DUBLIN
CITY SCHOOLS

K-12 SCIENCE
Graded Course of Study
2025

A K-12 Dublin City Schools science education aims to create lifelong learners who are curious, critical thinkers, and effective collaborators, equipped with the scientific knowledge and skills necessary to navigate and shape a complex and ever-changing world.

Our vision is to inspire students to develop a deep appreciation for science and its applications, empowering them to:

- Ask questions, seek answers, and explore the natural world with a sense of wonder and curiosity.
- Think critically and creatively to solve problems and make informed decisions as a scientifically literate citizen.
- Communicate and collaborate effectively in our diverse community and beyond to address common challenges and create innovative solutions.
- Build their own identity as a scientist in order to apply scientific concepts and methods to understand and address real-world issues competently and confidently.
- Develop the resilience, adaptability, and perseverance needed to succeed in a rapidly evolving world.

Instructional Agreements for Science Learning within the Dublin City Schools

- Teachers will provide opportunities for students to engage in hands-on experiences, projects, and real-world simulations to provide context and relevance to science concepts.
- Teachers will create an environment that emphasizes the importance of effort, perseverance, and reflection in order to learn and grow from both success and failure.
- Content standards will be learned in conjunction with best practices regarding science education.

Together, we will cultivate resourceful, adaptable, and collaborative individuals with the ability to tackle real-world challenges with resilience and innovation.

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.	
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.
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 Human Endeavor	Science has been, and continues to be, advanced by individuals of various races, genders, ethnicities, languages, abilities, family backgrounds and incomes.
Scientific Knowledge is Open to Revision in Light of New Evidence	Science is not static. Science is constantly changing as we acquire more knowledge.

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

Ohio's Cognitive Demands for Science	
Educators will refer to "Ohio's Cognitive Demands for Science" to create experiences for students to engage in science content and demonstrate understanding of scientific concepts in ways that align with current research about how people learn.	
DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	Requires students 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	Requires students 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	Requires students 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	Requires students 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.

Environmental Sustainability and Societies Science

Course Goals

Environmental Sustainability and Societies incorporates biology, chemistry, physics and physical geology, and introduces students to key concepts, principles and theories within environmental science. Investigations are used to understand and explain the behavior of nature in a variety of inquiry and design scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications. It should be noted that there are classroom examples in the model curriculum that can be developed to meet multiple sections of the syllabus, so one well-planned long-term project can be used to teach multiple topics.

SUSTAINABILITY & THE ENVIRONMENT	
Content Statement	**Content Elaboration**
ENV.GP.4 Sustainability	• Define sustainability using the 3 sector model of the environment, society, and the economy. • Environmental indicators and ecological footprints can be used to assess sustainability. • Outline the significant historical influences on the development of the environmental movement. • Discuss environmental ethics, attitudes, and justice.

ECOLOGY AND BIODIVERSITY	
Content Statement	**Content Elaboration**
ENV.GP.5 Species depletion and extinction	• Discuss causes for species endangerment or extinction as well as possible solutions or interventions.
ENV.GP.8 Deforestation and loss of biodiversity	• Define deforestation and explain how it affects biodiversity.

	• Discuss current practices that increase sustainable foresting.
ENV.ER.5 Wildlife and Wilderness	Wildlife and wilderness management • Consider the impact of invasive species on an ecosystem. • Examine the possible positive and/or negative effects of introducing a new species to an ecosystem.
ENV.ES.1 Biosphere	Biodiversity • Define biodiversity and its importance. • Describe factors that affect biodiversity. Ecosystems • Compare and contrast open and closed ecosystems. • Describe what determines if an ecosystem is at equilibrium. • Define carrying capacity and how it affects an ecosystem. Population Dynamics • Evaluate population dynamics looking at various graphical representations. • Define and describe succession and the various stages. • Describe the various relationships between species.

HUMAN POPULATIONS	
Content Statement	**Content Elaboration**
ENV.GP.1 Human Population	• Compare developing and developed countries, identifying the factors that separate the two types of countries. • Interpret population demographic curves, graphs or pyramids (e.g. from US Census Bureau, the UN Census, World Fact Book) and discuss differences in population growth rates among several different countries (developing vs developed). • Compare local demographic data to national and international demographic data. Consider environmental and societal factors contributing to differences and include understanding of current events and populations. • Relative to resource availability and rates of consumption, assess the scope of human population growth and potential limits to its growth (e.g. Gapminder Foundation).

WATER MANAGEMENT	
Content Statement	**Content Elaboration**
ENV.GP.2 Potable water quality, use and availability	• Define water quality. • Explain how to test water quality and determine good quality water. • Explore access to fresh water in different regions; both locally and on an international scale.
ENV.ER.3 Water and water pollution	Hypoxia, eutrophication • Define hypoxia and eutrophication and explain the relationship between them. Point source and nonpoint source contamination. • Define and list examples of point and nonpoint contamination. Clean Water Act (Legislation) • Describe The Clean Water Act , explain why it was written, and describe the outcomes/results.
ENV.ES.5 Movement of matter and energy through the hydrosphere, lithosphere, atmosphere and biosphere	• Discuss the different types of Water (Where is our water coming from?) • Explain the movement of water and how that can be a mode of transmission and contamination. • Define permeability and porosity, and how this affects groundwater movement.

SOIL & AGRICULTURE	
Content Statement	**Content Elaboration**
ENV.GP.7 Food production and availability	• Describe the various types of agriculture production. • Discuss the pros/cons of using various fertilizers/pesticides. • Describe how factors (land, water, soil) effect food production.

	• Evaluate the availability of food across different locations. • List pros and cons of using GMOs in food production.
ENV.ER.4 Soil and land	Soil Quality and Composition • Examine local soil composition. • Perform soil testing (NPK test) and compare local results to national and/or international data. Desertification • Discuss soil depletion and strategies for conservation. • Define and list causes of desertification. • Predict future locations of desertification.
ENV.ES.5 Movement of matter and energy through the hydrosphere, lithosphere, atmosphere and biosphere	Biogeochemical Cycles • Explain the nitrogen cycle and its importance in an ecosystem.

AIR QUALITY	
Content Statement	**Content Elaboration**
ENV.GP.6 Air Quality	• Describe the various methods for measuring air quality.
ENV.ER.2 Air and air pollution	Primary and secondary contaminants • Describe the first two layers of the atmosphere. • Primary and secondary contaminants. • Analyze and draw conclusions regarding air quality at a local, national and global level. Greenhouse gases • Define and state examples of greenhouse gases. • List the sources and effects of greenhouse gases. • Describe observed changes in greenhouse gas levels.

	Clean Air Act • Describe The Clean Air Act , explain why it was written and describe the outcomes/results. • Define and list examples of point and nonpoint contamination.
ENV.ES.5 Movement of matter and energy through the hydrosphere, lithosphere, atmosphere and biosphere	Carbon Cycle • Understand the different parts of the carbon cycle. • Explain the role of the carbon cycle in the environment.
ENV.GP.3 Climate Change	• Describe what factors cause changes in climate and how to predict them. • Evaluate case study data explaining possible reasons for climate change.

ENERGY	
Content Statement	**Content Elaboration**
ENV.ER.1 Energy resources	Renewable and nonrenewable energy sources and efficiency • Compare/contrast and list renewable and nonrenewable energy sources. • Define and list examples of fossil fuels. Alternate energy sources and efficiency • Describe alternative energy sources (solar, wind, hydro, etc.) • Compare and contrast the energy efficiency of alternative and conventional energy resources. Resource availability • Predict the availability of future energy resources. Mining and resource extraction • Describe where different resources are extracted from and stored.
ENV.ES.5 Movement of matter and energy through the hydrosphere, lithosphere, atmosphere and biosphere	• Investigate energy transformation on global, regional and local scales.

WASTE MANAGEMENT	
Content Statement	**Content Elaboration**
ENV.GP.9 Waste management	Solid and hazardous waste • Discuss proper storage and disposal techniques for all different wastes. • Explain various ways to clean up waste. • Define toxic and hazardous waste. • Compare/contrast and give examples of solid/liquid waste. • Identify the materials that are non-recyclable and recyclable. • Describe the benefits and challenges of recycling. • Research composting techniques and analyze the waste products.
ENV.ES.5 Movement of matter and energy through the hydrosphere, lithosphere and biosphere	• Investigate energy transformation on global, regional and local scales.