K-12 Science Course of Study

Hilliard City Schools

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Science Course of Study

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Forward and Acknowledgment

The Hilliard City School District would like to acknowledge and thank the following staff who served on the K-12 Science Curriculum Revision Committee. This committee consisted of staff from all grade levels, buildings, disciplines and supports. Through their professional development, content knowledge, instructional experience, and knowledge of students, the committee revised the K-12 Science Course of Study to incorporate the Ohio Learning Standards for Science, evidence-based research, strong instructional strategies, and assessment practices. Thank you for the time you have given and the work you completed to design this Course of Study for our teachers and students.

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Introduction

As the world evolves, so too must teaching and learning. Today's student, at a glance, looks similar to the students of yesterday; however, on the inside, this student is really quite different. In general, 21st century students are walking into our classrooms with access to knowledge and content at their fingertips. They are more experienced and ready to engage in complex learning and real-world problem-solving. Additionally, today's global society, sparked by rapid technological advances and innovation is putting new demands on a global work-force. Students must possess a new set of skills and competencies to be successful in the future. As such, school districts must consistently and systematically review what is taught in school and how it is taught. The Hilliard City Schools Curriculum Department works alongside teachers, administrators, families, and the community to define and communicate what all students will know and be able to do at each grade level and within each course in order to be Ready for Tomorrow.

The Science Course of Study is the district's foundational document which outlines the K-12 Curriculum Program for Science. The Course of Study is designed, developed, and revised periodically to ensure that the most recent Ohio Learning Standards are taught with fidelity, incorporating current research within science and using evidence-based instructional strategies and practices to maximize students' knowledge and skills. In addition, resources are evaluated for alignment and intentionality. The Course of Study consists of several key components, including a foreword, table of contents, introduction, the district's philosophy and vision statement, the district's educational goals, the content area's vision and instructional commitments, the K-12 Ohio Science Learning Standards, a scope and sequence for each grade level and/or course, and assessment practices.

When revising this course of study, the following areas of science instruction were at the forefront of professional development to guide the design of this document:

- Ohio' Learning Standards and Model Curriculum for Science
- Next Generation Science Standards
- The Nature of Science
- Science and Engineering Practices
- The 5E Learning Cycle
- Scientific Phenomenon and Sense-making
- Ambitious Science Teaching
- Culturally Responsive Practices

The resources and research listed below anchored the work of revising the K-12 Science curriculum:

- 5E Learning Cycle Model for Science - This model is incorporated into the Ohio K-12 Science Model Curriculum. It provides support to students as they learn to frame questions, assess and analyze data, and create and critique explanations (including engaging with others in a public forum), all of which are important components of scientific and engineering practices.
- A Framework for K-12 Science Education (2012) - This resource proposes an approach to K-12 science education that will capture students' interest and provide them with the necessary foundational knowledge in the field. It outlines a broad set of expectations for students in science and engineering in grades K-12. The overarching goal is for all high school graduates to have sufficient knowledge of science and engineering to engage in public discussions on science-related issues, be careful consumers of scientific and technical information, and enter the careers of their choice.

- Ambitious Science Teaching (Windschitl et. al, 2018) - This resource outlines a powerful framework for science teaching to ensure that instruction is rigorous and equitable for students from all backgrounds. The book is organized around four sets of core teaching practices: planning for engagement with big ideas; eliciting student thinking; supporting changes in students' thinking; and drawing together evidence-based explanations.
- Culturally Responsive Teaching and the Brain (Hammond, 2014) - Culturally Responsive Practice is a systematic approach to teaching that recognizes a student's unique culture can strengthen a connectedness to school and enhance learning. In a culturally responsive classroom, student's lived experiences, cultures, and linguistic capital are recognized and valued, high expectations for learning are supported, high-quality, rigorous instruction is provided, and students are stretched cognitively to grow as independent learners.
- Helping Students Make Sense of the World using Next Generation Science and Engineering Practices. (Schwarz et. al - 2017) - This book provides real-world examples from science classrooms that help answer three important questions
    1. How will engaging students in science and engineering practices help improve science education?
    2. What do the eight practices look like in the classroom?
    3. How can educators engage students in practices to bring the NGSS to life?
- Instructional Sequence Matters Series (Brown, 2019) - This series of books show how to make simple shifts in the arrangement and combination of activities to improve student learning in a science classroom embedding the 5E Learning Cycle and POE (Predict, Observe, Explain).
- Ohio's Learning Standards and Model Curriculum for Science
- Order Matters Using the 5E Model to Align Teaching to How People Learn (Tanner, 2010) - This article defines the five components of the the 5E Model including engage, explore, explain, elaborate, evaluate.
- Science and Engineering Practices - These practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems. Scientific inquiry involves the formulation of a question that can be answered through investigation, while engineering design involves the formulation of a problem that can be solved through design.
- The Nature of Science - Nature of science (NOS) is a critical component of scientific literacy that enhances students' understanding of science concepts and enables them to make informed decisions about scientifically-based personal and societal issues.

District Mission and Educational Philosophy

District Mission: Hilliard City Schools will ensure that every student is Ready For Tomorrow.

Educational Philosophy, Purpose and Beliefs:
The district mission will be accomplished by:

1. Academics – The foundational knowledge we require all our students to be skilled in. The traditional focus of schools and our elite teachers as they prepare our students.

2. Interests – Connecting learning to life. We align students' strengths to their path after high school. This is accomplished by providing opportunities for students to discover their own potential.

3. Mindset – Our passion for growth leads to an understanding that change and improvement are a part of life. We foster student self awareness to guide students to an understanding of their personal strengths and weaknesses.

The purpose of the Hilliard City School District is to enable students to become productive citizens in an ever-changing world. We believe it is the responsibility of the District to ensure that all students can learn and grow.

1. Students are the focus of all school activities.

2. To develop all students' potential, the Hilliard City School District will strive to provide a safe and caring environment.

3. The District will guide students in the pursuit of excellence in knowledge and skills and prepare them to become productive citizens in a democratic society.

4. The District will provide ongoing professional learning for all staff, ensuring adequate facilities, resources and instructional tools essential to continuous student improvement.

5. A student's value system begins with the family.

6. Partnerships between home, school and community are essential to student success.

All building and course of study philosophies reflect and extend the Board's philosophy.

(Policy - AD, ADA)

District Instructional Goals

The educational goals for the District address the meaning of a quality education. Each learner who has the potential and inner strength should strive toward the ideal implicit in each goal.

The goals are intertwined: no one goal stands in isolation from the rest. They will help to define performance objectives for learners, identify tasks to be performed by teachers in giving substance to those objectives and help to determine means for evaluating learners' progress toward the goals.

1. **Physical and Emotional Well-Being** - Education should contribute to the learner's physical and emotional well-being, especially to a sense of self-worth and to a capacity for influencing one's own destiny through personal growth. Students will also learn to work effectively and to cooperate with others in order to form positive, healthy relationships.
2. **Communication Skills** - Education should develop in each learner the basic skills needed for communication, perception, evaluation, and conceptualization of ideas. Among the most important skills are reading, writing, speaking, listening, computational skills, visual literacy and technology literacy.
3. **Effective Use of Knowledge** - Education should provide each learner access to human cultural heritage. It should stimulate intellectual curiosity and promote intellectual development. Students should strive to produce high quality products based on knowledge work.
4. **Capacity and Desire for Lifelong Learning -** Education should foster and stimulate in each learner the natural desire for lifelong learning and should develop the skills necessary to fulfill that desire.
5. **Citizenship in a Democratic Society** - Education should provide each learner with an understanding of how our society functions in theory and in practice. Education must also foster individual commitment to exercise the rights and responsibilities of citizenship including participation in the democratic process and service to society.
6. **Respect for the Community of Man** - Education should provide each learner with the knowledge and experience which contribute to an understanding of human similarities and differences, thereby advancing mutual respect for humanity and for the dignity of the individual.
7. **Occupational Competence** - Education should provide the learner with the skills, experience, attitudes and understanding for future careers. It is also important for the learner to develop a capacity to adapt to change by solving problems and thinking creatively.
8. **Understanding of the Environment** - Education should provide each learner with knowledge and understanding of the social, physical, and biological worlds, and the balance between humans and their environment, and should develop attitudes and behavior leading to intelligent use of the environment. Students will learn to conserve the natural world in which they live.
9. **Creative Interests and Talents** - Education should provide each learner with varied opportunities to nurture interests, to discover and to develop natural talents and to express values and feelings through various media. Students should develop an appreciation of the arts, leisure and everyday life.
10. **Individual Values and Attitudes** - Education should expand and advance the humane dimensions of all learners, especially by helping them to identify and cultivate their own moral and ethical values and attitudes.

(Policy - IA)

Science Vision Statement and Instructional Commitments

Vision Statement:
Hilliard City Schools' Science vision is for all students to actively engage in meaningful, inquiry-based experiences that build deep scientific knowledge and critical thinking skills. Through authentic problem-solving and collaborative exploration, we foster curiosity, creativity, student agency, and scientific ways of thinking and knowing. Our science education empowers students to understand the world around them, adapt to change, make and investigate claims based on evidence, and become informed citizens who contribute positively to society.

Instructional Commitments:
In order to achieve our vision, Hilliard City Schools teachers of Science are committed to each of the following:

1. **Partnerships with Students** - Teachers of Science will build meaningful relationships with students, fostering classroom communities and learning environments that promote trust, curiosity, exploration and collaboration. Teachers will empower students to deeply understand fundamental science ideas, participate in the practices of science, collectively and collaboratively solve authentic problems, and engage in scientific dialogue centered on real world application.

2. **Culturally Responsive Practices** - Teachers of Science recognize that all students bring unique experiences, backgrounds, cultural perspectives, and language to the classroom community. Teachers will use this understanding to inform instructional practices and supports that enable all students to see themselves as scientists. Students will engage with science around real life phenomena, use their experiences and background knowledge to generate and discuss ideas, develop and test models, defend claims, and synthesize learning to provide explanations. Students will apply their scientific knowledge, ways of thinking, and skills to real life scenarios and personal interests.

3. **Appropriately Challenging, Rigorous Instruction** - Teachers of Science will recognize that each and every student is able to engage in scientific ways of thinking and knowing. Challenging tasks are at the core of lessons focused on inquiry, investigation, problem solving, and sense making, and these tasks help motivate students to learn more. Teachers must challenge students to persevere in order to give them the experience of success in meeting high expectations. Teaching with high expectations means giving each and every student access to challenging tasks, curriculum and courses that make reasoning and problem solving the focus for each student. Teaching science with high expectations for all students invites students to learn to identify misconceptions, develop arguments, and make connections to other contexts and disciplines.

4. **Research-Based Practices** - Teachers of Science teachers will provide students with high-quality, research-based science instruction to meet students' individual needs. The implementation of research-based practices, such as the Science and Engineering practices and the 5 E Learning Cycle, will improve student learning outcomes and equip students with the scientific knowledge and skills necessary to engage in reasoning, problem solving, and sense-making experiences.

5. **Authenticity and Real-World Connection**s - Teachers of Science will incorporate storylines, real-world phenomena, and/or sense making experiences in their courses in order to make science concepts relevant and relatable to their students. Through this approach, teachers will create shared experiences that spark interest and make learning accessible to all students. When possible, teachers will make connections with experts in the field or connect science learning to community issues and concerns. The ability to apply knowledge to solve problems will center a student's learning experience.

6. **Scientific Mindset** - Teachers of Science are committed to developing critical thinking and analytical reasoning skills in their students. Teachers will create a learning environment that encourages questioning, reasoning, interpreting and analyzing data and graphs, designing and performing experiments, and modeling. Teachers will provide opportunities for students to share their ideas and understanding as well as work collaboratively to solve problems and engineer solutions.

Current Research and Best Practices for Science

As referenced in the introduction, the K-12 Science Course of Study revision relied on current research and evidence-based practices that should be implemented in every classroom in order for all students to acquire the knowledge and skills to become scientists who think critically and contribute to a global community. The following is a summation of several key pieces that define science education including the Science and Engineering Practices, Scientific Phenomena and Sense-making, the 5 E Learning Cycle and the Ohio Department of Education and Workforce Model Curricula for Science (2019).

Hilliard's K-12 Science Course of Study is grounded in key principles related to science education beginning with the common definition of science which states that scientific knowledge is logical, predictive, testable, and expands and advances as new evidence is discovered. Science is a process of continuing investigation, based on observation, scientific hypothesis testing, measurement, experimentation and theory building which leads to explanations of natural phenomena, processes, or objects that are open to further testing and revision based on evidence. Science education is also rooted in the Science and Engineering Practices which describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of practices that engineers use as they design and build models and systems. There are eight key Science and Engineering Practices including

1. Asking questions and defining problems - A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world works and which can be empirically tested.
2. Developing and using models - A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations.
3. Planning and carrying out investigations - Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters.
4. Analyzing and interpreting data - Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis.
5. Using mathematics and computational thinking - In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; statistically analyzing data; and recognizing, expressing, and applying quantitative relationships.

6. Constructing explanations and designing solutions - The products of science are explanations and the products of engineering are solutions.
7. Engaging in argument from evidence - Argumentation is the process by which explanations and solutions are reached.
8. Obtaining, evaluating and communicating information - Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity.

The Nature of Science distinguishes science as a discipline and describes how scientific knowledge is advanced. It establishes that the goal of science education is to help students become scientifically literate citizens able to use science as a way of knowing about the natural and material world. All students should have sufficient understanding of scientific knowledge and scientific processes to enable them to distinguish what is science from what is not science and to make informed decisions about career choices, health maintenance, quality of life, community and other decisions that impact both themselves and others. "The Nature of Science is derived not only from the eight science practices delineated in the Framework for K–12 Science Education (2012), but also from decades of research supporting the various forms of systematic gathering of information through direct and indirect observations of the natural world and the testing of this information by the various research methods used in science, such as descriptive, correlational, and experimental designs. All science educators and those involved with science teaching and learning should have a shared accurate view of the nature of scientific knowledge, and recognize that the Nature of Science should be taught explicitly alongside science and engineering practices, disciplinary core ideas, and crosscutting concepts." The Nature of Science is outlined in the Ohio Department of Education and Workforce Model Curriculum for Science which identifies the skills students in each grade band should build in order to demonstrate scientific literacy.

Science, engineering, and technology is embedded into nearly every facet of modern life, and hold the key to meeting many of humanity's most pressing current and future challenges. The Committee on a Conceptual Framework for New K-12 Science Education Standards was charged with developing a framework that articulates a broad set of expectations for students in science. The overarching goal of the framework for K-12 science education is to ensure that by the end of high school, all students will appreciate the beauty and wonder of science; possess sufficient knowledge of science and engineering to engage in public discussions on related issues; are careful consumers of scientific and technological information related to their everyday lives; are able to continue to learn about science outside school; and have the skills to enter careers of their choice, including (but not limited to) careers in science, engineering, and technology. The framework is based on a rich and growing body of research on teaching and learning in science, as well as on nearly two decades of efforts to define foundational knowledge and skills for K-12 science and engineering. From this work, the committee concludes that K-12 science and engineering education should focus on a limited number of disciplinary core ideas and crosscutting concepts, be designed so that students continually build on and revise their knowledge and abilities over multiple years, and support the integration of such knowledge and abilities with the practices needed to engage in scientific inquiry and engineering design.

Science education in grades K-12 should be built around three major dimensions. These dimensions are

- Scientific and engineering practices
- Crosscutting concepts that unify the study of science and engineering through their common application across fields
- Core ideas in four disciplinary areas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science

To support students' meaningful learning in science and engineering, all three dimensions need to be integrated into standards, curriculum, instruction, and assessment. Engineering and technology are featured alongside the natural sciences (physical sciences, life sciences, and earth and space sciences) for two critical reasons: (1) to reflect the importance of understanding the human-built world and (2) to recognize the value of better integrating the teaching and learning of science, engineering, and technology. An illustration of the Framework for K-12 Science Education is provided below.

Phenomena-based learning in science and engineering is an educational approach that uses real-world phenomena or complex problems as the basis for teaching and learning. This way of teaching is based on the idea that students can learn about science by investigating events that happen around them every day. Phenomena have traditionally been a missing piece in science education, which too often has focused on teaching general knowledge that students can have difficulty applying to real world contexts. Anchoring learning in explaining phenomena supports student agency for wanting to build science and engineering knowledge. Students are able to identify an answer to "why do I need to learn this?" before they even know what the "this" is. In contrast, students might not understand the importance of learning science ideas that teachers and curriculum designers know are important but that are unconnected from phenomena. By centering science education on phenomena that students are motivated to explain, the focus of learning shifts from learning about a topic to figuring out why or how something happens. For example, instead of simply learning about the topics of photosynthesis and mitosis,

THE THREE DIMENSIONS OF THE FRAMEWORK

1 Scientific and Engineering Practices
1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

2 Crosscutting Concepts
1. Patterns
2. Cause and effect: Mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: Flows, cycles, and conservation
6. Structure and function
7. Stability and change

3 Disciplinary Core Ideas

Physical Sciences
PS1: Matter and its interactions
PS2: Motion and stability: Forces and interactions
PS3: Energy
PS4: Waves and their applications in technologies for information transfer

Life Sciences
LS1: From molecules to organisms: Structures and processes
LS2: Ecosystems: Interactions, energy, and dynamics
LS3: Heredity: Inheritance and variation of traits
LS4: Biological evolution: Unity and diversity

Earth and Space Sciences
ESS1: Earth's place in the universe
ESS2: Earth's systems
ESS3: Earth and human activity

Engineering, Technology, and Applications of Science
ETS1: Engineering design
ETS2: Links among engineering, technology, science, and society

students are engaged in building evidence-based explanatory ideas that help them figure out how a tree grows. Explaining phenomena and designing solutions to problems allow students to build general science ideas in the context of their application to understanding phenomena in the real world, leading to deeper and more transferable knowledge. Students who come to see how science ideas can help explain and model phenomena related to compelling real world situations learn to appreciate the social relevance of science. They get interested in and identify with science as a way of understanding and improving real world contexts. Focusing investigations on compelling phenomena can help sustain students' science learning. The most powerful phenomena from an educational perspective are culturally or personally relevant or consequential to students. Such phenomena highlight how science ideas help us explain aspects of real world contexts or design solutions to science-related problems that matter to students, their communities, and society.

Finally, the 5E Learning Cycle for Science is a research-based approach to designing instructional sequences within a unit where each phase (engage, explore, explain, elaborate, and evaluate) is used as the basis for one or more lessons. By using the 5E Learning Cycle, teachers will be able to

- Provide supports to students as they learn to frame questions, assess and analyze data, and create and critique explanations (including engaging with others in a public forum) – all important components of scientific and engineering practices.
- Select instructional materials that promote the teaching and learning of science by using scientific and engineering practices.
- Assess students' abilities in multiple ways that are compatible with scientific and engineering practices.

Students engaging with grade-appropriate science content through scientific and engineering practices and the 5E Learning Cycle will be better prepared to meet the challenges as they enter higher education or pursue careers. Here is an illustration of the 5E Learning Cycle for Science

A Balanced Assessment System

A balanced assessment framework allows all learners to demonstrate their understanding, all teachers to use results as a means of providing responsive instruction and intervention, and all stakeholders to recognize areas of strength and need in support of every student, without exception. Battelle for Kids, as part of their Assessment21 professional learning series, identified four big ideas regarding assessments and how they can be leveraged to drive deeper learning.

- Testing is an event. Assessment is a process.
- Assessing deeper learning cannot be done in a vacuum.
- Assessment for deeper learning promotes transfer.
- Students are important stakeholders in the assessment process - now more than ever.

A combination of diagnostic, formative, and summative assessments provide learners and educators with valuable information to ensure that the learning environment is responsive to the diverse needs of all students and provides equitable opportunities to engage with academics, interests, and mindsets in a culturally relevant way. Assessments **for**, **as**, and **of** learning allow teachers and students to gather, examine, and use data in support of deep learning and thinking.

Assessments for learning are intended to occur during the learning process to gather specific information about each student's learning path based on what they know and can do. These opportunities work to unlock prior knowledge, identify misconceptions and errors in thinking, and demonstrate understanding and progress toward mastery of a particular standard or outcome. These assessments should be designed such that teachers can easily unpack and use the information to differentiate instruction, provide targeted and responsive interventions, and create conditions so that they, in partnership with students, can identify successful next steps in the learning process.

Assessments for learning also provide each student with accurate and descriptive feedback and help all stakeholders gain an understanding of achievement, progress, and any necessary support. Assessments as learning serve as opportunities to promote self-assessment and self-monitoring. In order for students to adequately plan for learning, connect new ideas to existing understandings, monitor progress, identify misconceptions, make sense of new concepts, and reflect on learning, teachers must both support the ambiguity and uncertainty that is inevitable with new learning as well as model and guide mechanisms of questioning one's own thinking.

Assessments of learning serve as a summary of student achievement and often represent summative demonstrations of mastery. These assessments are meant to be fair and accurate sources of information regarding student progress toward identified outcomes and can be used, when appropriate, to make educational decisions about and for students. To ensure these assessments are reliable, valid, and accurate representations of student learning, they should be transparent, aligned to curricular goals and outcomes, and accurately reflect the rigor of the course and intended learning.

The Hilliard City School District strives to accurately measure student achievement using a balanced assessment system. A single data point has limitations and tells only a part of the full picture of the district and a student's academic performance. By utilizing multiple data points, we can create a robust picture of student achievement that allows us to truly prepare students to be Ready for Tomorrow. In creating that balanced assessment system, each assessment type has unique benefits. Listed below are some of the roles of the major assessments in our system.

1. **Purpose of Classroom Teacher Assessments:**
    - Monitor student progression on mastery of state standards
    - Identify common student misconceptions
    - Identify where to adjust instruction
    - Identify student strengths and weaknesses
    - Help inform student grades
    - Communication tool for students to benchmark their learning

2. **Purpose of Common District Assessments (in Performance Matters):**

For Teachers:

- Monitor student progression on mastery of state standards
- Identify common student misconceptions
- Identify where to adjust instruction
- Identify student strengths and weaknesses
- Compare student progress to other students in the building and district
- Encourage collaboration in data analysis and instructional planning

For Building Leaders:

- Monitor student progression on mastery of state standards
- Compare student progress to other students in the district
- Identify where teachers need professional development (PD) and/or support
- Identity areas for celebration and improvement
- Lead data team discussions and encourage collaboration
- Monitor building progress toward state assessment goals
- Identify trends among student groups

For District Leaders:

- Identify where buildings/teachers need support/PD
- Identify district learning gaps
- Inform district improvement planning
- Monitor student progression toward master of state standards
- Identify resources needed for support and justify the investment in those resources
- Identify trends with subgroups or other identified populations
- Monitor consistency in student achievement district wide

3. **Purpose for STAR (Renaissance) Assessments:**
    - Impartial, third party, look at student achievement
    - Calculates nationally normed, comparative, student growth data
    - Monitors student mastery of state standards and progress toward success on state assessments
    - Allows for student data comparison over time, including multiple years
    - Allows for the identification and monitoring of academic interventions
    - Allows for progress monitoring for EL students, students on IEPs, or other students as needed
    - Inform district improvement planning

4. **Purpose for Ohio State Assessments:**
    - Impartial, third party, look at student achievement
    - Identify district curriculum gaps
    - Identify where buildings/teachers need support/PD
    - Identify student achievement and mastery of state standards district wide
    - Creates comparative growth data
    - Inform district improvement planning
    - Identify trends with subgroups or other identified populations
    - Allows students to demonstrate competency toward graduation pathways
    - Are the basis for the state's school evaluation system (District Report Card)
    - Evaluation of our district progress in comparison to other district in the state
    - Evaluate student skills in preparation for post secondary options

Ohio K-12 Science Standards Organization and Overview

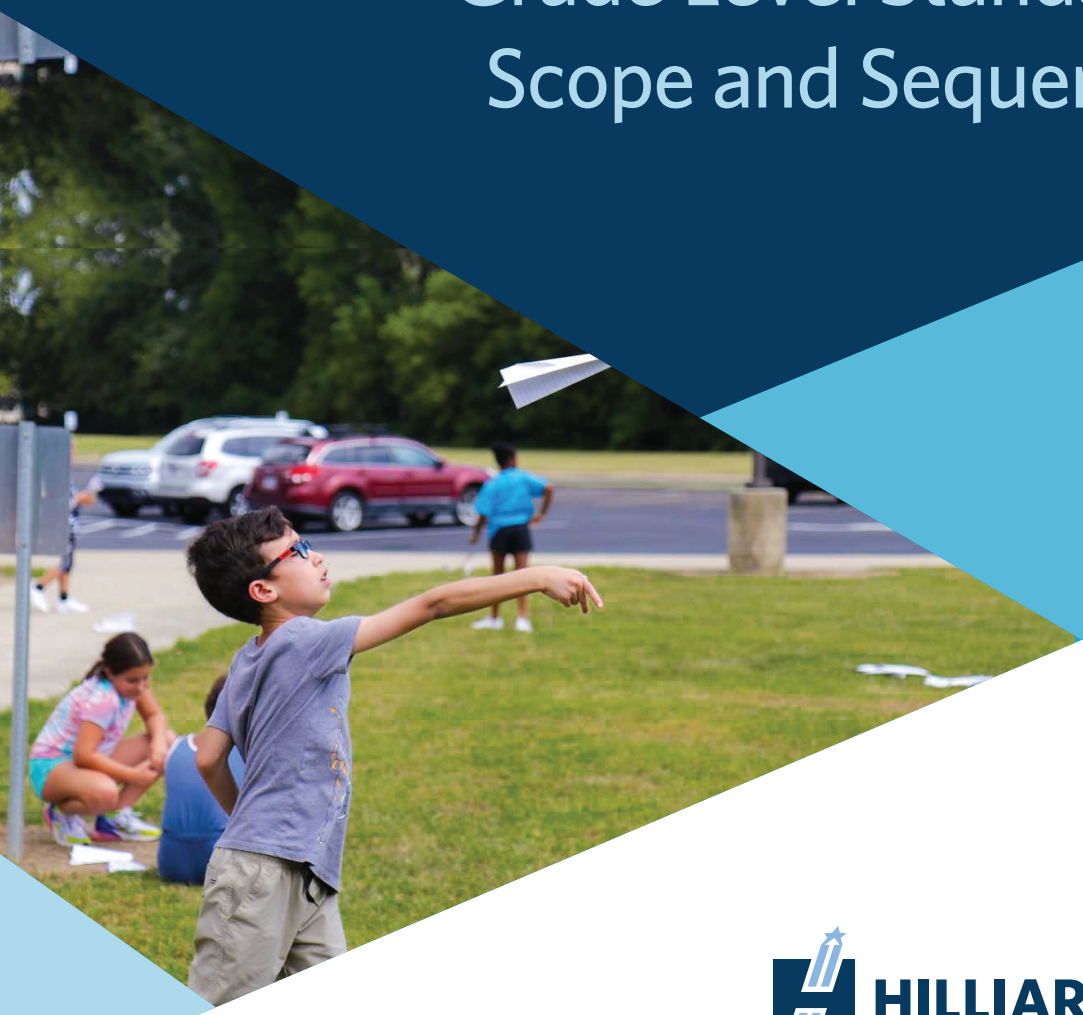
The K-12 Science Course of Study aligns to the Ohio Science Learning Standards. It establishes a foundation for the planning and development of lessons, resource selection and instruction. The standards are research and evidence-based, aligned with college and workforce expectations, rigorous, and internationally benchmarked. They define what students should know and be able to do in their study of science. The Nature of Science identifies by grade band (K-2, 3-5, 6-8 and high school) the skills students should build in science classrooms around the following categories: scientific inquiry, practice and applications, science is a way of knowing, science is a human endeavor, and scientific knowledge is open to revision in light of new evidence. In addition, Ohio's Cognitive Demands for Science describe the thinking and actions of students necessary to demonstrate scientific literacy.

COGNITIVE DEMAND	DESCRIPTION
DESIGNING TECHNOLOGICAL/ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS (T)	Requires student to solve science-based engineering or technological problems through application of scientific inquiry. Within given scientific constraints, propose or critique solutions, analyze and interpret technological and engineering problems, use science principles to anticipate effects of technological or engineering design, find solutions using science and engineering or technology, consider consequences and alternatives, and/or integrate and synthesize scientific information.
DEMONSTRATING SCIENCE KNOWLEDGE (D)	Requires student to use scientific practices and develop the ability to think and act in ways associated with inquiry, including asking questions, planning and conducting investigations, using appropriate tools and techniques to gather and organize data, thinking critically and logically about relationships between evidence and explanations, constructing and analyzing alternative explanations, and communicating scientific arguments. (Slightly altered from National Science Education Standards)
INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS (C)	Requires student to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.
RECALLING ACCURATE SCIENCE (R)	Requires student to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students' knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

The K-12 Science Course of Study outlines the Nature of Science by grade band, specific grade level topics that students will learn within earth and space science, physical science, and life science and the specific content standards students will learn at each grade level. The science standards are written as content statements which describe the science content to be learned. These are the "what" of science that should be accessible to students at each grade level to prepare them to learn about and use scientific knowledge, principles, and processes with increasing complexity in subsequent grades.

K-12 Science
Graded Course of Study

Grade Level Standards
Scope and Sequence



HILLIARD CITY SCHOOLS

The following Graded Course of Study identifies the Science Standards taught at each grade level and/or course as well as provides a sample Scope and Sequence that illustrates how standards are paired together and sequenced throughout the course of a school year. The Scope and Sequence is a flexible guide and should be adaptive based on student learning. The Elementary Scope and Sequence, grades K-5, reflects all of the standards that could be potentially touched upon in a given trimester. The Secondary Scope and Sequence, grades 6-12, reflects the specific standards assessed in a unit.

The Nature of Science

Nature of Science
One goal of science education is to help students become scientifically literate citizens able to use science as a way of knowing about the natural and material world. All students should have sufficient understanding of scientific knowledge and scientific processes to enable them to distinguish what is science from what is not science and to make informed decisions about career choices, health maintenance, quality of life, community and other decisions that impact both themselves and others.

Categories	Grades K-2	
Scientific Inquiry, Practice and Applications:	All students must use these scientific processes with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas.	• Apply knowledge of science content to real-world challenges. • Plan and conduct simple scientific investigations using appropriate safety techniques based on explorations, observations and questions. • Employ simple equipment and tools to gather data and extend the senses. • Use data and mathematical thinking to construct reasonable explanations. • Communicate with others about investigations and data.
Science is a Way of Knowing	Science assumes the universe is a vast single system in which basic laws are consistent. Natural laws operate today as they did in the past, and they will continue to do so in the future. Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise and extend this knowledge.	• The world is discovered through exploration. • Exploration leads to observation. Observation leads to questions. • Natural events happen today as they happened in the past. • Events happen in regular patterns and cycles in the natural world.
Science is a Human Endeavor	Science has been, and continues to be, advanced by individuals of various races, genders, ethnicities, languages, abilities, family backgrounds and incomes.	• Everyone explores the world which generates questions. • The answer is not always as important as the process. • Questions often lead to other questions. • Discoveries are communicated and discussed with others. • People address questions through collaboration with peers and continued exploration. • Everyone can see themselves as scientists.
Scientific Knowledge is Open to Revision in Light of New Evidence	Science is not static. Science is constantly changing as we acquire more knowledge.	• It is essential to learn how to identify credible scientific evidence. • Ideas are revised based on new, credible scientific evidence.

Categories	Grades 3-5	
Scientific Inquiry, Practice and Applications:	All students must use these scientific processes with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas.	• Observe and ask questions about the world that can be answered through scientific investigations. • Design and conduct scientific investigations using appropriate safety techniques. • Use appropriate mathematics, tools and techniques to gather data and information. • Develop and communicate descriptions, models, explanations and predictions. • Think critically and ask questions about the observations and explanations of others. • Communicate scientific procedures and explanations. • Apply knowledge of science content to real-world challenges.
Science is a Way of Knowing	Science assumes the universe is a vast single system in which basic laws are consistent. Natural laws operate today as they did in the past and they will continue to do so in the future. Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise and extend this knowledge.	• Science is both a body of knowledge and processes to discover new knowledge. • Science is a way of knowing about the world around us based on evidence from experimentation and observations. • Science assumes that objects and events occur in consistent patterns that are understandable through measurement and observation.
Science is a Human Endeavor	Science has been, and continues to be, advanced by individuals of various races, genders, ethnicities, languages, abilities, family backgrounds and incomes.	• People from many generations and nations contribute to science knowledge. • People of all cultures, genders, and backgrounds can pursue a career in science. • Scientists often work in teams. • Science affects everyday life. • Science requires creativity and imagination.
Scientific Knowledge is Open to Revision in Light of New Evidence	Science is not static. Science is constantly changing as we acquire more knowledge.	• Science develops theories based on a body of scientific evidence. • Science explanations can change based on new scientific evidence.
Categories	**Grades 6-8**	
Scientific Inquiry, Practice and Applications:	All students must use these scientific processes with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas.	• Apply knowledge of science content to real-world challenges. • Identify questions that can be answered through scientific investigations. • Design and conduct scientific investigations using appropriate safety techniques. • Use appropriate mathematics, tools and techniques to gather data and information. • Analyze and interpret data.

		• Develop descriptions, models, explanations and predictions. • Think critically and logically to connect evidence and explanations. • Recognize and analyze alternative explanations and predictions. • Communicate scientific procedures and explanations. • Design technological/engineering solutions.
Science is a Way of Knowing	Science assumes the universe is a vast single system in which basic laws are consistent. Natural laws operate today as they did in the past and they will continue to do so in the future. Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise and extend this knowledge.	• Science is a way of knowing about the world around us based on evidence from experimentation and observations. • Science is a continual process and the body of scientific knowledge continues to grow and change. • Science assumes that objects and events occur in consistent patterns that are understandable through measurement and observation. • Science should carefully consider and evaluate all data including outliers. • Science is based on observable phenomena and empirical evidence. • Science disciplines share common rules for obtaining and evaluating empirical evidence.
Science is a Human Endeavor	Science has been, and continues to be, advanced by individuals of various races, genders, ethnicities, languages, abilities, family backgrounds and incomes.	• Individuals from different social, cultural, and ethnic backgrounds work as scientists and engineers. • Scientists and engineers are guided by habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism and openness to ideas. • Scientists and engineers rely on human qualities such as persistence, precision, reasoning, logic, imagination and creativity.
Scientific Knowledge is Open to Revision in Light of New Evidence	Science is not static. Science is constantly changing as we acquire more knowledge.	• Science explanations are subject to revision and improvement in light of additional scientific evidence or new understanding of scientific evidence.
Categories	**High School**	
Scientific Inquiry, Practice and Applications:	All students must use these scientific processes with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas.	• Identify questions and concepts that guide scientific investigations. • Design and conduct scientific investigations using a variety of methods and tools to collect empirical evidence, observing appropriate safety techniques. • Use technology and mathematics to improve investigations and communications. • Formulate and revise explanations and models using logic and scientific evidence (critical thinking). • Recognize and analyze explanations and models. • Communicate and support scientific arguments.

Science is a Way of Knowing	Science assumes the universe is a vast single system in which basic laws are consistent. Natural laws operate today as they did in the past and they will continue to do so in the future. Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise and extend this knowledge.	• Various science disciplines use diverse methods to obtain evidence and do not always use the same set of procedures to obtain and analyze data (i.e., there is no one scientific method).
		  ▪ Make observations and look for patterns.
		  ▪ Determine relevant independent variables affecting observed patterns.
		  ▪ Manipulate an independent variable to affect a dependent variable.
		  ▪ Conduct an experiment with controlled variables based on a question or hypothesis.
		  ▪ Analyze data graphically and mathematically.
		• Science disciplines share common rules of evidence used to evaluate explanations about natural phenomenon by using empirical standards, logical arguments and peer reviews.
		  ▪ Empirical standards include objectivity, reproducibility, and honest and ethical reporting of findings.
		• Logical arguments should be evaluated with open-mindedness, objectivity and skepticism.
		• Science arguments are strengthened by multiple lines of evidence supporting a single explanation.
		• The various scientific disciplines have practices, methods, and modes of thinking that are used in the process of developing new science knowledge and critiquing existing knowledge.

Science is a Human Endeavor	Science has been, and continues to be, advanced by individuals of various races, genders, ethnicities, languages, abilities, family backgrounds and incomes.	• Science depends on curiosity, imagination, creativity and persistence. • Individuals from different social, cultural, and ethnic backgrounds work as scientists and engineers. • Science and engineering are influenced by technological advances and society; technological advances and society are influenced by science and engineering. • Science and technology might raise ethical, social and cultural issues for which science, by itself, does not provide answers and solutions.
Scientific Knowledge is Open to Revision in Light of New Evidence	Science is not static. Science is constantly changing as we acquire more knowledge.	• Science can advance through critical thinking about existing evidence. • Science includes the process of comparing patterns of evidence with current theory. • Some science knowledge pertains to probabilities or tendencies. • Science should carefully consider and evaluate anomalies (persistent outliers) in data and evidence. • Improvements in technology allow us to gather new scientific evidence.

Science Topics By Grades K-8

Note: The below content themes, strands and statements associated by grade within the Ohio Model Curriculum for Science may be taught in any order. The sequence provided here does not represent the Ohio Department of Education and Workforce recommended sequence as there is no recommended sequence. As such, Hilliard City School's Science Scope and Sequence may adjust accordingly and differ from the table below.

Science Inquiry, Practices and Applications: During the years of **K to grade 4**, all students must develop the ability to: Observe and ask questions about the natural environment; Plan and conduct simple investigations; Employ simple equipment and tools to gather data and extend the senses; Use appropriate mathematics with data to construct reasonable explanations; Communicate about observations, investigations and explanations; and Review and ask questions about the observations and explanations of others.

Themes	Grade	The Physical Setting		The Living Environment
		Earth and Space Science		Life Science
Observations of the Environment This theme focuses on helping students develop the skills for systematic discovery to understand the science of the natural work around them in greater depth by using scientific inquiry.	K	Living and nonliving things have specific physical properties that can be used to sort and classify. The physical properties of air and water are presented as they apply to weather.		
		Daily and Seasonal Changes	***Properties of Everyday Objects and Materials***	***Physical and Behavioral Traits of Living Things***
	1	Energy is observed through movement, heating, cooling and the needs of living organisms.		
		Sun, Energy and Weather	***Motion and Materials***	***Basic Needs of Living Things***
	2	Living and nonliving things may move. A moving object has energy. Air moving is wind and wind can make a windmill turn. Changes in energy and movement can cause change to organisms and the environments in which they live.		
		The Atmosphere	***Changes in Motion***	***Interactions within Habitats***
Interconnections within Systems This theme focuses on helping students explore the components of various systems and then investigate dynamic and sustainable relationships within systems using scientific inquiry.	3	Matter is what makes up all living and nonliving substances on Earth. Matter has specific properties and exists in different states. Earth's resources are made of matter. Matter can be used by living things for materials and energy. There are many different forms of energy. Each living component of an ecosystem is composed of matter and uses energy.		
		Earth's Resources	***Matter and Forms of Energy***	***Behavior, Growth and Changes***
	4	Heat and electrical energy are forms of energy that can be transferred from one location to another. Matter has properties that allow the transfer of heat and electrical energy. Heating and cooling affect the weathering of Earth's surface and Earth's past environments. The processes that shape Earth's surface and the fossil evidence found can help decode Earth's history.		
		Earth's Surface	***Electricity, Heat and Matter***	***Earth's Living History***

Science Inquiry, Practices and Applications: During the years of **grades 5 through 8,** all students must have developed the ability to: Identify questions that can be answered through scientific investigations; Design and conduct a scientific investigation; Use appropriate mathematics, tools and techniques to gather data and information; Analyze and interpret data; Develop descriptions, models, explanations and predictions; Think critically and logically to connect evidence and explanations; Recognize and analyze alternative explanations and predictions; and Communicate scientific procedures and explanations.

Themes	Grade	The Physical Setting		The Living Environment
		Earth and Space Science		Life Science
Interconnections within Systems This theme focuses on helping students explore the components of various systems and then investigate dynamic and sustainable relationships within systems using scientific inquiry.	5	Cycles on Earth, such as those occurring in ecosystems, in the solar system, and in the movement of light and sound result in describable patterns. Speed is a measurement of movement. Change in speed is related to force and mass. The transfer of energy drives changes in systems, including ecosystems and physical systems.		
		Cycles and Patterns in the Solar System	***Light, Sound and Motion***	***Interactions within the Ecosystems***
	6	All matter is made of small particles called atoms. The properties of matter are based on the order and organization of atoms and molecules. Cells, minerals, rocks and soil are all examples of matter.		
		Rocks, Minerals and Soil	***Matter and Motion***	***Cellular to Multicellular***
	7	Systems can exchange energy and/or matter when interactions occur within systems and between systems. Systems cycle matter and energy in observable and predictable patterns.		
		Cycles and Patterns of Earth and the Moon	***Conservation of Mass and Energy***	***Cycles of Matter and Flow of Energy***
Order and Organization This theme focuses on helping students use scientific inquiry to discover patterns, trends, structures and relationships that may be inferred from simple principles. These principles are related to the properties or interactions within and between systems.	8	Systems can be described and understood by analysis of the interaction of their components. Energy, forces and motion combine to change the physical features of Earth. The changes of the physical Earth and the species that have lived on Earth are found in the rock record. For species to continue, reproduction must be successful.		
		Cycles and Patterns of Earth and the Moon	***Conservation of Mass and Energy***	***Cycles of Matter and Flow of Energy***

Kindergarten Science Standards

Earth and Space Science (ESS)

Topic: Daily and Seasonal Changes This topic focuses on observing, exploring, describing and comparing weather changes, patterns in the sky and changing seasons.	
K.ESS.1	Weather changes are long-term and short term.
K.ESS.2	The moon, sun and stars can be observed at different times of the day or night.

Physical Science (PS)

Topic: Properties of Everyday Objects and Materials This topic focuses on the production of sound and on observing, exploring, describing and comparing the properties of objects and materials with which the student is familiar.	
K.PS.1	Objects and materials can be sorted and described by their properties.
K.PS.2	Some objects and materials can be made to vibrate and produce sound.

Life Science (LS)

Topic: Physical and Behavioral Traits of Living Things This topic focuses on observing, exploring, describing and comparing living things in Ohio.	
K.LS.1	Living things have specific characteristics and traits.
K.LS.2	Living things have physical traits and behaviors, which influence their survival.

Kindergarten Scope and Sequence

	Earth Science	Physical Science	Life Science
Trimester 1	K.ESS.1		K.LS.1 K.LS.2
Trimester 2	K.ESS.1	K.PS.1	K.LS.1 K.LS.2
Trimester 3	K.ESS.1 K.ESS.2	K.PS.2	K.LS.1 K.LS.2

First Grade Science Standards

Earth and Space Science (ESS)

Topic: Sun, Energy and Weather This topic focuses on the sun as a source of energy and energy changes that occur to land, air and water.	
1.ESS.1	The sun is the principal source of energy.
1.ESS.2	Water on Earth is present in many forms.

Physical Science (PS)

Topic: Motion and Materials This topic focuses on the changes in properties that occur in objects and materials. Changes of position of an object are a result of pushing or pulling.	
1.PS.1	Properties of objects and materials can change.
1.PS.2	Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.

Life Science (LS)

Topic: Basic Needs of Living Things This topic focuses on the physical needs of living things in Ohio. Energy from the sun or food, nutrients, water, shelter and air are some of the physical needs of living things.	
1.LS.1	Living things have basic needs, which are met by obtaining materials from the physical environment.
1.LS.2	Living things survive only in environments that meet their needs.

First Grade Scope & Sequence

	Earth Science	Physical Science	Life Science
Trimester 1	1.ESS.1 1.ESS.2		1.LS.1 1.LS.2
Trimester 2	1.ESS.1 1.ESS.2	1.PS.1 1.PS.2	1.LS.1 1.LS.2
Trimester 3	1.ESS.1 1.ESS.2		1.LS.1 1.LS.2

Second Grade Science Standards

Earth and Space Science (ESS)

Topic: The Atmosphere This topic focuses on air and water as they relate to weather and weather changes that can be observed and measured.	
2.ESS.1	The atmosphere is primarily made up of air.
2.ESS.2	Water is present in the atmosphere.
2.ESS.3	Long- and short-term weather changes occur due to changes in energy.

Physical Science (PS)

Topic: Changes in Motion This topic focuses on observing the relationship between forces and motion.	
2.PS.1	Forces change the motion of an object.

Life Science (LS)

Topic: Interactions within Habitats This topic focuses on how ecosystems work by observations of simple interactions between the biotic/living and abiotic/nonliving parts of an ecosystem. Just as living things impact the environment in which they live, the environment impacts living things.	
2.LS.1	Living things cause changes on Earth.
2.LS.2	All organisms alive today result from their ancestors, some of which may be extinct. Not all kinds of organisms that lived in the past are represented by living organisms today.

Second Grade Scope and Sequence

	Earth Science	Physical Science	Life Science
Trimester 1	2.ESS.1 2.ESS.2 2.ESS.3		
Trimester 2	2.ESS.3	2.PS.1	
Trimester 3	2.ESS.3		2.LS.1 2.LS.2

Third Grade Science Standards

Earth and Space Science (ESS)

Topic: Earth's Resources This topic focuses on Earth's resources. While resources can be living and nonliving, within this strand, the emphasis is on Earth's nonliving resources, such as water, air, rock, soil and the energy resources they represent.	
3.ESS.1	Earth's nonliving resources have specific properties.
3.ESS.2	Earth's resources can be used for energy.
3.ESS.3	Some of Earth's resources are limited.

Physical Science (PS)

Topic: Matter and Forms of Energy This topic focuses on the relationship between matter and energy. Matter has specific properties and is found in all substances on Earth. Heat is a familiar form of energy that can change the states of matter.	
3.PS.1	All objects and substances in the natural world are composed of matter.
3.PS.2	Matter exists in different states, each of which has different properties.
3.PS.3	Heat, electrical energy, light, sound and magnetic energy are forms of energy.

Life Science (LS)

Topic: Behavior, Growth and Changes This topic explores life cycles of organisms and the relationship between the natural environment and an organism's (physical and behavioral) traits, which affect its ability to survive and reproduce.	
3.LS.1	Offspring resemble their parents and each other.
3.LS.2	Individuals of the same kind of organism differ in their inherited traits. These differences give some individuals an advantage in surviving and/or reproducing.
3.LS.3	Plants and animals have life cycles that are part of their adaptations for survival in their natural environments.

Third Grade Scope and Sequence

	Earth Science	Physical Science	Life Science
Trimester 1	3.ESS.1 3.ESS.2 3.ESS.3		3.LS.3
Trimester 2		3.PS.1 3.PS.2 3.PS.3	3.LS.3
Trimester 3			3.LS.1 3.LS.2 3.LS.3

Fourth Grade Science Standards

Earth and Space Science (ESS)

Topic: Earth's Resources This topic focuses on Earth's resources. While resources can be living and nonliving, within this strand, the emphasis is on Earth's nonliving resources, such as water, air, rock, soil and the energy resources they represent.	
4.ESS.1	Earth's surface has specific characteristics and landforms that can be identified.
4.ESS.2	The surface of Earth changes due to weathering.
4.ESS.3	The surface of Earth changes due to erosion and deposition.

Physical Science (PS)

Topic: Electricity, Heat and Matter This topic focuses on the conservation of matter and the processes of energy transfer and transformation, especially as they relate to heat and electrical energy	
4.PS.1	When objects break into smaller pieces, dissolve, or change state, the total amount of matter is conserved.
4.PS.2	Energy can be transferred from one location to another or can be transformed from one form to another.

Life Science (LS)

Topic: Earth's Living History This topic focuses on using fossil evidence and living organisms to observe that suitable habitats depend upon a combination of biotic and abiotic factors.	
4.LS.1	Changes in an organism's environment are sometimes beneficial to its survival and sometimes harmful.
4.LS.2	Fossils can be compared to one another and to present-day organisms according to their similarities and differences.

Fourth Grade Scope and Sequence

	Earth Science	Physical Science	Life Science
Trimester 1	4.ESS.1 4.ESS.2 4.ESS.3		4.LS.3
Trimester 2		4.PS.1 4.PS.2 4.PS.3	4.LS.3
Trimester 3			4.LS.1 4.LS.2 4.LS.3

Fifth Grade Science Standards

Earth and Space Science (ESS)

Topic: Cycles and Patterns in the Solar System This topic focuses on the characteristics, cycles and patterns in the solar system and within the universe. Topic: Interactions within Ecosystems This topic focuses on foundational knowledge of the structures and functions of ecosystems.	
5.ESS.1	The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.
5.ESS.2	The sun is one of many stars that exist in the universe.
5.ESS.3	Most of the cycles and patterns of motion between the Earth and sun are predictable.

Physical Science (PS)

Topic: Light, Sound and Motion This topic focuses on the forces that affect motion. This includes the relationship between the change in speed of an object, the amount of force applied and the mass of the object. Light and sound are explored as forms of energy that move in predictable ways, depending on the matter through which they move.	
5.PS.1	The amount of change in movement of an object is based on the mass of the object and the amount of force exerted.
5.PS.2	Light and sound are forms of energy that behave in predictable ways.

Life Science (LS)

Topic: Interactions within Ecosystems This topic focuses on foundational knowledge of the structures and functions of ecosystems.	
5.LS.1	Organisms perform a variety of roles in an ecosystem.
5.LS.2	All of the processes that take place within organisms require energy.

Fifth Grade Scope and Sequence

	Earth Science	Physical Science	Life Science
Trimester 1	5.ESS.1 5.ESS.2 5.ESS.3		
Trimester 2		5.PS.1 5.PS.2	
Trimester 3			5.LS.1 5.LS.2

Sixth Grade Science Standards

(Courses: Science 6)

Earth and Space Science (ESS)

Topic: Rocks, Minerals and Soil This topic focuses on the study of rocks, minerals and soil, which make up the lithosphere. Classifying and identifying different types of rocks, minerals and soil can decode the past environment in which they formed.	
6.ESS.1	Minerals have specific, quantifiable properties.
6.ESS.2	Igneous, metamorphic and sedimentary rocks have unique characteristics that can be used for identification and/or classification.
6.ESS.3	Igneous, metamorphic and sedimentary rocks form in different ways.
6.ESS.4	Soil is unconsolidated material that contains nutrient matter and weathered rock.
6.ESS.5	Rocks, minerals and soils have common and practical uses.

Physical Science (PS)

Topic: Matter and Motion This topic focuses on the study of foundational concepts of the particulate nature of matter, linear motion, and kinetic and potential energy	
6.PS.1	Matter is made up of small particles called atoms.
6.PS.2	Changes of state are explained by a model of matter composed of particles that are in motion.
6.PS.3	There are two categories of energy: kinetic and potential.
6.PS.4	An object's motion can be described by its speed and the direction in which it is moving.

Life Science (LS)

Topic: Cellular to Multicellular This topic focuses on the study of the basics of Modern Cell Theory. All organisms are composed of cells, which are the fundamental unit of life. Cells carry on the many processes that sustain life. All cells come from pre-existing cells.	
6.LS.1	Cells are the fundamental unit of life.
6.LS.2	All cells come from pre-existing cells.
6.LS.3	Cells carry on specific functions that sustain life.
6.LS.4	Living systems at all levels of organization demonstrate the complementary nature of structure and function.

Science 6 Scope and Sequence

	Earth Science	Physical Science	Life Science
SEMESTER 1			
Unit 1 • Nature of Science and Measuring in Science	Nature of Science Component to State curriculum NS1,NS2, NS3,NS4		
Unit 2 • Organization of Matter			6.PS.1
Unit 3 • Density			6.PS.2
Unit 4 • Phases of Matter & Thermal Energy			6.PS.3
SEMESTER 2			
Unit 5 • Minerals	6.EES.1 6.EES.5		
Unit 6 • Rocks • Rock Cycle	6.ESS.2 6.ESS.3 6.EES.5		
Unit 7 • Soil	6.EES.4 6.EES.5		
Unit 8 • Measurement in 3D Geometry		6.LS.1 6.LS.2 6.LS.3	
Unit 9 • Cell structures • Cell processes		6.LS.1 6.LS.2 6.LS.3 6.LS.4	
Unit 10 • Levels of Organizations • Classification		6.LS.1 6.LS.4	
Unit 11 • Motion and Speed			6.PS.3 6.PS.4

Seventh Grade Science Standards

(Courses: Science 7, Honors Science 7)

Earth and Space Science (ESS)

Topic: Cycles and Patterns of Earth and the Moon This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun and moon.	
7.ESS.1	The hydrologic cycle illustrates the changing states of water as it moves through the lithosphere, biosphere, hydrosphere and atmosphere.
7.ESS.2	Thermal-energy transfers in the ocean and the atmosphere contribute to the formation of currents, which influence global climate patterns.
7.ESS.3	The atmosphere has different properties at different elevations and contains a mixture of gases that cycle through the lithosphere, biosphere, hydrosphere and atmosphere.
7.ESS.4	The relative patterns of motion and positions of Earth, moon and sun cause solar and lunar eclipses, tides and phases of the moon.
7.ESS.5	The relative positions of Earth and the sun cause patterns we call seasons.

Physical Science (PS)

Topic: Conservation of Mass and Energy This topic focuses on the empirical evidence for the arrangements of atoms on the Periodic Table of Elements, conservation of mass and energy, transformation and transfer of energy.	
7.PS.1	Elements can be organized by properties.
7.PS.2	Matter can be separated or changed, but in a closed system, the number and types of atoms remains constant.
7.PS.3	Energy can be transformed or transferred but is never lost.
7.PS.4	Energy can be transferred through a variety of ways.

Life Science (LS)

Topic: Cycles of Matter and Flow of Energy This topic focuses on the impact of matter and energy transfer within the biotic component of ecosystems.	
7.LS.1	Energy flows and matter is transferred continuously from one organism to another and between organisms and their physical environments. 7.LS.2
7.LS.2	In any particular biome, the number, growth and survival of organisms and populations depend on biotic and abiotic factors.

Science 7 Scope and Sequence

	Earth Science	Physical Science	Life Science
SEMESTER 1			
Unit 1 • Environmental Science		7.LS.1 7.LS.2	
Unit 2 • Biomes		7.LS.1 7.LS.2	
Unit 3 • Earth's Waters	7.ESS.1 7.ESS.3		
Unit 4 • Photosynthesis, Respiration, and the	7.ESS.3	7.LS.1	
Unit 5 • The Atmosphere	7.ESS.3		
SEMESTER 2			
Unit 6 • Atmospheric	7.ESS.2		
Unit 7 • Ocean Currents	7.ESS.2		
Unit 8 • Seasons	7.EES.5		
Unit 9 • Phases of the Moon, Tides, and Eclipses	7.ESS.4		
Unit 10 • Elements, Compounds, and Mixtures			7.PS.2
Unit 11 • Atoms and the Periodic Table			7.PS.1
Unit 12 • Chemical and Physical Changes			7.PS.2 7.PS.3
Unit 13 • Chemical and Physical Changes			7.PS.3 7.PS.4

Eighth Grade Science Standards

(Courses: Science 8, Honors Science 8)

Earth and Space Science (ESS)

Topic: Physical Earth This topic focuses on the physical features of Earth and how they formed. This includes the interior of Earth, the rock record, plate tectonics and landforms.	
8.ESS.1	The composition and properties of Earth's interior are identified by the behavior of seismic waves.
8.ESS.2	Earth's lithosphere consists of major and minor tectonic plates that move relative to each other.
8.ESS.3	A combination of constructive and destructive geologic processes formed Earth's surface.
8.ESS.4	Evidence of the dynamic changes of Earth's surface through time is found in the geologic record.

Physical Science (PS)

Topic: Forces and Motion This topic focuses on forces and motion within, on and around the Earth and within the universe.	
8.PS.1	Objects can experience a force due to an external field such as magnetic, electrostatic or gravitational fields.
8.PS.2	Forces can act to change the motion of objects.

Life Science (LS)

Topic: Species and Reproduction This topic focuses on continuation of the species.	
8.LS.1	Diversity of species, a result of variation of traits, occurs through the process of evolution and extinction over many generations. The fossil records provide evidence that changes have occurred in number and types of species.
8.LS.2	Every organism alive today comes from a long line of ancestors who reproduced successfully every generation.
8.LS.3	The characteristics of an organism are a result of inherited traits received from parent(s).

Science 8 Scope and Sequence

	Earth Science	Physical Science	Life Science
SEMESTER 1			
Unit 1 • Earth's Interior	8.ESS.1		
Unit 2 • Continental Drift and Heat transfer	8.ESS.2		
Unit 3 • Sea Floor Spreading	8.ESS.2		
Unit 4 • Theory of Plate Tectonics	8.ESS.2		
Unit 5 • Plate Boundaries	8.ESS.2		
Unit 6 • Topographic Maps	8.ESS.3		
Unit 7 • Constructive Destructive Forces	8.ESS.3		
Unit 8 • Geologic Data and Time Scale	8.ESS.4		
SEMESTER 2			
Unit 9 • Change over Time		8.LS.1	
Unit 10 • Natural Selection		8.LS.1	
Unit 11 • Reproduction & cell division		8.LS.2	
Unit 12 • Inheritance and Mendel's Laws		8.LS.3	
Unit 13 • Punnet Squares & Pedigrees		8.LS.3	
Unit 14 • Force and Motion			8.PS.2 8.PS.3
Unit 15 • Fields and Non-Contact Forces			8.PS.1

Biology Standards

(Courses: Biology, Honors Biology)

Content Description: Biology investigates the composition, diversity, complexity and interconnectedness of life on Earth. Fundamental concepts of heredity and evolution provide a framework through inquiry-based instruction to explore the living world, the physical environment and the interactions within and between them. Students engage in investigations to understand and explain the behavior of living things in a variety of scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications.

Earth and Space Science (ESS)

Topic: Heredity This topic focuses on the explanation of genetic patterns of inheritance	
B.H.1	Cellular genetics
B.H.2	Structure and function of DNA in cells
B.H.3	Genetic mechanisms and inheritance
B.H.4	Mutations
B.H.5	Modern genetics

Physical Science (PS)

Topic: Evolution The study of evolution includes Modern Synthesis, the unification of genetics and evolution, historical perspectives of evolutionary theory, gene flow, mutation, speciation, natural selection, genetic drift and sexual selection.	
B.E.1	Mechanisms • Natural selection • Mutation • Genetic drift • Gene flow (immigration, emigration) • Sexual selection
B.E.2	Speciation • Biological classification expanded to molecular evidence • Variation of organisms within species due to population genetics and gene frequency

Life Science (LS)

Topic: Diversity and Interdependence of Life This topic focuses on the study of diversity and similarity at the molecular level of organisms.	
B.DI.1	Biodiversity • Genetic diversity • Species diversity
B.DI.2	Ecosystems • Equilibrium and disequilibrium • Carrying capacity
B.DI.3	Loss of Diversity • Climate change • Anthropocene effects • Extinction • Invasive species

Topic: Cells This topic focuses on the cell as a system itself (single-celled organism) and as part of larger systems (multicellular organism), sometimes as part of a multicellular organism, always as part of an ecosystem.	
B.C.1	Cell structure and function • Structure, function and interrelatedness of cell organelles • Eukaryotic cells and prokaryotic cells
B.C.2	Cellular processes • Characteristics of life regulated by cellular processes • Photosynthesis, chemosynthesis, cellular respiration, biosynthesis of macromolecules

Biology Scope and Sequence

	Heredity	Evolution	Diversity and Interdependence of Life	Cells
SEMESTER 1				
Unit 1 • Intro to Biology				B.C.1
Unit 2 • Biochemistry and Enzymes				B.C.1, B.C.2
Unit 3 • Cell Types and Components				B.C.1
Unit 4 • Cell Transport				B.C.1, B.C.2
Unit 5 • Cell Energy				B.C.2
Unit 6 • Cell Division	B.H.1			
Unit 7 • DNA replication	B.H.1, B.H.2			
SEMESTER 2				
Unit 8 • Transcription and Translation and Mutations	B.H.2, B.H.4			B.C.2
Unit 9 • Genetics	B.H.3			
Unit 10 • Modern Genetics, biotechnology	B.H.5			
Unit 11 • Natural Selection		B.E.1		
Unit 12 • Mechanisms of Evolution		B.E.1, B.E.2		
Unit 13 • Ecosystems and Population Ecology			B.DI.1 B.DI.2	
Unit 14 Human impact on			B.DI.3	

Physical Science Standards

(Courses: Physical Science, Honors Physical Science)

Content Description: Physical science introduces students to key concepts and theories that provide a foundation for further study in other sciences and advanced science disciplines. Physical science comprises the systematic study of the physical world as it relates to fundamental concepts about matter, energy and motion. A unified understanding of phenomena in physical, living, Earth and space systems is the culmination of all previously learned concepts related to chemistry, physics, and Earth and space science, along with historical perspective and mathematical reasoning.

Topic: Study of Matter This topic focuses on the structure and classification of matter as well as how elements combine to form compounds.	
PS.M.1	Classification of matter • Heterogeneous vs. homogeneous • Properties of matter • States of matter and its changes
PS.M.2	Atoms • Models of the atom (components) • Ions (cations and anions) • Isotopes
PS.M.3	Periodic trends of the elements • Periodic law • Representative groups
PS.M.4	Bonding and compounds • Bonding (ionic and covalent) • Nomenclature
PS.M.5	Reactions of matter • Chemical reactions • Nuclear reactions

Topic: Energy and Waves This topic focuses on qualitative understandings of energy and waves to ones that are more quantitative using mathematical formulas, manipulations and graphical representations.	
PS.EW.1	Conservation of energy • Quantifying kinetic energy • Quantifying gravitational potential energy
PS.EW.2	Transfer and transformation of energy (including work)
PS.EW.3	Waves • Refraction, reflection, diffraction, absorption, superposition • Radiant energy and the electromagnetic
PS.EW.4	Thermal energy
PS.EW.5	Electricity • Movement of electrons • Current • Electric potential (voltage) • Resistors and transfer of energy

Topic: Forces and Motion This topic focuses on forces having both magnitude and direction, can be represented with force diagrams, added to find a net force and affect motion. Motion is limited to segments of uniform motion (e.g., at rest, constant velocity, constant acceleration) in a straight line either horizontally, vertically, up an incline or down an incline. Additionally, motions of two objects may be compared or addressed simultaneously (e.g., when or where would they meet).	
PS.FM.1	Motion • Introduction to one-dimensional vectors • Displacement, velocity (constant, average and instantaneous) and acceleration • Interpreting position vs. time and velocity vs. time graphs
PS.FM.2	Forces • Force diagrams • Types of forces (gravity, friction, normal, tension) • Field model for forces at a distance
PS.FM.3	Dynamics (how forces affect motion) • Objects at rest • Objects moving with constant velocity • Accelerating objects

Topic: The Universe The universe and galaxies are introduced, building upon the knowledge about space and the solar system from earlier grades.	
PS.U.1	History of the universe
PS.U.2	Galaxies
PS.U.3	Stars • Formation: stages of evolution • Fusion in stars

Physical Science and Honors Physical Science Scope and Sequence

	Study of Matter	Energy and Waves	Force and Motion	The Universe
SEMESTER 1				
Unit 1 • Solutions	PS.M.1			
Unit 2 • Properties of Matter	PS.M.1			
Unit 3 • Phases of Matter	PS.M.1			
Unit 4 • Atoms and Periodic Table	PS.M.2, PS.M.3			PS.U.3
Unit 5 • Bonding	PS.M.4			
Unit 6 • Chemical Reactions	PS.M.5			
SEMESTER 2				
Unit 7 • Motion			PS.FM.1, PS.FM.3	
Unit 8 • Forces			PS.FM.2, PS.FM.3	
Unit 9 • Energy		PS.EW.1, PS.EW.2		
Unit 10 • Waves		PS.EW.3		
Unit 11 • Thermal Energy		PS.EW.5		
Unit 12 • Electricity		PS.EW.4		

Chemistry Standards

(Courses: Chemistry, Honors Chemistry)

Content Description: This course introduces students to key concepts and theories that provide a foundation for further study in other sciences as well as advanced science disciplines. Chemistry comprises a systematic study of the predictive physical interactions of matter and subsequent events that occur in the natural world. The study of matter through the exploration of classification, its structure and its interactions is how this course is organized. Investigations are used to understand and explain the behavior of matter in a variety of inquiry and design scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications. An understanding of leading theories and how they have informed current knowledge prepares students with higher order cognitive capabilities of evaluation, prediction and application.

Topic: Structure and Properties of Matter This topic focuses on an element(s) atomic structure and its chemical and physical properties given its location on the periodic table. How atoms bond together, how compounds are represented, and the forces that occur between and within substances are also discussed.	
C.PM.1	Atomic structure • Evolution of atomic models/theory • Electrons • Electron configurations
C.PM.2	Periodic Table • Properties • Trends
C.PM.3	Chemical bonding • Ionic • Polar/covalent
C.PM.4	Representing compounds • Formula writing • Nomenclature • Models and shapes (Lewis structures, ball and stick, molecular geometries)
C.PM.5	Quantifying matter
C.PM.6	Intermolecular forces of attraction • Types and strengths • Implications for properties of substances (Melting and boiling point, Solubility Vapor pressure)

Topic: Energy and Waves This topic focuses on the various types of chemical reactions and the stoichiometry that can be used to solve chemistry related problems. Solutions, gas laws and thermochemistry topics allow for application of knowledge learned earlier in the course.	
C.IM.1	Chemical reactions • Types of reactions • Kinetics • Energy • Equilibrium • Acids/bases
C.IM.2	Gas laws • Pressure, volume and temperature • Ideal gas law
C.IM.3	Stoichiometry • Molecular calculations • Solutions • Limiting reagents

Chemistry and Honors Chemistry Scope and Sequence

	Structure and Properties of Matter	Interactions of Matter
SEMESTER 1		
Unit 1 • Safety and the Measurement	Nature of Science Standards: Scientific Inquiry, Practice, Application and Science as a Way of Knowing categories	
Unit 2 • Classifying Matter	C.M.1	
Unit 3 • Thermochemistry		C.IM.1
Unit 4 • Quantifying Matter	C.PM.5	
Unit 5 • Atomic Structure and Theory	C.PM.1	
Unit 6 • Periodic Table and Trends	C.PM.2	
Unit 7 Chemical Bonding	C.PM.3, C.PM.4, C.PM.6	
SEMESTER 2		
Unit 8 • Chemical Reactions	C.PM.3, C.PM.4	C.IM.1
Unit 9 • Stoichiometry		C.IM.3
Unit 10 • Gases		C.IM.2
Unit 11 • Solutions	C.PM.5. C.PM.6	C.IM.3
Unit 12 • Acid Base Chemistry		C.IM.1

Physics Standards
(Course: Physics)

Content Description: Physics elaborates on the study of the key concepts of motion, forces and energy as they relate to increasingly complex systems and applications that will provide a foundation for further study in science and scientific literacy. Students engage in investigations to understand and explain motion, forces and energy in a variety of inquiry and design scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications.

Topic: Motion This topic focuses on the motion and visual representations of an object where an object's speed is constant or changing or the object is launched as a projectile.	
P.M.1	Motion Graphs • Position vs. time • Velocity vs. time • Acceleration vs. time
P.M.2	Problem Solving • Using graphs (average velocity, instantaneous velocity, acceleration, displacement, change in velocity) • Uniform acceleration including free fall (initial velocity, final velocity, time, displacement, acceleration, average velocity)
P.M.3	Projectile Motion • Independence of horizontal and vertical motion • Problem-solving involving horizontally launched projectiles

Topic: Forces, Momentum and Motion This topic focuses on the relationship between forces (elastic, non-contact, in one dimension,or in two dimension), motion, and momentum.	
P.F.1	Newton's laws applied to complex problems
P.F.2	Gravitational force and fields
P.F.3	Elastic forces
P.F.4	Friction force (static and kinetic)
P.F.5	Air resistance and drag
P.F.6	Forces in two dimensions • Adding vector forces • Motion down inclines • Centripetal forces and circular motion
P.F.7	Momentum, impulse and conservation of momentum

Topic: Energy This topic focuses on types of energy, conservation of energy, and/or transformation of energy.	
P.E.1	Gravitational potential energy
P.E.2	Energy in springs
P.E.3	Work and power
P.E.4	Conservation of energy
P.E.5	Nuclear energy

Topic: Waves This topic focuses on the properties of waves (longitudinal and transverse) as well as the duality of light and the visible spectrum.	
P.W.1	Wave properties • Conservation of energy • Reflection • Refraction • Interference • Diffraction
P.W.2	Light phenomena • Ray diagrams (propagation of light) • Law of reflection (equal angles) • Snell's law • Diffraction patterns • Wave—particle duality of light • Visible spectrum of color

Physics Scope and Sequence

	Motion	Forces, Momentum and Motion	Energy	Waves	Electricity and Magnetism
SEMESTER 1					
Unit 1 • Measurement and Scientific Processes	Nature of Science Standards: Scientific Inquiry, Practice, and Application and Science as a Way of Knowing categories				
Unit 2 • Motion in 1D and 2D	P.M.1, P.M.2, P.M.3, P.M.6				
Unit 3 • Forces in 1D and 2D		P.F.1, P.F.2, P.F.4			
Unit 4 • Momentum, Impulse, Conservation of momentum		P.F.7			
Unit 5 • Energy			P.E.1, P.E.3, P.E.4		
SEMESTER 2					
Unit 6 • Electrostatics					P.EM.1, P.EM.2, P.EM.3
Unit 7 • Electricity					P.EM.4
Unit 8 • Magnetism					P.EM.5, P.EM.6
Unit 9 • Waves		P.F.3	P.E.2	P.W.1	
Unit 10 • Gases				P.W.2	

AP Course Descriptions & Standards

Currently, Hilliard City Schools offers four AP Science courses - AP Biology, AP Chemistry, AP Physics - Electricity and Magnetism and AP Physics - Mechanics. Each course's Standards and Scope & Sequence are determined by the AP Central College Board. Links to each of these courses descriptions, including Standards, Scope & Sequence, and Exam Descriptions, are below:

AP Biology: https://apcentral.collegeboard.org/courses/ap-biology
AP Chemistry: https://apcentral.collegeboard.org/courses/ap-chemistry
AP Physics - Electricity and Magnetism:
https://apcentral.collegeboard.org/courses/ap-physics-c-electricity-and-magnetism
AP Physics - Mechanics: https://apcentral.collegeboard.org/courses/ap-physics-c-mechanics

AP Courses offered are determined annually through the Program of Studies process.

Science Electives: Seventh-Twelfth Grades

The Hilliard City School District offers students in seventh through twelfth grades the opportunity to participate in a variety of elective courses. These courses are evaluated and revised annually through our Middle School and High School Program of Studies review based on student interest. There are several elective courses that are categorized as science electives due to the knowledge and skills students use in the class which support and reinforce Science Standards. For example, Human Anatomy, Geology and Environmental Science are elective courses with specific Ohio Learning Standards identified. If your student is participating in those courses, refer to the Ohio Learning Standards for Science which outlines the specific course content. However, there are several other science electives which supplement science standards and do not serve as the primary way science standards are explicitly taught to students. As such, the Science Course of Study does not list each of the science standards that are explicitly taught or reinforced in any given elective, year to year. Please refer to the Middle School and High School Program of Studies for the specific science course elective offerings annually. Science elective teachers have a copy of the Science Learning Standards for their grade band which are utilized based on the design of the course and student interest.

References

Banilower, E., Cohen, K., Pasley, J. & Weiss, I. (2010). Effective science instruction: What does research tell us? Second edition. Portsmouth, NH: RMC Research Corporation, Center on Instruction.

Creative Commons (2016). Using Phenomena in NGSS-Designed Lessons and Units https://www.nextgenscience.org/sites/default/files/Using%20Phenomena%20in%20NGSS.pdf

Hammond, Z. (2015). Culturally responsive teaching and the brain: Promoting authentic engagement and rigor among culturally and linguistically diverse students. Thousand Oaks, CA: Corwin.

National Research Council (NRC). 2012. A framework for K–12 science education: Practices, crosscutting concepts, and core ideas. Washington, DC: National Academies Press. National Science Teachers Association. 1982. Science-technology-society: Science education for the 1980s. Washington, DC: Author.

National Science Teachers Association. 2000. The nature of science: NSTA Position Statement. Arlington, VA: Author.

National Science Teachers Association. 2018. Transitioning from scientific inquiry to three-dimensional teaching and learning. Arlington, VA: Author.

Ohio Department of Education and Workforce (2018). Ohio's Learning Standards: Science. https://education.ohio.gov/getattachment/Topics/Learning-in-Ohio/Science/Ohios-Learning-Standards-and-MC/SciFinalStandardsMC060719.pdf.aspx?lang=en-US

Ohio Department of Education and Workforce Model Curriculum for Science (2019). https://education.ohio.gov/Topics/Learning-in-Ohio/Science/Ohios-Learning-Standards-and-MC

Tanner K. D. (2010). Order matters: using the 5E model to align teaching with how people learn. CBE life sciences education, 9(3), 159–164. https://pmc.ncbi.nlm.nih.gov/articles/PMC2931660/

Windschitl, M., Thompson, J., & Braaten, M. (2018) Ambitious Science Teaching. Harvard Education Press.

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