

Variables

Some of the most important scientific concepts students learn are the result of their ability to see relationships between objects and events. Relationships always involve interactions, dependencies, and cause and effect. In the Variables unit, students will complete investigations that help them discover relationships through controlled experimentation. Students will fling, float, fly, and flip objects as they discover relationships in each investigation.

Essential Questions: What are variables in a system?
 How can data be used to communicate relationships between variables?
 How does changing a variable affect the outcome of an experiment?

Unit Length: 8-10 weeks

Resources: FOSS Variables Module
 FOSS Variables Science Stories

NJCCCS: 5.1.8B 1- Identify questions and make predictions that can be addressed by conducting investigations.
 5.1.8B 2- Design and conduct investigations incorporating the use of a control.
 5.1.8B 3- Collect, organize, and integrate data that result from experiments.
 5.3.8C 1- Express physical relationships in terms of mathematical equations derived from collected data.
 5.6.6A 4- Describe characteristic physical properties.

Science Content (Declarative Conceptual Knowledge)	NJCCCS
Students Will Know and Understand:	
A variable is anything that you can change in an experiment that might affect the outcome.	5.1.8B 2
In a controlled experiment only one variable is changed, and the results are compared to a standard.	5.1.8B 2
The length of a pendulum determines the number of swings in a unit of time.	5.3.8C 1
Capacity is the maximum volume of fluid a container can hold.	5.6.6A 4
A system is a set of related objects that can be studied in isolation.	5.1.8B 3

Thinking Processes (Procedural Knowledge)	NJCCCS
Students Will Be Able To:	
Observe and compare the behavior of pendulums.	5.1.8B 3
Experiment to find out what variables affect the number of cycles a pendulum makes in a unit of time.	5.1.8B 3
Relate pendulum length to the number of cycles it makes in a unit of time.	5.1.8B 3
Predict the behavior of new pendulums, using a graph.	5.1.8B 1
Communicate findings.	5.1.8A 2

Observe and compare the buoyancy of different boats.	5.1.8B 3
Organize information on a graph	5.1.8B 3
Relate capacity of boats to the mass they can hold before sinking.	5.1.8B 3
Predict the behavior of new boats, using a graph.	5.1.8A 1
Observe and compare the behavior of a standard plane system to modified plane systems.	5.1.8B 3
Conduct controlled experiments.	5.1.8B 3
Organize data in a flight log.	5.1.8B 3
Relate the effect of variables to the distance the plane travels.	5.1.8B 3
Predict outcomes of plane flights.	5.1.8B 1
Observe and compare the behavior of objects flipped from a catapult.	5.1.8B 3
Organize and communicate results of investigations.	5.1.8B 3
Relate the effects of variables to the trajectory of objects.	5.1.8B 3
Predict the behavior of new objects on the catapult.	5.1.8B 1

Mixtures and Solutions

The Mixtures and Solutions unit introduces students to foundational concepts in chemistry. Students will investigate the structure of matter and the changes that take place in it. Through a series of experiments students will demonstrate understanding of physical and chemical changes, and the nature of mixtures and solutions.

Essential Questions: What are mixtures?
How can solids be separated from a liquid in a mixture?
How do different variables affect solubility and concentration of a solution?
How can observable characteristics be used to identify chemical or physical changes?

Unit Length: 8-10 weeks

Resources: FOSS Mixtures and Solutions Module
FOSS Mixtures and Solutions Science Stories

NJCCCS: 5.6.6A 3- Describe the properties of mixtures and solutions, including concentration and saturation.
5.6.6B 1- Recognize evidence of a chemical change.
5.1.8A 2- Communicate experimental findings to others.
5.1.8B 3- Collect, organize, and integrate data that result from experiments.

Science Content (Declarative Conceptual Knowledge)	NJCCCS
Students Will Know and Understand:	
A mixture combines two or more materials that retain their own properties.	5.6.6A 3
A solution forms when a material dissolves in a liquid (solvent) and cannot be retrieved with a filter.	5.6.6A 3
Evaporation can separate a liquid from a solid in a solution.	5.6.6A 3
The solid materials separated by evaporation form a solution forms distinctive patterns.	5.6.6A 3
Solubility is the property that substances have of dissolving in solvents. Solubility is different for different materials and can change with temperature and different solvents.	5.6.6A 3
A solution is saturated when as much solid material as possible has dissolved in the liquid.	5.6.6A 3
When equal volumes of two solutions made from the same ingredients are compared, the heavier one is the more concentrated solution.	5.6.6A 3
Concentration expresses a relationship between the amount of dissolved material and the volume of solvent.	5.6.6A 3
The more material dissolved in a liquid, the more concentrated the solution.	5.6.6A 3
A concentrated solution can be made more dilute by adding solvent to the solution.	5.6.6A 3

A physical change occurs when a material changes form but retains its original chemical makeup.	5.6.6B 1
When a change results from mixing two or more materials, that change is a chemical reaction. A reaction results in new materials.	5.6.6B 1
Formation of a gas is one change that occurs in some reactions.	5.6.6B 1
Not all chemicals react when they are mixed.	5.6.6B 1

Thinking Processes (Procedural Knowledge)	NJCCCS
Students Will Be Able To:	
Measure solids and liquids to make mixtures and solutions.	5.6.6A 3
Observe the behavior of solid materials in water.	5.6.6A 3
Compare the mass of a mixture to the mass of its parts.	5.6.6A 3
Organize observations on a student sheet.	5.1.8B 3
Communicate observations.	5.1.8A 2
Observe the behavior of a saturated solution.	5.6.6A 3
Compare the quantities of two solid materials required to saturate a volume of water.	5.6.6A 3
Relate the added mass of the solution to the dissolved materials in the saturated solution.	5.6.6A 3
Compare the solubility of materials in water.	5.6.6A 3
Relate the concentrations of a solution to the amount of solid materials dissolved in a volume of water.	5.6.6A 3
Determine the relative concentrations of solutions.	5.6.6A 3
Measure solids and liquids while conducting chemical reactions.	5.6.6B 1
Compare properties of precipitates to determine their identities.	5.6.6B 1
Determine all possible pairs of reactants involving a set of three chemicals.	5.6.6B 1

Levers and Pulleys

Humans are the only living creatures that have been able to put materials together to construct machines to do work. Our capacity to see and invent relationships between effort and work produced through simple machines has led us into a world that is becoming more technologically oriented. Knowledge of these relationships is necessary for understanding all mechanics. In this unit, students will create use, and analyze levers and pulleys and discover the relationship between effort and work.

Essential Questions: How can simple machines be used to make work easier?
How can the mechanical advantage of a simple machine be increased?
What is the relationship between work input and work output?

Unit Length: 8-10 weeks

Resources: FOSS Levers and Pulleys Module
FOSS Levers and Pulleys Science Stories

NJCCCS: 5.1.8B 3- Collect, organize, and integrate data that result from experiments.
5.3.8B 1-Perform mathematical computations using labeled quantities and express answers in correctly derived units.
5.3.8C 1-Express physical relationships in terms of mathematical equations derived from collected data.
5.7.8B 2- Describe the nature of various forms of energy transfer, including mechanical.

Science Content (Declarative Conceptual Knowledge)	NJCCCS
Students Will Know and Understand:	
A lever is a simple machine that people use to gain an advantage, such as making work easier.	5.7.8B 2
An advantage is a benefit gained in effort, distance or change in direction resulting from the use of a simple machine.	5.7.8B 2
Effort is the force needed to move a load or overcome a resistance.	5.7.8B 2
Fulcrum is the point where a lever arm pivots.	5.7.8B 2
Load is a mass lifted or a resistance overcome by a lever.	5.7.8B 2
A class-1 lever has the fulcrum between the load and the effort.	5.7.8B 2
A class-2 lever has the load between the effort and the fulcrum.	5.7.8B 2
A class-3 lever has the effort between the fulcrum and the load.	5.7.8B 2
A single-pulley system can be set up in two ways, fixed or movable.	5.7.8B 2
A single-movable pulley system provides a mechanical advantage for its user.	5.7.8B 2
A single-fixed pulley system provides no mechanical advantage, but changes the direction of the effort.	5.7.8B 2
A two-pulley system can be made with one fixed and one movable system.	5.7.8B 2
A two-pulley system in which the effort is applied upward provides a greater advantage than one in which the effort is applied downward.	5.7.8B 2

The effort needed to lift a load with a pulley system can be predicted	5.7.8B 2
The amount of work put into a system is equal to the work output of the system.	5.7.8B 2

Thinking Processes (Procedural Knowledge)	NJCCCS
Students Will Be Able To:	
Measure the effort to lift a load when the load remains constant and the effort changes position and when the effort remains stationary but the load moves.	5.3.8B 1
Organize observations on a data table.	5.1.8B 3
Discover the relationships between the parts of a lever.	5.1.8B 3
Observe the behaviors of different kinds of levers.	5.1.8B 3
Compare the effort to lift loads with different kinds of levers.	5.1.8B 3
Diagram the relative positions and sizes of lever components in different systems.	5.1.8B 3
Analyze tools in terms of their application as levers.	5.1.8B 3
Observe and measure the effort to lift a load with a single-fixed and single-movable pulley systems.	5.3.8B 1
Diagram and compare four kinds of pulley systems.	5.1.8B 3
Observe and measure the effort to lift a load with one- and two- pulley systems.	5.3.8B 1
Determine the advantage of pulley systems.	5.3.8B 1
Measure and compare the distance the effort and load travels in different pulley systems.	5.3.8C 1

Environments

All living things depend on the conditions in their environment. The study of the relationships between one organism and its environment builds knowledge of all organisms. With this knowledge comes an awareness of limits. Changes in an environment can be hard on organisms. Such knowledge is important because human activities have an impact on various environments. In this unit, students will investigate terrestrial and aquatic environments in a controlled setting and use this knowledge to explore conditions in our local environment. Students will also research and discuss global environmental issues.

Essential Questions: What factors make up an organisms environment?
How do environmental factors affect an organism’s survival, growth, and reproduction?
How do organisms affect the conditions in their environments?
How do humans interact with the environment?

Unit Length: 8-10 weeks

Resources: FOSS Environments Module
FOSS Environments Science Stories

NJCCCS: 5.10.6A 1- Explain how organisms interact with other components of an ecosystem.
5.10.6A 2- Describe the natural processes that occur over time in places where direct human contact is minimal.
5.10.6B 1- Describe the effect of human activities on various ecosystems.
5.10.6B 2- Evaluate the impact of personal activities on the local environment.

Science Content (Declarative Conceptual Knowledge)	NJCCCS
Students Will Know and Understand:	
Everything that surrounds an organism makes up the organism’s environment.	5.10.6A 1
Terrestrial and aquatic environments include both living and nonliving factors.	5.10.6A 1
Each organism has a set of preferred environmental conditions.	5.10.6A 1
Organisms have a range of tolerance for environmental factors.	5.10.6A 1
Optimum conditions are those most favorable to an organism’s survival, growth, and reproduction.	5.10.6A 1
Organisms impact their environment.	5.10.6A 1
Human activities have an impact on a variety of environments.	5.10.6B 1
Succession is the natural process that occurs over time in places where direct human impact is minimal.	5.10.6A 2

Thinking Processes (Procedural Knowledge)	NJCCCS
Students Will Be Able To:	
Observe and describe changes in a terrarium and in an aquarium over time.	5.10.6A 1
Organize and communicate observations.	5.10.6A 1
Set up and observe animal investigations.	5.10.6A 1
Relate the behavior of an animal to environmental factors.	5.10.6A 1
Conduct a plant experiment to determine range of tolerance.	5.10.6A 1
Relate differences in growth to the factor of water.	5.10.6A 1
Use a chemical indicator to indirectly measure an environmental factor.	5.10.6A 1
Use technology to monitor a factor in our local environment.	5.10.6B 1
Research the impact of human activities on our local environment and other ecosystems.	5.10.6B 1&2
Communicate findings.	5.10.6B 1&2
Describe the natural processes that occur over time in places where direct human impact is minimal.	5.10.6A 2