## 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 | |
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| 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 | |
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| **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. |

# GRADE 1

## Grade 1 Course Goals:

Students in first grade will focus on developing the skills for systematic discovery to understand the science of the physical world around them in greater depth by using scientific inquiry. Students will learn that energy is observed through movement, heating, cooling and the needs of living organisms. They learn about the sun as a source of energy and energy changes that occur to land, air and water. Students develop an understanding that energy allows for changes to occur in both living and nonliving things. Additional learning focuses on the changes in properties that occur in objects and materials and that changes of position of an object are a result of pushing or pulling.

## Strand Connections:

Energy is observed through movement, heating, cooling and the needs of living organisms.

| **EARTH AND SPACE SCIENCE (ESS)** | |
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| Topic: Changes on Earth<br>This topic focuses on the sun as a source of energy and energy changes that occur to land, air and water. | |
| **Content Statement** | **Content Elaboration** |
| **1.ESS.1: The sun is the principal source of energy Sunlight warms Earth's land, air and water.** The amount of exposure to sunlight affects the amount of warming or cooling of air, water and land. | Quantitative measurements are used to observe and document the warming and cooling of air, water or soil. The length of time an object or material (including water) is exposed to sunlight and its resulting temperature can be observed, as should the amount of time for the object or material to cool down after it is taken out of the sunlight. Appropriate tools and technology are used to collect, compare and document data. Investigation and experimentation are combined with explanation, questioning and discussion of the results and findings. |
| **1.ESS.2: Water on Earth is present in many forms.** The physical properties of water can change. These changes occur due to changing energy. Water can change from a liquid to a solid and from a solid to a liquid. Note: Water as a vapor is not introduced until grade 2; the water cycle is reserved for later grades | Water can be observed in lakes, ponds, streams, wetlands, the ocean and through weather events. Freezing and melting of water are investigated through measurements and observations using technology, in the classroom or in a natural setting. Examining maps of Ohio, world maps or globes can illustrate the amount of Earth's surface that is covered in water and why it is important to learn about water. Water can change the shape of the land (e.g., moving soil or sand along the banks of a river or at the beach). |

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| | Water can also be observed in the air as clouds, steam or fog, but this content should be limited to observation only at this grade level. Investigations (inside or outside) and experimentation are used to demonstrate the changing properties of water. Use appropriate tools to test and measure water's weight, texture, temperature or size (e.g., compare measurements of water before and after freezing, examine the texture of snow or ice crystals using a hand lens) to document the physical properties. |

| **PHYSICAL SCIENCE (PS)** | |
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| Topic: Objects in Motion<br>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. | |
| **Content Statement** | **Content Elaboration** |
| **1.PS.1: Properties of objects and materials can change.** Objects and materials change when exposed to various conditions, such as heating or cooling. Changes in temperature are a result of changes in energy. Not all materials change in the same way. | Materials can be exposed to conditions that change some of their properties, but not all materials respond the same way. The properties of a material can change as it interacts with other materials. Heating and cooling changes some, but not all, properties of materials. Emphasis is placed on observations. Concepts of thermal energy, atoms and heat transfer are not appropriate at this grade level. Some materials are a liquid or solid at room temperature and may change from one form to the other with a change in temperature. A liquid may turn into a solid when cooled. A solid may turn into a liquid when heated. The amount of the material in the solid or liquid remains the same before and after the change. Investigations and experiments (may include virtual investigations) are conducted to explore property changes of objects and materials. |
| **1.PS.2: Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.** The position of an object can be described by locating it relative to another object or to the object's surroundings. An object is in motion when its position is changing. The motion of an object can be affected by pushing or pulling. A push or pull is a force that can make an object move faster, slower or go in a different direction. Changes in motion are a result of changes in | The position of an object is described by comparing its location relative to another object (e.g., in front, behind, above, below). Objects can be moved and their positions changed. Objects can move in a straight line (e.g., a dropped coin falling to the ground) or a circle (e.g., a pinwheel) or back and forth (e.g., a swing) or even in a zigzag pattern. Objects near Earth fall to the ground unless something holds them from falling. Object motion can be faster, slower or change direction by pushing or pulling the object. Experimentation, testing and investigations of different ways to change the motion of different objects (e.g., a ball, a pinwheel, a kite) can be used to demonstrate movement. Force is a push or pull between two objects and energy is |

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| energy. | the property of an object that can cause change. A force acting on an object can sometimes result in a change in energy. The differences between force and energy will be developed over time and are not appropriate for this grade level. Note: Scientific definitions and calculations of speed are not appropriate at this grade level. |

| **LIFE SCIENCE (LS)** | |
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| Topic: Basic Needs of Living Things - Survival on Earth<br>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. | |
| **Content Statement** | **Content Elaboration** |
| **1.LS.1: Living things have basic needs, which are met by obtaining materials from the physical environment.** Living things require energy, water, and a particular range of temperatures in their environments. Plants get energy from sunlight. Animals get energy from plants and other animals. Living things acquire resources from the living and nonliving components of the environment. | Earth has many different environmental conditions that support living things. The emphasis of this content statement is that living things meet their basic needs for survival by obtaining necessary materials from the environment. This includes, but is not limited to, temperature range, amount of water, amount of sunlight and available food sources. The environment includes both living (plants and animals) and nonliving (e.g., water, air, sunlight, nutrients) things. Living things get the energy they require to respond, grow and reproduce from the environment. Observing energy being used in everyday situations can help promote understanding that living things get resources from the physical environment. A detailed discussion of energy is not appropriate at this grade level. Energy is not scientifically explained until grade 3. When studying living things, ethical treatment of animals and safety must be employed. Respect for and proper treatment of living things must be modeled. For example, shaking a container, rapping on insect bottles, unclean cages or aquariums, leaving living things in the hot sun or exposure to extreme temperatures (hot or cold) must be avoided. The National Science Teachers Association (NSTA) has a position paper to provide guidance in the ethical use and treatment of animals in the classroom. Investigations about the types of living things that live in specific ecosystems can be done virtually or in nature. |
| **1.LS.2: Living things survive only in environments that meet their needs.** Resources are necessary to meet the needs of an individual and populations of individuals. Living things interact with their physical | Plants and animals require resources from the environment. The focus at this grade level is on macroscopic interactions and needs of common living things (plants and animals). Animals require basic habitat components, including food, water, cover and space. The amount and distribution of the basic components will influence the types |

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| environments as they meet those needs. Effects of seasonal changes within the local environment directly impact the availability of resources. | of animals that can survive in an area. Food sources might include plants, fruits, seeds, insects or other animals. Water sources may be as small as drops of dew found on grass or as large as a lake or river. Animals need cover for many life functions including nesting, escaping from predators, seeking shelter from unfavorable weather conditions and resting. Animals also need space in which to perform necessary activities such as feeding or raising young. Seasonal changes affect the resources available to living things (e.g., grasses are not as available in winter as they are in summer). The needs of plants include room to grow, appropriate temperature range, light, water, air and nutrients. Changes in these conditions can affect the growing season for certain plants. The amount and distribution of these conditions will influence the types of plants that can survive in an area. Observations of seasonal changes in temperature, liquid water availability, wind and light are applied to the effect of seasonal changes on local plants. |