

## Physical Science

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		
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	Section B Physical and Chemical Changes
C.1.PS.3	Discuss and model the relative size and placement of sub-atomic particles	Elements, Compounds and Mixtures	Section A The Nuclear Atom
C.1.PS.4	Illustrate the placement of electrons in the first twenty elements using energy levels and orbitals	Elements, Compounds and Mixtures	Section B Patterns on the Periodic Table
C.1.PS.5	Distinguish among atoms, ions, and isotopes	Elements, Compounds and Mixtures	Section B Ions and Isotopes
C.1.PS.6	Model the valence electrons using electron dot structures (Lewis electron dot structures)		
C.1.PS.7	Explain the role of valence electrons in determining chemical properties	Elements, Compounds and Mixtures	Section B Patterns on the Periodic Table Section C 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	Section B Patterns on the Periodic Table Section C Tutorial: It's All About the Electrons

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C.1.PS.9	Model bonding:		
C.1.PS.9.a	ionic	Elements, Compounds and Mixtures	Section C Ionic Bonds
C.1.PS.9.b	covalent	Elements, Compounds and Mixtures	Section C Covalent Bonds
C.1.PS.9.c	metallic		
C.1.PS.10	Identify commonly used polyatomic ions	Elements, Compounds and Mixtures	Section C Ionic Bonds
C.1.PS.11	Write formulas for ionic and covalent compounds	Elements, Compounds and Mixtures	Section C Ionic Bonds Covalent Bonds
C.1.PS.12	Name ionic and covalent compounds	Elements, Compounds and Mixtures	Section C Ionic Bonds Covalent Bonds

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C.1.PS.13	Identify the mole and amu (atomic mass unit) as units of measurement in chemistry		
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	Section B 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		

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C.2.PS.2.d	triple point		
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		
C.2.PS.4	Compare and contrast Boyle's law and Charles' law	Matter, Energy and Change	Section B Robert Boyle and Boyle's Law Jacques Charles and Charles' Law
C.2.PS.5	Compare and contrast endothermic and exothermic reactions as energy is transferred	Chemical Reactions	Section A Lab and Discussion: Endothermic and Exothermic Reactions
C.2.PS.6	Distinguish between nuclear fission and nuclear fusion	Chemical Reactions	Section C Nuclear Reactions: Fusion Nuclear Reactions: Fission
C.2.PS.7	Compare and contrast the emissions produced by radioactive decay:		

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C.2.PS.7.a	alpha particles	Chemical Reactions	Section C Nuclear Reactions: Radioactive Decay
C.2.PS.7.b	beta particles	Chemical Reactions	Section C Nuclear Reactions: Radioactive Decay
C.2.PS.7.c	gamma rays	Chemical Reactions	Section C Nuclear Reactions: Radioactive Decay
C.3	Students shall compare and contrast chemical reactions.		
C.3.PS.1	Identify and write balanced chemical equations:		
C.3.PS.1.a	decomposition reaction	Chemical Reactions	Section A Tutorial: Types of Reactions
C.3.PS.1.b	synthesis reaction	Chemical Reactions	Section A Tutorial: Types of Reactions
C.3.PS.1.c	single displacement reaction	Chemical Reactions	Section A Tutorial: Types of Reactions

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C.3.PS.1.d	double displacement reaction	Chemical Reactions	Section A Tutorial: Types of Reactions
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	Section A Tutorial: Types of Reactions
C.3.PS.3	Balance chemical equations using the Law of Conservation of Mass	Chemical Reactions	Section B Conservation of Matter
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	Matter, Energy and Change	Section B Physical and Chemical Changes
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		

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C.3.PS.8	Identify the observable evidence of a chemical reaction:		
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.		
C.4.PS.1	Summarize carbon bonding:		

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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	Elements, Compounds and Mixtures	Section C Organic Compounds
C.4.PS.2.b	structure	Elements, Compounds and Mixtures	Section C Organic Compounds
C.4.PS.2.c	properties		
C.4.PS.2.d	functional groups		

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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		
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.		

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P.5.PS.1	Distinguish among thermal energy, heat, and temperature	Matter, Energy and Change	Section C A Closer Look at Heat Energy
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, $\Delta T$ = 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	Section B Force Vectors Balanced and Unbalanced Forces
P.6.PS.1.b	two-dimensional (projectile and rotational)		

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P.6.PS.2	Explain how motion is relative to a reference point	Energy in Motion	Section A Tutorial: Motion
P.6.PS.3	Compare and contrast among speed, velocity and acceleration	Energy in Motion	Section A Speed Velocity Acceleration
P.6.PS.4	Solve problems using the formulas for speed and acceleration:		
P.6.PS.4.a	$v = d/t$	Energy in Motion	Section A Speed
P.6.PS.4.b	$a = \Delta v / \Delta t$		
P.6.PS.4.c	Where a = acceleration, v = speed (velocity), $\Delta t$ = change in time, $\Delta v$ = 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	Section A Using Graphs to Represent Speed

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P.6.PS.5.b	velocity versus time (v-t)	Energy in Motion	Section A Graphing Velocity and Acceleration
P.6.PS.5.c	acceleration versus time (a-t)	Energy in Motion	Section A Graphing Velocity and Acceleration
P.6.PS.6	Compare and contrast Newton's three laws of motion	Energy in Motion	Section C Newton's First Law of Motion Newton's Second Law of Motion Newton's Third Law of Motion
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:		
P.6.PS.10.a	$F=ma$	Energy in Motion	Section C Newton's Second Law of Motion

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P.6.PS.10.b	Where $f$ =force, $m$ =mass, $a$ =acceleration	Energy in Motion	Section C Newton's Second Law of Motion
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	Section C Other Properties of Fluids
P.6.PS.12.b	Pascal's principle	Energy in Motion	Section C Pascal's Principle
P.6.PS.12.c	Bernoulli's principle	Energy in Motion	Section C Bernoulli's Principle
P.6.PS.13	Design an experiment to show conversion of energy:		
P.6.PS.13.a	mechanical (potential and kinetic)		

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P.6.PS.13.b	chemical		
P.6.PS.13.c	thermal		
P.6.PS.13.d	sound		
P.6.PS.13.e	light		
P.6.PS.13.f	nuclear		
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	$PE = mgh$		

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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		
P.7.PS.2	Explain diffraction of waves	Waves	Section D Diffraction of Light
P.7.PS.3	Explain Doppler effect using examples	Waves	Section B The Doppler Effect
P.7.PS.4	Calculate problems relating to wave properties:		
P.7.PS.4.a	$\gamma = vt$		
P.7.PS.4.b	$f = 1/T$	Waves	Section A Frequency and Period

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P.7.PS.4.c	$v = f \gamma$		
P.7.PS.4.d	Where $\gamma$ = wavelength, $f$ = frequency, $T$ = period, $v$ = velocity		
P.7.PS.5	Describe how the physical properties of sound waves affect its perception	Waves	Section C The Origin of Sound
P.7.PS.6	Define light in terms of waves and particles	Waves	Section D The Wave Properties of Light
P.7.PS.7	Explain the formation of color by light and by pigments		
P.7.PS.8	Investigate the separation of white light into colors by diffraction		
P.7.PS.9	Illustrate constructive and destructive interference of light waves	Waves	Section B Wave Interference
P.7.PS.10	Differentiate among the reflected images produced by concave, convex, and plane mirrors		

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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	Section B Ohm's Law
P.8.PS.1.a.1	$V = IR$	Electricity and Magnetism	Section B Ohm's Law
P.8.PS.1.a.2	$I = V/R$	Electricity and Magnetism	Section B Ohm's Law
P.8.PS.1.a.3	$R = V/I$	Electricity and Magnetism	Section B Ohm's Law

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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	$I \text{ (source)} = I_1 = I_2 = I_3$		
P.8.PS.1.b.3	$R \text{ (total)} = R_1 + R_2 + R_3$		
P.8.PS.1.c	Parallel		
P.8.PS.1.c.1	$V \text{ (source)} = V_1 = V_2 = V_3$		
P.8.PS.1.c.2	$I \text{ (source)} = I_1 + I_2 + I_3$		
P.8.PS.1.c.3	$R \text{ (total)} = 1/R_1 + 1/R_2 + 1/R_3$		

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P.8.PS.1.d	Where = voltage, VI= current, R= resistance		
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		
P.8.PS.4	Explain the use of electromagnets in step-up and step-down transformers	Electricity and Magnetism	Section D Transformers

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P.8.PS.5	Research current uses of electromagnets	Electricity and Magnetism	Section D Project: The Story of Your Power
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	Section A The Nature of Science
NS.9.PS.2	Compare and contrast hypotheses, theories, and laws	Scientific Nature	Section E Clearing Up Terminology Misconceptions
NS.9.PS.3	Distinguish between a scientific theory and the term "theory" used in general conversation	Scientific Nature	Section E 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	Section D Making Conclusions from Your Data

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NS.9.PS.4.b	hypotheses must be testable	Scientific Nature	Section B Questions and Hypotheses
NS.9.PS.4.c	understandings and/or conclusions may change with additional empirical data	Scientific Nature	Section A The Nature of Science
NS.9.PS.4.d	scientific knowledge must have peer review and verification before acceptance	Scientific Inquiry	Section E Communicating Results
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	Section B Unit Project: Scientific Inquiry, Part 2
NS.10.PS.2	Research and apply appropriate safety precautions (refer to ADE Guidelines) when designing and/or conducting scientific investigations	Scientific Inquiry	Section C Unit Project: Scientific Inquiry, Part 3
NS.10.PS.3	Identify sources of bias that could affect experimental outcome	Scientific Nature	Section D Avoiding Bias
NS.10.PS.4	Gather and analyze data using appropriate summary statistics	Scientific Inquiry	Section C Unit Project: Scientific Inquiry, Part 3

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NS.10.PS.5	Formulate valid conclusions without bias	Scientific Inquiry	Section D Unit Project: Scientific Inquiry, Part 4
NS.10.PS.6	Communicate experimental results using appropriate reports, figures, and tables	Scientific Inquiry	Section E Unit Project: Scientific Inquiry, Part 5
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	Section E 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	Section E Avatar: A Closer Look at Laws and Theories
NS.11.PS.3	Summarize the development of the current atomic theory	Elements, Compounds and Mixtures	Section A Unit Portfolio Project Part 1: The Development of Atomic Theory
NS.11.PS.4	Analyze the development of the periodic table	Elements, Compounds and Mixtures	Section B The Periodic Table
NS.11.PS.5	Research historical events in physical science	Scientific Nature	Section A History of Physics and Chemistry

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NS.11.PS.6	Research current events and topics in physical science		
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	Section A Mathematics: The Language of Science
NS.12.PS.3	Utilize technology to communicate research findings		
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	Section D Science Ethics

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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		
NS.13.PS.5	Describe in detail the methods used by scientists in their research		
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		



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NS.14.PS.1.d	working conditions		
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