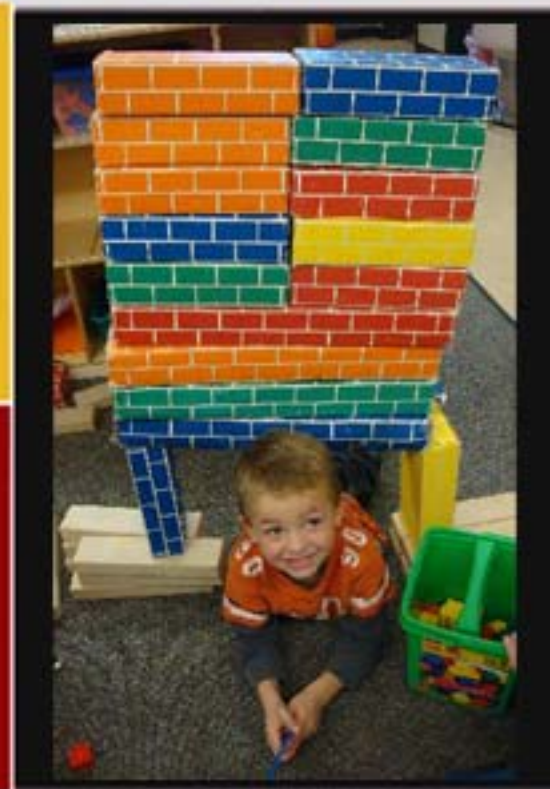


Preschool Science Academic Standards

In High Quality Early Childhood Care and Education Settings



Preschool Science Academic Standards in High Quality Early Childhood Care and Education Settings

How to use this document

Colorado Preschool Program staff developed this document to help link the new Colorado preschool academic standards with the early childhood best practices that are already present in high quality early childhood care and education settings. While this document is intended for early childhood teachers in classroom settings that will be adopting the standards, we wanted to give some examples of how the standards might look in family childcare homes and in other early care configurations.

The preschool academic standards form the “what” of early childhood teaching – the objectives and goals for children to experience in their formative preschool years. To make a connection between early childhood best practices and the new academic standards expectations, we relied on the Building Blocks to the Colorado Content Standards, the Colorado Quality Standards for Early Childhood Care and Education, and Results Matter assessment tools for examples and descriptions. These sources provide the “steps for getting there” or the “how” of early childhood teaching. Young children require a much different environment than their elementary school counterparts. For each standard and its evidence objectives, we describe what should be in place to ensure children have opportunities to master the objectives and goals of the standards in enriching, developmentally appropriate ways. We also provide examples of children and adults in various settings showing the standards in action so that connections can be made from the small and large moments of early childhood experiences that build towards more formal learning.

As you go through each standard domain, you will see the standard table as it appears in CDE documentation with the 21st Century Skills and Readiness competencies. On the next page, you will see the evidence outcomes, the steps for getting there, and the examples from early childhood settings. Each pair of tables is color-coded to help match the pages. These sections are not meant to be inclusive; they are guidance to begin thinking about the preschool academic standards and how they link to early childhood best practices.

Resources:

Preschool Standards & Assessments Crosswalk to Results Matter Systems, Building Blocks, and Head Start Early Learning Framework
<http://www.cde.state.co.us/scripts/ECCCrosswalks/crosswalk.asp>

The Colorado Quality Standards for Early Childhood Care and Education Services
<http://www.cde.state.co.us/cpp/qualitystandards.htm>

Building Blocks to the Colorado K-12 Content Standards (2007)
<http://www.cde.state.co.us/cpp/download/PPDocs/BuildingBlocksNov2010.pdf>

Preschool Science Academic Standards in High Quality Early Childhood Care and Education Settings

Children are captivated by the natural world and by physical events. They insist that teachers and family members answer their questions about the world around them. By cultivating this sense of wonder, we help children to become scientific thinkers.

Children can learn to use the scientific method in their everyday life. The questions that children ask about insects flying, making a shadow or mixing paints are transformed into hypotheses about their world. They use their senses and scientific tools to observe, collect and interpret data and draw conclusions. Communicating their findings informally in conversations, or through the documentation of results, lead children to ask new questions and to continue the cycle of scientific investigation.



Preschool Science Expectations at a Glance	
1. Physical Science	<ol style="list-style-type: none">1. Objects have properties and characteristics2. There are cause-and-effect relationships in everyday experiences
2. Life Science	<ol style="list-style-type: none">1. Living things have characteristics and basic needs2. Living things develop in predictable patterns
3. Earth Systems Science	<ol style="list-style-type: none">1. Earth's materials have properties and characteristics that affect how we use those materials2. Events such as night, day, the movement of objects in the sky, weather, and seasons have patterns

Preschool Science Academic Standards in High Quality Early Childhood Care and Education Settings

Content Area: Science	
Standard: 1. Physical Science	
Prepared Graduates: <ul style="list-style-type: none">➤ Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions	
Grade Level Expectation: Preschool	
Concepts and skills students master: <ul style="list-style-type: none">1. Objects have properties and characteristics	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ul style="list-style-type: none">a. Use senses to gather information about objectsb. Make simple observations, predictions, explanations, and generalizations based on real-life experiencesc. Collect, describe, and record information through discussion, drawings, and charts	Inquiry Questions: <ul style="list-style-type: none">1. How are various objects similar and different?
	Relevance and Application: <ul style="list-style-type: none">1. Use scientific tools such as magnets, magnifying glasses, scales, and rulers in investigations and play.
	Nature of Science: <ul style="list-style-type: none">1. Be open to and curious about new tasks and challenges.2. Explore and experiment.3. Show capacity for invention and imagination.4. Ask questions based on discoveries made while playing.

How does this standard look in high quality early childhood settings?

<p>Content Area: Science Standard: 1. Physical Science Prepared Graduates: Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions Grade Level Expectation: Preschool Concepts and skills students master: 1. Objects have properties and characteristics</p>		
Evidence Outcomes	Steps for Getting There	Examples from Early Childhood Settings
<p>Students can:</p> <ol style="list-style-type: none"> Use senses to gather information about objects Make simple observations, predictions, explanations, and generalizations based on real-life experiences Collect, describe, and record information through discussion, drawings, and charts 	<ul style="list-style-type: none"> Science concepts are integrated into children's daily experiences (both planned and spontaneous) and into the ongoing activities of the classroom. Adults provide children with opportunities to explore, manipulate, investigate and discover with various kinds of child-safe natural and manmade materials. Adults encourage children to take risks and engage in trial and error learning. Adults respond to children's questions in a way that extends the children's ideas. Adults provide time for conversation and ask children questions that require more than a one-word answer. Adults initially present concepts to children via concrete, hands-on materials, and provide concrete materials on an ongoing basis to reinforce concepts. Adults use multi-sensory activities to present information to children. Adults ask children questions that require more than a one-word answer (open-ended questions). 	<ul style="list-style-type: none"> Hakim looks out the window and says, "It's raining. We can't play outside." While playing with assorted buttons, Maggie says, "I like the shiny ones." Ms. Juanita says, "Let's find all the shiny ones. How do they feel when you touch them?" She runs her finger over the button's surface, as does Maggie. "It's smooth and soft," she says. At the sand table, Jimmy digs with the scoop. "There's something under here! It's hard." His friend Mac says, "It's a treasure chest!" After scooping the seeds out of a pumpkin, Ms. Henry sets the pumpkin outside to observe. Each day, she takes small groups outside to observe the pumpkin's decay. The children draw pictures of what they see and predict what will happen next. Meghan picks up a piece of bark that fell from a tree and says, "At my house, we have this too. It stays on the tree." Mr. Joe says, "That's called bark. It protects the tree like skin." Meghan asks if she can keep the bark to look at with a magnifying glass.

Preschool Science Academic Standards in High Quality Early Childhood Care and Education Settings

Content Area: Science	
Standard: 1. Physical Science	
Prepared Graduates: <ul style="list-style-type: none">➤ Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions	
Grade Level Expectation: Preschool Concepts and skills students master: <ul style="list-style-type: none">2. There are cause-and-effect relationships in everyday experiences	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ul style="list-style-type: none">a. Recognize and investigate cause-and-effect relationships in everyday experiences – pushing, pulling, kicking, rolling, or blowing objects	Inquiry Questions: <ul style="list-style-type: none">1. How do various objects react differently to the same cause?
	Relevance and Application: <ul style="list-style-type: none">1. Use scientific tools such as magnets, magnifying glasses, scales, and rulers in investigations and play.
	Nature of Science: <ul style="list-style-type: none">1. Be open to and curious about new tasks and challenges.2. Explore and experiment.3. Reflect on and interpret cause-and-effect relationships.

How does this standard look in high quality early childhood settings?

<p>Content Area: Science Standard: 1. Physical Science Prepared Graduates: Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions Grade Level Expectation: Preschool Concepts and skills students master: 2. There are cause-and-effect relationships in everyday experiences.</p>		
Evidence Outcomes	Steps for Getting There	Examples from Early Childhood Settings
<p>Students can:</p> <p>a. Recognize and investigate cause-and-effect relationships in everyday experiences – pushing, pulling, kicking, rolling, or blowing objects</p>	<ul style="list-style-type: none"> Physical science concepts are integrated into children's daily experiences (both planned and spontaneous) and into the ongoing activities of the classroom. Materials such as ramps, wheeled toys, balls, straws, pull toys, etc. are available for children to use in child-directed, as well as teacher-directed, activities. Adults provide children with opportunities to explore, manipulate, investigate and discover. Adults initially present concepts to children via concrete, hands-on materials, and provide concrete materials on an ongoing basis to reinforce concepts. Adults use multi-sensory activities to present information to children. Adults provide time for conversation asking children questions require more than a one-word answer (open-ended questions). 	<ul style="list-style-type: none"> In blocks, a group of children use planks as ramps to send toy cars down. Miss Amy joins them with paper and markers to help document which cars go faster down the ramps. Carlos, who uses a wheelchair, observes that he goes faster on the ramp leading to the parking lot than on the flat sidewalk. At a park, a child rolls a ball down the slide. Other children join at the bottom of the slide to roll the ball back up the slide in different ways, and experiment with making the ball go faster and slower. A small group activity featuring blowing through straws begins with the teacher asking the children to estimate how far across the table they think they can blow a feather in one puff. The children guess and then blow through the straws to see if their guesses are correct.

Preschool Science Academic Standards in High Quality Early Childhood Care and Education Settings

Content Area: Science	
Standard: 2. Life Science	
Prepared Graduates:	
<ul style="list-style-type: none"> ➤ Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection ➤ Explain and illustrate with examples how living systems interact with the biotic and abiotic environment 	
Grade Level Expectation: Preschool	
Concepts and skills students master:	
1. Living things have characteristics and basic needs	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ul style="list-style-type: none"> a. Use senses to gather information about living things b. Observe and explore the natural processes of growing, changing, and adapting to the environment c. Ask and pursue questions through simple investigations and observations of living things d. Collect, describe, and record information about living things through discussion, drawings, and charts 	Inquiry Questions: <ul style="list-style-type: none"> 1. What do living things need to survive?
	Relevance and Application: <ul style="list-style-type: none"> 1. Mittens and hats keep people warm when the weather is cold. 2. Gills on a fish allow them to "breathe" under water.
	Nature of Science: <ul style="list-style-type: none"> 1. Be open to and curious about new tasks and challenges. 2. Explore and experiment.

How does this standard look in high quality early childhood settings?

<p>Content Area: Science Standard: 2. Life Science Prepared Graduates:</p> <ul style="list-style-type: none"> Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection Explain and illustrate with examples how living systems interact with the biotic and abiotic environment <p>Grade Level Expectation: Preschool Concepts and skills students master: 1. Living things have characteristics and basic needs.</p>		
Evidence Outcomes	Steps for Getting There	Examples from Early Childhood Settings
<p>Students can:</p> <ol style="list-style-type: none"> Use senses to gather information about living things Observe and explore the natural processes of growing, changing, and adapting to the environment Ask and pursue questions through simple investigations and observations of living things Collect, describe, and record information about living things through discussion, drawings, and charts 	<ul style="list-style-type: none"> Life science concepts are integrated into children's daily experiences (both planned and spontaneous) and into the ongoing activities of the classroom. Adults provide children with opportunities to explore, manipulate, investigate and discover. The classroom environment includes both plants and animals. Materials such as magnifying glasses, found natural items like pinecones and snakeskin, seeds and planters, etc., are available for children to use in child-directed, as well as teacher-directed, activities. Adults initially present concepts to children via concrete, hands-on materials, and provide concrete materials on an ongoing basis to reinforce concepts. Adults use multi-sensory activities to present information to children. Adults provide time for conversation asking children open-ended questions. 	<ul style="list-style-type: none"> Children share pictures of their pets. Each child takes a turn showing their pictures, describing their pets, and answering questions about them. In the spring, the children use a playground, a park, or a field for an Insect Hunt. They point out insects when they find them and identify or draw them to identify in books later. One child asks "How do the grasshoppers know when to jump out of the way?" That inquiry leads the adult to collect books on grasshoppers to read and discuss with the children. A special guest, a reptile specialist, brings in a python to show the children. She talks about snakes, and then lets volunteers touch the python. Later on, the teachers read stories about snakes and leave the books in the class library. Plastic snakes are added to blocks. Snakeskin is available to examine with magnifying glasses. More activities are added as children discover areas of interest to explore.

Preschool Science Academic Standards in High Quality Early Childhood Care and Education Settings

Content Area: Science	
Standard: 2. Life Science	
Prepared Graduates:	
<ul style="list-style-type: none"> ➤ Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection ➤ Explain and illustrate with examples how living systems interact with the biotic and abiotic environment 	
Grade Level Expectation: Preschool	
Concepts and skills students master:	
2. Living things develop in predictable patterns	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ol style="list-style-type: none"> a. Identify the common needs such as food, air, and water of familiar living things b. Predict, explain, and infer patterns based on observations and representations of living things, their needs, and life cycles c. Make and record by drawing, acting out, or describing observations of living things and how they change over time 	Inquiry Questions: <ol style="list-style-type: none"> 1. How do different living things change over time? 2. What are some similarities and differences in how living things develop? 3. How do the adults of various animals compare to younger versions of those same animals?
	Relevance and Application: <ol style="list-style-type: none"> 1. Butterflies have a predictable growth cycle. 2. Leaves on a tree change color and fall every year.
	Nature of Science: <ol style="list-style-type: none"> 1. Show a capacity for invention and imagination when looking for patterns of development.

How does this standard look in high quality early childhood settings?

<p>Content Area: Science Standard: 2. Life Science Prepared Graduates:</p> <ul style="list-style-type: none"> Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection Explain and illustrate with examples how living systems interact with the biotic and abiotic environment <p>Grade Level Expectation: Preschool Concepts and skills students master: 2. Living things develop in predictable patterns.</p>		
Evidence Outcomes	Steps for Getting There	Examples from Early Childhood Settings
<p>Students can:</p> <ol style="list-style-type: none"> Identify the common needs such as food, air, and water of familiar living things Predict, explain, and infer patterns based on observations and representations of living things, their needs, and life cycles Make and record by drawing, acting out, or describing observations of living things and how they change over time 	<ul style="list-style-type: none"> Life science concepts are integrated into children's daily experiences (both planned and spontaneous) and into the ongoing activities of the classroom. Adults provide children with opportunities to explore, manipulate, investigate and discover. Adults initially present concepts to children via concrete, hands-on materials, and provide concrete materials on an ongoing basis to reinforce concepts. Adults use multi-sensory activities to present information to children. Adults provide time for conversation and ask children open-ended questions. Materials such as seeds and planters, dramatic play items, and writing tools are available for children to use in child-directed, as well as teacher-directed, activities. 	<ul style="list-style-type: none"> In dramatic play, there are bottles and "baby food" to feed dolls. Children playing there make sure their babies are fed and taken care of. Mac says, "Eddie's crying. He must be hungry. I'm hungry, too." Children bring in pictures of themselves as babies to share. Adults display the pictures alongside current pictures of the children to allow for comparisons. Butterfly kits show the growth from caterpillars to butterflies. Children watch the caterpillars eat, observe the chrysalises and finally see the butterflies emerge. Each day brings questions, new observations, and excitement about the process. After reading <i>Jack and the Bean Stalk</i>, the children plant beans. They measure and record the growth of their plants in a classroom journal.

Preschool Science Academic Standards in High Quality Early Childhood Care and Education Settings

Content Area: Science	
Standard: 3. Earth Systems Science	
Prepared Graduates:	
➤ Describe how humans are dependent on the diversity of resources provided by Earth and Sun	
Grade Level Expectation: Preschool	
Concepts and skills students master:	
1. Earth's materials have properties and characteristics that affect how we use those materials	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ol style="list-style-type: none"> Use senses to gather information about Earth's materials Make simple observations, explanations, and generalizations about Earth's materials based on real-life experiences Describe how various materials might be used based on characteristics or properties 	Inquiry Questions: <ol style="list-style-type: none"> What are the similarities and differences among various earth materials? How do scientists study and describe Earth's materials?
	Relevance and Application: <ol style="list-style-type: none"> Use scientific tools in investigations, and play with materials such as rocks, soil, sand, and water.
	Nature of Science: <ol style="list-style-type: none"> Ask testable question based on discoveries made while playing. Collect, describe, and record information through discussions, drawings, and charts.

How does this standard look in high quality early childhood settings?

<p>Content Area: Science Standard: 3. Earth Systems Science Prepared Graduates: Describe how humans are dependent on the diversity of resources provided by Earth and Sun Grade Level Expectation: Preschool Concepts and skills students master: 1. Earth’s materials have properties and characteristics that affect how we use those materials</p>		
Evidence Outcomes	Steps for Getting There	Examples from Early Childhood Settings
<p>Students can:</p> <ol style="list-style-type: none"> Use senses to gather information about Earth’s materials Make simple observations, explanations, and generalizations about Earth’s materials based on real-life experiences Describe how various materials might be used based on characteristics or properties 	<ul style="list-style-type: none"> Earth science concepts are integrated into children's daily experiences (both planned and spontaneous) and into the ongoing activities of the classroom. Adults provide children with a wide variety of earth science materials including sand, dirt, water, mud, rocks, and scientific tools (scales, magnifiers, magnets) to explore, manipulate, investigate and discover. Adults initially present concepts to children via concrete, hands-on materials, and provide concrete materials on an ongoing basis to reinforce concepts. Adults use multi-sensory activities to present information to children. Adults provide time for conversation and ask children open-ended questions. 	<ul style="list-style-type: none"> Children are encouraged to add water to the sand in the sand box to change the texture and quality of the sand in play. When Shawnique adds a cup of water, she stirs it with a stick and says, “Now we have mud cake!” Different kinds of rocks – all shapes and sizes – are available to examine with magnifying glasses or sort into different categories. During water play at the sensory table, Devon uses eggbeaters to churn the water. Marie puts a toy boat near the “waves” and watches it rock. She says, “This is like the lake.” At the park, children discover a big puddle at the bottom of the slide preventing them from sliding down easily. One child says, “If we put the gravel in the puddle, the dirt will fill it up.” He leads a group of children in pushing and scooping gravel and dirt from around the puddle into it. Carter asks “Where is the water in the aquarium going?” The teacher assists him in marking the water level with a piece of tape. She asks him “What do you think might be happening to the water?”

Preschool Science Academic Standards in High Quality Early Childhood Care and Education Settings

Content Area: Science	
Standard: 3. Earth Systems Science	
Prepared Graduates:	
<ul style="list-style-type: none"> ➤ Describe and interpret how Earth's geologic history and place in space are relevant to our understanding of the processes that have shaped our planet 	
Grade Level Expectation: Preschool	
Concepts and skills students master:	
<ul style="list-style-type: none"> 2. Events such as night, day, the movement of objects in the sky, weather, and seasons have patterns 	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ul style="list-style-type: none"> a. Identify, predict, and extend patterns based on observations and representations of objects in the sky, daily weather, and seasonal changes b. Observe and describe patterns observed over the course of a number of days and nights, possibly including differences in the activities or appearance of plants and animals 	Inquiry Questions: <ul style="list-style-type: none"> 1. What natural patterns do you notice during the day? 2. What natural patterns do you notice at night? 3. What patterns do you notice in the seasons? 4. What patterns do you notice in weather?
	Relevance and Application: <ul style="list-style-type: none"> 1. Different activities of various animals – including humans – are aligned with daily and seasonal patterns.
	Nature of Science: <ul style="list-style-type: none"> 1. Be open to and curious about new tasks and challenges. 2. Explore and experiment.

How does this standard look in a high quality early childhood settings?

<p>Content Area: Science Standard: 3. Earth Systems Science Prepared Graduates: Describe and interpret how Earth's geologic history and place in space are relevant to our understanding of the processes that have shaped our planet Grade Level Expectation: Preschool Concepts and skills students master: 2. Events such as night, day, the movement of objects in the sky, weather, and seasons have patterns</p>		
Evidence Outcomes	Steps for Getting There	Examples from Early Childhood Settings
<p>Students can:</p> <ol style="list-style-type: none"> a. Identify, predict, and extend patterns based on observations and representations of objects in the sky, daily weather, and seasonal changes b. Observe and describe patterns observed over the course of a number of days and nights, possibly including differences in the activities or appearance of plants and animals 	<ul style="list-style-type: none"> • Earth science concepts are integrated into children's daily experiences (both planned and spontaneous) and into the ongoing activities of the classroom. • Adults initially present concepts to children via concrete, hands-on materials, and provide concrete materials on an ongoing basis to reinforce concepts. • Adults use multi-sensory activities to present information to children. • Adults provide time for conversation and ask children open-ended questions. • Books about day and night, seasonal changes, and objects in the sky are available and read to children. 	<ul style="list-style-type: none"> • The weather person, a classroom job chosen by different children every day, observes and reports on the weather everyday by looking outside and then affixing a symbol (sun, snowflake, raindrops, etc) to a graph. • Mr. John leads children in sorting pictures of items you see in the daytime (the sun, blue sky, flowers, butterflies, etc), and pictures of items you see at night (the moon, stars, streetlamps, moths, etc). • After reading a book about the day and night, Miss Myra turns off the lights and asks a child to be the earth and another child to be the sun. "The sun" holds a flashlight, shining it on "the earth". The other children watch as one side of "the earth" stays lit and the other side stays in the shadows. • In the fall, children in Miss Lee's family childcare home take a nature walk, observing the changes in leaves, seed pods, and flowers. In the spring, they take a nature walk in the same area and look for leaf buds, new growth, and other signs of the change in seasons.

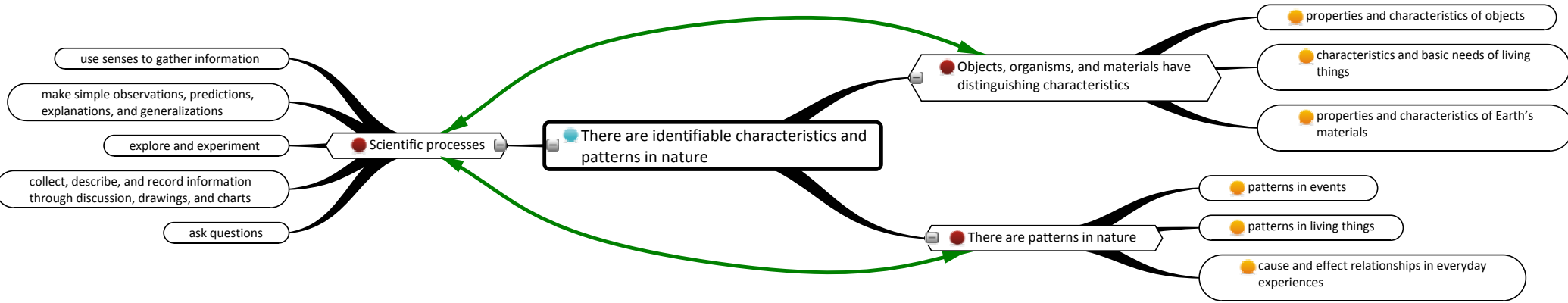
Using the Discipline Concept Maps

Discipline Concept Maps (DCM) provide a visual representation of unifying themes and organizing and supporting concepts at each grade level. The DCMs provide a central purpose for that discipline at that grade level and depict how concepts relate to each other for intentional planning. They provide a framework for entering the standards in a way that honors the emphasis on 21st Century learning and interdisciplinary connections across the content areas.

Three key terms are used in the discipline concept maps:

- **Unifying themes** provide an overview of content at a grade level. They are found in the center of the DCM and denoted by a blue dot.
- **Organizing concepts** connect multiple grade level expectations (GLEs) and evidence outcomes (EOs). They are the first node out from the center and are denoted by a red dot.
- **Supporting concepts** elaborate on and show the depth of an organizing concept. They are second node out from the center and are denoted by a yellow dot.

Science Pre-K



- KEY:**
- Unifying Theme
 - Organizing Concept
 - Supporting Concept
 - Explicit Connection
 - ***** Supporting Connection

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