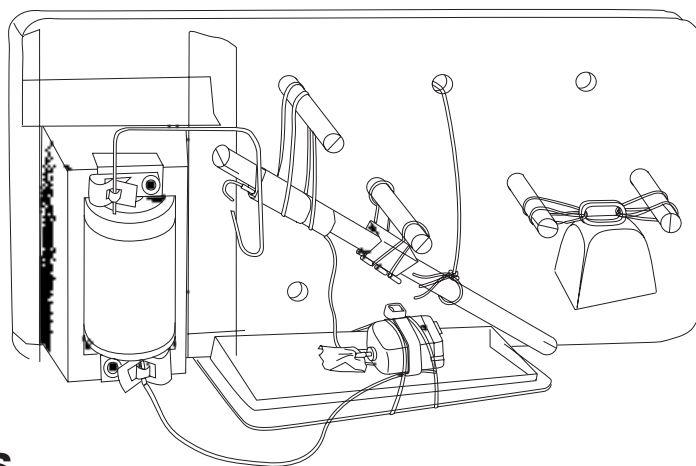


# OVERVIEW

## MODELS AND DESIGNS



### GOALS

The four investigations in the **Models and Designs Module** provide experiences that develop the concept of a scientific model and engage students in design and construction. The atmosphere generated by this module is one of open discussion, free exchange of ideas, and development of ideas into products.

### FOSS EXPECTS STUDENTS TO

- Manipulate objects and materials.
- Design and construct conceptual and physical models.
- Look for relationships between structure and function of materials and systems.
- Organize and analyze data from investigations with physical objects and systems.
- Apply mathematics in the context of science.
- Acquire vocabulary associated with engineering and technology.
- Gain confidence in their abilities to solve problems.
- Learn that there is often more than one solution to a problem.
- Communicate ideas to peers and work in a collaborative scientific manner.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, and relating.

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# MODELS AND DESIGNS MODULE MATRIX

## SYNOPSIS

## SCIENCE CONTENT

## THINKING PROCESSES

### 1. BLACK BOXES

Students make multisensory observations of sealed black boxes to determine what is inside. They develop conceptual models and construct physical models that they compare to the black boxes. The models help students explain what is in the black boxes.

- Scientists develop models to explain how systems work.
- A model is a representation or explanation of a system or interaction that cannot be observed directly.
- Conceptual models can be communicated through words and drawings.

- Observe the behavior of black boxes.
- Organize and communicate observations.
- Develop conceptual models.
- Relate conceptual models to observations to develop physical models.

### 2. HUM DINGERS

Students are presented with a device that hums when its string is pulled and dings when the string is released. They design and build a physical model of a hum dinger, comparing the performance of the real device to their models.

- Scientists construct physical models to demonstrate how something works or how it is constructed.
- Scientists collaborate to find solutions to problems.
- Electric devices need a complete circuit in order to work.
- Levers are used to move objects.

- Observe the behavior of the hum dinger.
- Organize and assemble components to design a physical model of a device.
- Compare physical models to the working hum dinger.
- Relate the structure and arrangement of materials to a functional hum-dinger system.

### 3. GO-CARTS

Students work in pairs to design and build a self-propelled cart. They relate structures to functions as they design, test, and improve their rolling carts.

- The way something is put together is its design.
- Using scientific principles and knowledge to design useful products is the work of engineers.
- Some land vehicles have wheels fixed to axles. Power turns the axle and thereby turns the wheels.

- Observe the performance of a self-propelled go-cart designed by students.
- Compare the go-cart's performance to an established objective.
- Organize and communicate observations of investigations to solve a problem.
- Relate structures and arrangement of materials to a functional self-propelled go-cart.

### 4. CART TRICKS

Students work in pairs to modify their self-propelled carts to perform interesting maneuvers such as turn corners, bob up and down, and wobble from side to side. Students gain experience with design and engineering tasks as they investigate the relationships among go-cart variables.

- Systems can be designed to perform specific functions.
- Application of science for the benefit of people is called technology and is the work of engineers.
- Problem solving involves designing, constructing, testing, evaluating, and redesigning based on evidence from testing.
- A variable is anything you can change that might affect the performance.

- Compare the go-cart's performance to established objectives.
- Organize and communicate observations of investigations to solve a specific problem.
- Relate cart design to cart performance.
- Investigate the relationships among variables in a cart design.

**Language Extension**

- Research models of the solar system.

**Math Extensions**

- Problem of the week.
- Draw blueprints for a house.
- Play model-building games.

**Science Extensions**

- Gather more information about black boxes.
- Introduce more boxes.

See the Science Stories folio.

- *Everyday Mysteries*
- *Scientists and Models*
- *Life on Earth 150 Million Years Ago*

www.fossweb.com

Check the FOSS website for interactive simulations, to write questions to a scientist, for teaching tips, and to talk with other classes using FOSS.

Home/School Connection: Students list black boxes they encounter in their lives.

**Language Extensions**

- Write directions for construction.
- Look up *switch*.
- Use *humdinger* as an idiom.
- Share other words for *device*.

**Math Extension**

- Problem of the week.

**Art Extension**

- Create hum-dinger ads.

**Science Extensions**

- Replicate simple devices.
- Make a doorbell.

See the Science Stories folio.

- *Simulations*
- *The Path to Invention*

Home/School Connection: Students look for motors and levers and attempt to figure out how they are used.

**Language Extensions**

- Find out about engineers.
- Write a letter to a manufacturer.

**Math Extension**

- Problem of the week.

**Science and Social Studies Extensions**

- Compare carts in other lands.
- Improve a household device.
- Design a rubber-band boat.
- Examine self-propelled toys.
- Use air power.
- Use spring power.
- Propel a wagon.

See the Science Stories folio.

- *Early Autos*
- *Henry Ford and His Model T*
- *On the Line*
- *What Makes Things Move?*

Home/School Connection: Students investigate their toaster's design.

**Language Extensions**

- Research automotive engineering advances.
- Sell go-carts.
- Compare features of cars.

**Math Extension**

- Problem of the week.

**Science and Art Extensions**

- Design effective presentation posters.
- Investigate cart mass and cart performance.
- Investigate rollers and creepers.

See the Science Stories folio.

- *Smart Cars and Space Planes*
- *Inertia and Momentum*

Home/School Connection: Students will need some extra time at home to work on their projects and get them ready to present to the class.



### FOSS AND NATIONAL STANDARDS

The **Models and Designs Module** encourages students to develop the skills of investigation in order to build explanations based on knowledge and evidence. This module supports the following National Science Education Standards.

#### SCIENCE AS INQUIRY

Develop students' abilities to do and understand scientific inquiry.

- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, explanations, predictions, and models using evidence.
- Think critically and logically to make the connections between evidence and explanations.
- Recognize and analyze alternative explanations and predictions.
- Communicate procedures and explanations.
- Understand that scientists use different kinds of investigations and tools to develop explanations using evidence and knowledge.

#### CONTENT: PHYSICAL SCIENCE

Develop students' understanding of energy transfer.

- Energy is associated with electricity, mechanical motion, and sound. Electric circuits transfer electric energy.

#### SCIENCE AND TECHNOLOGY

Develop students' abilities in technological design.

- Design a solution or product.
- Implement a proposed design.
- Evaluate completed technological designs or products.
- Communicate the process of technological design.

Develop students' understandings about science and technology.

- Technological designs have constraints due to properties of materials and friction.
- Scientists and engineers work collaboratively in teams and use tools and scientific techniques to make better observations.