

COURSE TITLE

Science 8

LENGTH

Full Year

DEPARTMENT

STEM Department

SCHOOL

Union Middle School

Primary Content

Science

Initial Board of Education Approval Date (Born on): August 23, 2021

Embedded Content

Career Readiness, Life Literacies and Key Skills

Initial Board of Education Approval Date (Born on): August 23, 2021

Science 8

I. Introduction/Overview/Philosophy

Our middle school science program reflects a comprehensive, integrated, thematic approach to the study of the field of science which supports the philosophy of the NJSL-S. Over the course of three years, students will develop an understanding of the core middle school principles of physical, earth, space, and life science while engaging in engineering and technology through exposure to rich, non-fiction text and a rich application of mathematical skills through data analysis and problem solving.

II. Objectives

Course Outline:

1. Structure and Properties of Matter
2. Interactions of Matter
3. Chemical Reactions
4. Structure and Function
5. Body Systems
6. Inheritance and Variation of Traits
7. Organization for Matter and Energy Flow in Organisms
8. Earth's Systems

Student Outcomes:

After successfully completing this course, the student will:

- Develop models to describe the atomic composition of simple molecules and extended structures.
- Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
- Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
- 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.
- Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
- Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
- Use argument supported by evidence for how the body is a system of interacting subsystems composed of

groups of cells.

- Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
- Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
- 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.
- Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
- Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

New Jersey Student Learning Standards

SCIENCE

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

MS-PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from 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 are a more reliable way to encode and transmit information than analog signals.

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 evolutionary relationships.

MS-LS4-3 Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.

MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

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.

MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused climate change over the past century.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

COMPANION STANDARDS FOR SCIENCE AND TECHNICAL SUBJECTS

RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.

RST.6-8.5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.

RST.6-8.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

RST.6-8.8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

RST.6-8.10. By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.

WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

WHST.6-8.7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

CAREER READINESS, LIFE LITERACIES, AND KEY SKILLS PRACTICES***CRLLKSP 1 Act as a responsible and contributing community members and employee.***

Students understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRLLKSP 2 Attend to financial well-being.

Students take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

CRLLKSP 3 Consider the environmental, social and economic impacts of decisions.

Students understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRLLKSP 4 Demonstrate creativity and innovation.

Students regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRLLKSP 5 Utilize critical thinking to make sense of problems and persevere in solving them.

Students readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRLLKSP 6 Model integrity, ethical leadership and effective management.

Students consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' actions, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRLLKSP 7 Plan education and career paths aligned to personal goals.

Students take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have

perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRLKSP 8 Use technology to enhance productivity, increase collaboration and communicate effectively.

Students find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

CRLKSP 9 Work productively in teams while using cultural/global competence.

Students positively contribute to every team, whether formal or informal. They apply an awareness of cultural differences to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

III. Proficiency Levels

Science 8 is a full year course appropriate for all grade 8 students.

IV. Methods of Assessment

Student Assessment

Assessment at this level falls into two categories: formative and summative. Formative assessments include teacher observations, work in student journals, lab reports, and performance-assessment tasks. Summative assessments demonstrate the extent and depth of learning. End of the module assessments and portfolios of accumulated work could serve as tools for this type of evaluation.

Curriculum/Teacher Assessment

The teacher will provide the subject area supervisor with suggestions for changes on an ongoing basis.

V. Grouping

This is a required course for all students in grade 8.

VI. Articulation/Scope & Sequence/Time Frame

Course length is one year.

VII. Resources

Texts/Supplemental Reading/References

Resources include but are not limited to: online resources, interactive models, documentaries, hyperdocs, etc.

VIII. Suggested Activities

Appropriate activities are listed in the curriculum map.

IX. Methodologies

The following methods of instruction are suggested: lecture, group projects, demonstration, hands-on applications, lab activities, and class presentations.

X. Interdisciplinary Connections

At this grade level, connections to many other disciplines are appropriate and natural. Reading and writing become an integral part of the science process. Connections with mathematics are frequent throughout this curriculum. Technology plays an important role in learning science as well.

XI. Differentiating Instruction for Students with Special Needs: Students with Disabilities, Students at Risk, English Language Learners, Students with a 504 Plan, and Gifted & Talented Students

Differentiating instruction is a flexible process that includes the planning and design of instruction, how that instruction is delivered, and how student progress is measured. Teachers recognize that students can learn in multiple ways as they celebrate students' prior knowledge. By providing appropriately challenging learning, teachers can maximize success for all students.

Differentiating in this course includes but is not limited to:

Differentiation for Support (ELL, Special Education, Students at Risk, Students with a 504 Plan)

- Peer mentoring on problems
- Differentiated teacher feedback on assignments
- Modeling out problems on whiteboard
- Visual aids as we project problems on whiteboard
- Study guides
- Tiered assignments
- Scaffolding of materials and assignments
- Re-teaching and review
- Guided note taking
- Exemplars of varied performance levels
- Multi-media approach to accommodating various learning styles
- Word Wall
- Visual Aides
- Assistive Technology
- Extended Time

Differentiation for Enrichment

- Supplemental reading material for independent study

- Flexible grouping
- Tiered assignments
- Topic selection by interest
- Enhanced expectations for independent study
- Elevated questioning techniques using Webb's Depth of Knowledge matrix

XII. Professional Development

The teacher will continue to improve expertise through participation in a variety of professional development opportunities.

XII. Curriculum Map/Pacing Guide

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
<p>Evidence of Common Ancestry</p> <p>Supporting Topic 1: An organism's chance of survival is based on changes to the genetic code and can be impacted by changes in the environment</p> <p>Supporting Topic 2 : Scientific evidence such as fossils, embryos, and geological samples can provide evidence of an organism's existence, diversity, extinction, and progression of life forms throughout</p>	4 - 5 weeks	<p><i>For Support:</i></p> <ul style="list-style-type: none"> ● Consistently review/enforce class expectations orally ● Provide oral reviews of main concepts using index cards or review cards ● Assist students in small groups ● Prompt students before writing task by asking questions to brainstorm <p><i>For Enhancement:</i></p> <ul style="list-style-type: none"> ● Real World application of material ● Modeling ● Inquiry based instruction 	MS-LS4-1 MS-LS4-2 MS-LS4-3 RST.6-8.4, 5, 6, 8, 9, 10	<p><i>Formative Assessment:</i></p> <ul style="list-style-type: none"> ● Discussion ● Classwork ● Group work on Design Project ● Shared reading ● Questioning on Design <p><i>Summative Assessment</i></p> <ul style="list-style-type: none"> ● Homework ● Quizzes ● Labs ● Tests ● Projects
<p>Selection and Adaptation</p> <p>Supporting Topic 1: Natural selection and adaptation lead to changes within and between populations over time.</p>	4 - 5 weeks	<p><i>For Support:</i></p> <ul style="list-style-type: none"> ● Modify assessments, quizzes and/or homework if need be ● Provide extended time on tasks, ● Re-read questions with rephrasing, ● Review projects/ideas individually with students to check for understanding 	MS-LS4-4 MS-LS4-5 MS-LS4-6 RST.6-8.4, 5, 6, 8, 9, 10	<p><i>Formative Assessment:</i></p> <ul style="list-style-type: none"> ● Discussion ● Classwork ● Group work on Design Project ● Shared reading ● Questioning on Design

		<p>Provide additional help/review after school</p> <ul style="list-style-type: none"> ● Provide one to one direction/clarification of instructions if needed ● Use graphic organizers for note <p><i>For Enhancement:</i></p> <ul style="list-style-type: none"> ● Real World application of material ● Inquiry based instruction ● Student Choice 		<p><i>Summative Assessment</i></p> <ul style="list-style-type: none"> ● Homework ● Quizzes ● Labs ● Tests ● Projects
<p>Stability and Change on Earth</p> <p>Supporting Topic 1: Resources including minerals, energies, groundwater, and soil are distributed unevenly on Earth due to past and current geoscience processes, as well as removal by humans.</p> <p>Supporting Topic 2 Earth’s climate is changing as proven primarily by the rise in global temperatures; in addition, other scientific records of the planet’s qualitative and quantitative characteristics can also provide evidence to support this claim.</p> <p>Supporting Topic 3:</p>	<p>4 - 5 weeks</p>	<p><i>For Support:</i></p> <ul style="list-style-type: none"> ● Modify assessments, quizzes and/or homework if need be, ● Provide extended time on tasks, ● Re-read questions with rephrasing, ● Review projects/ideas individually with students to check for understanding ● Provide additional help/review after school ● Provide one to one direction/clarification of instructions if needed ● Use graphic organizers for notes <p><i>For Enhancement:</i></p> <ul style="list-style-type: none"> ● Real World application of material ● Inquiry based instruction ● • Student Choice 	<p>MS-ESS3-1 MS-ESS3-2 MS-ESS3-4 MS-ESS3-5 RST.6-8.4, 5, 6, 8, 9, 10</p>	<p><i>Formative Assessment:</i></p> <ul style="list-style-type: none"> ● Discussion ● Classwork ● Group work on Design Project ● Shared reading ● Questioning on Design <p><i>Summative Assessment</i></p> <ul style="list-style-type: none"> ● Homework ● Quizzes ● Labs ● Tests ● Projects

<p>Humans can mitigate the effects of the changing climate by developing new technologies that address these concerns</p>				
<p>Human Impact</p> <p>Supporting Topic 1: Humans negatively impact the earth by redistributing and/or depleting natural resources in terms of land usage, water usage, pollution, increases in population and per capita consumption. Alternatively, humans positively impact the earth by designing and engineering solutions to counter and prevent these impacts on Earth’s resources.</p>	<p>4 - 5 weeks</p>	<p><i>For Support:</i></p> <ul style="list-style-type: none"> ● Provide assistance with note taking ● Provide oral reviews of main concepts using index cards or review cards ● Modify assessments, quizzes and/or homework ● Provide extended time on tasks, re-read questions with rephrasing ● Provide completed notes with key ideas outlined (if necessary) ● Activate prior knowledge and prompting while completing their “Do Now” <p><i>For Enhancement:</i></p> <ul style="list-style-type: none"> ● Real World application of material ● Extension Activities ● Inquiry based instruction ● Student Choice 	<p>MS-ESS3-3 MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 RST.6-8.4, 5, 6, 8, 9, 10</p>	<p><i>Formative Assessment:</i></p> <ul style="list-style-type: none"> ● Discussion ● Classwork ● Group work on Design Project ● Shared reading ● Questioning on Design <p><i>Summative Assessment</i></p> <ul style="list-style-type: none"> ● Homework ● Quizzes ● Labs ● Tests ● Projects
<p>Relationships Among Forms of Energy</p> <p>Supporting Topic 1:</p>	<p>4 - 5 weeks</p>	<p><i>For Support:</i></p> <ul style="list-style-type: none"> ● Provide assistance with note taking 	<p>MS-PS3-1 MS-PS3-2 MS-PS3-5 RST.6-8.4, 5, 6, 8, 9, 10</p>	<p><i>Formative Assessment:</i></p> <ul style="list-style-type: none"> ● Discussion ● Classwork ● Group work on Design Project

<p>Objects use kinetic energy due to their velocity and mass. Comparatively, objects store potential energy due to their relative distances from a reference point and the objects' masses. Kinetic and potential energies are proportionally related in a defined system and can be represented mathematically using given formulas.</p> <p>Supporting Topic 2: Energy can change from one form of energy to another based on the specific properties of the energy type.</p> <p>Supporting Topic 3:</p>		<ul style="list-style-type: none"> ● Provide oral reviews of main concepts using index cards or review cards ● Modify assessments, quizzes and/or homework ● Provide extended time on tasks, re-read questions with rephrasing ● Provide completed notes with key ideas outlined (if necessary) ● Activate prior knowledge and prompting while completing their "Do Now" <p><i>For Enhancement:</i></p> <ul style="list-style-type: none"> ● Real World application of material ● Extension Activities ● Inquiry based instruction ● Student Choice 		<ul style="list-style-type: none"> ● Shared reading ● Questioning on Design <p><i>Summative Assessment</i></p> <ul style="list-style-type: none"> ● Homework ● Quizzes ● Labs ● Tests ● Projects
<p>Thermal Energy</p> <p>Supporting Topic 1: The thermal energy in a system depends on the type, state, environment and amount of matter present.</p>	<p>4 - 5 weeks</p>	<p><i>For Support:</i></p> <ul style="list-style-type: none"> ● Provide assistance with note taking ● Consistently review/enforce class expectations orally ● Provide oral reviews of main concepts using index cards or review cards • Provide one to one direction/clarification of instructions if needed, ● Monitor on task performance 	<p>MS-PS3-2 MS-PS3-3 MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4 RST.6-8.4, 5, 6, 8, 9, 10</p>	<p><i>Formative Assessment:</i></p> <ul style="list-style-type: none"> ● Discussion ● Classwork ● Group work on Design Project ● Shared reading ● Questioning on Design <p><i>Summative Assessment</i></p> <ul style="list-style-type: none"> ● Homework ● Quizzes ● Labs

		<ul style="list-style-type: none"> ● Provide/use graphic organizers for notes ● Provide visual aides ● Monitor on task performance. ● Provide completed notes with key ideas outlined (if necessary) <p><i>For Enhancement:</i></p> <ul style="list-style-type: none"> ● Real World application of material ● Modeling ● Inquiry based instruction 		<ul style="list-style-type: none"> ● Tests ● Projects
<p>Electromagnetic Spectrum</p> <p>Supporting Topic 1: Waves including electromagnetic, sound, and seismic have properties that are influenced by the medium through which it travels and its level of energy.</p> <p>Supporting Topic 2 : Electromagnetic and mechanical waves are used for communication and advanced technologies purposes.</p>	<p>4 - 5 weeks</p>	<p><i>For Enhancement:</i></p> <ul style="list-style-type: none"> ● Real World application of material ● Extension Activities ● Inquiry based instruction ● Student Choice 	<p>MS-PS4-1 MS-PS4-2 MS-PS4-3 RST.6-8.4, 5, 6, 8, 9, 10</p>	<p><i>Formative Assessment:</i></p> <ul style="list-style-type: none"> ● Discussion ● Classwork ● Group work on Design Project ● Shared reading ● Questioning on Design <p><i>Summative Assessment</i></p> <ul style="list-style-type: none"> ● Homework ● Quizzes ● Labs ● Tests ● Projects