

Welcome to
Headwaters Science Center's
List of Demonstrations & and their alignment to
Minnesota State Graduation Standards

Click on the demonstration listed to go directly to its page:

[Animal Menagerie](#)

[Combustion](#)

[Cryogenics](#)

[Pushes and Pulls](#)

[Animal Raptors](#)

[Simple Circuits](#)

[Sound and Light](#)

[StarLab®](#)

[Unique Properties of Water](#)

Please call HSC at (218) 444-4472 with any questions or to schedule a demonstration.



Name of Demonstration: Animal Menagerie

Description of Demonstration: The Headwaters Science Center is home to many animals. Learn more about our animals' habitats, characteristics, adaptations, behaviors, defenses, variations, proper handling, and more. For all ages.

MN SCIENCE Grad Stand/Strand/Sub-strand: Number####:

0L 1.2.1.2, 0L 2.1.1.3, 0L 3.1.1.1
1L 3.1.1.1, 1L 3.2.2.2
3L 3.2.1.1, 3L 4.1.1.1, 3L 4.2.1.1
4L 4.2.1.2
5L.4.1.2.1
7L.2.1.1.1, 7L.3.2.1.1, 7L.4.1.1.2

Grade Level(s): Kindergarten through 5th Grades

Content Area(s): Life Science, Earth

Learning Target(s):

1. I can ask questions from observations about the similarities and differences found in animals and other living things.
2. I can explain how patterns in the behavior of parents and their offspring help offspring survive.
3. I can explain, using evidence, how variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
4. I can apply my knowledge about specific Headwaters Science Center animals to explain the strategies a variety of animals use to survive.
5. I can obtain information from resources to determine that animals have traits inherited from parents and that variations of these traits exist in a group of similar organisms.

Essential Question(s):

1. What differences can you see between two animals?
2. What similarities can you see between two animals?
3. What human invention mimics animal characteristics?
4. What do skunks do to protect themselves from enemies? What do snakes do to protect themselves? What do bears do to protect themselves? etc.
5. How do variations in characteristics among individuals of the same species provide advantages?
6. What are strategies animals use to survive? Why are the strategies successful? Why aren't some strategies successful? Which group strategies are effective?
7. What variations are the result of inherited traits from parents of animals?

Key Vocabulary: Mammals, Reptiles, Amphibians, Vertebrates, Invertebrates, Camouflage, Warm-Blooded, Cold-Blooded, Predator, Prey, Habitat, Biome.

Prerequisite Terms: Adaptation, Advantage, Behavior, Characteristics, Differences, Function, Lineage, Mimic, Model, Observation, Patterns, Protect, Range, Relationship, Similarities, Strategies, Structure, Traits, Variation

Name of Demonstration: Combustion

Description of Demonstration: Fire! It has fascinated human-kind for all of history. Whether seen as a life-giving tool or death-dealing disaster, its power is a force we can all relate to. In this demonstration clouds of fire flash into the air, metals burn and balloons explode. All of these phenomena and more are woven into a discussion of the basic nature of a chemical reaction using combustion as an example. Ages 9 and up.

MN SCIENCE Grad Stand/Strand/Sub-strand: Number####:

2P 1.2.1.1, 2P. 3.1.1.1,

5P 2.1.1.1,

8P 1.1.1.1, Periodic table and chemical reactions, 8P 1.2.1.1, 8P. 2.1.1.1, 8P 3.2.1.1, 8P 4.1.1.2

9C. 3.2.1.1

Grade Level(s): 2nd through 9th Grades.

Content Area(s): Physical Science, Earth and Space Science

Learning Target(s):

1. I can explain that energy can be transferred from place to place by sound, light, heat and electric current.
2. I can measure, show, and explain that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved (does not change).
3. I can explain scientific ideas showing how to convert energy from one form to another form.
4. I can explain, and describe additional experiments that show the effects of temperature on a substance.
5. I can analyze the effects on the properties of substances before and after interactions to determine if a chemical reaction has occurred.

Essential Question(s):

1. Can energy be transferred from place to place by sound, light, heat, and electric current? How does sound, light, heat and/or electricity transfer energy from place and place?
2. When heat, cold (cool), or mixing occurs, what happens with the total weight of the matter?
3. How can energy be converted from one form to another?
4. What effect does the transfer of energy have on the temperature of a substance? What effect does the mass of an object have on the temperature of a substance? What effect does the type of matter have on the temperature of a substance?
5. How do chemical reactions affect the properties of substances?

Key Vocabulary: Fire, Combustion, Chemical Reaction, Atoms, Molecules, Substance, Oxygen, Fuels, Endothermic, Exothermic, Energy, Capillary Action, Convection, Solid, Liquid, Gas, Heat, Flammable.

Prerequisite Terms: Analyze, Convert, Current, Describe, Effects, Electricity, Experiment, Explain, Force, Interactions, Matter, Measure, Mixing, Properties, Temperature, Transfer

Name of Demonstration: Cryogenics

Description of Demonstration: Learn about conditions, substances, and processes at extremely low temperatures. Using liquid nitrogen, the presenter shows how substances change from solid to liquid to gas, describes the nature and importance of thermal energy in matter, illustrates the behavior of heat, and shows how substances change when their temperature is varied by hundreds of degrees. Ages 8 and up.

MN SCIENCE Grad Stand/Strand/Sub-strand: Number####:

2P 3.1.1.1

5P 2.1.1.1

8E 1.1.1.1, 8P 1.2.1.1, 8P 1.2.1.4, 8P 3.2.1.1, 8P 3.2.1.1

Grade Level(s): 2nd through 8th Grades

Content Area(s): Physical Science, Energy, Matter and Its Interaction

Learning Target(s):

1. I can explain that all matter is made of particles, either single atoms or molecules. I can identify, assess, and describe the physical properties of objects.
2. I can explain that particles are always in motion colliding with one another which can cause the matter to heat up when the particles give up some of their kinetic energy.
3. I can explain the state of a substance – solid, liquid, or gas – is determined by the velocity of its particles.
4. I can explain why heat energy never goes from something cool to something warmer. It always moves from warm to cool. I know and can explain in terms of molecular motion why objects tend to expand when they are heated and contract when they are cooled.
5. I can explain that, in scientific terms, freezing means changing from a liquid to a solid, melting means changing from a solid to a liquid, evaporating means changing from a liquid to a gas, boiling means rapidly changing from a liquid to a gas, and condensing means changing from a gas to a liquid. Also, each substance has its own freezing point, melting point, and boiling point.
6. I can create a list of causes of frostbite and explain the possibility of serious and painful injury.

Essential Question(s):

1. How does heating and cooling affect materials such as metal, glass, plastic, etc.?
2. What changes caused by heating and/or cooling can be reversed?
3. What changes caused by heating and/or cooling cannot be reversed?
4. What are the differences between liquids, solids and gasses?
5. What are the effects of thermal energy on the kinetic energy of the particles and the state of matter?
6. What effect does the transfer of energy have on the temperature of a substance? What effect does the mass of an object have on the temperature of a substance? What effect does the type of matter have on the temperature of a substance?
7. How do chemical reactions affect the properties of substances?
8. What happens when molecules are in motion, or not in motion?
9. What causes frostbite? How does the freezing of cell tissue relate to the movement of particles?

Key Vocabulary: Molecules, Cryogenics, Liquid Nitrogen, Nitrogen, 321°(Degrees) Below Zero, Gas, Liquid, Solid, Fahrenheit, Celsius, Chemical Reaction, Cells, Cellular Composition, Cellular Structure, Properties (changes), State of Matter, Freezing, Melting, Evaporating, Boiling, Condensing, Molecular Motion

Prerequisite Terms: Atom, Differences, Effects, Energy, Energy Transfer, Heat Energy, Investigation, Kinetic Energy, Mass, Model, Particles, Phenomena, Similarities, Temperature

Name of Demonstration: Pushes and Pulls

Description of Demonstration: This program demonstrates forces and how simple machines multiply forces. Ages 8 and up.

MN SCIENCE Grad Stand/Strand/Sub-strand: Number####:

0P 2.2.1.1, 0P 4.1.1.1

2P 1.1.1.1, 2P 2.2.1.1

4P 1.1.1.1, 4P 1.1.2.1

5P 1.1.1.1, 5P 3.2.1.1

6E 3.1.1.1

8P 1.1.1.2, 8P 1.2.1.2, 8P 1.2.1.3, 8P 2.1.1.2, 8P 2.2.1.2, 8P 3.1.1.3, 8P 3.2.2.2, 8P 4.1.1.1, 8P 4.1.1.2

Grade Level(s): 1st through 8th Grades

Content Area(s): Physical Science and Energy Science

Learning Target(s):

1. I can ask questions about how things move.
2. I can identify and predict quantitative patterns of the effects of balanced and unbalanced forces on the motion of objects.
3. I can ask investigative questions and make predictions using information from observations about changes in energy, related to speed, when two objects interact.
4. I can create an explanation based on evidence relating to the speed of an object to the energy of the object.
5. I understand and can explain that a change in an object's motion depends on the sum of the forces on the object and the mass of the object.
6. I can plan and conduct my own investigation that evaluates the experimental design providing evidence that objects exert forces on other objects even though the objects are not in direct contact.
7. I can explain solutions to problems involving the motion of two colliding objects using Newton's 3rd Law.

Essential Question(s):

1. Stop, Go, and Change Direction, how did it happen?
2. How do balanced and unbalanced forces affect various objects?
3. What will happen to an object if balanced forces are applied to the object? What will happen to an object if unbalanced forces are applied to the object?
4. How does the speed and direction affect two colliding objects?
5. What is speed? How is speed affected by energy?
6. How can energy be converted from one form to another?
7. What happens to an object when forces are applied to the object, and what effect does the mass of the object have on the motion?
8. Do objects exert force on other objects even when the objects are not in direct contact?
What experiments can be conducted that provides evidence of the forces based on those effects?
9. What are the relationships of kinetic energy and the mass and speed of an object?
10. What is Newton's 3rd law?

Key Vocabulary: Precession, Balanced Forces, Unbalanced Forces, Speed, Sir Isaac Newton, Kinetic Energy, Potential Energy, Mass.

Prerequisite Terms: Apply, Collide, Convert, Energy, Evidence, Evaluate, Exert, Explanation, Interact, Observation, Pattern, Prediction, Problem, Quantitative, Solution, State of Matter

Name of Demonstration: Animal Raptors

Description of Demonstration: This is an exciting opportunity to get a close-up view of live raptors and learn about the characteristics that make raptors different from other birds. Learn about various raptors found in Minnesota and their habitats. Learn what you can do to help preserve the environment and protect these spectacular creatures. All ages.

MN SCIENCE Grad Stand/Strand/Sub-strand: Number####:

0L 1.2.1.2, 0L 2.1.1.3, 0L 3.1.1.1
1L 1.1.1.1, 1L 3.1.1.1, 1L 3.2.2.2, 1L 4.2.1.2, 1E 4.1.1.1
2L 4.1.1.1
3L 3.1.1.2, 3L 3.2.1.1, 3L 4.1.1.1, 3L 4.2.1.1
4L 4.1.1.1
5L 4.1.2.1
7L 2.1.1.1, 7L 3.2.1.1, 7L 4.1.1.2, 7L 4.1.1.2
9L 3.2.1.4

Grade Level(s): Kindergarten through 9th Grades

Content Area(s): Life Science and Earth Science

Learning Target(s):

1. I can ask questions from similarities/differences observations between Raptors and other living beings.
2. I can make a convincing argument, that evaluates how in particular habitats, Raptor survival does very well, not so well, or becomes threatened.
3. I can construct an argument about strategies Raptors use to survive.
4. I can explain that Raptors have internal and external structures that function to support survival, growth, behavior, and reproduction.
5. I can explain the effects of resource availability on the population of organisms (Raptors) in an ecosystem.
6. I can explain, based on evidence, how genetic variations of traits in Raptors increases the probability of surviving and reproduction in a specific environment.

Essential Question(s):

1. How are two animals the same? How are two animals different?
2. What are some reasons that some organisms survive better than others in a habitat?
3. How do variations in characteristics among individuals of the same species provide advantages and disadvantages?
4. What are strategies that animals use to survive? Why are the strategies successful? Why aren't they successful? Why do group strategies work?
5. What are internal and external structures that function to support animals in survival, growth, behavior and reproduction?
6. Does resource availability have an effect on the population of the organisms in an ecosystem?
What are the effects of resource availability on the population of the organisms in an ecosystem?
7. What traits in a population are the most beneficial towards surviving in an environment?

Key Vocabulary: Raptor, Camouflage, Talon, Sharp Curved Beak, Tomial Tooth, Keen Eye Sight, Feathers, Merlin, Falcon, Owl, Hawk, Predator, Prey, Habitat, Biome, Mew, Variation, Adaptation, Characteristics, Traits, Diversity, Population, Evolution, Behavior, Observation, Compare and Contrast.

Prerequisite Terms: Argument, Beneficial, Differences, Ecosystem, Environment, External, Function, Genetic, Internal, Organism, Reproduction, Resource, Similarities, Strategy, Survival, Threatened, Variation.

Name of Demonstration: Simple Circuits

Description of Demonstration: This introduces basic engineering principles, including design, creation, testing to failure, and teamwork. It challenges students to create a simple circuit using a battery, wires, and a light bulb or motor. Geared toward 3rd, 4th, and 5th grades.

MN SCIENCE Grad Stand/Strand/Sub-strand: Number####:

5P 2.1.1.1, 5P 3.2.2.1,
8P 1.1.1.2

Grade Level(s): 5th through 8th Grades

Content Area(s): Physical Science, Engineering

Learning Target(s):

1. I can explain how to obtain evidence that the temperature of a substance is affected by the transfer of energy, the amount of the mass, and the type of matter.

Essential Question(s):

1. What effect does the transfer of energy have on the temperature of a substance?
2. What effect does the mass of an object have on the temperature of a substance?
3. What effect does the type of matter have on the temperature of a substance?

Key Vocabulary: Circuit, Current, Energy Transfer.

Prerequisite Terms: Differences, Energy, Mass, Similarities, Substance

Name of Demonstration: Sound and Light

Description of Demonstration: We will ponder the characteristics and behaviors of sound and light and the mechanisms by which they are produced, propagated, and detected. We will explore the nature of each and provide an entertaining sound and light show to bring us to a sensory crescendo. Ages 10 and up.

MN SCIENCE Grad Stand/Strand/Sub-strand: Number####:

1P 1.2.1.1, 1P 2.1.1.1, 1P 3.2.2.1

3P 1.1.1.1, 3P 1.2.1.1, 3P 3.1.1.1

8P 3.1.1.4, 8P 4.2.1.2

Grade Level(s): 1st through 8th Grades

Content Area(s): Physical Science

1. I can explain which materials have the best properties for producing or transmitting sounds.
2. I can explain the affect placed on objects, made of different materials, have on the path of a beam of light.
3. I can explain, using a model, that light reflecting from objects and entering the eye allows objects to be seen.

Essential Question(s):

1. Which materials have the best properties for producing and transmitting sounds?
2. How does a light beam affect materials and objects?
3. How can the eye see objects (reflecting)?
4. What produces waves?

Key Vocabulary: Volume, Pitch, Waves, Vibrations, Amplify, Frequency, Resonate, Ear and drum, Energy, Compression, Transverse, Additive vs Subtractive, Color.

Prerequisite Terms: Beam, Detect, Differences, Propagate, Properties, Reflect, Similarities, Transmit

Name of Demonstration: StarLab

Description of Demonstration: This is a portable planetarium where up to 20 star-gazers can observe the night sky at any time of the day! Learn about stars, constellations, and planets and how they appear in the night sky on any day and hour of the year. See the [STARLAB® home page](#) for detailed information. Ages 8 and up.

MN SCIENCE Grad Stand/Strand/Sub-strand: Number####:

3E 2.1.1.1, 3E 2.2.1.1, 3E 4.2.2.1

5E 2.2.1.2, 5E 4.1.1.1,

6E 1.1.1.1, 6E 2.1.1.1, 6E 3.1.1.1, 6E 4.2.2.1

Grade Level(s): 3rd through 6th Grades

Content Area(s): Earth and Space Science

Learning Target(s):

1. I can make observations of the sun, moon, and stars and predict continuing/future patterns.
2. I can explain how to electronically present collected data that identifies and describes patterns in the amount of daylight in the different times of the year.
3. I can describe patterns in the daily changes in length and direction of shadows, day and night, and the seasonal appearances of some stars in the night sky.
4. I can ask informed questions from observations of objects in the night sky.
5. I can collect and organize data from observations demonstrating the effects of sunlight on the Earth's surface.
6. I can use scale models of solar system objects to describe the size of objects, the location of objects, and the motion of objects in the solar system.

Essential Question(s):

1. What is the effect of sunlight on the Earth's surface?
2. How can recorded observations of the sun, moon and stars predict future patterns?
3. What future patterns of the sun, moon, and stars can be made based on recorded patterns?
3. What are the different amounts of daylight during the year? What effect does this have?
4. What are the daily changes in the length and direction of shadows, day and night, and seasonal appearances?
5. What is in the night sky?
6. What is the relative size, location, and movement of objects in the solar system?
What role does gravity and inertia play in controlling motion in the solar system?

Key Vocabulary: Astronomy, Atmosphere, Cardinal directions, Constellations, Cycle, Galaxy, Horizon, Lunar, Model, Moons, Night sky, Orbit, Phases, Planet, Revolution, Rotation, Solar, Solar System, Stratosphere

Prerequisite Terms: Collect, Data, Demonstrate, Describe, Gravity, Inertia, Informed Question, Observation, Organize, Patterns, Predict, Present, Scale Model, Seasonal, Star

Name of Demonstration: Unique Properties of Water

Description of Demonstration: Learn all about water and why it does such amazing things. Ages 12 and up.

MN SCIENCE Grad Stand/Strand/Sub-strand: Number####:

1E 4.2.1.1

2E 2.1.1.1, 2E 4.2.1.1, 2E 4.2.1.2

4E 1.1.1.2, 4E 2.2.1.1, 4E 3.1.1.1

6E 1.2.1.1, 6E 3.1.1.3

Grade Level(s): 1st through 6th Grades

Content Area(s): Physical Science, Life Science, Earth Science

Learning Target(s):

1. I can explain the multiple locations where water is found on Earth.
2. I can generate solutions and/or evaluate multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
3. I can explain salinity, the outcomes from salinity, and solutions to prevent increases in salinity.
4. I can compare the amount of salt water as compared to fresh water, as a way of providing evidence about distribution of water on Earth.
5. I can explain, using a model, to describe ways the geosphere, biosphere, hydrosphere, and atmosphere interact.
6. I can explain a model, based on observational and experimental evidence, to describe the cycling of water through Earth's systems (evaporation, condensation, precipitation) driven by energy from the sun and the force of gravity.
7. I can generate and compare multiple solutions to reduce the impacts of natural Earth processes resulting from human actions.

Essential Question(s):

1. What are the types and places of water sources on the Earth?
2. What are ways to prevent wind and/or water from changing the shape of the land?
3. How can we stop erosion (water and wind)?
4. What are the different amounts of salt water vs fresh water on Earth? What effect does this have?
5. How do the geosphere, biosphere, hydrosphere, and atmosphere interact?
6. What are solutions to reduce natural Earth processes and their effects on human beings?
7. How does the energy of the sun affect water and the water cycle? How does gravity effect water and the water cycle?

Key Vocabulary: Cohesion, Adhesion, Polarity, Molecules, Hydrogen, Oxygen, H²O, Capillarity, Surface Tension, Atmosphere, Hydrosphere, Geosphere, Biosphere, Water Cycle

Prerequisite Terms: Condensation, Cycling, Differences, Distribution, Energy, Erosion, Evaporation, Evidence, Gravity, Interaction, Model, Precipitation, Salinity, Similarities