Name of Course: **Science**	**Strand:** **Scientific Reasoning and Technology**
Grade Level(s): **5**	
Unit: **Models and Designs: Go-Carts**	
Estimated Instructional Time: **5 class periods (approximately 40 minutes)**	
PA Academic Standards: **3.2.4.A Identify and use the nature of scientific and technological knowledge.** **3.2.4.C Recognize and use the elements of scientific inquiry to solve problems.** **3.2.4.D Recognize and use the technological design process to solve problems.**	
New Standards Performance Standards: **S5e Identifies problems; proposes and implements solutions; and evaluates the accuracy, design, and outcomes of investigations.** **S5f Works individually and in teams to collect and share information and ideas.** **S8c A design, such as building a model or scientific apparatus.**	
Unit Objectives: **1. Observe the performance of a self-propelled go-cart designed by students.** **2. Compare the go-cart's performance to an established objective.** **3. Organize and communicate observations of investigations to solve a problem.** **4. Relate structures and arrangement of materials to a functional self-propelled go-cart.**	
Text/Resource Materials: **FOSS Teacher Guide: Models and Designs: Go-Carts** **FOSS Kit** **2 pairs of scissors** **Pliers** **1 pair large scissors**	

Activities:
Part I: Free-Rolling Go-Carts (pgs. 8-12)
-Students work in pairs to design and construct a rolling cart, using common construction materials.
Part II: Self-Propelled Go-Carts (pgs. 13-19)
-Students are challenged to power their carts so that they will be self-propelled (using rubber bands) over a distance of 2 m.
Part III: The Two-Meter Run (pgs. 20-23)
-Each team of students demonstrates their go-cart and describes its successful design elements.

Assessment:
Part I: Free-Rolling Go-Carts
-Teacher observation
-Informal notes
-Assessment chart for Investigation 3
Part II: Self-Propelled Go-Carts
-Response sheet- Go-Carts
Part III: The Two-Meter Run
-Teacher observation
-Assessment chart for Investigation 3

Enabling Objectives:

1. **Construct rolling carts from familiar materials.**
2. **Use a design-and-test approach to solve problems.**
3. **Use eye/hand coordination and spatial relationships to design carts that perform predetermined functions.**
4. **Relate structures to functions.**
5. **Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, and relating.**

Extensions:

Science Extensions:
-Improve a household device.
-Design a rubber band boat.
-Examine self-propelled toys.
-Use air power.
-Use spring power.
-Propel a wagon.

Language Extensions:
-Write a letter to a manufacturer.
-Find out about engineers.

Math Extension:
-Problem of the Week

Social Studies Extension:
-Compare carts in other lands.

Remediation:
Use the FOSS website: www.fossweb.com
-gives interactive simulations
-teaching tips
-ask questions to a scientist

Name of Course:	**Strand:**
Science	**Scientific Reasoning and Technology**

Grade Level(s):
5

Unit:
Models and Designs: Cart Tricks

Estimated Instructional Time:
8 class periods (approximately 40 minutes)

PA Academic Standards:
3.1.4.B: Know models as useful simplifications of objects or processes.
3.1.4.C: Recognize and use the elements of scientific inquiry to solve problems.
3.1.4.D: Recognize and use the technological design process to solve problems.
3.4.4.C: Observe and describe different types of force and motion.

New Standards Performance Standards:
S4a: Big ideas and unifying concepts, such as order and organization; models, form and function; change and constancy; and cause and effect.
S5d: Evaluates different points of view using relevant experiences, observations, and knowledge; and distinguishes between fact and opinion.
S5e: Identifies problems; proposes and implements solutions; and evaluates the accuracy, design, and outcomes of investigations.

S5f: Works individually and in teams to collect and share information and ideas.
S7c: Critiques written and oral explanations, and uses data to resolve disagreements.
S8c: A design, such as building a model or scientific apparatus.

Unit Objectives:

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

Text/Resource Materials:
FOSS Teacher Guide: Models and Designs- Cart Tricks
FOSS Kit
1 pair of scissors per group
Cardboard
1 large pair of scissors
1 box

Activities:
Part I: The Run-Around Cart (pgs. 6-10)
-Students work in pairs to modify their self-propelled carts to turn a corner as well as to go the distance.
Part II: Advanced Tricks (pgs. 11-15)
-Students work in pairs to modify their self-propelled carts to perform interesting maneuvers such as bobbing up and down and wobbling from side to side. Students gain experience with design and engineering tasks as they investigate the relationships among go-cart variables.
Part III: Choosing Your Own Investigation (pgs. 16-20)
-Students create a model to explain something that cannot be observed directly or design a useful device.

Assessment:
Part I: The Run-Around Cart
-Response Sheet-Cart Tricks
Part II: Advanced Tricks
-Student Sheet-Design Plan
Part III: Choose Your Own Investigation
-Performance Assessment-Project Proposal

Enabling Objectives:

1. **Modify self-propelled carts to perform tricks.**
2. **Relate cart design to cart performance.**

3. **Gain experience with design and engineering tasks.**
4. **Investigate the relationships among variables that result in various cart tricks, including wheel size, position, and orientation.**
5. **Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, and relating.**

Extensions:

Science Extensions:
-Investigate mass and cart performance.
-Investigate rollers and creepers.

Language Extensions:
-Research automotive engineering advances.
-Sell a go-cart.
-Compare features of cars.
-Prepare oral presentations.

Math Extension:
-Problem of the week.

Art Extension:
-Design effective presentation posters.

Remediation:
Use the FOSS website: www.fossweb.com
-Gives interactive simulations
- Teaching tips
-Ask questions to a scientist

Name of Course:	**Strand:**
Science	**Scientific Reasoning and Technology**

Grade Level(s):
5

Unit:
Models and Designs: Hum Dingers

Estimated Instructional Time:
6 class periods (approximately 40 minutes)

PA Academic Standards:

3.1.4.B Know models as useful simplifications of objects or processes.
3.2.4.A Identify and use the nature of scientific and technological knowledge.
3.2.4.C Recognize and use the elements of scientific inquiry to solve problems.
3.2.4.D Recognize and use the technological design process to solve problems.

New Standards Performance Standards:
S4a: Big ideas and unifying concepts, such as order and organization; models, form and function; change and constancy; and cause and effect.
S5e: Identifies problems; proposes and implements solutions; and evaluates the accuracy, design, and outcomes of investigations.
S5f: Works individually and in teams to collect and share information and ideas.
S8c: A design, such as building a model or scientific apparatus.

Unit Objectives:

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

Text/Resource Materials:
FOSS Teacher Guide: Models and Designs
FOSS Kit
Scissors
Pliers
Large paper bag

Activities:
Part I: Exploring Hum Dingers (pgs. 8-16)
-Students are presented with a device that hums when its string is pulled and dings when the string is released. Working in collaborative groups, they design and build a physical model of a hum dinger, comparing the performance of the real device to their models.
Part II: Model Hum Dingers (pgs. 17-21)
-Over several sessions, students observe, design, test, compare, and redesign until they engineer a successful model that replicates the sounds produced by the hum dinger.
Part III: Reveal and Replicate (optional) (pgs. 22-24)
- The inner workings of the original hum dinger are revealed. Students construct the same design and compare their model with the original

Assessment:
Part I: Exploring Hum Dingers
-Response sheet- Hum Dingers
Part II: Model Hum Dingers
-Teacher Observation
-Assessment chart for Investigation 2
Part III: Reveal and Replicate
-Informal notes
-Assessment chart for Investigation 2

Enabling Objectives:

1. **Observe a fanciful device called a hum dinger.**
2. **Organize and assemble components to make a physical model of a hum dinger.**
3. **Compare their models to a working hum dinger.**
4. **Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, and relating.**

Extensions: (pgs. 25-28)
Science Extensions:
-Replicate simple devices.
-Make a doorbell.

Language Extensions:
-Write directions for construction.
-Use humdinger as an idiom.
- Share other words for device.

Math Extension:
-Problem of the week.

Art Extension:
-Create hum-dingers ads.

Remediation:
Use the FOSS website: www.fossweb.com
-Gives interactive simulations
- Teaching tips
-Ask questions to a scientist

Name of Course:	**Strand:**
Science	**Scientific Reasoning and Technology**

Grade Level(s):
5

Unit:
Models and Designs: Black Boxes

Estimated Instructional Time:
5 class periods (approximately 40 minutes)

PA Academic Standards:
3.1.4.B Know models as useful simplifications of objects or processes.
3.2.4.A Identify and use the nature of scientific and technological knowledge.
3.2.4.C Recognize and use the elements of scientific inquiry to solve problems.
3.2.4.D Recognize and use the technological design process to solve problems.

New Standards Performance Standards:
S4a: Big ideas and unifying concepts, such as order and organization; models, form and function; change and constancy; and cause and effect.
S5d: Evaluates different points of view using relevant experiences, observations and phenomena.
S5f: Works individually and in teams to collect and share information and ideas.
S7d: Critiques written and oral explanations, and uses data to resolve disagreements.
S8c: A design, such as building a model or scientific apparatus.

Unit Objectives:
1. **Observe the behavior of black boxes.**

2. **Organize and communicate observations.**
3. **Develop conceptual models.**
4. **Relate conceptual models to observations to develop physical models.**

Text/Resource Materials:
FOSS Teacher Guide: Models and Designs-Black Boxes
FOSS kit
Notebook paper
Stapler
1 permanent marking pen
2 sheets of chart paper
1 flip chart

Activities:
Part I: Black-Box Investigations (pgs. 8-17)
-Students make multisensory observations of sealed black boxes in an effort to determine what is inside. They develop conceptual models and try to reach consensus with other students who investigated the same black box. The models help students explain what is in the black box.
Part II: Building Black Boxes (pgs. 18-21)
-Students construct physical models of black boxes in an effort to replicate the behaviors of the original black boxes they investigated.
Part III: The Drought Stopper (pgs. 22-25)
-Students observe a device that produces 500 ml of water when only 100 ml of water is put in. They draw models to explain how they think the device works.

Assessment:
Part I: Black-Box Investigations
-Teacher observation
-Informal notes
-Assessment chart for investigation 1
Part II: Building Black Boxes
-Response sheet- Black Boxes
Part III: The Drought Stopper
-Teacher observation
-Assessment chart for investigation 1

Enabling Objectives:
1. **Make multisensory observations of black boxes.**
2. **Develop conceptual models of black boxes based on evidence.**
3. **Communicate models through discussion and drawing.**

4. **Construct physical models to compare to conceptual models.**
5. **Modify and revise models based on additional evidence.**
6. **Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, and relating.**

Extensions: (**pgs. 25-28**)

Science Extensions:

-Listen to the box with a stethoscope.
-Use a magnet to see if the marble is a steelie.
-Get a family member or friend with health-service connections to x-ray the boxes.
-Get another class to make models and compare.
-Spray the box with a spray mister to cover the bottom of the box with a fine layer of water droplets. Put the box in the freezer. Observe the frozen droplets as they melt.
-Stick a thin wire probe through the crack in the box to feel around gently.

Language Extensions:

-Research models of the solar system

Math Extensions:

-Problem of the week. (**pg. 26**)
-Draw blueprints.
-Play model-building games.

Remediation:

Use the FOSS website: www.fossweb.com

-gives interactive simulations
-teaching tips
-ask questions to a scientist