

5th Grade Science Curriculum 2011

Variables Unit

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

NJ Cumulative Progress Indicator (CPI):

- 5.1.8.A.1 Demonstrate understanding and use interrelationships among central scientific concepts to revise explanations and to consider alternative explanations.
- 5.1.8.A.2 Use mathematical, physical, and computational tools to build conceptual-based models and to pose theories.
- 5.1.8.A.3 Use scientific principles and models to frame and synthesize scientific arguments and pose theories.
- 5.1.8.B.1 Design investigations and use scientific instrumentation to collect, analyze, and evaluate evidence as part of building and revising models and explanations.
- 5.1.8.B.3 Use qualitative and quantitative evidence to develop evidence-based arguments.
- 5.1.8.B.4 Use quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.
- 5.1.8.D.2 Engage in productive scientific discussion practices during conversations with peers, both face-to-face and virtually, in the context of scientific investigations and model-building.
- 5.2.6.A.2 Calculate the density of objects or substances after determining volume and mass

5.2.6.E.2 Describe the force between two magnets as the distance between them is changed

5.2.6.E.3 Demonstrate and explain the frictional force acting on an object with the use of a physical model

Science Content (Declarative Conceptual Knowledge)	NJCPI
Students Will Know and Understand:	
A variable is anything that you can change in an experiment that might affect the outcome.	5.1.8.B.4
In a controlled experiment only one variable is changed, and the results are compared to a standard.	5.1.8.B.4
The length of a pendulum determines the number of swings in a unit of time.	5.1.8.B.3
Capacity is the maximum volume of fluid a container can hold.	5.2.6.A.2
A system is a set of related objects that can be studied in isolation.	5.1.8.B.1

Thinking Processes (Procedural Knowledge)	NJCPI
Students Will Be Able To:	
Observe and compare the behavior of pendulums.	5.1.8.B.1
Experiment to find out what variables affect the number of cycles a pendulum makes in a unit of time.	5.1.8.B.1
Relate pendulum length to the number of cycles it makes in a unit of time.	5.1.8.B.1
Predict the behavior of new pendulums, using a graph.	5.1.8.A.2
Communicate findings.	5.1.8.D.2
Observe and compare the buoyancy of different boats.	5.1.8.B.1
Organize information on a graph	5.1.8.B.1
Relate capacity of boats to the mass they can hold before sinking.	5.1.8.B.1
Predict the behavior of new boats, using a graph.	5.1.8.A.2
Observe and compare the behavior of a standard plane system to modified plane systems.	5.1.8.B.1
Conduct controlled experiments.	5.1.8.B.1
Organize data in a flight log.	5.1.8.B.1
Relate the effect of variables to the distance the plane travels.	5.1.8.B.1
Predict outcomes of plane flights.	5.1.8.A.3
Observe and compare the behavior of objects flipped from a catapult.	5.1.8.B.1
Organize and communicate results of investigations.	5.1.8.B.1
Relate the effects of variables to the trajectory of objects.	5.1.8.B.1
Predict the behavior of new objects on the catapult.	5.1.8.A.3

Mixtures and Solutions Unit

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

NJCPI: **5.1.8.B.1** Design investigations and use scientific instrumentation to collect, analyze, and evaluate evidence as part of building and revising models and explanations.

5.1.8.D.1 Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.

5.2.6.A.3 Determine the identity of an unknown substance using data about intrinsic properties.

5.2.6.B.1 Compare the properties of reactants with the properties of the products when two or more substances are combined and react chemically.

Science Content (Declarative Conceptual Knowledge)	NJCPI
Students Will Know and Understand:	
A mixture combines two or more materials that retain their own properties.	5.2.6.A.3
A solution forms when a material dissolves in a liquid (solvent) and cannot be retrieved with a filter.	5.2.6.A.3
Evaporation can separate a liquid from a solid in a solution.	5.2.6.A.3
The solid materials separated by evaporation form a solution forms distinctive patterns.	5.2.6.A.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.	5.2.6.A.3 5.2.6.A.3

A solution is saturated when as much solid material as possible has dissolved in the liquid.	5.2.6.A.3
When equal volumes of two solutions made from the same ingredients are compared, the heavier one is the more concentrated solution.	5.2.6.A.3
Concentration expresses a relationship between the amount of dissolved material and the volume of solvent.	5.2.6.A.3
The more material dissolved in a liquid, the more concentrated the solution.	5.2.6.A.3
A concentrated solution can be made more dilute by adding solvent to the solution.	5.2.6.A.3
A physical change occurs when a material changes form but retains its original chemical makeup.	5.2.6.B.1
When a change results from mixing two or more materials, that change is a chemical reaction. A reaction results in new materials.	5.2.6.B.1
Formation of a gas is one change that occurs in some reactions.	5.2.6.B.1
Not all chemicals react when they are mixed.	5.2.6.B.1

Thinking Processes (Procedural Knowledge)	NJCPI
Students Will Be Able To:	
Measure solids and liquids to make mixtures and solutions.	5.2.6.A.3
Observe the behavior of solid materials in water.	5.2.6.A.3
Compare the mass of a mixture to the mass of its parts.	5.2.6.A.3
Organize observations on a student sheet.	5.1.8.B.1
Communicate observations.	5.1.8.D.1
Observe the behavior of a saturated solution.	5.2.6.A.3
Compare the quantities of two solid materials required to saturate a volume of water.	5.2.6.A.3
Relate the added mass of the solution to the dissolved materials in the saturated solution.	5.2.6.A.3
Compare the solubility of materials in water.	5.2.6.A.3
Relate the concentrations of a solution to the amount of solid materials dissolved in a volume of water.	5.2.6.A.3
Determine the relative concentrations of solutions.	5.2.6.A.3
Measure solids and liquids while conducting chemical reactions.	5.2.6.B.1
Compare properties of precipitates to determine their identities.	5.2.6.B.1
Determine all possible pairs of reactants involving a set of three chemicals.	5.2.6.B.1

Levers and Pulleys Unit

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

- NJCPI:**
- 5.1.8.B.1** Design investigations and use scientific instrumentation to collect, analyze, and evaluate evidence as part of building and revising models and explanations.
 - 5.1.8.B.2** Gather, evaluate, and represent evidence using scientific tools, technologies, and computational strategies.
 - 5.1.8.B.3** Use qualitative and quantitative evidence to develop evidence-based arguments.

Science Content (Declarative Conceptual Knowledge)	NJCPI
Students Will Know and Understand:	
A lever is a simple machine that people use to gain an advantage, such as making work easier.	5.1.8.B.1
An advantage is a benefit gained in effort, distance or change in direction resulting from the use of a simple machine.	5.1.8.B.1
Effort is the force needed to move a load or overcome a resistance.	5.1.8.B.1
Fulcrum is the point where a lever arm pivots.	5.1.8.B.1
Load is a mass lifted or a resistance overcome by a lever.	5.1.8.B.1
A class-1 lever has the fulcrum between the load and the effort.	5.1.8.B.1
A class-2 lever has the load between the effort and the fulcrum.	5.1.8.B.1
A class-3 lever has the effort between the fulcrum and the load.	5.1.8.B.1
A single-pulley system can be set up in two ways, fixed or movable.	5.1.8.B.1
A single-movable pulley system provides a mechanical advantage for its user.	5.1.8.B.1

A single-fixed pulley system provides no mechanical advantage, but changes the direction of the effort.	5.1.8.B.1
A two-pulley system can be made with one fixed and one movable system.	5.1.8.B.1
A two-pulley system in which the effort is applied upward provides a greater advantage than one in which the effort is applied downward.	5.1.8.B.2
The effort needed to lift a load with a pulley system can be predicted	5.1.8.B.2
The amount of work put into a system is equal to the work output of the system.	5.1.8.B.2

Thinking Processes (Procedural Knowledge)	NJCPI
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.	5.1.8.B.2
Organize observations on a data table.	5.1.8.B.1
Discover the relationships between the parts of a lever.	5.1.8.B.1
Observe the behaviors of different kinds of levers.	5.1.8.B.1
Compare the effort to lift loads with different kinds of levers.	5.1.8.B.1
Diagram the relative positions and sizes of lever components in different systems.	5.1.8.B.1
Analyze tools in terms of their application as levers.	5.1.8.B.1
Observe and measure the effort to lift a load with a single-fixed and single-movable pulley systems.	5.1.8.B.2
Diagram and compare four kinds of pulley systems.	5.1.8.B.1
Observe and measure the effort to lift a load with one- and two- pulley systems.	5.1.8.B.2
Determine the advantage of pulley systems.	5.1.8.B.2
Measure and compare the distance the effort and load travels in different pulley systems.	5.1.8.B.3

Environments Unit

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

- NJCPI:**
- 5.1.8.D.2** Engage in productive scientific discussion practices during conversations with peers, both face-to-face and virtually, in the context of scientific investigations and model-building.
 - 5.3.6.A.1** Systems of the human body are interrelated and regulate the body's internal environment.
 - 5.3.6.A.2** Essential functions of plant and animal cells are carried out by organelles.
 - 5.3.6.B.1** Plants are producers: They use the energy from light to make food (sugar) from carbon dioxide and water. Plants are used as a source of food (energy) for other organisms.
 - 5.3.6.B.2** All animals, including humans, are consumers that meet their energy needs by eating other organisms or their products.
 - 5.3.6.C.1** Various human activities have changed the capacity of the environment to support some life forms.
 - 5.3.6.C.2** The number of organisms and populations an ecosystem can support depends on the biotic resources available and on abiotic factors, such as quantities of light and water, range of temperatures, and soil composition.

- 5.3.6.C.3** All organisms cause changes in the ecosystem in which they live. If this change reduces another organism's access to resources, that organism may move to another location or die.
- 5.3.6.D.1** Reproduction is essential to the continuation of every species.
- 5.3.6.E.1** Changes in environmental conditions can affect the survival of individual organisms and entire species.
- 5.4.6.G.2** Create a model of ecosystems in two different locations, and compare and contrast the living and nonliving components.
- 5.4.6.G.3** Describe ways that humans can improve the health of ecosystems around the world.
- 5.4.12.G.2** Explain the unintended consequences of harvesting natural resources from an ecosystem.
- 5.4.12.G.5** Assess (using maps, local planning documents, and historical records) how the natural environment has changed since humans have inhabited the region.

Science Content (Declarative Conceptual Knowledge)	NJCPI
Students Will Know and Understand:	
Everything that surrounds an organism makes up the organism's environment.	5.4.6.G.2
Terrestrial and aquatic environments include both living and nonliving factors.	5.4.6.G.2
Each organism has a set of preferred environmental conditions.	5.4.6.G.2
Organisms have a range of tolerance for environmental factors.	5.4.6.G.2
Optimum conditions are those most favorable to an organism's survival, growth, and reproduction.	5.3.6.D.1 5.4.6.G.2
Organisms impact their environment.	5.3.6.C.3 5.4.6.G.2
Human activities have an impact on a variety of environments.	5.4.12.G.5
Succession is the natural process that occurs over time in places where direct human impact is minimal.	5.4.12.G.2

Thinking Processes (Procedural Knowledge)	NJCPI
Students Will Be Able To:	
Observe and describe changes in a terrarium and in an aquarium over time.	5.3.6.A.2 5.3.6.A.1

	5.4.6.G.2
Organize and communicate observations.	5.4.6.G.2
Set up and observe animal investigations.	5.4.6.G.2
Relate the behavior of an animal to environmental factors.	5.4.6.G.2
Conduct a plant experiment to determine range of tolerance.	5.3.6.E.1 5.4.6.G.2
Relate differences in growth to the factor of water.	5.4.6.G.2
Use a chemical indicator to indirectly measure an environmental factor.	5.4.6.G.2
Use technology to monitor a factor in our local environment.	5.4.12.G.5
Research the impact of human activities on our local environment and other ecosystems.	5.3.6.C.1 5.4.6.G.3 5.4.12.G.5
Communicate findings.	5.1.8.D.2
Describe the natural processes that occur over time in places where direct human impact is minimal.	5.4.12.G.2
Identify biotic and abiotic elements.	5.3.6.C.2
Describe the relationships among biotic and abiotic factors.	5.3.6.C.2
Relate the characteristics of a population, community, and ecosystem.	5.3.6.C.2 5.3.6.D.1
Use data to construct a food web.	5.3.6.B.1 5.3.6.B.2

Connections to “Common Core” Reading and Writing:

Reading Informational Text:

Key Ideas and Details

- RI.5.1. Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
- RI.5.2. Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
- RI.5.3. Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.

Craft and Structure

- RI.5.4. Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 5 topic or subject area*.
- RI.5.5. Compare and contrast the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in two or more texts.
- RI.5.6. Analyze multiple accounts of the same event or topic, noting important similarities and differences in the point of view they represent.

Integration of Knowledge and Ideas

- RI.5.7. Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.

Aligned to NJCCCS 2009 & CCS Reading & Writing Reference

- RI.5.8. Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s).
- RI.5.9. Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

Range of Reading and Level of Text Complexity

- RI.5.10. By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4–5 text complexity band independently and proficiently.

Writing:

Text Types and Purposes

- W.5.1. Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
 - Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped to support the writer’s purpose.
 - Provide logically ordered reasons that are supported by facts and details.
 - Link opinion and reasons using words, phrases, and clauses (e.g., *consequently*, *specifically*).
 - Provide a concluding statement or section related to the opinion presented.
- W.5.2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
 - Introduce a topic clearly, provide a general observation and focus, and group related information logically; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
 - Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
 - Link ideas within and across categories of information using words, phrases, and clauses (e.g., *in contrast*, *especially*).
 - Use precise language and domain-specific vocabulary to inform about or explain the topic.
 - Provide a concluding statement or section related to the information or explanation presented.
- W.5.3. Narratives (N/A)

Production and Distribution of Writing

- W.5.4. Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
- W.5.5. With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
- W.5.6. With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting.

Research to Build and Present Knowledge

- W.5.7. Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.
- W.5.8. Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
- W.5.9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
 - Apply *grade 5 Reading standards* to literature (e.g., “Compare and contrast two or more characters, settings, or events in a story or a drama, drawing on specific details in the text [e.g., how characters interact]”).
 - Apply *grade 5 Reading standards* to informational texts (e.g., “Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point[s]”).

Range of Writing

- W.5.10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.