.e	combustion reaction		
C.3.PS.2	Predict the product(s) of a chemical reaction when given the reactants using chemical symbols and words	Chemical Reactions	Tutorial: Types of Reactions

Physical Science CR

C.3.PS.3	Balance chemical equations using the Law of Conservation of Mass	Chemical Reactions	Tutorial: Balancing Chemical Equations
C.3.PS.4	Determine mole ratio from a balanced reaction equation		
C.3.PS.5	Compare and contrast the properties of reactants and products of a chemical reaction	Chemical Reactions	Chemical Reactions
C.3.PS.6	Model the role of activation energy in chemical reactions		
C.3.PS.7	Examine factors that affect the rate of chemical reactions, including but not limited to temperature, light, concentration, catalysts, surface area, pressure		
C.3.PS.8	Identify the observable evidence of a chemical reaction:		

Physical Science CR

C.3.PS.8.a	formation of a precipitate		
C.3.PS.8.b	production of a gas		
C.3.PS.8.c	color change		
C.3.PS.8.d	changes in heat and light		
C.3.PS.9	Relate fire safety measures to conditions necessary for combustion		
C.4	Students shall classify organic compounds.		

Physical Science CR

C.4.PS.1	Summarize carbon bonding:		
C.4.PS.1.a	allotropes (diamond, graphite, fullerenes)		
C.4.PS.1.b	carbon-carbon (single, double, triple)		
C.4.PS.1.c	isomers (branched, straight-chain, ring)		
C.4.PS.2	Identify organic compounds by their:		
C.4.PS.2.a	formula		

Physical Science CR

C.4.PS.2.b	structure		
C.4.PS.2.c	properties		
C.4.PS.2.d	functional groups		
C.4.PS.3	Distinguish between saturated and unsaturated hydrocarbons		
C.4.PS.4	Describe organic compounds and their functions in the human body:		
C.4.PS.4.a	carbohydrates		

Physical Science CR

C.4.PS.4.b	lipids		
C.4.PS.4.c	proteins		
C.4.PS.4.d	nucleic acids		
P	Physics		
P.5	Students shall demonstrate an understanding of the role of energy in physics.		
P.5.PS.1	Distinguish among thermal energy, heat, and temperature	Matter, Energy and Change	A Closer Look at Heat Energy

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P.5.PS.2	Calculate changes in thermal energy using:		
P.5.PS.2.a	$q = mc(p) \Delta T$		
P.5.PS.2.b	Where q = heat energy, m = mass, $c(p)$ = specific heat, ΔT = change in temperature		
P.6	Students shall demonstrate an understanding of the role of forces in physics.		
P.6.PS.1	Analyze how force affects motion:		
P.6.PS.1.a	one-dimensional (linear)	Energy in Motion	What is Force?

Physical Science CR

P.6.PS.1.b	two-dimensional (projectile and rotational)		
P.6.PS.2	Explain how motion is relative to a reference point	Energy in Motion	Tutorial: Motion
P.6.PS.3	Compare and contrast among speed, velocity and acceleration	Energy in Motion	Speed Velocity Acceleration
P.6.PS.4	Solve problems using the formulas for speed and acceleration:	Energy in Motion	Speed Acceleration
P.6.PS.4.a	$v = d/t$	Energy in Motion	Speed
P.6.PS.4.b	$a = \Delta v / \Delta t$		

Physical Science CR

P.6.PS.4.c	Where a = acceleration, v = speed (velocity), Δt = change in time, Δv = change in velocity, t = time and d = distance		
P.6.PS.5	Interpret graphs related to motion:		
P.6.PS.5.a	distance versus time (d-t)	Energy in Motion	Using Graphs to Represent Speed
P.6.PS.5.b	velocity versus time (v-t)	Energy in Motion	Graphing Velocity and Acceleration
P.6.PS.5.c	acceleration versus time (a-t)	Energy in Motion	Graphing Velocity and Acceleration
P.6.PS.6	Compare and contrast Newton's three laws of motion	Energy in Motion	Tutorial: Newton's Three Laws of Motion

Physical Science CR

P.6.PS.7	Design and conduct investigations demonstrating Newton's first law of motion		
P.6.PS.8	Conduct investigations demonstrating Newton's second law of motion		
P.6.PS.9	Design and conduct investigations demonstrating Newton's third law of motion		
P.6.PS.10	Calculate force, mass, and acceleration using Newton's second law of motion:	Energy in Motion	Tutorial: Newton's Three Laws of Motion
P.6.PS.10.a	$F=ma$		
P.6.PS.10.b	Where f =force, m =mass, a =acceleration	Energy in Motion	Tutorial: Newton's Three Laws of Motion

Physical Science CR

P.6.PS.11	Relate the Law of Conservation of Momentum to how it affects the movement of objects		
P.6.PS.12	Compare and contrast the effects of forces on fluids:		
P.6.PS.12.a	Archimedes' principle	Energy in Motion	Tutorial: Archimedes' Principle
P.6.PS.12.b	Pascal's principle	Energy in Motion	Tutorial: Bernoulli's and Pascal's Principles
P.6.PS.12.c	Bernoulli's principle	Energy in Motion	Tutorial: Bernoulli's and Pascal's Principles
P.6.PS.13	Design an experiment to show conversion of energy:		

Physical Science CR

P.6.PS.13.a	mechanical (potential and kinetic)	Matter, Energy and Change	Kinetic and Potential Energy The Law Of Conservation of Energy
P.6.PS.13.b	chemical	Chemical Reactions	Tutorial: Conservation of Energy and Enthalpy Values
P.6.PS.13.c	thermal	Matter, Energy and Change	The Law Of Conservation of Energy
P.6.PS.13.d	sound		
P.6.PS.13.e	light	Matter, Energy and Change	The Law Of Conservation of Energy
P.6.PS.13.f	nuclear		

Physical Science CR

P.6.PS.14	Solve problems by using formulas for gravitational potential and kinetic energy:		
P.6.PS.14.a	$KE = \frac{1}{2} mv^2$		
P.6.PS.14.b	$PE = mgh$		
P.6.PS.14.c	Where KE = kinetic energy, PE = potential energy, m = mass, v = velocity		
P.7	Students shall demonstrate an understanding of wave and particle motion.		
P.7.PS.1	Compare and contrast a wave's speed through various mediums	Waves	Tutorial: Understanding Waves

Physical Science CR

P.7.PS.2	Explain diffraction of waves		
P.7.PS.3	Explain Doppler effect using examples	Waves	The Doppler Effect
P.7.PS.4	Calculate problems relating to wave properties:		
P.7.PS.4.a	$v = \lambda f$		
P.7.PS.4.b	$f = 1/T$	Waves	Tutorial: Understanding Waves
P.7.PS.4.c	$v = \lambda f$		

Physical Science CR

P.7.PS.4.d	Where λ = wavelength, f = frequency, T = period, v = velocity		
P.7.PS.5	Describe how the physical properties of sound waves affect its perception	Waves	Tutorial: Understanding Sound
P.7.PS.6	Define light in terms of waves and particles	Waves	Tutorial: The Properties of Light
P.7.PS.7	Explain the formation of color by light and by pigments	Waves	Visible Light
P.7.PS.8	Investigate the separation of white light into colors by diffraction	Waves	Visible Light
P.7.PS.9	Illustrate constructive and destructive interference of light waves	Waves	Wave Interference

Physical Science CR

P.7.PS.10	Differentiate among the reflected images produced by concave, convex, and plane mirrors		
P.7.PS.11	Differentiate between the refracted images produced by concave and convex lenses		
P.7.PS.12	Research current uses of optics and sound		
P.8	Students shall demonstrate an understanding of the role of electricity and magnetism in the physical world.		
P.8.PS.1	Calculate voltage, current, and resistance from a schematic diagram:		
P.8.PS.1.a	Ohm's Law	Electricity and Magnetism	Tutorial: Understanding Ohm's Law, Currents, and Circuits

Physical Science CR

P.8.PS.1.a.1	$V = IR$	Electricity and Magnetism	Tutorial: Understanding Ohm's Law, Currents, and Circuits
P.8.PS.1.a.2	$I = V/R$	Electricity and Magnetism	Tutorial: Understanding Ohm's Law, Currents, and Circuits
P.8.PS.1.a.3	$R = V/I$	Electricity and Magnetism	Tutorial: Understanding Ohm's Law, Currents, and Circuits
P.8.PS.1.b	Series		
P.8.PS.1.b.1	$V \text{ (source)} = V_1 + V_2 + V_3$		
P.8.PS.1.b.2	$I \text{ (source)} = I_1 = I_2 = I_3$		

Physical Science CR

P.8.PS.1.b.3	$R \text{ (total)} = R1 + R2 + R3$		
P.8.PS.1.c	Parallel		
P.8.PS.1.c.1	$V \text{ (source)} = V1 = V2 = V3$		
P.8.PS.1.c.2	$I \text{ (source)} = I1 + I2 + I3$		
P.8.PS.1.c.3	$R \text{ (total)} = 1/R1 + 1/R2 + 1/R3$		
P.8.PS.1.d	Where V = voltage, I = current, R = resistance	Electricity and Magnetism	Tutorial: Understanding Ohm's Law, Currents, and Circuits

Physical Science CR

P.8.PS.2	Calculate electrical power using current and voltage:		
P.8.PS.2.a	$P = IV$		
P.8.PS.2.b	Where P = power, I = current, V = voltage		
P.8.PS.3	Calculate electrical energy using electrical power and time:		
P.8.PS.3.a	$E = Pt$		
P.8.PS.3.b	Where E = energy, P = Power, t = time		

Physical Science CR

P.8.PS.4	Explain the use of electromagnets in step-up and step-down transformers	Electricity and Magnetism	Tutorial: Electromagnetic Induction
P.8.PS.5	Research current uses of electromagnets	Electricity and Magnetism	Energy Sources
NS	Nature of Science		
NS.9	Students shall demonstrate an understanding that science is a way of knowing.		
NS.9.PS.1	Explain why science is limited to natural explanations of how the world works	Scientific Nature	Tutorial: What is Science?
NS.9.PS.2	Compare and contrast hypotheses, theories, and laws	Scientific Nature	Avatar: A Closer Look at Laws and Theories

Physical Science CR

NS.9.PS.3	Distinguish between a scientific theory and the term "theory" used in general conversation	Scientific Nature	Clearing Up Terminology Misconceptions
NS.9.PS.4	Summarize the guidelines of science:		
NS.9.PS.4.a	explanations are based on observations, evidence, and testing	Scientific Inquiry	Tutorial: The Scientific Method
NS.9.PS.4.b	hypotheses must be testable	Scientific Inquiry	The Scientific Method, continued
NS.9.PS.4.c	understandings and/or conclusions may change with additional empirical data	Scientific Nature	Scientific Conclusions are Tentative
NS.9.PS.4.d	scientific knowledge must have peer review and verification before acceptance	Scientific Inquiry	Communicating Results

Physical Science CR

NS.10	Students shall design and safely conduct a scientific inquiry to solve valid problems.		
NS.10.PS.1	Develop and explain the appropriate procedure, controls, and variables (dependent and independent) in scientific experimentation	Scientific Inquiry	Tutorial: Variables
NS.10.PS.2	Research and apply appropriate safety precautions (refer to ADE Guidelines) when designing and/or conducting scientific investigations	Scientific Inquiry	Safety During Investigations
NS.10.PS.3	Identify sources of bias that could affect experimental outcome	Scientific Nature	Avoiding Bias
NS.10.PS.4	Gather and analyze data using appropriate summary statistics	Scientific Inquiry	Tutorial: Trends in Data
NS.10.PS.5	Formulate valid conclusions without bias	Scientific Nature Scientific Inquiry	Avoiding Bias Making Conclusions from Your Data

Physical Science CR

NS.10.PS.6	Communicate experimental results using appropriate reports, figures, and tables	Scientific Inquiry	Sequencing Data Classifying Data Tutorial: Constructing Tables and Graphs
NS.11	Students shall demonstrate an understanding of historical trends in physical science.		
NS.11.PS.1	Recognize the factors that constitute a scientific theory	Scientific Nature	Avatar: A Closer Look at Laws and Theories
NS.11.PS.2	Explain why scientific theories may be modified or expanded using additional empirical data, verification, and peer review	Scientific Nature	Avatar: A Closer Look at Laws and Theories
NS.11.PS.3	Summarize the development of the current atomic theory	Elements, Compounds and Mixtures	Early History of Chemistry
NS.11.PS.4	Analyze the development of the periodic table	Elements, Compounds and Mixtures	The Periodic Table

Physical Science CR

NS.11.PS.5	Research historical events in physical science	Covered throughout the course	
NS.11.PS.6	Research current events and topics in physical science	Covered throughout the course	
NS.12	Students shall use mathematics, science equipment, and technology as tools to communicate and solve physical science problems.		
NS.12.PS.1	Use appropriate equipment and technology as tools for solving problems (e.g., balances, scales, calculators, probes, glassware, burners, computer software and hardware)		
NS.12.PS.2	Collect and analyze scientific data using appropriate mathematical calculations, figures, and tables	Scientific Nature Scientific Inquiry	Units of Measurement Unit Conversions Scientific Notation Tutorial: Constructing Tables and Graphs
NS.12.PS.3	Utilize technology to communicate research findings		

Physical Science CR

NS.13	Students shall describe the connections between pure and applied science.		
NS.13.PS.1	Compare and contrast physical science concepts in pure science and applied science		
NS.13.PS.2	Discuss why scientists should work within ethical parameters	Scientific Nature	Science Ethics
NS.13.PS.3	Evaluate long-range plans concerning resource use and by-product disposal for environmental, economic, and political impact		
NS.13.PS.4	Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology	Scientific Inquiry	Technological Design
NS.13.PS.5	Describe in detail the methods used by scientists in their research	Scientific Inquiry	Tutorial: The Scientific Method Technological Design

Physical Science CR

NS.14	Students shall describe various physical science careers and the training required for the selected career.		
NS.14.PS.1	Research and evaluate physical science careers using the following criteria:		
NS.14.PS.1.a	educational requirements		
NS.14.PS.1.b	salary		
NS.14.PS.1.c	availability of jobs		
NS.14.PS.1.d	working conditions		