# Wilmette Public Schools, District 39 Science Curriculum, Grade 5 (updated summer 2016)

| **CONNECTED/21st Century Learning Technology** | **Global Perspective/Social Responsibility:** Carbon Footprint Comparisons | **Communication Skills/Characteristics of Successful Learners** Small Group Collaborative Work |
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| • SMART Board<br>• Microscopes<br>• Digital Data Analysis<br>• Personal Electronic Devices | • Impact of new technology on health<br>• Citizen Scientists gathering and sharing data<br>• Vehicle safety/efficiency | • Claims and Evidence<br>• Creating representation/metaphor<br>• Student Scientist Summit<br>• RAFT strategy for writing task |

| **Guiding Questions** | **Scientific and Engineering Practices** |
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| **Scientific Practices:**<br><br>What is the nature of scientific inquiry?<br><br>How do scientists go about their work?<br><br>How do theories become accepted or refuted?<br><br>What is the relationship of scientific claims to evidence?<br><br>Why are controls needed?<br><br>How can a problem be stated so that it can be solved?<br><br>How can creative solutions be developed, clearly expressed, and evaluated?<br><br>What constitutes a strong experimental design?<br><br>How can we use experimental design process to solve problems?<br><br>Why is experimental design important to consider when analyzing the validity of data?<br><br>How have others solved similar problems?<br><br>How can data be represented accurately and visually (drawings, graphs, data tables, models, etc)?<br><br>**Technological and Engineering** | Asking Questions and Defining Problems<br><br>Ask questions about what would happen if a variable is changed.<br><br>Identify scientific (testable) and non-scientific (non-testable) questions.<br><br>Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.<br><br>Use prior knowledge to describe problems that can be solved.<br><br>Developing and Using Models<br><br>Identify limitations of models.<br><br>Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.<br><br>Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.<br><br>Develop and/or use models to describe and/or predict phenomena.<br><br>Develop a diagram or simple physical prototype to convey a proposed object, tool, or process.<br><br>Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.<br><br>Planning and Carrying Out Investigations<br><br>Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.<br><br>Evaluate appropriate methods and/or tools for collecting data.<br><br>Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.<br><br>Make predictions about what would happen if a variable changes.<br><br>Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.<br><br>Analyzing and Interpreting Data<br><br>Represent data in tables and/or various graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships.<br><br>Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.<br><br>Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.<br><br>Analyze data to refine a problem statement or the design of a proposed object, tool, or process.<br><br>Use data to evaluate and refine design solutions. |

| **Practices:** | Using Mathematics and Computational Thinking |
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| How can technology be developed as the best possible solution to a problem? | Decide if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success |
| | Organize simple data sets to reveal patterns that suggest relationships. |
| What is technology and how does technological development shape our world? | Constructing Explanations and Designing Solutions |
| | Construct an explanation of observed relationships (e.g., the distribution of plants in the back yard). |
| How are technological problems defined and researched? | Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. |
| | Identify the evidence that supports particular points in an explanation. |
| | Apply scientific ideas to solve design problems. |
| | Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. |
| | Engaging in Argument from Evidence |
| | Compare and refine arguments based on an evaluation of the evidence presented. |
| | Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation. |
| | Construct and/or support an argument with evidence, data, and/or a model. |
| | Use data to evaluate claims about cause and effect. |
| | Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. |
| | Obtaining, Evaluating, and Communicating Information |
| | Combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices. |
| | Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem |
| | Communicate scientific and/or technical information orally and/or in written formats, including various forms of media as well as tables, diagrams, and charts. |

## Unit: Force and Motion - Newton's Laws

**Time Frame (in weeks): 12 Weeks**

**Essential Question:** How is energy transferred through forces and motions?

***Cross-Cutting Concepts:***

***Systems and system models***

*Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.*

***Cause and effect: Mechanism and explanation***

*Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.*

***Influence of Science, Engineering, and Technology on Society and the Natural World***

*People's needs and wants change over time, as do their demands for new and improved technologies.*

*Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.*

**SCIENCE VOCABULARY:** Newton's Laws, energy transfer, potential energy, collision, kinetic energy, force, motion, distance, speed, acceleration, center of mass, deceleration, inertia
**ACADEMIC VOCABULARY:** claim, evidence, force

**District Grade Level Summative Assessment:** Support choice of safest vehicle based on evidence gathered throughout the unit.

**Guiding Questions:**

1. How can we measure and compare forces?
2. How do forces impact the movement, speed, and direction of objects?
3. How can we apply our understanding of forces to analyze events?
4. What evidence can we find that energy is transferred?
5. How do we describe and predict motion of objects?
6. What happens to the parts of a system when the system changes? (macroscopic)
7. What is energy?

| Next Generation Science Standards<br>**Performance Expectations** | Disciplinary Core ideas | Science & Engineering Practices, Skills, & Knowledge |
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| Students who demonstrate understanding can:<br>• 3-PS2-1. Conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment is limited to gravity being addressed as a force that pulls objects down.]<br>• 3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]<br>• 4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.<br>• 4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide. [Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [Assessment Boundary: Assessment does not include quantitative measurements of energy.]<br>• 5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down. [Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]<br>• MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.* [Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space | **Connected NGSS Disciplinary Core Ideas:**<br>Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.<br>The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)<br>Objects in contact exert forces on each other.<br>For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).<br>The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.<br>When objects collide, the contact forces transfer energy so as to change the objects' motions.<br>The faster a given object is moving, the more energy it | **Formative Understandings & Skills**<br>• Understand means to measure forces<br>• Analyze forces as transfer of energy<br>• Compare direction, speed, and movement to determine interrelationships<br>• Measure and graph speed<br>• Analyze data gathered to support claims with evidence<br>• Compare and contrast balanced and unbalanced forces<br>• Analyze cause and effect of forces on objects<br>• Analyze energy transfer from one system to another<br>**Science and Engineering Practices**<br>• Describe, measure, estimate, and/or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems.<br>• Create and/or use graphs and/or charts generated from simple algorithms to compare alternative solutions to an engineering problem.<br>• 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.<br>• 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.<br>• Although one design may not perform the best |

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| vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]<br>• MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.] | possesses.<br><br>When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.<br><br>The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.<br><br>MS-PS3.A-1: Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. | across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)<br>• At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2) |

**Unit: Human Body - Systems and Interactions** **Time Frame: 12 Weeks**

**Essential Question:** *How do body systems work together and interact?*

**CROSSCUTTING CONCEPTS:**

**Structure and Function**

- The way in which an object or living thing is shaped and its substructure determine many of its properties and functions

**Systems and System Models**

- Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering
- Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems

**ACADEMIC VOCABULARY:** system, interaction, structure, function, cause/effect, maintain, claims, evidence

**SCIENCE VOCABULARY:** cell, tissue, organ, organ system, disease, healthy choices

***District Grade Level Summative Assessments:*** Create a Medical Brochure/flyer for a body system of choice.

**Guiding Questions:**

1. What are the parts of the body systems?
2. How do body systems work together?
3. How do parts of systems influence each other?
4. How do the systems of the human body work together to sustain life?
5. What factors can impact body systems?
6. What can you do to help your body work well?
7. What choices do people make that can harm how the body systems work?

| Next Generation Science Standards Performance Expectations | Disciplinary Core ideas | Science & Engineering Practices, Skills, & Knowledge |
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| Students who demonstrate understanding can:<br>• Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]<br>• Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]<br>Students who meet the standard can<br>• IL 23A - describe and explain the structure and functions of the human body systems & how they interrelate.<br>  ○ Explain the basic functions of<br>  ○ the muscular-skeletal system<br>  ○ the nervous system<br>  ○ the digestive system<br>  ○ the circulatory system<br>  ○ the respiratory system<br>  ○ the reproductive system<br>  • Explain how nerves and the brain work together.<br>  • Describe how body systems work together within the body.<br>• IL 23B - explain the effects of health-related actions on the body systems.<br>  • Describe positive health behaviors and choices that may prevent common injuries, diseases, and illnesses.<br>  • Explain how health choices affect the performance of the body's systems.<br>• IL 23C -describe factors that affect growth and development<br>  • Recognize personal health behaviors and/or choices that reduce risks of health problems<br>  • Understand how proper amounts of rest, work, sleep, exercise/activity/play, and nutrition promote physical, mental, and | **Connected NGSS Disciplinary Core Ideas:**<br>Many characteristics of organisms are inherited from their parents.<br>Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.<br>Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.<br>All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).<br>In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.<br>Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.<br>**Illinois Physical Development & Health Standards**<br>STATE GOAL 23. Understand human body systems and factors that influence growth and development<br>• To achieve healthful individual development, students need to understand human anatomy and physiology, nutrition, stages of growth and development, avoidance of harmful actions, and the characteristics of good health habits. Early learners begin with basic recognition of body systems and growth stages. As students progress, they understand how systems work together and how individual actions affect health. As they themselves grow and develop, students can learn to enhance the process throughout their school years and later life.<br>A. Describe and explain the structure and functions of the human body systems and how they interrelate.<br>B. Explain the effects of health-related actions on the body systems. | **Formative Understandings**<br>• Identify system parts and their functions<br>• Create a scientific drawings of body systems<br>• Identify risk factors and beneficial factors associated with systems<br>• Identify new technologies designed aid body systems<br>• Evaluate interactions of systems both positive and negative<br>• Explain interactions across systems<br>**Science and Engineering Practices**<br>• Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. Develop models to describe phenomena. (3-LS1-1) |

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| social well-being<br>• Define the word 'puberty'<br>• Identify changes associated with puberty<br>• Identify characteristics of puberty and the effects of these changes on physical, mental, and social | C. Describe factors that affect growth and development. | |

## Unit: Impact Earth

**Time Frame: 12 Weeks**

**Essential Question:** How do interactions influence systems?

**CROSSCUTTING CONCEPTS:**

**Systems and Interactions**

- *A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They can also describe a system in terms of its components and their interactions.*

**Stability and Change**

- *For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study*
- *Change can be measured in terms of differences over time, and may occur at different rates. Some systems appear stable, but over long periods of time they will eventually change.*
- *Stability might be disturbed either by sudden events or gradual changes that accumulate over time.*

**SCIENCE VOCABULARY:** climate, organisms, populations, manipulated variable, data, mean, median, mode, interaction, cost, benefit, microorganism, control, variable, carbon footprint, benefit, cost, citizen scientist

**ACADEMIC VOCABULARY:** evidence, claim, inquiry, result, data, representation

***District Grade Level Summative Assessments:***

**Summative Assessment #1:** Journal entry: Using the data you have gathered, support with evidence the best growing conditions for yeast.

**Summative Assessment #2:** Argue your position on climate change based on the evidence gathered through reading, research, and observations.

**Guiding Questions:**

1. How do observations inform what we know?
2. How do changing conditions impact populations? What evidence do you have?
3. What evidence have scientists gathered to support the theory of climate change?
4. Do all scientists agree?
5. How can we reduce our carbon footprint?
6. How do scientists investigate and use evidence to support their claims?
7. How do human activities alter Earth's climate?
8. What will happen to life on Earth if temperatures continue to rise?
9. How can humans reduce climate change and minimize its negative effects?

| Next Generation Science Standards<br>Performance Expectations | Disciplinary Core ideas | Science & Engineering Practices, Skills, & Knowledge |
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| Students who demonstrate understanding can:<br>• 3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]<br>• 3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.* [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms]<br>• 4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; nonrenewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]<br>• 5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a | **Connected NGSS Disciplinary Core Ideas:**<br>When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.<br>Some kinds of plants and animals that once lived on Earth are no longer found anywhere.<br>Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.<br>For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.<br>Populations live in a variety of habitats, and change in those habitats affects the organisms living there.<br>Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.<br>Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.<br>A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.<br>Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.<br>Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.<br>Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.<br>Human activities have significantly altered the biosphere, sometimes | **Formative Understandings**<br>*Prior to Assessment 1*<br>• Conduct controlled investigations<br>• Manipulate variables<br>• Collect and represent data<br>• Synthesize test results<br>• Draw inferences based upon findings<br>• Identify ideal conditions to grow yeast cultures<br>*Prior to Assessment 2*<br>• Identify the impact of human actions on the planet (positive/negative)<br>• Support ideas with evidence informed by careful analysis of observations<br>• Investigate changing populations as indicators of climate change<br>• Investigate strategies for reducing carbon footprint<br>• Graph data collected<br>**Science and Engineering Practices**<br>• Read and comprehend grade-appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas<br>and describe how they are supported by evidence.<br>• Compare and/or combine across complex texts and/or other reliable media to support the engagement in other scientific and/or engineering practices. |

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| system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]<br>• 5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]<br>• 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. | damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.<br><br>Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.<br><br>Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. | |