The Mission of the Chardon Local Schools is High Achievement for All Students, Where Learning is Our Most Important Work.

Science Course of Study:

ECOLOGY

(Grades 11-12)

Revised February 2022

CHARDON
LOCAL SCHOOLS
#WeAreChardon

Committee Members: Heather Spreitzerand Jodie Tagliaferri

Strand: Nature of Science

Learning Standards: Ohio Learning Standards
Scientific Inquiry, Practice and Application

- 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

- 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 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

How Taught?
Teaching activities may include, but are not limited to:

- Students closely read select passages from documents to analyze text structure, development, and consequent meanings
- Teacher provides direct instruction, give feedback, and model critical thinking
- Small group and class discussions
- Cooperative learning groups
- Students to define, use, and connect to content area and based vocabulary
- Students analyze video content related to standards that provide a broader global perspective of content.
- Design and conduct lab-based investigations that connect content to real-life experiences.
- Provide opportunities for out of building excursions (field trips) to provide additional real world application of standards.
- Using technology and mathematics to improve investigations and communications.
- Utilize data to impact instruction

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 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.

Materials:

- Textbook
- Workbook
- Online resources (supplemental resources)
- Interactive academic games (Kahoot, Gimkit, Quizlet)
- Study Stack flashcards
- Explore Learning (Gizmos)

How Assessed?
Assessments may include, but are not limited to:

- Pre-Assessments (pre-tests, observation, questioning, diagnostics)
- Formative Assessments (entry/exit slips, mini analysis assignments, group work, discussions, homework/classwork, self and peer evaluations, checklists, guided notes, observations,quizzes, conferences, rubrics, lesson review questions, lab reports)
- Summative Assessments (formal essays, using rubrics; tests/exams, project, evaluation, demonstration, lab practicals)

How Re-Taught?
Re-teaching activities may include, but are not limited to:

- descriptive feedback on original task/assessment
- student examples of expectations
- modeling
- student self assessments
- manipulatives
- presenting the information again in a different way
- review sessions
- graphic organizers
- small-group instruction
- practice activities
- computer tutorials / programs
- peer tutoring
- breaking down concept into smaller components
- games and hands-on activities
- cooperative learning
- Universal Design for Learning principles offering students opportunities to experience and engage material in new and different ways

Strand: Earth's Systems : Interconnected Spheres of Earth

Learning Standards:

Biosphere
- Evolution and adaptation in populations
- Biodiversity
- Ecosystems (equilibrium, species interactions, stability)
- Population dynamics

Atmosphere
- Atmospheric properties and currents

Lithosphere
- Geologic events and processes

Hydrosphere
- Oceanic currents and patterns (as they relate to climate)
- Surface and groundwater flow patterns and movement
- Cryosphere

Movement of matter and energy through the 4 spheres
- Energy transformations on global, regional and local scales
- Biogeochemical cycles
- Ecosystems
- Weather
- Climate
- Focus on connections and interactions between Earth's spheres (the hydrosphere, atmosphere, biosphere and lithosphere).
    - Natural and anthropogenic interactions are studied including an understanding of causes and effects of climate, global climate (including El Niño/La Niña patterns and trends) and changes in climate through Earth's history, geologic events, the effect of abiotic and biotic factors within an ecosystem, and the understanding that each of Earth's spheres is part of the dynamic Earth system.
    - Groundwater and surface water velocities and patterns are included as the movement of water (either at the surface, in the atmosphere or beneath the surface) can be a mode of transmission of contamination.
        - Geomorphology and topography are helpful in determining flow patterns and pathways for contamination.
    - The connections and interactions of energy and matter between Earth's spheres are researched and investigated using actual data.
    - Emphasis on interconnectedness of Earth's spheres and the understanding of the complex relationships between them, including both abiotic and biotic factors.
        - Some impacts are long-term, others are short-term and most are a combination of both long- and

How Taught?
Teaching activities may include, but are not limited to:
- Students closely read select passages from documents to analyze text structure, development, and consequent meanings
- Teacher provides direct instruction, give feedback, and model critical thinking
- Small group and class discussions
- Cooperative learning groups
- Students to define, use, and connect to content area and based vocabulary
- Students analyze video content related to standards that provide a broader global perspective of content.
- Design and conduct lab-based investigations that connect content to real-life experiences.
- Provide opportunities for out of building excursions (field trips) to provide additional real world application of standards.
- Using technology and mathematics to improve investigations and communications.
- Utilize data to impact instruction

<table>
<tr><td>short-term.
● Use of real, quantifiable data to study the interactions, patterns and cycles among Earth's spheres.</td><td></td></tr>
<tr><td rowspan="2">Materials:

● Textbook
● Workbook
● Online resources (supplemental resources)
● Interactive academic games (Kahoot, Gimkit, Quizlet)
● Study Stack flashcards
● Explore Learning (Gizmos)</td><td>How Assessed?
Assessments may include, but are not limited to:

● Pre-Assessments (pre-tests, observation, questioning, diagnostics)
● Formative Assessments (entry/exit slips, mini analysis assignments, group work, discussions, homework/classwork, self and peer evaluations, checklists, guided notes, observations,quizzes, conferences, rubrics, lesson review questions, lab reports)
● Summative Assessments (formal essays, using rubrics; tests/exams, project, evaluation, demonstration, lab practicals)</td></tr>
<tr><td>How Re-Taught?
Re-teaching activities may include, but are not limited to:
● descriptive feedback on original task/assessment
● student examples of expectations
● modeling
● student self assessments
● manipulatives
● presenting the information again in a different way
● review sessions
● graphic organizers
● small-group instruction
● practice activities
● computer tutorials / programs
● peer tutoring
● breaking down concept into smaller components
● games and hands-on activities
● cooperative learning
● Universal Design for Learning principles offering students opportunities to experience and engage material in new and different ways</td></tr>
</table>

Strand: Earth's Resources

Learning Standard:	**How Taught?** **Teaching activities may include, but are not limited to:**
Energy resources ● Renewable and nonrenewable energy sources and efficiency ● Alternate energy sources and efficiency ● Resource availability ● Mining and resource extraction **Air and air pollution** ● Primary and secondary contaminants ● Greenhouse gasses ● Clean Air Act **Water and water pollution** ● Potable water and water quality ● Hypoxia, eutrophication ● Clean Water Act ● Point source and nonpoint source contamination **Soil and land** ● Desertification ● Mass movement and erosion ● Sediment contamination ● Land use and land management (including food production, agriculture and zoning) ● Solid and hazardous waste **Wildlife and wilderness** ● Wildlife and wilderness management ○ Endangered species ● Invasive Species ● Introduced Species ● Availability of Earth's resources, extraction of the resources, contamination problems, remediation techniques and the storage/disposal of the resources or by-products. ● Conservation, protection and sustainability of Earth's resources are also included. ● To understand the effects that certain contaminants may have on the environment, scientific investigations and research should be conducted on a local, national and global level. ● Water, air, land and biotic field and lab sampling/testing equipment and methods are utilized with real-world application. ● Quantifiable field and/or lab data are used to analyze and draw conclusions regarding air, water or land quality. ○ Examples of types of water-quality testing include: hydraulic conductivity, suspended and dissolved solids, dissolved oxygen, biochemical oxygen demand, temperature, pH, fecal	●Students closely read select passages from documents to analyze text structure, development, and consequent meanings ●Teacher provides direct instruction, give feedback, and model critical thinking ●Small group and class discussions ●Cooperative learning groups ●Students to define, use, and connect to content area and based vocabulary ●Students analyze video content related to standards that provide a broader global perspective of content. ●Design and conduct lab-based investigations that connect content to real-life experiences. ●Provide opportunities for out of building excursions (field trips) to provide additional real world application of standards. ●Using technology and mathematics to improve investigations and communications. • Utilize data to impact instruction

<table>
<tr>
<td>
coliform and macro-invertebrate studies.
● Wetland or woodland delineations and analysis, land use analysis and air monitoring
● The study of relevant, local problems can be a way to connect the classroom to the real world.
○ Examples include wetland loss or mitigation, surface or groundwater contamination, watershed management, acid rain, septic system or sewage overflows/failures, landfill seepage, underground storage tank/pipe releases, deforestation, invasive species, air pollution, soil loss/erosion or acid mine drainage.
● Renewable and nonrenewable energy resources including topics such as risk and efficiency for differing types of energy resources at a local, state, national and global level. Nuclear and geothermal energy are included in this topic.
</td>
<td></td>
</tr>
<tr>
<td rowspan="2">
Materials:

● Textbook
● Workbook
● Online resources (supplemental resources)
● Interactive academic games (Kahoot, Gimkit, Quizlet)
● Study Stack flashcards
● Explore Learning (Gizmos)
</td>
<td>
How Assessed?
● Pre-Assessments (pre-tests, observation, questioning, diagnostics)
● Formative Assessments (entry/exit slips, mini analysis assignments, group work, discussions, homework/classwork, self and peer evaluations, checklists, guided notes, observations,quizzes, conferences, rubrics, lesson review questions, lab reports)
● Summative Assessments (formal essays, using rubrics; tests/exams, project, evaluation, demonstration, lab practicals)
</td>
</tr>
<tr>
<td>
How Re-Taught?
Re-teaching activities may include, but are not limited to:

● descriptive feedback on original task/assessment
● student examples of expectations
● modeling
● student self assessments
● manipulatives
● presenting the information again in a different way
● review sessions
● graphic organizers
● small-group instruction
● practice activities
● computer tutorials / programs
● peer tutoring
● breaking down concept into smaller components
● games and hands-on activities
● cooperative learning
● Universal Design for Learning principles offering students opportunities to experience and engage material in new and different ways
</td>
</tr>
</table>

Strand: Global Environmental Problems and Issues

<table>
<tr>
<td>

Learning Standard:

- Human population
- Potable water quality, use and availability
- Climate change
- Sustainability
- Species depletion and extinction
- Air quality
- Food production and availability
- Deforestation and loss of biodiversity
- Waste management (solid and hazardous)
- Case studies, developing and using models, collecting and analyzing water and/or air quality data, conducting or researching population studies and methods of connecting to the real world is emphasized for this topic.
- Use technology for comparative studies to share local data internationally so that specific quantifiable data can be compared and used in understanding the impact of some of the environmental problems that exist on a global scale.
- Researching and investigating environmental factors on a global level contributes to the depth of understanding by applying the environmental science concepts to problem solving and design.
    - Examples of global topics include building water or air filtration models, investigating climate change data, monitoring endangered, introduced or invasive species and studying the environmental effects of an increasing human population.
- Researching contemporary discoveries, new technology and new discoveries can lead to improvement in environmental management.

</td>
<td>

How Taught?

Teaching activities may include, but are not limited to:

- Students closely read select passages from documents to analyze text structure, development, and consequent meanings
- Teacher provides direct instruction, give feedback, and model critical thinking
- Small group and class discussions
- Cooperative learning groups
- Students to define, use, and connect to content area and based vocabulary
- Students analyze video content related to standards that provide a broader global perspective of content.
- Design and conduct lab-based investigations that connect content to real-life experiences.
- Provide opportunities for out of building excursions (field trips) to provide additional real world application of standards.
- Using technology and mathematics to improve investigations and communications.

Utilize data to impact instruction

</td>
</tr>
<tr>
<td>

Materials:

- Textbook
- Workbook
- Online resources (supplemental resources)
- Interactive academic games (Kahoot, Gimkit, Quizlet)
- Study Stack flashcards
- Explore Learning (Gizmos)

</td>
<td>

How Assessed?

Assessments may include, but are not limited to:

- Pre-Assessments (pre-tests, observation, questioning, diagnostics)
- Formative Assessments (entry/exit slips, mini analysis assignments, group work, discussions, homework/classwork, self and peer evaluations, checklists, guided notes, observations,quizzes, conferences, rubrics, lesson review questions, lab reports)
- Summative Assessments (formal essays, using rubrics; tests/exams, project, evaluation, demonstration, lab practicals)

</td>
</tr>
<tr>
<td></td>
<td>

How Re-Taught?

Re-teaching activities may include, but are not limited to:

- descriptive feedback on original task/assessment
- student examples of expectations
- modeling

</td>
</tr>
</table>

	● student self assessments ● manipulatives ● presenting the information again in a different way ● review sessions ● graphic organizers ● small-group instruction ● practice activities ● computer tutorials / programs ● peer tutoring ● breaking down concept into smaller components ● games and hands-on activities ● cooperative learning ● Universal Design for Learning principles offering students opportunities to experience and engage material in new and different ways