SCIENCE

Standards Alignment Toolkit

High School

KANSAS STATE DEPARTMENT OF EDUCATION

Kansas leads the world in the success of each student.

Feb. 4, 2025

Contents

CONTENTS

Overview

Purpose of the Toolkit

The Standards Alignment Toolkit supports educators with aligning curriculum, instruction, and assessments with the Kansas State Standards, the first step toward ensuring all students receive a high-quality education. This toolkit is designed to reduce the time and effort required to break down or make sense of the standards, enabling teachers to focus more on preparing to deliver meaningful instruction that fosters student engagement.

This Standards Alignment Toolkit offers:

- Guidance to deeply understand and internalize the expectations of the Kansas State Standards
- Insights into the interconnectedness of the standards, including vertically (across grade levels) and horizontally (within grade levels)
- Instructional resources to support the delivery of content that is coherent, relevant, and aligned with the expectations of the standards

By aligning standards, curriculum, and assessments, the toolkit plays a critical role in ensuring that:

- Instruction is cohesive, building logically on prior knowledge while also preparing students for future learning.
- Instructional materials are relevant and tailored to meet students' unique learning needs.
- Students are set up for success with the knowledge and skills they need to meet the expectations of grade-level learning outcomes.

The Kansas State Department of Education (KSDE) recognizes that a deep understanding of and alignment to Kansas State Standards is essential to ensuring that all students receive an excellent education. **This toolkit simplifies the process of standards alignment, equipping educators with the tools they need to enhance student success while focusing on what matters most - providing effective and meaningful instruction.**

HOW TO USE THE TOOLKIT

Teachers might use this toolkit to:

- Engage in a guided process to internalize what their grade-level standards expect students to know and be able to do by the end of the year
- Leverage a deeper understanding of the standards to assess student learning aligned to the standards and the alignment of instructional materials: Are the lessons and units I'm currently using fully aligned to the depth of the standards? If not, how can or should I fill those gaps?
- Use provided resources, templates, and processes to plan for upcoming units and/or lessons.

School, **district** and **regional leaders** might use this toolkit to:

- Internalize what high-quality, grade-level instruction looks and sounds like for the content area and how standards form the basis of that vision
- Deepen their understanding of the grade-level standards for the content areas they coach and/or support in other ways (e.g. professional development).
- Align on language and resources used within the content area to be better equipped to support educators with content-specific development

Four Fundamentals

In Kansas, building capacity to elevate and unlock opportunities for all students and reduce limitations involves the **Four Fundamentals**[1] at the district, school building, and classroom levels:

Structured Literacy

We provide literacy instruction in pre-K-12 aligned to the science of reading and assure teachers and admin are well-trained and knowledgeable in the elements and implementation of structured literacy.

Structured Literacy refers to the explicit, systematic, diagnostic, and cumulative approach to teaching literacy that acknowledges the value of both word recognition and oral and written language comprehension as evidenced in all grades and disciplines.

Standards Alignment

We align lessons, instruction, and materials to Kansas standards and clearly identify what students must know and be able to do. This includes interpersonal, intrapersonal, and cognitive skills in pre-K-12.

Standards Alignment refers to clearly defined student learning expectations aligned to Kansas State Standards and supported with evidence-based instruction and materials. Content, lessons, instruction, and materials should support the standards.

Balanced Assessment

We assess students for risk and standards in pre-K-12 and use data to adjust instruction. We have a deep understanding of the purpose of each assessment and how to use the data to raise achievement.

A **Balanced Assessment** system refers to a collection of varying types of assessments that provide feedback regarding instruction and student learning. It utilizes assessment as a measure for learning and of learning.

Quality Instruction

We have a culture of high expectations in our classrooms and provide each student access to grade-level standards and content through high-quality instructional materials in pre-K-12.

Quality Instruction refers to implementation of evidence-based lesson design that reflects high expectations, meaningful student engagement, and learning activities aligned to the Kansas State Standards. A data-driven system of differentiated supports is necessary to help each student meet rigorous state standards.

1 KSDE. *Fundamentals: The foundation for school improvement in Kansas Schools.* In Kansas School Improvement Model. [PDF] https://www.ksde.gov/Portals/0/TLA/Accreditation/Rue%20Docs/Updated%20SI%20Model.pdf?ver=2025-01-17-093630-683

Instructional Vision for Science

The Kansas State Department of Education (KSDE) believes that all Kansas students deserve consistent access to high-quality science instruction that empowers them to make sense of the world around them through inquiry, investigation, and evidence-based reasoning. Kansas students will engage in science experiences that are anchored in meaningful and relevant real-world phenomena and drive students to ask and investigate questions, think critically, and revise their thinking. Students will develop the skills and confidence to explain how and why the world works and to solve real-world problems.

To that end, Kansas' learners should have consistent access to strong science instruction and high-quality instructional materials aligned to the **Kansas Science Standards**.[2]

All Kansas learners deserve science instruction characterized by:

- **Sensemaking:** Students do the work of scientists, seeking to understand and explain how and why the world works the way it does. Teachers organize instruction in a way that allows students to ask and investigate question(s), develop knowledge through investigations (rather than simply being given knowledge), communicate evidence-based explanations, and develop solutions to authentic problems. Even when the teacher provides support and scaffolds, students still own the complex work of sensemaking.
- **Phenomena:** Students explore natural phenomena to note observations, ask questions, and make predictions about how the world works. They identify real-world problems and propose solutions. Teachers create opportunities for students to experience phenomena in a variety of ways (firsthand or through video, images, graphs, maps, etc.) and facilitate students' efforts to gather evidence to figure out how or why the phenomena occur.
- **Three-Dimensional Instruction:** Students engage with relevant science and engineering practices, disciplinary core ideas, and cross-cutting concepts needed to explain how or why a phenomenon occurs. Teachers intentionally and coherently integrate the science and engineering practices, disciplinary core ideas, and cross cutting concepts appropriate for the grade and subject, scaffolding students' understanding so they can make sense of rigorous content, big science ideas, and phenomena.
- **Discourse and Collaboration:** Students share ideas, build on and critique one another's ideas, and revise their thinking as new evidence emerges or compelling ideas are shared related to the lesson's content, concepts or phenomenon. Teachers cultivate a community of learners in which students feel comfortable taking intellectual risks among their peers and engaging in productive struggle through the process and in service of scientific inquiry.
- **Local and Cultural Relevance:** Students have opportunities to apply scientific knowledge, skills, and problem-solving to real-world examples, making connections to their lives outside of the classroom. The cultural knowledge, languages, and ways of thinking students bring with them are valued and incorporated into learning experiences wherever possible. Teachers strategically adapt and supplement instructional materials to address students' and local needs.

Sources:

- **Sensemaking**[3] (NSTA)
- **Vision for Science Education**[4] (Wisconsin Department of Public Instruction)
- **Equity and Access in Science Education**[5] (Wisconsin Department of Public Instruction)

2 KSDE, (2009). *Kansas Science Standards.* https://community.ksde.gov/science/KansasScienceStandards/KSScienceStandards.aspx

3 Sensemaking. (n.d.). NSTA. https://www.nsta.org/sensemaking#tab

4 https://dpi.wi.gov/science#:~:text=A%20Vision%20for%20Science%20Education,requiring%20that%20type%20of%20work

5 https://dpi.wi.gov/sites/default/files/imce/science/WSST_and_DPI_Science_-_Equity_and_Access_Position_Statement_-_Nov_2021.pdf

Kansas Science Standards

Kansas Next Generation Science Standards, NGSS, are three-dimensional standards. The Performance Expectation (PE) and its supporting elements are considered the standard. Each standard consists of a Science and Engineering Practice (SEP), a Disciplinary Core Idea (DCI), and a Cross Cutting Concept (CCC). Science is a multi-dimensional discipline, and all three dimensions must be considered and taught. Throughout this document, the vertical alignment, K-12, of each dimension is provided for every single standard. The full appendix for the SEPs [6], DCIs , and CCCs [7] were used to create this document.

The Kansas State standards reflect what students should know and be able to do at each grade level. We do not recommend prioritizing standards at the exclusion of other standards. High quality instruction includes teaching **all standards for all students** at the appropriate depth and rigor and includes reteaching standards that students have not mastered.[8]

The NGSS standards document and its appendices are the board adopted standards and should supersede this tool. This tool is intended to provide an outline of the vertical alignment of all three dimensions of each standard in this course and to provide clarity in expectations of each standard to ensure appropriate rigor of content.

Depth of Knowledge for the science standards is determined from the Science and Engineering Practices (SEP). While this process looks different from other content areas, it reflects the intent of the Framework for K-12 Science Education[9] and the Kansas State Department of Education.

The organization of this document follows the recommended scope and sequence that may be found in the 2023 KSDE Science High School Scope and Sequence Guidance.

The information for this document came from three locations: Disciplinary Core Idea Appendix2, Cross Cutting Concepts Appendix[10], Science and Engineering Appendix.1

6 *APPENDIX F – Science and Engineering Practices in the NGSS* – April 2013 (nextgenscience.org) [PDF] https://www.nextgenscience.org/sites/default/files/resource/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf

7 *Appendix G Cross Cutting Concepts in the NGSS* - FINAL 060513.pdf (nextgenscience.org) [PDF]: https://www.nextgenscience.org/sites/default/files/resource/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

8 *Addressing the Prioritization of Standards*, Fact Sheet https://www.ksde.gov/LinkClick.aspx?fileticket=Z5tBLSYTR9k%3D&tabid=472&portalid=0&mid=4744

9 National Academies of Sciences, Engineering, and Medicine. 2012. A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press. https://nap.nationalacademies.org/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts

10 2023 Science High School Scope and Sequence Guidance https://community.ksde.gov/LinkClick.aspx?fileticket=wmQyOpyeCBs%3d&tabid=5785&mid=13857

Standards Alignment Process and Purpose

PROCESS AND PURPOSE

Standards alignment involves several key steps to ensure that educational content being taught is coherent, relevant, and effectively represents what students at each grade level should know and be able to do.

It involves three-way alignment between standards, curriculum (the intentional plan and resources for guiding students to learn what is necessary to meet the standard) and assessment (an examination of to what extent the student meets the standard).

Carefully aligning curriculum to standards is a process that takes time. It also requires intentionality, communication and a desire to closely reflect on the effectiveness of our practices and resources. It is a process that is most successful if all teachers are fully engaged in the process. Carefully planned professional learning will be needed throughout this process. The following steps will lead educators through the process of standards alignment.

1. **Define learning outcomes by close examination of the "unpacked" standards.**

   Note: The KSDE science team has unpacked each standard to identify key experiences, ideas, and concepts students need to reach the level of the standard. These unpacked standards are included in course-specific standards alignment toolkits. The process used to unpack these standards is included in the next section of this document.

2. **Vertical alignment:**

   Note: The KSDE science team has unpacked each standard which includes information on the vertical alignment for each dimension of each standard. These unpacked standards are included in course-specific standards alignment toolkits. The process used to unpack these standards is included in the next section of this document.

3. **Horizontal alignment:**

   a. Identify how/when the content standards are addressed within a grade level (horizontal alignment).

      Note: It is recommended to determine "bundles" of standards that can be aligned to a shared phenomena. KSDE recommendations for standards bundles can be found in the "recommended scope and sequence".

   b. Clarify if there is a district-wide scope and instructional sequence.

      Note: KSDE has a recommended scope and sequence for science standards for each grade level

   c. Intentionally collaborate to coordinate instruction of grade level content across subjects.

   d. Review standards and the assessment blueprint.

4. **Analyze existing curriculum:**
    a. Review the current curriculum adopted. In review, consider any required or recommended learning objectives, content, and assessments.
    c. Identify any gaps, redundancies, or outdated resources.

    Note: The KSDE Instructional Materials and Curriculum Evaluation Tool can be used to analyze an existing curriculum.

5. **Assessments alignment and timeline:**
    a. Align all assessments (quizzes, tests, projects) with learning outcomes.
    b. Select continuing formative assessments that will inform instruction.

6. **Map content and skills:**
    a. Map existing content (lessons, units, activities) to the defined learning outcomes.
    b. Ensure that instruction is at the appropriate level of all three dimensions of the science standards
    c. Identify specific gaps of content or skills that may exist and identify or create supplemental materials to fill the gaps.
    d. Consider the unique characteristics of the students in your classroom and how they will engage with the content and skills.

    Note: The "Student Standard Alignment Tool" is intended to be used in the planning process to consider the unique knowledge, interests, and needs of students.

7. **Monitor and revise:**
    a. Continuously monitor student performance and adjust as needed. Plan intentionally for all educators to be actively involved in data analysis and interpretation to determine changes that should be made.
    b. Regularly review and update the curriculum based on feedback and data. Remember that curriculum alignment is an ongoing process, and collaboration among teachers, administrators, and stakeholders is crucial for its success!

Unpacked Science Standards

(Define learning outcomes and vertical alignment)

The KSDE science team has unpacked each standard for the three-dimensions of content. There should not be an expectation for an individual teacher to do the work of unpacking standards in science, but instead to engage deeply with the unpacked science standards to consider how to best plan instruction and assessment of the students in their classrooms. Below is an overview of the process used to systematically identify the key ideas, experiences, and concepts a student needs to show mastery of a standard.

1. Identify the standards.
    - Performance Expectation (PE) and its supporting elements are considered the standard.
        - Each standard consists of a Science and Engineering Practice (SEP), a Disciplinary Core Idea (DCI), and a Cross Cutting Concept (CCC).
        - Students need access to each of the three dimensions of the standard to be successful
    - The standards have been arranged into Standards Bundles that are aligned to KSDE's 2023 Science HS Scope and Sequence Guidance

2. Closely examine **vertical alignment** of the elements of the standard.
    - For each dimension of the standard (DCI, SEP, CCC) the elements from grades K-8 that specifically build towards each specific high school standard have been included in this document.
        - For the DCI elements, the foundational concepts that bridge the gap between prior grade level standards and the grade 9-12 standard were identified as the key information that must be taught before reaching the intent of the standard.
        - For the SEP and CCC dimensions, the differences between prior grade level elements and the 9-12 elements were identified.

3. Determine the key experiences, ideas, and concepts necessary to show mastery.
    - Only content that is explicitly indicated in the standard (in the performance expectation and/or defined elements) is included and expected of students.
    - Each standard has key experiences, ideas, and concepts that are necessary to meet the full standard.
        - The key experiences are aligned to the Science and Engineering Practices (SEPs).
        - The key ideas are aligned to the Disciplinary Core Ideas (DCIs).
        - The key concepts are aligned to the Cross Cutting Concepts (CCCs).

4. Identify any additional information needed to understand the unpacked standard.
    - This could include decisions that were made about what to include and/or not include in the key experiences, ideas, or concepts.
    - This could include clarification around the intention of the standard as determined during the unpacking process
    - This could include clarification needed

    Note: Engineering and Technology Standards (ETS)

    ETS are included in NGSS, however each is explicitly tied to an additional performance expectation aligned to either life, physical, or earth and space science and are not intended to be taught in isolation.

    The ETS standards were not unpacked in this document. However, components of engineering design were considered when unpacking standards that are linked to ETS and are included in multiple SEPs.

Recommended High School Scope and Sequence Guidance

(Horizontal alignment)

The graduation requirements outlined by the Kansas Department of Education state that students should earn three credits in the areas of science that include concepts of Life Science (LS), Physical Science (PS) and Earth/ Space Science (ESS). The intent is that all the standards in these areas are mapped to courses at the local level and KSDE does not dictate which courses are required and we recognize that the scope and sequence of courses vary greatly across the state.

Historically across the nation a sequence including the Physics, Biology, and Chemistry has been identified as the most common. For this reason we have bundled the high school standards to align to these three courses and incorporated the Earth and Space standards into discipline courses where it best aligns.

We recognize that student choice and agency is important and as such intend for the recommended standards' bundles to only serve as guidance while making decisions at the local level.

The grouping below show an overview of the recommended bundling and course alignment of the Kansas Curricular Standards for Science.

Physical Science (03159) or Physics (03151)

ONE DIMENSIONAL MOTION
- HS-PS2-1
- HS-PS2-2
- HS-PS2-3

GRAVITY AND ORBITS
- HS-PS2-4
- HS-ESS1-4
- HS-ESS1-6

EARTH'S SURFACE AND INTERIOR PROCESSES
- HS-ESS2-3
- HS-ESS2-1
- HS-ESS1-5

ENERGY CONVERSION
- HS-PS3-2
- HS-PS3-3

ELECTRICITY AND MAGNETISM
- HS-PS2-5
- HS-PS3-5

CLIMATE CHANGE
- HS-PS3-1
- HS-ESS2-4
- HS-ESS3-1
- HS-ESS3-4
- HS-ESS3-5
- HS-ESS3-6

ELECTROMAGNETIC RADIATION AND TECHNOLOGY
- HS-PS4-1
- HS-PS4-2
- HS-PS4-3
- HS-PS4-4
- HS-PS4-5

Note: This recommendation for physics is aligned to the NGSS physical science standards and the standards include clear assessment boundaries that support physics for all students. For example most standards are limited to 1-dimensional motion, basic algebraic expressions, computations, and manipulations, and simple systems. Many school systems use "physics" as an advanced science course that goes beyond the expectations of the NGSS standards. In this case this scope and sequence could be used in a "physical science" class.

Life Science - Biology (03051)

STRUCTURES AND PROCESSES OF LIFE
- HS-LS1-1
- HS-LS1-2
- HS-LS1-3
- HS-LS1-4
- HS-LS3-1
- HS-LS3- 2

ECOSYSTEMS
- HS-LS2-1
- HS-LS2-4
- HS-LS2-6

NATURAL SELECTION
- HS-ESS2-7
- HS-LS3-3
- HS-LS4-5
- HS-LS4-1
- HS-LS4-2
- HS-LS4-3
- HS-LS4-4
- HS-LS2-8

BIODIVERSITY
- HS-LS2-2
- HS-LS2-7
- HS-LS4-6
- HS-ESS2-2
- HS-ESS3-3
- HS-ESS3-2

Chemistry (03101)

PERIODIC TABLE AND BONDING
- HS-PS1-1
- HS-PS1-2

INTERMOLECULAR FORCES
- HS-PS1-3
- HS-PS2-6
- HS-ESS2-5

CHEMICAL REACTIONS AND BOND ENERGY
- HS-PS1-4
- HS-LS1-7
- HS-LS1-5
- HS-LS2-3

CYCLING AND CONSERVATION OF MATTER
- HS-PS1-7
- HS-LS1-6
- HS-LS2-5
- HS-ESS2-6

KINETICS AND EQUILIBRIUM
- HS-PS1-6
- HS-PS1-5
- HS-PS3-4

NUCLEAR ENERGY
- HS-ESS1-2
- HS-ESS1-1
- HS-ESS1-3
- HS-PS1-8

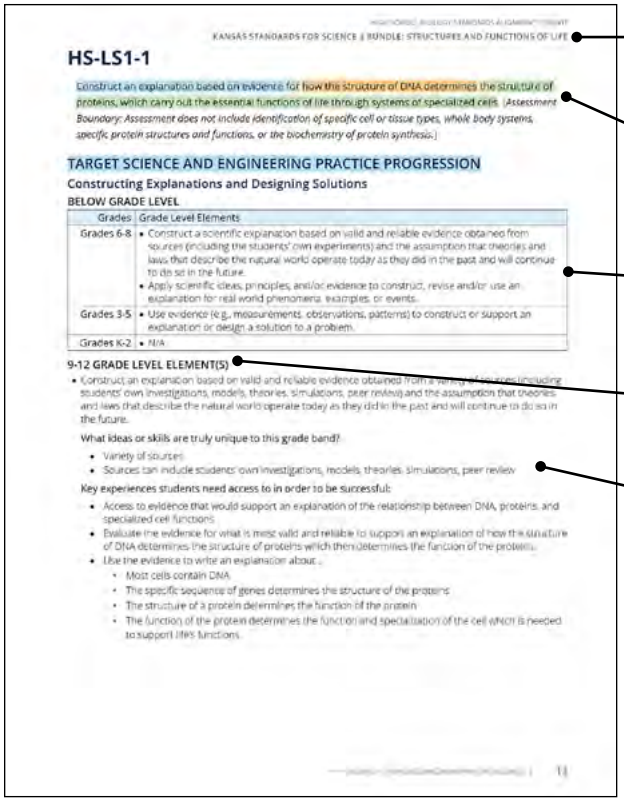
SCIENCE STANDARDS ALIGNMENT TOOLKIT - HIGH SCHOOL

Making Sense of the Unpacked Standards

Course specific toolkits have been developed for high school physics, biology, and chemistry based on the recommended scope and sequence standards guidance. In these toolkits KSDE has provided fully unpacked standards that include vertical alignment information, grade-band specific expectations, and key ideas, experiences, and concepts students need in order to master each standard.

With these Unpacked Standards Tools, we do not expect individual teachers to unpack the science standards. Instead, teachers should focus on analyzing curriculum, aligning assessments, mapping content and planning for students, and monitoring standards alignment.

The example below shows what to expect from the Unpacked Standards tools.



KANSAS STANDARDS FOR SCIENCE | BUNDLE: STRUCTURES AND FUNCTIONS OF LIFE

HS-LS1-1

Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells. (*Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.*)

TARGET SCIENCE AND ENGINEERING PRACTICE PROGRESSION

Constructing Explanations and Designing Solutions

BELOW GRADE LEVEL

Grades	Grade Level Elements
Grades 6-8	• Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. • Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real world phenomena, examples, or events.
Grades 3-5	• Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.
Grades K-2	• N/A

9-12 GRADE LEVEL ELEMENT(S)

• Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

What ideas or skills are truly unique to this grade band?

- Variety of sources
- Sources can include students' own investigations, models, theories, simulations, peer review

Key experiences students need access to in order to be successful:

- Access to evidence that would support an explanation of the relationship between DNA, proteins, and specialized cell functions
- Evaluate the evidence for what is most valid and reliable to support an explanation of how the structure of DNA determines the structure of proteins which then determines the function of the protein.
- Use the evidence to write an explanation about:
  - Most cells contain DNA
  - The specific sequence of genes determines the structure of the proteins
  - The structure of a protein determines the function of the protein
  - The function of the protein determines the function and specialization of the cell which is needed to support life's functions.

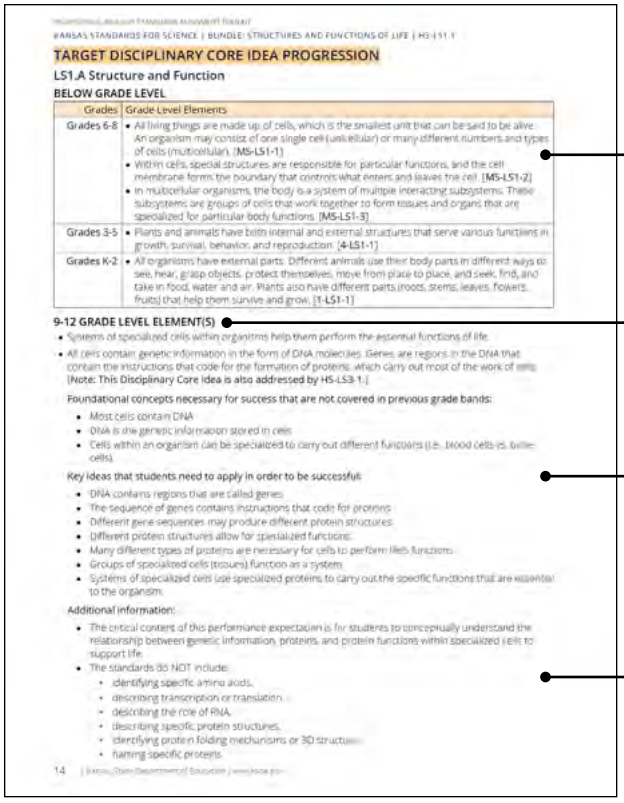
The standards have been grouped into "bundles" that are recommended to be taught and assessed together.

The performance expectation (PE) is the standard. The PE has been color coded to identify the three dimensions of the standard.

The vertical alignment information for the Science and Engineering Practice (SEP) comes from the NGSS Appendix F

The grade-level element is identified by NGSS for each dimension of each performance expectation.

The SEP has been unpacked by KSDE to identify what is new in the 9-12 grade band based on the vertical alignment and what are the key experiences a student needs to successfully reach the expectations of this SEP within the context of this standard.



KANSAS STANDARDS FOR SCIENCE | BUNDLE: STRUCTURES AND FUNCTIONS OF LIFE | HS-LS1-1

TARGET DISCIPLINARY CORE IDEA PROGRESSION

LS1.A Structure and Function

BELOW GRADE LEVEL

Grades	Grade Level Elements
Grades 6-8	• All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). [MS-LS1-1] • Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. [MS-LS1-2] • In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. [MS-LS1-3]
Grades 3-5	• Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. [4-LS1-1]
Grades K-2	• All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. [1-LS1-1]

9-12 GRADE LEVEL ELEMENT(S)

- Systems of specialized cells within organisms help them perform the essential functions of life.
- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)

Foundational concepts necessary for success that are not covered in previous grade bands:

- Most cells contain DNA.
- DNA is the genetic information stored in cells.
- Cells within an organism can be specialized to carry out different functions (i.e., blood cells vs. brain cells).

Key ideas that students need to apply in order to be successful:

- DNA contains regions that are called genes.
- The sequence of genes contains instructions that code for proteins.
- Different gene sequences may produce different protein structures.
- Different protein structures allow for specialized functions.
- Many different types of proteins are necessary for cells to perform life's functions.
- Groups of specialized cells (tissues) function as a system.
- Systems of specialized cells use specialized proteins to carry out the specific functions that are essential to the organism.

Additional information:

- The critical content of this performance expectation is for students to conceptually understand the relationship between genetic information, proteins, and protein functions within specialized cells to support life.
- The standards do NOT include:
  - identifying specific amino acids.
  - describing transcription or translation.
  - describing the role of RNA.
  - describing specific protein structures.
  - identifying protein folding mechanisms or 3D structures.
  - naming specific proteins.

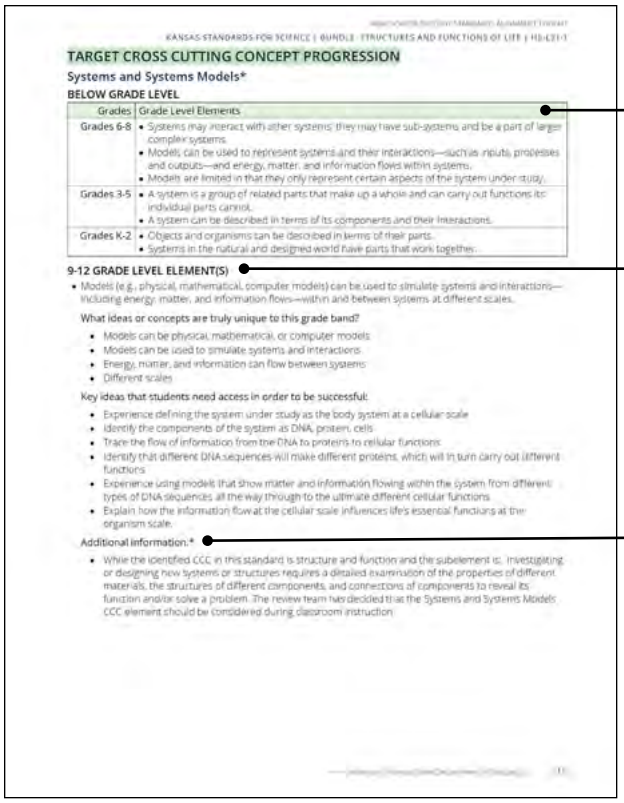
14 | Kansas State Department of Education | www.ksde.gov

The vertical alignment information for the Disciplinary Core Idea (DCI) comes from the NGSS Appendix E.

The grade-level element is identified by NGSS for each dimension of each performance expectation. Some standards include more than one element.

The DCI has been unpacked by KSDE to identify what is critical foundational information needed for a student to have before they access the new DCI content in the 9-12 grade band based on the vertical alignment.

When additional clarification, limitations, or other information is necessary to understand the standard it will be provided.



KANSAS STANDARDS FOR SCIENCE | BUNDLE: STRUCTURES AND FUNCTIONS OF LIFE | HS-LS1-1

TARGET CROSS CUTTING CONCEPT PROGRESSION

Systems and Systems Models*

BELOW GRADE LEVEL

Grades	Grade Level Elements
Grades 6-8	• Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. • Models are limited in that they only represent certain aspects of the system under study.
Grades 3-5	• A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. • A system can be described in terms of its components and their interactions.
Grades K-2	• Objects and organisms can be described in terms of their parts. • Systems in the natural and designed world have parts that work together.

9-12 GRADE LEVEL ELEMENT(S)

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

What ideas or concepts are truly unique to this grade band?

- Models can be physical, mathematical, or computer models.
- Models can be used to simulate systems and interactions.
- Energy, matter, and information can flow between systems.
- Different scales.

Key ideas that students need access in order to be successful:

- Experience defining the system under study as the body system at a cellular scale.
- Identify the components of the system as DNA, protein, cells.
- Trace the flow of information from the DNA to proteins to cellular functions.
- Identify that different DNA sequences will make different proteins, which will in turn carry out different functions.
- Experience using models that show matter and information flowing within the system from different types of DNA sequences all the way through to the ultimate different cellular functions.
- Explain how the information flow at the cellular scale influences life's essential functions at the organism scale.

Additional information:*

- While the identified CCC in this standard is structure and function and the subelement is: Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. The review team has decided to tie the Systems and Systems Models CCC element should be considered during classroom instruction.

The vertical alignment information for the Cross Cutting Concept (CCC) comes from the NGSS Appendix G.

The grade-level element is identified by NGSS for each dimension of each performance expectation. Some standards include more than one element.

The CCC has been unpacked by KSDE to identify what is new in the 9-12 grade band based on the vertical alignment and what are the key concepts a student needs to engage with to successfully reach the expectations of this CCC within the context of this standard.


KANSAS STANDARDS FOR SCIENCE | BUNDLE: STRUCTURES AND FUNCTIONS OF LIFE | HS-LS1-1

Aligning this standard to your students

- What everyday experiences or knowledge from other content areas might students bring to help them develop the targets from the SEP, DCI, and CCC?
- Where are students using and experiencing these ideas, practices, and concepts outside of the science classroom?
- What questions may students have related to these ideas about how the world works?
- What scaffolding might my students need to fully understand this particular standard?
- What phenomena could capture students' interest and provide opportunities to use the science covered in this standard to understand the phenomena?

Every standard includes the guiding questions for aligning the standard to students. These questions should be used when planning for instruction and assessment based on the unpacked standards.

SCIENCE STANDARDS ALIGNMENT TOOLKIT - HIGH SCHOOL

Using the Unpacked Science Standards

KSDE has provided unpacked standards for high school science in course-specific toolkits and therefore we do not recommend asking teachers to do the work of unpacking the NGSS performance expectations.

However, deep engagement with the science standards is critical for building capacity in the fundamental of standards alignment. Below are recommendations for meaningful ways that teachers can engage with the unpacked standards.

Aligning Standards to your Students

We have provided unpacked standards in this document. It is recommended that teachers align the components of the standard to their local context and the unique experiences of their students using the provided tool: "Aligning Science Standards to your Students". Aligning the standards to the unique knowledge and experiences that students bring into the classroom can increase the engagement and learning for students who may otherwise not engage as deeply.

Connections to other Fundamentals

Quality Instruction

- Quality science instruction must include three-dimensional instruction. The unpacked standards provide guidance for three-dimensional instruction by providing key experiences (SEP), key ideas (DCI), and key concepts (CCC) that students can use to explain how or why a phenomenon occurs.

  Note: the performance expectations articulate what a student should be able to do by the end of instruction. It is likely that during instruction of a concept students will engage in and with science and engineering practices and cross cutting concepts that are not explicitly in the standard as a part of the sensemaking process.

Balanced Assessment

- The key experiences, ideas, and concepts identified in the unpacked standard can be used to evaluate a provided assessment for standard alignment or used as guidance to develop an aligned formative or summative classroom-based assessment.

Structured Literacy

Science Instructional Materials and Curriculum Evaluation Tool

(Analyze existing curriculum)

This tool[11] is designed to help districts evaluate curricula and can be used both in the curriculum adoption process and for analyzing existing curricula. Even well-aligned instructional materials and resources may not fully meet the intent of the standards or the unique needs of students and teachers, often requiring additional supplementation.

The tool can be used to assess instructional resources by examining objectives, content, and assessments while identifying gaps, redundancies, or outdated materials. The Curriculum Evaluation Tool is divided into two sections:

The first section focuses on the non-negotiables for a science curriculum to ensure standards alignment.

The second section examines additional aspects of a curriculum resource, highlighting how it supports quality instruction and assessment.

Section 1: Non-negotiables

- Standards Alignment
- Three Dimensional Learning
- Literacy Supports
- Coherence and Scope

Section 2: Additional features to consider

- Balanced Assessment
- Usability
- Teacher Supports

QUESTIONS TO CONSIDER WHEN ANALYZING A CURRENT RESOURCE

If any criteria within section 1 was not met, what additional explicit supports are available or are needed to ensure this criteria is met?

11 KSDE. (2024). *2024 Instructional Materials Evaluation Tool.* (PDF). https://community.ksde.gov/LinkClick.aspx?fileticket=lEKBcCORJcA%3d&tabid=5785&mid=13857

Student Standard Alignment Tool

(Analyze Students' Interests and Identities.[4])

This tool is intended as an instructional planning tool. The standards are the expectation for every student in the state of Kansas. However, we acknowledge that Kansas students are a diverse population. Teachers should think intentionally about how the ideas and experiences that students bring to the classroom relate to the science standards in order to plan for the unique students in your classroom.

Question	Ideas and Experiences
What everyday experiences or knowledge from other content areas might students bring to help them develop the targets from the SEP, DCI, and CCC?	
Where are students using and experiencing these ideas, practices, and concepts outside of the classroom?	
What questions may students have related to these ideas about how the world works?	
What scaffolding might my students need to fully understand this particular standard?	
What phenomena could capture students' interest and provide opportunities to use the science covered in this standard to understand the phenomena?	

Glossary of Terms

Cross Cutting Concept[11]

These are concepts that hold true across the natural and engineered world. Students can use them to make connections across seemingly disparate disciplines or situations, connect new learning to prior experiences, and more deeply engage with material across the other dimensions. The NGSS requires that students explicitly use their understanding of the CCCs to make sense of phenomena or solve problems.

Disciplinary Core Idea[11]

The fundamental ideas that are necessary for understanding a given science discipline. The core ideas all have broad importance within or across science or engineering disciplines, provide a key tool for understanding or investigating complex ideas and solving problems, relate to societal or personal concerns, and can be taught over multiple grade levels at progressive levels of depth and complexity.

Elements[11]

The bulleted practices, disciplinary core ideas, and crosscutting concepts that are articulated in the foundation boxes of the standards as well as the in the NGSS appendices on each dimension.

Next Generation Science Standards (NGSS)[12]

K–12 science content standards. Standards set the expectations for what students should know and be able to do. Adopted in as Kansas Science Standards in 2013

Performance Expectation[11]

Each NGSS standard is written as a performance expectation that sets the learning goals for students, but does not describe how students get there. Each standard is not a daily standard but an expectation of what students should be able to do by the end of instruction (years or grade-bands).

Science and Engineering Practice[11]

The practices are what students DO to make sense of phenomena. They are both a set of skills and a set of knowledge to be internalized. The SEPs reflect the major practices that scientists and engineers use to investigate the world and design and build systems.

Standards[13]

End of instruction goals or benchmarks for student proficiency.

12 Next Generation Science Standards https://www.nextgenscience.org/

13 NGSS Glossary https://www.nextgenscience.org/glossary

Standards Alignment[9]

Standards-Aligned instruction has clearly defined student learning expectations aligned to Kansas State Standards and supported with evidence-based instruction and materials.

Standards Bundles[11]

Grouping elements or concepts from multiple PEs in lessons, units, and/or assessments that students can develop and use together to build toward proficiency on a set of PEs in a coherent manner.

Standards Unpacking

A systematic process of identifying the key ideas, experiences, and concepts that students need to demonstrate to show mastery of a standard.

Three-Dimensions[11]

These are the three strands of knowledge and skills that students should explicitly be able to use to explain phenomena and design solutions to problems. The three dimensions are the Disciplinary Core Ideas (DCIs), Crosscutting Concepts (CCCs), and Science and Engineering Practices ("the Practices" or SEPs).

Unpacked Standard

The key ideas, experiences, and concepts that are identified as necessary for a student to demonstrate to show mastery of a standard. An unpacked standard is intended to provide clarity on the expectations of the standard and intentionally does not include any ideas, concepts, or experiences beyond the standard.

References

Kansas State Department of Education (KSDE). (2024, April 17). *4 Fundamentals Defined*. https://www.ksde.gov/Portals/0/Learning%20Services%20Documents/4%20Fundamentals%202%20-%20Definitions.pdf

Kansas State Department of Education (KSDE). (2024, March). *Addressing the prioritization of standards fact sheet.* https://www.ksde.gov/LinkClick.aspx?fileticket=Z5tBLSYTR9k%3D&tabid=472&portalid=0&mid=4744

Kansas State Department of Education (KSDE). (n.d.). *Guidance to leveraging student identity and interests*. https://docs.google.com/document/d/1N2ciKuxcgIyEhD4s1RwmO_GBvjsLv2dAwrqFFI8JFTY/edit

Kansas State Department of Education (KSDE). (2023). *2023 Science High School Scope and Sequence Guidance.* https://community.ksde.gov/LinkClick.aspx?fileticket=wmQyOpyeCBs%3d&tabid=5785&mid=13857

Kansas State Department of Education (KSDE). (2024). *2024 Science Instructional Materials Evaluation Tool.* https://community.ksde.gov/LinkClick.aspx?fileticket=lEKBcCORJcA%3d&tabid=5785&mid=13857

National Academies of Sciences, Engineering, and Medicine. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* The National Academies Press. https://nap.nationalacademies.org/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts

Next Generation Science Standards. (2013, April). *Appendix F – Science and Engineering Practices in the NGSS.* https://www.nextgenscience.org/sites/default/files/resource/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf

Next Generation Science Standards. (2013, June 5). *Appendix G Cross Cutting Concepts in the NGSS - FINAL*. https://www.nextgenscience.org/sites/default/files/resource/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Next Generation Science Standards. (n.d.). Bundling the NGSS. https://www.nextgenscience.org/resources/bundling-ngss

Next Generation Science Standards. (2013, May 9). *Disciplinary Core Ideas in the Next Generation Science Standards (NGSS) Final Release*. https://www.nextgenscience.org/sites/default/files/Handout%2004%20-%20NSTA%20DCIs%20Matrix.pdf

Next Generation Science Standards. (n.d.). *NGSS Glossary*. https://www.nextgenscience.org/glossary

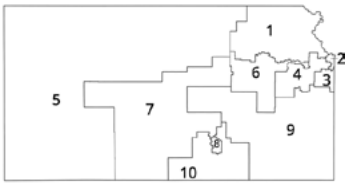
Next Generation Science Standards. (n.d.). *Next Generation Science Standards.* https://www.nextgenscience.org/

REFERENCES

Kansas State Board of Education

BOARD MEMBERS

900 S.W. Jackson Street, Suite 600
Topeka, Kansas 66612-1212
(785) 296-3203
www.ksde.gov/board



DISTRICT 1

Danny Zeck
Vice Chair
Danny.Zeck@ksde.gov

DISTRICT 2

Melanie Haas
Melanie.Haas@ksde.gov

DISTRICT 3

Michelle Dombrosky
Michelle.Dombrosky@ksde.gov

DISTRICT 4

Connie O'Brien
Connie.O'brien@ksde.gov

DISTRICT 5

Cathy Hopkins
Chair
Cathy.Hopkins@ksde.gov

DISTRICT 6

Dr. Beryl A. New
Beryl.New@ksde.gov

DISTRICT 7

Dennis Hershberger
Dennis.Hershberger@ksde.gov

DISTRICT 8

Betty Arnold
Betty.Arnold@ksde.gov

DISTRICT 9

Jim Porter
Jim.Porter@ksde.gov

DISTRICT 10

Debby Potter
Debby.Potter@ksde.gov

SUCCESS DEFINED

A successful Kansas high school graduate has the

- Academic preparation,
- Cognitive preparation,
- Technical skills,
- Employability skills and
- Civic engagement

to be successful in postsecondary education, in the attainment of an industry recognized certification or in the workforce, without the need for remediation.

OUTCOMES

- Social-emotional growth
- Kindergarten readiness
- Individual Plan of Study
- Civic engagement
- Academically prepared for postsecondary
- High school graduation
- Postsecondary success

Kansans CAN

MISSION

To prepare Kansas students for lifelong success through rigorous, quality academic instruction, career training and character development according to each student's gifts and talents.

VISION

Kansas leads the world in the success of each student.

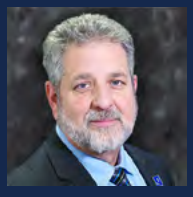
MOTTO

Kansans Can

COMMISSIONER OF EDUCATION

Dr. Randy Watson
Randy.Watson@ksde.gov

DEPUTY COMMISSIONER
Division of Fiscal and Administrative Services



Dr. Frank Harwood
Frank.Harwood@ksde.gov

DEPUTY COMMISSIONER
Division of Learning Services

Dr. Ben Proctor
Ben.Proctor@ksde.gov

Kansas leads the world in the success of each student.

Jan. 25, 2025

For more information, contact:

Stephanie Alderman-Oler
K-12 STEM Program Manager
Career, Standards and Assessment Services
(785) 296-8108
stephanie.alderman-oler@ksde.gov

Kansas State Department of Education
900 S.W. Jackson Street, Suite 102
Topeka, Kansas 66612-1212

https://www.ksde.gov