Science and Health Education: Resources for Anytime

21st Century Community Learning Centers Grant
Professional Development Institute

March 18-19, 2014

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Office of Science and Health Education

VIRGINIA DEPARTMENT OF EDUCATION

What do the students need?

- Science
- Mathematics
- Reading
- Writing
- History/Social Studies
- Health And Physical Education
- Fine and Performing Arts

- Critical Thinking
- Problem Solving
- Etc.

What are the students' interests?

Avoid the question, "why are we doing this?" or "how am I going to use this?"

- STEM
- Health and wellness
- Environment
- Sustainability
- Civic engagement
- Etc.

Now What…And, Where Do We Go?

- Health and Physical Education SOL Technical Education Guides
- Health Smart Virginia
- Enhanced Scope and Sequence
- Lessons from the Bay
- Green STEM
- Virginia Science Activities, Models, and Simulations
- Design Squad

K-12 Health and Physical Education SOL Technical Education Guides

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INSTRUCTION

PHYSICAL EDUCATION

ON THIS PAGE: Instructional Resources · Links to Outside Resources · Professional Organizations

STANDARDS OF LEARNING

Physical Education

Physical education provides students with the knowledge, processes, and skills to become physically educated, physically fit and responsible in their physical activity choices and behaviors for a lifetime. Virginia's standards for physical education are grouped into five strands: skilled movement, movement principles and concepts, personal fitness, responsible behaviors and physically active lifestyle. The standards in each strand are sequenced to progress in complexity from grade level to grade level.

Instructional Resources

- Physical Education Program Guidelines for Public Elementary and Middle Schools (PDF)
- Nutrition & Physical Activity Best Practices Database – Research and share information about successful programs and local efforts to improve the well being of students and promote healthy lifestyles.
- Walk Smart, Virginia!
- K-12 Physical Education SOL Technical Education Guide (PDF)
- Heart Healthy Resources for Schools: Nutrition and Physical Activitiy Guide (PDF)
- Governor's Physical Activity Awards Program brochure (PDF)
- Virginia's Wellness-Related Fitness Testing Program
  - Resources for administering the health-related FitnessGram assessment
  - Cumulative Wellness-Related Fitness Record (PDF)
  - Wellness School Summary Form (PDF)
  - Wellness Teacher Summary Form (PDF)
- Report: Fitness Data State Summaries
  - Spring 2013 (PDF)
  - Spring 2012 (PDF)

INSTRUCTION

MAIN MENU

English & Reading
Mathematics
Science
History & Social Science
Career & Technical Education
Driver Education
Economics & Personal Financ
Family Life Education
Fine Arts
Foreign Language
Health Education
Physical Education
Character Education
Leadership (PDF)

Teacher Direct

Specialized Instruction:

Early Childhood
Adult Education
English as a Second Languag

K-12 Health and Physical Education SOL Technical Education Guide

4.3 The student will correlate regular participation in physical activity with various components of fitness and improvement in fitness and skill development.

a) Identify the components of health-related fitness (e.g., cardiorespiratory endurance, muscular strength and endurance, flexibility, body composition).
b) **Apply data** from a standardized health-related fitness assessment to determine personal fitness goals.
c) Apply the **Frequency, Intensity, Time, Type** (FITT) principle of training to implement personal fitness goals.

This is just one of the activities listed:

- **Have students monitor pulse rate while participating in cardiorespiratory endurance activities.**

What are some ways to make connections across the curriculum?

writing, mathematics, reading, science, etc.

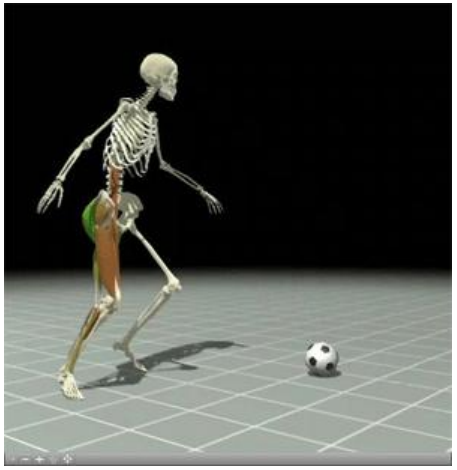
http://www.doe.virginia.gov/instruction/physed/technical_assistance_guide/physedk-12.pdf

Science, Mathematics, Engineering, Writing, Reading, Health, and Physical Education

There are many meaningful connections.

7.2 The student will understand and apply movement principles and concepts.

a) Apply biomechanical principles (e.g., **center of gravity, base of support, trajectory**) to understand and perform skillful movements.



PS.10 The student will investigate and understand the scientific principles of **work, force, and motion**. Key concepts include

a) speed, velocity, and acceleration;
b) Newton's laws of motion;
c) work, force, mechanical advantage, efficiency, and power; and
d) technological applications of work, force, and motion.

Be Creative!!!

Health Smart Virginia

Health Smart Virginia

HEALTH SMART VIRGINIA
www.healthsmartva.org

Virginia Teaching Requirements for Standard 5.5

Students in grade five distinguish reliable from unreliable health information and resources. Students' practices and behaviors demonstrate health knowledge and skills. Emphasis is placed on demonstrating interpersonal skills; assuming responsibility for personal health habits; and practicing behaviors that promote active, healthy lifestyles. Students critique advertising and various media displays and work with others to improve community health.

Standard 5.5: The student will explain how peers, families, and community groups work together to build a healthy community.

Key concepts/skills include	Understanding the Standard	Essential Knowledge and Skills	Assessment Ideas
a. collaborative support for environmental issues; b. examination of community health issues; c. promotion of volunteerism and community service; ;	The student will examine community health issues and explain the benefits of volunteering and working together to support environmental issues.	The student will: • define collaborative support. (working together) • list some health issues. (something that will effect the health of the individual or community) • define volunteerism. (someone who offers a service without being paid) • list types of pollutants. • explain how pollution affects health. (environmental pollution damages people's health and harms animals and plants). • identify community workers who help protect the environment. (park rangers, fire and rescue personnel, trash collectors, etc.) • explain how volunteering contributes to the health of individuals and the community.	1. select one type of pollution and explain how it effects individual and family health. 2. explain how to reduce air, water, land, and noise pollution. 3. research volunteer organizations in the community.

Suggest objectives/activities related to health and the environment:

- Types of pollution
- Pollution – health relationship
- Community partners and volunteer efforts

STEM: Enhanced Scope and Sequence

The Rate of Motion

Introduction
Every four years the world becomes transfixed by the athletes participating in the Olympic Games. From their inception in 776 B.C. to the present day, the Games have showcased the human body and its ability to move through space and time in powerful, complex, and beautiful ways.

Modern athletes often apply the laws of physics to improve their performance. For example, long jumpers strive to maximize the force with which their feet push off the track to generate the greatest velocity. By leaping up *and* out, they hope to increase their "hang time" and cover the greatest distance possible before the force of gravity causes them to touch down. Likewise, high divers push down with tremendous force on the board to accelerate quickly upward. The greater the acceleration, the higher the divers fly, and the longer they have in which to perform their amazing spins, tucks, and rotations before they hit the water.

One need not look far to see how the laws of motion and principles of physics apply to the motion of athletes competing not only against one another but also against the forces of mass, inertia, and gravity.

Questions for Investigation
- How can speed, velocity, and acceleration be used to describe the motion of objects?
- What is the relationship between speed, velocity and acceleration?
- How do scientific principles of work, force, and motion apply to safety technology?
- How can Newton's Laws be used to predict and describe the motion of a common object?

Materials
Newsprint or large sheet of paper for designing data table
Graph paper for data table, calculations, and graph
Meter stick or metric tape measure
Stop watch or timer (2)
Black marker or pen
Masking tape with which to mark off a distance of 0, 5 and 10 meters respectively

Open-Ended Questions

What is the relationship between speed, velocity, and acceleration?

How can work, force, and motion apply to safety technology?

http://www.doe.virginia.gov/testing/sol/standards_docs/science/2010/lesson_plans/index.shtml

STEM: Enhanced Scope and Sequence

6. The mover then skips along the same distance with the timers collecting data at the 5 m and 10 m mark. The mover will then hop along the 10 meter track.

7. Once the mover has completed one trial each for walking, skipping, and hopping, the members of the group rotate their roles. Continue rotations until all 4 members have completed one trial each for walking, skipping, and hopping.

8. Return the materials to the place indicated by your teacher and collaboratively work to perform the following calculations using the data you have collected.

   a) Calculate and record the mean time in seconds of all four trials for walking, skipping, and hopping.

   b) Calculate the average speed for each type of motion for 5 meters *and* for 10 meters. Use the formula to make your calculations.

   $$\text{Speed} = \frac{\text{distance}}{\text{time}} \qquad s = \frac{d}{t}$$

   c) Calculate the acceleration for each type of motion from 0 to 5 meters using the formula to make your calculations.

   $$\text{Acceleration} = \frac{\text{velocity @ 5m - velocity @ 0 m}}{\text{Time @ 5m - Time @0m}} \qquad a = \frac{v_5 - v_0}{T_5 - T_0}$$

   d) Calculate the acceleration for each type of motion from the 5m mark to the 10 m mark using the formula

   $$\text{Acceleration} = \frac{\text{velocity @ 10m - velocity @ 5 m}}{\text{Time @ 10m - Time @5m}} \qquad a = \frac{v_{10} - v_5}{T_{10} - T_5}$$

9. Collaboratively or individually create a distance-time graph that includes each of the three types of motion. Remember to include a title that accurately describes the data displayed. Create a key to indicate which line represents walking, skipping, and hopping.

What is the relationship between speed, velocity, and acceleration?

- Mathematical relationship

How can work, force, and motion apply to safety technology?

- Offer a problem for students to solve using what they have learned.

STEM: Enhanced Scope and Sequence

What is the relationship between speed, velocity, and acceleration?

- Mathematical relationship

How do we calculate speed?

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

What if we were given distance or time and we needed to calculate the other variables?

Distance = ?

Time = ?

STEM: Enhanced Scope and Sequence

How can work, force, and motion apply to safety technology?

- Offer a problem for students to solve using what they have learned.

What are some safety technologies?

How is motion changed to alter the force?

Lessons from the Bay

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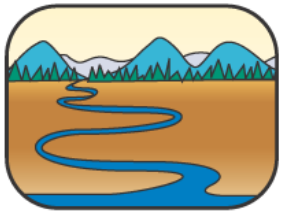
SCIENCE

LESSONS FROM THE BAY

About this project



As part of the Chesapeake 2000 Agreement, the states of Virginia, Maryland, and Pennsylvania, along with the District of Columbia, the Chesapeake Bay Commission, and the U.S. Environmental Protection Agency, reaffirmed their long-term commitment to "protect and restore the Chesapeake Bay's ecosystem."

A major part of this commitment was "to engage everyone – individuals, businesses, schools and universities, communities and governments" in the effort "to work toward a shared vision – a system with abundant, diverse populations of living resources, fed by healthy streams and rivers, sustaining strong local and regional economies, and our unique quality of life."

In co-signing this document, Virginia agreed to accomplish specific goals, including the following regarding public education:

- Beginning with the class of 2005, provide a meaningful Bay or stream outdoor experience for every school student in the watershed before graduation from high school.
- Provide students and teachers alike with opportunities to directly participate in local restoration and protection projects and to support stewardship efforts in schools and on school property.

How teachers can use this site

The purpose of Lessons from the Bay is to help Virginia school teachers of grades 3 through 6 incorporate into their classrooms a variety of activities and projects related to protecting and restoring the Chesapeake Bay watershed, in keeping with the state's commitment in the Chesapeake 2000 Agreement.

To accomplish this purpose, Lessons from the Bay offers five sections of instructional resources.

- Process Model – Suggested steps and graphic organizers for planning indoor and outdoor activities designed to give students hands-on experience in the process of scientific inquiry.
- About the Watershed: Instructional Framework – An outline that provides the teacher with basic background information on the Chesapeake Bay watershed, along with related Web resources.
- Lesson Plans – A series of 16 lessons about various aspects of the Chesapeake Bay watershed, each including background information, a materials list, classroom activities and procedures, handouts, related Standards of Learning (grades 3–6), and resources for the student and teacher. The teacher should evaluate each lesson and emphasize the instruction and activities that are most appropriate for the students' grade level.
- Project Action Guide – A roadmap for teachers and administrators planning extended activities and long-term projects related to the watershed, along with instructions for several specific projects, including information about organizing student teams, selecting a project, and teaching skills related to project success (keeping records, doing research, connecting with businesses, and promoting a project). Adapted from Virginia Institute of Marine Science's Rally Round publication.
- Glossary of Wetland Terms – Alphabetical listing of defined terms related to the study and exploration of the Chesapeake Bay watershed.

Instruction
Science
LESSONS FROM THE BAY
MAIN MENU

Process Model
About the Watershed: Instructional Framework
Lesson Plans
Project Action Guide
Glossary of Wetland Terms
Watershed Gallery of Images
User Tips
Lessons from the Bay Site Map

Information on this page is provided by the Office of Standards, Curriculum & Instruction.

Staff Contacts

Lessons from the Bay

Project Action Guide

This section contains detailed plans for several large-scale environmental projects. Teachers may wish to use these projects as extensions of earlier lesson plans, or they may prefer to use them as resources for independent class or schoolwide initiatives. Projects include:

- Build Your Own Rain Garden
- Conducting a Stream Quality Survey
- Recycling to Protect the Watershed
- Precycling to Prevent Environmental Clutter
- Restoring the Environment through Land Cleanups
- Improving Streams through Waterway Cleanups
- Building an Outdoor Classroom

Lessons from the Bay

Part 3: Projects

Build Your Own Rain Garden

This project was developed by the Student Baysavers Projects, Chesapeake Bay Foundation, Save the Bay (http://www.cbf.org) and is used with their permission.

Goals

- To help students see the connection between runoff in their community and the health of the whole Chesapeake Bay watershed
- To help students restore a wildlife habitat in their community
- To help students learn to appreciate and care for the natural environment

Materials

- 3 sections of 2-inch x 12-inch #1 treated pine (lengths depend on the size of the rain garden to be built)
- 10 2-foot sections of steel reinforcing bar (rebar)
- 2 stainless steel elbow brackets with 4 -1/2-inch stainless steel wood screws
- Screwdrivers and a hammer
- Shovels and rakes
- Topsoil (number of bags depends on the size of the rain garden)
- Mulch or straw
- Sand
- Plants

Directions

Understanding the project

During the instructional planning stages, the teacher may wish to read ***About the Watershed: Instructional Framework****, especially parts IV, V, VI, and VII.*

What is a rain garden?

To begin this project, the teacher may wish to introduce students to the concept of a rain garden, including its purposes, forms, potential locations, and importance.

A rain garden is designed to catch rainwater and slow, decrease, and improve the quality of storm water runoff. A rain garden can take many different forms and, for the most part, is limited only by the resources and time a group has to put into it. It can be large, complicated, and expensive or small and relatively simple. Chesapeake Bay Foundation's rain garden design, described here step-by-step, is inexpensive and easy enough for most students to complete with minimal help from adults. And while this rain garden project is specifically written with the schoolyard in mind, it would work just as well at a home, community center, religious center, or any other private property.

Scientists have found that nutrient and sediment pollution are the largest threats to water quality in the Chesapeake Bay watershed. Here is something students can do about it.

Why create a rain garden?

Virtually every school has a substantial amount of impervious surface (area that rainwater cannot soak into) that affects the quality of storm water runoff. When rain lands on an impervious surface, it cannot soak into the ground and eventually enters a storm drain or a nearby creek. This excess water, called runoff, causes the soil in its path to erode more rapidly than it would naturally. Gravity then causes this runoff to flow downhill and into the closest stream or other waterway, carrying with it the sediment, pesticides, fertilizers, and other pollutants it encounters along the way.

Rain gardens contain plants that intercept and slow down the storm water runoff and absorb or trap much of what it contains. Rain gardens also restore wildlife habitat by attracting creatures such as insects, butterflies, toads, and predators like hawks. Creating a rain garden also helps build environmental stewardship in students.

How should the garden be paid for?

Materials, like lumber, tools, soil, and plants are needed to complete the rain garden, and these materials cost money. There are many ways to get funding for materials. For example, a fundraiser could be held at school, a grant may be obtained, or the principal may be able to allot money from the school's budget.

However the money is raised for the rain garden, students will need to have a good idea of how much the supplies will cost. Actual costs will depend on the size of the rain garden and the plants chosen. Using a materials chart similar to the one below will help students estimate how much money they will need. (Note: The prices in the chart are estimates. Actual costs may vary.)

Build Your Own Rain Garden
Sample Materials Budget

Material	Quantity	Price Each	Total Price	Source
2-inch x 12-inch #1 treated pine board	3	$15.00	$45.00	Hardware store
2-foot steel rebar	10	$ .96	$9.60	Hardware store
Stainless steel elbow brackets w/screws	2	$7.00	$14.00	Hardware store
40-lb. bag topsoil	4	$3.00	$12.00	Donated by Nice Guy Landscaping Co.
20-lb. bag sand	1	$5.00	$5.00	Donated by Nice Guy Landscaping
40-lb. bag mulch	1	$3.00	$3.00	Donated by Nice Guy Landscaping
Straw bale	1	$5.00	$5.00	Donated by Sally's Dad
Screwdriver	1	$4.00	$4.00	Borrow from maintenance
Hammer	1	$12.00	$12.00	Borrow from maintenance
Shovels	3	$20.00	$60.00	Borrow from home
Rakes	2	$10.00	$20.00	Borrow from home
Plants	30	$3.00	$90.00	Donated by Hometown Nursery
		Total =	$279.60	$279.60 – 214.00 = $68.60

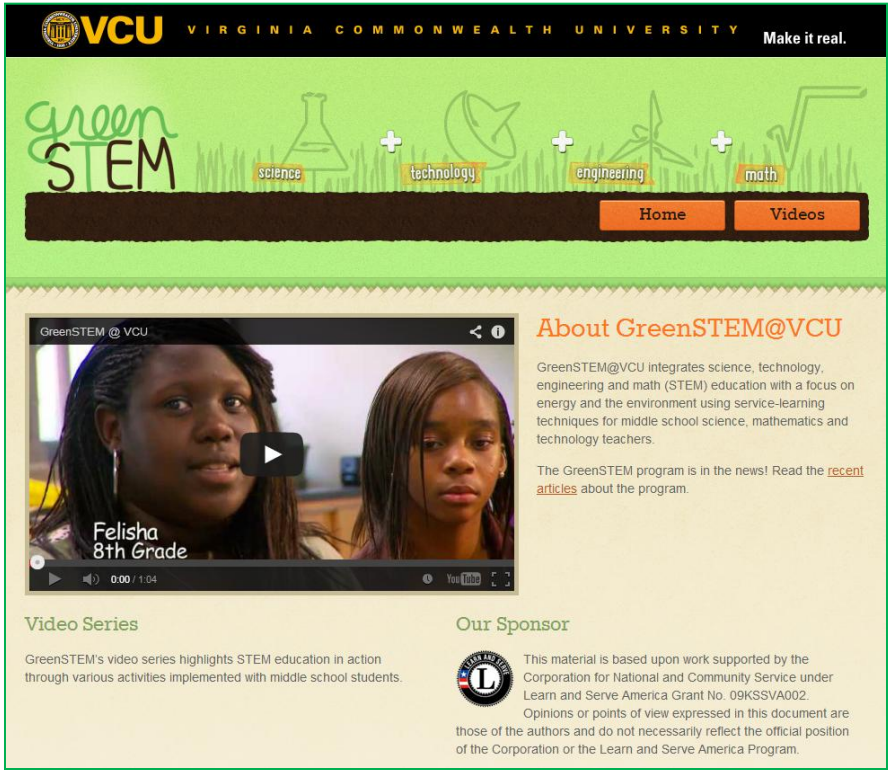
Prices will vary, depending on where the items are purchased. Not everything on this list will be needed, and some items not listed may be needed. The budget will also depend on what kinds of plants are used, how many are used, and what size garden is designed. Remember, if materials can be borrowed or donated, they can be subtracted from the actual cost of the project. In other words, the total cost of materials in this sample budget is $279.60, but the group only needs to raise $68.60 because many of the items have been donated or borrowed. Remember also that parents and neighbors may be willing to donate plants and flowers from their own gardens.

Constructing the rain garden

Once permission is received, plants are selected, a site is chosen, and materials are collected, the building and planting of the rain garden may begin. Students should follow the instructions below:

Lessons from the Bay

- Build Your Own Rain Garden
- Restoring the Environment through Land Cleanups
- Building an Outdoor Classroom



Virginia Science Activities, Models, and Simulations

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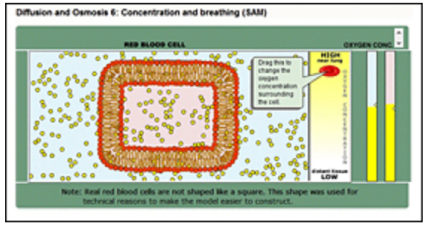
SCIENCE

VIRGINIA SCIENCE ACTIVITIES, MODELS & SIMULATIONS (SAMS)

The Virginia Science Activities, Models and Simulations project engages students in middle and high school in practices that are essential for learning science through inquiry. The activities involve asking questions or defining problems, using models or sensors, collecting data, interpreting results, using mathematics, technology and computational thinking, constructing explanations and designing solutions based on evidence.

These activities, models and simulations are correlated to the 2010 Science Standards of Learning and Curriculum Framework and are also organized by standard as stand-alone tools.



Resources by Grade/Subject

- Grade 6 Science (Word)
- Life Science (Word)
- Physical Science (Word)
- Earth Science (Word)
- Biology (Word)
- Chemistry (Word)
- Physics (Word)

What's in SAMS?

Activities

Activities engage students in practices that are essential for learning science through inquiry. The activities involve asking questions or defining problems, using models or sensors, collecting data, interpreting results, using mathematics, technology and computational thinking, constructing explanations, and designing solutions based on evidence. The activities also link science concepts to science careers.

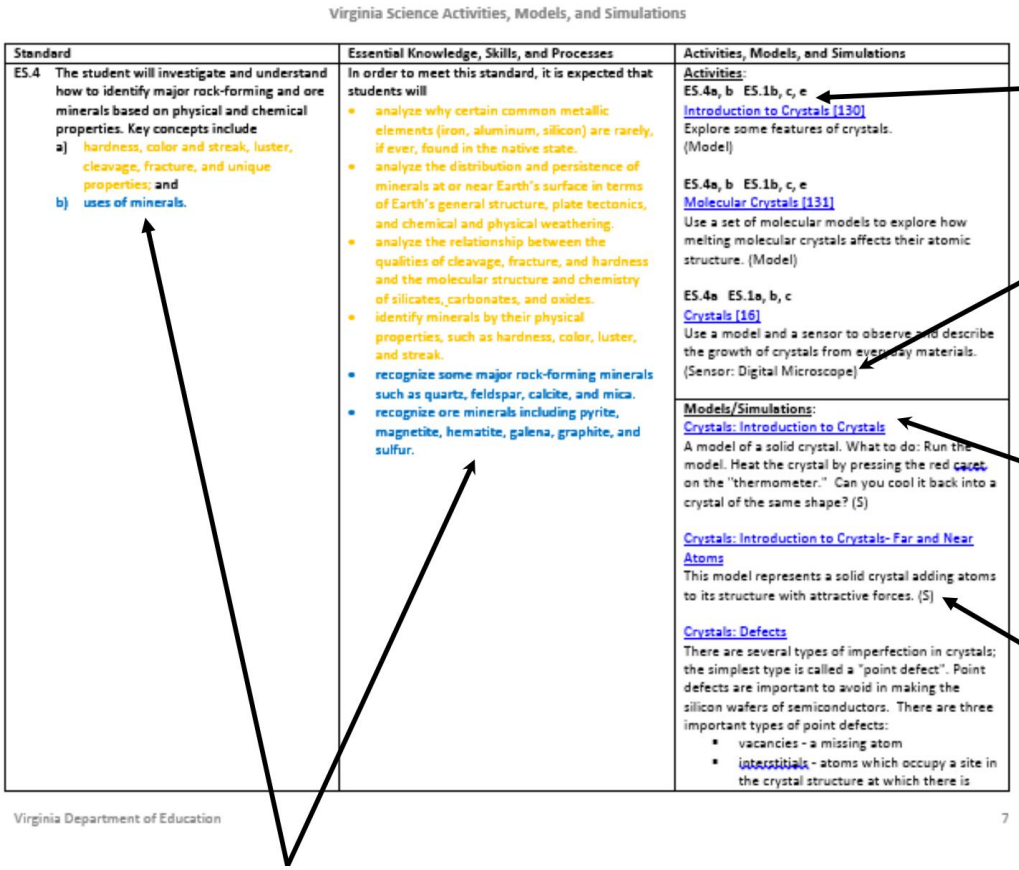
Models & Simulations

Models and simulations are identified as those that may be used in stand-alone situations. These may be used by teachers, indicated by a T, for demonstration purposed or by students, indicated by an S, as they work independently or in small groups.

To use these resources to their fullest capacity, please go to the ITSU-SU portal to register. The ITSI-SU portal is open and available to all. If you have questions about the portal, please contact itsisu@concord.org.

Virginia Science Activities, Models, and Simulations

Virginia Science, Models, and Simulations Diagram



Virginia Science Activities, Models, and Simulations

Standard	Essential Knowledge, Skills, and Processes	Activities, Models, and Simulations
ES.4 The student will investigate and understand how to identify major rock-forming and ore minerals based on physical and chemical properties. Key concepts include a) hardness, color and streak, luster, cleavage, fracture, and unique properties; and b) uses of minerals.	In order to meet this standard, it is expected that students will • analyze why certain common metallic elements (iron, aluminum, silicon) are rarely, if ever, found in the native state. • analyze the distribution and persistence of minerals at or near Earth's surface in terms of Earth's general structure, plate tectonics, and chemical and physical weathering. • analyze the relationship between the qualities of cleavage, fracture, and hardness and the molecular structure and chemistry of silicates, carbonates, and oxides. • identify minerals by their physical properties, such as hardness, color, luster, and streak. • recognize some major rock-forming minerals such as quartz, feldspar, calcite, and mica. • recognize ore minerals including pyrite, magnetite, hematite, galena, graphite, and sulfur.	Activities: ES.4a, b ES.1b, c, e Introduction to Crystals [130] Explore some features of crystals. (Model) ES.4a, b ES.1b, c, e Molecular Crystals [131] Use a set of molecular models to explore how melting molecular crystals affects their atomic structure. (Model) ES.4a ES.1a, b, c Crystals [16] Use a model and a sensor to observe and describe the growth of crystals from everyday materials. (Sensor: Digital Microscope) Models/Simulations: Crystals: Introduction to Crystals A model of a solid crystal. What to do: Run the model. Heat the crystal by pressing the red caret on the "thermometer." Can you cool it back into a crystal of the same shape? (S) Crystals: Introduction to Crystals- Far and Near Atoms This model represents a solid crystal adding atoms to its structure with attractive forces. (S) Crystals: Defects There are several types of imperfection in crystals; the simplest type is called a "point defect". Point defects are important to avoid in making the silicon wafers of semiconductors. There are three important types of point defects: ▪ vacancies - a missing atom ▪ interstitials - atoms which occupy a site in the crystal structure at which there is

Virginia Department of Education 7

Activities include a correlation to science standard(s), a brief description, and the interactive component (model or sensor).

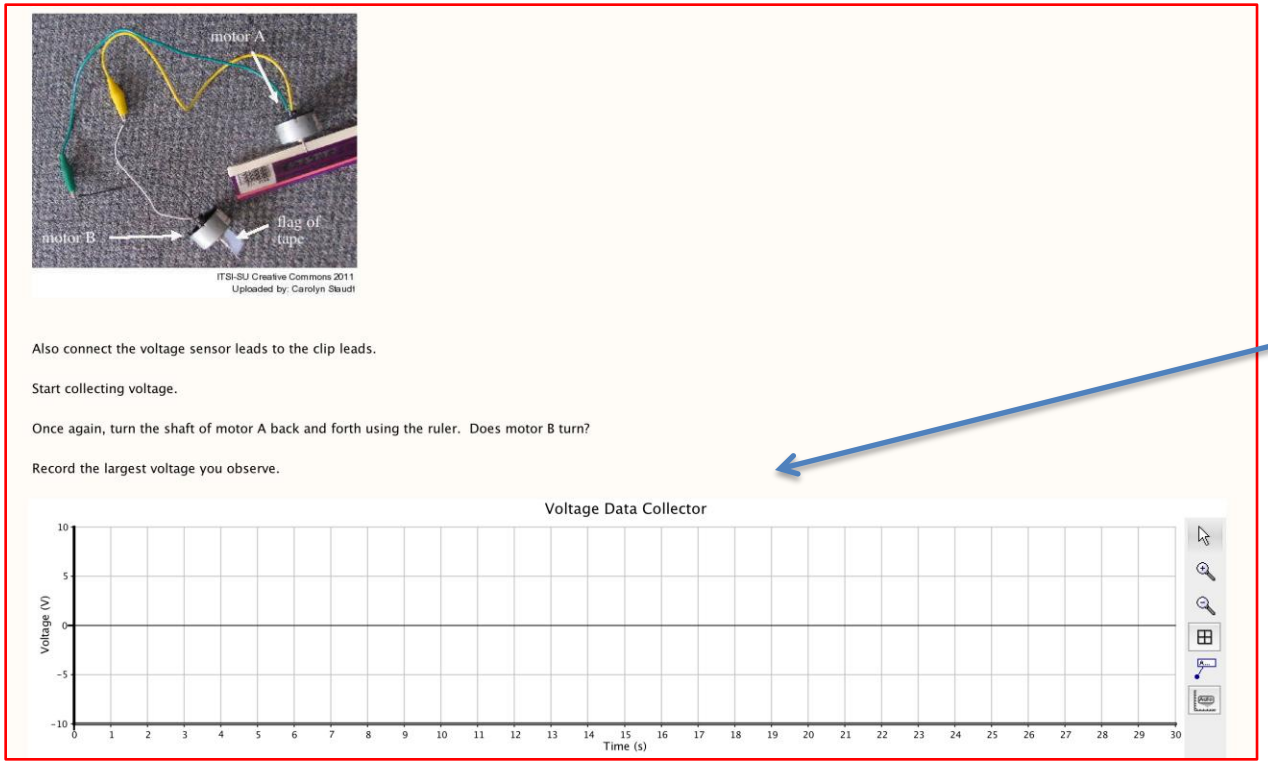
Each activity indicates the components incorporated in the activity. For this lesson, both a model and a sensor (probeware) are used by students in the activity.

Models/Simulations include a short description of each model or simulation along with a brief description. These may be used as stand-alone tools.

Each model/simulation has a suggestion for student **(S)** use or teacher **(T)** use.

The key concepts of the standards and the student expectations of the Essential Knowledge, Skills, and Processes are linked by color.

Virginia Science Activities, Models, and Simulations

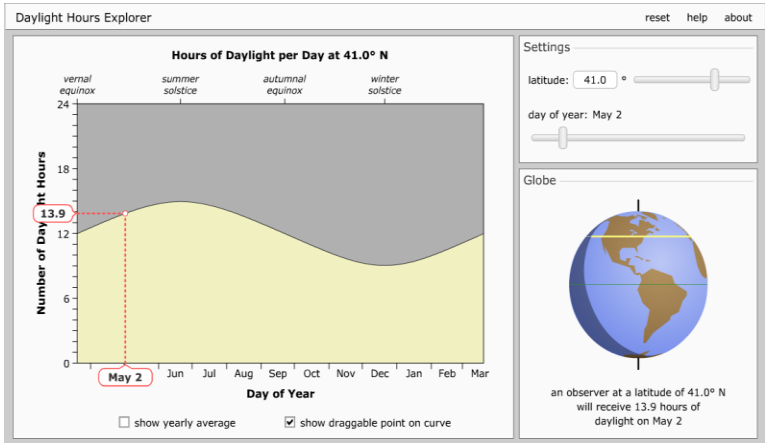


Students:

- Make predictions
- Collect data
- Analyze data (make calculations)
- Write explanations
- Draw conclusions
- Career connections

How can modeling and simulations be used inside and outside the classroom?

1. <u>Experiencing Simulations:</u> Are used to **set the stage**, cognitively or affectively, for future learning and are used before formal presentation of the material to be learned.
2. <u>Informing Simulations:</u> Are used to **transmit information** to the student and to **supplement or replace the lecture or textbook** as a means of initial formal exposure to a topic.

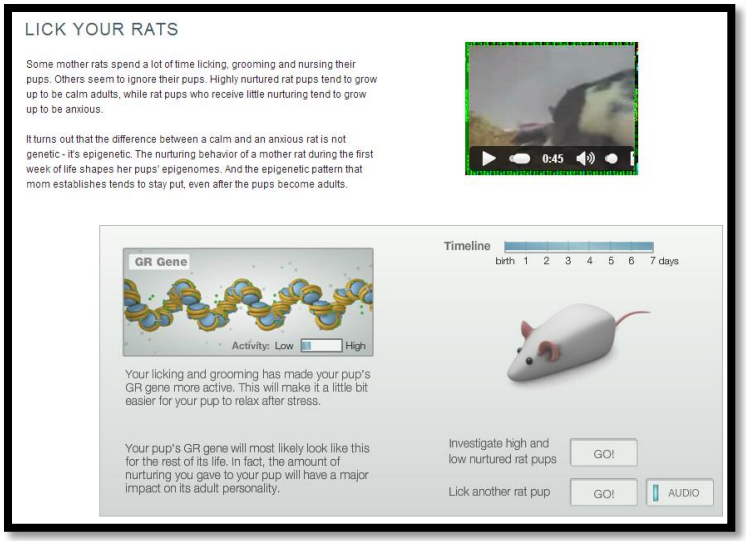


Thomas and Hooper (1991)

VIRGINIA DEPARTMENT OF EDUCATION

How can modeling and simulations be used inside and outside the classroom?

3. Reinforcing Simulations: Apply knowledge in the same context in which it was learned and are used to **strengthen specific learning objectives**.
4. Integrating Simulations: Aid the student in **integrating separate facts, concepts, and principles into functional units** and assimilating them with other units. They are used in any situation where several knowledge elements have been learned independently and need to be applied collectively.



Thomas and Hooper (1991)

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Design Squad

Parents and Teachers

Design Squad

http://pbskids.org/designsquad/parentseducators/guides/mission_solar_system.html

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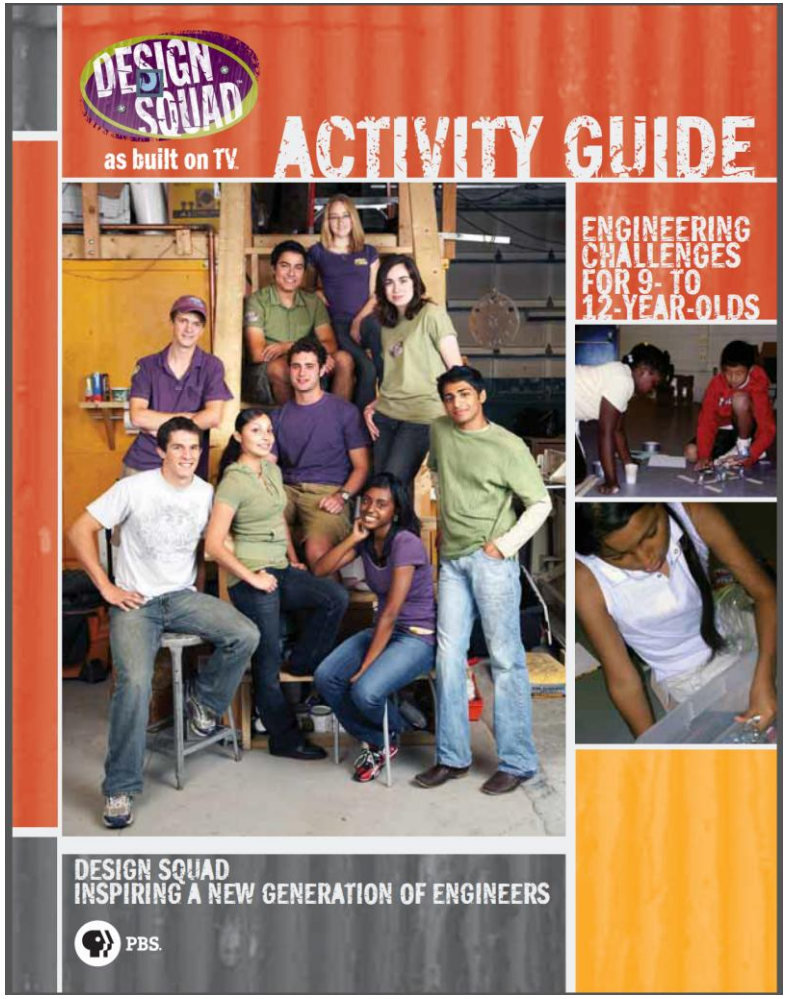
http://pbskids.org/designsquad/parentseducators/guides/mission_solar_system.html

Design Squad



Challenge 1: Watercraft
Find out if you can build an unsinkable boat out of straws and plastic wrap.

Challenge 2: Paper Table
See how strong a table you can build out of paper.

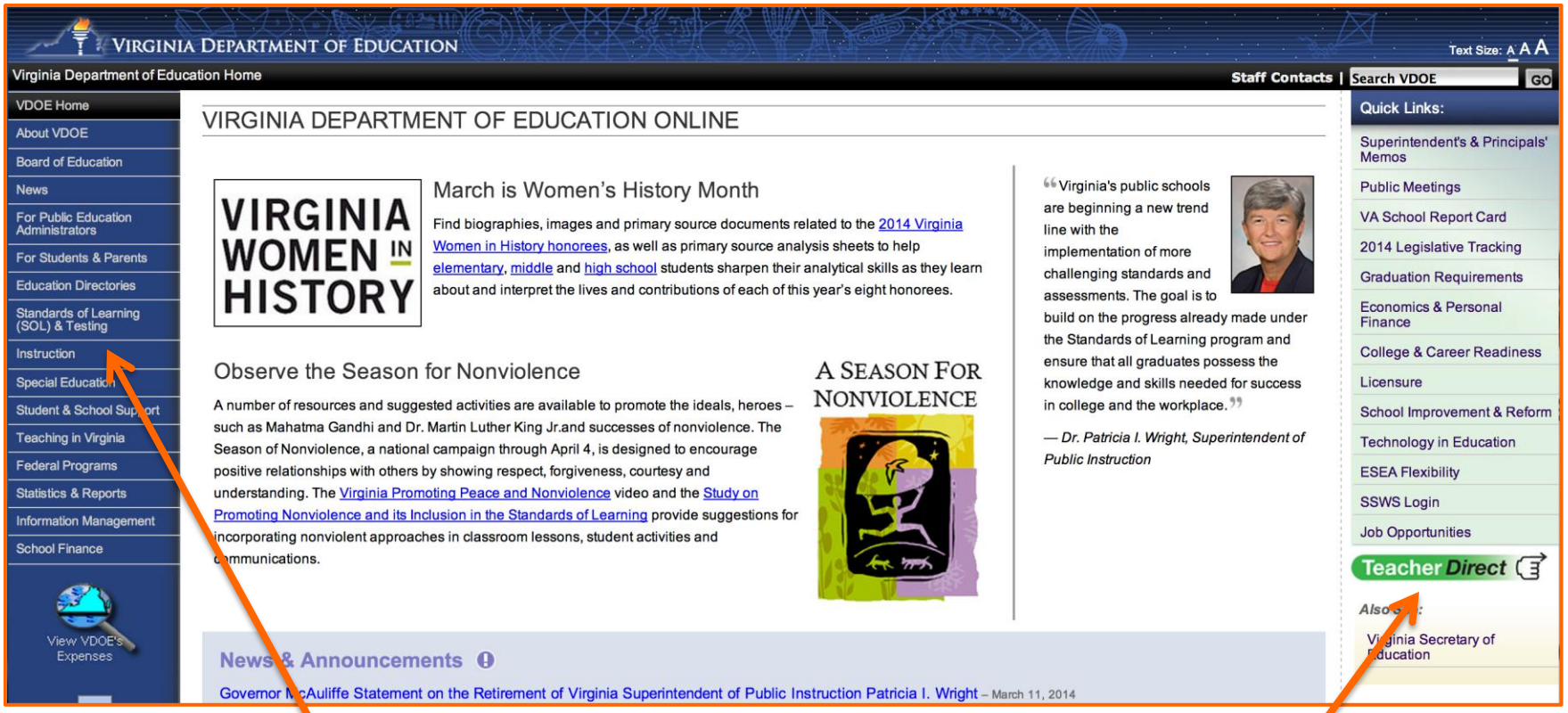
Challenge 3: Zip Line
Test how quickly you can get a Ping Pong ball to the bottom of a zip line string.

Challenge 4: Paddle Power
Check out how fast a boat can paddle itself across a container of water.

Challenge 5: Helping Hand
See how many objects you can grab with a homemade "bionic" arm.

http://pbskids.org/designsquad/parentseducators/guides/mission_solar_system.html

All of these an more may be found at…



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