

Science Big Ideas - KWL

NBTA Middle Level Subject Council

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May 6, 2016

The Purpose

To understand what students should have in terms of understanding when coming into middle school for conceptual understanding and how far middle school needs to take them before high school.

Science Curriculum - Core Ideas Framework

<p>k-2 Ideas about phenomena that students can directly experience and investigate</p>	<p>3-5 Include invisible but still macroscopic ideas (physical models and pictures can represent them in a way children can investigate)</p>	<p>6-8 Include atomic level level explanations of physical phenomena and cellular level explanations of life processes and structure</p>	<p>9-12 Use sub-atomic and sub-cellular explanations for physical phenomena and life processes</p>
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Previous Learning	Middle School	Continued Learning
<p>Grade 3 - Plant Growth and Changes</p> <p>Grade 4 - Habitats</p>	<p>Grade 6 - Diversity of Life</p>	<p>Grade 7 - Interaction Within Ecosystems</p> <p>Grade 10 - Sustainability of Ecosystems</p>
<p>Grade 3 - Invisible Forces</p>	<p>Grade 6 - Electricity</p>	<p>Grade 9 - Characteristics of Electricity</p>
<p>Grade 3 - Materials and Structures</p> <p>Grade 5 - Forces and Simple Machines</p>	<p>Grade 6 - Flight</p>	
	<p>Grade 6 - Space</p>	<p>Grade 9 - Space Exploration</p>

Previous Learning	Middle School	Continued Learning
<p data-bbox="87 201 518 302">Grade 3 - Plant Growth and Changes</p> <p data-bbox="87 323 518 386">Grade 4 - Habitats</p>	<p data-bbox="583 270 1013 369">Grade 7 - Interaction Within Ecosystems</p>	<p data-bbox="1053 270 1484 369">Grade 10 - Sustainability of Ecosystems</p>
<p data-bbox="87 554 518 617">Grade 3 - Exploring Soils</p> <p data-bbox="87 638 518 739">Grade 4 - Rocks, Minerals and Erosion</p>	<p data-bbox="583 623 1013 695">Grade 7 - Earth's Crust</p>	<p data-bbox="1053 623 1484 695">Grade 8- Water Systems on Earth</p>
<p data-bbox="87 785 518 877">Grade 5 - Properties and Changes in Materials</p>	<p data-bbox="583 785 1013 877">Grade 7 - Heat</p>	<p data-bbox="1053 785 1484 877">Grade 8 - Fluids</p>
<p data-bbox="87 924 518 1016">Grade 5 - Properties and Changes in Materials</p>	<p data-bbox="583 924 1013 1016">Grade 7 - Mixtures and Solutions</p>	<p data-bbox="1053 924 1484 1016">Grade 9- Atoms and Elements</p>
<p data-bbox="87 1079 518 1142">Grade 3 - Exploring Soils</p> <p data-bbox="87 1163 518 1264">Grade 4 - Rocks, Minerals and Erosion</p> <p data-bbox="87 1285 518 1352">Grade 7 - Earth's Crust</p>	<p data-bbox="583 1163 1013 1264">Grade 8- Water Systems on Earth</p>	
<p data-bbox="87 1415 518 1486">Grade 4 - Light</p>	<p data-bbox="583 1415 1013 1486">Grade 8 - Optics</p>	
<p data-bbox="87 1541 518 1633">Grade 5 - Forces and Simple Machines</p> <p data-bbox="87 1654 518 1747">Grade 5 - Properties and Changes in Materials</p> <p data-bbox="87 1768 518 1835">Grade 7 - Heat</p>	<p data-bbox="583 1667 1013 1738">Grade 8 - Fluids</p>	
<p data-bbox="87 1898 518 1969">Grade 5 - Healthy Bodies</p>	<p data-bbox="583 1898 1013 1969">Grade 8 - Cells</p>	<p data-bbox="1053 1898 1484 1969">Grade 9 - Reproduction</p>

Diversity of Life - Grade 6

Previous Learning	Diversity of Life	Continued Learning
G4 - Habitats - Classify organisms according to role on food chain	Role of common classification system	G7 - Ecosystems - Energy flow through a food web G7 - Ecosystems - Classification and diversity of life
G3 Plants - Identify and describe parts of plants	Classifying vertebrates, invertebrates, animal kingdom, and arthropods	G7 - Ecosystems - Role of producers, consumers, and decomposers
	Microorganisms	G7 - Ecosystems - Recycling matter - microorganisms
G4 - Habitats - Compare structural features of plants that allow them to survive	Adaptations and Fossils	

What students should already know...

- Students should have a basic idea of how to classify according to 2 or more attributes.
- Students should understand the basic concept of a plant and that they absorb water from the ground and use sunlight for energy

What's the focus of Diversity of Life...

- The major focus is on classifying plants and animals. There is no requirement that students understand all levels, but they should have exposure to kingdoms because of the need to classify vertebrates, invertebrates, specifically arthropods.

What is something of interest (only time/last time its taught)

- This is the only time that students learn about adaptations. Teacher should make an effort thoroughly cover the concept, but the concept of evolution is not required.

Where will they go from here...

- This unit is a building block for the Ecosystems unit. Since the focus of Diversity of Life is on classification of species and understanding adaptations, Ecosystems will assume they understand these concepts when building food webs and understanding biodiversity.

Electricity - Grade 6

Previous Learning	Electricity	Continued Learning
	Circuit Pathways Series v Parallel	G9 - Characteristics of Electricity - Series v Parallel involving resistance, voltage, and current
	Conductivity	
G3 - Invisible Forces - Conditions that affect and how to use Static Electricity	Comparing Static to Current Electricity	G9 - Characteristics of Electricity - Quantitatively comparing static and current
G3 Invisible Forces - Use of magnets, polarity of magnets and distinguishing from which materials can be magnetized	Electromagnets	
	Circuits produce light, heat, sound, motion, and magnetic effects	G9 - Characteristics of Electricity - Describe the flow of charge in a circuit

What students should already know...

- Students have learned about the basics of static electricity. They will have exposure to the concept but no understanding of the charges and electrons

What's the focus of Electricity...

- The major focus is to construct circuit pathways, specifically series and parallel. Students should be able to physically build each of these circuits and apply their uses to real world. In order to do this effectively, students will have to understand insulators and conductors.

What is something of interest (only time/last time its taught)

- Electromagnets should be emphasized, they would have been touched on in elementary, but this unit is the only opportunity to building a usable electromagnet.

Where will they go from here...

- Students will expand their understanding of circuits but learning about resistance and voltage. Also, students will learn about the atom and how the "negative charge" is an electron.

Flight - Grade 6

Previous Learning	Flight	Continued Learning
G3 - Materials and Structures - Build and modify structures for stability and strength G5 - Forces and Simple Machines - Effects of Friction	Altering Drag	
	Role of Lift	
G5 - Forces and Simple Machines - Gravitational force causes movement	Overcoming Gravity	
G5 - Forces and Simple Machines - Forces used to move objects	Means of Propulsion	

What students should already know...

- Students should have a generic understanding of force under the concept of friction.
- Students should understand strength and stability of structure from building materials and structures.

What's the focus of Flight...

- The major focus is to qualitatively teach the four forces that interact during flight. Students should have exposure to building a variety of different devices based on the independent force that they are learning.

What is something of interest (only time/last time its taught)

- This is the only time drag, lift and propulsion are taught so each of the concepts should be understood. Gravity is covered on different occasions but it should be understood as a force.

Where will they go from here...

- Students will use this understanding when learning about space exploration and how forces change according to gravity.

Space - Grade 6

Previous Learning	Space	Continued Learning
	Earth's rotation causes day and night and revolution causes year cycle of seasons	G9 - Space Exploration - Explain motion of celestial bodies
	Relative positions of Earth, moon and sun cause moon phases, eclipses, and tides	
	Components of solar system - sun, planets, moons, comets, asteroids and meteors	G9 - Space Exploration - Theories on formation of solar systems and universe G9 - Space Exploration - Describe and classify major components of the universe

What students should already know...

- Students have no previous learning about space, but french immersion students may have reference to the atmosphere and earth and sun interactions from grade 5 Weather.

What's the focus of Space...

- The major focus is to teach the interaction between Earth, Moon, and Sun. Specifically students will know that Earth's rotation on its axis causes day and night cycle, the angle of tilt and revolution around the sun cause the seasons. Also, students will understand how Earth's moon orbit around the planet causes moon phases and tides.

What is something of interest (only time/last time its taught)

- The success of Grade 9 Space Exploration depends on students understanding the interacting movements of the Earth, Moon, and Sun.

Where will they go from here...

- Students will expand on the physical understanding of the solar system to expand to the universe. Also, student will dig into major theories that associate with space exploration.

Interactions Within Ecosystems - Grade 7

Previous Learning	Interaction Within Ecosystems	Continued Learning
	Interactions between biotic and abiotic factors	Grade 10 - Sustainability of Ecosystems - Cycling matter through biotic and abiotic - tracking carbon, nitrogen, and oxygen
G4 - Habitats - Identify local habitats and populations of plants and animals	Roles of producers, consumers, and decomposers in a local ecosystem	Grade 10 - Sustainability of Ecosystems - bioaccumulation and diversity of consumers at all trophic levels
G4 - Habitats - Classify organisms according to role on food chain	Energy flow through a food web	
G6 - Diversity of Life - Role of common classification system	Classification and diversity of life	Grade 10 - Sustainability of Ecosystems - Biodiversity contributes to sustainability
G6 - Diversity of Life - Microorganisms	Recycling matter- microorganisms	
	Ecological succession	

What students should already know...

- Students have a basic understanding of an organisms habitat and how to determine a basic food chain.
- From Diversity of Life, students understand how the role of a common classification scheme assists to classify by attributes. Also, students have been introduced to microorganisms.

What's the focus of Interactions Within Ecosystems...

- The major focus is for students to understand how biotic and abiotic factors interact as producers, consumers, and decomposers in an ecosystem. The big concept for students to grasp is how a habitat expands based the organisms to incorporate all factors in an ecosystem in order for survival and biodiversity

What is something of interest (only time/last time its taught)

- This is the only opportunity to teach ecological succession. Teachers should make emphasis on how ecosystems can regenerate after various events.

Where will they go from here...

- In grade 10 the unit focusses on the sustainability of the ecosystems. It is critical that students understand how an ecosystem interacts and later they will look at different cycles (carbon, nitrogen and oxygen).

Earth's Crust - Grade 7

Previous Learning	Earth's Crust	Continued Learning
	Catastrophic events - earthquakes and volcanic eruptions	
G4 - Rocks, Minerals and Erosion - Natural phenomena that cause changes to the landscape	Mountain formation	
	Chronological Model of Earth's history	
G4 - Rocks, Minerals and Erosion - Describe rocks and minerals by physical properties	Mineral classifications	
G4 - Rocks, Minerals and Erosion - Compare different rocks and minerals in local area - rocks contain records of Earth's history	Rock cycle	
G4 - Rocks, Minerals and Erosion - Describe a variety of weathering and erosion - Effects of wind, water and ice - Describe ways soil formed from rocks	Weathering and Erosion	G8 - Water System on Earth - Erosion and deposition result from wave action and water flow
G3 - Exploring Soils - Describe a variety of soils, similarities and differences among them - Investigate and describe soil components	Soil Types	

What students should already know...

- Students should have a very good understanding of the concept of erosion from their work with soils and rocks and minerals.

What's the focus of Earth's Crust...

- The major focus is on plate tectonic activity, leading to earthquakes and volcanic eruptions. From here, students can then backfill information to better understand how rocks and minerals were formed.

What is something of interest (only time/last time its taught)

- This is the only time students learn about tectonic plates.

Where will they go from here...

- Since erosion will be touched again and with a more applicable way in grade 8 water systems, it does not need to be a major point of emphasis.

Heat - Grade 7

Previous Learning	Heat	Continued Learning
	Instruments used to measure temperature	
G5 - Properties and Changes in Materials - Group materials as solids, liquids and gases	Change of State - Particle Theory	G8 - Fluids - Describe relationship of mass, volume, and density of solids, liquids and gases using particle theory
	Kinetic Energy - Particle Theory	G8 - Fluids - Relationship among pressure, volume, and temperature when fluids are compressed or heated
	Compare heat - conduction, convection, and radiation	
	Heat capacities - Particle Theory	

What students should already know...

- Students will have little theoretical understanding of heat as a concept and links to understanding of integers in math are key to understanding. Students will know that things change state based on temperature (more or less heat).

What's the focus of Heat...

- The major focus is to introduce students to the concept of heat gain, heat loss and the different types of heat transfer.

What is something of interest (only time/last time its taught)

- This unit focusses on the movement of particles under different heat conditions and it is the building block for future understanding in physics.

Where will they go from here...

- Students learn about fluids in grade 8, they will use the particle theory and the movement of particles under different heat conditions when learning about density and pressure of fluids.

Mixtures and Solutions - Grade 7

Previous Learning	Mixtures and Solution	Continued Learning
	Distinguish pure substances and mixtures - Particle Theory	G9 - Atoms and Elements - Investigate physical properties of materials - Use models to describe structures of atoms and molecules
	Separate components of mixtures	G9 - Atoms and Elements - Changes to properties from chemical reactions
	Describe solutions - Particle Theory	
	Concentrations of solutions	
G5 - Properties and Changes in Materials - Identify properties such as texture, hardness, colour, buoyancy, and solubility that allow materials to be distinguished	Solubility	

What students should already know...

- Students may have an understanding of solubility from their work with identifying physical properties. Also, students should have a general understanding of what a mixture is.

What's the focus of Mixtures and Solutions...

- The major focus is to work at the particle level to distinguish a solution from a pure substance.

What is something of interest (only time/last time its taught)

- This unit is the only opportunity to understand solubility. Teachers should make a concerned effort to help students understand these concept for further learning.

Where will they go from here...

- Students, along with the Heat unit, learn about the particle theory and the movement of particle. This is the beginning understanding for bonding in chemistry when students learn at an atomic level in grade 9 atoms and elements.

Water Systems on Earth- Grade 8

Previous Learning	Water System on Earth	Continued Learning
	Waves and tides interacting with shorelines	
G4 - Rocks, Minerals and Erosion - Describe a variety of weathering and erosion - Effects of wind, water and ice - Describe ways soil formed from rocks G7 - Earth's Crust - Weathering and Erosion	Erosion and deposition result from wave action and water flow	
	Interactions of ocean currents, winds, and regional climates	
	Species distribution	
	Glaciers and polar icecaps	

What students should already know...

- Students have had several opportunities to learn about erosion, they should understand the concept of movement of soil from various factors.

What's the focus of Water Systems on Earth...

- The major focus is to understand the interactions involved in shorelines. Erosion is a major part of the change to shorelines from waves from storms and tidal actions. Also, students look at the global impact of climate change.

What is something of interest (only time/last time its taught)

- Since most students have not learned the grade 5 Weather unit, they lack the understanding of how winds work and how pressure changes impact weather.

Where will they go from here...

- Students will need to understand how weather patterns, winds, tides, and ocean ecosystems interact to better understand environmental issues surrounding the moving water systems.

Optics- Grade 8

Previous Learning	Optics	Continued Learning
G4 - Light - Light travels away from a source	Properties of visible light	
G4 - Light - Investigate how light interacts to cast shadows, allow light to pass through or reflect the light	Laws of reflection of visible light	
G4 - Light - Show change of direction of light	Quantitatively describe how light is refracted	
	Electromagnetic radiation	

What students should already know...

- Students have learned about light in grade 4. The focus in elementary is the concept of how light is dispersed and how it can change direction.

What's the focus of Optics...

- The major focus is to learn the properties and laws of visible light. There is no quantitative measurements in the optics unit. Students should have a firm understanding of the difference between reflection and refraction of light.

What is something of interest (only time/last time its taught)

- This is the only opportunity for students to study electromagnetic radiation.

Where will they go from here...

- Students will need to understand how the laws of reflection and explaining how light refracts before entering high school physics.

Fluids- Grade 8

Previous Learning	Fluids	Continued Learning
G5 - Properties and Changes in Materials - Group materials as solids, liquids and gases G7 - Heat - Changes of State - Particle Theory	Describe relationship of mass, volume, and density of solids, liquids and gases using particle theory	
	Quantify Density	
	Describe changes of temperature on density of solids, liquids and gases using particle theory	
G5 - Forces and Simple Machines - Forces used to move objects or hold them in place	Balanced and unbalanced forces	
	Relationship between mass and weight	
	Quantify relationship between force, area, and pressure	
G7 - Heat - Kinetic Energy - Particle Theory	Relationship among pressure, volume, and temperature when fluids are compressed or heated	
	Viscosity and how to modify viscosity of a liquid	

What students should already know...

- Students have learned about the concept of forces in grade 5 Forces and Simple Machines unit by studying friction. They should understand the difference between a solid, liquid, and gas in order to distinguish a fluid.

What's the focus of Fluids...

- The major focus of the Fluids unit is the concept of density, viscosity and continuing the learning about force with the addition of pressure. First, density at the particle level should be distinguished and later quantified in various settings with different fluids. Next, the learning about density should extend to viscosity. The unit involves the concept of the force of fluids that later builds to quantifying amount of pressure exerted.

What is something of interest (only time/last time its taught)

- Students will struggle with quantifying pressure as a measurement. They should understand qualitatively what force, area and pressure represent, but applying the concepts to the Pascal's formula should require specific instruction to the math concepts.

Where will they go from here...

- Students will need to understand how this unit in order to have success in physics.

Cells - Grade 8

Previous Learning	Cells	Continued Learning
	Cell as a living system and exhibits all characteristics of life	
G5 - Healthy Body - Relate bodily changes to growth and development	Growth and reproduction depend on cell division	G9 - Reproduction - Describe basic process of cell division - cell membrane - Distinguish between sexual and asexual reproduction
	Distinguish plant from animal cells	G9 - Reproduction - Recognize nucleus contains genetic information and determines cellular process
	Relate cell and organ function to needs of human	
G5 - Healthy Body - Role of Skin	Explain structures of cells, tissues, organs and systems	
G5 - Healthy Body - Describe structure and function of the major organs of the: digestive, excretory, respiratory, circulatory, and nervous systems	Describe factor that affect, respiratory, circulatory, digestive, excretory, and nervous systems	
G5 - Healthy Body - Describe body defences against infections	Describe interdependence of the body systems	

What students should already know...

- Students will have a general understanding of the major function of each body system.

What's the focus of Cells...

- The major focus of this unit is to understand the concept of a cell being the building blocks of organisms. From there students will study different types of cells, from generic plant and animal, to specialized animal cells that perform a function.
- Learning all organelles is not required, rather ones that serve a specific function that are relatable to the human as a whole can be emphasized and applied in learning.

What is something of interest (only time/last time its taught)

- Only students from the French Immersion strand will have been exposed to this unit

Where will they go from here...

- The concept of cell division only needs to be understand as a concept of growth and division, the grade 9 Reproduction unit will focus on the genetic material in the nucleus and the difference of mitosis and meiosis.