K-12 SCIENCE EDUCATION VISION

A K-12 Dublin City Schools science education engages *all students* in critical thinking and problem solving as they experience science and engineering. We believe that students can become scientifically literate citizens equipped with the knowledge and skills demanded by the ever-changing future, whether in the workforce or higher education.

We believe in developing our learners through high quality experiences that include:

- A challenging, collaborative and inquiry based environment.
- Opportunities to solve and investigate real-world problems that require critical and global thinking.
- Opportunities for students to build an identity as a scientist, able to interpret the natural world, participate productively in scientific practices and contribute to society in meaningful ways.
- Opportunities to research, generate and evaluate evidence and explanations that uphold or refute scientific data.

We believe these learning experiences will grow independent, confident students who will become creative, innovative adults that are capable of using informed scientific judgement to improve their world.

Instructional Agreements for Science Learning within the Dublin City Schools

1. Learning goals will be communicated to guide students through the expectations of science learning using a variety of instructional techniques and technology integration.
2. Teachers will ensure a safe, challenging learning environment focused on inquiry and science exploration.
3. Teachers will provide support to students as they learn to frame questions, assess and analyze data, and create and critique explanations – all important components of scientific and engineering practices.
4. Content standards will be learned in partnership with Ohio's Cognitive Demands for Science, Science and Engineering Practices and Nature of Science practices.

Dublin City Schools Science Graded Course of Study

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	
Cognitive Demand	**Description**
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

Environmental Sustainability and Societies 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 & BIODIVERSITY	
Content Statement	**Content Elaboration**
ENV.GP.5 Species depletion and extinction	● Species depletion and extinction
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 ○ Endangered species ● Invasive species ● Introduced species

ENV.ES.1 Biosphere	● Define biodiversity and its importance ● Describe factors that affect biodiversity ● 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 ● Evaluate population dynamics looking at various graphical representations ● Define and describe succession and the various stages ● Describe the various relationships between species
ENV.ES.5 Movement of matter and energy through the hydrosphere, lithosphere, atmosphere and biosphere	● Ecosystems

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,	● Define water quality

use and availability	● Explain how to test water quality and determine good quality water ● Access to fresh water
ENV.ER.3 Water and water pollution	● Define hypoxia and eutrophication and explain the relationship between them ● 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	● Water Cycle ● Define permeability and porosity, and how this affects groundwater movement ● Types of Water (Where is our water coming from)

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 composition ● Soil Testing (NPK test) ● Soil depletion and 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	● Nitrogen Cycle

Dublin City Schools Science Graded Course of Study

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	● Describe the first two layers of the atmosphere ● Primary and secondary contaminants ● Define and state examples of greenhouse gases ● List the sources and effects of greenhouse gases ● Describe observed changes in greenhouse gas levels ● 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
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	● Compare/contrast and list renewable and nonrenewable energy sources ● Define and list examples of fossil fuels ● Describe alternative energy sources (solar, wind, hydro, etc.) ● Compare and contrast the energy efficiency of alternative and conventional energy resources ● Predict the availability of future energy resources ● Describe where different resources are extracted from and stored
ENV.ES.5 Movement of matter and energy through the	● Energy transformation on global, regional and local scales ● Carbon Cycle

hydrosphere, lithosphere, atmosphere and biosphere	

WASTE MANAGEMENT	
Content Statement	**Content Elaboration**
ENV.GP.9 Waste management (solid & hazardous)	● 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	● Energy transformation