OSTP Science Data Interpretation Guidebook

OKLAHOMA STATE DEPARTMENT OF EDUCATION
CHAMPION EXCELLENCE

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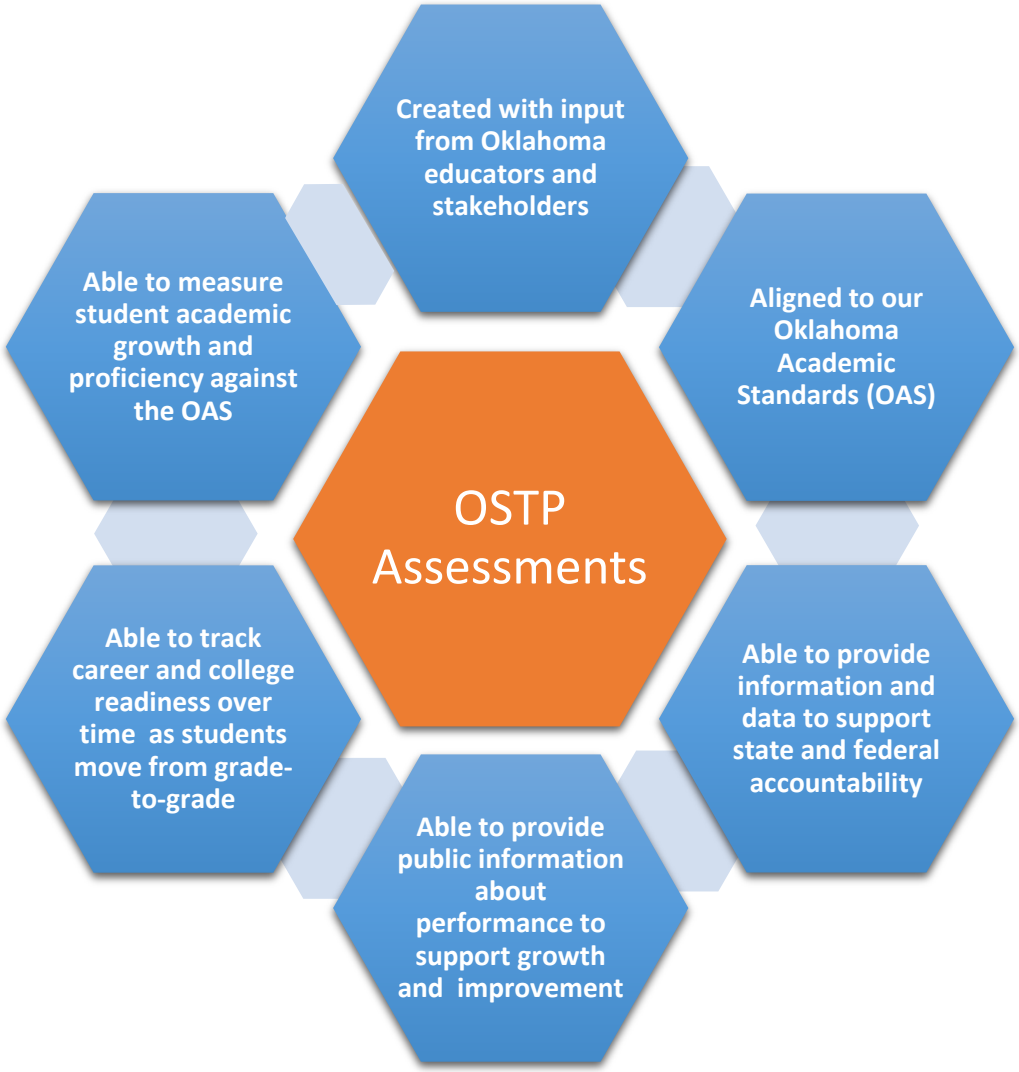
Introduction

We believe that **all students can grow and all schools can improve** and are committed to ensuring that state testing in Oklahoma is both effective and meaningful to families, districts, educators, and members of the community. Assessments within the Oklahoma School Testing Program are:



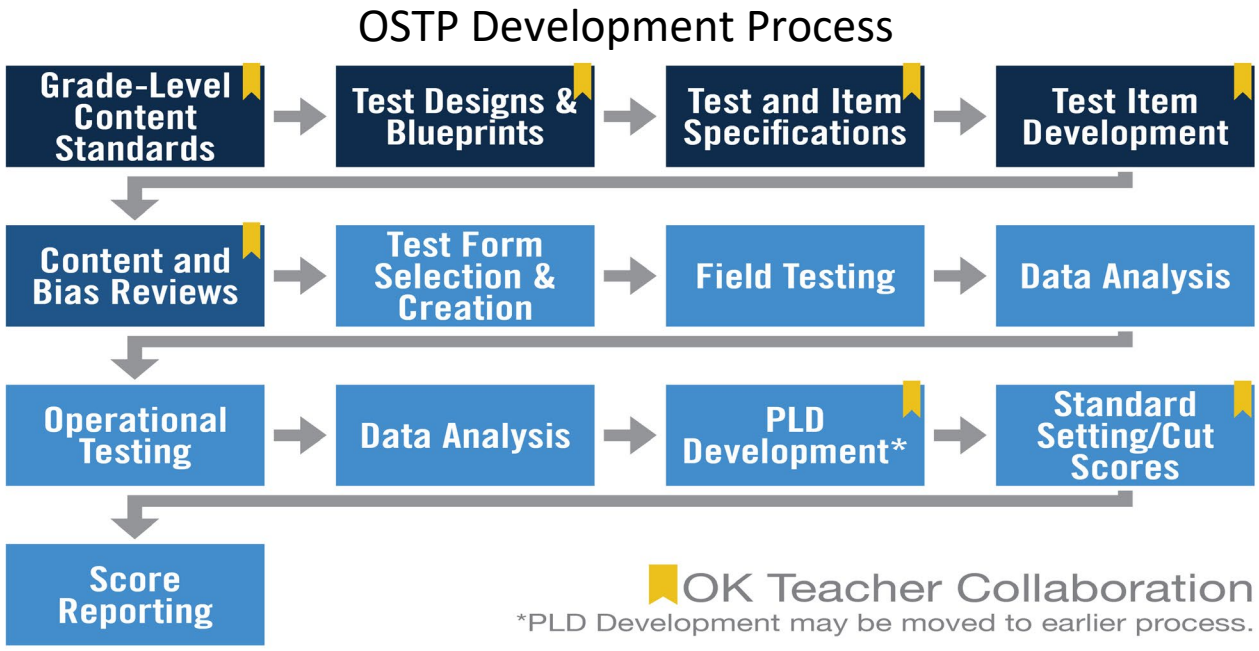
It is important to note that, while annual state assessments do not capture everything our students are capable of or learn in school, state assessments are the most reliable way to objectively measure student performance across the state. Statewide data allows educators and community leaders to see gaps in learning among student groups as compared to other students across the state. These assessments also provide evidence that can inform local educators and school and district leaders on the changes needed to strengthen student outcomes in their district.

About the Oklahoma School Testing Program (OSTP)

"Oklahoma recognizes that a **robust assessment system** is tied closely to students' learning and teachers' instructional practices by valuing and promoting **local, classroom-based formative assessments** that help make **student learning visible**. At the same time, that system should provide a **strong summative assessment** program that fits as a component within a multifaceted state, district and school accountability system." *Oklahoma ESSA Plan (pp 48-49)*

The **OSTP** consists of Oklahoma's grade-level and Career- and College-Ready (CCR) summative assessments in ELA, math and science. OSTP assessments tell us how well our students are growing in the knowledge, skills, and abilities outlined in Oklahoma's Academic Standards (OAS) by supporting criterion-referenced interpretations at appropriate levels and grain size (e.g., grade, student group, teacher, building/district administrator, state). OSTP results support state and federal accountability and allow the public to know how their local schools are performing compared to others around the state.

The **OSTP** development process is an extensive, ongoing process that ensures our state assessments are valid and appropriate measures of student knowledge, skills, and abilities. The Oklahoma State Department of Education (OSDE) works with groups of Oklahoma educators through our contract with Measured Progress to develop the state tests as shown in the graphic below.

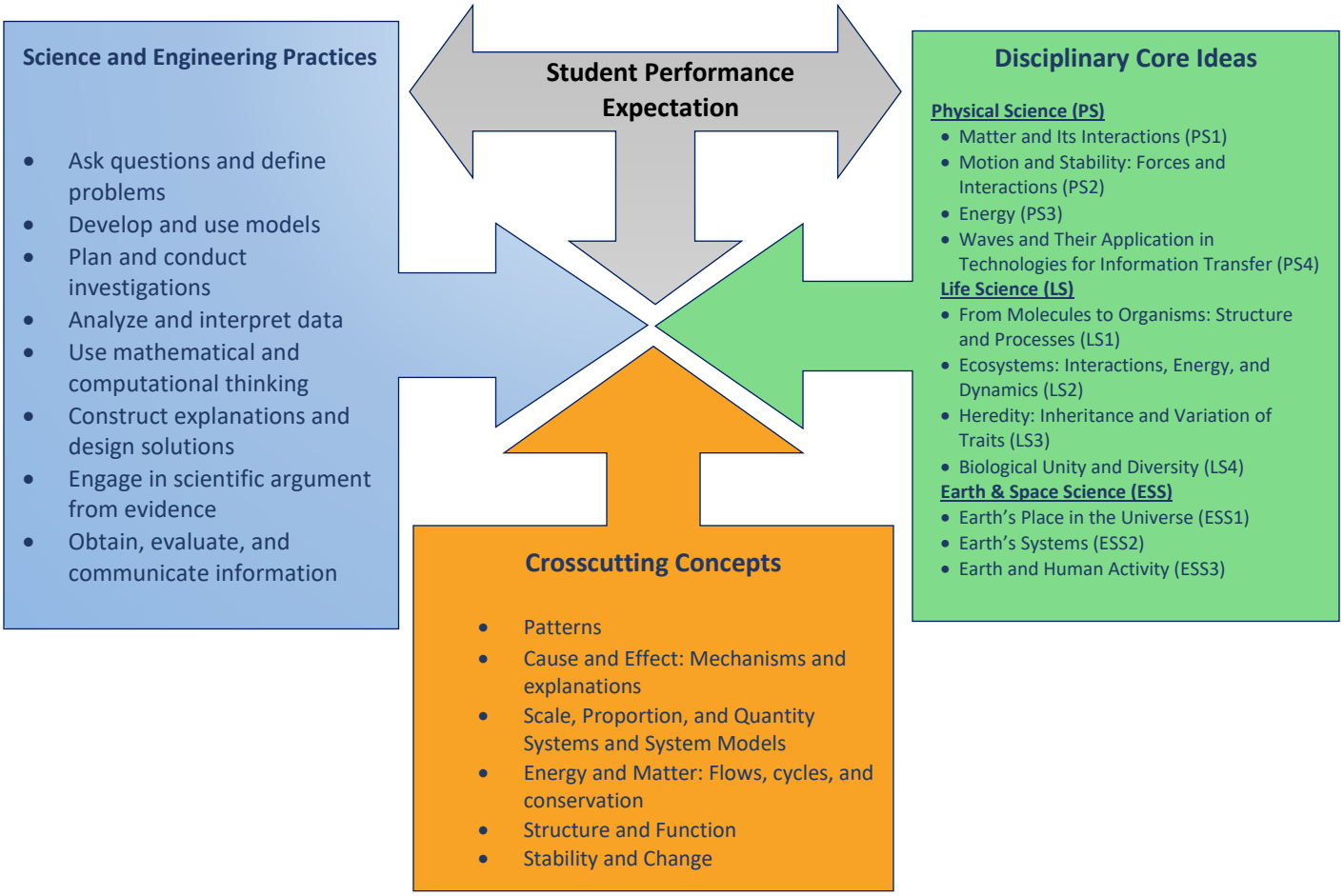


About OSTP Data

Data from state summative assessments serve as a point-in-time snapshot of what students know and are able to do relative to the standards being assessed. Measuring real-world skills like problem-solving and critical thinking, the assessments are aligned to the standards so that teachers are able to teach the standards and do not have to "teach to the test." The Oklahoma Academic Standards for Science were developed and organized around three dimensions

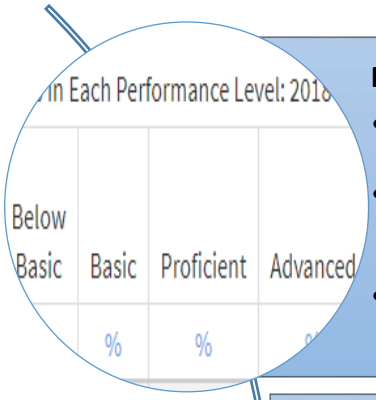
Science Dimension	About this Dimension
Science and Engineering Practices	The Science and Engineering Practices (SEPs) describe the major practices that scientists employ as they investigate and build models and theories about the world and a key set of engineering practices that engineers use as they design and build systems. The term "practice" is used instead of the term "process" to emphasize that scientists and engineers use skill and knowledge simultaneously, not in isolation
Disciplinary Core Ideas	The Disciplinary Core Ideas (DCIs) represent a set of science and engineering ideas for K-12 science education that have broad importance across multiple sciences or engineering disciplines. DCIs provide a key tool for understanding or investigating more complex ideas and solving problems; relate to the interests and life experiences of students; and be teachable and learnable over multiple grades at increasing levels of sophistication.
Crosscutting Concepts	The Crosscutting Concepts (CCCs) represent common threads or themes that span across science disciplines (biology, chemistry, physics, environmental science, Earth/space science) and have value to both scientists and engineers because they identify universal properties and processes found in all disciplines.

The standards progress from grades K-12 by setting **Performance Expectations** for what students should know, understand, and be able to do at each grade level. Student Performances represent a thoughtful and deliberate **integration** of the three dimensions: **Science and Engineering Practices (SEPs)**, **Disciplinary Core Ideas (DCIs)**, and **Crosscutting Concepts (CCCs)** that define the grade-level expectations for Oklahoma students with the aim of helping them be career and college ready when they leave our K-12 system.



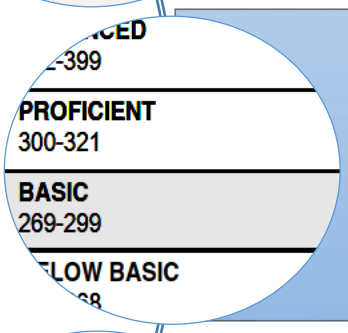
While state summative assessments are only one measure of what students know and can do, having Oklahoma students take standardized science assessments at grades 5, 8, and 11 provides reliable data that can be compared across schools and districts. Data from state assessments provides evidence in the form of an instructionally useful claim that serves to support evaluation and enhancement of curriculum and programs while meeting state and federal accountability requirements.

Claims made by the Oklahoma School Testing Program (OSTP) are reported out at three different grain sizes- ***Performance Level, Oklahoma Performance Index Score, and Reporting Category Indicator***. Data related to each claim can be aggregated to help identify instructional and programmatic strengths and gaps.



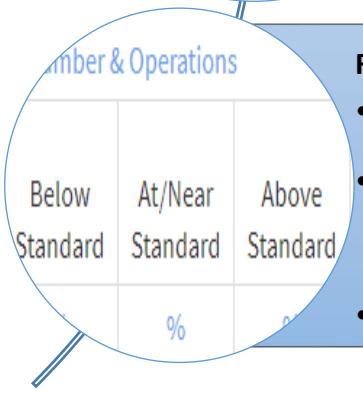
Performance Level (PL)- Are we on track?

- Reported as one of four levels: **Advanced, Proficient, Basic (Limited Knowledge), or Below Basic (Unsatisfactory)**
- Relate what a typical student at each level should know and be able to do relative to the **Oklahoma Academic Standards (OAS)** as described in the **Performance Level Descriptors (PLDs)**
- Provides a **broad view** of whether a student, program, or group is **on-track** with the grade level-expectations needed to be career and college ready (**CCR**)



Oklahoma Performance Index Scores (OPI)- Are we progressing?

- Reported as a number between **200-399**
- Built on a **comparable** scale from **200-399** related to the Performance Level wherein **300** is always **Proficient**
- Provides a more specific data point that can be used **to measure gro**wth from year-to-year and determine where a student or program is in relation to grade-level expectations.



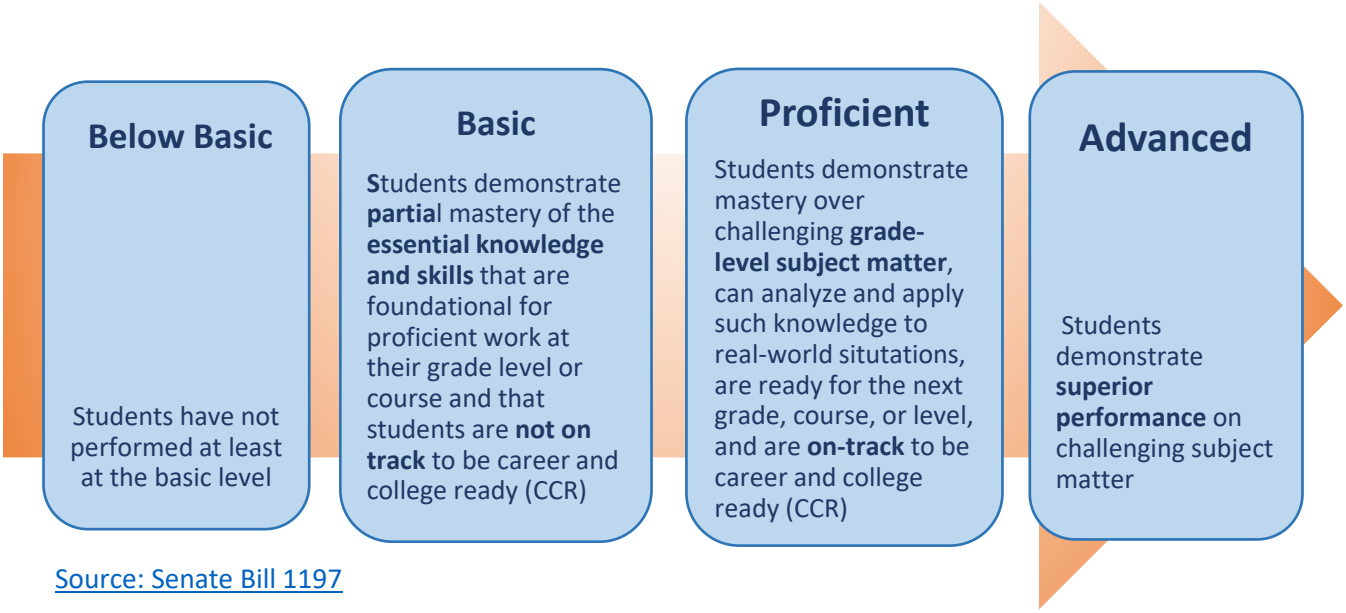
Reporting Category Indicators- Where are our strengths?

- Identified on the OSTP Test Blueprints and reported out as one of three indicators: **Above Standard, At/Near Standard, or Below Standard**
- Determined by comparing student performance on items associated with each reporting category against the expectations of Proficiency; communicates confidence regarding student ability to demonstrate the Proficient knowledge, skills, and abilities.
- Provides point-in-time data about student or program strengths and gaps

OSTP data can be accessed through the Measured Progress portal; however, a username and password are needed. Please contact your district test coordinator to find out about your school/district policy related to accessing data in the portal.

OSTP Performance Level Data- Are we on Track?

Reported as one of four levels (***Advanced, Proficient, Basic, or Below Basic,*** performance levels provide a **broad view** of whether a student, program, or group is **on-track** with grade- level expectations needed to be career and college ready (**CCR**).



Source: Senate Bill 1197

Performance levels were determined by Oklahoma educators using grade-level OAS standards to identify the knowledge, skills and abilities (KSAs) students should demonstrate based on their command of grade-level standards. The resulting Performance Level Descriptors (PLDs) and 2017 OSTP test results were used during the standard setting process to determine the "cut scores" for each performance band. The range of scores for each performance level band varies by grade as shown in the table below. The table communicates the range of index scores in each performance band and the percentage of Oklahoma students that scored at each level.

Science Performance Levels and % of OK Students Scoring at Level by Grade Level (2017-18)

Grade	Unsatisfactory (below Basic)	% at Band	Limited Knowledge (Basic)	% at Band	Proficient	% at Band	Advanced	% at band
Gr 5	200-271	20%	272-299	39%	300-329	32%	330-399	9%
Gr 8	200-283	40%	284-299	21%	300-327	29%	328-399	10%
Gr 11	Field Test in 2017-18 Performance Level bands will be set after the 2019 administration							

Performance Level claims inform stakeholders of how to interpret student test scores in relation to the **OAS** through Performance Level Descriptor (PLD). PLDs define the intended interpretations of state tests scores by providing a narrative account of the knowledge, skills, and abilities students should demonstrate at each grade and in each level of achievement.

5th Grade Science Performance Level Descriptors by Level			
Below Basic	**Basic**	**Proficient**	**Advanced**
Students have not performed at least at the **Basic** level.	Students demonstrate partial mastery of the essential knowledge and skills appropriate to their grade level. Students scoring at the **Basic** level typically:	Students demonstrate mastery over appropriate grade-level subject matter and readiness for the next grade level. Students scoring at the **Proficient** level typically:	Students demonstrate superior performance on challenging subject matter. In addition to demonstrating a broad and in-depth understanding and application of all skills at the **Proficient** level, students scoring at the **Advanced** level typically:
	➢ Identify basic models to represent common features of matter and/or energy, ecosystems, and/or Earth's systems. ➢ Recognize scale, proportion, quantity, or patterns when performing basic computations with data as it pertains to distribution of water on Earth, conservation of matter, and/or Earth's relationship with the sun, moon, and stars. ➢ Identify evidence, data, or models to distinguish relationships between an object and Earth's gravity, how basic scale and proportion affect the brightness of the sun and other stars, or how plants use air and water. ➢ Observe or measure phenomenon to recognize patterns of materials and identify basic relationships when mixing substances within an investigation framework.	➢ Describe, use and/or develop basic models at various scales to explain the movement of matter and energy between organisms, ecosystems, and Earth's systems and explain the outcomes of these interactions. ➢ Apply scale, proportion, quantity, and/or patterns when performing computational thinking to data as it pertains to distribution of water on Earth, conservation of matter, and Earth's relationship with the sun, moon, and stars. ➢ Use evidence, data, and/or models to engage in argument to explain the cause and effect relationships between an object and Earth's gravity, how scale and proportion affect the apparent brightness of the sun and other stars, or how plants use matter (chiefly air and water) to grow. ➢ Observe and measure phenomenon to identify patterns that classify materials based on properties. ➢ Describe cause and effect relationships when mixing substances within an investigation framework.	➢ Analyze scale, proportion, quantity and patterns when performing computational thinking to complex data as it pertains to distribution of water on Earth, conservation of matter, and Earth's relationship with the sun, moon and stars. ➢ Predict, modify, and extend complex models at various scales to analyze the movement of matter and energy between organisms, ecosystems, and Earth's systems, and analyze the outcomes of these interactions. ➢ Describe complex cause and effect relationships when mixing substances within an investigation framework. ➢ Analyze and compare evidence, data, and models to engage in argument to explain the cause and effect relationships between an object and Earth's gravity, how scale and proportion affect the apparent brightness of the sun and other stars, and/or how plants use matter (chiefly air and water) to grow. ➢ Observe and measure phenomenon to interpret and evaluate patterns that classify materials based on properties.

8th Grade Science Performance Level Descriptors by Level			
Below Basic	**Basic**	**Proficient**	**Advanced**
Students have not performed at least at the **Basic** level.	Students demonstrate partial mastery of the essential knowledge and skills appropriate to their grade level. Students scoring at the **Basic** level typically:	Students demonstrate mastery over appropriate grade-level subject matter and readiness for the next grade level. Students scoring at the **Proficient** level typically:	Students demonstrate superior performance on challenging subject matter. In addition to demonstrating a broad and in-depth understanding and application of all skills at the **Proficient** level, students scoring at the **Advanced** level typically:
	➢ Identify or describe basic components or concept(s) of a model involving conservation of matter in chemical reactions, patterns in the structure and function of waves, or stability and change at varying scales in Earth's systems. ➢ Identify or describe basic steps or processes within investigations about stability and change of forces and motion, or identify and define patterns in data about common ancestry and diversity of organisms, the geologic history of Earth, or natural hazards. ➢ Identify components of a design solution or describe simple relationships within a design solution in various systems involving energy transfer in chemical reactions or forces in collisions. ➢ Identify or describe basic relationships shown in evidence of anatomy and common ancestry of organisms, or aspects of Earth systems, including geologic history, materials and processes, natural resources, or human impacts on those systems using the concept of patterns in cause and effect relationships or the concept of scale and proportion.	➢ Make predictions about, describe, develop, or use a given model involving conservation of matter in chemical reactions, patterns in the structure and function of waves, or stability and change at varying scales in Earth's systems. ➢ Identify, describe, or explain how to plan or perform investigations about stability and change of forces and motion, or identify and apply patterns in data about common ancestry and diversity of organisms, the geologic history of Earth, or natural hazards. ➢ Use, describe, or explain a design solution, or identify evidence of relationships within a design solution in various systems involving energy transfer in chemical reactions or forces in collisions. ➢ Construct explanations by identifying, describing, or comparing evidence of anatomy and common ancestry of organisms, or aspects of Earth systems including geologic history, materials and processes, natural resources, or human impacts on those systems using the concept of patterns in cause and effect relationships or the concept of scale and proportion.	➢ Evaluate, revise, or develop a model from evidence, or apply models to complex concepts involving conservation of matter in chemical reactions, patterns in the structure and function of waves, or stability and change at varying scales in Earth's systems. ➢ Design, evaluate, or modify investigations about stability and change of forces and motion, or analyze and draw conclusions from patterns in data about common ancestry and diversity of organisms, the geologic history of Earth, or natural hazards. ➢ Modify, synthesize, or apply a design solution, or evaluate evidence of relationships within a design solution in various systems involving energy transfer in chemical reactions or forces in collisions. ➢ Analyze, infer, relate, or identify complex relationships within a system to construct or evaluate explanations for evidence of anatomy and common ancestry of organisms, or aspects of Earth systems including geologic history, materials and processes, natural resources, or human impacts on those systems using the concept of patterns in cause and effect relationships or the concept of scale and proportion.

Performance level claims serve as a **starting point** for discussions and analysis related to the **overall Performance** and readiness of programs, and groups of students to move to the next grade, course, or level.

State, District, Site, and Teacher Level Insights

- Where students are as a whole
- Equity gaps across student groups
- Patterns or trends across groups of students and/or grade levels
- Vertical alignment across grade levels
- Horizontal alignment across teachers/ student groups
- Comparison to the state
- How data from local assessments compares
- How other evidence of student learning fits

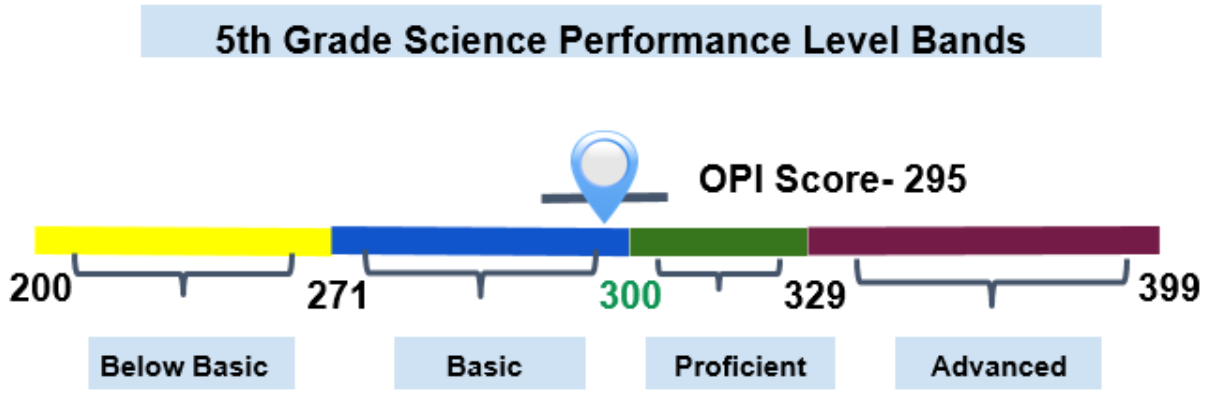
Student Level Considerations

Performance level data tells only part of the student's story and other relevant information should be considered when making student level decisions.

- Other relevant information includes:
    - Student work samples
    - Course grades
    - Teacher observations

Oklahoma Performance Index Scores (OPI): Are we progressing?

Oklahoma Performance Index (OPI) scores supplement performance-level data by pin-pointing where a score is relative to the performance level.

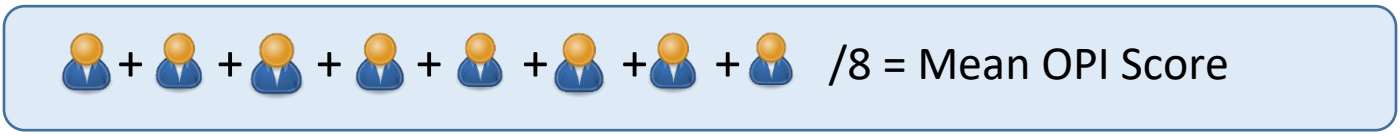


Built on a comparable scale from 200-399, wherein 300 is always proficient, OPI scale scores allow for numerical comparison between test takers taking the same test. OPI scores also allow us to compare individual student performance from one year to the next as a measure of growth in ELA and math because they test in consecutive years. Score ranges differ by grade and subject area as shown in the performance level lookup table linked here.

5th Grade	Mean OPI 2017	Mean OPI 2018
Science	295	293
Math	288	285
Reading	291	291

8th Grade	Mean OPI 2017	Mean OPI 2018
Science	292	291
Math	276	275
Reading	287	286

OPI scores are obtained by statistically adjusting and converting raw scores onto a common scale to account for differences in difficulty across different assessment forms. This allows for consistency in score interpretation. When combined across a student population, mean OPI scores can be used to describe state, district, and school level changes in performance, as well as identify gaps in achievement among different groups of students.



Also referred to as an average, the mean OPI score is calculated by adding all the individual student scores and dividing by the number of total scores and communicates the average performance for a group of students.

Performance index scores add information to the conversation started with performance levels by **pin-pointing** where a student, grade, or student group is **relative to the next level** along a continuum.

State, District, Site, and Teacher Insights

- Changes in achievement gaps overtime
- Changes in student growth from year to year
- Equity gaps across student groups
- Trends and patterns across groups of students and/or grade levels
- Alignment across grade levels
- Comparison to state and other districts
- Relation to local level evidence of learning

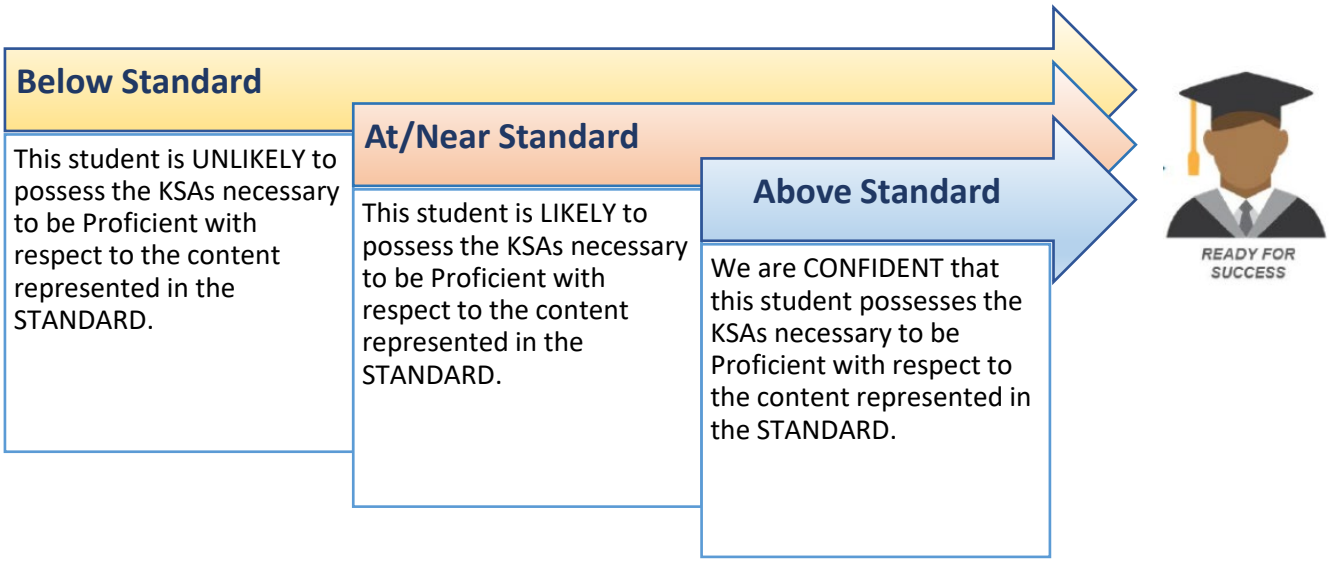
Student Level Considerations

Performance level data tells only part of the student's story and other relevant information should be considered when making student level decisions.

- Other relevant information includes:
    - Student work samples
    - Course grades
    - Teacher observations

OSTP Reporting Category Indicators: Where are our Strengths?

Oklahoma Academic Standards measured by the OSTP assessment are outlined on the OSTP Blueprints. Science assessments in grades 5 and 8 have three reporting categories. Reporting categories represent groups of similar student skills assessed within each grade level and subject area. Reporting Category Performance utilizes an indicator that communicates a confidence level of a student's likelihood of being able to demonstrate the proficient level **Knowledge, Skills, and Abilities (KSAs)** being assessed through at least five items. Indicators include ***Below Standard, At/Near Standard, and Above Standard.***



Reporting category indicators communicate domain level performance on a subset of items within the state test. Domain level information can help you gauge where groups of students or programs are relative to the proficient level KSAs needed to be ready for the next grade, course, or level. State averages in each domain for the 2017-18 state test are shown in the table below.

Domain- Physical Science (PS)	Gr 5	Gr 8
➢ Below Standard	35%	43%
➢ At/Near Standard	35%	28%
➢ Above Standard	29%	29%
Domain- Life Science (LS)	**Gr 5**	**Gr 8**
➢ Below Standard	44%	35%
➢ At/Near Standard	34%	39%
➢ Above Standard	22%	26%
Domain- Earth and Space Science (ESS)	**Gr 5**	**Gr 8**
➢ Below Standard	37%	48%
➢ At/Near Standard	32%	24%
➢ Above Standard	31%	28%

Reporting category indicator claims have the **smallest grain size** and can provide an additional piece of evidence to inform instructional and programmatic decisions by **bringing to the surface** what is working and what may need to change relative to the standards.

As with all OSTP data, other relevant information such as student work samples and local level standards-based assessments should be considered when making decisions.

State, District, Site, and Teacher Level Insights

- Where strengths and gaps may exist in the curriculum
- Equity gaps across student groups
- Effectiveness of differentiation
- Needs for enhancement
- Alignment across grade levels
- Comparison to state and other districts

Student Level Considerations

Performance level data tells only part of the student's story and other relevant information should be considered when making student level decisions.

- Other relevant information includes:
  - Student work samples
  - Course grades
  - Teacher observations

Reporting Category Analysis- Grade 5 Science

Reporting Category indicator claims can best be interpreted by linking the Oklahoma Academic Standards measured on the assessment with proficient level knowledge, skills, and abilities (KSAs) described in the grade five performance level descriptor (PLD). PLDs define the intended interpretations of tests scores by describing what students should know and be able to do in each level of achievement.

To fully understand the breadth and depth of the standard/PE, click on each one to show the **Science and Engineering Practices (SEPs)**, **Crosscutting Concepts (CCCSs),** and **Disciplinary Core Ideas (DCIs)** that serve as support for instructors in providing clarity and further guidance for each Performance Expectation.

Physical Science	On Track Knowledge, Skills, and Abilities (KSAs)
5-PS1-1 *Develop a model to describe that matter is made of particles too small to be seen.* ***5-PS1-2*** *Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.* ***5-PS1-3*** *Make observations and measurements to identify materials based on their properties.* ***5-PS1-4*** *Conduct an investigation to determine whether the mixing of two or more substances results in new substances.*	*Students receiving **At/Near or Above Standard** indicators are likely to be able to* ✓ **apply scale, proportion, quantity, and/or patterns** when **performing computational thinking to** data as it pertains to **conservation of matter** ✓ **observe and measure phenomenon** to identify **patterns** that **classify materials based on properties** ✓ describe **cause and effect** relationships when **mixing substances** within an **investigation framework**.
Life Science	**On Track Knowledge, Skills, and Abilities (KSAs)**
5-LS1-1 *Support an argument that plants get the materials they need for growth chiefly from air and water.* ***5-LS2-1*** *Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.* ***5-LS2-2*** *Use models to explain factors that upset the stability of local ecosystems.* ***5-PS3-1*** *Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.*	*Students receiving **At/Near or Above Standard** indicators are likely to be able to* ✓ describe, **use and/or develop basic models** at **various scales** to **explain** the **movement of matter and energy between organisms and ecosystem** to explain the **outcomes of these interactions.** ✓ use **evidence, data, and/or models** to engage in **argument to explain** how **plants use matter** (chiefly air and water) to grow
Earth and Space Science	**On Track Knowledge, Skills, and Abilities (KSAs)**
5-ESS1-1 *Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.* ***5-ESS1-2*** *Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.* ***5-ESS2-1*** *Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.* ***5-ESS2-2*** *Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.* ***5-PS2-1*** *Support an argument that the gravitational force exerted by the Earth is directed down.*	*Students receiving **At/Near or Above Standard** indicators are likely to be able to* ✓ **describe, use and/or develop basic models** at **various scales** to **explain** the **movement of matter and energy between Earth's systems** and to explain **the outcomes of these interactions.** ✓ **apply scale, proportion, quantity, and/or patterns** when performing **computational thinking to data** as it pertains to **distribution of water on Earth and Earth's relationship with the sun, moon, and stars** ✓ **use evidence, data, and/or models to engage in argument** to **explain** the **cause and effect relationships** between an **object and Earth's gravity**, ✓ **use evidence, data, and/or models to engage in argument** as to how **scale and proportion affect** the **apparent brightness of the sun and other stars**

The Oklahoma Academic Standards for Science represent a progression from grades K-12 and it is critical that students have access to science teaching at each grade level so that they have the knowledge, skills and abilities needed to be on track and ready for the next level.

Grade Level	Overview of Grade Level Performance Expectations
6th Grade	Students in middle school continue to develop understanding of four core ideas in the physical sciences. The middle school performance expectations in the Physical Sciences build on the K – 5 ideas and capabilities to allow learners to explain phenomena central to the physical sciences but also to the life sciences and earth and space science. The performance expectations in physical science blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain real world phenomena in the physical, biological, and earth and space sciences. In the physical sciences, performance expectations at the middle school level focus on students developing understanding of several scientific practices. These include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations; and to use these practices to demonstrate understanding of the core ideas. Students are also expected to demonstrate understanding of several of engineering practices including design and evaluation.
5th Grade	The performance expectations in fifth grade help students formulate answers to questions such as: "When matter changes, does its weight change? How much water can be found in different places on Earth? Can new substances be created by combining other substances? How does matter cycle through ecosystems? Where does the energy in food come from and what is it used for? How do lengths and directions of shadows or relative lengths of day and night change from day to day, and how does the appearance of some stars change in different seasons?" In the fifth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, engaging in argument from evidence, and obtaining, evaluating, and communicating information; and to use these practices to demonstrate understanding of the core ideas.
4th Grade	The performance expectations in fourth grade help students formulate answers to questions such as: "What are waves and what are some things they can do? How can water, ice, wind and vegetation change the land? What patterns of Earth's features can be determined with the use of maps? How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals? What is energy and how is it related to motion? How is energy transferred? How can energy be used to solve a problem?" In the fourth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.
3rd Grade	The performance expectations in third grade help students formulate answers to questions such as: "What is typical weather in different parts of the world and during different times of the year? How can the impact of weather-related hazards be reduced? How do organisms vary in their traits? How are plants, animals, and environments of the past similar or different from current plants, animals, and environments? What happens to organisms when their environment changes? How do equal and unequal forces on an object affect the object? How can magnets be used?" In the third grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions and defining problems; developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

2nd Grade	The performance expectations in second grade help students formulate answers to questions such as: "How does land change and what are some things that cause it to change? What are the different kinds of land and bodies of water? How are materials similar and different from one another, and how do the properties of the materials relate to their use? What do plants need to grow? How many types of living things live in a place?" In the second grade performance expectations, students are expected to demonstrate grade appropriate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.
1st Grade	The performance expectations in first grade help students formulate answers to questions such as: "What happens when materials vibrate? What happens when there is no light? What are some ways plants and animals meet their needs so that they can survive and grow? How are parents and their children similar and different? What objects are in the sky and how do they seem to move?" Students are expected to develop understanding of the relationship between sound and vibrating materials as well as between the availability of light and ability to see objects. The idea that light travels from place to place can be understood by students at this level through determining the effect of placing objects made with different materials in the path of a beam of light. Students are also expected to develop understanding of how plants and animals use their external parts to help them survive, grow, and meet their needs as well as how behaviors of parents and offspring help the offspring survive. The understanding is developed that young plants and animals are like, but not exactly the same as, their parents. Students are able to observe, describe, and predict some patterns of the movement of objects in the sky. The crosscutting concepts of patterns; cause and effect; structure and function; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the first grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.
Kindergarten	The performance expectations in kindergarten help students formulate answers to questions such as: "What happens if you push or pull an object harder? Where do animals live and why do they live there? What is the weather like today and how is it different from yesterday?" Students are expected to develop an understanding of patterns and variations in local weather and the purpose of weather forecasting to prepare for, and respond to, severe weather. Students are able to apply an understanding of the effects of different strengths or different directions of pushes and pulls on the motion of an object to analyze a design solution. Students are also expected to develop an understanding of what plants and animals (including humans) need to survive and the relationship between their needs and where they live. The crosscutting concepts of patterns; cause and effect; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the kindergarten performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate an understanding of the core ideas.
Source: OSDE Science Frameworks Grade Level Introductions	

The OSDE frameworks are **c**urricular tools and resources developed by Oklahoma teachers that may be helpful to educators as they evaluate, select and implement instruction, curriculum and local-level classroom assessments aligned to standards. Resources found within the science frameworks for each grade level include:

Performance Expectation Analysis	Performance Expectations represent the things students should know, understand, and be able to do to be proficient in science. Performance Expectations are the standards. Each Performance Expectation is built around *A Framework for K-12 Science Education* recommendation that science education in grades K-12 be built around three major dimensions: 1. Science and Engineering Practices 2. Crosscutting Concepts 3. Disciplinary Core Ideas (NRC, 2012, p. 2) *The additional components in the standard documents serve as support for instructors in providing clarity and further guidance for each Performance Expectation.* Analysis for each standard is provided in a manner to support deep understanding for the teacher. A Framework for K-12 Science Education includes grade band endpoints for second, fifth, eighth, and twelfth grades. This information provides guidance on where students should be in their understanding of each objective by the ends of those grade levels.
Instructional Bundles	The instructional bundles represent curricular resources developed by Oklahoma teachers to help teachers translate standards into classroom practice. The Framework Overviews represent how a group of Oklahoma teachers, at a given grade level, might bundle performance expectations/standards found in the Oklahoma Academic Standards for Science. Bundling is how teachers would group performance expectations/standards for developing instructional units of study.
Vertical Progressions	Vertical progression documents are provided for the Disciplinary Core Ideas, Crosscutting Concepts, and the Science & Engineering Practices. There is also a Domain Comparison Chart that provides a quick look at the DCI found in each grade level.

Reporting Category Analysis: Grade 8 Science

Reporting Category indicator claims can best be interpreted by linking the Oklahoma Academic Standards measured on the assessment with proficient level knowledge, skills, and abilities described in the grade eight performance level descriptor (PLD). PLDs define the intended interpretations of tests scores by describing what students should know and be able to do in each level of achievement.

To fully understand the breadth and depth of the standard, click on each one to show the **Science and Engineering Practices (SEPs)**, **Crosscutting Concepts (CCCSs),** and **Disciplinary Core Ideas (DCIs)** that provide clarity and further guidance for instruction.

Physical Science	On Track Knowledge, Skills, and Abilities
MS-PS1-5 *Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.* ***MS-PS1-6*** *Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.* ***MS-PS2-1*** *Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.* ***MS-PS2-2*** *Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.* ***MS-PS4-1*** *Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.* ***MS-PS4-2*** *Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.* ***MS-PS4-3*** *Integrate qualitative scientific and technical information to support the claim that digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.*	*Students receiving **At/Near or Above Standard** indicators are likely to be able to* ✓ **make predictions about, describe, develop, or use a given model** involving **conservation of matter** in **chemical reactions** ✓ **use patterns make predictions about, describe, develop, or use a given model** about the **structure and function** of **waves** ✓ **identify, describe, or explain how to plan or perform investigations** about **stability and change** of **forces and motion** ✓ **use, describe, or explain a design solution, or identify evidence** of **relationships** within a **design solution** in **various systems** involving **energy transfer in chemical reactions or forces in collisions**
Life Science	**On Track Knowledge, Skills, and Abilities (KSAs)**
MS-LS1-7 *Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.* ***MS-LS4-1*** *Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.* ***MS-LS4-2*** *Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer ancestral relationships.*	*Students receiving **At/Near or Above Standard** indicators are likely to be able to* ✓ **use, describe, explain, or identify evidence** of **relationships in various systems** involving **energy transfer** ✓ **analyze data to identify** and **apply patterns** in data about **common ancestry**, the **diversity of organisms**, and the **geologic history of Earth** ✓ **construct explanations** by **identifying, describing, or comparing patterns** in **evidence** of anatomy and common ancestry of organisms

Earth and Space Science	CCR Knowledge, Skills, and Abilities (KSAs)
MS-ESS1-4 *Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's geologic history.* ***MS-ESS2-1*** *Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.* ***MS-ESS2-2*** *Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.* ***MS-ESS2-3*** *Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.* ***MS-ESS3-1*** *Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.* ***MS-ESS3-2*** *Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.*	*Students receiving **At/Near or Above Standard** indicators are likely to be able to* ✓ **make predictions about, describe, develop, or use a given model involving stability and change at varying scales in Earth's systems** ✓ **identify and apply patterns in data about the geologic history of Earth, or natural hazards to explain cause and effect relationships** ✓ **use the concept of patterns in cause and effect relationships or the concept of scale and proportion to construct explanations by identifying, describing, or comparing evidence or aspects of Earth systems including geologic history, materials and processes, natural resources or human impacts on those systems**

The Oklahoma Academic Standards for Science represent a progression from grades K-12 and it is critical that students have access to science teaching at each grade level so that they have the knowledge, skills and abilities needed to be on track and ready for the next level.

Grade Level	Overview of Grade Level Performance Expectations
Physical Science	Students in high school continue to develop their understanding of the four core ideas in the physical sciences. These ideas include the most fundamental concepts from chemistry and physics, but are intended to leave room for expanded study in upper-level high school courses. The high school performance expectations in Physical Science build on the middle school ideas and skills and allow high school students to explain more in-depth phenomena central not only to the physical sciences, but to life and earth and space sciences as well. These performance expectations blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain ideas across the science disciplines. In the physical science performance expectations at the high school level, there is a focus on several scientific practices. These include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations; and to use these practices to demonstrate understanding of the core ideas. Students are also expected to demonstrate understanding of several engineering practices including design and evaluation.
Biology	Students in high school develop understanding of key concepts that will help them make sense of life science. The ideas are built upon students' science understanding of disciplinary core ideas, science and engineering practices, and crosscutting concepts from earlier grades. There are four life science disciplinary core ideas in high school: 1) From Molecules to Organisms: Structures and Processes, 2) Ecosystems: Interactions, Energy, and Dynamics, 3) Heredity: Inheritance and Variation of Traits, 4) Biological Evolution: Unity and Diversity. The performance expectations for high school life science blend core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge that can be applied across the science disciplines. While the performance expectations in high school life science couple particular practices with specific disciplinary core ideas, instructional decisions should include use of many practices underlying the performance expectations.

8th Grade	Students in middle school continue to develop understanding of four core ideas in the physical sciences. The middle school performance expectations in the Physical Sciences build on the K – 5 ideas and capabilities to allow learners to explain phenomena central to the physical sciences but also to the life sciences and earth and space science. The performance expectations in physical science blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain real world phenomena in the physical, biological, and earth and space sciences. In the physical sciences, performance expectations at the middle school level focus on students developing understanding of several scientific practices. These include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations; and to use these practices to demonstrate understanding of the core ideas. Students are also expected to demonstrate understanding of several of engineering practices including design and evaluation.
7th Grade	Students in middle school continue to develop understanding of four core ideas in the physical sciences. The middle school performance expectations in the Physical Sciences build on the K – 5 ideas and capabilities to allow learners to explain phenomena central to the physical sciences but also to the life sciences and earth and space science. The performance expectations in physical science blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain real world phenomena in the physical, biological, and earth and space sciences. In the physical sciences, performance expectations at the middle school level focus on students developing understanding of several scientific practices. These include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations; and to use these practices to demonstrate understanding of the core ideas. Students are also expected to demonstrate understanding of several of engineering practices including design and evaluation.
6th Grade	Students in middle school continue to develop understanding of four core ideas in the physical sciences. The middle school performance expectations in the Physical Sciences build on the K – 5 ideas and capabilities to allow learners to explain phenomena central to the physical sciences but also to the life sciences and earth and space science. The performance expectations in physical science blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain real world phenomena in the physical, biological, and earth and space sciences. In the physical sciences, performance expectations at the middle school level focus on students developing understanding of several scientific practices. These include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations; and to use these practices to demonstrate understanding of the core ideas. Students are also expected to demonstrate understanding of several of engineering practices including design and evaluation.
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OSTP Glossary

criterion-referenced test: An assessment that allows its users to make score interpretations of a student's performance in relation to specified performance standards or criteria, rather than in comparison to the performances of other test takers. See also **performance standard/level**.

cut score: Selected points on the score scale of a test. The points are used to determine whether a particular test score is sufficient for some purpose. For example, student performance on a test maybe classified into one of several categories, such as unsatisfactory, limited knowledge, proficient or advanced on the basis of cut scores.

mean: The quotient obtained by dividing the sum of a set of scores by the number of scores; also called the "average." Mathematicians call it the "arithmetic mean."

Oklahoma Performance Index (OPI): The Oklahoma Performance Index (OPI) is a scaled score resulting from the mathematical transformation of the true score, which is associated with each of the raw scores. The OPI score is used to place students in one of four performance levels. The (OPI) score allows for a numerical comparison between students. For example, we can compare scale scores for students who took the 5th grade mathematics test this year with those who will take this test next year. Scale scores are not comparable across different subjects

performance level: A level of performance on a test, established by education experts, as a goal of student attainment. It may also refer to a description of the knowledge, skills, and abilities typically held by students within a performance level.

performance level descriptors (PLD): Descriptors that convey the degree of student achievement in a given achievement level. Taken together with grade- and content-specific PLDs and threshold scores, they convey to educators, parents, student, and the public the meaning of assessment results relative the Oklahoma Academic Standards

performance-level score range: A range of scale scores that corresponds to one of the four performance levels: Advanced, Proficient, Below Basic, and Basic.

reporting category: Groups of similar student skills or content standards assessed within each grade and subject and are communicated on the OSTP test blueprints.

reporting category Indicators: Smallest grain-size OSTP data that relates student performance on a subset of items associated with a reporting category with an indicator, rather than with scale scores. These indicators are Below Standard, At/Near Standard, and Above Standard.

scale scores: Scores on a single scale with intervals. The scale can be applied to all groups taking a given test, regardless of group characteristics or time of year, making it possible to compare scores from different groups of students. Scale scores are appropriate for various statistical purposes. For example, they can be added, subtracted, and averaged across test levels. Such computations permit educators to make direct comparisons among examinees or compare individual scores to groups in a way that is statistically valid. This cannot be done with percentiles or grade equivalents.

standardized test: A test that is given in exactly the same way to all children taking the test. The items are the same, the instructions are the same, the timing is the same, the method of determining correctness is the same, and the scoring is the same. No variations are allowed.