



## Educational Programs for School Groups 2009-2010

### Massachusetts Curriculum Frameworks

*Opportunities for inquiry based learning are an integral part of all of the programs offered by the EcoTarium. Students develop scientific expertise while exploring concepts using the unique resources of the museum: the planetarium, materials and resident organisms. Each program focuses on understanding how scientific discovery takes place today and includes background on how scientific discovery took place in the past and why we know what we know today. As part of the discovery process, students are encouraged to draw on their previous knowledge about the natural world, observe or investigate in a hands-on manner, formulate and ask questions, and draw conclusions based on their own investigations during the program.*

Pond Ecosystems			
PreK-2	Earth Science	4	The sun supplies heat and light to the earth and is necessary for life
		5	Events around us have repeating patterns, including the seasons of the year, day, and night.
PreK-2	Life Science	1	Animals and plants are living things that grow, reproduce, & need food, air, & water.
		3	Plants and animals have life cycles that vary.
		6	People and other animals interact with the environment through their senses.
		7	Animals and plants go through changes in appearance as the seasons change.
3-5	Life Science	8	An organism's habitat provides for its basic needs.
		1	Physical characteristics of plants and animals
		3	Plants and animals go through predictable life cycles, including birth, growth, development, reproduction, and death.
		8	Organisms meet needs by using behaviors in response to information from the environment. Some behaviors are instinctive and others learned.
		9	Plants have characteristic behaviors. Plants and animals can

			survive harsh environments via seasonal behaviors
		10	Organisms can cause changes in their environment to ensure survival, which may affect the ecosystem.
		11	Energy derived from the sun is used by plants to produce sugars and is transferred with-in a food chain from producers to consumers to decomposers.
6-8	Life Science	1	Organisms are classified into kingdoms.
		13	Organisms interact and have different functions within an ecosystem that enable the ecosystem to survive.
		14	Roles & relationships among producers, consumers, and decomposers in the process of energy transfer in a food web.
		15	Dead plants and animals are broken down by other living organisms, which contributes to the system as a whole.
		16	Producers use energy from sunlight to make sugars through photosynthesis, which can be used immediately, stored for later use, or used by other organisms.
HS	Life Science	6.2	Changes in population size and biodiversity result from a variety of influences.
		6.3	A food web identifies producers, consumers, and decomposers, and explains the transfer of energy through trophic levels. Relationships among organisms add to the complexity of biological communities
		6.4	Water, carbon, and nitrogen cycle between abiotic resources and organic matter, and oxygen cycles through photosynthesis and respiration.

## Mysteries of Animal Tracking

PreK- 2	Earth Science	5	Events around us have repeating patterns, including the seasons of the year, day, and night.
PreK- 2	Life Science	1	Animals and plants are living things that grow, reproduce, & need food, air, & water.
		2	Characteristics of living and nonliving things.
		3	Plants and animals have life cycles that vary.
		6	People and other animals interact with the environment through their senses.
		7	Animals and plants go through changes in appearance as the seasons change.
		8	An organism's habitat provides for its basic needs.
PreK- 2	Physical Science	1	Observable properties of objects include size, shape, color, weight, and texture.
3-5	Life Science	8	Organisms meet needs by using behaviors in response to information from the environment. Some behaviors are instinctive and others learned.

		9	Plants have characteristic behaviors. Plants and animals can survive harsh environments via seasonal behaviors
		10	Organisms can cause changes in their environment to ensure survival, which may affect the ecosystem.
3-5	Physical Science	1	Observable properties of objects include size, shape, color, weight, and texture.

## Tide Pool Investigations

PreK- 2	Earth Science	4	The sun supplies heat and light to the earth and is necessary for life
		5	Events around us have repeating patterns, including the seasons of the year, day, and night.
PreK- 2	Life Science	1	Animals and plants are living things that grow, reproduce, & need food, air, & water.
		3	Plants and animals have life cycles that vary.
		6	People and other animals interact with the environment through their senses.
		8	An organism's habitat provides for its basic needs.
PreK- 2	Tech/ Engineering	2.2	Human beings and animals use parts of the body as tools.
3-5	Life Science	1	Physical characteristics of plants and animals
		3	Plants and animals go through predictable life cycles, including birth, growth, development, reproduction, and death.
		8	Organisms meet needs by using behaviors in response to information from the environment. Some behaviors are instinctive and others learned.
		10	Organisms can cause changes in their environment to ensure survival, which may affect the ecosystem.
		11	Energy derived from the sun is used by plants to produce sugars and is transferred with-in a food chain from producers to consumers to decomposers.
6-8	Earth Science	9	Lunar and solar eclipses, moon phases, and tides are related to relative positions of the earth, moon, and sun.
6-8	Life Science	1	Organisms are classified into kingdoms.
		10	Genetic variation and environmental factors are causes of evolution and the diversity of organisms.
		11	Evidence drawn from multiple sources provides the basis of the theory of evolution.
		12	Extinction of species is related to a mismatch of adaptation and environment
		13	Organisms interact and have different functions within an ecosystem that enable the ecosystem to survive.

## Wide World of Insects

PreK- 2	Earth Science	4	The sun supplies heat and light to the earth and is necessary for life
		5	Events around us have repeating patterns, including the seasons of the year, day, and night.
PreK- 2	Life Science	1	Animals and plants are living things that grow, reproduce, & need food, air, & water.
		3	Plants and animals have life cycles that vary.
		6	People and other animals interact with the environment through their senses.
		7	Animals and plants go through changes in appearance as the seasons change.
		8	An organism's habitat provides for its basic needs.
3-5	Life Science	1	Physical characteristics of plants and animals
		3	Plants and animals go through predictable life cycles, including birth, growth, development, reproduction, and death.
		4	Major life cycle stages of the frog and butterfly.
		6	Inherited characteristics may change over time as adaptations to changes in the environment enable organisms to survive
		7	Changes in the environment have caused some plants and animals to die or move to new locations.
		8	Organisms meet needs by using behaviors in response to information from the environment. Some behaviors are instinctive and others learned.
		9	Plants have characteristic behaviors. Plants and animals can survive harsh environments via seasonal behaviors
		10	Organisms can cause changes in their environment to ensure survival, which may affect the ecosystem.
		11	Energy derived from the sun is used by plants to produce sugars and is transferred with-in a food chain from producers to consumers to decomposers.
6-8	Life Science	1	Organisms are classified into kingdoms.
		10	Genetic variation and environmental factors are causes of evolution and the diversity of organisms.
		13	Organisms interact and have different functions within an ecosystem that enable the ecosystem to survive.
		14	Roles & relationships among producers, consumers, and decomposers in the process of energy transfer in a food web.
		16	Producers use energy from sunlight to make sugars through photosynthesis, which can be used immediately, stored for later use, or used by other organisms.
		18	Biological evolution accounts for species diversity developed

over generations.

## Designing for Wind

3-5	Mathematics Number Sense	3.N.8	Select and use appropriate operations (addition, subtraction, multiplication, and division) to solve problems, including those involving money.
		3.N.9	Know multiplication facts through $10 \times 10$ and related division facts, e.g., $9 \times 8 = 72$ and $72 \div 9 = 8$ . Use these facts to solve related problems, e.g., $3 \times 5$ is related to $3 \times 5$ .
		4.N.10	Select and use appropriate operations (addition, subtraction, multiplication, and division) to solve problems, including those involving money.
		4.N.11	Know multiplication facts through $12 \times 12$ and related division facts. Use these facts to solve related multiplication problems and compute related problems, e.g., $3 \times 5$ is related to $30 \times 50$ , $300 \times 5$ , and $30 \times 500$ .
		4.N.12	Add and subtract (up to five-digit numbers) and multiply (up to three digits by two digits) accurately and efficiently.
3-5	Mathematics; Patterns, Relations, Algebra	4.P.4	Use pictures, models, tables, charts, graphs, words, number sentences, and mathematical notations to interpret mathematical relationships.
		4.P.5	Solve problems involving proportional relationships, including unit pricing (e.g., four apples cost 80¢, so one apple costs 20¢) and map interpretation (e.g., one inch represents five miles, so two inches represent ten miles)
3-5	Mathematics: Data Analysis, Statistic, Probability	3.D.1	Collect and organize data using observations, measurements, surveys, or experiments, and identify appropriate ways to display the data.
		3.D.3	Construct and draw conclusions from representations of data sets in the forms of tables, line plots, pictographs, tallies, and bar graphs.
		4.D.1	Collect and organize data using observations, measurements, surveys, or experiments, and identify appropriate ways to display the data.
		4.D.3	Construct, draw conclusions, and make predictions from various representations of data sets, including tables, bar graphs, pictographs, line graphs, line plots, and tallies.
3-5	Physical Science	4	Identify the basic forms of energy (light, sound, heat, electrical, and magnetic). Recognize that energy is the ability to cause motion or create change.
		5	Give examples of how energy can be transferred from one form to another.
		6	Recognize that electricity in circuits requires a complete loop through which an electrical current can pass, and that electricity can produce light, heat, and sound.
3-5	Tech/ Engineering	2.1	Identify a problem that reflects the need for shelter, storage, or convenience.

		2.2	Describe different ways in which a problem can be represented, e.g., sketches, diagrams, graphic organizers, and lists.
6-8	Mathematics Number Sense	6.N.9	Select and use appropriate operations to solve problems involving addition, subtraction, multiplication, division, and positive integer exponents with whole numbers, and with positive fractions, mixed numbers, decimals, and percents.
		7.N.9	Select and use appropriate operations—addition, subtraction, multiplication, division, and positive integer exponents—to solve problems with rational numbers (including negatives).
		8.N.12	Select and use appropriate operations—addition, subtraction, multiplication, division, and positive integer exponents—to solve problems with rational numbers (including negatives).
6-8	Mathematics: Data Analysis, Statistics, Probability	6.D.1	Use tree diagrams and other models (e.g., lists and tables) to represent possible or actual outcomes of trials. Analyze the outcomes.
		7.D.1	Select, create, interpret, and utilize the following tabular and graphical representations of data: circle graphs, Venn diagrams, stem-and-leaf plots, tables, and charts
		8.D.2	Select, create, interpret, and utilize various tabular and graphical representations of data, e.g., circle graphs, Venn diagrams, scatterplots, stem-and-leaf plots, box-and-whisker plots, histograms, tables, and charts. Differentiate between continuous and discrete data and ways to represent them
6-8	Physical Science	11	Explain and give examples of how the motion of an object can be described by its position, direction of motion, and speed.
6-8	Tech/ Engineering	2.1	Identify and explain the steps of the engineering design process, i.e., identify the need or problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign
		2.5	Explain how such design features as size, shape, weight, function, and cost limitations would affect the construction of a given prototype
HS	Earth Science	2.1	Renewable energy resources and nonrenewable energy resources.
		2.2	Effects on the environment and on the carbon cycle of using renewable and nonrenewable resources.
HS	Physical Science	5.6	Moving electric charges produce magnetic forces and moving magnets produce electric forces. The interplay of electric and magnetic forces is the basis for many technologies
HS	Tech/ Engineering	1.1	Steps of the engineering design process.
		1.2	The engineering design process is used to solve problems, advance society, and modify technologies, objects, and processes.

- 4.4 Alternatives to nonrenewable energies.
- 5.5 Alternating current and direct current.

## Secret of the Cardboard Rocket

PreK- 2	Earth Science	4	The sun supplies heat and light to the earth and is necessary for life
3-5	Earth Science	13	Earth is a part of the “solar system” that includes the sun, planets, and many moons. Earth is the third planet from the sun.

## The Problem with Pluto

3-5	Earth Science	13	Earth is a part of the “solar system” that includes the sun, planets, and many moons. Earth is the third planet from the sun.
6-8	Earth Science	8	Gravity is a force that pulls all things toward the center of the earth. Gravity influences the formation and movement of the planets, stars, and solar system
		10	Properties and conditions of objects in the solar system and those on Earth.

## Cycles of the Earth and Beyond

3-5	Earth Science	6	Air temperature, moisture, wind speed and direction, and precipitation make up the weather in a particular place and time.
		7	Various forms of precipitation are connected to the weather in a particular place and time.
		8	Global patterns influence local weather, which can be measured
		9	Weather is different from climate.
		10	Water on earth cycles in different forms and locations
		11	Cycling of water, both in and out of the atmosphere, has an effect on climate.
		13	Earth is a part of the “solar system” that includes the sun, planets, and many moons. Earth is the third planet from the sun.
		14	Earth orbits the sun in a year’s time and rotates on its axis in approximately 24 hours. The rotation of the earth, day/night, and apparent movements of the sun, moon, and stars are connected.
		15	Changes occur in the observable shape of the moon over a month.
3-5	Life Science	3	Plants and animals go through predictable life cycles, including birth, growth, development, reproduction, and death.

		4	Major life cycle stages of the frog and butterfly.
		7	Changes in the environment have caused some plants and animals to die or move to new locations.
		9	Plants have characteristic behaviors. Plants and animals can survive harsh environments via seasonal behaviors
		10	Organisms can cause changes in their environment to ensure survival, which may affect the ecosystem.
		11	Energy derived from the sun is used by plants to produce sugars and is transferred with-in a food chain from producers to consumers to decomposers.
3-5	Physical Science	3	Water can be changed from one state to another by adding or taking away heat
		4	Basic forms of energy, which cause motion or create change.
		12	Light travels in a straight line until it strikes an object or travels from one medium to another. Light can be reflected, refracted, and absorbed.
6-8	Earth Science	2	Layers of the earth include the lithosphere, mantle, and core.
		4	Energy provided by the sun, global patterns of atmospheric movement, and temperature differences among water, land, and atmosphere are related.
		5	Movement of the earth's crustal plates causes both slow and rapid changes in the earth's surface.
		6	Earth's surface is built up and torn down by natural processes.
		7	Physical evidence supports theories that the earth has evolved over geologic time
		8	Gravity is a force that pulls all things toward the center of the earth. Gravity influences the formation and movement of the planets, stars, and solar system
		9	Lunar and solar eclipses, moon phases, and tides are related to relative positions of the earth, moon, and sun.
		10	Properties and conditions of objects in the solar system and those on Earth.
		11	Earth's tilt and its revolution around the sun result in uneven heating, causing the seasons
		12	The universe contains many billions of galaxies and each galaxy contains many billions of stars.
6-8	Life Science	5	Multi-cellular organisms can be hierarchically organized from cells to tissues to organs to systems to organisms.
		12	Extinction of species is related to a mismatch of adaptation and environment
		13	Organisms interact and have different functions within an ecosystem that enable the ecosystem to survive.
		16	Producers use energy from sunlight to make sugars through photosynthesis, which can be used immediately, stored for later use, or used by other organisms.

		17	Ecosystems have changed through geologic time in response to various influences.
6-8	Physical Science	14	Temperature change results from adding or taking away heat energy from a system
		16	Heat moves in predictable ways, from warmer to cooler objects until reaching equilibrium.
HS	Earth Science	1.3	The transfer of energy through radiation, conduction, and convection contributes to global atmospheric processes
		1.4	Unequal heating of Earth and the Coriolis effect influence global circulation patterns and impact Massachusetts weather and climate.
		1.5	The revolution of Earth around the Sun and the inclination of Earth on its axis cause Earth's seasonal variations.
		1.7	Oceanic currents relate to global circulation within the marine environment and climate.
		1.8	Ground-based observations, satellite data, and computer models are used to demonstrate interconnected Earth systems.
		2.1	Renewable energy resources and nonrenewable energy resources.
		2.2	Effects on the environment and on the carbon cycle of using renewable and nonrenewable resources.
		3.2	The carbon cycle.
		3.3	The nitrogen cycle
		3.5	The hydrologic cycle includes evaporation, condensation, precipitation, surface runoff and groundwater percolation, infiltration, and transpiration.
		3.6	The rock cycle, including the formation and physical properties of igneous, sedimentary, and metamorphic rocks.
		4.1	The Big Bang Theory and the evidence that supports it.
		4.2	Influence of gravity and inertia on the rotation and revolution of orbiting bodies; Sun-Earth-moon relationships.
		4.3	The Sun, Earth, and solar system formed from a nebula of dust and gas in a spiral arm of the Milky Way Galaxy about 4.6 billion years ago
HS	Life Science	6.4	Water, carbon, and nitrogen cycle between abiotic resources and organic matter, and oxygen cycles through photosynthesis and respiration.
HS	Physical Sciences	3.2	Heat energy will move from a higher temperature to a lower temperature until equilibrium is reached.
		6.1	Kinetic molecular theory explains the behavior of gases and the relationships among pressure, volume, temperature, and the number of particles in a gas sample. The combined gas law determines changes in pressure, volume, and temperature.

3-5	Earth Science	13	Earth is a part of the “solar system” that includes the sun, planets, and many moons. Earth is the third planet from the sun.
6-8	Earth Science	8	Gravity is a force that pulls all things toward the center of the earth. Gravity influences the formation and movement of the planets, stars, and solar system
		10	Properties and conditions of objects in the solar system and those on Earth.
		12	The universe contains many billions of galaxies and each galaxy contains many billions of stars.
6-8	Physical Science	5	Many elements combine in a multitude of ways to produce compounds that make up living and nonliving things.
HS	Earth Science	4.1	The Big Bang Theory and the evidence that supports it.
		4.2	Influence of gravity and inertia on the rotation and revolution of orbiting bodies; Sun-Earth-moon relationships.
		4.3	The Sun, Earth, and solar system formed from a nebula of dust and gas in a spiral arm of the Milky Way Galaxy about 4.6 billion years ago

### **Cosmic Collisions**

3-5	Earth Science	13	Earth is a part of the “solar system” that includes the sun, planets, and many moons. Earth is the third planet from the sun.
6-8	Earth Science	7	Physical evidence supports theories that the earth has evolved over geologic time
		8	Gravity is a force that pulls all things toward the center of the earth. Gravity influences the formation and movement of the planets, stars, and solar system
		10	Properties and conditions of objects in the solar system and those on Earth.
		12	The universe contains many billions of galaxies and each galaxy contains many billions of stars.
6-8	Physical Science	5	Many elements combine in a multitude of ways to produce compounds that make up living and nonliving things.
HS	Earth Science	1.2	Characteristics of electromagnetic radiation and its impact on life and Earth’s systems.
		4.1	The Big Bang Theory and the evidence that supports it.
		4.2	Influence of gravity and inertia on the rotation and revolution of orbiting bodies; Sun-Earth-moon relationships.
		4.3	The Sun, Earth, and solar system formed from a nebula of dust and gas in a spiral arm of the Milky Way Galaxy about 4.6 billion years ago

### **The Zula Patrol: Under the Weather**

PreK-2	Earth Science	3	Weather changes from day to day and over the seasons.
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2 Air is a mixture of gases all around us and wind is moving air.

## Touchable Tales

PreK- 2	Life Science	1	Animals and plants are living things that grow, reproduce, & need food, air, & water.
		2	Characteristics of living and nonliving things.
		3	Plants and animals have life cycles that vary.
		6	People and other animals interact with the environment through their senses.
		7	Animals and plants go through changes in appearance as the seasons change.
		8	An organism's habitat provides for its basic needs
		1	Observable properties of objects include size, shape, color, weight, and texture.
		1	Characteristics of natural and human-made materials
PreK- 2	Tech/ Engineering	1.1	Characteristics of natural and human-made materials
		1.2	Possible uses for natural and human-made materials.
		2.2	Human beings and animals use parts of the body as tools.