IT'S SIMPLY MACHINES

Grade Level and Special Area: Second Grade

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Length of Unit: Twelve lessons about one hour in length each

I. ABSTRACT

Students will develop an understanding of the types of simple machines and their uses. Through the exploration of each simple machine the children will examine how the tools perform, their uses in familiar machines, the friction that is produced, and the ways that they make work easier. The children will learn about a lever, a pulley, a wheel and axle, gears, an inclined plane, a wedge, and a screw. Through the children's discoveries they will understand how simple machines may be combined in more complex machines. The science biography of Elijah McCoy will be introduced with the study of simple machines.

II. OVERVIEW

A. Concept Objectives
   1. Students will develop an understanding of quantities associated with energy, movement, and change. (Colorado Science Standard 2)
   2. Students will understand interrelationships among science, technology, and human activity and how they can affect the world. (Colorado Science Standard 5)
   3. Students will understand the importance of scientific technology.

B. Content from the *Core Knowledge Sequence* (page 61)
   1. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs.
   2. The children will see how simple machines make work easier, and how they are applied and combined in familiar tools and machines.
   3. There are six basic simple machines: lever, pulley, wheel-and-axle (including gears), inclined plane, wedge, and screw.
   4. Friction is produced when two surfaces are rubbed against one another.
   5. Elijah McCoy was instrumental in the invention of a machine to reduce friction.

C. Skill Objectives
   1. The student will identify that machines help us work.
   2. The student will be able to name different types of machines and how they work.
   3. The student will identify the force that causes the machine to work.
   4. The student will explain that force is the push or pull on an object.
   5. The student will explain that when work is done, if the effort increases, the distance decreases, and vice versa.
   6. The student will explain that power is the time and rate of doing work.
   7. The student will explain that energy is the ability to do work.
   8. The student will be able to identify the six basic simple machines.
   9. The student will identify that an inclined plane is a simple machine that makes lifting easier.
   10. The student will identify that a wedge is a simple machine that is also a small inclined plane that is used a tool.
   11. The student will identify everyday objects that are wedges.
   12. The student will identify that a screw is an inclined plane that curves around a shaft or pole.
   13. The student will explain how a screw works in wood.
   14. The student will be able to label the parts of a lever.

15. The student will explain how a lever operates.
16. The student will explain how moving the fulcrum of a lever can change the effort needed to lift a load.
17. The student will record the results of the movement on the lever and fulcrum.
18. The student will identify that a wheel and axle is a simple machine that helps us apply more force or lift a heavy load with less effort.
19. The student will observe and record what happens when a wheel and axle is used to move an object.
20. The student will examine different gears and the movements of the gears against each other.
21. The student will explain that a pulley is a simple machine that is used for lifting heavy objects or moving objects up and down or side to side.
22. The student will explain that simple machines can be combined together to make a complex machine.
23. The student will examine and name the types of simple machines that are found in a complex machine.
24. The student will identify Elijah McCoy and how he contributed to the technological world today.
25. The student will identify what is friction and how it can be reduced.

III. BACKGROUND KNOWLEDGE

A. For Teachers
   1. Albert, Toni M. Ed., *Simple Machines, Step-by-Step Science Series*
   2. Carratello, John and Patty. *Simple Machines, Hands-On- Science*
   3. Hodge, Deborah. *Simple Machines, Starting with Science*

B. For Students
   1. The student must be able to record data that is collected and communicate it in complete sentences.
   2. The student must be able to understand the common states of matter.
   3. The student must be able to understand the standard units of measurement.

IV. RESOURCES

A. Albert, Toni M. Ed. *Simple Machines, Step-by-Step-Science Series*. Greensboro, North Carolina. Carson-Dellosa Publishing Company, Inc., 1994. CD-7296 (used in Lessons Three, Four, Five and Eight)

B. Carratello, John and Patty. *Simple Machines, Hands-On- Science*. Sunset Beach, California. Teacher Created Materials. 1988. TCM-227 (used for Background Knowledge)

C. Hirsch Jr., E.D. *What Your Second Grader Needs to Know*. New York: Dell Publishing. 1991. ISBN 0-385-31027-7 (used for Background Knowledge)

D. Hodge, Deborah. *Simple Machines, Starting with Science*. Buffalo, New York. Kids Can Press, Ltd. 1998. ISBN 1-55074-311-2 (used in simple machine project-Culminating Activity)

V. LESSONS

Lesson One: What is Work? (approximately one hour long)

A. *Daily Objective*
   1. Concept Objective(s)
      a. Students will develop an understanding of quantities associated with energy, movement, and change.
      b. Students will understand interrelationships among science, technology,

and human activity and how they can affect the world.

2. Lesson Content
   a. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs.
   b. The children will see how simple machines make work easier, and how they are applied and combined in familiar tools and machines.
3. *Skill Objective(s)*
   a. The student will identify that machines help us work.
   b. The student will be able to name different types of machines and how they work.

B. *Materials*
1. Two half-pints of whipping cream (for the entire class)
2. A jar with a screw-on lid (for the entire class)
3. A clear glass bowl
4. An electric mixer
5. Salt - 1 teaspoon
6. Crackers, one 16 oz. package (two crackers per child)
7. A stopwatch
8. Chart paper
9. Simple Machines Journal (Appendices L and M) and a pencil for each student
10. Copies of Appendix A - Making Butter for each student

C. *Key Vocabulary*
1. Work: the result of a force moving on an object
2. Force: a push or pull on an object that causes it to change direction, move or stop
3. Machine: a device for doing some kind of work

D. *Procedures/Activities*
1. Discuss with the students the definitions of work, force, and machine. Examples of work: riding a bike, walking, and pushing a box. Examples of force: opening a door or pushing a wagon. Write the definitions on the chalkboard. Give each student a copy of his or her Simple Machines Journal. Have the students write down in the journal the vocabulary words and definitions.
2. Ask students to name different kinds of machines and how they work. Do these machines make work easier? How do the machines move? Do these machines push or pull on the object?
3. Explain to the students that the class will be making butter. Tell the students that when cream is mixed for a time, it will separate into butter and buttermilk. Ask students to hypothesize: Would it be quicker and easier to make butter from cream by using an electric mixer (a machine) than by shaking the cream in a jar? Record the student's responses on chart paper.
4. Now pour one half-pint of cream into a jar. Screw the lid on tightly. Pour the other half-pint of cream into a bowl. Ask students to take turns shaking the jar to mix the cream. Tell them that you will use a stopwatch to see how long it takes to make butter. Ask the students if they are pushing or pulling on the cream by shaking the jar. Why is it pushing on the cream? Record the time on the chart paper that it took for the students to make butter by shaking the jar.
5. Next, pour the other half-pint of cream into a bowl and mix with the electric mixer. Ask students to make a prediction of the amount of time it will take to make the butter with the electric mixer. Ask the students if they are pushing or pulling when making the butter with a mixer. Set the stopwatch to see how long it takes to make butter this time. Did it take the amount of time that they predicted? Did it take longer to make butter by shaking it? Or, did it take longer

by making it with the electric mixer? Record the results on the chart paper.

6. Pour off the buttermilk that has separated from the cream. Add salt to the butter and serve the butter on the bread or crackers to the children as a treat.
7. Ask the students if they can name other machines that make work easier. List some of their examples on the chart paper.

E. *Assessment/Evaluation*

1. Have the students compare the two times that are recorded on the chart paper. How long did it take to make butter by shaking the cream? How long did it take to make butter with the electric mixer? Which method required more work? Did the electric mixer make work easier and quicker? The students can write simple sentences to answer each question. The answers can be evaluated for each student to record (Appendix A).
2. Record in a Simple Machines Journal what the students learned about work. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson, and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.

Lesson Two: What is a Force? (approximately one hour long)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students will develop an understanding of quantities associated with energy, movement, and change.
   b. Students will understand interrelationships among science, technology, and human activity and how they can affect the world.
2. Lesson Content
   a. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs. (page 61)
   b. The children will see how simple machines make work easier, and how they are applied and combined in familiar tools and machines. (page 61)
3. Skill Objective(s)
   a. The student will identify the force that causes the machine to work.
   b. The student will explain that force is the push or pull on an object.

B. *Materials*

1. Index cards with simple descriptions of actions that involve a push or a pull, such as: a batter hitting a baseball, a game of tug-of-war, a person pushing a door shut, a person pulling a door open, a person pulling a wagon, a person riding a bike, a football player kicking a ball, a person pushing a stroller, etc.
2. Crayons
3. Kinds of Work - Appendix B
4. Simple Machines Journal (Appendices L and M) and a pencil for each student

C. *Key Vocabulary*

There is no new vocabulary for this lesson. Refer to Lesson One.

D. *Procedures/Activities*

1. This lesson is adapted from *Simple Machines, Step-by-Step Science Series.*
2. Review the meanings of the vocabulary words in Lesson One. Explain that you are going to play a game of "Force Charades" where students take turns acting out actions that involve some kind of force, either a push or a pull. The student who performs the action may not speak at all. The rest of the students will guess what action is being performed and tell whether the force is a push or a pull.

Read the one of the actions on the cards to the students to give them an example of what they will be doing.

3. Begin by letting the student pick one of the cards that you have prepared, so that they will know what kind of action to perform. Once they understand the game the students can think of their own actions to illustrate force.
4. Distribute a copy of Appendix B to each student. Ask the students to draw a picture of a type of work that they do at home. Write a short description of each child's work on chart paper. Go over each example and see if it involved the movement of an object by a force. If there is no movement in an example, then cross it out.
5. In their Simple Machines Journal, have the students write a few sentences about what they learned in this lesson. They can answer the questions: Where do we see force in things we do or other machines? What kinds of force do we do in every day activities?

E. *Assessment/Evaluation*

1. The students can write a short description of what kind of work is done in their class drawing. The worksheet can determine if the students understood the concepts (Appendix B).
2. The students can record in their Simple Machines Journal what they learned from the lesson. The students need to include their description of force. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson, and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.

Lesson Three: What is Power and Energy? (approximately one hour long)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students will develop an understanding of quantities associated with energy, movement, and change.
   b. Students will understand interrelationships among science, technology, and human activity and how they can affect the world.
2. Lesson Content
   a. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs. (page 61)
3. Skill Objective(s)
   a. The student will explain that when work is done, if the effort increases, the distance decreases, and vice versa.
   b. The student will explain that power is the time and rate of doing work.
   c. The student will explain that energy is the ability to do work.

B. *Materials*

1. Clay, about a cup for each student
2. "Carving tools," toothpick one for each student
3. One paper plate for each child
4. Simple Machines Journal (Appendices L and M) and a pencil for each student
5. Appendix C

C. *Key Vocabulary*

1. Effort: the amount of energy exerted
2. Distance: the amount of area an object will move
3. Power: the rate at which work is done
4. Energy: the ability to do work; it is in these forms: light, heat, motion, electrical,

chemical, and nuclear

D. *Procedures/Activities*

1. This lesson is adapted from *Simple Machines, Step-by-Step Science Series.*
2. Explain to the students that they are going to make a mountain out of clay. Pass out to the students the materials needed to make their mountain and road. (the clay, the paper plate, and the toothpick) The children need to construct a road up their mountain. Discuss the ways the roads can be made, for example: go straight up, circle around the mountain, or zig-zag back and forth. Then ask the students to use the carving tool to make a road on the mountain that they constructed.
3. After the roads are constructed, have the children examine each other's roads. Discuss the shorter and longer routes up the students' mountains. Explain that a person climbing the mountain does work whether or not the road is straight up or winds around the mountain.
4. Explain that work has two aspects: effort and distance. Write the words and the definitions on the chalkboard. Have the students record these words in their Simple Machines Journal. Explain to the students that if the effort increases, the distance decreases; and if the effort decreases, the distance increases. This is a basic principle of all machines.
5. Now have the students imagine that they are the runners going up their mountains. Explain that each runner takes the same route to the top and goes the same distance. Only one runner reaches the top in ten minutes and the other runner reaches the top in twenty minutes.
6. Ask the students why they think this happened. Record the students' explanations on the chalkboard. Explain that the person who reached the top first used more power. Write the definitions of power and energy on the chalkboard and have the students copy it into their Simple Machine Journals. Scientists define power as the time rate of doing work, and energy is the ability to do work. Give the students examples of power and energy, such as a strong motor or a fast runner.
7. At the end of the explanation of power and energy, have the students complete the worksheet on power and energy (Appendix C).

E. *Assessment/Evaluation*

1. Have the students write a few sentences on what they learned in this lesson about power and energy. The students can give an example of another way power and energy is used in a machine or everyday life (Appendix C). The worksheet can be graded for the students' knowledge of the concepts.
2. The students' journals need to include the concepts that to do work we use energy, and the amount of energy determines the effort and distance. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.

Lesson Four: What are Simple Machines? (approximately one hour long)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students will develop an understanding of quantities associated with energy, movement, and change.
   b. Students will understand interrelationships among science, technology, and human activity and how they can affect the world.

2. Lesson Content
   a. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs. (page 61)
   b. The children will see how simple machines make work easier, and how they are applied and combined in familiar tools and machines. (page 61)
   c. There are six basic simple machines: lever, pulley, wheel-and-axle (including gears), inclined plane, wedge, and screw. (page 61)
3. Skill Objective(s)
   a. The student will be able to name all the types of simple machines.

B. *Materials*
1. One screw
2. One screwdriver (a wedge)
3. One hammer (a lever)
4. One toy car with wheels (wheel and axle)
5. One pulley and rope
6. One example of a wheel with notched teeth (gears and handle)
7. Crayons
8. Copies of Appendix D for each student
9. Simple Machines Journal (Appendices L and M) and a pencil for each student

C. *Key Vocabulary*
1. Simple machine: a tool that is either a wedge, screw, lever, wheel and axle, gear, or inclined plane

D. *Procedures/Activities*
1. Write the definition of a simple machine on the chalkboard. Have the students copy the meaning of simple machine into their Simple Machines Journal.
2. Explain to the students that they have been learning about all the ways we work, and now we will study the tools that make the work easier. For the first part of the lesson, show the students the examples of the different kinds of simple machines. (Screw, wheel and axle, lever, pulley, inclined plane, wedge). Explain to the students that in further lessons the class will be examining the properties of each tool.
3. To review the concept of force in Lesson Two, ask the students if they can name the force that the simple machine uses. Is it a push, pull, or both?
4. Let the students experiment with each kind of simple machine. These machines can be put into a science center where the students can interact with the examples when other assignments are completed.
5. Each student can draw a picture of someone using a simple machine (Appendix D). The student must identify the kind of simple machine that is in their picture. The drawings can be shared with the rest of the class. A couple of sentences can be written to explain their drawing.

E. *Assessment/Evaluation*
1. The worksheet and drawing that the students made and the explanations can serve as assessment for the lesson (Appendix D).
2. The students will write in their journal what they learned about simple machines, the types, and an example of the uses of each. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.

Lesson Five: What is an Inclined Plane? (approximately one hour)

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Students will develop an understanding of quantities associated with energy, movement, and change.
      b. Students will understand interrelationships among science, technology, and human activity and how they can affect the world.
   2. Lesson Content
      a. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs. (page 61)
      b. The children will see how simple machines make work easier, and how they are applied and combined in familiar tools and machines. (page 61)
      c. There are six basic simple machines: lever, pulley, wheel-and-axle (including gears), inclined plane, wedge, and screw. (page 61)
   3. Skill Objective(s)
      a. The student will identify that an inclined plane is a simple machine that makes lifting easier.

B. *Materials*
   1. One heavy book
   2. One large, strong rubber band
   3. One length of string about 3 feet long
   4. Three smooth boards, one 2 feet long, one 3 feet long, and one 4 feet long
   5. One large paper clip
   6. One chair
   7. One spring scale
   8. One measuring tape
   9. Simple Machines Journal (Appendices L and M) and a pencil for each student
   10. An Incline Plane - Appendix E, a copy for each student

C. *Key Vocabulary*
   1. Inclined plane: a sloping surface used to move heavy loads up or down

D. *Procedures/Activities*
   1. This lesson is adapted from *Simple Machines, Step-by-Step Science Series*
   2. Write the definition of an inclined plane on the chalkboard and have the students enter it into their journal. After giving the definition of an inclined plane to the students, they can give examples of inclined planes in everyday life.
   3. Demonstrate to the students by using one of the boards, a chair, a heavy book, rubber band, string, and a paper clip how you can pull the heavy book up an inclined plane and the work is made easier. To demonstrate, put the large rubber band around the book, place the paper clip in the rubber band, and attach the string to the other end of the paper clip. The teacher can demonstrate pulling the book up the incline plane the first time.
   4. Replace the string with the spring scale. Afterwards, have different students pull the book up the incline plane. Discuss with the students how much force is used in the pulling of the book by noticing the number of pounds of force it took to pull the book up the inclined plane. The needle will move on the spring scale as the book is pulled up the incline plane. The number on the spring scale is the pounds of force used to pull the book.
   5. Attach a heavy book to the spring scale by placing a large rubber band around the book and attaching it to the paper clip on the spring scale. Have a student lift the book without the use of the inclined plane by holding the spring scale with the book attached to the scale. Discuss the difference in the amount of force that was

used by lifting the book straight up and compare it to using the incline plane. Did it need more power and energy to lift it straight up? If you would like to do this in small groups then additional materials can be used for each group.

6. Now have the students try to use different lengths of wood to make the inclined plan. The students can observe that the two foot board is at a very steep incline, the three foot board is at a medium incline and the four foot board is at the gentlest incline. Give each student a copy of the inclined plane worksheet (Appendix E) to record the information for the next part of the lesson.
7. The students can measure the length of the board with a measuring tape on their worksheet and write the length of the boards, then record the number on the spring scale when the book is pulled up the incline. The number on the spring scale is the pounds of force used to pull the book and the length of the board is the distance.
8. The students can record this information on their worksheet. Have them answer questions: Which inclined plane required the least force to move the book? Which inclined plane was the longest? Which incline plane required more force and what was the length of that inclined plane? Discuss the answers with the students (Appendix E).
9. With the teacher's guidance the students should come to the conclusion that the gentler the slope of the inclined plane, the less the force, or effort is needed to move an object up the slope. Only the object must be moved further when less force is used. And the steeper the slope the more force is needed to move the object up the slope.

E. *Assessment/Evaluation*

1. The teacher will evaluate the worksheet that the students filled out about inclined planes. The student will need to completely fill out the worksheet for evaluation.
2. The students will write in their Simple Machines Journal what they learned in today's lesson about incline planes and the amount of force it takes to move an object. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.

Lesson Six: What is a Wedge? (approximately one hour long)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students will develop an understanding of quantities associated with energy, movement, and change.
   b. Students will understand interrelationships among science, technology, and human activity and how they can affect the world.
2. Lesson Content
   a. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs. (page 61)
   b. The children will see how simple machines make work easier, and how they are applied and combined in familiar tools and machines. (page 61)
   c. There are six basic simple machines: lever, pulley, wheel-and-axle (including gears), inclined plane, wedge, and screw. (page 61)
3. Skill Objective(s)
   a. The student will identify that a wedge is a simple machine that is also a small inclined plane that is used a tool.

b. The student will identify everyday objects that are wedges.

B. *Materials*

1. One apple for each student
2. One large wooden block approximately four inches square (cube)
3. Smaller blocks of wood approximately 2'' high and 4'' long, cut into a shape of a door wedge, one for each student
4. Washable markers for each student
5. One small can of play dough
6. A variety of objects such as: nail, chisel, push pin, scissors, pencils, door wedge, index cards, tape, etc. (some items are wedges, some are not)
7. Simple Machines Journal (Appendices L and M) and a pencil for each student
8. Copies of Which One is a Wedge? Appendix F for each student

C. *Key Vocabulary*

1. Wedge: an object with a wide end and a pointed or sharp edge; a wedge is used to split, raise, or separate things

D. *Procedures/Activities*

1. Before this lesson, the students can bring in an apple. Pass out an apple for each student. Have each student take a bite out of the apple. Tell the students to use their front teeth first. Take another bite using your back teeth. Ask the class which is easier and why? Explain that your front teeth are good examples of wedges. Write the definition of wedge on the chalkboard and have the children record it into their Simple Machines Journal.
2. This part of the lesson is adapted from *Simple Machines, Step-by-Step Science Series.*
3. Have a student use the large square wooden block and prop open the classroom door. Next have another student prop open the door with one of the wooden wedges. Discuss with the class which worked better and why. Did it raise an object or split an object apart? Did the wedge exert a force on the door? (It raised the door slightly and exerted a strong force on it.)
4. Now ask a student to divide the mound of playdough with the large flat wooden block. Ask the class what happened? Next ask the student to divide the playdough using a wedge. The wedge cut the play dough in half very easily and the wooden block just mashed the play dough. Discuss what happened in each instance. Did it split or raise an object.
5. Write the definition of a wedge on the chalkboard and have the students record it in their journals. Then see if they can name other wedges that they may use in everyday life.
6. Arrange the different objects on a table and have students identify each object. Next, ask if the objects are wedges. Pass out the worksheet for the students (Appendix F) and have the student select which objects are wedges.
7. Give each student one of the wooden wedges. Explain that they are going to take their wedges and decorate it with markers. The wedge can be used as a doorstop in their home.

E. *Assessment/Evaluation*

1. The teacher will evaluate whether or not the student selected the wedges on the worksheet that they completed during the lesson (Appendix F).
2. The student can write a few sentences in the Simple Machines Journal of what was learned about wedges in this lesson. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson and the skills for that lesson. Appendix O is a

generic form that can be used for all of the lessons.

Lesson Seven: What is a Screw? (approximately one hour)

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Students will develop an understanding of quantities associated with energy, movement, and change.
      b. Students will understand interrelationships among science, technology, and human activity and how they can affect the world.
   2. Lesson Content
      a. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs. (page 61)
      b. The children will see how simple machines make work easier, and how they are applied and combined in familiar tools and machines. (page 61)
      c. There are six basic simple machines: lever, pulley, wheel-and-axle (including gears), inclined plane, wedge, and screw. (page 61)
   3. Skill Objective(s)
      a. The student will identify that a screw is an inclined plane that curves around a shaft or pole.
      b. The student will explain how a screw works in wood.

B. *Materials*
   1. A large wood screw (#8) for each student (Phillips or flathead)
   2. Pencil for each student
   3. Paper cut into 5" x 8" rectangles, one sheet for each student
   4. Scissors
   5. Tape
   6. A block of wood for each child, approximately 2" x 4"(soft pine works best)
   7. Phillips or flat head screwdrivers, one for every four students
   8. Simple Machines Journal (Appendices L and M) and a pencil for each student
   9. Copies of Screws - Appendix G for each student
   10. *Screws* by David Glover
   11. Examples of types of screws can be placed in the Science Center: a pepper grinder, clamps, bolts, or a hand drill

C. *Key Vocabulary*
   1. Screw: an inclined plane that is wrapped around a shaft or pole
   2. Shaft: the middle portion of the screw that the incline plane wraps around
   3. Friction: the rubbing force of one object against another; friction causes objects to slow down

D. *Procedures/Activities*
   1. This lesson is adapted from *Simple Machines, Step-by-Step Science Series*.
   2. Write the new vocabulary words on the chalkboard and have each student record the new words in their Simple Machines Journal.
   3. Pass out one screw to each student. Have each student examine the screw. Let them use a pencil to trace the thread of the screw. Do they see an inclined plane curving upward around the shaft?
   4. Give each student a piece of paper about 5" x 8" in size. Have the students cut the paper diagonally across. This will make two triangles or inclined planes.
   5. Have the students roll the paper around their pencils, starting with the longest side of the triangle first. They can use a piece of tape to hold the paper in place as they roll it on the pencil.
   6. As the students wrap the paper around their pencils, let them notice the edge of

the paper begins to look like a screw because they have wrapped an incline plane around the pencil and the edge of the paper is the slope of the screw.

7. Before starting the next activity, the teacher can prepare the wood blocks by starting the wood screws into the blocks of wood. This will help those students who have a hard time using the screwdriver. One screwdriver can be used for every four students and the children can take turns using it.
8. As the students take turns practicing turning the screw into the wood, ask them to observe and record their findings on the worksheet (Appendix G). How many times does it take to turn the screw into the wood? Explain that with the screw, you do a little work over a long distance so that the machine can do a lot of work over a short distance. This makes work easier. Remind the students about the runner going up the mountain in lesson three.
9. Ask the students: How secure is the screw into the wood? Can you pull in out with your hands? Will the screw work itself loose? Explain that friction acts to hold the screw in the wood.
10. Read the book *Screws* by David Glover to the students. This book describes many examples of screws that we use each day. Pause and discuss the kinds of screws in the book.
11. In the science center, other examples of screws can be displayed so that the children can experiment with them. Examples: clamps, nuts and bolts, vises, a hand drill.

E. *Assessment/Evaluation*

1. The teacher can evaluate the students' explanations on the workings of the screw that the students filled out in the activity. (Appendix G)
2. Have the students explain in their own words how a screw works in their Simple Machines Journal. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson, and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.

Lesson Eight: What is a Lever? (two days, approximately one hour each day)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students will develop an understanding of quantities associated with energy, movement, and change.
   b. Students will understand interrelationships among science, technology, and human activity and how they can affect the world.
2. Lesson Content
   a. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs. (page 61)
   b. The children will see how simple machines make work easier, and how they are applied and combined in familiar tools and machines. (page 61)
   c. There are six basic simple machines: lever, pulley, wheel-and-axle (including gears), inclined plane, wedge, and screw. (page 61)
3. Skill Objective(s)
   a. The student will be able to label the parts of a lever.
   b. The student will explain how a lever operates.
   c. The student will explain how moving the fulcrum of a lever can change the effort needed to lift a load.
   d. The student will record the results of the movement on the lever and

fulcrum.

B. *Materials*

1. One board 2” x 6” x 6’ long
2. One small triangular piece of wood about 6”high and 8”long
3. Fifteen books of the same size
4. One black marker
5. One tape measure
6. Simple Machines Journal (Appendices L and M) and a pencil for each student
7. Copies of What Happens with a Lever? Appendix H for each student
8. For the Science center, examples of levers: a nutcracker, a claw hammer, a flat head screw driver, and an empty can of paint

C. *Key Vocabulary*

1. Lever: a stiff bar that turns on a fulcrum and is used to move heavy objects
2. Fulcrum: the part of the lever that supports the length of the bar
3. Weight arm: the part from the fulcrum to the weight you want to lift
4. Force arm: the part from the fulcrum to where you are pushing or pulling the weight
5. Load: the amount of weight that the lever will lift

D. *Procedures/Activities*

1. This lesson is adapted from *Simple Machines, Step-by-Step Science Series.*
2. Explain to the students that in this activity one of the students is going to be able to lift up the teacher. Set the fulcrum (triangular piece of wood) and the lever (the long piece of wood) on the floor. Place the wood so that one end of the board is only about a foot from the fulcrum.
3. Ask a student to come forward and press down on the opposite end of the lever, using only their arms. Could the student lift you? Was it difficult or easy?
4. Explain to the students the parts of the fulcrum: the lever, fulcrum, force arm, and weight arm. Write the definitions on the chalkboard and have the students copy these definitions into their Simple Machines Journal.
5. Have the students answer the question: It is easier to lift a load when the fulcrum is closer to the weight arm or further away? Discuss their answers and the reasons why. Explain that in the next part of the lesson they will discover the answer to this question.
6. Give each student the worksheet, What Happens with a Lever? (Appendix H), before beginning the next part of the lesson. The students will record their answers on the worksheet.
7. Measure the long board used in the above activity, and mark the center of the board with the marker. Next, mark the board every 12” from the center of the board to one end. Print the number 1 on the center mark, the number 2 at the next mark and so on, until all of the marks have been numbered.
8. Set the center of the board on the fulcrum, then have a student place six books on the end of the board that has been marked (this is the weight arm and the books are the load).
9. Now have a student place books on the other end of the lever, until the six books have been lifted as high as possible (this is the force arm). The students can record on their worksheet how many books it took to lift the load and what number was the position of the fulcrum (number 1).
10. Repeat the same process as in steps 6 and 7, but move the fulcrum to the second, third, and fourth positions. Record the number of books it took to lift the load and the position of the fulcrum.
11. Explain to the students that the number of books it takes to lift the load is the

effort needed to lift. Recall lesson number three with the terms: effort, power and energy.

12. Continue to have students move the fulcrum and record the number of books it takes to lift the load until you reach the last position on the lever.
13. Students can take the information that they recorded and graph the outcome on their worksheet. (Appendix H) Have the students share the conclusion of the experiment. The closer the fulcrum is to the load, the easier it is to lift the load.
14. In the science center, there can be other examples of levers placed so that the students can discover more about levers. Examples: A nutcracker, a claw hammer, a flat head screw driver, and an empty can of paint.

E. *Assessment/Evaluation*

1. The teacher can evaluate the information and the graph given on the worksheet that was completed during the lesson (Appendix H).
2. The students can record in their Simple Machines Journal their observations of a lever and fulcrum, the uses of a lever and how does it make work easier. Ask the students to name the parts of the fulcrum and the conclusion of lifting with a fulcrum. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson, and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.

Lesson Nine: What is a Wheel and Axle and Gears?

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students will develop an understanding of quantities associated with energy, movement, and change.
   b. Students will understand interrelationships among science, technology, and human activity and how they can affect the world.
2. Lesson Content
   a. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs. (page 61)
   b. The children will see how simple machines make work easier, and how they are applied and combined in familiar tools and machines. (page 61)
   c. There are six basic simple machines: lever, pulley, wheel-and-axle (including gears), inclined plane, wedge, and screw. (page 61)
3. Skill Objective(s)
   a. The student will identify that a wheel and axle is a simple machine that helps us apply more force or lift a heavy load with less effort.
   b. The student will observe and record what happens when a wheel and axle is used to move an object.
   c. The student will examine different gears and the movements of the gears against each other.

B. *Materials*

1. A toy car that the wheels and axles can be removed
2. A piece of ½” thick plywood, 18” x 24”
3. Two skateboards
4. Two heavy boxes
5. A variety of cardboard shapes: circles, squares, triangles, and hexagons, two shapes of each kind for each student
6. Pencils, one for each student

7. Book: *Pulleys and Gears* by David Glover
8. Simple Machines Journal (Appendices L and M) and a pencil for each student
9. Copies of Shapes for the Wheels and Axles - Appendix I for each student

C. *Key Vocabulary*

1. Wheel and axle: a wheel or set of wheels fastened to a bar or rod; a wheel and axle is used to move things or change the power, speed, or direction of a movement
2. Gears: a wheel with ridges or teeth; one gear connects and turns another
3. Teeth: the notches on the outside of a gear

D. *Procedures/Activities*

1. This lesson is adapted from *Simple Machines, Step-by-Step Science Series.*
2. Remove the wheels from the toy car. Ask a student to try and push the car without the wheels. Discuss with the class how the car moves. When the class tells you the wheels, make sure that they also mention the axle. Explain the parts of wheel and axle and its function.
3. Write the definitions of wheel and axle, and gears on the chalkboard. The students can write the definitions in their Simple Machines Journals.
4. Arrange the skateboards, plywood, and boxes in front of the class. Place several heavy boxes on the piece of plywood. Have a student or students attempt to move the plywood forward by a few feet. Ask the students how difficult was it to move? Then ask the class if they can think of an easier way to move the plywood and boxes. Let the class explore until they can arrange the boxes on the plywood and the skateboards. Discuss why it is easier to move the boxes with something with wheels. (The wheel and axle helps move objects with less effort.)
5. Let each student select two shapes that are identical. Have each student poke a hole in the middle of each shape; insert their pencil between the two shapes.
6. Discuss with the class which shape works better as a wheel and axle. Why is the circle the best shape? Of course, the circle is the best. Have students explain why.
7. Introduce to the students the gears. Explain that gears are another type of wheel with notched teeth. The gears can be connected together, and when they are connected they will work together to turn an object.
8. Read the book Pulleys and Gears to the class. The book shows many examples of gears and how they work. Pause at different points in the book and discuss ways we use gears everyday. Explain that gears will move in a clockwise and counterclockwise motion. Have them predict which way the gears will move in the illustrations in the book.

E. *Assessment/Evaluation*

1. In a short paragraph, the students can record in their Simple Machines Journal what they learned about wheels, axles, and gears (Appendix I).
2. The students will write in their journals what they learned about wheels and axles, and gears. The students need to include the purpose of the wheel and axle and the movement of gears against each other. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson, and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.

Lesson Ten: What is a Pulley?

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Students will develop an understanding of quantities associated with energy, movement, and change.
      b. Students will understand interrelationships among science, technology, and human activity and how they can affect the world.
   2. Lesson Content
      a. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs. (page 61)
      b. The children will see how simple machines make work easier, and how they are applied and combined in familiar tools and machines. (page 61)
      c. There are six basic simple machines: lever, pulley, wheel-and-axle (including gears), inclined plane, wedge, and screw. (page 61)
   3. Skill Objective(s)
      a. The student will explain that a pulley is a simple machine that is used for lifting heavy objects or moving objects up and down or side to side.

B. *Materials*
   1. Book: *Pulleys and Gears* by David Glover
   2. A load moving pulley system (Appendix P)
   3. Small pieces of paper to write notes and pencils
   4. Paper clips
   5. Simple Machines Journal (Appendices L and M) and a pencil for each student
   6. Copies of Pulleys - Appendix J for each student

C. *Key Vocabulary*
   1. Pulley: a wheel with a groove that a rope or wire fits into; a pulley is used to lift or move objects

D. *Procedures/Activities*
   1. Write the definition of a pulley on the chalkboard and have the students write it in their Simple Machines journal.
   2. Reread the book Pulleys and Gears by David Glover and stop at the illustrations of the different kinds of pulleys. Ask the students if they can name something that the school may use each day that is a pulley. (The raising of the flag on the flagpole.)
   3. Explain to the students that they are going to use a pulley system to send messages to one another. The Message Pulley System can be assembled before the lesson or make up the form of the pulley and wrap the string over the pulleys while showing how it works to the class. Demonstrate how the message system works and the movements of the pulleys.
   4. Pass out the message paper and have the students write a note to someone else in the class. In pairs, the students can send their message to their friend using the message pulley system (Appendix P).
   5. The students can attach their notes to the pulley system with paper clips. Each pair of students stands at one end of the pulleys. The students will pull the top of the cord and send their message to the other student to retrieve. Let all of the students have a turn using the pulley message system.
   6. After they have sent their messages, hand out the worksheet (Appendix J) on the message pulley system and have them fill in their responses.

E. *Assessment/Evaluation*
   1. The worksheet about pulleys can be evaluated for the student's description of the workings of pulleys.

2. In their Simple Machines Journal, have the students write a paragraph describing what happened when they used the pulley message system. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson, and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.

Lesson Eleven: What is a Complex Machine? (approximately one hour long)

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Students will develop an understanding of quantities associated with energy, movement, and change.
      b. Students will understand interrelationships among science, technology, and human activity and how they can affect the world.
   2. Lesson Content
      a. The students will examine how certain tools work, the properties of work, and how they are made to perform specific jobs.
      b. The children will see how simple machines make work easier, and how they are applied and combined in familiar tools and machines.
      c. There are six basic simple machines: lever, pulley, wheel-and-axle (including gears), inclined plane, wedge, and screw.
   3. Skill Objective(s)
      a. The student will explain that simple machines can be combined together to make a complex machine.
      b. The student will examine and name the types of simple machines that are found in a complex machine.

B. *Materials*
   1. An apple coring and peeling machine
   2. One apple for each student
   3. Crayons
   4. 8½ " x 11" drawing paper, one for each student
   5. Simple Machines Journal (Appendices L and M) and a pencil for each student

C. *Key Vocabulary*
   1. Complex machine: a device that combines one or more simple machines to complete a task

D. *Procedures/Activities*
   1. The apple-coring machine can be purchased at local hardware stores. There are different kinds of models, and usually they can be attached to a counter or tabletop. Mount the machine on a table before the lesson begins. Students could bring an apple to school prior to this lesson.
   2. Have each student come back to the table and attach their apple to the machine. The student will turn the handle of the apple peeler and watch the action as it peels and cores the apple.
   3. While the student munches on their apple treat, have each student describe in complete sentences how the machine worked. Make sure each student tries to write down each simple machine that they observed while the apple was peeled. The student should name a wedge, screw, wheel and axle and an incline plane.
   4. After all of the students have peeled their apple and written their paragraphs, discuss their findings with the other students in the class. Did the machine have many simple machines within the larger one? What were the machines that the students used?

5. Have each student draw a picture of their own invention of a complex machine. Remind them of the different kinds of simple machines and how they are used. Each student can label on their drawing all of the simple machines that their invention may use.

E. *Assessment/Evaluation*

1. The students will write in their Simple Machines Journal a paragraph describing how the apple machine worked and the list of the machines in the activity. The students can explain what they learned about complex machines in their journal. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson, and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.
2. The teacher can evaluate the student's drawing of their complex machine and the types of simple machines in their invention to see if the student understood the concepts of the lesson.

Lesson Twelve: Who was Elijah McCoy?

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students will understand the importance of scientific technology.
2. Lesson Content
   a. Elijah McCoy was instrumental in the invention of a machine to reduce friction.
   b. Friction is produced when two surfaces are rubbed against one another and lubricants or rollers can reduce friction.
3. Skill Objective(s)
   a. The student will identify Elijah McCoy and how he contributed to the technological world today.
   b. The student will identify what is friction and how it can be reduced.

B. *Materials*

1. Book*: The Real McCoy, the Life of an African-American Inventor*, by Wendy Towle
2. Vegetable oil ¼ cup for each group of students
3. Paper towels for each student
4. Sand paper one sheet for each group of students
5. A variety of matchbox toy cars for each group of students
6. Simple Machines Journal (Appendices L and M) and a pencil for each student
7. Copies of Friction - Appendix K for each student

C. *Key Vocabulary*

1. Oil cup: a device that Elijah McCoy invented to help lubricate the wheels of steam engines
2. Friction (review from lesson one): the rubbing force of one object against another; friction causes moving objects to slow down

D. *Procedures/Activities*

1. Write the definitions of the new vocabulary words on the chalkboard and have the students enter them into their Simple Machines Journal.
2. Explain to the students that many years ago, inventors discovered ways to make life easier for us. Elijah McCoy was very important in the steam locomotive industry.
3. Read the biography of Elijah McCoy to the students. Explain unusual words or

difficult concepts that the students may not have knowledge of from the book.

4. After the story is read, discuss the life of Elijah McCoy with the students. How has his discovery affected the world today? What would have been the outcome if he had not invented the oil cup?
5. Explain that the invention that Elijah McCoy made helped reduce friction in the steam engine's wheels, which helped the wheels move more smoothly.
6. In small groups, give each group a toy car, paper towels, a piece of sand paper, and a small cup of oil. Have each child in the group roll the toy car over the piece of sandpaper. Write a sentence explaining how the car moved on the sand paper.
7. Next, have the students pour oil over the sandpaper, then roll the toy car again. Did the car move more easily on the sand paper? Write a sentence describing how it moved.
8. After the students have cleaned up the oil with the paper towels and disposed of the sand paper and towels, have the students come together again in a large group and discuss their findings. Explain that the oil helped the car move more easily over the paper. Thus, lubricants in machines can reduce the friction or rubbing of the object against one another.

E. *Assessment/Evaluation*

1. The teacher will evaluate the responses of the students on the worksheet for the lesson to see if the student learned the skills of the lesson (Appendix K).
2. The students will write in their journals what they learned about Elijah McCoy and friction. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson, and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.

VI. CULMINATING ACTIVITY

A. At the beginning of the unit, instructions can be sent home to the parents explaining that the student will make a simple machine of their own. The invention can contain more that one simple machine, but the student must be able to identify the simple machines in their project. A simple machine fair will be held at the end of the unit. Each child will present their invention and explain how it works. The machines can be displayed for all of the parents and children to see. The parents can be invited to the "Simple Machine Fair". The simple machines that the students constructed can be evaluated with the rubric Appendix Q.

B. Each day the students will turn in their journals to be rubriced with a checklist form found in Appendix O. The form will include what the daily lesson was, what concepts the student needed to learn, the vocabulary for the lesson, and the skills for that lesson. Appendix O is a generic form that can be used for all of the lessons.

C. The students will take a unit test on Simple Machines that will include vocabulary and skills for the unit (Appendix N).

VII. HANDOUTS/WORKSHEETS

A. Appendix A: Making Butter
B. Appendix B: Kinds of Work
C. Appendix C: Power and Energy
D. Appendix D: My Simple Machine
E. Appendix E: An Incline Plane
F. Appendix F: What is a Wedge?

G. Appendix G: Screws
H. Appendix H: What Happens with a Lever?
I. Appendix I: Shapes for the Wheel and Axle
J. Appendix J: Pulleys
K. Appendix K: Friction
L. Appendix L: Simple Machines Journal Page
M. Appendix M: Cover of the Simple Machine Journal
N. Appendix N: Simple Machine Unit Test
O. Appendix O: Grading Rubric for the Simple Machine Journal
P. Appendix P: Message Pulley System
Q. Appendix Q: Rubric for Grading Simple Machine Project

VIII. BIBLIOGRAPHY

A. Albert, Toni M. Ed., *Simple Machines, Step-by-Step-Science Series*. Greensboro, North Carolina: Carson-Dellosa Publishing Company, Inc., 1994. CD-7296.

B. Carratello, John and Patty. *Simple Machines, Hands-On- Science*. Sunset Beach, California. Teacher Created Materials. 1988. TCM-227.

C. *Core Knowledge Sequence*. Canada. Core Knowledge Foundation, Charlottesville, VA. 1999. ISBN 1-890517-20-8.

D. Dahl, Michael. *Inclined Planes*. Mankato, MN. Capstone Press. 1996. ISBN 1-56065-447-3.

E. Glover, David. *Pulleys and Gears, Simple Machines*. United Kingdom. Rigby Interactive Library-Rigby Education. 1997. ISBN 1-57572-084-1

F. Glover, David. *Screws, Simple Machines*. United Kingdom. Rigby Interactive Library-Rigby Education. 1997. ISBN 1-57572-085-X.

G. Glover, David. *Wheels and Cranks, Simple Machines*. United Kingdom. Rigby Interactive Library-Rigby Education. 1997. ISBN 1-57572-081-7.

H. Glover, David. *Ramps and Wedges, Simple Machines*. United Kingdom. Rigby Interactive Library-Rigby Education. 1997. ISBN 1-57572-083-3.

I. Glover, David. *Levers, Simple Machines*. United Kingdom. Rigby Interactive Library-Rigby Education. 1997. ISBN 1-57572-080-9.

J. Haslam, Andrew and David Glover. *Make It Work-Machines*. Princeton, New Jersey. Two-Can Publishing. 2001. ISBN 1-587-28-368-9.

K. Hirsch Jr., E.D. *What Your Second Grader Needs to Know*. New York: Dell Publishing, 1991. ISBN 0-385-31027-7.

L. Hodge, Deborah. *Simple Machines, Starting with Science*. Buffalo, New York. Kids Can Press Ltd. 1998. ISBN 1-55074-311-2.

M. *Simple Tools & Machines*. Grand Rapids, Michigan. Ideal School Supply. ID5751. ISBN 1-56451-928-7.

N. Towle, Wendy. *The Real McCoy, the Life of an African-American Inventor.* U.S.A. Scholastic, Inc. 1993. ISBN 0-590-43596-5.

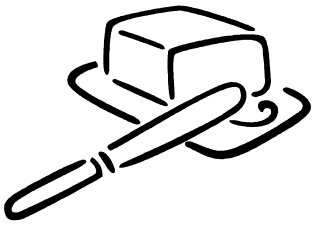
O. Whittle, Fran and Sarah Lawrence. *Design and Create Simple Machines*. Austin, TX. 1998. ISBN 0-8172-4889-7.

P. Zubrowske, Bernie. *Wheels at Work*. New York. A Boston Children's Museum Activity Book, Morrow Junior Books. 1986. ISBN 0-688-06348-9.

Appendix A
Making Butter (Lesson One)

NAME: _____

Answer each question in a complete sentence.



MAKING BUTTER WORKSHEET

1. How long did it take to make the butter by shaking it in the jar?

_____

_____

2. How long did it take to make the butter by mixing it with the electric mixer?

_____

_____

3. Which method required more work?

_____

_____

4. Did the electric mixer make the work easier and quicker? How?

_____

_____

_____

_____

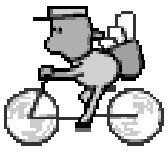
5. Name another machine that helps make work easier.

_____

_____

Appendix B
Kinds of Work (Lesson Two)

Name: _____



KINDS OF WORK

Draw a picture of the one of the kinds of work that you might do at home.

Describe what kind of work that you do. What kind of force do you do when you do your job?

_____

_____

_____

_____

_____

Appendix C
Power and Energy (Lesson Three)

Name: _____

POWER AND ENERGY

1. What is another way you use energy everyday?

_____

_____

_____

2. What are two machines that use energy? What kind of energy do they use?

_____

_____

_____

_____

_____

3. Draw a picture of someone using energy and power.

Appendix D
My Simple Machine (Lesson Four)

Name: _____

MY SIMPLE MACHINE

Draw a picture of someone using a simple machine. Make sure you label the kind of simple machine it contains.

Write a sentence describing your picture.

_____

_____

_____

_____

Appendix E
An Incline Plane (Lesson Five)

Name: _____

AN INCLINED PLANE

Write the numbers in the chart below as we do the lesson today.

Length of the Board	The Number on the Spring Scale

1. Which incline plane required the least force to move the book? How long was the incline plane?

_____

2. Which incline plane required more force and what was the length of that incline plane?

_____

Appendix F
Which One Is a Wedge? (Lesson Six)

Name: _____

Which One is a Wedge?

Circle the pictures that are wedges. Put an x on the ones that are not wedges.

Appendix G
Screws (Lesson Seven)

Name: _____

SCREWS

Answer each question in a complete sentence.

1. How many times did it take to turn the screw into the wood?

_____

2. How secure is the screw in the wood?
(very tight, tight,loose)

_____

_____

3. Can you pull the screw out with your hands?

_____

4. Will the screw work itself loose? Why?

_____

_____

_____

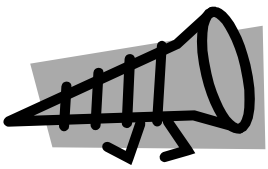
_____

5. Can you name another kind of machine that uses a screw? What is it?

_____

_____

_____



Appendix H
What Happens With a Lever? (Lesson Eight)

Name:_____

What Happens with a Lever?

As we do our lesson, fill in the chart.

Where is the fulcrum? What position?	What is the length of the "Weight Arm"?	How many books did it take to lift the load?
Position 1		
Position 2		
Position 3		
Position 4		

1. What do I want to find out about levers?

_____

_____

_____

2. What did I learn about levers?

_____

_____

_____

_____

_____

Color in the number of books it took to raise the lever:

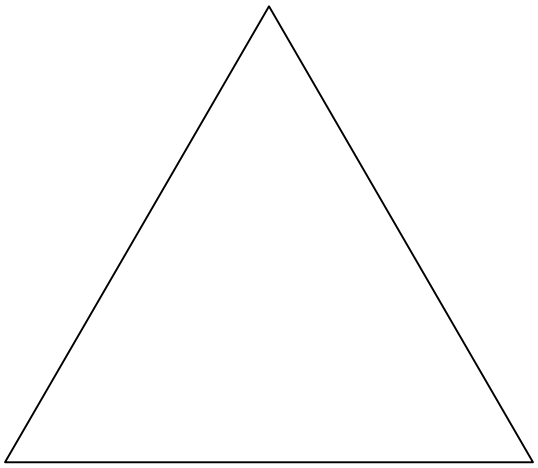
How many books?	Position #1		Position #2		Position #3		Postion #4
14							
13							
12							
11							
10							
9							
8							
7							
6							
5							
4							
3							
2							
1							
	#1		#2		#3		#4

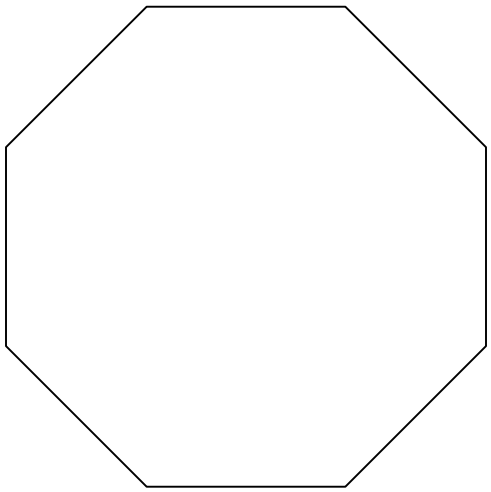
Which position took the least amount of books?_____

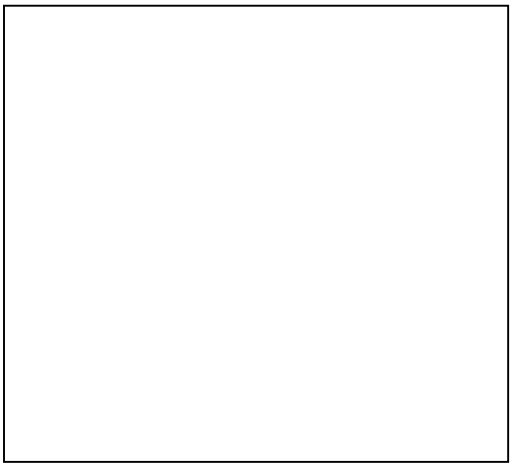
Which postion took the most amount of books? _____

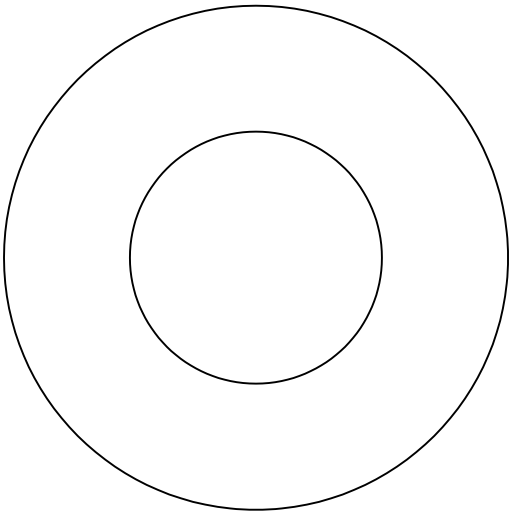
Appendix I
Shapes for the Wheel and Axle (Lesson Nine)

SHAPES FOR THE WHEEL AND AXLE









Appendix J
Pulleys (Lesson Ten)

Name:_____

PULLEYS

Answer each question in a complete sentence.

1. How did the pulley message system work? What did it do?

_____

_____

_____

_____

_____

_____

2. Can you name two other ways that we use pulleys in our everyday life?

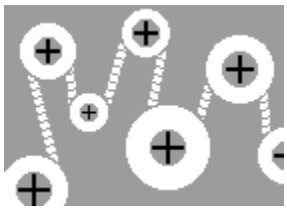
1._____

_____

2._____

_____

3. Draw a picture of someone using a pulley.



Appendix K
Friction (Lesson Twelve)

Name:_____

FRICTION

1. Describe what happened when you pushed the toy car over the sandpaper?How did it move?

_____

_____

_____

_____

_____

2. Describe what happened when you pushed the toy car over the sandpaper after the oil had been poured on it. How did it move?

_____

_____

_____

_____

_____

3. Name one way we use liquids such as soap or oil to reduce friction in our everyday life?

_____

_____

_____

Today's date: _____

My Simple Machine Journal

The name of the lesson today was:

_____

What happened in our experiment today?

_____

_____

_____

_____

What did I learn today?

_____

_____

_____

_____

_____

_____

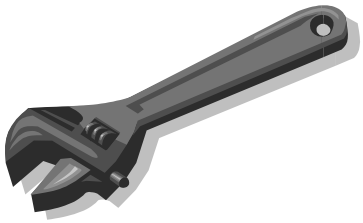
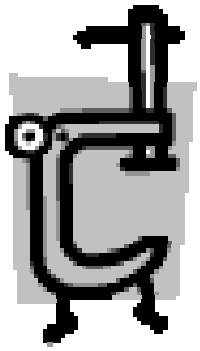
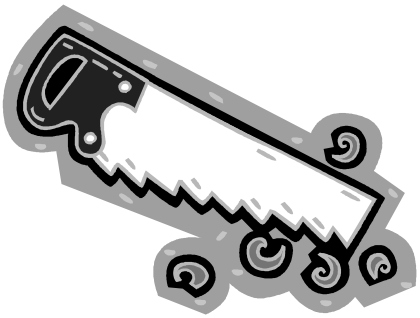
_____

_____

_____

_____

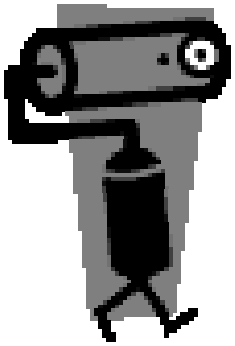
Appendix M
Simple Machine Journal Cover

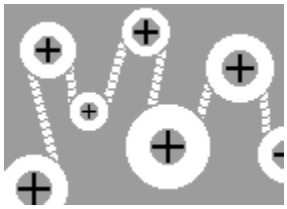
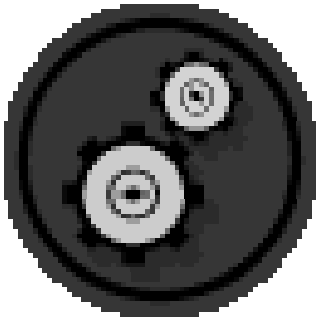
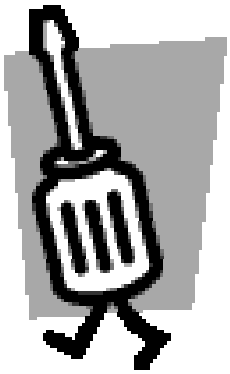




MY SIMPLE MACHINE JOURNAL

NAME:_____

Class:_____



Appendix N
UNIT TEST

Name: _____

SIMPLE MACHINES UNIT TEST

Circle the correct answer.

1. The purpose of a tool is to

    a. fill up a tool box.
    b. make work easier.
    c. make houses.

2. A tool becomes a simple machine when

    a. it is being used to make work easier.
    b. it gets big enough.
    c. when two of them are put together.

3. The definition of a complex machine is

    a. something that is run with a battery.
    b. something that is complicated.
    c. a machine that is made of two or more simple machines.

4. An inclined plane lets you

    a. move things to a up or down.
    b. move things from side to side.
    c. lets you cut things.

5. A wedge is made of

    a. two screws put together.
    b. two pulleys put together.
    c. two inclined planes put together.

6. A lever lets you

    a. move things that weigh twice as much as you do.
    b. move things from side to side.
    c. cut things in half.

Simple Machines Unit Test continued

7. A lever has these three parts

   a. a top, a bottom, and a middle.
   b. a fulcrum, force arm, and weight arm.
   c. a force arm, a lever, and a screw.

8. A wheel and axle is

   a. a wheel that turns on a post.
   b. a wheel that rolls up an inclined plane.
   c. a pulley that moves things up and down.

9. A pulley lets you

   a. move things in circles.
   b. move things from a higher place to a lower place.
   c. move things up and down or from side to side.

10. The definition of a screw is

   a. two inclined planes put together.
   b. an inclined plane wrapped around a cylinder.
   c. a wheel that moves on a post.

11. Screws are used to

   a. move things from side to side.
   b. hold pieces of wood or metal together.
   c. to hold ropes for pulleys.

12. Gears are really

   a. wheels that turn on posts.
   b. two pulleys that are put together.
   c. wheels with notches or teeth around their outer edge.

Simple Machines Unit Test continued

13. Elijah McCoy was an inventor

    a. who made a machine that would reduce friction.
    b. told stories about machines.
    c. played music around the country.

14. Energy is the

    a. something very powerful.
    b. the ability to do work.
    c. juice you get from a soft drink.

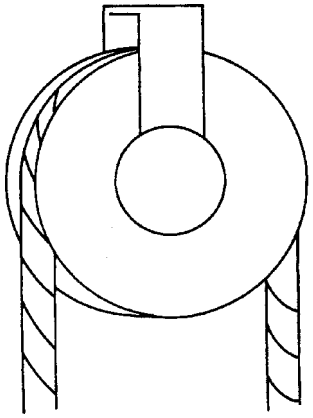
15. Effort is

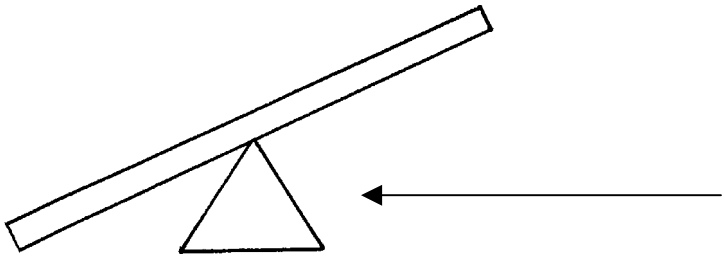
    a. the amount of force that you use working.
    b. how much work is done.
    c. what you had for breakfast.

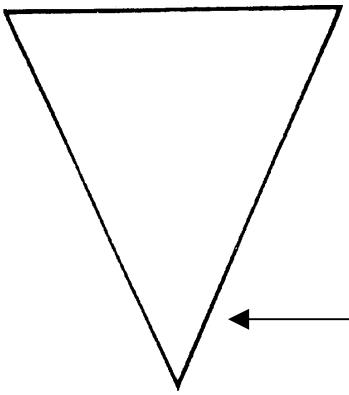
Simple Machines Unit Test continued

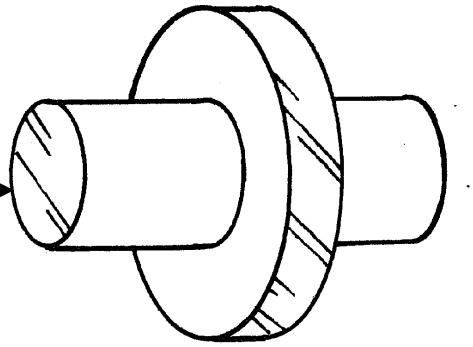
Write the name of each simple machine on the arrow.

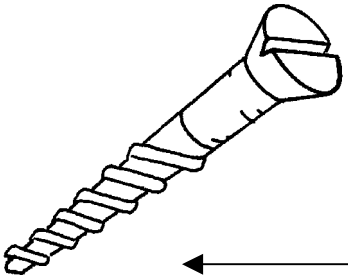
Word Bank:					
Wheel and Axle	Lever	Pulley	Wedge	Screw	Incline Plane

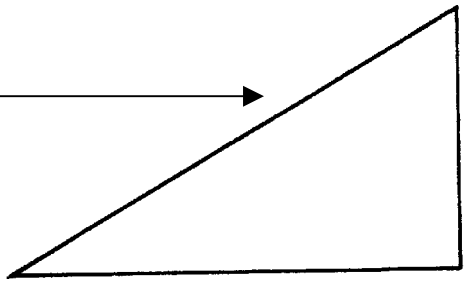












Appendix O
Grading Rubric for Journal

Name:_____

Grading Rubric for the Simple Machine Journal

Subject Area			**Scale**			
1. Journal contains all vocabulary words.	0	1	2	3	4	5
2. The student used complete sentences.	0	1	2	3	4	5
3. The student used correct punctuation.	0	1	2	3	4	5
4. The student used correct spelling.	0	1	2	3	4	5
5. The student completed all topics.	0	1	2	3	4	5
6. The student used proper grammar.	0	1	2	3	4	5
7. The student was creative in their discoveries.	0	1	2	3	4	5
8. The student completed all assignments.	0	1	2	3	4	5
9. The student's drawings were complete.	0	1	2	3	4	5
10. The student was creative in their drawings.	0	1	2	3	4	5

Score:_____

Grade: _____

Appendix P
A Message Pulley System (Lesson Ten)

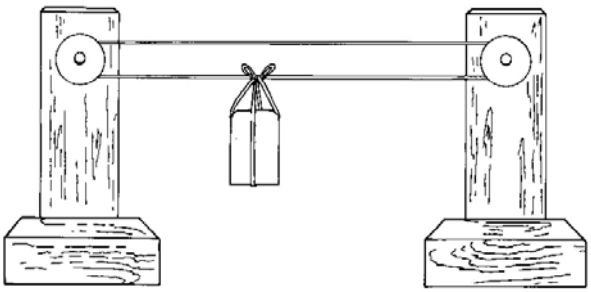
Adapted from Simple Tools &Machines by Ideal School Supply

You will need:

Two thread spools
Three feet of string
Long nails the longer than your thread spools
Smaller nails to nail your boards together
Four boards, these can be cut from a 2” x 4” x 8’ of lumber
(Cut the lumber in four sections two feet long)
Hammer
Paper clips and paper (to send messages)
Small pieces of paper to write messages

Directions:

1. Hammer two of the four sections together to make an upside down “T”.
2. Attach the thread spools with the long nails by putting them through the opening in the spools and hammering them into the upright part of the “T”.
3. Tie the ends of the string together and loop it over the pulley spools.
4. Pull on the upper string to move your messages.



Appendix Q
Rubric for Simple Machine Project

Simple Machine Project Rubric

Student's Name: _____

Project Name: _____

Project Description	Points					
1. The student identified the project.	0	1	2	3	4	5
2. The student identified the simple machines used.	0	1	2	3	4	5
3. The student explained in detail how it was made.	0	1	2	3	4	5
4. The student identified the materials in the project.	0	1	2	3	4	5
5. The student spoke clearly in their presentation.	0	1	2	3	4	5
6. The student understood and explained the how it operated.	0	1	2	3	4	5

Total number of points: _____

Grade: _____