



Colorado's Standards

Purpose of this document: These assessment frameworks function as an assessment development document. They guide the development of the Colorado Student Assessment Program (CSAP), and thus reflect only those student skills and knowledge that can be assessed on a large scale, paper pencil assessment. The entire body of knowledge of any content area is beyond the scope of a summative assessment. The CSAP simply provides a once yearly snapshot of student progress relative to the Colorado Model Content Standards.

NOTE: CSAP Assessment Frameworks are not in lieu of a curriculum.

Who created this document?

As a result of activities from the Year of Science in 2006, the standards and benchmarks were reviewed and revised by stakeholders representing the state of Colorado and the science community. This group included science educators, science curriculum experts, scientists, and higher education faculty. At various stages through the development and writing, these documents were made available for public comment. The Colorado Model Content Standards for Science were approved by the State Board of Education in February 2007.

As the key document which guides development of the CSAP, the assessment frameworks were then reviewed and revised with the input of a standing Science Assessment Committee, along with the input of additional qualified stakeholders.

ASSESSMENT FRAMEWORK– *defines what can be assessed on the State’s large-scale, paper and pencil, standardized assessment (CSAP). This document is organized as follows:*

Standard		<i>Indicates the broad knowledge and skills that all students should be acquiring in Colorado schools at grade level. Each standard is assessed every year.</i>	
Topic	Benchmark	<i>Tactical descriptions of the knowledge and skills students should acquire by each grade level assessed by CSAP (5,8,10) or by district assessments at all grade levels.</i>	
	Assessment Objectives	a	<i>Specific knowledge and skills selected to be measured by CSAP for each grade level. Assessment Objectives are assessed on a cyclical basis.</i>

Grade 8 Science Assessment Frameworks

Standard 1		Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:	
Processes of Scientific Investigation	Benchmark 1.1	Ask questions and state hypotheses that lead to different types of scientific investigations (for example: experimentation, collecting specimens, constructing models, researching scientific literature)	
	Assessment Objectives	1.1.a	Plan and design a scientific investigation that includes: <ul style="list-style-type: none"> • developing a testable question • researching scientific literature • stating a hypothesis • identifying the independent and the dependent variables • designing a written procedure for a controlled experiment • using an appropriate observation/measurement technique for data collection • keeping all other conditions constant
		1.1.b	Identify the independent and dependent variables in a previously conducted scientific investigation on a specific topic.
		1.1.c	Identify different methods used to investigate scientific questions (e.g., controlled experiments, collecting specimens, constructing models, researching scientific literature, etc.).
	Benchmark 1.2	Use appropriate tools, technologies and metric measurements to gather and organize data and report results	
	Assessment Objectives	1.2.a	Record and report data from a scientific investigation using the appropriate tool and metric units.
		1.2.b	Describe how different types of technologies are used in scientific investigations (e.g., telescopes, computers, calculators, seismographs, satellites, microscopes, etc.).
1.2.c		Construct and use different types of visual methods (e.g., data tables, bar and line graphs, diagrams, etc.) to summarize and present data.	

Grade 8 Science Assessment Frameworks

Standard 1		Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:	
Processes of Scientific Investigation	Benchmark 1.3	Interpret and evaluate data in order to formulate a logical conclusion	
	Assessment Objectives	1.3.a	Interpret and evaluate data/observations (e.g., data tables, bar and line graphs, diagrams, written descriptions, etc.) to formulate a logical conclusion.
		1.3.b	Use evidence to state if a hypothesis is supported or not supported.
		1.3.c	Make predictions based on experimental data.
	Benchmark 1.4	Demonstrate that scientific ideas are used to explain previous observations and to predict future events (for example: plate tectonics and future earthquake activity)	
	Assessment Objective	1.4.a	Evaluate collected data/observations and explain the patterns seen in past, current, and future scientific phenomena (e.g., plate tectonics, future earthquake activity, etc.).
	Benchmark 1.5	Identify and evaluate alternative explanations and procedures	
	Assessment Objectives	1.5.a	Describe other reasonable explanations, using the same independent and dependent variable, for the resulting data or observations from an investigation.
		1.5.b	Recognize and/or explain that alternative experimental designs can be used to investigate the same testable question.
	Benchmark 1.6	Communicate results of their investigations in appropriate ways (for example: written reports, graphic displays, oral presentations)	
Assessment Objective	1.6.a	Recognize that there are several different ways to communicate the results of investigations (e.g., it is good to keep written reports so that information is preserved over time; oral presentations given to a large group are best when accompanied by a visual presentation; data is best suited for certain types of visual displays - bar graphs, line graphs, tables, etc.), and they are each used at different times.	

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Standard 2		Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry) Students know and can demonstrate understanding that:	
Properties of Substances	Benchmark 2.1	Physical properties of solids, liquids, gases and the plasma state and their changes can be explained using the particulate nature of matter model	
	Assessment Objectives	2.1.a	Describe the particulate model for solid, liquid, gas, and plasma including the arrangement, motion, and energy of the particles (for example, a lit fluorescent light bulb contains plasma which has widely spaced and highly energetic particles).
		2.1.b	Using the kinetic molecular theory, predict how changes in temperature affect the behavior of particles of matter.
	Benchmark 2.2	Mixtures of substances can be separated based on their properties (for example: solubility, boiling points, magnetic properties, densities and specific heat)	
	Assessment Objectives	2.2.a	Explain how to use differences in solubility, boiling points, and magnetic properties to separate mixtures of substances (for example, filtration can be used to separate mixtures by solubility or physical size).
		2.2.b	Apply the concept of density to explain how mixtures of liquids and solids can be separated (for example, relative densities – sinking and floating).
	Benchmark 2.3	Mass is conserved in a chemical or physical change	
	Assessment Objectives	2.3.a	Distinguish between a physical change and a chemical change.
		2.3.b	Apply the law of conservation of mass to physical changes (for example, predict the mass of a substance after a phase change).
		2.3.c	Apply the law of conservation of mass to chemical changes (for example, determine the mass of products given the mass of reactants).
	Benchmark 2.4	Mass and weight can be distinguished	
	Assessment Objectives	2.4.a	Explain that the mass of an object is the amount of matter (measured in grams using a balance) it has and the weight of an object is the force of gravity (measured in Newtons using a spring scale) acting on its mass.
		2.4.b	Predict how changes in the force of gravity affect the mass and weight of an object (for example, the mass of an object on the Moon will stay the same but its weight will be less than if the object were on Earth).

Standard 2		Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry) Students know and can demonstrate understanding that:	
Atomic and Molecular Structure	Benchmark 2.5	All matter is made up of atoms that are comprised of protons, neutrons and electrons and when a substance is made up of only one type of atom, it is an element	
	Assessment Objectives	2.5.a	Identify that all matter is made up of atoms and that atoms are made of protons, neutrons, and electrons, and describe the location and charge of the parts of an atom.
		2.5.b	Identify that a substance made up of only one type of atom is an element, an atom is the smallest unit of an element that still retains the properties of that element, and different elements have different properties.
		2.5.c	Explain that the number of protons in an atom determines what element it is.
	Benchmark 2.6	When two or more elements are combined a compound is formed which is made up of molecules	
	Assessment Objectives	2.6.a	Explain that two or more atoms may chemically combine to form a molecule, and recognize that a molecule can be represented by a chemical formula that shows the ratio of atoms of each element in the molecule (for example, H ₂ and H ₂ O are molecules).
		2.6.b	Describe that two or more elements may chemically combine to form a compound that may have different properties than the elements.
2.6.c		Explain how mixtures are different than compounds.	
2.6.d		Identify that the smallest unit of a compound that still retains the properties of that compound is a molecule.	
Forces and Motion	Benchmark 2.7	Quantities (for example: time, distance, mass, force) that characterize moving objects and their interactions within a system (for example, force, speed, velocity, potential energy, kinetic energy) can be described, measured and calculated	
	Assessment Objectives	2.7.a	Use measurements for objects that are moving in a straight line to relate distance, time, and average speed with words, graphs, and calculations.
		2.7.b	Identify the forces acting on a moving object and explain the effects of changes in the direction and magnitude of forces on the motion of the object.
		2.7.c	Compare the relative amount of potential energy (stored energy) and kinetic energy (energy of motion) of a moving object at different points along its path (for example, a moving roller coaster has the most potential energy at the top of a hill and the most kinetic energy at the bottom of the hill).

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Standard 2		Physical Science: Students know and understand common properties, forms, and changes in matter and energy. <i>(Focus: Physics and Chemistry)</i> Students know and can demonstrate understanding that:	
Forms and Transfer of Energy	Benchmark 2.8	There are different forms of energy and those forms of energy can be transferred and stored (for example: kinetic, potential) but total energy is conserved	
	Assessment Objectives	2.8.a	Recognize that energy is the ability to make objects move, and identify that mechanical, sound, thermal, solar, electromagnetic, chemical, and nuclear are some of the forms of energy.
		2.8.b	Explain that energy can be transferred (moved) from one object to another and transformed (changed) from one form to another.
		2.8.c	Identify the energy transformations that occur in a specific system.
		2.8.d	Apply the law of conservation of energy to describe what happens when energy is transferred and/or transformed.
	Benchmark 2.9	Electric circuits provide a means of transferring electrical energy when heat, light, sound, magnetic effects and chemical changes are produced	
	Assessment Objectives	2.9.a	Describe the flow of electrons through a circuit.
		2.9.b	Identify series circuits and parallel circuits, and compare the two types of circuits.
	Benchmark 2.10	White light is made up of different colors that correspond to different wavelengths	
	Assessment Objectives	2.10.a	Describe that white light is made of different colors of light (ROYGBIV).
2.10.b		Compare the relative wavelengths of different colors of light (for example, red light has a longer wavelength than blue light).	

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Standard 3		Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. <i>(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)</i> Students know and can demonstrate understanding that:	
Structure and Function in Living Systems	Benchmark 3.1	Classification schemes can be used to understand the structure of organisms	
	Assessment Objective	3.1.a	Identify physical characteristics used to classify vertebrates.
		3.1.b	Classify organisms by their physical characteristics (e.g. using a key, accessing prior knowledge).
	Benchmark 3.2	Human body systems have specific functions and interactions (for example: circulatory and respiratory, muscular and skeletal)	
	Assessment Objectives	3.2.a	Identify organs, organ systems and describe their functions.
		3.2.b	Explain the interaction of body systems.
	Benchmark 3.3	There is a differentiation among levels of organization (cells, tissues, and organs) and their roles within the whole organism	
Assessment Objective	3.3.a	Identify levels of organization within an organism.	
Life Cycles of Organisms	Benchmark 3.4	Multicellular organisms have a variety of ways to get food and other matter to their cells (for example: digestion, transport of nutrients by circulatory system)	
	Assessment Objectives	3.4.a	Describe the various processes that food undergoes to be absorbed by an organism's cells.
		3.4.b	Identify and compare ways various organisms transport nutrients and wastes (open and closed circulatory systems, plant vascular systems, etc.).
		3.4.c	Identify and compare ways various organisms exchange carbon dioxide and oxygen (stomata, lungs, skin, gills, etc.) with the environment.
	Benchmark 3.5	Photosynthesis and cellular respiration are basic processes of life (for example, set up a terrarium or aquarium and make changes such as blocking out light)	
Assessment Objectives	3.5.a	Describe the processes of photosynthesis and cellular respiration.	
	3.5.b	Describe the relationship between photosynthesis and cellular respiration within plants and between plants and animals (for example, animals can only do cellular respiration, plants do both).	

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Life Cycles of Organisms	Benchmark 3.6	Different types of cells have basic structures, components and functions (for example: cell membrane, nucleus, cytoplasm, chloroplast, single-celled organisms in pond water, Elodea, onion cell, human cheek cell)	
	Assessment Objectives	3.6.a	Identify cellular organelles and their functions.
		3.6.b	Differentiate between animal and plant cells and single celled organisms.
	Benchmark 3.7	There are noncommunicable conditions and communicable diseases (for example: heart disease and chicken pox)	
	Assessment Objective	3.7.a	Classify conditions as communicable or noncommunicable and recognize the cause of communicable diseases.
Populations and Ecosystems	Benchmark 3.8	There is a flow of energy and matter in an ecosystem (for example: as modeled in a food chain, web, pyramid, decomposition)	
	Assessment Objectives	3.8.a	Examine and analyze the flow of energy and matter in a dynamic ecosystem (e.g. sun to producer to consumer, roles and importance of different organisms).
		3.8.b	Infer the number of organisms or amount of energy available at each level of an energy pyramid.
Reproduction and Heredity	Benchmark 3.9	Asexual and sexual cell reproduction/division can be differentiated	
	Assessment Objectives	3.9.a	Differentiate between mitosis and meiosis.
		3.9.b	Relate the number of chromosomes to the final product of mitosis or meiosis.
	Benchmark 3.10	Chromosomes and genes play a role in heredity (for example, genes control traits, while chromosomes are made up of many genes)	
	Assessment Objectives	3.10.a	Describe the relationship between chromosomes, genes and traits and their role in heredity.
	3.10.b	Infer the traits of the offspring based on the genes of the parents (including dominant, recessive traits and use of punnet square diagrams).	

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Biological Evolution	Benchmark 3.11	Changes in environmental conditions can affect the survival of individual organisms, populations, and entire species	
	Assessment Objectives	3.11.a	Describe several environmental factors that could limit the size of an organism's population.
		3.11.b	Describe the impact of humans on the environment and how that affects the survival of populations and entire species.
		3.11.c	Describe how organisms change in response to environmental factors.
	Benchmark 3.12	Changes or constancy in groups of organisms over geologic time can be revealed through evidence	
	Assessment Objective	3.12.a	Compare and contrast evidence of past life from different epochs to existing organisms.
	Benchmark 3.13	Individual organisms with certain traits are more likely than others to survive and have offspring	
Assessment Objective	3.13.a	Evaluate the potential of an organism with specific traits to survive and reproduce in an environment.	

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Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. <i>(Focus: Geology, Meteorology, Astronomy, Oceanography)</i> Students know and can demonstrate understanding that:		
Earth's Composition, Processes and History	Benchmark 4.1	Inter-relationships exist between minerals, rocks and soils	
	Assessment Objectives	4.1.a	Understand the three types of rocks (igneous, sedimentary, metamorphic) and the processes that formed them through the rock cycle.
		4.1.b	Understand the composition and relationships of rocks, minerals, and soil formation.
	Benchmark 4.2	Humans use renewable and nonrenewable resources (for example: forests and fossil fuels)	
	Assessment Objectives	4.2.a	Understand the differences between renewable and nonrenewable energy resources.
		4.2.b	Predict the advantages and disadvantages of using both types of energy resources (renewable and non-renewable) and their sustainability.
	Benchmark 4.3	Natural processes shape Earth's surface (for example: landslides, weathering, erosion, mountain building, volcanic activity)	
	Assessment Objective	4.3.a	Explain why Earth's surface is always building up in some places and wearing and down in others (types of erosion, types of deposition).
	Benchmark 4.4	Major geological events such as earthquakes, volcanic eruptions, and mountain building are associated with plate boundaries and attributed to plate motion	
	Assessment Objective	4.4.a	Understand plate boundaries, their movements, and the resulting geologic events.
	Benchmark 4.5	Fossils are formed and used as evidence to indicate that life has changed through time	
	Assessment Objective	4.5.a	Describe methods of fossil formation.
	Benchmark 4.6	Successive layers of sedimentary rock and the fossils contained within them can be used to confirm age, geologic time, history, and changing life forms of the Earth; this evidence is affected by the folding, breaking and uplifting of layers	
	Assessment Objectives	4.6.a	Interpret rock layers, including position (concept of superpositioning), composition and fossil content to determine past conditions.
4.6.b		Predict the change in rock layer sequence due to folding, breaking and uplifting.	

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Standard 4		Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. <i>(Focus: Geology, Meteorology, Astronomy, Oceanography)</i> Students know and can demonstrate understanding that:	
Atmosphere and Weather	Benchmark 4.7	The atmosphere has basic composition, properties, and structure (for example: the range and distribution of temperature and pressure in the troposphere and stratosphere)	
	Assessment Objective	4.7.a	Identify all of the layers of the atmosphere, their order and the properties and individual characteristics that define them.
	Benchmark 4.8	Atmospheric circulation is driven by solar heating (for example: the transfer of energy by radiation, convection, conduction)	
	Assessment Objective	4.8.a	Explain that the Sun heats Earth via radiation that in turn heats the atmosphere via conduction and convection.
	Benchmark 4.9	There are quantitative changes in weather conditions over time and space (for example: humidity, temperature, air pressure, cloud cover, wind, precipitation)	
	Assessment Objective	4.9.a	Interpret weather data and the changes that occur over time (graph, charts, weather maps).
	Benchmark 4.10	There are large-scale and local weather systems (for example: fronts, air masses, storms)	
	Assessment Objectives	4.10.a	Use several pieces of evidence (cloud observations, weather maps) to identify causes of changes in weather and weather patterns (weather moves west to east).
	4.10.b	Identify the inter-relationship between large scale weather systems and local weather.	
	4.10.c	Explain how Earth's surface features (such as mountains, oceans) affect local weather.	

Standard 4		Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. <i>(Focus: Geology, Meteorology, Astronomy, Oceanography)</i> Students know and can demonstrate understanding that:	
Earth's Water	Benchmark 4.11	The world's water is distributed and circulated through oceans, glaciers, rivers, groundwater, and atmosphere	
	Assessment Objective	4.11.a	Explain the processes and relationships that connect elements (all water sources) of the water cycle.
Solar System and the Universe	Benchmark 4.12	The ocean has a certain composition and physical characteristics (for example: currents, waves, features of the ocean floor, salinity, and tides)	
	Assessment Objective	4.12.a	Understand the composition and physical characteristics of oceans (for example: temperature, salinity, wavelength, ocean floor, etc).
	Benchmark 4.13	There are characteristics (components, composition, size) and scientific theories of origin of the Solar System	
	Assessment Objectives	4.13.a	Describe the parts (planets, Sun, moons, asteroids, comets) of the Solar System and their motions.
		4.13.b	Compare and contrast the characteristics of the Sun, Moon and Earth.
		4.13.c	Examine and explain the scientific theories on the formation of our Solar System, Earth, and Moon.
	Benchmark 4.14	Relative motion, axes tilt and positions of the Sun, Earth, and Moon have observable effects (for example: seasons, eclipses, moon phases)	
	Assessment Objectives	4.14.a	Understand how the location of the Moon affects the phases of the Moon, eclipses, and the tides.
		4.14.b	Understand how the tilt and motions of Earth results in days, years and seasons.
	Benchmark 4.15	The universe consists of many billions of galaxies (each containing many billions of stars) and that vast distances separate these galaxies and stars from one another and from Earth	
Assessment Objective	4.15.a	Describe the components of the universe in terms of galaxies, stars, and solar systems.	
Benchmark 4.16	Technology is needed to explore space (for example: telescopes, spectrosopes, spacecraft, life support systems)		
Assessment Objective	4.16.a	Understand the technologies needed to explore space and evaluate their effectiveness and challenges.	

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Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:	
Benchmark 5.1	A controlled experiment must have comparable results when repeated	
Assessment Objectives	5.1.a	Identify a controlled factor in a scientific investigation.
	5.1.b	Explain that by repeating a controlled experiment, it should lead to comparable results.
	5.1.c	Identify and/or explain that evidence collected through repeated experiments cannot be accurately compared to previous experimental results, if conditions were not kept the same.
Benchmark 5.2	Scientific knowledge changes as new knowledge is acquired and previous ideas are modified (for example: through space exploration)	
Assessment Objective	5.2.a	Identify and/or describe the reasons why scientific knowledge changes over time.
Benchmark 5.3	Contributions to the advancement of science have been made by people in different cultures and at different times in history	
Assessment Objective	5.3.a	Recognize the concept of multicultural contributions to the advancement of science over time.
Benchmark 5.4	Models can be used to predict change (for example: computer simulation, video sequence, stream table)	
Assessment Objective	5.4.a	Recognize and/or describe that models can be used to obtain information about scientific processes and/or objects that may be difficult to study.
	5.4.b	Describe a model that would be appropriate to understand a scientific process and content.
	5.4.c	Explain that models are used to understand processes and predict change in many situations: <ul style="list-style-type: none"> • where it may take several years to collect the data firsthand (e.g., sea floor spreading, etc.) • where the event has already occurred and evidence has been lost or is limited (e.g., asteroid impact, fossil record, etc.) • when a process is dangerous to study (e.g., volcanoes, earthquakes, tornados, etc.) • when a process is very slow (e.g., erosion, continental drift, rock cycle, climate change, etc.) • when the scale of size is difficult to replicate and makes observations difficult (e.g., atoms, cells, solar system, etc.) • to make an abstract more understandable (e.g., Newton's Laws and amusement park physics, etc.)
Benchmark 5.5	There are interrelationships among science, technology and human activity that affect the world	
Assessment Objective	5.5.a	Explain that human activity, including current scientific studies and technological advancements, can have both positive and negative effects on the natural world.

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