



## **Science Education in Noblesville Schools**

### **Philosophy of Science Education**

The aim of science education in Noblesville Schools is for learners to inquire, explore, and understand the world. Learners develop and use evidence-based reasoning to improve their lives and communities by applying scientific processes to real-life questions and problems.

### **Mission-related Program Goals for Science Education**

#### **Learners will**

- Develop a mindset to inquire and persevere to understand, investigate, and seek answers or solutions.
- Naturally question themselves, others, information, and the world.
- Take risks and innovate.
- Engage in meaningful collaboration to achieve a goal.
- Use science processes as they explore and understand the world.
- Purposefully use a variety of ever-changing tools to investigate, collaborate, and communicate globally.

### **K - 12 Science Program Beliefs**

#### **Science learning**

- Is an active process that involves asking questions, hypothesizing answers, performing investigations, analyzing data, and revising hypotheses based on findings.
- Encourages student voice and choice; involves active, hands-on challenges; and is integrated across the curriculum.
- Should engage and inspire learners beyond the school setting, and student scientists will apply their learning to impact the community and the world at large.
- Occurs through collaboration and problem solving; learners listen and understand multiple perspectives on the same topic.
- Promotes collaborative risk-taking, engaging in debate from evidence, and reflecting on many possible answers or solutions.
- Is a progression in which students develop a deeper understanding, re-evaluating and questioning prior knowledge from year to year, and recognizing that the world is ever-changing and solutions may be temporary.



## Overview of the Science Curriculum in Noblesville Schools

Grades K - 2			
Domain	Big Ideas Scientists will learn about . . .	Enduring Understandings Scientists will understand that . . .	Essential Questions Scientists will keep considering . . .
Physical	structure, function, and properties of energy and matter	they can use the scientific process: <ul style="list-style-type: none"> <li>- ask</li> <li>- predict</li> <li>- investigate</li> <li>- observe</li> <li>- explain</li> </ul>	How can the scientific process support or develop our thinking?  How are matter and energy connected?
Earth and Space	cause and effect  patterns of systems and system models	their observations lead to an awareness of patterns in earth and space, enabling them to see effects and make predictions  they can communicate, develop, and design solutions based on their observations	Why should we recognize universal patterns that exist within our world?  How do natural or manmade changes in earth and space impact our world?
Life	growth and development  specific traits that contribute to the structure and function of living things	living things grow and change  there are similarities and differences in living things	How does investigating living things help us understand our world?  How does understanding the structure and function of living things aid innovation?  What impact--positive or negative--can living things have on one another?
Engineering	defining and delimiting problems  developing and optimizing design solutions	they ask questions, collect and analyze data, design and evaluate solutions  every problem has multiple solutions	Why do we use the engineering design process to solve problems?  How can the design process benefit us in solving problems in our daily lives?  How does failing help us find solutions?
Grades 3 - 5			
Domain	Big Ideas Scientists will learn about . . .	Enduring Understandings Scientists will understand that . . .	Essential Questions Scientists will keep considering . . .
Physical	physical properties, force and motion, energy (grades) <ul style="list-style-type: none"> <li>- volume, mass: conservation of mass, weight, gravity (5)</li> <li>- forces: effects of forces on motion (3, 4)</li> <li>- simple machines: relationship of speed and</li> </ul>	matter can be described by its mass, volume and weight  forces--lift, drag, friction, thrust, and gravity--can affect an object's motion  simple and complex machines make everyday tasks easier	How can matter, objects in our world, be described and determined?  How can scientists plan, conduct, and investigate the effects of forces on an object's motion?  How do machines allow humans to perform tasks?  How does speed affect an object's

	<p>energy of an object (3, 4)</p> <ul style="list-style-type: none"> <li>- sound energy: motion, and properties of sound through various materials (3, 4)</li> <li>- energy: generate, convert, transfer (3, 4)</li> </ul> <p>scientific processes: plan, generate, describe, investigate, determine, conduct, demonstrate, identify, observe, recognize</p>	<p>speed and energy of an object affect one another</p> <p>sound can be described by its properties of pitch, amplitude (loudness), and vibrations</p> <p>sound energy can be changed and converted as it travels through various matters (solids, liquids, gases)</p>	<p>energy? How can sounds be generated and described?</p> <p>What are the effects of matter on sound energy?</p>
Earth and Space	<p>solar systems; weather; soil, rocks, and minerals; Earth's systems and structure (grades)</p> <ul style="list-style-type: none"> <li>- patterns and perspective in systems (4, 5)</li> <li>- synthesis of information (3, 4)</li> <li>- effects of weather (3)</li> <li>- geology (3)</li> <li>- human impact on different spheres: geo-, bio- hydro-, atmo- (5)</li> </ul>	<p>the moon produces daily effects on Earth</p> <p>they can use multiple sources to develop answers or solutions</p> <p>precautions are taken to minimize negative effects of weather</p> <p>rocks, minerals, and fossil fuels have distinct characteristics, developed in certain ways, and are affected by humans</p> <p>communities use resources to protect the environment</p>	<p>How do the Earth and moon affect our everyday lives?</p> <p>How can different sources of information or types of media be used to answer the same question?</p> <p>How can we make our world safe from natural disasters?</p> <p>How does weather affect how people live and survive?</p> <p>What can fossils tell us about our past?</p>
Life	<p>growth and development (K - 4)</p> <ul style="list-style-type: none"> <li>- inherited traits of offspring</li> <li>- survival and reproduction</li> </ul> <p>structure and function (K, 1, 4)</p> <ul style="list-style-type: none"> <li>- internal and external structures of plants and animals</li> </ul> <p>systems (K, 1, 2, 3, 5)</p> <ul style="list-style-type: none"> <li>- patterns</li> <li>- diversity</li> <li>- life cycles</li> </ul>	<p>offspring of parents have traits that will allow them to survive and reproduce</p> <p>internal and external structures support the survival and reproduction of plants and animals according to their different ecosystems</p> <p>they can observe, compare, contrast, investigate, and develop models to understand how patterns affect the survival and reproduction of plants and animals</p>	<p>What similarities and differences from their parents do the offspring of plants and animals have?</p> <p>How do variations allow offspring to survive and reproduce?</p> <p>How do environmental changes affect traits inherited from parents?</p> <p>How do internal and external structures support survival, growth, behavior, and reproduction of plants and animals?</p> <p>How do patterns affect the survival and reproduction of plants and animals?</p>
Engineering	<p>design process (grade)</p> <ul style="list-style-type: none"> <li>- defining a real-world problem (3)</li> <li>- moving systems and measuring their motion (4)</li> <li>- prototypes to replace the</li> </ul>	<p>they can identify a real-world problem and recognize an appropriate tool to solve it</p> <p>forces affect the speed and movement of an object in motion</p> <p>muscles and the skeletal system work</p>	<p>What problems do people face daily?</p> <p>What tools can be used to collect data and solve problems?</p> <p>What makes objects move?</p> <p>What is the relationship between force and motion?</p> <p>How does applying a force affect the</p>

	function of a human body part (5)	together to create movement  they can investigate and design prototypes that mimic human or animal musculoskeletal systems	way an object moves?  How does technology help to provide answers or solve problems?  How can technology mimic human body systems?  How do the muscular and skeletal systems work together?  How do humans move?
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**Grades 6 - 8**

<b>Domain</b>	<b>Big Ideas</b> Scientists will learn about . . .	<b>Enduring Understandings</b> Scientists will understand that . . .	<b>Essential Questions</b> Scientists will keep considering . . .
Physical	<p>6 foundational vocabulary of motion</p> <p>differences between kinetic and potential energy</p> <p>basic components of waves and their functions</p> <p>7 the composition of matter</p> <p>conservation of energy</p> <p>Newton's laws of motion</p> <p>8 atoms and subatomic particles</p> <p>the periodic table</p> <p>unchanging properties of matter</p> <p>physical and chemical changes in matter</p>	<p>6 position, distance, displacement, speed, and velocity are terms to describe motion</p> <p>motion can be represented with a graph</p> <p>energy can be transferred, as in waves</p> <p>7 matter and energy are conserved</p> <p>interactions between objects create forces that can change an object's motion</p> <p>8 subatomic particles determine types of matter and their classification on the periodic table</p> <p>changes in matter are conservative, and are either physical or chemical</p>	<p>6 How can scientists describe motion?  How can energy be transferred?</p> <p>7 What does it mean to conserve?  How do objects interact?</p> <p>8 How do subatomic particles affect matter?  What does the periodic table represent and how is it organized?  How can matter change?</p>
Earth and Space	<p>6 solar system</p> <p>7 changing Earth</p>	<p>6 gravity and inertia drive motions of planets</p> <p>Earth's interaction with the sun and moon affects seasons, tides, daylight hours, eclipses, and phases of the moon</p> <p>similarities and differences exist between Earth and other planets, comets, and asteroids</p> <p>7 changes in Earth result from interactions of chemical and physical processes various evidence supports Earth's</p>	<p>6 How do gravity and inertia affect the motion of objects in the solar system?  How is Earth affected through interactions with the sun and moon?  How does Earth compare with other celestial bodies in our solar system?</p> <p>7 How have chemical and physical processes affect Earth's structure?  How has Earth changed over time?</p>

	8 human impact on Earth	<p>changes over time</p> <p>Earth provides energy resources that positively and negatively affect the environment</p> <p>8 the water cycle and use of natural resources are key components of the theory of climate change</p>	<p>How do humans affect Earth's resources?</p> <p>8 How does the use of natural resources affect the climate?</p> <p>What is the role of the water cycle in climate change?</p>
Life	<p>growth and development</p> <p>structure and function</p> <p>interactions, energy, and dynamic relationships in ecosystems</p>	<p>7 - 8 all living things are made of cells</p> <p>7 cells divide for repair, growth, and reproduction</p> <p>8 genetic variance and predictable patterns of inheritance resulting from cellular reproduction</p> <p>7 organizational levels of cells, tissues, organs, and organ systems</p> <p>relationship between cell structure and how living things obtain energy to perform functions</p> <p>8 inheritance and its role in evolution</p> <p>6 - 8 interactions within and between organisms and their environments; outcomes of those interactions</p>	<p>7 - 8 What role do cells play in our daily lives?</p> <p>7 Why do cells divide?</p> <p>8 How can genetic characteristics be changed, disrupted, or manipulated?</p> <p>7 - 8 How and why are species still evolving?</p> <p>What causes biodiversity on Earth?</p> <p>What will life on Earth be like in the future?</p> <p>6 - 8 How do I impact living systems?</p> <p>What are my roles and relationships in living systems?</p> <p>Where does my energy come from?</p>
Engineering	design, construction, testing, and optimization of solutions	<p>designs are subject to criteria and constraints</p> <p>investigations yield data about design solutions</p>	<p>How can solutions be created and tested?</p> <p>How can results be measured and depicted?</p>
<b>Grades 9 - 12</b>			
Domain	Big Ideas Scientists will learn about . . .	Enduring Understandings Scientists will understand that . . .	Essential Questions Scientists will keep considering . . .
Physical	Chemistry - matter and energy	Chemistry matter is composed of particles that are conserved in changes  energy changes the motion of particles, which directly affects the properties of the substance  substances have unique chemical and	Chemistry How is matter categorized?  How does matter interact?  What is energy?  How does energy affect matter?

	<p>Physics</p> <ul style="list-style-type: none"> <li>- describing object motion (kinematics, dynamics)</li> <li>- conservation principles with energy and momentum</li> <li>- electrical interactions (electrostatics, circuits)</li> <li>- wave properties (sound, light, optics)</li> </ul>	<p>physical properties</p> <p>amounts of particles can be determined by mass relationships</p> <p>Physics motion can be described with mathematical expressions and is caused by interactions between objects</p> <p>energy and momentum of individual objects can change due to interactions between objects, but the overall system energy and momentum remain the same</p> <p>interactions between electrical charges can produce forces and motion that can cause electrical current if applied within a closed-loop system</p> <p>waves and transfer energy through multiple methods such as light and sound</p>	<p>How are matter and energy conserved?</p> <p>Physics How and why do objects move?</p> <p>What happens when objects interact with one another?</p> <p>How do waves transfer energy?</p> <p>How do Kirchoff's Loop Rule and Junction Rule help us describe how series and parallel circuits operate in conjunction with conservation of mass and energy principles with resistor-only circuits, RC circuits, LR circuits, LC circuits, and RLC circuits?</p>
Earth and Space	<p>use of data to understand the development of the universe</p> <p>cycle of materials through Earth's systems</p> <p>equilibrium of Earth's systems</p> <p>factors and conditions that produce weather and climate</p> <p>constant changes in Earth's systems</p>	<p>scientists use data, current natural events, and models to create logical explanations of the creation of the universe</p> <p>biogeochemical materials cycle through the biosphere, hydrosphere, atmosphere, and lithosphere</p> <p>Earth is a complex system of systems that must remain in equilibrium for life to exist</p> <p>the Earth's atmosphere and oceans work together to produce weather and climate</p> <p>the solid Earth is a system that is always changing because of interactions between gravity, chemistry, and life</p>	<p>How were the universe, our solar system, and the Earth/moon/sun system formed?</p> <p>How have scientists gathered information about the universe?</p> <p>What does it mean that Earth's systems are dynamic?</p> <p>How does a change in one part of Earth's system change other Earth systems?</p> <p>How do materials cycle on planet Earth?</p> <p>How does Earth's atmosphere and oceans produce weather and climate?</p> <p>What active geological processes occur at plate boundaries?</p> <p>How do landscapes form?</p> <p>What processes are at work that produce the solid earth?</p>
Life	<p>structure and function: cells and evolution</p> <p>systems: interdependence, matter cycles, and energy transfer</p>	<p>systems of specialized cells within organisms help them perform essential functions of life</p> <p>biomolecules are formed by macromolecules, and the shape of the biomolecule determines its role in cellular processes</p> <p>ecosystems have limited resources--including energy, water, carbon, and nitrogen--and a complex set of</p>	<p>How are new cells and organisms formed?</p> <p>What is fitness, and why don't the strongest always win?</p> <p>Why are some antibiotics no longer effective in treating bacterial infections?</p> <p>Why do we need new pesticides and herbicides?</p>

	<p>growth and development: inheritance</p>	<p>interactions which affects the biodiversity and stability in an ecosystem</p> <p>human activity can disrupt biodiversity and stability in an ecosystem</p> <p>as matter and energy flow through organizational levels of living systems, chemical elements recombine differently to form different products: photosynthesis and respiration, carbon cycle, food chains, energy pyramids</p> <p>genetic information from common ancestry and diversity provides evidence of evolution</p> <p>natural selection, adaptations, changes in physical environment, and extinction contribute to the evolutionary process</p>	<p>How do breeders use evolutionary concepts to improve their breeding practices?</p> <p>How do we know which organisms are more closely and which are less closely related?</p> <p>What is an ecosystem, and how can I decide if it is "healthy" or balanced?</p> <p>Should I intervene if an ecosystem is not healthy or balanced?</p> <p>How do my actions affect the environment?</p> <p>How do ecosystems and populations respond to positive and negative inputs?</p> <p>How does resource availability in an environment affect population growth?</p> <p>Is genetic privacy a right or a privilege?</p> <p>Should we clone human parts or humans?</p> <p>Why sex?</p> <p>How can knowledge of my genetic code and family history be used to make informed decisions that will help keep me and my future offspring healthy?</p>
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