

# Science Unit 2- Plan Levers and Pulleys Grade 5

Unit Length:  
November 10, 2014 to January 30, 2014



# Grade 5 Levers and Pulleys

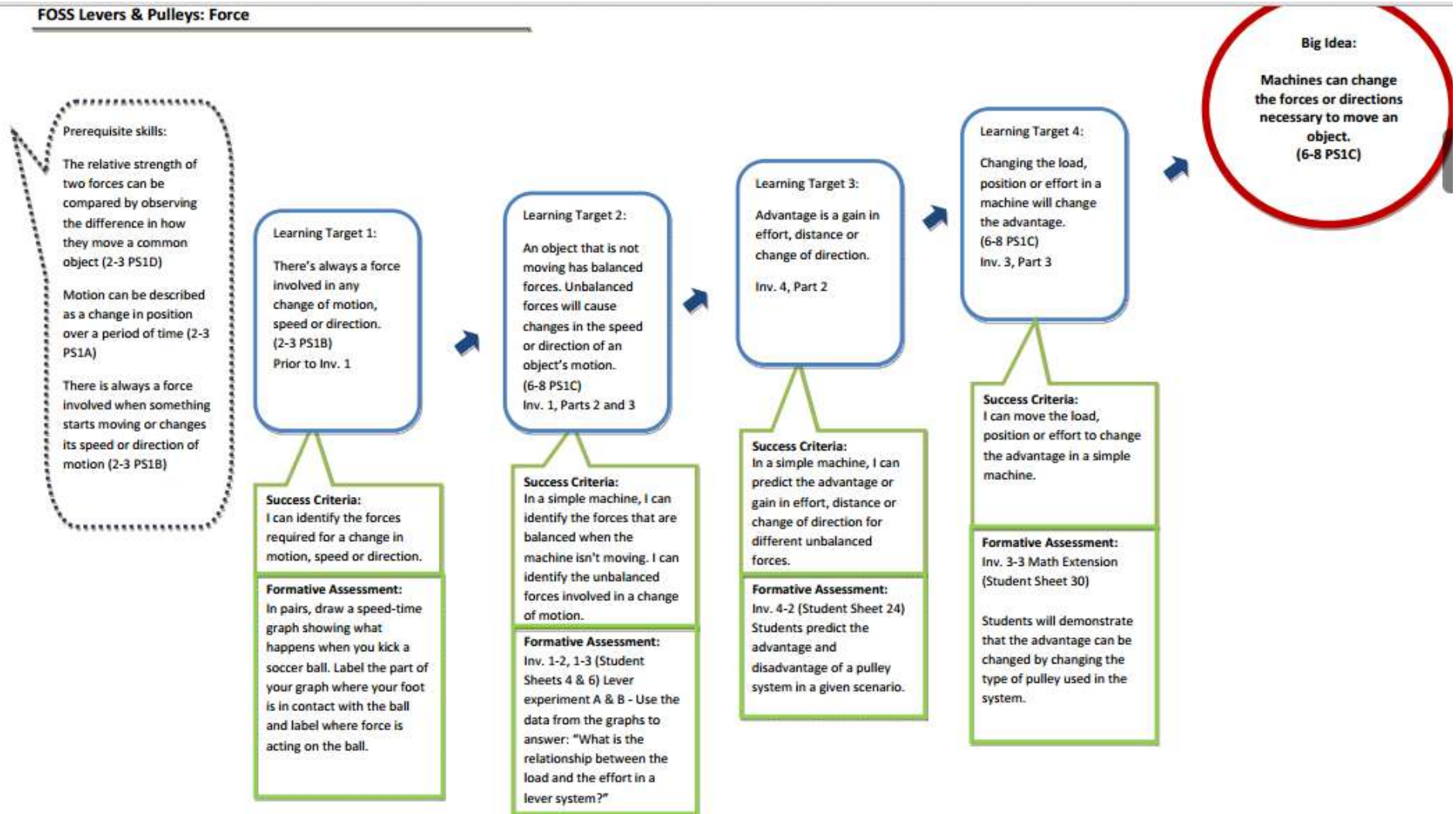
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# CONCEPTUAL FLOW

## FOSS Levers & Pulleys: Force



## UNIT OVERVIEW

### UNIT OVERVIEW

#### Magnetism and Electricity Unit

### Summary

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.

The **Levers and Pulleys Module** consists of four investigations that involve students in fundamental concepts of simple machines

<b><i>Enduring Understanding:</i></b>	<b><i>Essential Questions: Overarching</i></b>
<ul style="list-style-type: none"> <li>Simple machines are used to transfer energy in order to complete a task.</li> <li>Simple machines may change the direction of an applied force (directional advantage) or the size of the force that is applied (mechanical advantage) but that the amount of energy transferred by the simple machine is equal to the amount of energy transferred to the simple machine</li> <li>The effort force and the effort distance form an inverse relationship (sometimes described in terms of “trade-off”). This relationship stems from the fact that it takes a specific amount of energy to complete a given task. Changes take place because of the transfer of energy. Energy is transferred to matter through the action of forces. Different forces are responsible for the transfer of the different forms of energy.</li> <li>The longer the inclined plane, the smaller the effort force needed to move the object up the inclined plane and vice versa.</li> <li>In a lever and fulcrum system, placement of the fulcrum closer to the load will reduce the amount of effort force needed to lift the load.</li> <li>Directional advantage in a pulley system can create an advantage for the user.</li> <li>Mechanical advantage in a pulley system can create an advantage for the user.</li> <li>Energy input in a pulley system is equal to the effort force multiplied by the effort distance.</li> </ul>	<ul style="list-style-type: none"> <li>What makes a question scientific?</li> <li>What constitutes evidence? When do you know you have enough evidence?</li> <li>Why is it necessary to justify and communicate an explanation?</li> <li>How can energy be transferred from one material to another?</li> <li>What happens to a material when energy is transferred to it?</li> <li>How does energy play a role in our lives?</li> <li>How do machines impact our lives?</li> <li>Why is it important to learn the relationship between effort and work produced through simple machines?</li> </ul>
<b><i>Knowledge:</i></b>	<b><i>Skills:</i></b>
<p><b><i>Student will Know....</i></b></p> <ul style="list-style-type: none"> <li>All simple machines operate on the fact that the input energy is equal to the output energy, but the effort force and effort distance are most likely different from the load/resistance force and load/resistance distance.</li> <li>The ratio (comparison) of load/resistance force to the effort force is called the mechanical advantage (MA).</li> <li>When using simple machines, the smaller the effort force, the larger the effort distance. This is an inverse relationship.</li> <li>The load is not an object, but a force. The “load” in a simple machine system is typically the weight of an object, but it can also be a resistance force</li> </ul>	<p><b><i>Students will be able to...</i></b></p> <ul style="list-style-type: none"> <li>Determine where to place the effort force and fulcrum in order to lift an object with the least amount of effort force.</li> <li>Read a spring scale to measure the amount of effort force.</li> <li>Recognize and describe how levers used in daily life.</li> <li>Describe the relationship between the effort force and the effort distance.</li> <li>Collect data in a single and a double pulley system.</li> <li>Make observations of pulley systems and draw conclusions using data.</li> <li>Use multiplication skills to complete a data table.</li> <li>Draw conclusions about data from previous inquiries to use with present investigations.</li> </ul>

<p>such as the force of friction between a nail and a piece of wood.</p> <ul style="list-style-type: none"> <li>• A lever is composed of three basic parts. They are the effort force, the load/resistance force, and the fulcrum.</li> <li>• The placement of the fulcrum, effort force, and the load/resistance force determines the classification of the lever and more importantly how it can be used to transfer energy.</li> <li>• A pulley can create an advantage to the user simply by changing the direction of the effort force and it may or may not also provide a mechanical advantage as well.</li> <li>• An inclined plane can also provide a mechanical advantage to its user. The longer the inclined plane, the smaller the effort force needed to move the object up the inclined plane.</li> <li>• A screw is actually an inclined plane wrapped around an axis.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the effort force and effort distance in an inclined plane system.</li> <li>• Make observations about inclined plane systems, collect data in an inclined plane system, and draw conclusions.</li> <li>• Apply knowledge of inclined plane systems to practical applications.</li> <li>• Identify how the screw is an example of an inclined plane.</li> <li>• Conduct investigations using simple machines to demonstrate how forces transfer energy. Explain that simple machines may change the direction of an applied force (directional advantage) or the size of the force that is applied (mechanical advantage) but that the amount of energy transferred by the simple machine is equal to the amount of energy transferred to the simple machine.</li> </ul>
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### ***Evidence of Understanding:***

<p>Pre- Assessment Notebook and Journal Entries FOSS Reading Writing Prompt Teacher Observation/Anecdotal Notes Homework Checkpoint Assessments I-Check Assessments Unit Assessments</p>	<p><b><i>Assessments Data –Propagated to Genesis Investigation 1</i></b> Pre Assessment Notebook Assessment- Summative I-Check 1 I-Check 2 I-Check 3 Unit Post Assessment</p>
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### **Preconception /Misconceptions**

#### **Describing motion—kinematics**

- Two objects side by side must have the same speed.
- Acceleration and velocity are always in the same direction.
- Velocity is a force.
- If velocity is zero, then acceleration must be zero too.
- Heavier objects fall faster than light ones.
- Acceleration is the same as velocity.
- The acceleration of a falling object depends upon its mass.  
If the speed of an object is increasing, so is its acceleration.
- Velocity is another word for speed. An object's speed and velocity are always the same.
- Acceleration always means that an object is speeding up. Acceleration is always in a straight line. Acceleration always occurs in the same direction as an object is moving.
- If an object has a speed of zero (even instantaneously), it has no acceleration.

***List other that you discover in your class:***

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#### **Mass, Weight, and Gravity**

- A kilogram of iron weighs more than a kilogram of feathers.

- Weight and mass are the same thing; weight is not considered as a gravitational force.
- There must be air for gravity to take effect; therefore, there is no gravity on the moon, nor is there gravity out in space.
- Earth's magnetism and spin are connected with gravity.
- Things fall naturally without the need for a force.
- Heavier things fall faster than light things.
- Gravity only acts on an object when it begins to fall and when falling.
- Gravity ceases to act when the object lands on the ground and becomes stationary.
- All objects can be moved with equal ease in the absence of gravity.

**List other that you discover in your class:**

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### **Explaining motion—dynamics**

- Forces are only associated with movement.
- Forces get things going rather than making things stop.
- Forces are associated with living things, physical activity and muscular strength.
- Inanimate objects do not apply forces.
- Forces keep objects in motion.
- When an object is moving, there is a force in the direction of its motion.
- A moving object has a force within it which keeps it going.
- Force is a property of a single object rather than a feature of the interaction between two objects.
- If the pushing force ceases there is a force on the moving object which keeps it moving but which gradually gets used up and then the object stops.
- Friction is associated with heat.
- Friction only occurs between solids.
- If an object is at rest, no forces are acting on the object. Only animate objects can exert a force. Thus, if an object is at rest on a table, no forces are acting upon it.
- A force is needed to keep an object moving with a constant speed.
- Action–reaction forces act on the same object.
- Inertia is the force that keeps objects in motion.
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**List other that you discover in your class:**

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### **Energy**

- Energy gets used up or runs out.
- Something not moving does not have energy.
- Gravitational potential energy is the only type of potential energy.
- Energy is only caused by life/animal activity.
- Conservation of energy means that energy should be conserved.
- Energy and force are the same thing.
- Energy is a thing.
- Gravitational potential energy depends only on the height of an object.
- Doubling the speed of a moving object doubles the kinetic energy.
- Energy can be changed completely from one form to another (no energy losses).
- Energy is truly lost in many energy transformations. Things 'use up' energy

**List other that you discover in your class:**



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### ***Pressure, Momentum, and Machines***

- Only wind, and not still air, has a pressure.
- Air pressure is a downwards influence.
- A vacuum sucks.
- Pressure is the same as force.
- Momentum is the same as force.
- Momentum and kinetic energy are the same thing.
- Machines must have a motor.
- Machines are only inanimate objects.

***List other that you discover in your class:***

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<b><i>Investigation</i></b>	<b><i>Timeframe</i></b>
Investigation 1 Levers	3-5 hours/days
Investigation 2 More Leverage	5-7 hours/days
Investigation 3 Pulleys	4-5 hours/days
Investigation 4 Pulleys at Work	4 hours/days

## Materials Sheet

### THE MAGNETISM AND ELECTRICITY

#### A FULL KIT CONTAINS

- 1 Teacher Guide
- 1 Teacher Preparation Video
- Equipment for 32 students working in 8 collaborative groups of 4 students
- FOSS Science Stories, Magnetism and Electricity and

#### LEVERS AND PULLEYS EQUIPMENT

- 18 Binder clips, medium size, 1 1/4"
- 9 Cardboard sheets, 30 cm X 50 cm
- 420 Dots, adhesive, 3/4" diameter, light blue
- 18 Dowels, 36 cm, 5/16" diameter
- 1 roll Duct tape, 20 m/roll
- 20 Erasers, pencil-cap
- 17 Half-meter sticks
- 18 Loads, 240 g
- 1 box Paper clips, regular
- 1 set Posters of levers and pulleys, 8/set
- 2 Pulleys, double-wheel
- 18 Pulleys, single-wheel
- 3 pkgs Rope, cotton mason line, 22.5 m
- 120 Rubber bands, # 62
- 18 Spring scales, 10-N limit
- 1 Transparency, *Spring Scale*

#### REFILL PACKAGES

Standard Refill Packages of consumable items are available. A Refill Package for a module includes sufficient quantities of all consumable materials to use the kit with two classes of 32 students.

**Be aware that the classroom teacher or school site must supply a few items. Here is a summary of supplies not included in the kit.**

#### Investigation 1: Levers

- Masking tape, 1" wide
- 1 Permanent marking pen
- 1 Overhead projector
- Notebook paper
- 2 Lengths of wood
- 1 Flip chart
- 1 Transparency (optional)

#### Investigation 2: More Leverage

- Masking tape
- 1 Broom
- 1 Nutcracker
- 1 Scissors
- 1 Bottle opener
- 1 Pliers
- 1 Tweezers
- 1 Hammer

#### Investigation 3: Pulleys

- Heavy books
- Masking tape
- 1 Scissors
- 1 Overhead projector (optional)
- 1 Overhead-transparency pen
- 1 Transparency

#### Investigation 4: Pulleys at Work

- Heavy books
- Masking tape
- 8 Sheets of white paper
- Poster board (optional)
- Scissors

# STANDARDS

## New Jersey Common Core Standards

5.1 Science Practices	All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.
<b>Strand A</b>	<b>Understand Scientific Explanations: Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world. Who, what, when, where, why, and how questions form the basis for young learners' investigations during sensory explorations, experimentation, and focused inquiry</b>
5.1.8.A.3	Use scientific principles and models to frame and synthesize scientific arguments and pose
<b>Strand B</b>	<b>Generate Scientific Evidence Through Active Investigations: Observations and investigations form young learners' understandings of science concepts.</b>
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.
5.1.8.B.4	Use quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.
<b>Stand C</b>	<b>Reflect on Scientific Knowledge: Interacting with peers and adults to share questions and explorations about the natural world builds young learners' scientific knowledge.</b>
5.1.8.C.1	Monitor one's own thinking as understandings of scientific concepts are refined.
5.1.8.C.2	Revise predictions or explanations on the basis of discovering new evidence, learning new information, or using models.
5.1.8.C.3	Generate new and productive questions to evaluate and refine core explanations.
<b>Strand D</b>	<b>Participate Productively in Science: Science practices include drawing or "writing" on observation clipboards, making rubbings, or charting the growth of plants.</b>
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.
5.1.8.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
5.1.8.D.3	Demonstrate how to safely use tools, instruments, and supplies.
5.1.8.D.4	Handle and treat organisms humanely, responsibly, and ethically.
5.2Physical Science	All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.
<b>Strand E</b>	<b>Forces and Motion: It takes energy to change the motion of objects. The energy change is understood in terms of forces.</b>
5.2.2.E.2	Predict an object's relative speed, path, or how far it will travel using various forces and surfaces.
5.2.2.E.3	Distinguish a force that acts by direct contact with an object (e.g., by pushing or pulling) from a force that can act without direct contact (e.g., the attraction between a magnet and a steelpaper clip).
5.2.8.E.1	Calculate the speed of an object when given distance and time.
5.2.8.E.2	Compare the motion of an object acted on by balanced forces with the motion of an object acted on by unbalanced forces in a given specific scenario.

## Next Generation Science Standards

### Performance Expectations

**3-5-ETS1-1** Students who demonstrate understanding can define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

**3-5-ETS1-2** Students who demonstrate understanding can generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

**3-5-ETS1-3** Students who demonstrate understanding can plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

### NGSS Science and Engineering Practices

#### **Asking Questions and Defining Problems**

Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

#### **Planning and Carrying Out Investigations**

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3)

#### **Constructing Explanations and Designing**

Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)

### Disciplinary Core Ideas

#### **ETS1.A: Defining and Delimiting Engineering Problems**

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

#### **ETS1.B: Developing Possible Solutions**

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

#### **ETS1.C: Optimizing the Design Solution**

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)

### Cross Cutting Concepts

Influence of Engineering, Technology, and Science on Society and the Natural World

- People's needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1)
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

## Common Core State Standards

### CCSS: English Language Arts

#### Reading Informational Text

RI.5.1	Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (3-5-ETS1-2)
RI.7.7	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. (3-5-ETS1-2)
RI.5.9	Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS1-2)

#### CCSS: Writing-

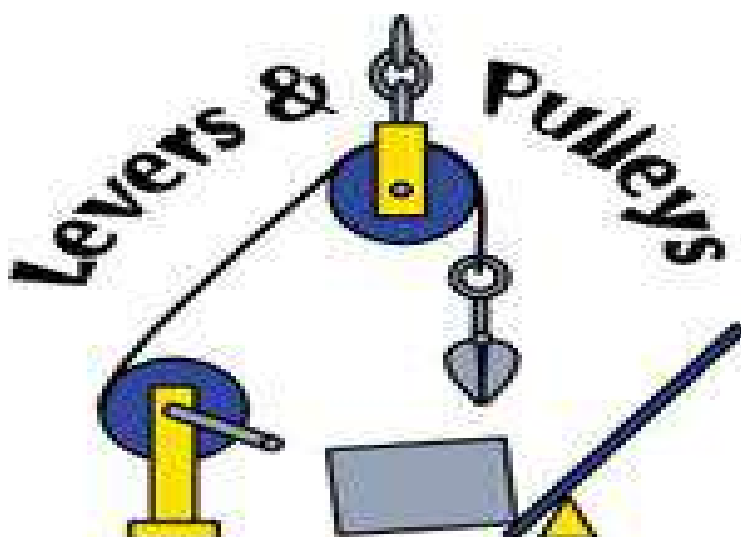
W.5.7	Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1),(3-5-ETS1-3)
W.5.8	Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-1),(3-5-ETS1-3)
W.5.9	Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1),(3-5-ETS1-3)

### CCSS: Mathematics

MP.2	Reason abstractly and quantitatively. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
MP.4	Model with mathematics. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
MP.5	Use appropriate tools strategically. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
3-5.OA	Operations and Algebraic Thinking (3-5-ETS1-1),(3-5-ETS1-2)

***Before beginning unit administer pretest.***

Check that all materials are available, usable, and ready



## INVESTIGATION I

### “Levers”

#### Summary

Students are introduced to levers as devices that help lift weight or overcome resistance. Students investigate the fulcrum, effort, and load of one kind of lever (class-1) and conduct experiments with a spring scale to discover the relationships between the parts of leversy stems. They gather data and graph the results in order to draw conclusions about the advantage in using levers.

#### Core Conceptual Ideas

- A lever is a simple machine that people use to gain an advantage, such as making work easier.
- An advantage is a benefit obtained by using a lever (or other simple machine).
- Effort is the force needed to move a load or overcome a resistance.
- Fulcrum is the point where a lever arm pivots.
- Load is a mass lifted or a resistance over come by a lever

#### Goals and Objectives

Students...

- Gain experience constructing and using levers.
- Learn the concepts of lever arm, fulcrum, load, and effort.
- Experience one advantage that can be gained by using a lever-reduced effort.
- Collect, organize, and analyze data from lever experiment,
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, and relating.

#### New Vocabulary

Levers, Advantage, Effort, Fulcrum, Lever, Lever arm, Load, Newton, Two-coordinate graph, Weight, Mass

#### Interdisciplinary Connections:

#### Math Extensions

- Problem of the week.
- Introduce decimals.

#### Science Extensions

- Build a teeter-totter.
- Pull some nails.

### Body of Evidence

#### Assessments

*(Should be scored in Genesis)*

Pretest – No grade in Genesis

#### Embedded Assessment

Science Notebook Entry (minimum 3)  
Student Response Sheets No. 2,4, 5& 6  
Teacher Observation

#### Benchmark Assessment

- I-Check 1

#### Assessments Data –Propagated to Genesis

Pre Assessment – no grade  
Notebook Investigation Entry Part 1  
I-Check 1

## Part I

### Investigation 1

#### Part 1 - “Introduction to Levers”

##### Summary

Students are introduced to levers as devices that help lift weight and overcome resistance. They develop an intuitive sense of how levers work, become familiar with lever terminology, and learn to use a spring scale.

##### Core Ideas/Understandings

- A lever is a simple machine.
- Simple machines provide advantage to the user.
- The unit used to measure the amount of force needed to lift a load or overcome a resistance is the Newton (N)

##### S&E Practices Alignment

NGSS  
Asking Questions and  
Defining Problems

##### CC Concepts Alignment

NGSS  
Defining and  
Delimiting  
Engineering  
Problems

##### Focus Questions

- What do you notice about a lever?
- How can a lever make work easier?

##### **Teacher Preparation/Notes**

- **Read Teachers Edition**
- Investigation 1 “At A Glance Matrix, ”, Background for Teachers” and Teaching Children About Levers, “Teacher Guide Science Stories Folio
- **Review**
- “ Materials”, “Getting Ready” & “Guiding the Investigation”
- **Prepare** materials

Note: Plan to obtain a real world lever

##### **Body Of Evidence**

- **Diagnostic Assessment:** Survey/Pre- Assessment
- **Notebook:** Investigation 1 Entry 1
- **Student Sheet:** No. 2
- **FOSS Science Stories:** Simple Machines, pages 1-4
- **Writing Prompt:** Respond to Focus Question
- **Journal Entry:** Reflection
- **Teacher Observation:** Anecdotal Notes

**Data to be recorded in Genesis**

##### **Est. Time**

2 Sessions

##### **Homework/Center Activities/Extra Practices**

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• Rising Readorium (20 min/night),</li> <li>• Spelling City(vocab);</li> <li>• FOSS Digital Resources: eBook, Audio Stories</li> <li>• Suggested websites</li> </ul> | <ul style="list-style-type: none"> <li>• Word wall activities</li> <li>• Cross Curriculum Extensions</li> <li>• Informational Text–Reading</li> <li>• Home School Connection.</li> </ul> |
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**Suggested Homework:** What is an example of a lever you use at home? Make a scientific drawing of this lever. Write a description of how this lever makes work easier for you

## Part 2

### Investigation 1

#### ***Part 2–Investigation More Magnetic Properties***

Students conduct a lever experiment, keeping the load stationary, to discover the relationship among the load, fulcrum, and effort. They gather data and graph the results in order to draw conclusions about the advantage in using levers.

<u>Core Ideas/Understandings</u>	<u>S&amp;E Practices Alignment</u>	<u>CC Concepts Alignment</u>
<ul style="list-style-type: none"><li>• The greatest advantage is gained if the load close to the fulcrum and the effort is applied as far from the fulcrum as possible.</li><li>• Two-coordinate graphs show a relationship between two variables</li></ul>	<u>NGSS</u> Planning and Carrying Out Investigations	<u>NGSS</u> Defining and Delimiting Engineering Problems
<u>Focus Questions</u>		
What is the relationship between the position of the effort and the amount of force needed to lift the load?		
Teacher Preparation	Body Of Evidence	Est. Time
Read Teacher’s Guide <ul style="list-style-type: none"><li>• “Materials” “Getting Ready” &amp; “Guiding the Investigation</li><li>• Watch Video Demo of Inv.1 Part 2</li><li>• Prepare Materials</li></ul>	<ul style="list-style-type: none"><li>• <b>Notebook:</b> Investigation 1 Entry Part 2</li><li>• <b>Student Sheets:</b> No. 4 and 5</li><li>• <b>Reading:</b> FOSS Student Text Class-1 Levers, pages 5-6</li><li>• <b>Writing Prompt:</b> Respond to Focus Questions</li><li>• <b>Journal Entry:</b> Reflection</li></ul>	2 sessions
Homework/Center Activities/Extra Practices		
<ul style="list-style-type: none"><li>• Rising Readorium (20 min/night),</li><li>• Spelling City(vocab);</li><li>• FOSS Digital Resources: eBook, Audio Stories</li><li>• Suggested websites</li></ul>	<ul style="list-style-type: none"><li>• Word wall activities</li><li>• Cross Curriculum Extensions</li><li>• Informational Text –Reading</li><li>• Math Extension, Student Sheet No. 28</li></ul>	
Culminating Activity		
TBA		



## Part 3

### Investigation 1

#### Part 3 – Breaking The Force

Students conduct another lever experiment, this time applying the effort in the same position every time to see what happens to the amount of effort needed as the load moves to different positions on the lever arm

<u>Core Ideas/Understandings</u>	<u>S&amp;E Practices Alignment</u>	<u>CC Concepts Alignment</u>
<ul style="list-style-type: none"> <li>When effort is applied at a predetermined position, the closer the load is to the fulcrum, the easier it is to lift.</li> </ul>	<u>NGSS</u> Planning and Carrying Out Investigations	<u>NGSS</u> Developing Possible Solutions

#### Focus Questions

What happens to the effort needed to lift a load as the position of the load changes?

Teacher Preparation	Body Of Evidence	Est. Time
<u>Read Teacher’s Guide</u> <ul style="list-style-type: none"> <li>Review “Materials” “Getting Ready” &amp; “Guiding the Investigation”</li> </ul> Watch Video Demo of Inv.1 Part 3	<ul style="list-style-type: none"> <li><b>Notebook:</b> Investigation 1 Entry 3</li> <li><b>Student Sheet:</b> No. 6</li> <li><b>Reading FOSS Science Stories:</b> The Wheel and Axle, pages 7-9</li> <li><b>Writing Prompt:</b> Respond to Focus Question</li> <li><b>Journal Entry:</b> Reflection</li> <li><b>Teacher Observation:</b> Assessment Chart for Investigation 1, Part 3</li> <li><b>Benchmark Assessment: I Check 1</b></li> </ul>	2 sessions

#### Homework/Center Activities/Extra Practices

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>Rising Readorium (20 min/night),</li> <li>Spelling City(vocab);</li> <li>FOSS Digital Resources: eBook, Audio Stories</li> <li>Suggested websites</li> </ul> | <ul style="list-style-type: none"> <li>Word wall activities</li> <li>Cross Curriculum Extensions</li> <li>Informational Text –Reading</li> <li>Home School Connection- Student Sheet No. 32</li> </ul> |
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Suggested Homework: Class/group activity: Make a list of 26 machines— one for each letter of the alphabet. (Hint: you may use simple or complex machines.)  
Review Experiment

#### Culminating Activity

**TBA**

## INVESTIGATION 2

### Investigation 2 "More Leverage"

#### Summary

Students investigate and diagram class-1, class-2, and class-3 lever systems. They investigate and diagram common tools to determine how the tools apply levers. Observe the behavior of different kinds of levers. Students compare the effort to lift loads with different kinds of levers. They diagram the relative positions and sizes of lever components in different systems. Students also analyze tools in terms of their application as levers. They analyze pictures of familiar tools, identify them by lever class, and diagram the lever system.

#### Concepts:

- A class-1 lever has the fulcrum between the load and the effort.
- A class-2 lever has the load between the effort and the fulcrum.
- A class-3 lever has the effort between the fulcrum and the load.
- Conventions are operating procedures that help people communicate more efficiently.
- Advantage is a gain in effort, distance, or change of direction resulting from the use of a simple machine.

#### Goals and Objectives

*Students...*

- Learn to identify class-1, class-2, and class-3 levers.
- Diagram levers to show placement and direction of the load and effort.
- Analyze common tools in terms of levers.
- Analyze Pictures of tools in terms of levers.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communication, comparing, organizing and relating.

#### New Vocabulary Investigation 2

Class-1 Lever, Class-2 Lever, Class-3 Lever

#### Interdisciplinary Connections:

##### Language Extensions

- Make up riddles.
- List everyday levers.
- Diagram make-believe levers.

##### Math Extensions

- Problem of the week.
- Graph class-2 levers.
- Graph class-3 levers.

##### Science Extensions

- Build a compound lever.

##### Art Extension

- Make a levers bulletin board.

#### Body Of Evidence

##### Assessments

*(Should be scored in Genesis)*

##### Embedded Assessment

Science Notebook Entry (minimum 4)

Student Response Sheets No. 7,,10,11,12,16,&17

Teacher Observation

##### Benchmark Assessment

- I-Check 2

##### Assessments Data –Propagated to Genesis

I Check 2

Student Observation/ Anecdotal Notes

## Part I

### Investigation 2

#### ***Part 1: Lighting the Bulb***

#### ***Summary***

Students use lever-system components to explore the possible arrangements of the fulcrum, effort, and load on the lever arm. They learn that each arrangement has a name: class 1, class 2, or class 3

<u>Core Ideas/Understandings</u>	<u>S&amp;E Practices Alignment</u>	<u>CC Concepts Alignment</u>
<ul style="list-style-type: none"> <li>A class-1 lever has the fulcrum between the load and the effort.</li> <li>A class-2 lever has the load between the effort and fulcrum.</li> <li>A class-3 lever has the effort between the fulcrum and the load.</li> </ul>	<u>NGSS</u> Asking Questions and Defining Problems	<u>NGSS</u> Defining and Delimiting Engineering Problems

#### ***Focus Questions***

How can you arrange the fulcrum, load and effort to make different lever systems?

<b>Teacher Preparation</b>	<b>Body Of Evidence</b>	<b>Est. Time</b>
<b>Read Teacher's Edition</b> <ul style="list-style-type: none"> <li>"At A Glance", "Background for the Teacher"&amp; "Teaching Children More About Levers"</li> <li>"Materials" "Getting Ready" &amp; "Guiding the Investigation"</li> </ul> <b>Watch</b> Video Demonstration of Inv. 2 Part1 <b>Prepare</b> materials	<ul style="list-style-type: none"> <li><b>Notebook:</b> Investigation 2 Entry 1</li> <li><b>Writing Prompt:</b> Respond to Focus Questions</li> <li><b>Journal Entry:</b></li> <li><b>Teacher Observation:</b> Assessment Chart for Investigation 2, Part 1</li> </ul>	2sessions

#### **Homework/Center Activities/Extra Practices**

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| <ul style="list-style-type: none"> <li>Rising Readorium (20 min/night)</li> <li>Spelling City(vocab);</li> <li>FOSS Digital Resources: eBook, Audio Stories</li> <li>Suggested websites</li> </ul> | <ul style="list-style-type: none"> <li>Word wall activities</li> <li>Cross Curriculum Extensions</li> <li>Informational Text–Reading</li> <li>Home School Connection , Student Sheet No. 35</li> </ul> |
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## Part 2

### Investigation 2

#### Part 2 – Levers Diagrams

#### Summary

Students explore the advantage that can be gained by using each class of lever. They learn several conventions for communicating and keeping permanent records of lever systems.

<u>Core Ideas/Understandings</u>	<u>S&amp;E Practices Alignment</u>	<u>CC Concepts Alignment</u>
<ul style="list-style-type: none"> <li>Conventions acknowledged by a group of people help them to communicate better and more efficiently.</li> <li>Advantage is a gain in effort, distance, or change of direction resulting from the use of a simple machine.</li> </ul>	<u>NGSS</u> Planning and Carrying Out Investigations	<u>NGSS</u> Defining and Delimiting Engineering Problems

#### Focus Questions

How can we communicate our lever system designs with others?

Teacher Preparation	Body Of Evidence	Est. Time
<b>Read Teacher's Guide</b> <ul style="list-style-type: none"> <li>"Materials" "Getting Ready" &amp; "Guiding the Investigation"</li> </ul> <b>Watch Video Demo of Inv.2 Part 2</b> Prepare materials	<ul style="list-style-type: none"> <li><b>Notebook:</b> Investigation 2 Entry 2</li> <li><b>Student Sheets:</b> No. 10 and 11</li> <li><b>Reading FOSS Science Stories:</b> Class-2 Levers, pages 10-11</li> <li><b>Writing Prompt:</b> Respond to Focus Question</li> <li><b>Journal Entry:</b></li> <li><b>Teacher Observations:</b> Assessment Chart for Investigation 2, Part 2</li> </ul>	2sessions

#### Homework/Center Activities/Extra Practices

<ul style="list-style-type: none"> <li>Rising Readorium (20 min/night)</li> <li>Spelling City(vocab);</li> <li>FOSS Digital Resources: eBook, Audio Stories</li> <li>Suggested websites</li> </ul>	<ul style="list-style-type: none"> <li>Word wall activities</li> <li>Cross Curriculum Extensions- Math Extension, Student Sheet No. 29</li> <li>Informational Text -Reading</li> </ul>
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***Suggested Homework:*** Look around your neighborhood to find examples of inclined planes, wedges or screws. Record your findings in your laboratory notebook. Include a photo or drawing and description.

## Part 3

<b><u>Investigation 2</u></b> <b><u>Part 3 – Real-World Levers</u></b>		
<b><u>Summary</u></b> Students investigate common tools to determine that they are applications of the three classes of levers.		
<b><u>Core Ideas/Understandings</u></b>	<b><u>S&amp;E Practices Alignment</u></b>	<b><u>CC Concepts Alignment</u></b>
<ul style="list-style-type: none"> <li>Conventions acknowledged by a group of people help them to communicate better and more efficiently.</li> <li>Advantage is a gain in effort, distance, or change of direction resulting from the use of a simple machine.</li> </ul>	<b><u>NGSS</u></b> Asking Questions and Defining Problems	<b><u>NGSS</u></b> Defining and Delimiting Engineering Problems Developing Possible Solutions
<b><u>Focus Questions</u></b> <ul style="list-style-type: none"> <li>How do levers help us make work easier in everyday situations?</li> </ul>		
<b>Teacher Preparation</b>	<b>Body Of Evidence</b>	<b>Est. Time</b>
<b>Read Teacher’s Guide</b> <ul style="list-style-type: none"> <li>“Materials” “Getting Ready” &amp; “Guiding the Investigation</li> </ul> <b>Watch Video Demo of Inv.2 Part 3</b> <b>Prepare materials</b>	<ul style="list-style-type: none"> <li><b>Notebook:</b> Investigation 2 Entry 3</li> <li><b>Student Sheet:</b> No. 12</li> <li><b>Reading FOSS Science Stories:</b> Class-3 Levers, pages 12-13</li> <li><b>Writing Prompt:</b> Respond to Focus Questions</li> <li><b>Journal Entry:</b></li> <li><b>Teacher Observation Assessment:</b> Chart for Investigation 2, Part 3</li> </ul>	2sessions
<b>Homework/Center Activities/Extra Practices</b>		
<ul style="list-style-type: none"> <li>Rising Readorium (20 min/night)</li> <li>Spelling City(vocab);</li> <li>FOSS Digital Resources: eBook, Audio Stories</li> <li>Suggested websites</li> </ul>	<ul style="list-style-type: none"> <li>Word wall activities</li> <li>Cross Curriculum Extensions- Math Extension, Student Sheet No. 30</li> <li>Informational Text -Reading</li> </ul>	
<b><i>Suggested Center Activities: Spelling City, Foss suggested websites, word wall activities, extensions, additional supporting Science Activities,</i></b>		
<b><i>Culminating Activity: Continue to work on projects.</i></b>		

## Part 4

### Investigation 2

#### Part 4 – Lever Pictures

#### Summary

Students analyze pictures of familiar tools, identify them by lever class, and diagram the lever systems.

<u>Core Ideas/Understandings</u>	<u>S&amp;E Practices Alignment</u>	<u>CC Concepts Alignment</u>
<ul style="list-style-type: none"><li>Conventions acknowledged by a group of people help them to communicate better and more efficiently.</li><li>Advantage is a gain in effort, distance, or change of direction resulting from the use of a simple machine.</li></ul>	<u>NGSS</u> Asking Questions and Defining Problems	<u>NGSS</u> Defining and Delimiting Engineering Problems
<p style="text-align: center;"><u>Focus Questions</u></p> <ul style="list-style-type: none"><li>How can we analyze and classify different lever systems</li></ul>		
Teacher Preparation	Body Of Evidence	Est. Time
<p><b>Read Teacher’s Guide</b></p> <ul style="list-style-type: none"><li>“Materials” “Getting Ready” &amp; “Guiding the Investigation</li></ul> <p><b>Watch</b> Video Demo of Inv.2 Part 4</p> <p><b>Prepare</b> materials</p>	<ul style="list-style-type: none"><li><b>Notebook:</b> Investigation 2 Entry 4</li><li><b>Student Sheets:</b> Nos. 16, 17</li><li><b>Reading FOSS Science Stories:</b> The Inclined Plane, pages 14-15About Edison, pages 14-15</li><li><b>Writing Prompt:</b> Respond to Focus Question</li><li><b>Journal Entry</b></li><li><b>Benchmark Assessment: I-Check 2</b></li></ul>	3 sessions
Homework/Center Activities/Extra Practices		
<ul style="list-style-type: none"><li>Rising Readorium (20 min/night)</li><li>Spelling City(vocab);</li><li>FOSS Digital Resources: eBook, Audio Stories</li><li>Suggested websites</li></ul>	<ul style="list-style-type: none"><li>Word wall activities</li><li>Cross Curriculum Extensions</li><li>Informational Text–Reading</li><li>Home School Connection Student Sheet No. 32</li></ul>	
Culminating Activity: Continue to work on projects.		

## INVESTIGATION 3

### Investigation 3

#### "Pulleys"

#### Summary

Students are introduced to a second simple machine and discover how to setup single fixed and single movable pulleys to lift a load. They use a scale to quantify effort with single pulleys. They go on to set up and diagram multiple pulley systems.

#### Concepts

- A single-pulley system can be set up in two ways, fixed or movable.
- A single-movable-pulley system provides a mechanical advantage for its user.
- A single-fixed-pulley system provides no mechanical advantage, but changes the direction of the effort.
- A two-pulley system can be made with one fixed and one movable pulley.
- A two-pulley system in which the effort is applied upward provides a greater advantage than one in which the effort is applied downward.

#### Goals and Objectives

*Students...*

- Assemble and investigate one- and two-pulley systems.
- Learn vocabulary associated with pulley system.
- Discover the advantages of using pulleys: decrease in effort and change in direction of effort.
- Diagram pulley systems.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, and relating.

#### New Vocabulary Investigation 3

Directional Advantage, Fixed pulley, Mechanical advantage, Movable pulley, Pulley, Compound Effort up, Compound Effort down, Simple machine

#### Interdisciplinary Connections:

##### Language Extensions

- Write about Sparky and his troop.
- Research block and tackle.
- Write a make-believe story about how the pulley got its name

##### Math Extensions

- Problem of the week.
- Explore number patterns.

##### Science Extensions

- Set up a pulley learning center.
- Do real work with pulleys.
- Find pulleys in use at home and school

#### Body of Evidence

##### Assessments

*(Should be scored in Genesis)*

##### Embedded Assessment

Science Notebook Entry (minimum 3)  
Student Response Sheets No. 18&19  
Teacher Observation

##### Benchmark Assessment

- I-Check 3

##### Assessments Data –Propagated to Genesis

I Check 3

## Part I

### Investigation 3

#### Part 1: One-Pulley Systems

#### Summary

Students discover two ways to set up a one-pulley system to lift a load: single fixed pulley and single movable pulley. They use a spring scale to quantify and compare the effort needed to lift the load in each system.

#### Core Ideas/Understandings

- A single pulley can be set up in two ways, fixed or moveable.
- A single movable pulley can lift a load using half as much force as a single fixed pulley.
- A single fixed pulley gives the advantage of change of direction.

#### S&E Practices Alignment

NGSS  
Developing Possible Solutions

#### CC Concepts Alignment

NGSS  
Constructing Explanations and Designing

#### Focus Questions

- What do you notice about pulleys?

#### **Teacher Preparation**

##### **Read Teacher's Edition**

- "At A Glance", "Background for the Teacher" & "Teaching Children About Pulleys"
- "Materials" "Getting Ready" & "Guiding the Investigation"

**Watch** Video Demonstration of Inv. 3 Part I

**Prepare** materials

#### **Body Of Evidence**

- **Notebook:** Investigation 3 Entry 1
- **Student Sheet:** No. 18
- **Reading FOSS Science Stories:** Pulleys, pages 16-18
- **Writing Prompt:** Respond to Focus Questions
- **Journal Entry:**
- **Teacher Observation:** Assessment Chart for Investigation 3

#### **Est. Time**

2 sessions

#### **Homework/Center Activities/Extra Practices**

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|--|---|
| <ul style="list-style-type: none"> <li>• Rising Readorium (20 min/night)</li> <li>• Spelling City(vocab);</li> <li>• FOSS Digital Resources: eBook, Audio Stories</li> <li>• Suggested websites</li> </ul> | <ul style="list-style-type: none"> <li>• Word wall activities</li> <li>• Cross Curriculum Extensions</li> <li>• Informational Text–Reading</li> <li>• Home School Connection, Student Sheet No. 36</li> </ul> |
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## Part 2

### Investigation 3:

#### Part 2. Building Parallel Circuits

#### Summary

Students investigate how two pulleys can be used together. Then they diagram the four pulley systems that can be assembled with one or two pulleys.

<u>Core Ideas/Understandings</u>	<u>S&amp;E Practices Alignment</u>	<u>CC Concepts Alignment</u>
<ul style="list-style-type: none"> <li>Two-pulley systems often use one fixed pulley and one moveable pulley.</li> <li>A two-pulley system in which the effort is applied upward provides a greater mechanical advantage than one in which the effort is applied downward.</li> </ul>	<u>NGSS</u> Developing Possible Solutions	<u>NGSS</u> Constructing Explanations and Designing

#### Focus Question

How can we use two pulleys at the same time?

<b>Teacher Preparation</b>	<b>Body Of Evidence</b>	<b>Est. Time</b>
<b>Read Teacher's Guide</b> <ul style="list-style-type: none"> <li>"Materials" "Getting Ready" &amp; "Guiding the Investigation"</li> </ul> <b>Watch Video Demo of Inv.3 Part 2</b> Prepare materials	<ul style="list-style-type: none"> <li><b>Notebook:</b> Investigation 3 Entry 2</li> <li><b>Student Sheet:</b> No. 19</li> <li><b>Reading:</b> <i>FOSS Science Stories</i>: Dear Boss, pages 19-20</li> <li><b>Writing:</b> Respond to Focus Questions</li> <li><b>Journal Entry:</b></li> <li><b>Teacher Observation:</b> Assessment Chart for Investigation 3, Part 2</li> </ul>	2sessions

#### **Homework/Center Activities/Extra Practices**

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| <ul style="list-style-type: none"> <li>Rising Readorium (20 min/night)</li> <li>Spelling City(vocab);</li> <li>FOSS Digital Resources: eBook, Audio Stories</li> <li>Suggested websites</li> </ul> | <ul style="list-style-type: none"> <li>Word wall activities</li> <li>Cross Curriculum Extensions-Math Extension, Student Sheet No. 30</li> <li>Informational Text-Reading</li> </ul> |
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## Part 3

### Investigation 3:

#### Part 3. Solving the String of Lights Problem

#### Summary

Students play a game of setting up different pulley systems to practice what they have learned in the first two parts.

<u>Core Ideas/Understandings</u>	<u>S&amp;E Practices Alignment</u>	<u>CC Concepts Alignment</u>
<ul style="list-style-type: none"> <li>Two-pulley systems often use one fixed pulley and one moveable pulley.</li> <li>A two-pulley system in which the effort is applied upward provides a greater mechanical advantage than one in which the effort is applied downward.</li> </ul>	<u>NGSS</u> Developing Possible Solutions	<u>NGSS</u> Constructing Explanations and Designing

#### Focus Question

What observations can we make about pulley systems?

<u>Teacher Preparation</u>	<u>Body Of Evidence</u>	<u>Est. Time</u>
<b>Read Teacher's Guide</b> <ul style="list-style-type: none"> <li>"Materials" "Getting Ready" &amp; "Guiding the Investigation"</li> </ul> <b>Watch Video Demo of Inv. 3 Part 3</b> Prepare materials	<ul style="list-style-type: none"> <li><b>Notebook:</b> Investigation 3 Entry 3</li> <li><b>Reading FOSS Science Stories:</b> The Wedge, pages 21-22</li> <li>Writing Prompt: Respond to Focus Questions</li> <li><b>Teacher Observations:</b> Assessment Chart for Investigation 3, Part 3</li> <li><b>Journal Entry:</b></li> <li><b>Benchmark Assessment:</b> I Check 3</li> </ul>	3sessions

#### Homework/Center Activities/Extra Practices

<ul style="list-style-type: none"> <li>Rising Readorium (20 min/night)</li> <li>Spelling City(vocab);</li> <li>FOSS Digital Resources: eBook, Audio Stories</li> <li>Suggested websites</li> </ul>	<ul style="list-style-type: none"> <li>Word wall activities</li> <li>Cross Curriculum Extensions</li> <li>Informational Text –Reading</li> <li>Math Extension, Student Sheet No. 31</li> </ul>
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Make a graph showing how many electrical devices are used in your home at three different times of the day.

## INVESTIGATION 4

### Investigation 4 “Pulleys at Work”

#### Summary

Students systematically investigate four pulley systems. They record data on each system. They graph and determine the relationship between the number of ropes pulling on the load and the effort needed to lift it. They determine the distance that the load and effort travel when work is done. Students determine the advantage (and disadvantage) of different pulley systems.

#### Concepts

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

#### Goals and Objectives

*Students...*

- Investigate pulley systems with one and two pulleys.
- Discover the relationship between the number of ropes pulling on a load and the effort required to lift that load.
- Record and compare the distance moved by the load and the effort in four different pulley systems.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, and relating.

#### Interdisciplinary Connections

##### Language Extensions

- Research other simple machines.
- Research complex machines.

##### Math Extensions

- Problem of the week.
- Graph pulley results.

##### Science Extensions

- Try a different approach with two pulleys.
- Send pulleys home.
- Set up a complex system

#### Body Of Evidence

##### Assessments

*(Should be scored in Genesis)*

##### Embedded Assessment

Science Notebook Entry (minimum 3)  
Student Response Sheets No. 20, 23, 24, 25, 26& 27  
Teacher Observation

##### Benchmark Assessment

- I-Check 4

##### Assessments Data Due for District Analysis

Unit Post Test  
Science Notebook Assessment

## Part I

<b><u>Investigation 4</u></b> <b><u>Part 1: Effort in Pulley Systems</u></b>		
<b><u>Summary</u></b> Students systematically investigate four different pulley systems. They record the force of the load, the effort needed to lift the load, and the number of ropes supporting the load.		
<b><u>Core Ideas/Understandings</u></b>	<b><u>S&amp;E Practices Alignment</u></b>	<b><u>CC Concepts Alignment</u></b>
<ul style="list-style-type: none"> <li>The effort needed to lift a load can be predicted from the weight of the load and the number of ropes supporting the load.</li> </ul>	<b><u>NGSS</u></b> Developing Possible Solutions	<b><u>NGSS</u></b> Optimizing the Design Solution
<b><u>Focus Questions</u></b> <ul style="list-style-type: none"> <li>How can we use our data to predict the effort needed to lift a load in a pulley system?</li> </ul>		
<b>Teacher Preparation</b>	<b>Body Of Evidence</b>	<b>Est. Time</b>
<b>Read Teacher’s Edition</b> <ul style="list-style-type: none"> <li>“At A Glance”, “Background for the Teacher” &amp; “Teaching Children About Work”</li> <li>“Materials” “Getting Ready” &amp; “Guiding the Investigation”</li> </ul> <b>Watch</b> Video Demonstration of Inv. 4 Part1 <b>Prepare</b> materials	<ul style="list-style-type: none"> <li><b>Notebook:</b> Investigation 4 Entry 1</li> <li><b>Student Sheet:</b> No. 20</li> <li><b>Reading:</b> <i>FOSS Science Stories</i>: The Work of Pulleys, pages 23-25</li> <li><b>Teacher Observation:</b> Assessment Chart for Investigation 4, Part 1 –</li> <li><b>Writing Prompt:</b> Respond to Focus Question</li> <li>Journal Entry</li> </ul>	2sessions
<b>Homework/Center Activities/Extra Practices</b>		
<ul style="list-style-type: none"> <li>Rising Readorium (20 min/night)</li> <li>Spelling City(vocab);</li> <li>FOSS Digital Resources: eBook, Audio Stories</li> <li>Suggested websites</li> </ul>	<ul style="list-style-type: none"> <li>Word wall activities</li> <li>Cross Curriculum Extensions</li> <li>Informational Text –Reading</li> <li>Home School Connection, Student Sheet No. 34</li> </ul>	

## Part 2

### Investigation 4

#### Part 2: Measuring Distance

##### Summary

Students measure the distance over which effort must be applied to lift a load 5 cm. They discover that even though the effort is reduced, the distance it must cover increases, and that the distance traveled by the effort times the force of the effort is equal to the distance traveled by the load times the weight of the load.

<u>Core Ideas/Understandings</u>	<u>S&amp;E Practices Alignment</u>	<u>CC Concepts Alignment</u>
<ul style="list-style-type: none"> <li>“You never get something for nothing; for example, if the effort decrease, the distance you pull the rope increases.</li> </ul>	<u>NGSS</u> Developing Possible Solutions	<u>NGSS</u> Optimizing the Design Solution

##### Focus Questions

- What are the advantages and disadvantages of using pulleys?

<b>Teacher Preparation</b>	<b>Body Of Evidence</b>	<b>Est. Time</b>
<b>Read Teacher’s Guide</b> <ul style="list-style-type: none"> <li>“Materials” “Getting Ready” &amp; “Guiding the Investigation</li> </ul> <b>Watch</b> Video Demo of Inv.4, Part 1 Prepare materials	<ul style="list-style-type: none"> <li><b>Notebook:</b> Investigation 4 Entry2</li> <li><b>Student Sheets:</b> No. 23 and 24</li> <li><b>Reading:</b> <i>FOSS Science Stories: The Screw</i>, pages 26-27:</li> <li><b>Writing Prompt:</b> Respond to Focus Question</li> <li>Journal Entry</li> <li><b>Teacher Observation:</b> Assessment Chart for Investigation 4, Part 2</li> <li><b>Benchmark:</b> I-Check 4</li> </ul>	3 sessions

##### **Homework/Center Activities/Extra Practices**

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|--|---|
| <ul style="list-style-type: none"> <li>Rising Readorium (20 min/night)</li> <li>Spelling City(vocab);</li> <li>FOSS Digital Resources: eBook, Audio Stories</li> <li>Suggested websites</li> </ul> | <ul style="list-style-type: none"> <li>Word wall activities</li> <li>Cross Curriculum Extensions- Math Extension, Student Sheet No. 31</li> <li>Informational Text –Reading</li> <li>Home School Connection, Student Sheet</li> </ul> |
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## Part 3

### Investigation 4

#### Part 2: Choosing Your Own Investigation

Students choose a topic to investigate in greater depth. They share their findings with the class in a formal presentation

<u>Core Ideas/Understandings</u>	<u>S&amp;E Practices Alignment</u>	<u>CC Concepts Alignment</u>
<ul style="list-style-type: none"> <li>The effort needed to lift a load can be predicted from the weight of the load and the number of ropes supporting the load.</li> </ul>	<u>NGSS</u> Developing Possible Solutions	<u>NGSS</u> Optimizing the Design Solution

#### Focus Questions

- What other lever and pulley systems can you design?

**Students use their own focus questions.**

Guiding Questions:

- How did you plan your investigation?
- What steps were taken to develop and refine your procedure?
- How did you prepare to present your findings?

Teacher Preparation	Body Of Evidence	Est. Time
<b>Read Teacher's Guide</b> <ul style="list-style-type: none"> <li>"Materials" "Getting Ready" &amp; "Guiding the Investigation"</li> </ul> <b>Watch</b> Video Demo of Inv.3, Part 3 Prepare materials	<ul style="list-style-type: none"> <li><b>Notebook:</b> Investigation 4 Entry 3</li> <li><b>Student Sheet:</b> 25, 26, 27</li> <li><b>Reading:</b> FOSS Science Stories: Thank You, Mr. Clumpet, pages 28-32</li> <li>Writing Prompt: Respond to Focus Questions</li> <li>Journal Entry: Reflection</li> <li><b>Teacher Observation:</b> Assessment Chart for Investigation 4, Part 3</li> <li><b>Assessment:</b> Unit Post Test</li> <li><b>Authentic Assessment:</b> Notebook</li> </ul>	2sessions

#### Homework/Center Activities/Extra Practices

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| <ul style="list-style-type: none"> <li>Rising Readorium (20 min/night)</li> <li>Spelling City(vocab);</li> <li>FOSS Digital Resources: eBook, Audio Stories</li> <li>Suggested websites</li> </ul> | <ul style="list-style-type: none"> <li>Word wall activities</li> <li>Cross Curriculum Extensions</li> <li>Informational Text –Reading</li> <li>Home School Connection, Student Sheet No. 37</li> </ul> |
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## **Body of Evidence**

This guide is intended to support the collection of a Body of Evidence. A student's Body of Evidence should, at a minimum, include work from the listed prompts and in-class investigations that demonstrate a student's level of proficiency. The FOSS pre-assessment given at the beginning of the unit, the I-checks given after each investigation and Grade 3 DISTRICT Earth Science Benchmark Assessment given at the end of the unit (Post-assessment) may also be included in the body of evidence.

## **Writing Prompts Overview**

These prompts support the investigations and can be used with their journaling.

### **Investigation 1**

Part 1 – What do you notice about a lever?

Part 2 – What is the relationship between the position of the effort and the amount of force needed to lift the load?

Part 3 – What happens to the effort needed to lift a load as the position of the load changes?

### **Investigation 2**

Part 1 – How can you arrange the fulcrum, load and effort to make different lever systems?

Part 2 – How can we communicate our lever system designs with others?

Part 3 – How do levers help us make work easier in everyday situations?

Part 4 – How can we analyze and classify different lever systems?

### **Investigation 3**

Part 1 – What do you notice about pulleys?

Part 2 – How can we use two pulleys at the same time?

Part 3 – What observations can we make about pulley systems?

### **Investigation 4**

Part 1 – How can we use our data to predict the effort needed to lift a load in a pulley system?

Part 2 – What are the advantages and disadvantages of using pulleys?

Part 3 – What other lever and pulley systems can you design?

Students use their own focus questions.

Guiding Questions:

- \*How did you plan your investigation?

- \*What steps were taken to develop and refine your procedure?

- \*How did you prepare to present your findings?

## Resources

Integration of Technology:

FOSS Website [www.fossweb.com](http://www.fossweb.com)

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

### **Interactive Websites**

Electricity and Magnetism <http://ippex.pppl.gov/interactive/electricity/>

Conductors and Insulators [http://www.pge.com/microsite/PGE\\_dgz/wires/resist.html](http://www.pge.com/microsite/PGE_dgz/wires/resist.html)

Circuits and Conductors [http://www.bbc.co.uk/schools/scienceclips/ages/8\\_9/circuits\\_conductors.shtml](http://www.bbc.co.uk/schools/scienceclips/ages/8_9/circuits_conductors.shtml)

The Blobz Guide to Electric Circuits <http://www.andythelwell.com/blobz/>

Electrical Safety World <http://www.smud.org/safety/world/index.html>

### **Information Websites**

Batteries <http://www.howstuffworks.com/battery.htm>

Electromagnets <http://science.howstuffworks.com/electromagnet2.htm>

Static Electricity <http://www.sciencemadesimple.com/static.html>

Electricity Web Quest <http://volweb.utk.edu/Schools/sullivan/colonial/electricity.html>

Electricity and Magnetism <http://library.thinkquest.org/16600/intermediate/electricity.shtml>

Energy Kid's Page <http://www.eia.doe.gov/kids/energyfacts/sources/electricity.html>

Tech Topics: Electricity <http://www.thetech.org/exhibits/online/topics/10a.html>

### **Electricity Experiments**

Electricity and Magnetism Experiments <http://www.galaxy.net/~k12/electric/#exper>

Electricity: Simple Circuits <http://www.can-do.com/uci/lessons99/electricity.html>

Make a Battery from a Lemon <http://www.energyquest.ca.gov/projects/lemon.html>

Electrical Fleas [http://www.exploratorium.edu/snacks/electrical\\_fleas.html](http://www.exploratorium.edu/snacks/electrical_fleas.html)

Spelling City:

[www.spellingcity.com](http://www.spellingcity.com)

United Streaming Videos

<http://www.discoveryeducation.com//?ref=streaming&returnUrl=http%3A%2F%2Fstreaming%2Ediscoveryeducation%2Ecom%2Findex%2Ecfm>

Brainpop (see if your school has license for this)

<http://www.brainpopjr.com/>