High School Physics Curriculum Essentials Document

Boulder Valley School District
Department of Curriculum and Instruction
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Boulder Valley School District
Board of Education

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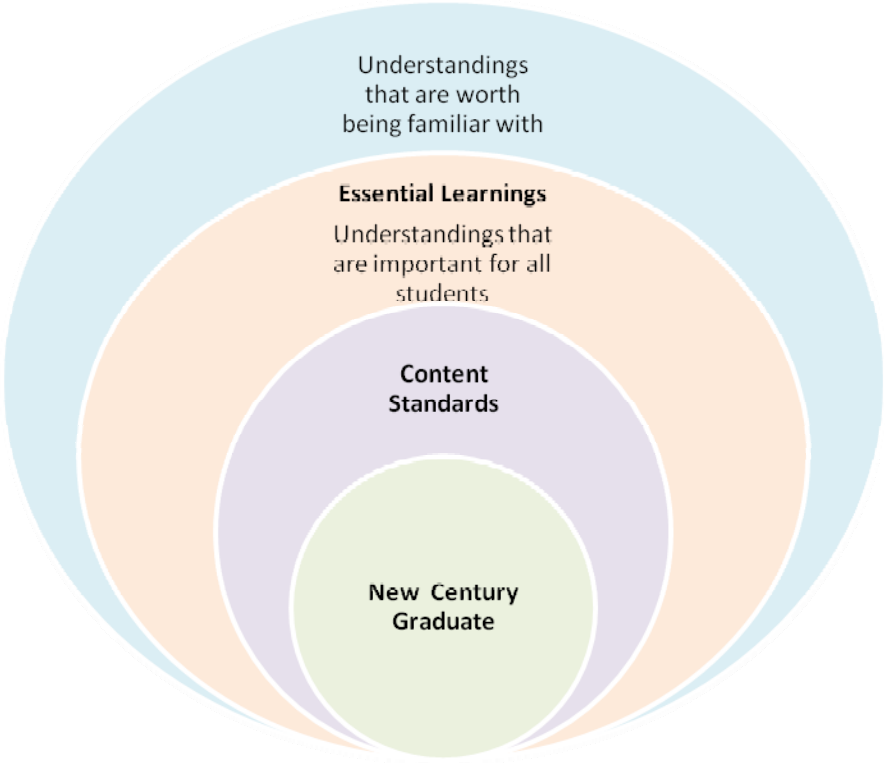
High School Physics Curriculum Essentials

General Introduction

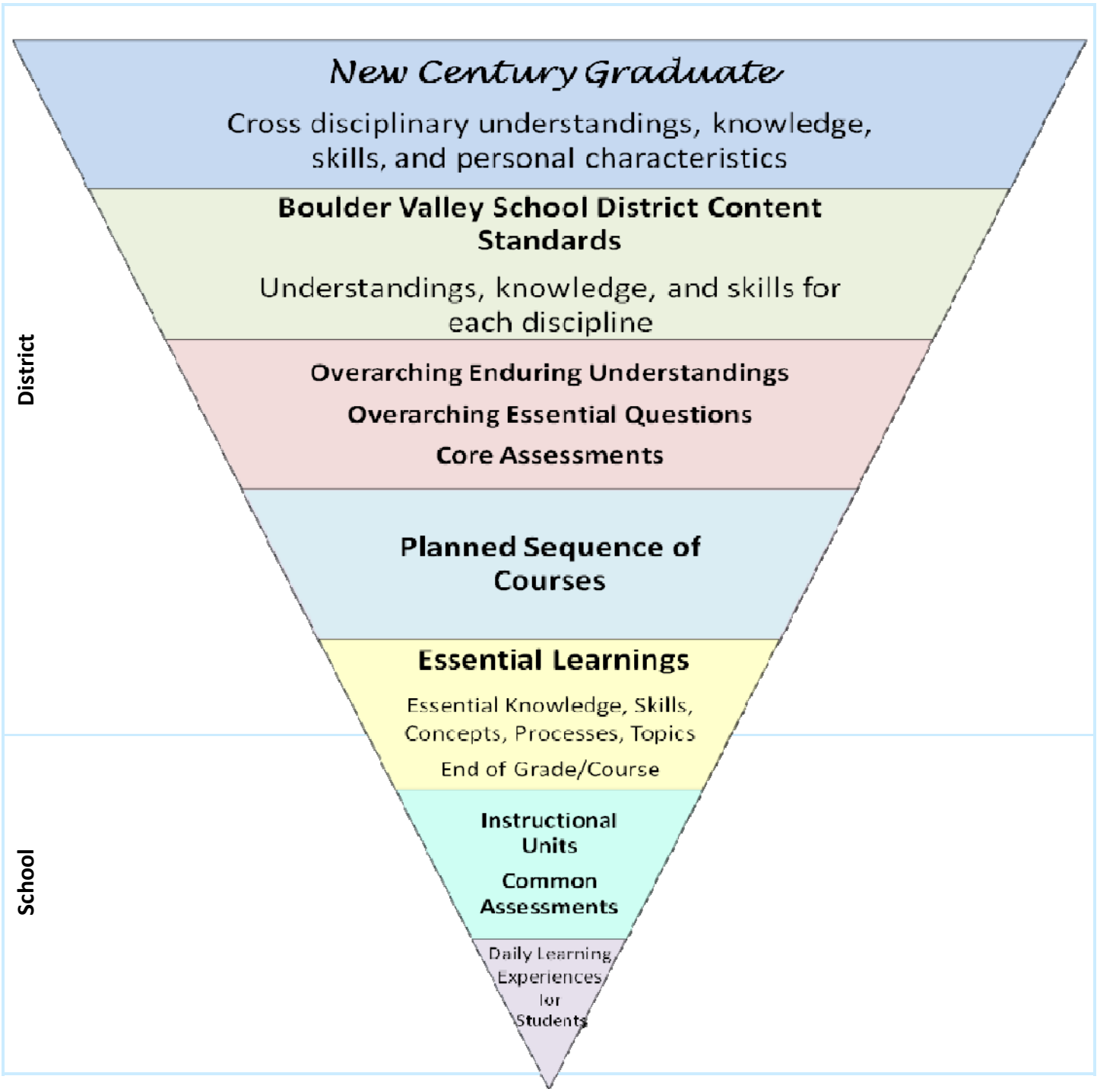
What is a Curriculum Essentials Document? How Does it Relate to a Guaranteed and Viable Curriculum?



Because we are faced with more content than we can reasonably address, we are obligated to make choices and frame priorities. A useful framework for establishing priorities is graphically depicted using 4 nested ovals. The innermost oval, *New Century Graduate*, represents the goals of schooling that have been identified by the Boulder Valley School District community. Moving to the next oval, *Content Standards*, levels of performance for each program of study are clearly articulated. The third oval, *Essential Learnings*, represents the **viable curriculum**. A curriculum is viable when the number of learnings can be accomplished in the time provided (usually a semester, trimester, or year). Thus, an Essentials Document identifies the priorities for learning that are necessary for successful learning at a particular grade level or course and beyond. It also identifies the essential knowledge, skills, concepts, topics, and processes that support the attainment of the essential learning. Finally, the largest oval represents the field of all possible content that might be examined during a grade level or course. This includes extended learning opportunities for students who have achieved the essential learnings or attending to background knowledge and skills that students may need to review or learn to ensure achievement of grade level or course essential learnings.

Curriculum Framework: Macro and Micro Levels

The New Century Graduate identifies the knowledge, skills and personal characteristics that our community has identified as the goals of schooling. Programs of study and curricular content are identified and addressed as a means



Adapted from Grant Wiggins and Jay McTighe (2007). *Schooling by Design.* Alexandria, VA: Association for Supervision and Curriculum

New Century Graduate
Knowledge and Skills

Life Competencies

Leads a balanced life: exhibits physical fitness, knows good nutrition rules, stays safe and drug free, knows how to have fun and relax, manages anger and stress, exhibits self-sufficiency and self confidence, and finishes tasks.

Understands money management, budgeting, balancing a checkbook, debt management, and record keeping.

Demonstrates time management skills and a broad base of knowledge in practical skills such as cooking, sewing, driving, and map reading.

Knows how to search for a job and knows where to go to find answers.

Communication: Speaking and Writing

Writes and speaks thoughtfully and articulately to inform, to express one's thinking and creativity, and to communicate to diverse audiences.

Uses correct grammar, spelling, and mechanics; organizes for effectiveness

Uses technology for effective communication

.

Multicultural/Global Perspective

Understands global customs, economics, literature, history, politics, religions, geography, and demographics.

Understands the contributions of different cultures to our society

Demonstrates proficiency in a language other than English.

Literacy: Reading

Reads critically, fluently, and with comprehension.

Reads for information research, pleasure and knowledge of literature.

Mathematics

Demonstrates basic math computational skills and understand higher-level mathematical concepts and reasoning.

Understands conservation and resource management.

History

Possesses knowledge of American and World Histories and their influence upon the present and the future.

Employs literature as a tool for learning about history across cultures.

Science

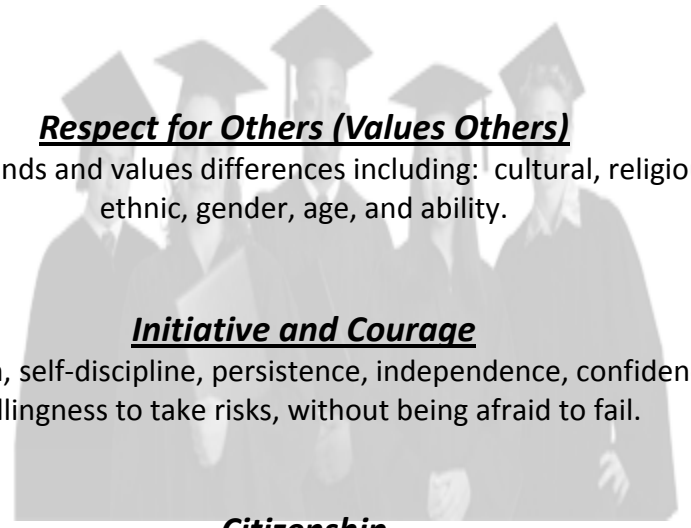
Demonstrates basic sciences knowledge and understands high-level scientific systems including environmental systems.

Knows how to apply the scientific method to real situations.

Arts

Experiences and appreciates music, visual arts, dance and theater.

New Century Graduate
Personal Characteristics



Respect for Others (Values Others)

Understands and values differences including: cultural, religious, ethnic, gender, age, and ability.

Initiative and Courage

Exhibits self-motivation, self-discipline, persistence, independence, confidence, curiosity, and willingness to take risks, without being afraid to fail.

Citizenship

Understands his or her role and responsibilities and contributes to the community, nation, and world.

Responsibility

Takes responsibility for own thoughts and actions, accepting the consequences.

Ethical Behavior

Exhibits personal integrity through honesty, fairness, sincerity, and a sense of justice.

Flexibility and Open Mindedness

Demonstrates flexibility, open-mindedness, adaptability, resiliency, and openness to change.

Self-respect

Possesses self-respect and confidence, while recognizing one's own limitations.

What are Enduring Understandings and Essential Questions?

Enduring Understandings

are the big ideas central to a content area that have lasting value beyond the classroom and are transferable to new situations. Enduring understandings describe what, specifically, students should understand about the topic. Such understandings are generally abstract in nature and are often not obvious, thus requiring uncovering of a topic through sustained inquiry.

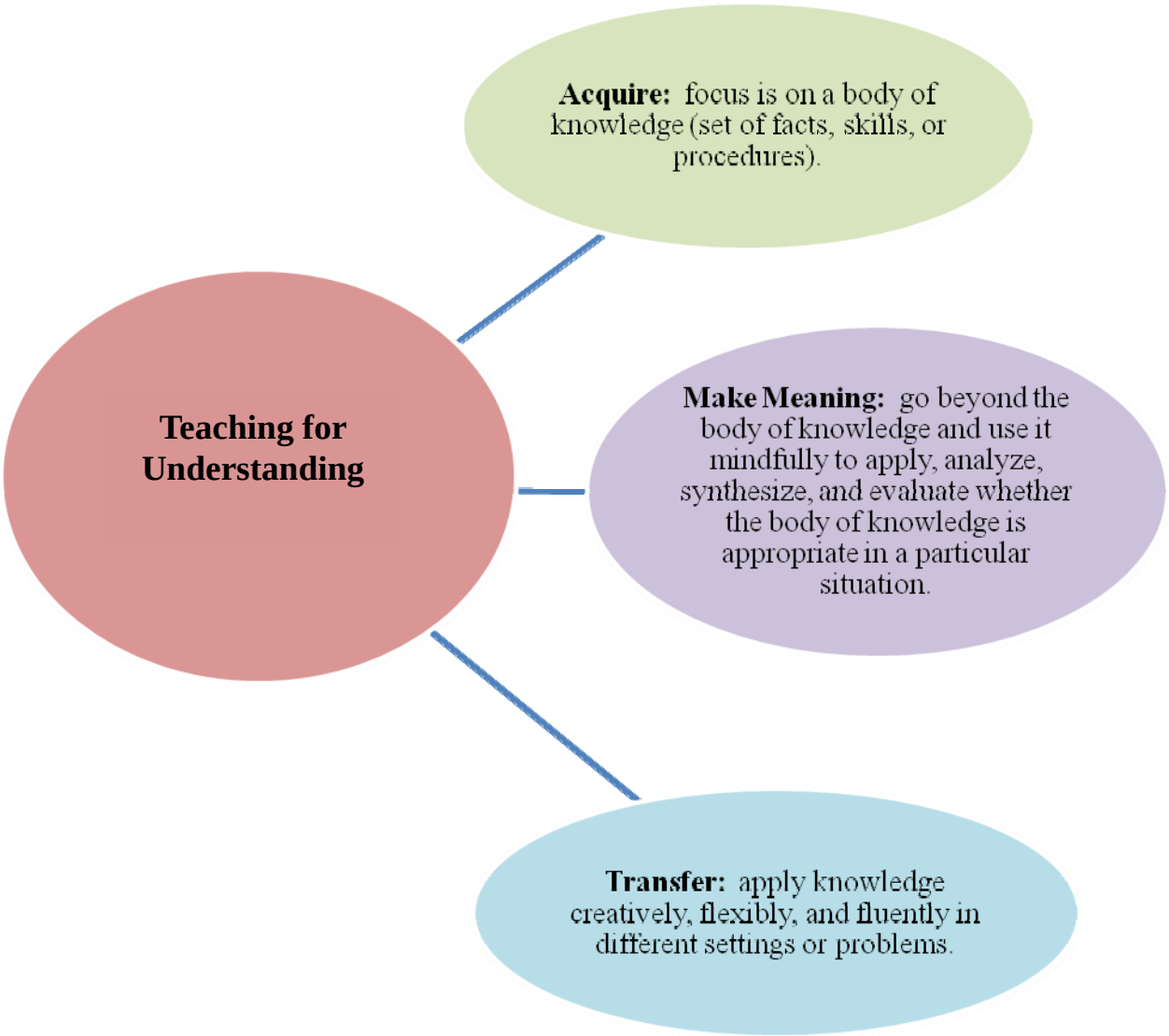
An understanding can be overarching or topical. Overarching understandings are broad (as the name implies) and offer a possible bridge to other units and courses. Overarching understandings at identified at the district-level. Topical understandings are unit specific, identified by teachers about the understandings the unit will cultivate about specific topics.

Essential Questions provoke deep thought, lively discussion, sustained inquiry, and new understandings culminating in meaningful performances. They require students to consider alternatives, weigh evidence, support their ideas, and justify answers. Essential questions do not yield a single straightforward answer, but produce different plausible responses, about which thoughtful and knowledgeable people may disagree. Essential questions spark meaningful connections with prior learnings and personal experiences and create opportunities for transfer to other situations and subjects.

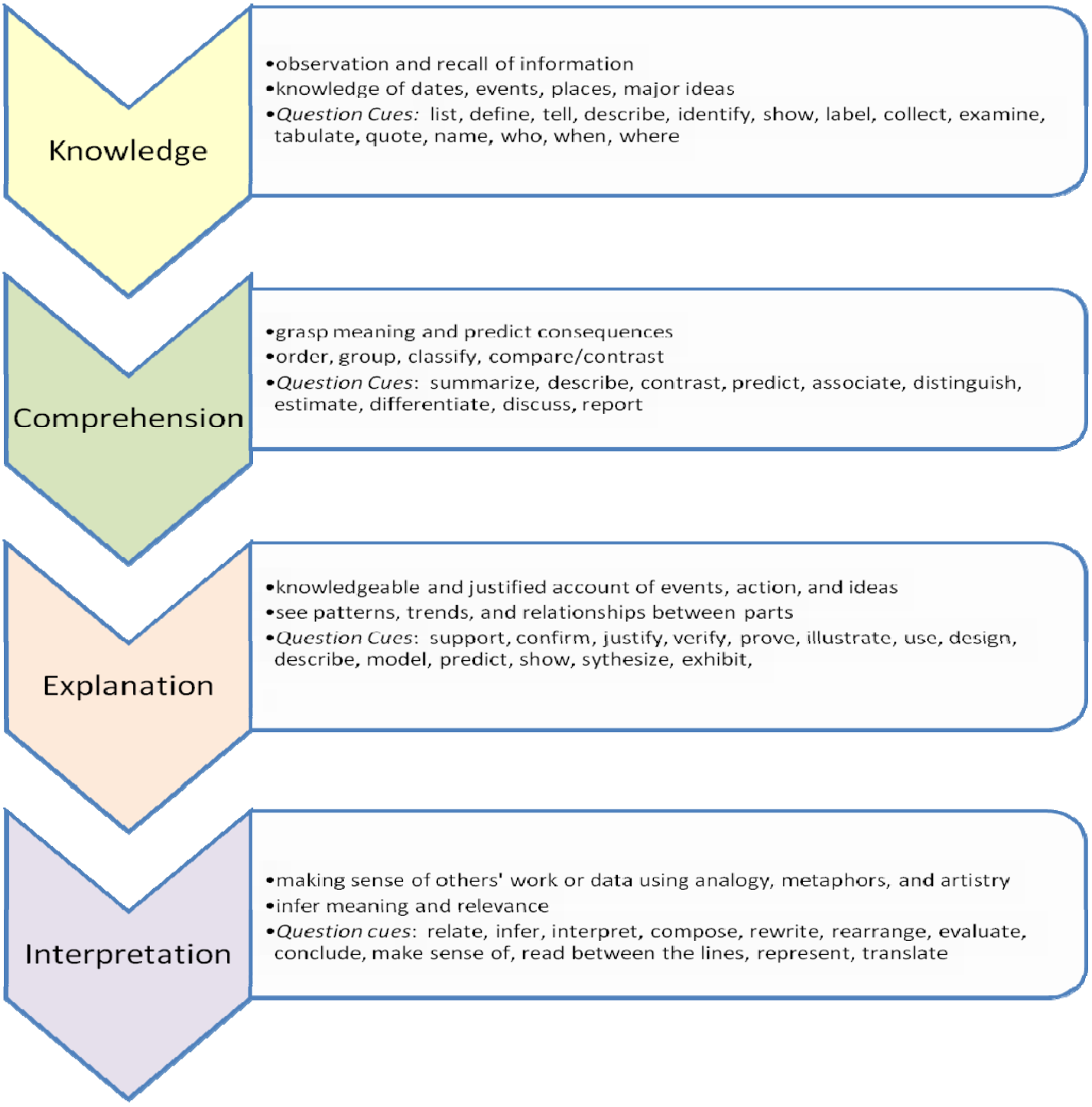
An essential questions can be either overarching or topical in scope. Overarching essential questions are general in nature, causing genuine and relevant inquiry into the big ideas and core content. They cut across units and/or courses. Topical essential questions focus on a specific topic and meant to be answered—if only provisionally—by unit's end.

Teaching for Understanding

If learning is to endure in a flexible, adaptable way for future use, then teachers must design units that in provide opportunity for students to 1) acquire knowledge; 2) to deepen the meaning of that knowledge by using it mindfully, and 3) to transfer their learning to new situations or problems.



What Does it Mean to Understand?



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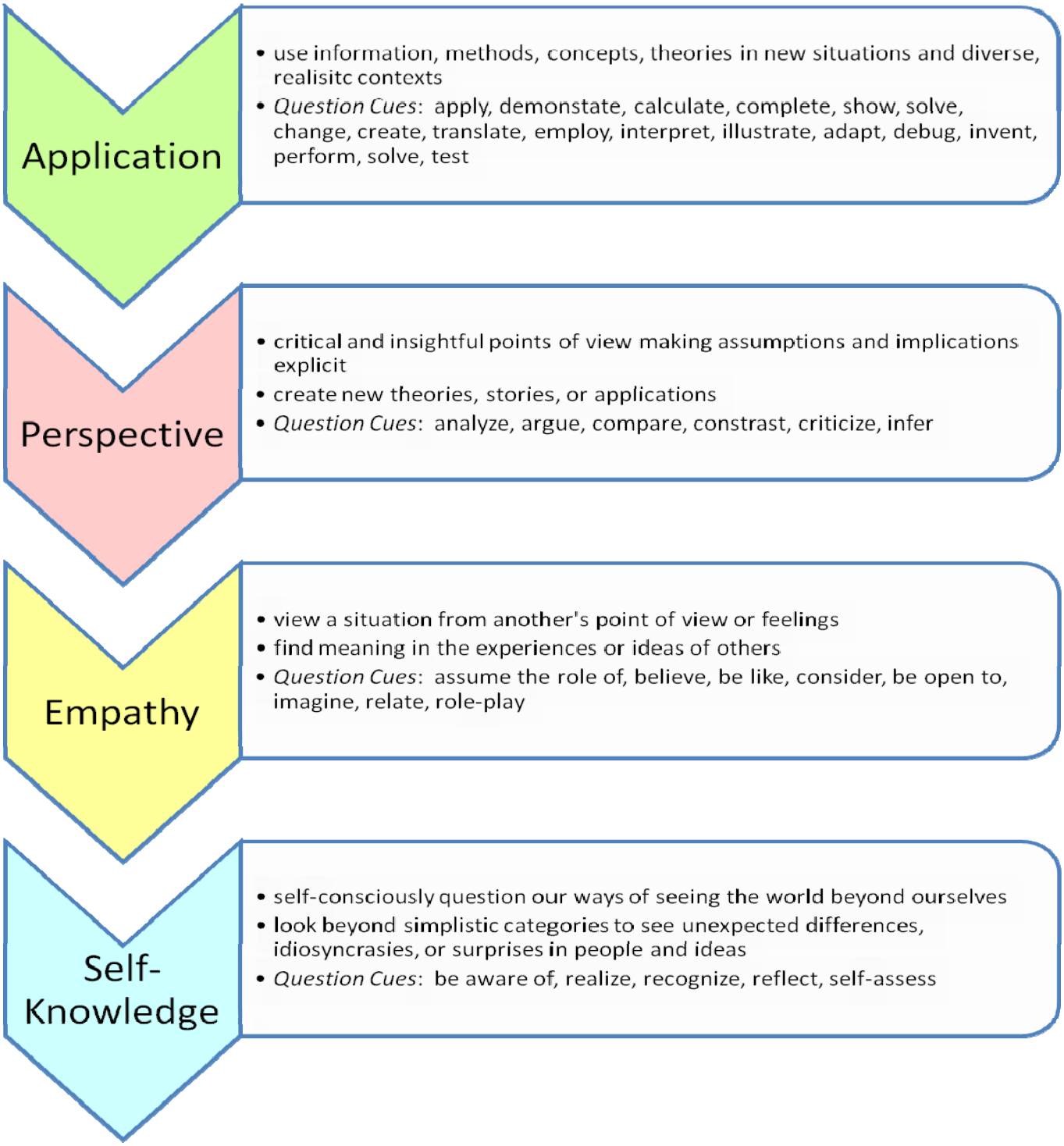
What Does it Mean to Understand? (continued)



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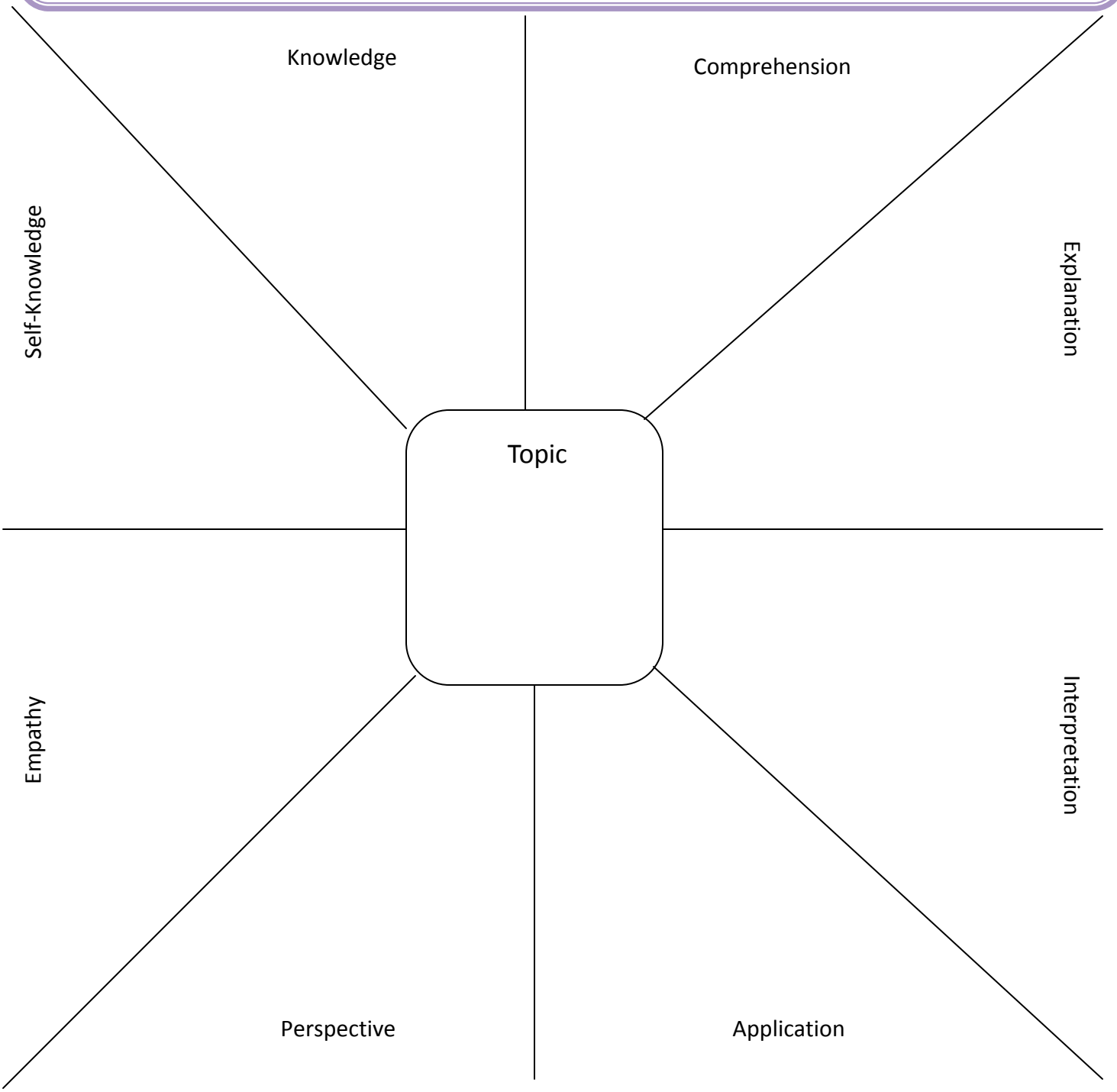
Levels of Understanding Essential Questions



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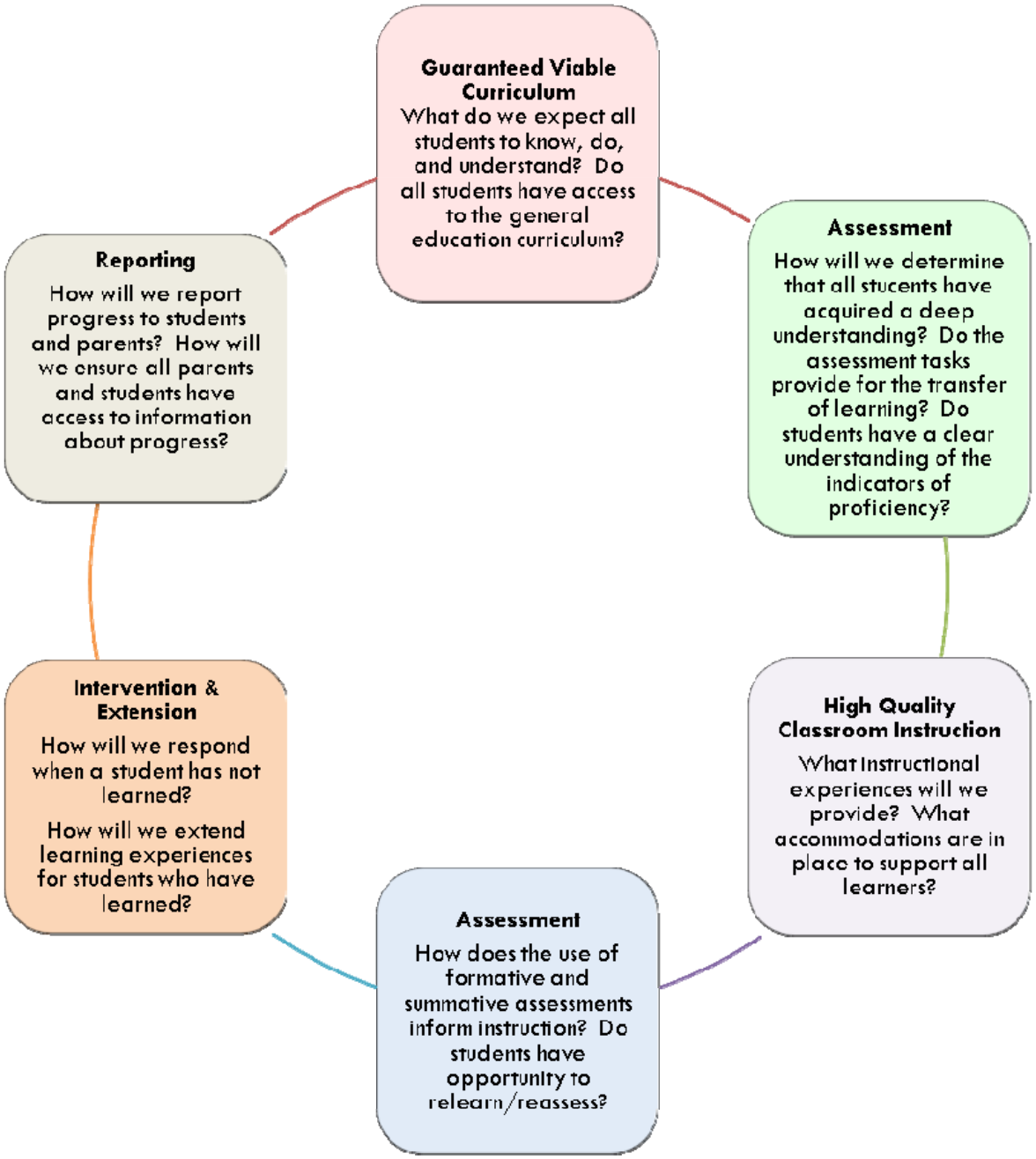
Instructional Framework
Making the Connections

A rigorous and challenging standards-based instructional program ensures maximum academic achievement for all students. The Boulder Valley School District Instructional Framework is a graphic representation that demonstrates how all of the components of an instructional program fit together. Teachers should use this framework and its questions to guide instructional planning and decision-making.



Characteristics of a Boulder Valley School District Standards-based Classroom

Curriculum

All Students Have Access to the General Education Curriculum

- Standards/essential learnings are clearly visible—in writing—in age appropriate student-friendly language
- Continual correlation of curriculum is made to the standards/essential learnings
- Models of high quality products (teacher generated, student generated or both) are provided by the district
- Students and parents are informed of expectations (course syllabus course, standards/essential learnings, grading policy, homework policy, and final culminating activity)
- All students are guaranteed access to the standards/essential learnings
- Lessons and units are developed using a backwards design process
- Suggested timelines are followed

Instruction

Quality Instruction Demands Student-Teacher Collaboration in the Learning Process

Instruction focuses on standards/essential learnings/curriculum

- Clear and high expectation for all students
- Instruction driven by standards/curriculum, not materials or a published program
- Frequent, timely, meaningful feedback of student accomplishment

Instruction supports equity with multiple opportunities to learn through grouping, scaffolding, differentiation, and extension

- Teachers use multiple forms of representation are used (e.g., pictures, words, symbols, diagrams, tables, graphs, word walls)

Students actively engage in learning

- Participate in classroom talk (listening, elaborating, clarifying, expanding)
- Apply rigorous, strategic thinking (application, explanation, perspective, interpretation, perspective, empathy, self-knowledge)

Characteristics of a Boulder Valley School District Standards-based Classroom

Assessment

Assessments are Tightly Aligned to the Standards

- Students and parents are provided with clear descriptions of proficiency
- Classroom grading practices clearly show how students are progressing toward essential learnings/standards
- Grading is based on attainment of the standards
- Student understanding is assessed through multiple types of formative and summative assessments
- Student assessment results are used to make instructional decisions about what direction to take
- Feedback explicitly guides continuous progress toward mastery of the standard and is provided to students in a timely manner
- Opportunities to relearn, reassess, and extend learning are embedded in every classroom
- Teachers collaborate in the design and analysis of common assessments that are aligned to standards
- Students create authentic products and performances for critical audiences

Learning Environment

A Healthy Community of Learners Thrives on Collaborative Processes That Value the Input of All Members

- Positive respectful relationships are evident within the classroom
- Students monitor and manage the quality of their own learning
- Student enrollment shows gender and racial/ethnic diversity
- Verbal and nonverbal cues indicate student engagement
- Teachers plan so that time is used purposefully and efficiently
- Students use time provided purposefully and efficiently
- Students and teachers negotiate and share decisions that positively impact the learning environment
- Teachers help students make connections between community, nation, world, and self
- Teachers show a connectedness with all students, respectful of student diversity and individual differences
- Students believe they are capable of success, take risks to engage in new experiences, and extend skills and habits of mind

High School Science Essential Learnings

High School Physical Science

- Asks questions and states hypotheses using prior scientific knowledge to help design and guide development and implementation of a scientific investigation
- Designs and conducts scientific investigations
- Appropriately selects and safely uses tools (including laboratory materials, equipment, technology, and electronic resources) to conduct scientific investigations
- Identifies major sources of error or uncertainly within an investigation (e.g., particular measuring devices and experimental procedures)
- Communicates and evaluates scientific thinking that leads to particular conclusions
- Using the kinetic-molecular model of matter, explains and predicts phase changes of matter relative to changes in thermal energy
- Explains that all elements have physical and chemical properties, which are determined by their atomic structure and are reflected in the element's location in the Periodic Table
- Describes how elements chemically combine to form compounds and that chemical changes can be represented in balanced chemical equations
- Explains that all substances have chemical and physical properties (density, pH, melting point, conductivity, magnetism, reactivity) that can be measured and used to compare and classify substances
- Uses quantitative measurements and calculations to demonstrate the conservation of mass and conservation of energy
- Explains that energy can be transferred or transformed through a variety of mechanisms, and that in any change, some energy is lost through transformation into heat
- Identifies the types and characteristics of waves and describes their interactions
- Explains how a variety of forces act on matter
- Describes the nature of electric charge and force and the relationship between electricity and magnetism
- Understands interrelationships among science, technology, and human activity and how they can affect the world
- Explains the difference between a hypothesis and a theory and between a theory and a law, and understands that science involves a particular way of knowing, and understanding common themes among scientific disciplines

High School Science Essential Learnings

High School Biology

- Asks questions and states hypotheses using prior scientific knowledge to help design and guide development and implementation of a scientific investigation
- Designs and conducts scientific investigations
- Appropriately selects and safely uses tools (including laboratory materials, equipment, technology, and electronic resources) to conduct scientific investigations
- Identifies major sources of error or uncertainly within an investigations (e.g., particular measuring devices and experimental procedures)
- Communicates and evaluates scientific thinking that leads to particular conclusions
- Recognizes and analyzes alternative explanations (hypotheses) and models
- Understands, describes, and demonstrates that living things are diverse, but all living things share common physical, genetic, and molecular characteristics, all of which are evidence of common ancestry.
- Describes the structure and function of cells, explain how new cells are made, and describes that cells differentiate to perform specific functions
- Explains that living systems have structures, such as molecules, organelles, cells, tissues, organs, and organ systems, which interact to maintain internal balance
- Describes and demonstrates that DNA codes for proteins and is the molecular basis for the transfer of biological characteristics from one generation to the next
- Explains that populations evolve over time through the non-random process of natural selection and other evolutionary mechanisms (both random and non-random)
- Explain that photosynthesis and cellular respiration are the biochemical processes by which most organisms obtain and use energy
- Demonstrates understanding of the complex interactions among organisms and their environments and the implications of these interactions for biodiversity
- Understands interrelationships among science, technology, and human activity and how they can affect the world
- Explains the relationship between hypotheses, theories and laws
- Understands that science involves a particular way of knowing and understand common themes among scientific disciplines

High School Science Essential Learnings

High School Chemistry

- Asks questions and states hypotheses using prior scientific knowledge to help design and guide development and implementation of a scientific investigation
- Designs and conducts scientific investigations
- Appropriately selects and safely uses tools (including laboratory materials, equipment, technology, and electronic resources) to conduct scientific investigations
- Identifies major sources of error or uncertainly within an investigation (e.g., particular measuring devices and experimental procedures)
- Communicates and evaluates scientific thinking that leads to particular conclusions
- Recognizes and analyzes alternative explanations and models
- Uses evidence to describe the structure of matter
- Uses chemical nomenclature accurately to identify and describe substances
- Explains, using models, observations of chemical and physical properties according to the nature of bonding within the substance
- Uses kinetic molecular theory (KMT) to explain rates of reactions and the relationships among temperature, pressure, and volume of a substance
- Applies the concept of equilibrium to different types of chemical reactions
- Applies the principle of conservation of mass to chemical reactions
- Understands interrelationships among science, technology, and human activity and how they can affect the world
- Describes the relationships among a hypothesis, a theory, and a law
- Understands that science involves a particular way of knowing and understands common themes among scientific disciplines

High School Science Essential Learnings

High School Physics

- Asks questions and states hypotheses using prior scientific knowledge to help design and guide development and implementation of a scientific investigation
- Designs and conducts scientific investigations
- Appropriately selects and safely uses tools (including laboratory materials, equipment, technology, and electronic resources) to conduct scientific investigations
- Identifies major sources of error or uncertainty within an investigation (e.g., particular measuring devices and experimental procedures)
- Communicates and evaluates scientific thinking that leads to particular conclusions
- Recognizes and analyzes alternative explanations and models
- Uses evidence to describe the concepts of linear and two-dimensional motion, including projectile motion
- Explains the relationships among forces, motion, momentum and impulse
- Demonstrates an understanding of the concept of energy as the ability to cause change
- Analyzes and explains the nature of electric charge and force and the relationship between electricity and magnetism
- Explains the nature and characteristics of waves and analyzes their interaction
- Describes the corrections to Newtonian physics given by quantum mechanics and relativity when matter is very small, moving fast compared to the speed of light, or very large
- Understands interrelationships among science, technology, and human activity and how they can affect the world
- Explains the difference between a hypothesis and a theory and between a theory and a law
- Understands that science involves a particular way of knowing and understands common themes among scientific disciplines

High School Science Essential Learnings

Earth, Space, and Geophysical Science

- Asks questions and states hypotheses using prior scientific knowledge to help design and guide development and implementation of a scientific investigation
- Designs and conducts scientific investigations
- Appropriately selects and safely uses tools (including laboratory materials, equipment, technology, and electronic resources) to conduct scientific investigations
- Identifies major sources of error or uncertainty within an investigation (e.g., particular measuring devices and experimental procedures)
- Recognizes and analyzes alternative explanations and models
- Describes and interprets Earth's surface features and explains changes in the Earth's surface due to geologic processes
- Describes rocks and minerals on a macroscopic and microscopic scale and explains the chemical and physical process through which they are formed
- Explains how scientific dating methods of fossils and rock sequences are used to construct a chronology of Earth's history expressed in a geologic time scale
- Describes both the structure of the Earth's interior and the evidence that supports this model
- Explains that plate tectonics is the global mechanism for major geologic processes and that heat transfer, governed by the principles of thermodynamics, is the driving force
- Describes how the use of Earth's resources impacts Earth's subsystems
- Describes how the hydrosphere and atmosphere subsystems interact on various time scales
- Explains how the Earth's global ocean, powered by the Sun, affects weather and climate through complex atmospheric interactions
- Explains how Earth interacts within a larger complex system and is unique in our solar system
- Analyzes interrelationships among science, technology, and human activity and how they affect the world
- Differentiates between a hypothesis and a theory and between a theory and a law
- Explains that science involves a particular way of knowing and understands common themes among scientific disciplines

Design Templates

Unit Design Template

Desired Results	
BVSD Standard(s)/Essential Learnings	
Unit Enduring Understandings	**Unit Essential Questions**
Students will know……	**Students will be able to……**
Assessment Evidence	
Performance/Transfer Tasks	**Other Evidence**
Rubric	**Student Self-Assessment and Reflection**

Unit Design Template (continued)

Learning Plans

Learning Activities

Materials

Accommodations

Technology Integration

Unit Design Template

Essential Learning:

Assessment:

Teaching for Understanding

	Acquire Knowledge	Make Meaning	Transfer
Essential Questions			
Learning Activities			
Materials			
Accommodations			

Curriculum Map

Month	Standards/Essential Learnings	Assessment	Knowledge Skills	Learning Activities	Accommodations	Materials

Curriculum Map

	August	September	October	November	December
Standards/ Essential Learnings					
Assessment					
Knowledge					
Skills					
Learning Activities					
Accommodations					
Materials					

Curriculum Map

	January	February	March	April	May
Standards/ Essential Learnings					
Assessment					
Knowledge					
Skills					
Learning Activities					
Accommodations					
Materials					

Curriculum Map

Month
Theme:
Unit Guiding Question(s):

Standards	Assessment	Knowledge and Skills	Learning Activities	Accommodations	Materials
Science					
Math					
Reading					
Writing					
Speaking					
Listening					
Social Studies					
Health					

Curriculum Map

Year At A Glance							
	Reading	**Writing**	**Math**	**Science**	**Social Studies**	**Health**	**Speaking/ Listening**
August							
September							
October							
November							
December							
January							
February							
March							
April							
May							

Curriculum Map

Unit: Timing:

Essential Questions					
Standards/Essential Learnings					
Notes	**Assessments**	**Knowledge and Skills**	**Learning Activities**	**Accommodations**	**Materials**

Curriculum Map

Unit: Timing:

Standards/Essential Learnings	
Enduring Understandings	**Assessment**
	Knowledge and Skills
Essential Questions	**Learning Activities**
	Accommodations
	Materials

Curriculum Glossary of Terms

Anchor	An anchor is a sample of work or performance used to set the specific performance standard for each level of proficiency. Anchors contribute to scoring reliability and support students by providing tangible models of quality work.
Assessment	Assessment refers to the act of determining a value or degree.
Authentic assessment	An authentic assessment is one composed of tasks and activities design to simulate or replicate important, real-world challenges. It asks a student to use knowledge in real-world ways, with genuine purposes, audiences, and situational variables. Authentic assessments are meant to do more than "test;" they should teach students what the "doing" of a subject looks like and what kinds of performance challenges are actually considered most important in a field or profession.
Backward Design	An approach to designing a curriculum or unit that begins with the end in mind and designs toward that end. This term is used by Grant Wiggins and Jay McTighe in *Understanding by Design*.
Benchmark	Clearly demarcated progress points that serve as concrete indicators for a standard.
Big Idea	In *Understanding by Design* (Wiggins and McTighe, 2005), the core concepts, principles, theories, and processes that should serve as the focal point of the curriculum, instruction, and assessment. Big ideas are enduring and important and transferable beyond the scope of a particular unit.
Concept	A concept is a mental construct or category represented by a word or phrase. Concepts include both tangible objects (chair, telephone) and abstract ideas (bravery, anarchy).
Content Standard	A content standard answers the question, "What *a student should know, do or understand*?"
Curriculum	The curriculum represents what should be taught. It is an explicit and comprehensive plan that is based on content and process standards.
Curriculum Implementation	Curriculum implementation is putting the curriculum into place.
Curriculum Mapping	Curriculum mapping and webbing are approaches that require teachers to align the curriculum, standards, and learning activities across grade levels, within a grade level to ensure a continuum of learning that makes sense for all students.
Enduring Understanding	Enduring understandings are specific inferences, based on big ideas that have lasting value beyond the classroom. They are full-sentence statements that describe specifically what students will understand about the topic.

Curriculum Glossary of Terms (continued)

Essential Learnings	Essential Learnings are the backbone of a guaranteed viable curriculum. Essential Learnings are aligned with standards and articulate the skills, content, and concepts determined to be non-negotiable areas of proficiency attainment by all students so that they are prepared for the next year/level of education. The Essential Learnings are the mandated curriculum of the Boulder Valley School District and form the basis upon which summative assessments are created.
Essential Question	An Essential Question lies at the heart of a subject or a curriculum (as opposed to being either trivial or leading) and promotes inquiry and uncoverage of a subject. Essential questions do not yield a single answer, but produce different plausible responses, about which thoughtful and knowledgeable people may disagree. An essential question can be overarching, grade level specific, or unit specific in scope.
Essential Topics, Skills, Processes, Concepts	The topics, skills, processes, and concepts clarify the Essential Learnings, describe indicators of achievement, and inform the selection of formative and summative assessments.
Formative assessment	An assessment is considered formative when the feedback from learning activities is actually used to adapt the teaching to meet the learner's needs.
Guaranteed Viable Curriculum	In researching what works in schools, Robert Marzano (2003), found five school-level factors that promote student achievement. Using the process of statistical effect size analysis, Marzano concluded that a guaranteed and viable curriculum is the most powerful school-level factor in determining overall student achievement. Marzano defines a guaranteed and viable curriculum as a combination of opportunity to learn (guaranteed) and time to learn (viable). According to Marzano, students have the opportunity to learn when they study a curriculum that clearly articulates required standards to be addressed at specific grade levels and in specific courses. A curriculum is viable when the number of required standards is manageable for a student to learn to a level of mastery in the time provided (usually a semester, trimester, or year).
Learning Activities	These represent the experiences and instruction that will enable students to achieve the desired results such as materials, projects, lectures, videos, homework, assignments, presentations, accommodations, and vocabulary.
Performance Task	A performance task uses one's knowledge to effectively act or bring to fruition a complex product that reveals one's knowledge and expertise.
Prerequisite knowledge and skill	The knowledge and skill required to successfully perform a culminating tasks or achieve an understanding. These typically identify discrete knowledge and know-how required to put everything together in a meaningful, final performance.

Curriculum Glossary of Terms (continued)

Processes	Processes include all the strategies, decisions, and sub-skills a student uses in meeting the content standard.
Product	The tangible and stable result of a performance and the processes that led to it. The product is valid for assessing the student's knowledge to the extent that success or failure in producing the product reflects the knowledge taught and being assessed.
Rubric	A scoring tool that rates performance according to clearly stated levels of criteria and enables students to self-assess. A rubric answers the question, *What does understanding or proficiency for an identified result look like?* The scales can be numeric or descriptive.
Scope and Sequence	Scope refers to the breadth and depth of content to be covered in a curriculum at any one time (e.g. week, term, year, over a student's school life). Sequence refers to the order in which content is presented to learners over time. The order in which you do it. Together a scope and sequence of learning bring order to the delivery of content, supporting the maximizing of student learning and offering sustained opportunities for learning. Without a considered scope and sequence there is the risk of ad hoc content delivery and the missing of significant learning.
Strategies	Strategies are procedures, methods, or techniques to accomplish an essential learning.
Summative assessment	An assessment is considered summative when the feedback is used as a summary of the learning up to a given point in time.

High School Physics Curriculum Essentials

Boulder Valley School District Science Background

Content and Goals

Since the publications of the *National Science Education Standards* by the National Research Council in 1996, the teaching of science in grades K-12 has undergone a gradual revolution. Instead of presenting science as a collection of isolated facts, teachers strive to help each student develop the ability to conduct scientific inquiry, a strong understanding of scientific concepts and how they are connected, and an understanding of the nature and history of science. In 2007, the Colorado Department of Education published the most recent version of the Colorado Model Content Standards for Science and Colorado Assessment Frameworks for Science.

This revision of the Boulder Valley School District Science Curriculum had three key goals:

- Clearly articulate what every student should know, understand, and be able to do with regards to science at every grade level
- Align with the revised Colorado Standards and Frameworks
- Reduce the breadth of science content at each grade level so that concepts can be explored in greater depth.

Scientific Inquiry

A central focus of the revised BVSD science curriculum is scientific inquiry. The following definition from the *National Science Education Standards* serves as the basis for our common understanding of how scientific inquiry is defined.

> **Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work.**
>
> **Inquiry also refers to the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world.**

The following points serve to clarify the vision of what inquiry means in BVSD.

- Inquiry involves five essential features. Students engaged in scientific inquiry should ask or respond to scientifically oriented questions, give priority to evidence, formulate explanations based on evidence, connect explanations to scientific knowledge, and communicate and justify explanations *(Inquiry and the National Science Education Standards).*
- Inquiry-based science instruction involves a continuum of learning experiences from teacher-led to learner self-directed activities, including but not limited to hands-on labs. Hence, both a structured assignment involving reading and written reflection and an open-ended, hands-on investigation could be considered inquiry as long as they involve the five essential features identified above.
- The ultimate goals of inquiry-based instruction are to engage learners, develop their conceptual understanding of the natural world around them, and to overcome misconceptions in science.
- Inquiry-based activities should balance students' application of content knowledge, creativity, and critical thinking in order to analyze data, solve a problem, or address a unique question.

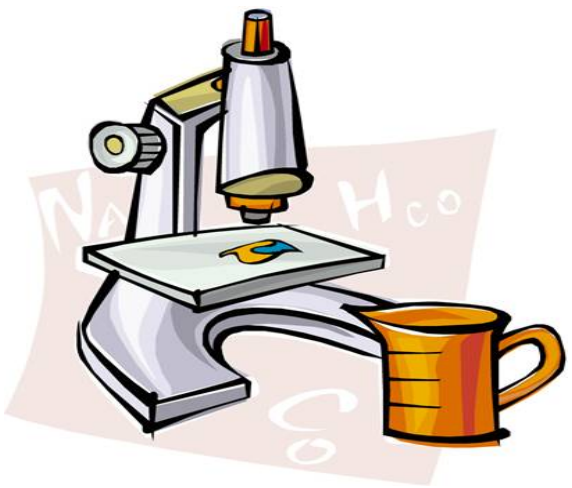
Literature Cited

National Research Council. 1996. *National Science Education Standards.* Washington, DC: National Academy Press.
National Research Council. 2000. *Inquiry and the National Science Education Standards*. Washington, DC: National Academy Press.

Boulder Valley School District Science Content Standards

Science Standard 1

Students apply the processes of scientific investigation and design, safely conduct, communicate about and evaluate such investigations.



Science Standard 2

Students know and understand common properties, forms, and changes in matter and energy.

Science Standard 3

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.

Science Standard 4

Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space.

Science Standard 5

Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world.

Science Overarching Enduring Understandings and Essential Questions

Overarching Enduring Understanding

- Science involves a particular way of knowing that includes relying on empirical evidence, logical arguments, skepticism, and peer review. Scientific ideas are revised over time as new evidence becomes available.
- Benefits and costs of scientific research and technological innovation include consequences that are long-term as well as short-term, and indirect as well as direct.
- Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying explanations.
- Matter has properties related to its structure that can be measured and used to identify, classify and describe substances or objects.
- Energy occurs in different forms and is necessary to do work or to cause change.
- All organisms share similar characteristics and basic needs, but they also have differences that allow people to identify, describe and classify them.
- The Earth System is composed of and part of a multitude of systems, which cycle and interact resulting in dynamic equilibrium.

Overarching Essential Questions

- How is science different from other disciplines in the way it approaches questions?
- How have science and technology affected the quality of life?
- How do people use the process of science to investigate questions about the natural world?
- What is matter?
- What is energy?
- How does energy interact with matter to cause change and do work?
- How are all living things the same, and how are they different?
- How do Earth's systems interact?

Boulder Valley School District Content Standards and High School Physics Essential Learnings

Science Standard 1: *Students apply the processes of scientific investigation and design, safely conduct, communicate about and evaluate such investigations.*

To meet this standard, a High School Physics student:

- √ Asks questions and states hypotheses using prior scientific knowledge to help design and guide development and implementation of a scientific investigation.
- √ Designs and conducts scientific investigations.
- √ Appropriately selects and safely uses tools (including laboratory materials, equipment, technology, and electronic resources) to conduct scientific investigations.
- √ Identifies major sources of error or uncertainty within an investigation (e.g., particular measuring devices and experimental procedures).
- √ Communicates and evaluates scientific thinking that leads to particular conclusions.
- √ Recognizes and analyzes alternative explanations and models.

Science Standard 2: *Students know and understand common properties, forms, and changes in matter and energy.*

To meet this standard, a High School Physics student:

- √ Uses evidence to describe the concepts of linear and two-dimensional motion, including projectile motion.
- √ Explains the relationships among forces, motion, momentum and impulse.
- √ Demonstrates an understanding of the concept of energy as the ability to cause change.
- √ Analyzes and explains the nature of electric charge and force and the relationship between electricity and magnetism.
- √ Explains the nature and characteristics of waves and analyzes their interaction.
- √ Describes the corrections to Newtonian physics given by quantum mechanics and relativity when matter is very small, moving fast compared to the speed of light, or very large.

Science Standard 3: *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.*

No essential learning in High School Physics.

Science Standard 4: *Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space.*

No essential learning in High School Physics.

Science Standard 5: *Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world.*

To meet this standard, a High School Physics student:

- √ Understands interrelationships among science, technology, and human activity and how they can affect the world.
- √ Explains the difference between a hypothesis and a theory and between a theory and a law.
- √ Understands that science involves a particular way of knowing and understands common themes among scientific disciplines.

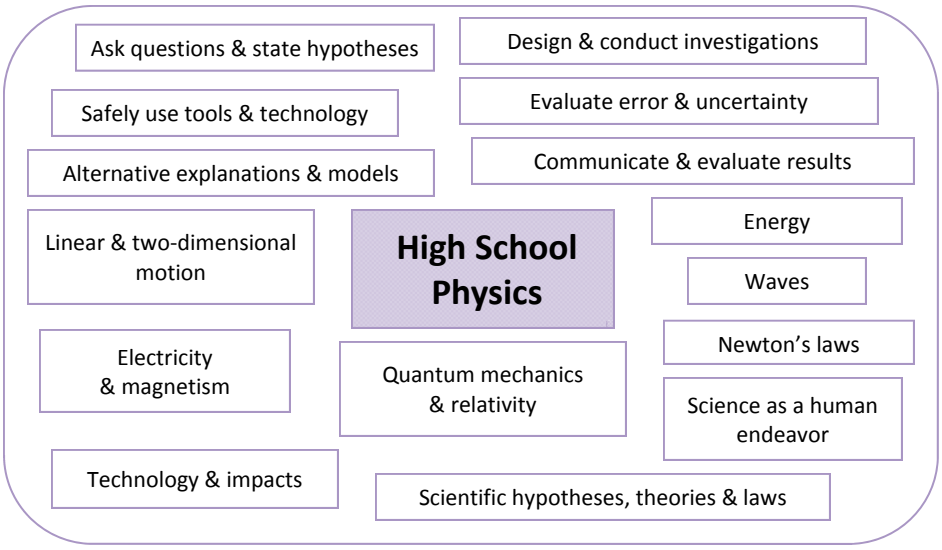
BVSD High School Physics Overview

Course Description

This course helps students understand the basic physical laws of our world. The course includes: scientific methods and measurement, forces, motion, energy, light, waves, electricity, magnetism, and atomic physics. Laboratory work serves to promote understanding and to illustrate the experimental nature of physics.

Effective Components of a HS Physics Program

- Maintains an inquiry-based learning environment
- Provides students with multiple opportunities to learn and timely feedback to help students know what they need to improve upon
- Uses assessment to guide instruction
- Differentiates instruction to meet student needs
- Draws out and actively engages the preexisting understandings about the natural world that students bring with them
- Assists students in developing metacognitive skills within the context of learning about science
- Integrates writing, reading, and mathematics with inquiry-based science
- Provides a safe, equitable and engaging learning environment for all students



Essential Questions

- What types of questions and hypotheses can be answered by science?
- What elements of design are critical in conducting a scientific investigation?
- How can we ensure that scientific investigations are both safe and consistent with standard scientific practice?
- How do we know whether scientific data are accurate?
- How do we know whether the conclusions of a scientific investigation are valid?
- Is there always only one explanation for how things behave in nature?
- How can we describe patterns of motion?
- How do forces explain motion?
- What is energy?
- What is electric charge and how does it relate to magnetism?
- How do we describe the behavior of waves?
- How does our understanding of the properties and motion of objects change when those objects are very small (subatomic particles), very large or far apart (stars, galaxies), or moving very fast (particles moving at or close to the speed of light)?
- How have science and technology affected the quality of life?
- What is the difference between a scientific hypothesis, theory, and law?
- What makes science different from other disciplines?

Assessment

√ Science ACT
√ Teacher-created assessments

Technology Integration & Information Literacy

- Uses technology responsibly for communication and transfer of ideas
- Uses technology to gather, organize, analyze and communicate about data
- Collaborates with others to identify information problems and to seek their solutions
- Organizes and reports information in a variety of complex ways including tables, graphs, charts, reports, labeled diagrams
- Evaluates the accuracy and objectivity of various information sources (text, audio, video, etc.)
- Presents information in a variety of formats including text, audio, pictures, video

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 1

Students apply the processes of scientific investigation and design, safely conduct, communicate about and evaluate such investigations.

Enduring Understanding

Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying explanations.

Essential Questions

What types of questions and hypotheses can be answered by science?

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys1	Asks questions and states hypotheses using prior scientific knowledge to help design and guide development and implementation of a scientific investigation	
		a	Develops scientific questions
		b	Formulates testable hypotheses
		c	Describes different methods used to investigate scientific questions (e.g., controlled experiments, constructing models, etc.)

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 1 (continued)

Students apply the processes of scientific investigation and design, safely conduct, communicate about and evaluate such investigations.

Enduring Understanding

Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying explanations.

Essential Questions

What elements of design are critical in conducting a scientific investigation?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys2	Designs and conducts scientific investigations	
		a	Creates and defends a written plan of action for a controlled experiment
		b	Identifies the independent and dependent variables in a scientific investigation
		c	Attempts to keep all conditions other than the independent variable constant, while monitoring variables that cannot be held constant
		d	Selects and uses the appropriate observation or measurement technique
		e	Selects and uses appropriate technologies to gather, process, and analyze data
		f	Records qualitative and quantitative observations
		g	Describes how different types of technologies are used in scientific investigations

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 1 (continued)

Students apply the processes of scientific investigation and design, safely conduct, communicate about and evaluate such investigations.

Enduring Understanding

Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying explanations.

Essential Questions

How can we ensure that scientific investigations are both safe and consistent with standard scientific practice?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys3	Appropriately selects and safely uses tools (including laboratory materials, equipment, technology, and electronic resources) to conduct scientific investigations	
		a	Uses personal protection equipment, such as safety goggles, when appropriate
		b	Knows the location and procedure for using safety equipment such as fire extinguishers, eyewashes, safety showers, etc.
		c	Measures accurately using common SI units and non-SI units common to physics (e.g. seconds, meters, kilograms, Celsius, newtons, joules)
		d	Reads and records measurements made on a piece of standard, calibrated scientific equipment with the correct degree of certainty/significant digits
		e	Uses dimensional analysis to appropriately solve problems

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 1 (continued)

Students apply the processes of scientific investigation and design, safely conduct, communicate about and evaluate such investigations.

Enduring Understanding

Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying explanations.

Essential Questions

How do we know whether scientific data are accurate?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys4	Identifies major sources of error or uncertainty within an investigation (e.g., particular measuring devices and experimental procedures)	
		a	Identifies when error has been introduced into a scientific investigation because certain variables are not controlled or more than one variable is changed
		b	Describes ways of minimizing experimental errors in a scientific investigation
		c	Distinguishes between error, uncertainty, and mistakes
		d	Calculates percent error

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 1 (continued)

Students apply the processes of scientific investigation and design, safely conduct, communicate about and evaluate such investigations.

Enduring Understanding

Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying explanations.

Essential Questions

How do we know whether the conclusions of a scientific investigation are valid?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys5	Communicates and evaluates scientific thinking that leads to particular conclusions	
		a	Summarizes data effectively using graphs and tables
		b	Identifies and uses evidence to support a particular conclusion
		c	Writes a conclusion that links the question being investigated to the evidence collected during the investigation
		d	Identifies and explains whether or not a conclusion is aligned with the testable question and the scientific investigation that was conducted
		e	Explains how conclusions and models from previous scientific investigations might be revised based on new evidence

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 1 (continued)

Students apply the processes of scientific investigation and design, safely conduct, communicate about and evaluate such investigations.

Enduring Understanding

Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying explanations.

Essential Questions

Is there always only one explanation for how things behave in nature?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys6	Recognizes and analyzes alternative explanations and models	
		a	Describes and explains that alternative models can be used to investigate the same testable question
		b	Describes and analyzes other reasonable explanations, using the same independent and dependent variable, for the resulting data or observations from an investigation

Key Academic Vocabulary: error, hypothesis, qualitative, quantitative, uncertainty, variable

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 2

Students know and understand common properties, forms, and changes in matter and energy.

Enduring Understanding

Energy occurs in different forms and is necessary to do work or to cause change.

Essential Questions

How can we describe patterns of motion?

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys7	Uses evidence to describe the concepts of linear and two-dimensional motion, including projectile motion	
		a	Defines and demonstrates an understanding of position, velocity, and acceleration in one dimension
		b	Constructs velocity versus time graphs depicting real motions, and interprets acceleration versus time graphs and position versus time graphs
		c	Writes and solves the equations of one-dimensional motion with constant accelerations
		d	Defines and describes uniform circular motion intuitively and mathematically
		e	Compares and contrasts scalar and vector quantities: speed & velocity and distance & displacement

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 2 (continued)

Students know and understand common properties, forms, and changes in matter and energy.

Enduring Understanding (continued)

Energy occurs in different forms and is necessary to do work or to cause change.

Essential Questions

How do forces explain motion?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts

HS Phys8		Explains the relationships among forces, motion, momentum and impulse
	a	States Newton's 1st and 3rd Laws and gives examples from the real world illustrating them
	b	Understands the concept of force as a vector and identifies all the forces acting on a chosen body
	c	Writes and solves Newton's 2nd law to describe the motion of a body in one and two dimensions
	d	Writes and solves the equations for conservation of linear momentum within a closed system
	e	Explains the relationships among force, time, and momentum
	f	Describes the motion of the center of mass
	g	Uses the Universal Law of Gravitation to describe and analyze circular orbits

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 2 (continued)

Students know and understand common properties, forms, and changes in matter and energy.

Enduring Understanding (continued)

Energy occurs in different forms and is necessary to do work or to cause change.

Essential Questions

What is energy?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys9	Demonstrates an understanding of the concept of energy as the ability to cause change	
		a	Defines and describes basic forms of energy such as kinetic energy, gravitational potential energy, thermal energy, elastic potential energy, and work
		b	Identifies the forms of energy within a simple closed system
		c	Writes and solves the equation of energy conservation for a simple closed system
		d	Analyzes, evaluates, and measures the transfer of energy by a force including work and power
		e	Designs and conducts investigations of mechanical energy and power

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 2 (continued)

Students know and understand common properties, forms, and changes in matter and energy.

Enduring Understanding (continued)

Energy occurs in different forms and is necessary to do work or to cause change.

Essential Questions

What is electric charge and how does it relate to magnetism?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys10	Analyzes and explains the nature of electric charge and force and the relationship between electricity and magnetism	
		a	Explains the basic phenomena of “static electricity” using the electron model
		b	Defines and demonstrates an understanding of the following concepts: electric force, electric field, electric potential, and electric potential energy for stationary point charges
		c	Describes and defines potential energy difference mathematically and using gravitational parallels
		d	Uses Ohm’s Law to describe DC circuits with combinations of resistors in series and parallel
		e	Uses right hand rules to describe magnetic field and magnetic force
		f	Explains how the magnetic force causes motors to spin

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 2 (continued)

Students know and understand common properties, forms, and changes in matter and energy.

Enduring Understanding (continued)

Energy occurs in different forms and is necessary to do work or to cause change.

Essential Questions

How do we describe the behavior of waves?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	**HS Phys11**	**Explains the nature and characteristics of waves and analyzes their interaction**	
		a	Defines and relates, using equations and graphs, velocity, frequency, amplitude, period and wavelength of a periodic wave
		b	Demonstrates that standing waves are a one-dimensional interference pattern
		c	Writes and solves Snell's Law to model the behavior of light passing from one medium to another
		d	Finds real and virtual images formed by a converging lens using ray drawings
		e	Finds real and virtual images formed by a converging lens using the thin lens formula
		f	Understands combinations of converging lenses, and understands the basic operation of the telescope and microscope
		g	Describes the electromagnetic wave model of light
		h	Understands the electromagnetic spectrum, and explains the origin of these broad types of radiation: radio waves, visible light, x-rays, and gamma rays
		i	Explains polarization of an electromagnetic wave

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 2 (continued)

Students know and understand common properties, forms, and changes in matter and energy.

Enduring Understanding

All motion is relative to whatever frame of reference is chosen, for there is no motionless frame from which to judge all motion.

Essential Questions

How does our understanding of the properties and motion of objects change when those objects are very small (subatomic particles), very large or far apart (stars, galaxies), or moving very fast (particles moving at or close to the speed of light)?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys12	Describes the corrections to Newtonian physics given by quantum mechanics and relativity when matter is very small, moving fast compared to the speed of light, or very large	
		a	Describes the limits to Newtonian physics
		b	Uses the Special Theory of Relativity to describe the mass, length, and age of high-speed particles
		c	Explains or describes the large-scale structure of the Universe

Key Academic Vocabulary: acceleration, amplitude, center of mass, converging, displacement, distance, elastic potential energy, electric force, electric field, electric potential, electric potential energy, electricity, electromagnetic spectrum, energy, force, frequency, gravitational potential energy, impulse, interference, kinetic energy, lens, light, linear, magnetism, medium, momentum, motion, period, polarization, position, power, projectile, relativity, resistor, scalar, speed, static electricity, stationary point charge, thermal energy, vector, velocity, virtual image, wave, work

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 5

Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world.

Enduring Understanding

Benefits and costs of scientific research and technological innovation include consequences that are long-term as well as short-term, and indirect as well as direct.

Essential Questions

How have science and technology affected the quality of life?

Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys13	Understands interrelationships among science, technology, and human activity and how they can affect the world	
		a	Analyzes the effects of technology and human activity on the natural world and the progression of scientific knowledge
		b	Analyzes benefits, limitations, costs, and consequences involved in using technology or resources (eg., X-rays, agricultural chemicals, natural gas reserves)
		c	Analyzes how the introduction of a new technology has affected or could affect human activity (eg., invention of telescope and applications of modern telecommunications)
		d	Give an example of the interrelationships between science and technology

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 5 (continued)

Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world.

Enduring Understanding

Science involves a particular way of knowing that includes relying on empirical evidence, logical arguments, skepticism, and peer review. Scientific ideas are revised over time as new evidence becomes available.

Essential Questions

What is the difference between a scientific hypothesis, theory, and law?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys14	Explains the difference between a hypothesis and a theory and between a theory and a law	
		a	Identifies examples of a scientific hypothesis, a scientific theory, and a scientific law
		b	Describes what distinguishes a scientific theory from a scientific law
		c	Describes what distinguishes a scientific hypothesis from a scientific theory

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Essential Learnings

Essential Knowledge, Skills, Topics, Processes, and Concepts

Science Standard 5 (continued)

Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world.

Enduring Understanding (continued)

Science involves a particular way of knowing that includes relying on empirical evidence, logical arguments, skepticism, and peer review. Scientific ideas are revised over time as new evidence becomes available.

Essential Questions

How is science different from other disciplines?

Essential Learnings (continued)

Essential Knowledge, Skills, Topics, Processes, and Concepts	HS Phys15	Understands that science involves a particular way of knowing and understands common themes among scientific disciplines	
		a	Identifies the key factors that distinguish science from other disciplines, such as the use of empirical evidence, logical arguments and skepticism
		b	Identifies examples of when new scientific evidence has dramatically changed previously accepted views in certain scientific fields

Key Academic Vocabulary: empirical evidence, peer review, scientific hypothesis, scientific law, scientific theory, skepticism

Suggested Timelines

Topic (can be done in any order)	Suggested Timeframe (can be done in any order)
Scientific Investigation Skills and Concepts Ask questions and state hypotheses Design and conduct investigations Safely use tools and technology Evaluate error and uncertainty Communicate and evaluate results Alternative explanations and models	Embedded throughout
Key Science Concepts Linear and 2D motion Newton's Laws Energy Electricity and magnetism Waves Relativity	 6 weeks 6 weeks 6 weeks 4 weeks 6 weeks 2 weeks
Nature of science Technology and impacts Scientific hypotheses, theories and laws Science as a human endeavor	Embedded throughout

Science Scope & Sequence K-5

Standard	K	1	2	3	4	5
Scientific Investigations	Observation, simple questions and predictions, safety	Observation, simple questions and predictions, recording data, safety	Observation, simple questions and predictions, recording data, explanations, and safety	Designing investigations, measurement, explanations, safety	Designing investigations, organizing and representing data, measurement, explanations, safety	Fair test, identifying and controlling variables, organizing and representing data, explanations, safety
Physical Science	Properties of objects	Balance and motion	States of matter	Matter and Energy	Magnetism and electricity	Changes in matter, Force and motion
Life Science	Characteristics of living things	Structures and life cycles of plants	Structures and life cycles of insects	Human body systems	Structure, function, and energy in organisms	Ecosystems
Earth and Space Science	Seasons	Sorting and comparing Earth's materials	Air and weather	Fossils	Water Solar system	Landforms
Nature of Science	N/A	N/A	N/A	Repeating investigations and models	Repeating investigations and models	Repeating investigations and models

Science Scope & Sequence 6-12

Standard	6	7	8	Physical Science	Biology
Scientific Investigations	Design and conduct investigations Use tools and technology Organize and use data Communicate results Safety	Design and conduct investigations Use tools and technology Organize and use data Communicate results Safety	Design and conduct investigations Use tools and technology Organize and use data Communicate results Safety	Ask questions and state hypotheses Design and conduct investigations Safely use tools and technology Evaluate error and uncertainty Communicate and evaluate results	Ask questions and state hypotheses Design and conduct investigations Safely use tools and technology Evaluate error and uncertainty Communicate and evaluate results Alternative explanations and models
Standards 2-4 • **Physical Science** • **Life Science** • **Earth and Space Science**	**Physical Science** Particulate model of matter Atoms Mixtures and solutions Compounds and molecules Conservation of matter Mass and weight Energy sources Energy transformations Force and motion Electrical circuits Light waves	**Life Science** Characteristics of organisms Human body Transport within multi-cellular organisms Photosynthesis and respiration Interactions within ecosystems Matter and energy in ecosystems Cells Evolution Genetics	**Earth and Space Science** Water cycle Bodies of water Processes that shape Earth's surface Atmosphere structure and function Fossils Atmosphere circulation Minerals, rocks, and soils Weather and climate Plate tectonics Solar System Sun, Earth, Moon Galaxies and space exploration	**Physical Science** Kinetic-molecular model of matter Atomic structure and the periodic table Chemical bonding and reactions Separating complex mixtures Conservation of matter and energy Energy transformations Waves Force and motion Electricity and magnetism	**Life Science** Physical and biochemical characteristics of living things Cell structure, function and differentiation Homeostasis and cellular transport Molecular basis of heredity Evolution Photosynthesis and cellular respiration Interactions within ecosystems
Nature of Science	Repeatability Models Technology and impacts Science as a human endeavor	Repeatability Models Technology and impacts Science as a human endeavor	Repeatability Models Technology and impacts Science as a human endeavor	Technology and impacts Scientific hypotheses, theories and laws	Technology and impacts Scientific hypotheses, theories and laws Science as a human endeavor

Science Glossary of Terms

Abiotic	not associated with or derived from living organisms; abiotic factors in an environment include such items as sunlight, temperature, wind patterns, and precipitation
Adaptation	a change by which an organism becomes better suited to its environment
Air	the invisible gaseous substance surrounding the earth, a mixture mainly of oxygen and nitrogen
Air mass	a body of air extending hundreds or thousands of miles horizontally and sometimes as high as the stratosphere and maintaining as it travels nearly uniform conditions
Air pressure	the pressure exerted by the atmosphere
Amino Acid	of a class of about twenty organic compounds which form the basic constituents of proteins and contain both acid and amine groups
Amplitude	the maximum extent of a vibration or oscillation from the point of equilibrium.
Anatomy	the science of the shape and structure of organisms and their parts
Asexual reproduction	reproduction without the fusion of gametes
Astronomy	the science of celestial objects, space, and the physical universe
Atmosphere	the envelope of gases surrounding the earth or another planet
Atom	the smallest particle of a chemical element, consisting of a positively charged nucleus surrounded by negatively charged electrons
Attract	to cause to draw near or adhere by physical force
Axis	an imaginary line through a body, about which it rotates
Bar graph	a graph consisting of parallel, usually vertical bars or rectangles with lengths proportional to the frequency with which specified quantities occur in a set of data
Bias	statistical sampling or testing error caused by systematically favoring some outcomes over others
Binary fission	a method of asexual reproduction, involves the splitting of a parent cell into two approximately equal parts
Biodiversity	the variability among living organisms on the earth, including the variability within and between species and within and between ecosystems
Biology	the scientific study of living organisms
Biosphere	the part of the earth and its atmosphere in which living organisms exist or that is capable of supporting life
Body system	a group of organs or structures within the body that work together to perform one or more specific functions

Science Glossary of Terms (continued)

Boiling point	the temperature at which a liquid boils at a fixed pressure, especially under standard atmospheric conditions
Botany	the scientific study of plants
Brain	the portion of the vertebrate central nervous system that is enclosed within the cranium, continuous with the spinal cord, and composed of gray matter and white matter. It is the primary center for the regulation and control of bodily activities, receiving and interpreting sensory impulses, and transmitting information to the muscles and body organs. It is also the seat of consciousness, thought, memory, and emotion
Capacity	the maximum amount that can be contained
Carbohydrate	any of a group of organic compounds that includes sugars, starches, celluloses, and gums and serves as a major energy source in the diet of animals. These compounds are produced by photosynthetic plants and contain only carbon, hydrogen, and oxygen, usually in the ratio 1:2:1
Carcinogen	a cancer-causing substance or agent
Cell	the smallest structural and functional unit of an organism
Cell division	the process in reproduction and growth by which a cell divides to form daughter cells
Cellular respiration	the series of metabolic processes by which living cells produce energy through the oxidation of organic substances
Celsius	of or relating to a temperature scale that registers the freezing point of water as 0° and the boiling point as 100° under normal atmospheric pressure
Centimeter	metric unit of length equal to 1/100 of a meter
Characteristic	a feature that helps to identify, tell apart, or describe recognizably; a distinguishing trait
Chemical change	a change in which the substances present at the beginning of the change are not present at the end; new substances are formed. The change cannot be “undone”
Chemical formula	A representation of a substance using symbols to represent constituent elements
Chemistry	the branch of science concerned with the properties and interactions of the substances of which matter is composed
Chloroplast	a structure in algal and green plant cells which contains chlorophyll and in which photosynthesis takes place
Chromosome	a thread-like structure found in the nuclei of most living cells, carrying genetic information in the form of genes
Circuit	a path followed or capable of being followed by an electric current
Circulation	movement in a circle or circuit

Science Glossary of Terms (continued)

Circulatory system	the body system that circulates blood through the body, consisting of the heart and blood vessels
Classification	the systematic grouping of organisms into categories on the basis of evolutionary or structural relationships between them; taxonomy
Climate	meteorological conditions including temperature, precipitation, and wind, which characteristically prevail in a particular region
Cloud	a visible body of very fine water droplets or ice particles suspended in the atmosphere at altitudes ranging up to several miles above sea level
Cohesion	the intermolecular attraction by which the elements of a body are held together
Communicable disease	a disease that can be communicated from one person to another
Community	a group of interdependent plants or animals growing or living together or occupying a specified habitat
Component	a single part of a larger system
Composition	the combining of distinct parts or elements to form a whole
Compound	a pure, macroscopically homogeneous substance consisting of atoms or ions of two or more different elements in definite proportions that cannot be separated by physical means. A compound usually has properties unlike those of its constituent elements
Conclusion	a judgment or decision reached by reasoning
Condensation	the process by which a gas or vapor changes to a liquid
Condensation, heat of	heat liberated by a unit mass of gas at its boiling point as it condenses into a liquid
Conduction	the transmission or conveying of something through a medium or passage, especially the transmission of electric charge or heat through a conducting medium without perceptible motion of the medium itself
Conductivity	the ability or power to conduct or transmit heat, electricity, or sound
Conductor	a substance or medium that conducts an electric charge
Conservation of energy	a principle stating that the total energy of an isolated system remains constant regardless of changes within the system
Conservation of mass	a principle in classical physics stating that the total mass of an isolated system is unchanged by interaction of its parts
Conservation of matter	a fundamental principle of classical physics that matter cannot be created or destroyed in an isolated system

Science Glossary of Terms (continued)

Constant	an experimental or theoretical condition, factor, or quantity that does not vary or that is regarded as invariant in specified circumstances
Consumer	an organism that cannot make its own food and must eat in order to survive
Controlled experiment	an experiment that isolates the effect of one variable on a system by holding constant all variables but the one under observation
Convection	heat transfer in a gas or liquid by the circulation of currents from one region to another
Coriolis effect	result of an apparent force that as a result of the earth's rotation deflects moving objects (as projectiles or air currents) to the right in the northern hemisphere and to the left in the southern hemisphere
Crust	solid, outermost layer of the Earth, lying above the mantle
Data	factual information (as measurements or statistics) used as a basis for reasoning, discussion, or calculation
Decomposer	an organism that breaks down organic materials in the environment
Decomposition	breakdown or decay of organic materials
Density	the mass of a substance per unit volume
Dependent variable	the observed or measured variable in an experiment or study whose changes are determined by the presence of one or more independent variables
Deposition	the laying down of matter by a natural process
Development	the process of an individual organism growing organically; a purely biological unfolding of events involved in an organism changing gradually from a simple to a more complex level
Digestive system	body system consisting of the alimentary canal and digestive glands and responsible for the ingestion, digestion, and absorption of food

Science Glossary of Terms (continued)

DNA (Deoxyribonucleic Acid)	a substance which is present in the cell nuclei of nearly all living organisms and is the carrier of genetic information
Dominant	an allele that produces the same phenotypic effect whether inherited with a homozygous or heterozygous allele
Earth	the third planet from the sun
Earthquake	a sudden movement of the Earth's crust caused by the release of stress accumulated within the Earth's crust
Earth's material	any substance occurring naturally on Earth, such as water, soil, rocks, etc
Eclipse	the partial or complete obscuring, relative to a designated observer, of one celestial body by another
Ecosystem	a biological community of interacting organisms and their physical environment
Electricity	a form of energy resulting from the existence of charged particles (such as electrons or protons), either statically as an accumulation of charge or dynamically as a current
Electromagnetic radiation	a kind of radiation including visible light, radio waves, gamma rays, and X-rays, in which electric and magnetic fields vary simultaneously
Electron	an elementary particle in all atoms that has a negative charge
Element	a substance composed of atoms having an identical number of protons in each nucleus; elements cannot be reduced to simpler substances by normal chemical means
Elevation	height above a given level, especially sea level
Embryo	an organism in its early stages of development, especially before it has reached a distinctively recognizable form
Energy	the capacity of a physical system to do work
Environment	the complex of physical, chemical, and biotic factors (as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival
Equator	the imaginary great circle around the Earth's surface, equidistant from the poles and perpendicular to the Earth's axis of rotation; it divides the Earth into the Northern Hemisphere and the Southern Hemisphere
Equilibrium	the state of a chemical reaction in which its forward and reverse reactions occur at equal rates so that the concentration of the reactants and products does not change with time
Erosion	the group of natural processes, including weathering, dissolution, abrasion, corrosion, and transportation, by which material is worn away from the earth's surface

Science Glossary of Terms (continued)

Error	difference between a computed or measured value and a true or theoretically correct value
Evaporation	to convert or change into a vapor
Evidence	information acquired through objective experience
Evolution	a gradual process in which something changes into a different form
Experiment	a test under controlled conditions that is made to examine the validity of a hypothesis or determine the efficacy of something previously untried
Explanation	a statement based on scientific evidence and logical argument about causes and effects or relationships between variables
Food chain	a succession of organisms in an ecological community that constitutes a continuation of food energy from one organism to another as each usually consumes a lower member and in turn is preyed upon by a higher member
Food pyramid	a graphic representation of the structure of a food chain, depicted as a pyramid having a broad base formed by producers and tapering to a point formed by end consumers. Between successive levels, total biomass decreases as energy is lost from the system.
Food web	a complex of interrelated food chains in an ecological community
Force	an influence tending to change the motion of a body or produce motion or stress in a stationary body; a push or a pull
Fossil	a remnant or trace of an organism of a past geologic age, such as a skeleton or leaf imprint, embedded and preserved in the Earth's crust
Fossil fuel	a hydrocarbon deposit, such as petroleum, coal, or natural gas, derived from living matter of a previous geologic time and used for fuel
Frequency	the number of complete cycles of a periodic process occurring per unit time
Friction	a force that resists the relative motion or tendency to such motion of two bodies in contact
Front	the interface between air masses of different temperatures or densities
Fruit	the ripened ovary or ovaries of a seed-bearing plant
Function	the role or purpose of a structure
Galaxy	any of numerous large-scale aggregates of stars, gas, and dust that constitute the universe
Gas	the state of matter distinguished from the solid and liquid states by relatively low density and viscosity, relatively great expansion and contraction with changes in pressure and temperature, the ability to diffuse readily, and the spontaneous tendency to become distributed uniformly throughout any container

Science Glossary of Terms (continued)

Gene	hereditary unit consisting of a sequence of DNA that occupies a specific location on a chromosome and determines a particular characteristic in an organism
Genetics	the branch of biology that deals with heredity, especially the mechanisms of hereditary transmission and the variation of inherited characteristics among similar or related organisms
Geologic time	the period of time covering the physical formation and development of Earth, especially the period prior to human history
Geology	the scientific study of the origin, history, and structure of the earth
Geosphere	the solid part of the earth consisting of the crust and outer mantle
Germination	the beginning of development of a seed after a period of dormancy or rest
Glacier	a huge mass of ice slowly flowing over a land mass, formed from compacted snow in an area where snow accumulation exceeds melting and sublimation
Gram	the basic unit of mass in the metric system
Gravity	the force that attracts a body towards the center of the Earth, or towards any other physical body having mass
Greenhouse effect	the phenomenon whereby the Earth's atmosphere traps solar radiation, caused by the presence in the atmosphere of gases such as carbon dioxide, water vapor, and methane that allow incoming sunlight to pass through but absorb heat radiated back from the Earth's surface
Greenhouse gas	a gas, such as carbon dioxide, that contributes to the greenhouse effect by absorbing infrared radiation
Groundwater	water beneath the Earth's surface, often between saturated soil and rock, which supplies wells and springs
Habitat	the area or environment where an organism or ecological community normally lives or occurs
Heart	the chambered muscular organ in vertebrates that pumps blood received from the veins into the arteries, thereby maintaining the flow of blood through the entire circulatory system
Heat	a form of energy associated with the motion of atoms or molecules and capable of being transmitted through solid and fluid media by conduction, through fluid media by convection, and through empty space by radiation
Heredity	genetic transmission of characteristics from parent to offspring

Science Glossary of Terms (continued)

Homeostasis	the ability or tendency of an organism or cell to maintain internal equilibrium by adjusting its physiological processes
Humidity	the amount of water suspended in the air in tiny droplets
Hydrologic cycle	the cycle of evaporation and condensation that controls the distribution of the Earth's water as it evaporates from bodies of water, condenses, precipitates, and returns to those bodies of water
Hydrosphere	the watery layer of the Earth's surface; includes water vapor
Hypothesis	a tentative explanation for an observation
Igneous	rocks or minerals formed by the cooling and hardening of magma or molten lava
Implication	a probable consequence
Independent variable	a manipulated variable in an experiment or study whose presence or degree determines the change in the dependent variable
Infrared	electromagnetic radiation having a wavelength just greater than that of red light but less than that of microwaves, emitted particularly by heated objects
Inheritance	genetic transmission of characteristics from parent to offspring
Insulator	a material that prevents the flow of electricity
Internal balance	balance within an organism of its internal environment
Intestines	the portion of the alimentary canal extending from the stomach to the anus and, in humans and other mammals, consisting of two segments, the small intestine and the large intestine
Invertebrate	an animal, such as an insect or mollusk, which lacks a backbone or spinal column
Investigation	a detailed inquiry or systematic examination
Kidneys	pair of organs in the dorsal region of the vertebrate abdominal cavity, functioning to maintain proper water and electrolyte balance, regulate acid-base concentration, and filter the blood of metabolic wastes, which are then excreted as urine
Kilogram	metric unit equaling 1000 grams
Kinetic energy	energy which a body possesses by virtue of being in motion
Landform	a recognizable, naturally formed feature on the Earth's surface. Landforms have a characteristic shape and can include such large features as plains, plateaus, mountains, and valleys, as well as smaller features such as hills, eskers, and canyons
Length	the distance of something from end to end, usually the longest dimension
Life cycle	the course of developmental changes in an organism from fertilized zygote to maturity when another zygote can be produced

Science Glossary of Terms (continued)

Life stage	the stages or forms that an insect goes through as it is developing; egg, larva, pupa, adult
Light	electromagnetic radiation that can produce a visual sensation
Line graph	a diagram that exhibits a relationship, often functional, between two sets of numbers as a set of points having coordinates determined by the relationship
Liquid	the state of matter in which a substance exhibits a characteristic readiness to flow, little or no tendency to disperse, and relatively high incompressibility
Liter	basic unit of fluid volume in the metric system
Lithosphere	the rigid outer part of the earth, consisting of the crust and upper mantle
Liver	a large, reddish-brown, glandular vertebrate organ located in the upper right portion of the abdominal cavity that secretes bile and is active in the formation of certain blood proteins and in the metabolism of carbohydrates, fats, and proteins
Living	alive, having life, not dead
Locomotion	movement
Lungs	the two spongy, saclike respiratory organs in most vertebrates, occupying the chest cavity together with the heart and functioning to remove carbon dioxide from the blood and provide it with oxygen
Macromolecule	a very large molecule, such as a polymer or protein, consisting of many smaller structural units linked together
Macroscopic	large enough to be perceived or examined by the unaided eye
Magnet	an object that sticks to iron
Magnetism	the property displayed by magnets and produced by the motion of electric charges, which results in attraction or repulsion between objects
Magnitude	relative size or extent
Mass	the quantity of matter which a body contains, as measured by its acceleration under a given force or by the force exerted on it by a gravitational field
Matter	physical substance or material in general; that which occupies space and possesses mass
Measure	to ascertain the dimensions, quantity, or capacity of
Mechanical	relating to the action of forces on material objects
Meiosis	the process of cell division in sexually reproducing organisms that reduces the number of chromosomes in reproductive cells from diploid to haploid, leading to the production of gametes in animals and spores in plants
Melting point	the temperature at which a solid becomes a liquid at standard atmospheric pressure

Science Glossary of Terms (continued)

Metamorphic	rocks altered considerably from the original structure and composition by pressure and heat
Metamorphosis	a change from larva to adult
Meteorology	the science that deals with the phenomena of the atmosphere, especially weather and weather conditions
Meter	metric unit of length
Metric	system of weights and measures based on multiples of ten
Microscopic	too small to be seen by the unaided eye but large enough to be studied under a microscope
Milliliter	one one-thousandth of a liter; 1000 milliliters equal 1 liter
Millimeter	one one-thousandth of a meter; 1000 millimeters equal 1 meter
Mineral	a naturally occurring, homogeneous inorganic solid substance having a definite chemical composition and characteristic crystalline structure, color, and hardness
Mitosis	a type of cell division in which daughter cells have the same number and kind of chromosomes as the parent nucleus
Mixture	a composition of two or more substances that are not chemically combined with each other and are capable of being separated
Model	an explanation or representation of an object, system, or process that cannot be easily studied
Molecule	the simplest unit of a chemical compound that can exist, consisting of two or more atoms held together by chemical bonds
Moon	the natural satellite of the earth, orbiting it every 28 days and shining by reflected light from the sun
Moon (lunar) phases	one of the cyclically recurring apparent forms of the moon
Motion	a natural event that involves a change in the position or location of something
Multicellular	describes organisms consisting of more than one cell
Muscular system	the body system that is composed of skeletal, smooth, and cardiac muscle tissue and functions in movement of the body or of materials through the body, maintenance of posture, and heat production
Mutation	a change in genetic structure which results in a variant form and may be transmitted to subsequent generations

Science Glossary of Terms (continued)

Natural resources	a material source of wealth, such as timber, fresh water, or a mineral deposit, that occurs in a natural state and has economic value
Natural selection	adapted to their environment tend to survive and transmit their genetic characteristics in increasing numbers to succeeding generations while those less adapted tend to be eliminated
Nervous system	the system of cells, tissues, and organs that regulates the body's responses to internal and external stimuli. In vertebrates it consists of the brain, spinal cord and nerves
Neutron	a neutral elementary particle of about the same mass as a proton
Niche	the function or position of an organism or population within an ecological community
Nonliving	not alive; referring to something that has never been alive
Nonrenewable resource	of or relating to an energy source, such as oil or natural gas, or a natural resource, such as a metallic ore, that is not replaceable after it has been used
Nuclear	relating to atomic nuclei; derived from the energy of atomic nuclei
Nutrient	any substance that can be metabolized by an organism to give energy and build tissue
Observation	the act of making and recording a measurement
Oceanography	the branch of science concerned with the physical and biological properties and phenomena of the sea
Opinion	a belief or conclusion held with confidence but not substantiated by positive knowledge or evidence
Orbit	the path of a celestial body or an artificial satellite as it revolves around another body
Organism	a living thing that has (or can develop) the ability to act or function independently
Organ	structure of the body that performs a particular function
Pangaea	(plate tectonics) a hypothetical super-continent that included all the landmasses of the earth before the Triassic Period. When continental drift began, Pangaea broke up into Laurasia and Gondwanaland
Parallel circuit	a closed circuit in which the current divides into two or more paths before recombining to complete the circuit
Parasite	an organism that grows, feeds, and is sheltered on or in a different organism while contributing nothing to the survival of its host
Particle	a very small piece of matter
Particulate model	model of matter describing all matter as composed of particles with space in between them; the relative distance between particles and the motion of the particles can be used to explain the phases of matter (gas, liquid, solid)

Science Glossary of Terms (continued)

Particulate model	model of matter describing all matter as composed of particles with space in between them; the relative distance between particles and the motion of the particles can be used to explain the phases of matter (gas, liquid, solid)
Periodic table	a table of the chemical elements arranged in order of atomic number, usually in rows, with elements having similar atomic structure appearing in vertical columns
pH	p(otential of) H(ydrogen); a measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. The pH scale commonly in use ranges from 0 to 14
Phase change	a change from one state (solid or liquid or gas) to another without a change in chemical composition
Photosynthesis	biochemical process of transforming light energy into stored chemical energy in the form of glucose; chemical formula $6CO_2 + 6H_20 +$ light energy $\rightarrow 6O_2 + C_6H_{12}O_6$
Physical change	a change from one state (solid or liquid or gas) to another without a change in chemical composition
Physical property	property of a substance that can be measured without altering the identity of the substance
Physics	the science of matter and energy and of interactions between the two
Physiology	the branch of biology concerned with the normal functions of living organisms and their parts
Planet	a non-luminous celestial body larger than an asteroid or comet
Plasma	an electrically neutral, highly ionized gas composed of ions, electrons, and neutral particles. It is a phase of matter distinct from solids, liquids, and normal gases.
Plate tectonics	a theory that explains the global distribution of geological phenomena such as seismicity, volcanism, continental drift, and mountain building in terms of the formation, destruction, movement, and interaction of the earth's lithospheric plates
Plateau	an elevated, comparatively level expanse of land
Polarity	the state of having poles or opposites
Pole	either extremity of an axis through a sphere
Pollination	transfer of pollen from the anther to the stigma of a plant
Population	all the organisms that constitute a specific group or occur in a specified habitat
Position	place or location
Potential energy	the energy possessed by a body by virtue of its position or state
Precipitation	any form of water, such as rain, snow, sleet, or hail, which falls to the Earth's surface

Science Glossary of Terms (continued)

Prediction	a statement about what one thinks will happen in an investigation
Pressure	force applied uniformly over a surface, measured as force per unit of area
Prevailing wind	a wind from the predominant or most usual direction
Producer	an organism, such as a green plant, that produces its own food
Product	a substance resulting from a chemical reaction
Property	something that can be known by looking at or feeling an object; something one can observe
Proton	an elementary particle in all atoms that has a positive charge
Qualitative	involving distinctions, descriptions, or comparisons based on qualities that can be observed without measurement (*e.g.* color, shape, appearance)
Quantitative	involving distinctions, descriptions, or comparisons that can be quantified or measured
Radiation	emission and propagation of energy in the form of rays or waves
Radiometric dating	a method of determining the age of objects or material using the decay rates of radioactive components such as potassium-argon
Ratio	the relationship between two quantities expressed as the quotient of one divided by the other
Recessive	an allele that does not produce a characteristic effect when present with a dominant allele; a trait that is expressed only when the determining allele is present in the homozygous condition
Renewable resource	any natural resource (as wood or solar energy) that can be replenished naturally with the passage of time
Repel	push away, as similar poles of two magnets push away from one another
Replication	the process whereby DNA makes a copy of itself before cell division
Reproduction	the sexual or asexual process by which organisms generate new individuals of the same kind; procreation
Respiratory system	the organs that are involved in breathing; these include the nose, throat, larynx, trachea, bronchi, and lungs. Also called the respiratory tract
Resource	available supply of something that can be drawn upon when needed

Science Glossary of Terms (continued)

RNA	(Ribonucleic Acid) – a substance in living cells which carries instructions from DNA for controlling the synthesis of proteins and in some viruses carries genetic information instead of DNA
Rock	any natural material with a distinctive composition of minerals
Rock cycle	the process by which rocks are recycled and changed from one form of rock to another
Rotation	the act or process of turning around a center or an axis
Salinity	the relative proportion of salt in a solution
Satellite	any celestial body orbiting around a planet or star
Science	the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment
Scientific Law	a phenomenon of nature that has been shown to invariably occur whenever certain conditions exist or are met
Scientific Theory	a well-substantiated explanation of some aspect of the natural world; an organized system of accepted knowledge that applies in a variety of circumstances to explain a specific set of phenomena; "scientific theories must be falsifiable"
Season	one of the natural periods into which the year is divided by the equinoxes and solstices or atmospheric conditions
Sediment	material that has been deposited by water, ice or wind
Sedimentary	rocks formed when sediment is deposited and becomes tightly compacted
Series circuit	an electric circuit connected so that current passes through each circuit element in turn without branching
Sexual reproduction	reproduction by the union or fusion of two differing gametes
Shelter	something that provides cover or protection
Skeleton	hard inner framework of bones inside an animal that provides shape, support, and protection
Skin	flexible organ that covers the body and protects it
Soil	the top layer of the Earth's surface, consisting of rock and mineral particles mixed with organic matter
Solar system	a system of planets or other bodies orbiting a star

Science Glossary of Terms (continued)

Solid	the state in which a substance has no tendency to flow under moderate stress; resists forces (such as compression) that tend to deform it; and retains a definite size and shape
Solubility	the quality or condition of being soluble
Soluble	that can be dissolved, especially easily dissolved
Solution	homogeneous mixture of two or more substances, which may be solids, liquids, gases, or a combination of these
Sort	to arrange according to class, kind, or size; classify
Sound	vibrations transmitted through an elastic solid or a liquid or gas, capable of being detected by human organs of hearing
Source	the point or device from which electricity flows
Space	an empty area (usually bounded in some way between things); the expanse in which the solar system, stars, and galaxies exist; the universe
Species	a fundamental category of taxonomic classification, ranking below a genus or subgenus and consisting of related organisms capable of interbreeding
Specific heat	the ratio of the amount of heat required to raise the temperature of a unit mass of a substance by one unit of temperature to the amount of heat required to raise the temperature of a similar mass of a reference material, usually water, by the same amount
Spectroscope	an instrument for producing and observing spectra, the entire range of wavelengths of electromagnetic radiation
Speed	the rate or a measure of the rate of motion
Star	a celestial body of hot gases that radiates energy derived from thermonuclear reactions in the interior
State of matter	the physical state that matter exists in; solid, liquid or gas
Static electricity	electricity that is generated when one object rubs against another object; positive and negative electric charges that are separated from each other and are not moving
Stem	any stalk supporting leaves, flowers, or fruit
Stomach	the enlarged, saclike portion of the alimentary canal, one of the principal organs of digestion, located in vertebrates between the esophagus and the small intestine
Stratosphere	the atmospheric layer between the troposphere and the mesosphere
Structure	any identifiable part of an organism
Substance	a particular kind of matter with uniform properties
Sun	the star round which the earth orbits

Science Glossary of Terms (continued)

Support	to bear the weight of; to hold in position so as to keep from falling, sinking, or slipping
Switch	device used to open and close circuits
Surface	the outer or the topmost boundary of an object
Symbiotic	a close, prolonged association between two organisms in which both benefit
Synthesis	formation of a compound from simpler compounds or elements
System	a group of interacting, interrelated, or interdependent elements forming a complex whole
T-chart	a graphic organizer with two columns in which the entry in one column is paired with the entry in the other
Table	an orderly arrangement of data, especially one in which the data are arranged in columns and rows in an essentially rectangular form
Telescope	a scientific instrument designed to collect and record electromagnetic radiation from cosmic sources
Temperature	a measure of the average kinetic energy of the particles in a sample of matter, expressed in terms of units or degrees designated on a standard scale
Testable	able to be tested or investigated by a scientific investigation
Thermometer	a tool used to measure temperature
Tide	the alternate rising and falling of the sea due to the attraction of the moon and sun
Tissue	aggregation of morphologically similar cells and associated intercellular matter acting together to perform one or more specific functions in the body
Transfer	to convey or cause to pass from one place or thing to another
Transform	to convert from one form to another
Troposphere	the lowest region of the atmosphere between the Earth's surface and the tropopause, characterized by decreasing temperature with increasing altitude
Ultraviolet	electromagnetic radiation having a wavelength just shorter than that of violet light but longer than that of X-rays
Unicellular	consisting of a single cell

Science Glossary of Terms (continued)

Unit	a standard amount of a physical quantity, such as length or energy, used to express magnitudes of that quantity
Universe	all matter and energy, including the Earth, the galaxies, and the contents of intergalactic space, regarded as a whole
Uplift	upheaval; raising something to a higher level
Variable	a factor or condition that can change and might affect the outcome of an experiment
Velocity	a vector quantity whose magnitude is a body's speed and whose direction is the body's direction of motion
Verify	to determine or test the accuracy of, as by comparison, investigation, or reference
Visible light	electromagnetic radiation that can produce a visual sensation
Volcanic eruption	the sudden occurrence of a violent discharge of steam and volcanic material
Volcano	an opening in the Earth's crust through which molten lava, ash, and gases are ejected
Volume	the amount of 3-dimensional space occupied by an object
Water cycle	the circulation of the Earth's water, in which water from the sea evaporates, forms clouds, falls as rain or snow, and returns to the sea by rivers
Wavelength	the distance between one peak or crest of a wave of light, heat, or other energy and the next corresponding peak or crest
Weather	the state of the atmosphere at a given time and place, with respect to variables such as temperature, moisture, wind velocity, and barometric pressure
Weathering	any of the chemical or mechanical processes by which rocks exposed to the weather undergo changes in character and break down
Weight	the force with which a body is attracted to Earth or another celestial body, equal to the product of the object's mass and the acceleration of gravity
White light	apparently colorless light containing all the wavelengths of the visible spectrum at equal intensity (such as ordinary daylight)
Work	the transfer of energy from one physical system to another, especially the transfer of energy to a body by the application of a force that moves the body in the direction of the force
Year	the time taken by the Earth to make one revolution around the sun