

# SIMPLE MACHINES MADE SIMPLE

**Grade Level or Special Area:** 2<sup>nd</sup> Grade Science

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**Length of Unit:** 10 lessons (nine science and one writing, 45 minutes each) and a Culminating Activity (two hours)

## I. ABSTRACT

This 2<sup>nd</sup> grade science unit addresses the six simple machines: inclined planes, wedges, screws, levers, wheels and axles, and pulleys. Students will explore their uses in making work easier and faster in a variety of ways including: experimenting, sorting, labeling, filling in tables, using the scientific method, and writing a paragraph. The unit will culminate when students present the inventions they have created at home to their classmates.

## II. OVERVIEW

### A. Concept Objectives

1. Students will learn science by actively taking part in the process: asking questions, manipulating materials, working as a member of a team, making observations, drawing conclusions, and occasionally designing and conducting experiments. (Jefferson County Science Standard 2.1)
2. Students will understand how to communicate observations, experimental methods, understanding, and results in a variety of ways. (Jefferson County Science Standard 2.2)
3. Students will understand how to write effectively for a variety of purposes. (Jefferson County English Language Arts Standard 3)

### B. Content from the *Core Knowledge Sequence*

1. Science: Simple Machines (pg. 61)
  - a. Lever
  - b. Pulley
  - c. wheel-and-axle
    - i. gears: wheels with teeth and notches
    - ii. how gears work, and familiar uses (for example, in bicycles)
  - d. inclined plane
  - e. wedge
  - f. screw
  - g. friction, and ways to reduce friction (lubricants, rollers, etc.)
2. Language Arts: Writing (pg. 43)
  - a. Produce a variety of types of writing –such as stories, reports, letters, poems, descriptions—and make reasonable judgments about what to include in his or her own written works based on the purpose and type of composition.

### C. Skill Objectives

1. Students will experiment with examples of the six simple machines and correctly identify them.
2. Students will memorize definitions and actions for tested vocabulary words.
3. Students will explain that tools are used to do things better, faster, or more easily. (Jefferson County Science Standard 3.1.A)
4. Students will practice using the Scientific Method when doing an experiment.
5. Students will sort wedges into the appropriate categories according to their function.
6. Students will give examples of the different types of work screws do.

7. Students will record the results of an experiment in a table.
8. Students will distinguish between objects that have wheels and axles and those that do not.
9. Students will use a pulley to lift a heavy object and record their observations.
10. Students will use lubricants and rollers and observe how they reduce friction.
11. Students will decide which simple machine to use for a given task.
12. Students will explain their choice in a written paragraph.
13. Students will demonstrate understanding of simple machines by successfully completing the unit test.

### III. BACKGROUND KNOWLEDGE

- A. For Teachers
  1. [edtech.Kennesaw.edu/web/simmach.html](http://edtech.Kennesaw.edu/web/simmach.html)
  2. [www.mikids.com/Smachines.htm](http://www.mikids.com/Smachines.htm)
  3. [www.edheads.org/activities/simple-machines/](http://www.edheads.org/activities/simple-machines/)
- B. For Students
  1. None, this is an introductory unit.

### IV. RESOURCES

- A. *Inclined Planes* by Michael Dahl (Lesson Two)
- B. *Inclined Planes* by Anne Welsbacher (Lesson Two)
- C. *Wedges* by Anne Welsbacher (Lesson Three)
- D. *Screws* by Anne Welsbacher (Lesson Four)
- E. *Levers* by Michael Dahl (Lesson Five)
- F. *Levers* by Anne Welsbacher (Lesson Five)
- G. *Wheels and Axles* by Michael Dahl (Lesson Six)
- H. *Wheels and Axles* by Anne Welsbacher (Lesson Six)
- I. *Pulleys* by Michael Dahl (Lesson Seven)
- J. *Pulleys* by Anne Welsbacher (Lesson Seven)
- K. *All About Simple Machines* Schlessinger Media (Lesson Eight)
- L. *Simple Machines* 100% Educational Videos (Lesson Eight)

### V. LESSONS

#### Lesson One: What is a Simple Machine? (45 minutes)

- A. *Daily Objectives*
  1. Concept Objective(s)
    - a. Students will learn science by actively taking part in the process: asking questions, manipulating materials, working as a member of a team, making observations, drawing conclusions, and occasionally designing and conducting experiments. (Jefferson County Science Standard 2.1)
  2. Lesson Content
    - a. Simple Machines
  3. Skill Objective(s)
    - a. Students will experiment with examples of the six simple machines and correctly identify them.
    - b. Students will memorize definitions and actions for tested vocabulary words.
- B. *Materials*
  1. A large heavy object (see Procedure 1)
  2. Materials for Lesson One (Appendix A)

3. A light colored piece of 12" x 18" construction paper for each child, folded in half to make a Simple Machines folder
  4. A copy of Which Machine is It? (Appendix B) for each child
  5. A copy of Simple Machine Project Letter (Appendix C) for each child
  6. A copy of Simple Machine Project Checklist (Appendix D) for each child
  7. A copy of Simple Machines Report (Appendix R) for each child
- C. *Key Vocabulary*
1. Machine: something that makes work easier, faster, or better
  2. Work: when a force moves an object
  3. Force: a push or pull
- D. *Procedures/Activities*
1. Engage students by dragging a heavy box across the floor. Make comments like, "This is so hard. I wish I had something to make it easier. This is too much work. I need to lift it up on the desk, but it is too heavy."
  2. Have students briefly discuss what they think work is. Tell them the definition, work is when a force moves an object. Think of some simple motions to act out such as picking something up and moving it. Have students stand up and act out the definition while repeating it out loud. Define force as a push or pull. Again have students act out the definition, repeating it as they do so.
  3. Have a student or students do the following activities while the rest of the class determines whether what they are doing is work or not. If they say it is work, have them tell what the force is and what object was moved. If it is not work, have them say why not.
    - a. Stand holding a heavy pile of books. (no)
    - b. Push a pencil across a desk. (yes)
    - c. Pick up a chair and carry it. (yes)
    - d. Push against the wall. (no)
    - e. Turn a page in a book. (yes)
  4. Define machine as something that makes work easier, faster, or better. As with the other words you will have students repeat the definition and act it out. For easier, you might have them make a muscle. To go faster, have them jog in place and for better give the A-OK sign. Have them list some machines and tell how they fit the definition.
  5. Tell them that for the next two weeks, they will be learning about simple machines and using what they know to make an invention.
  6. Prior to class, set up six stations, one for each simple machine. See Appendix A for suggestions as to what to include. Be sure to have a sign at each station naming the simple machine.
  7. Divide students into six groups and have them rotate through each station, taking about three minutes per station. This is a discovery time so do not tell them what the six simple machines are ahead of time. Give them each a copy of the What Machine is It? worksheet (Appendix B) to complete as they go through the stations.
  8. Have students return to their seats and refer back to your attempt to move the heavy object. Ask them which simple machine would help make your work easier. Try their suggestions to see if they will work. (A wheel and axle such as a scoot board from the gym will move it more easily and an inclined plane such as a board will help raise it up to the desk.
  9. Pass out the folders. On the outside of the folders **at the top** they should write the title SIMPLE MACHINES and their name.

10. Discuss the at-home project, which is the creation of something that has at least two simple machines in it. Pass out the letter (Appendix C), the checklist (Appendix D), and the Simple Machines Report form (Appendix R) for students to take home.
  11. Have students stand up and do the actions and say the definitions for machine, work, and force.
- E. *Assessment/Evaluation*
1. Check Appendix B to see that students have labeled each picture correctly and place it in the Simple Machines folder.

**Lesson Two: Investigating Inclined Planes (45 minutes)**

- A. *Daily Objectives*
1. Concept Objective(s)
    - a. Students will learn science by actively taking part in the process: asking questions, manipulating materials, working as a member of a team, making observations, drawing conclusions, and occasionally designing and conducting experiments. (Jefferson County Science Standard 2.1)
    - b. Students will understand how to communicate observations, experimental methods, understanding and results in a variety of ways. (Jefferson County Science Standard 2.1)
  2. Lesson Content
    - a. Simple Machines
      - i. Inclined plane
  3. Skill Objective(s)
    - a. Students will explain that tools are used to do things better, faster, or more easily. (Jefferson County Science Standard 3.1.A)
    - b. Students will practice using the Scientific Method when doing an experiment.
    - c. Students will memorize definitions and actions for tested vocabulary words.
- B. *Materials*
1. *Inclined Planes* by Anne Welsbacher
  2. *Inclined Planes* by Michael Dahl
  3. Materials for Lesson Two (Appendix A)
  4. A copy of Inclined Plane Investigations (Appendix E) for each child
  5. A copy of Inclined Plane Investigations Checklist (Appendix F) for each child
  6. Each child's Simple Machine folder
- C. *Key Vocabulary*
1. Plane: any flat surface
  2. Inclined plane: a plane that has one end higher than the other
- D. *Procedures/Activities*
1. Read *Inclined Planes* by Michael Dahl through page 19 or *Inclined Planes* by Anne Welsbacher, omitting pages 15 and 19. Define plane and have students look for planes in the classroom: desktop, floor, pieces of paper, etc.
  2. Define inclined plane as a plane that has one end higher than the other. Have students stand and "act out" the definition as they say it by putting their arms at an oblique angle.
  3. Gather students to an area of the classroom where you have room for demonstrations. Hook the toy car onto the spring scale and have a student lift it straight up. Note the amount of effort or force it took on the white board. Measure the distance the car traveled (from the floor to where it stopped). Next

put one end of the board on the dictionary. Have a child pull the car up the board and record the effort. Measure the distance the car traveled (the length of the board). Help students to see that in order to use less force, the distance must be increased. Discuss how a path straight up a hill is harder to climb than one that goes back and forth. Option: You can continue adding dictionaries to the pile and measuring the effort with the spring scale so students can see that the steeper the incline the more effort it takes to travel up it.

4. Place two eggs on a desk. Have the ramp made out of aluminum foil boxes laying nearby. Elicit from students the question: "What is the best way to get the egg to the ground?" Have students make predictions (hypotheses) and discuss procedures guiding them towards using the ramp if necessary. Pass out Inclined Plane Investigation (Appendix E) and have students fill out the Question, Hypothesis, and Procedure parts. Drop the first egg straight off the desk. Be sure to cover the surrounding area with newspaper. (Note: You might want to try this beforehand to make sure the egg will break from that height). Following the procedures the students suggested, use the ramp to lower the egg to the floor. (Note: You might want to hard-boil this one just in case!) Discuss the results of the experiment and help students form a conclusion such as: "The ramp (inclined plane) helped lower the egg with less force so it didn't break." Have students complete the rest of the worksheet, recording the results and the conclusion.
5. On the front of students' Simple Machines folder, have them draw a horizontal line, dividing the front cover in half. From the horizontal line to the bottom of the page, have them draw a vertical line, dividing the bottom part of the folder in half. In the first rectangle (lower left hand corner) have them write the word **inclined plane** and the definition. Then have them draw and label a picture of some sort of inclined plane.
6. Review the definitions and actions for plane, inclined plane, work, force, and machine. Have students partner up and practice saying the definitions with actions for each other.

E. *Assessment/Evaluation*

1. Assess the Inclined Planes Investigation worksheet (Appendix E) using the Inclined Planes Investigation Checklist (Appendix F), then place it in the Simple Machines folder.

**Lesson Three: Working with Wedges (45 minutes)**

A. *Daily Objectives*

1. Concept Objective(s)
  - a. Students will learn science by actively taking part in the process: asking questions, manipulating materials, working as a member of a team, making observations, drawing conclusions, and occasionally designing and conducting experiments. (Jefferson County Science Standard 2.1)
  - b. Students will understand how to communicate observations, experimental methods, understanding, and results in a variety of ways. (Jefferson County Science Standard 2.2)
2. Lesson Content
  - a. Simple Machines
    - i. Wedges
3. Skill Objective(s)
  - a. Students will explain that tools are used to do things better, faster, or more easily. (Jefferson County Science Standard 3.1.A)

- b. Students will sort wedges into the appropriate categories according to their function.
  - c. Students will memorize definitions and actions for tested vocabulary words.
- B. *Materials*
  - 1. *Wedges* by Anne Welsbacher
  - 2. Materials for Lesson Three (Appendix A)
  - 3. A copy of Working with Wedges (Appendix G) for each student
  - 4. A copy of the bottom half of Appendix H for each student
  - 5. Students' Simple Machine folders
- C. *Key Vocabulary*
  - 1. Wedge: two inclined planes that come to a point to make lifting or splitting easier
- D. *Procedures/Activities*
  - 1. Read *Wedges* by Anne Welsbacher. Take two triangular blocks. Have students identify them as inclined planes. Put them back-to-back. Define wedge as two inclined planes that come to a point to make lifting or splitting easier. To act out, put hands together to form a point, then turn sideways to lift and split using a chopping motion. Have students practice the definition and actions twice.
  - 2. Pass out Working with Wedges (Appendix G). Hold up each of the items listed one at a time. Have students indicate on the paper whether each item is a wedge or not by circling yes or no.
  - 3. Bring students to the demonstration area. Hand a student the block of wood and ask him to put it against the door then try to move the door. Give another student a doorstop and ask her to put it against the door then try to move it. Discuss that the doorstop worked better because it lifted the door so it didn't move. Flatten the clay and place it on the newspaper. Using the block of wood have a student try to cut the clay in half. Then hand someone the doorstop and ask him or her to cut the clay. Discuss how this points out that wedges are good for splitting things apart. Take a nail and a bolt and try to hammer each of them into a board. Ask students to explain why the nail went in and the bolt didn't. Have them point out where the wedge is on the nail and explain that it is used to split.
  - 4. Have students refer back to their worksheets, as you show each item listed. Have them identify each as a wedge and tell where the wedge is on each. You might want to demonstrate how each is used. Have them correct any wrong answers. (Adapted from *Simple Machines* by Carson-Dellosa.)
  - 5. Review the two ways that wedges work: by lifting or splitting. Pass out the bottom half of Appendix H. (You will use the top half in Lesson Four.) Have students cut out each picture and place it in the correct column.
  - 6. When students finish their worksheet, have them place it in their Simple Machines folder. In the second square on the front cover (bottom right hand corner), have them write **wedge**, the definition, and draw and label an example of one. Have them place their worksheet in their folder.
  - 7. Leave out the materials **that are safe for students to handle** and allow them to experiment with them when they have finished their work.
  - 8. As a class review vocabulary definitions and actions from the first three lessons.
- E. *Assessment/Evaluation*
  - 1. Check Working with Wedges worksheet (Appendix G) to make sure students have sorted the wedges correctly.

## Lesson Four: Scrutinizing Screws (45 minutes)

### A. *Daily Objectives*

1. Concept Objective(s)
  - a. Students will learn science by actively taking part in the process: asking, questions, manipulating materials, working as a member of a team, making observations, drawing conclusions, and occasionally designing and conducting experiments. (Jefferson County Science Standard 2.1)
  - b. Student will understand how to communicate observations, experimental methods, understanding, and result in a variety of ways. (Jefferson County Science Standard 2.2)
2. Lesson Content
  - a. Simple Machines
    - i. Screws
3. Skill Objective(s)
  - a. Students will explain that tools are used to do things better, faster or more easily. (Jefferson County Science Standard 3.1.A)
  - b. Students will give examples of the different types of work screws do.
  - c. Students will memorize definitions and actions for tested vocabulary words.

### B. *Materials*

1. *Screws* by Anne Welsbacher
2. A copy of the top half of *Wedges and Screws* (Appendix H) for each student
3. Materials for Lesson Four (Appendix A)
4. A copy of *Scrutinizing Screws* (Appendix I) for each student
5. Students' Simple Machine folders

### C. *Key Vocabulary*

1. Screw: an inclined plane wrapped around a pole

### D. *Procedures/Activities*

1. Pass out the top half of Appendix H and have students cut out and color the triangle as indicated. Ask them to tell what simple machine it is (inclined plane). Have them wrap the triangle around a pencil, starting where indicated with the colored side out. With their finger, have them trace the colored line. Define a screw as an inclined plane wrapped around a pole. For actions start in inclined plane position and then wrap your arms around your body.
2. Give each pair of children two index cards and two different screws. Have them pierce the card with the screw then turn the card around and watch it move up the screw. If you want, you can have them mark one side of the card in some way and count how many rotations it takes to reach the top. This should be the same number as the number of threads. Have them repeat with the other screw and observe the differences.
3. Read *Screws* by Anne Welsbacher. Discuss how screws are used to join things together, grip them, lift them, or hold them tight.
4. Have students come to the demonstration area. Demonstrate each of the four things screws can do. For example for **join**, you might screw two boards together. For **grip**, you might glue two pieces of wood together and clamp them with a C-clamp or vise (if you have one). For **lift**, you might use a corkscrew to take a cork out of a bottle or show how a carjack works if you have access to the screw type. For **hold tight**, you could have a jar with a lid, a light bulb in a lamp, a tube of toothpaste, etc.

5. Pass out Scrutinizing Screws (Appendix I) and have students complete it. Leave the demonstration materials in a place where students can consult them if you would like.
  6. Have students divide the back cover of their Simple Machines folder into fourths. In the top left hand square have them write **screw** and the definition and draw and label an example. Place the worksheet in the folder.
  7. If students finish early, let them experiment with various types of screws.
  8. Have students review their vocabulary words with a partner.
- E. *Assessment/Evaluation*
1. Assess the Scrutinizing Screws worksheets (Appendix I) to make sure that students have the correct type of screw for each category.

### **Lesson Five: Lifting with Levers (45 minutes)**

- A. *Daily Objectives*
1. Concept Objective(s)
    - a. Students will learn science by actively taking part in the process: asking questions, manipulating materials, working as a member of a team, making observations, drawing conclusions, and occasionally designing and conducting experiments. (Jefferson County Science Standard 2.1)
    - b. Students will understand how to communicate observations, experimental methods, understanding, and results in a variety of ways. (Jefferson County Science Standard 2.2)
  2. Lesson Content
    - a. Simple Machines
      - i. levers
  3. Skill Objective(s)
    - a. Students will explain that tools are used to do things better, faster, or more easily. (Jefferson County Science Standard 3.1.A)
    - b. Students will record the results of an experiment in a table.
    - c. Students will memorize definitions and actions for tested vocabulary words.
- B. *Materials*
1. *Levers* by Michael Dahl
  2. *Levers* by Anne Welsbacher
  3. Materials for Lesson Five (Appendix A)
  4. A copy of Lifting with Levers (Appendix J) for each child
  5. Each child's Simple Machines folder
- C. *Key Vocabulary*
1. Lever: a bar that pivots around a fulcrum
  2. Fulcrum: the point on which a lever rests
- D. *Procedures/Activities*
1. Place your 6' board over the fulcrum so about two thirds of it is on one side and one third in on the other. Call the smallest child in the class to the front of the room and ask her to pick you up. Obviously she won't be able to do it. Tell her you have a simple machine that will help her make the job easier. Stand on the short end of the teeter-totter and have her stand on the long end. She should be able to lift you easily. Tell the class that the machine used was a lever.
  2. Read *Levers* by Anne Welsbacher or *Levers* by Michael Dahl. Define lever as a bar that pivots around a fulcrum. Act it out by having one arm be the bar and move it across the other, which is the fulcrum. Define fulcrum as the point on which a lever rests. Point to the arm, which is the fulcrum.

3. Call students up to the demonstration area and demonstrate with their help a variety of levers. Be sure to ask them each time to point out the fulcrum. Some examples of things to do are: pry a lid off a can with a screwdriver, hammer a nail into a board, pull the nail out of the board, swing a baseball bat, sweep with a broom, cut with scissors (you might want to review that the blades are wedges), staple a piece of paper, use a pair of pliers or tongs, use a balance scale, etc. I would not go into any more detail about first, second, or third class levers than what is in the book. The point you want to make is that there are a variety of levers and they help us in many ways.
  4. Pass out the index cards. Have students fold them into fourths, then tape into a triangle. (Note: one side will overlap.) Pass out the units to be weighed (color tiles, pennies, etc.) Have students make a lever using the ruler and the cardboard triangle and experiment with balancing units, including varying the position of the fulcrum. After about five minutes of exploration, ask what they have observed. Pass out *Lifting with Levers* (Appendix J) and have students complete it. You might have them share their results with a partner.
  5. Pass out the Simple Machines folders. Have students write **levers** in the top right hand square on the back cover and define the word, then draw and label an example. Place the worksheet in the folder. Let students experiment with the levers you have used when they finish their work.
  6. Call on groups of two or three students to do the definition and actions for each vocabulary word.
- E. *Assessment/Evaluation*
1. Review *Lifting with Levers* worksheets (Appendix J). The point is not so much that the answers are exact, but that the table shows that as one end of the lever nears the fulcrum, the other end can lift more. Look for understanding of the concept.

### **Lesson Six: Working with Wheels and Axles and Gears (45 minutes)**

- A. *Daily Objectives*
1. Concept Objective(s)
    - a. Students will learn science by actively taking part in the process: asking questions, manipulating materials, working as a member of a team, making observations, drawing conclusions, and occasionally designing and conducting experiments. (Jefferson County Science Standard 2.1)
    - b. Students will understand how to communicate observations, experimental methods, understanding and results in a variety of ways. (Jefferson County Science Standard 2.2)
  2. Lesson Content
    - a. Simple Machines
      - i. Wheel-and-axle
        - a) gears: wheels with teeth and notches
        - b) how gears work, and familiar uses (for example, in bicycles)
  3. Skill Objective(s)
    - a. Students will explain that tools are used to do things better, faster, or more easily. (Jefferson County Science Standard 3.1.A)
    - b. Students will distinguish between objects that have wheels and axles and those that do not.
    - c. Students will memorize definitions and actions for tested vocabulary words.

- B. *Materials*
1. *Wheels and Axles* by Michael Dahl
  2. *Wheels and Axles* by Anne Welsbacher
  3. Materials for Lesson Six (Appendix A)
  4. A copy of Which Ones are Wheels and Axles? (Appendix K) for each student
  5. A copy of Wheel and Axle Picture Page (Appendix L) for each student
  6. Students' Simple Machine folder
- C. *Key Vocabulary*
1. Wheel and axle: a wheel with an axle through its center to move loads
  2. Gear: wheels with teeth that fit together
  3. Friction: a force that slows down objects when they rub against each other
- D. *Procedures/Activities*
1. Take the students outside to an area where there is a sidewalk or parking lot. Put the board down on the ground and have one student sit on it. Ask the biggest child in the class to push the board down the sidewalk. (If he can budge it at all, it will be with great difficulty.) Show the students the two scoot boards or skateboards and ask them how they could use those to make the work easier. Put one scoot board under each end of the board and have the student move the other student on the board again. Discuss why this time it was easier. If you have time, you can let other students have a turn.
  2. Back in the classroom, read *Wheels and Axles* by Michael Dahl or *Wheels and Axles* by Anne Welsbacher. Define a wheel and axle as a wheel with an axle through its center to move loads. Act it out by making a circle with thumb and forefinger of one hand and putting the forefinger of the other hand through the center for an axle. Refer back to the outside activity and explain that it was friction that made it difficult for the board to move along the sidewalk. Define friction as a force that slows down objects when they rub against each other. Act it out by rubbing hands together quickly and then more slowly. (Note: Friction will be studied in more detail in Lesson Eight.)
  3. Bring students to the demonstration area. Ask someone to try to screw a screw into a board with their fingers. Then give them a screwdriver to use instead. Point out that the shaft is the axle and the handle is the wheel. Show other examples of wheels and axles that you might have such as a pencil sharpener, rolling pin, doorknob, etc. Ask students to list other examples of wheels and axles.
  4. Hold up a Judy clock or something else that has visible gears. Tell students that gears are a special kind of wheel. Define gears as wheels with teeth that fit together. Act out by interlacing fingers end-to-end and rolling them up and down. This is a very visual way for them to observe that gears travel in opposite directions. If you have anything else with gears in it such as Lego Dacta kit 9610, an eggbeater, a bicycle, you can show them those as well.
  5. Pass out Which Ones are Wheels and Axles? (Appendix K) and Wheel and Axle Picture Page (Appendix L) and have students complete it. Then have them on the lower left hand square of the back cover of their Simple Machines folder write **wheel and axle**, define it, and draw and label an example. Place the worksheets in the Simple Machines folders. Leave demonstration items out for students to experiment with as they finish.
  6. As a class review all of the vocabulary and actions.
- E. *Assessment/Evaluation*
1. Assess Which Ones Are Wheels and Axles? worksheet (Appendix K) to make sure students have sorted the objects correctly.

## Lesson Seven: Pulling with Pulleys (45 minutes)

### A. Daily Objectives

1. Concept Objective(s)
  - a. Students will learn science by actively taking part in the process: asking questions, manipulating materials, working as a member of a team, making observations, drawing conclusions, and occasionally designing and conducting experiments. (Jefferson County Science Standard 2.1)
  - b. Students will understand how to communicate observations, experimental methods, understanding, and results in a variety of ways. (Jefferson County Science Standard 2.2)
2. Lesson Content
  - a. Simple Machines
    - i. pulleys
3. Skill Objective(s)
  - a. Students will explain that tools are used to do things better, faster, or more easily. (Jefferson County Science Standard 3.1.A)
  - b. Students will use a pulley to lift a heavy object and record their observations.
  - c. Students will memorize definitions and actions for tested vocabulary words.

### B. Materials

1. *Pulleys* by Michael Dahl
2. *Pulleys* by Anne Welsbacher
3. Materials for Lesson Seven (Appendix A)
4. A copy of Pulling with Pulleys (Appendix M) for each student
5. A copy of Simple Machines Folder Checklist (Appendix N) for each student
6. Students' Simple Machines folders

### C. Key Vocabulary

1. Pulley: a wheel with a groove for a rope, used for lifting

### D. Procedures/Activities

1. Read *Pulleys* by Anne Welsbacher or *Pulleys* by Michael Dahl. Define pulley as a wheel with a groove for a rope that is used for lifting. For actions, mimic pulling down on the pulley.
2. Today's activity will be a little different, because students will be using the pulley one at a time and then filling out their Pulling with Pulleys worksheet (Appendix M). While students are waiting their turn, have them write **pulley** in the last square on their back cover and the definition, then draw and label an example. This would be a time for students to finish anything that isn't done. You could also have examples of the different simple machines set up around the room for students to explore. Whatever they do they need to be able to work independently, because unless you have an educational assistant or parent volunteer to help out, you will need to be assisting the student who is working with the pulley.
3. Hang the pulley in a sturdy spot. Hand the student the gallon milk carton that is full of water and ask him or her to lift it. Next attach it to the pulley and let the student raise it that way. If you have a rough rope, you will want to have gloves for them to wear so they don't get splinters. When students finish the activity, send them to their seats to do the worksheet and place it in their Simple Machines folder.

4. Call on volunteers to lead the rest of the class in reviewing the vocabulary words and actions.
- E. *Assessment/Evaluation*
1. Assess Pulling with Pulleys worksheet (Appendix M) to make sure students have answered the questions correctly. Evaluate the contents of their Simple Machines folder using the Simple Machines Folder Checklist (Appendix N). Send the Simple Machines folders home for students to use in studying for the unit test.

**Lesson Eight: Finding out About Friction (45 minutes)**

- A. *Daily Objectives*
1. Concept Objective(s)
    - a. Students will learn science by actively taking part in the process: asking questions, manipulating materials, working as a member of a team, making observations, drawing conclusions, and occasionally designing and conducting experiments. (Jefferson County Science Standard 2.1)
    - b. Students will understand how to communicate observations, experimental methods, understanding, and results in a variety of ways. (Jefferson County Science Standard 2.2)
  2. Lesson Content
    - a. Simple Machines
      - i. friction, and ways to reduce friction (lubricants, rollers, etc.)
  3. Skill Objective(s)
    - a. Students will use lubricants and rollers and observe how they reduce friction.
    - b. Students will memorize definitions and actions for tested vocabulary words.
- B. *Materials*
1. *Simple Machines* by 100% Educational Videos, Inc.
  2. *All About Simple Machines* by Schlessinger Media
  3. Materials for Lesson Eight (Appendix A)
- C. *Key Vocabulary*
1. Friction: a force that slows down objects when they rub against each other
  2. Lubricant: an oily or greasy substance applied to make a surface smooth or slippery
- D. *Procedures/Activities*
1. Remind students of the first lesson when you were dragging the heavy object and the sixth lesson when the student was trying to push the other student on the board. Tell them each task was difficult or impossible because of friction. Review the definition of friction. Ask them to recall what helped to reduce friction and make the work easier (a wheel and axle.) Tell them that wheels and axles are one way of reducing friction. They are rollers.
  2. Have students rub their hands together very rapidly. They should notice that the friction makes their hands get very warm. Tell them that in addition to slowing objects down, friction makes them get very hot so people use lubricants (oily or greasy substances applied to a surface to make it smooth or slippery) to reduce the friction. They will have the opportunity to explore how rollers and lubricants help reduce friction.
  3. Divide the class into groups to rotate through the four stations. Allow about four minutes at each station.

4. Station One Have students make two identical ramps out of the boards and books. Place the car with no wheels on one and the car with wheels on the other and see which goes down faster. Why?
  5. Station Two Have students turn one can upside down and cover the surface with marbles. Place the other can on top of it and spin it around. Then put the top can on the floor and spin it around. Which is easier? Why? (Adapted from *Simple Machines* by Jo Ann Merrell)
  6. Station Three Line half of the cookie sheet with coarse sandpaper and grease the other side with cooking oil. Incline one side on the books. Place identical Lego pieces on each side and see which goes faster. Why? (Adapted from *Simple Machines* by Sandra Ford Grove and Dr. Judi Hechtman)
  7. Station Four Cover a 1' x 2' section of the tablecloth with cooking oil. Keep the other side dry. Give students two identical blocks of wood and have them give each a shove to see which one slides farther. Why? (Adapted from *Simple Machines* by Toni Albert)
  8. Have students share what they observed at the stations. Ask them which stations used lubricants to reduce friction. (Stations 3 and 4) At which stations were rollers used to reduce friction? (Stations 1 and 2)
  9. As a review of the unit, show the video *Simple Machines* by 100% Educational Videos or *All About Simple Machines* by Schlessinger Media. (Note: You may choose instead to show a video as an introduction to the unit.)
- E. *Assessment/Evaluation*
1. During the group discussion after being at the stations, monitor students' understanding of friction and the use of lubricants and rollers to reduce it.

### **Lesson Nine: Which Simple Machine Should You Use? (45 minutes)**

- A. *Daily Objectives*
1. Concept Objective(s)
    - a. Students will understand how to communicate observations, experimental methods, understanding, and results in a variety of ways. (Jefferson County Science Standard 2.2)
    - b. Students will understand how to write effectively for a variety of purposes. (Jefferson County English Language Arts Standard 3)
  2. Lesson Content
    - a. Writing
      - i. Produce a variety of types of writing—such as stories, reports, letters, poems, descriptions—and make reasonable judgments about what to include in his or her own written works based on the purpose and type of composition.
  3. Skill Objective(s)
    - a. Students will decide which simple machine to use for a given task.
    - b. Students will explain their choice in a written paragraph.
- B. *Materials*
1. Writing paper for each child
  2. A copy of Which Simple Machine Should I Use? (Appendix O) for each child
  3. A copy of Which Simple Machine Should I Use? Rubric (Appendix P) for each child
- C. *Key Vocabulary*
- None

- D. *Procedures/Activities*
1. Since this is a writing lesson, you may do it during your normal writing time rather than during science.
  2. Pass out Which Simple Machine Should I Use? (Appendix O). Have students choose one of the scenarios to write about. Depending on how experienced they are at writing paragraphs, give them as detailed directions as needed. The rubric will assess their ability to write a topic sentence, details, and a concluding sentence, so if your students are not yet ready to do those things, you will need to modify it.
  3. You may wish to pass out the rubric and go over it, before students begin writing, so they will know what your expectations are.
  4. Have students write a paragraph telling which simple machine they would use and how they would use it for the picture they have chosen.
- E. *Assessment/Evaluation*
1. Assess students' writing using Which Simple Machine Should I Use? Rubric (Appendix P).

**Lesson Ten: Simple Machines Unit Test (45 minutes)**

- A. *Daily Objectives*
1. Concept Objective(s)
    - a. Students will learn science by actively taking part in the process: asking questions, manipulating materials, working as a member of a team, making observations, drawing conclusions, and occasionally designing and conducting experiments. (Jefferson County Science Standard 2.1)
    - b. Students will understand how to communicate observations, experimental methods, understanding and results in a variety of ways. (Jefferson County Science Standard 2.2)
  2. Lesson Content
    - a. Simple Machines
  3. Skill Objective(s)
    - a. Students will demonstrate understanding of simple machines by successfully completing the unit test.
- B. *Materials*
1. A copy of the Simple Machines Test (Appendix S) for each student
- C. *Key Vocabulary*
1. All key vocabulary will be tested
- D. *Procedures/Activities*
1. Pass out a copy of the Simple Machines Test to students and have them complete it independently.
- E. *Assessment/Evaluation*
1. Evaluate student mastery of the unit using the Simple Machines Unit Test (Appendix S).

**VI. CULMINATING ACTIVITY (two hours)**

- A. As a culminating activity, students will give an oral presentation of the simple machine project they made at home. Assess the project and presentation using the Simple Machine Project Checklist (Appendix D). If possible, you might want to put the projects on display for the rest of the school to see. Be sure to bring your camera to take a picture of the proud inventors with their creations. (Note: You might want to scatter these presentations throughout the day if you can. Otherwise little bodies can get very wiggly and inattentive.)

## VII. HANDOUTS/WORKSHEETS

- A. Appendix A: Materials Needed for Simple Machines Unit (three pages)
- B. Appendix B: What Simple Machine is It?
- C. Appendix C: Simple Machine Project Parent Letter
- D. Appendix D: Simple Machine Project Checklist
- E. Appendix E: Inclined Plane Investigation (two pages)
- F. Appendix F: Inclined Plane Investigation Checklist
- G. Appendix G: Working with Wedges
- H. Appendix H: Wedges and Screws
- I. Appendix I: Scrutinizing Screws
- J. Appendix J: Lifting with Levers
- K. Appendix K: Which Ones Are Wheels and Axles?
- L. Appendix L: Wheel and Axle Picture Page
- M. Appendix M: Pulling with Pulleys
- N. Appendix N: Simple Machines Folder Checklist
- O. Appendix O: Which Simple Machine Should I Use?
- P. Appendix P: Which Simple Machine Should I Use? Rubric
- Q. Appendix Q: Vocabulary and Actions (two pages)
- R. Appendix R: Simple Machines Report
- S. Appendix S: Simple Machine Test (three pages)
- T. Appendix T: Test Key (two pages)

## VIII. BIBLIOGRAPHY

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- M. Welsbacher, A. *Screws*. Mankato, MN: Bridgestone Books, 2001. 0-7368-0613-X
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## Appendix A, page 1

### Materials Needed for Simple Machines Unit

In addition to the materials listed here, you will want to have a variety of pieces of scrap wood and boards, nails, screws, bolts, Philips and regular head screwdrivers, hammers, etc. You might want to just go out in your garage and gather things up, although I have found it easier to keep a set of materials at school. Garage sales and flea markets are a good source. Before discarding something, cannibalize it for parts (it's off the subject, but I found very powerful magnets in an old speaker).

#### **LESSON ONE**

##### Inclined plane station

Several boards of different lengths  
2', 3', 4', at least 2" wide  
Little matchbox type cars  
A toy slide  
One or more spring scales  
Three or four books of a similar size such as  
dictionaries  
Etc.  
Sign "Inclined Planes"

##### Screw station

C-clamps  
Nuts and bolts  
Screws  
Jar with lid  
Lamp (unplugged!!) and light bulb  
Sign "Screws"  
Etc.

##### Wheel and axle station

Little cars  
Screwdriver  
Scoot board  
Hand-held eggbeater  
Crank type pencil sharpener  
Optional: Dacta Lego Kits 9616\* and 9610\*  
Etc.  
Sign "Wheel and axles"

##### Wedge station

Doorstop  
Plastic knife  
Nails  
Etc.  
Sign "Wedges"

##### Lever Station

Hammer  
Pliers  
Balance scale  
Ruler and pencil (for fulcrum)  
Optional: Dacta Lego Kit 9612\*  
Etc.  
Sign "Levers"

##### Pulley station

Small pulleys  
A block and tackle  
Optional: Dacta Lego Kit 9614\*  
Etc.  
Sign "Pulleys"

\* These Legos kits come with models for you to build so the students can experiment with simple machines. I found them in a teacher supply catalogue whose name escapes me, but you can probably order them directly from Lego Systems, Inc. 555 Taylor Road, P.O. Box 1600, Enfield, CT 06083.

## Appendix A, page 2

### LESSON TWO

Toy car  
Spring scale (measuring up to 5 pounds)  
Tape measure  
One or more books the same size, such as dictionaries  
A 4' long board at least 2" wide  
Two eggs (one hardboiled)  
A ramp made of 4 or 5 aluminum foil-type boxes, taped together with tops and ends cut out  
Newspaper

### LESSON THREE

Two triangular blocks	Scraps of wood
Push pin	Hammer
Scissors	Dinner knife
Nail	Doorstop
Block of wood 2" x 2" x 6"	Saw
A fist-sized or larger piece of clay	Chisel
A bolt that is flat on the bottom	

### LESSON FOUR

A pencil for each child  
An assortment of screws, at least one per child  
An index card for each child  
Scrap wood  
Screwdriver  
Wood glue  
C-clamps  
Vise (optional)  
Corkscrew, cork, and bottle or screw-type car jack  
Something with a screw on lid such as a jar or tube of toothpaste, etc.

### LESSON FIVE

2" x 10" x 6' board	Stapler
A fulcrum (a 6" x 6" x 10" post cut diagonally works well)	Scissors
Can with press on lid (paint, cocoa, etc.)	Broom
Flat-bladed screwdriver	Baseball bat
Balance scale	Scrap wood
One index card per child	Nail
One ruler per child	Hammer
Tongs or pliers	
15-20 units per child (i.e. pennies, color tiles, etc. something flat of uniform size)	

## Appendix A, page 3

### LESSON SIX

2" x 10" x 6' board

Two scoot boards or skateboards

Screw

Scrap wood

Screwdriver

Pencil sharpener

Optional: bicycle

Optional: Lego Dacta set 9610

Eggbeater

Judy clock (with visible gears)

Doorknob

Rolling pin

### LESSON SEVEN

Block and tackle or some other kind of pulley

Gallon milk jar filled with water

Optional: pair of child-sized gloves

Optional: Lego Dacta kit 9614

### LESSON EIGHT

#### Station One

Two identical boards (2" x 24")

Two cars, one with wheels and one without

Books to make two 12" stacks

#### Station Two

Two identical cans with rims (not empty)

50 marbles

#### Station Three

Cookie sheet with sides

Coarse sandpaper the size of half the cookie sheet

Vegetable cooking oil

Two identical flat Lego pieces

#### Station Four

Disposable plastic tablecloth

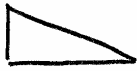
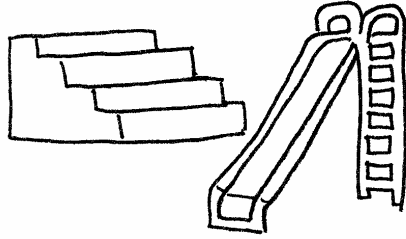
Cooking oil

Two wooden blocks (2" x 2")

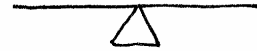
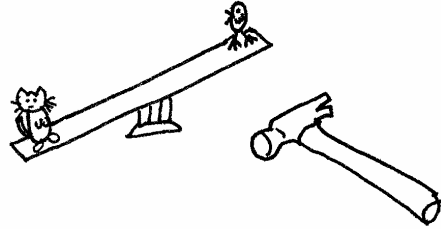
# Appendix B

## What Simple Machine is It?

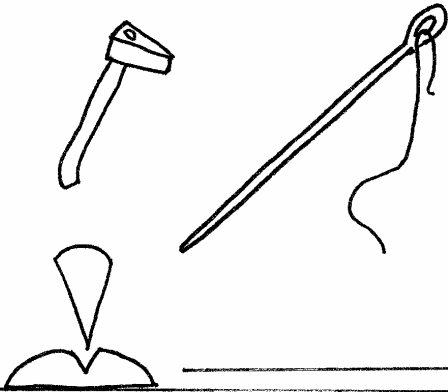
Write the name of each simple machine on the line by the correct pictures.



\_\_\_\_\_



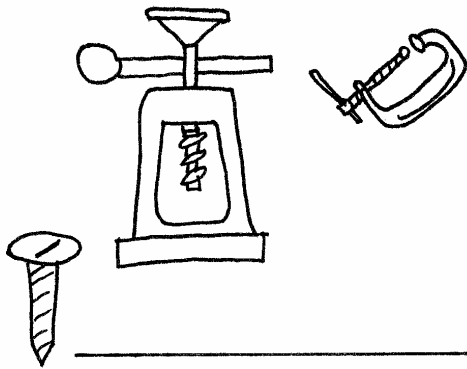
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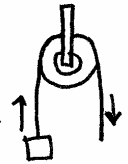
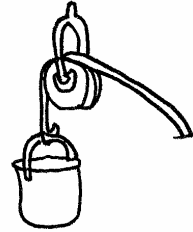
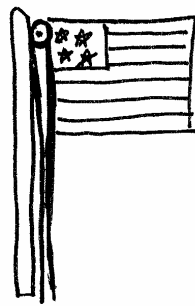
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## Appendix C

### Simple Machine Project Letter

We will be studying six simple machines in science. They are the inclined plane, the wedge, the wheel and axle (including gears), the lever, the pulley, and the screw.

**What:** You are to build an invention that includes two simple machines. Be creative and use your imagination! Your project should be small enough to fit on your desk. Fill out the report form telling about your invention using complete sentences. You must write this information yourself. You will present your invention to the class.

**When:** The project is due on Thursday, March 11, 2004.

**How:** You may use any materials that you wish to build your project such as wood, cardboard, glue, string, plastic bottles, etc. If you use Legos, K'nex, etc. you must make something that is your own creation not something from a kit. Use materials you have at home. Please do not go out and spend a lot of money on this.

**Grade:** Your grade will be in three parts: (See attached checklist)

1. The project itself  
(neatness, follows the assignment, etc.)
2. The written report  
(clear, neat, few mistakes)
3. The class presentation  
(explain what you did in a clear way and a loud voice and identify the simple machines used. You will need to know this information, not read it from your report because I will have that.)

Your parents may help you with things like sawing and drilling, but this should be **YOUR** idea and most of the **WORK** should be yours. Have fun with this! If you have any questions, be sure to ask us.

Mrs. Polzin  
Miss Hodge

Appendix D

Simple Machine Project Checklist

Name \_\_\_\_\_

**PROJECT (50 points)**

- \_\_\_/10 Neat
- \_\_\_/20 Includes 2 simple machines
- \_\_\_/10 Follows directions
- \_\_\_/10 Creativity

**WRITTEN REPORT (30 points)**

- \_\_\_/10 Complete
- \_\_\_/5 Neat
- \_\_\_/5 Easy to understand
- \_\_\_/5 Capital letters, punctuation, and spelling
- \_\_\_/5 Follows directions

**ORAL REPORT (20 points)**

- \_\_\_/15 Able to explain project
- \_\_\_/5 Audible

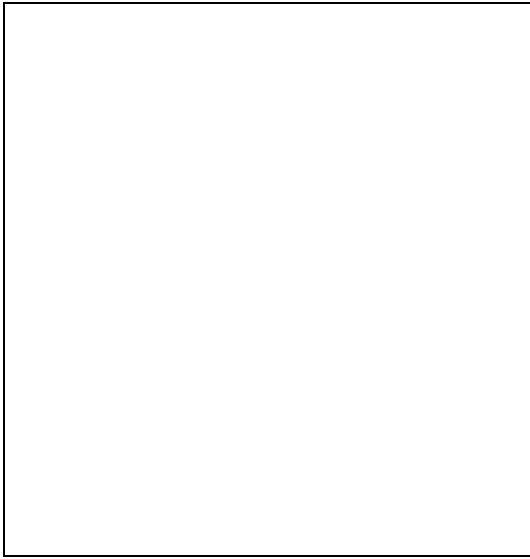
\_\_\_/100 TOTAL

\_\_\_ GRADE



**Appendix E, page 2**

Draw pictures and write about the **RESULTS** of the experiment (for both eggs).



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Write your **CONCLUSION** (what you learned). \_\_\_\_\_

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## Appendix F

### Inclined Plane Investigation Checklist

Name \_\_\_\_\_

#### Question

\_\_\_/2 Pertains to the experiment

\_\_\_/2 Is in the form of a question

#### Hypothesis

\_\_\_/2 Is reasonable

\_\_\_/2 A reason for the hypothesis is given

#### Procedures

\_\_\_/5 Are complete

\_\_\_/3 Are in order

#### Results

\_\_\_/4 First picture is neat, labeled, and clear

\_\_\_/4 Second picture is neat, labeled, and clear

\_\_\_/6 Written results clearly describe what happened

#### Conclusion

\_\_\_/3 Is accurate

\_\_\_/2 Refers to inclined planes

#### Total

\_\_\_/35

#### Comments:

## Appendix G

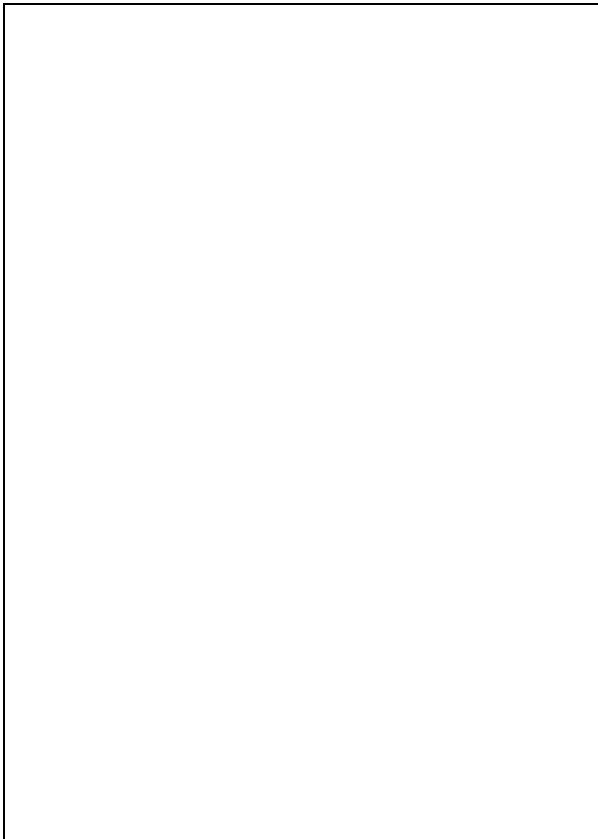
### Working with Wedges

Circle yes if the item listed is a wedge. Circle no if the item listed is not a wedge.

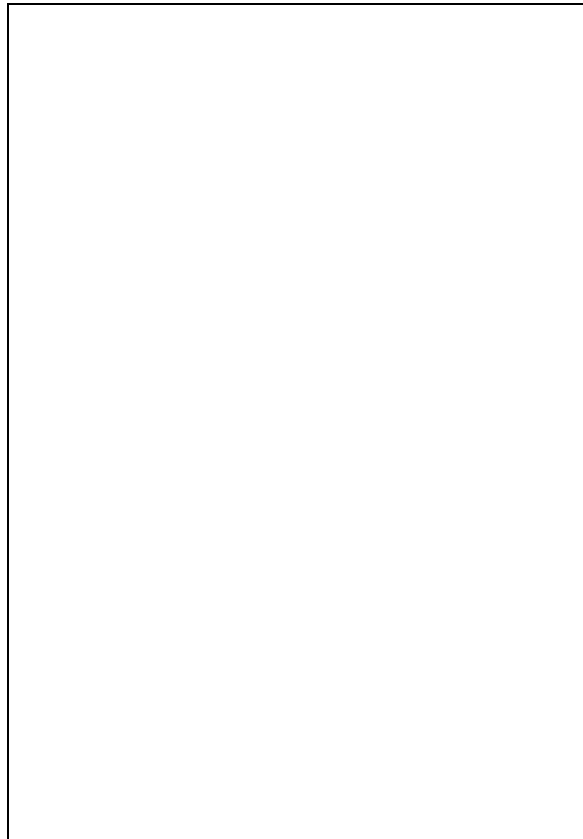
Push pin	yes	no
Scissors	yes	no
Nail	yes	no
Saw	yes	no
Chisel	yes	no
Doorstop	yes	no
Dinner knife	yes	no

Decide whether the wedge is used to lift or split apart. Glue its picture in the correct box.

**LIFT**



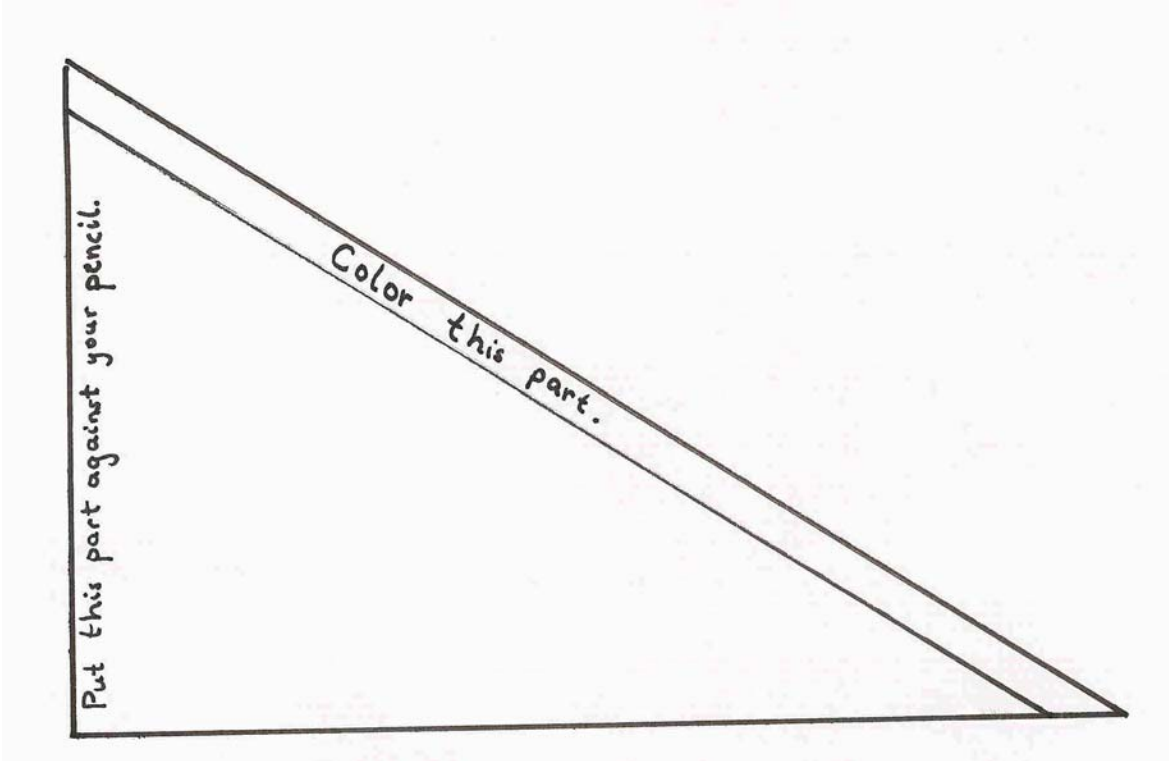
**SPLIT APART**



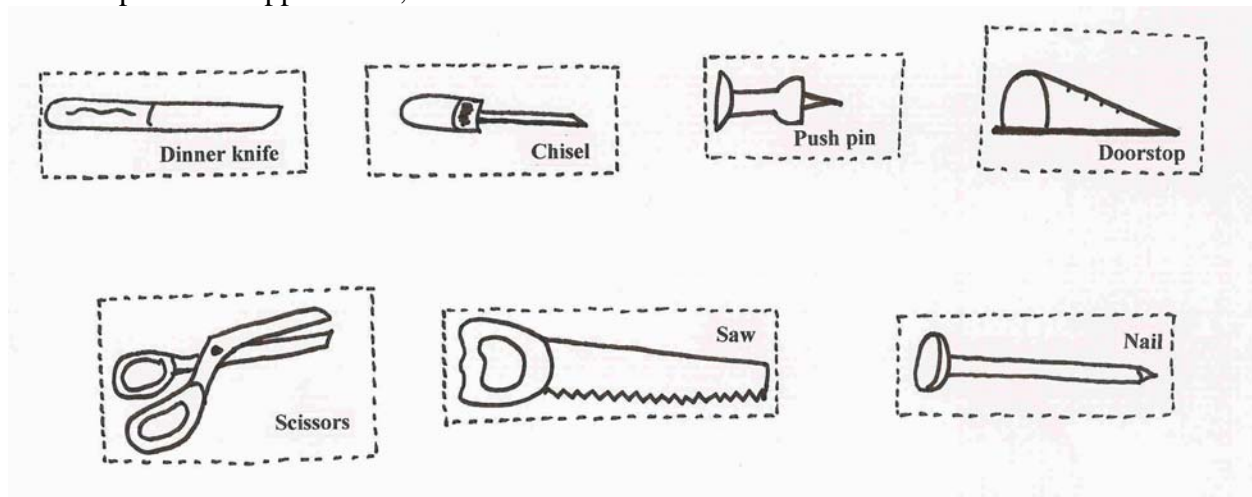
## Appendix H

### Wedges and Screws

Use this part with Lesson Four.



Use this part with Appendix G, Lesson Three.



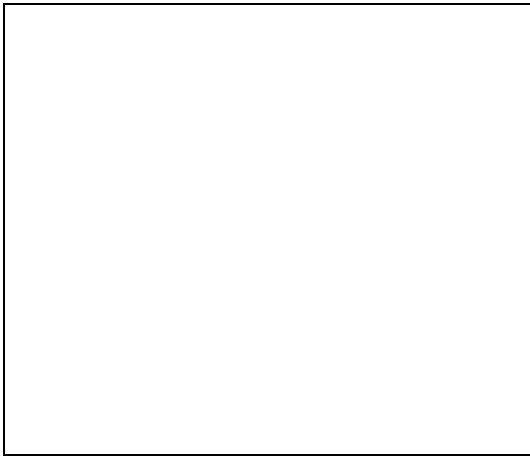
## Appendix I

Name \_\_\_\_\_

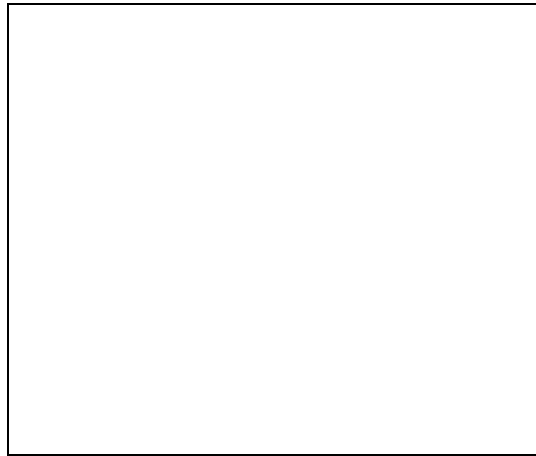
### Scrutinizing Screws

Screws can be used to join things, to grip things, to lift things, or to hold tight. In the boxes below, draw and label an example of each type.

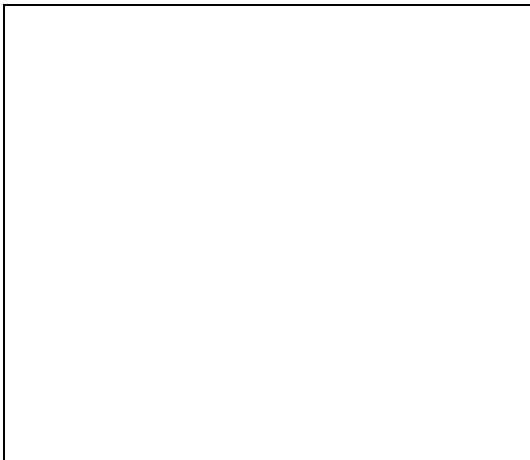
**JOIN**



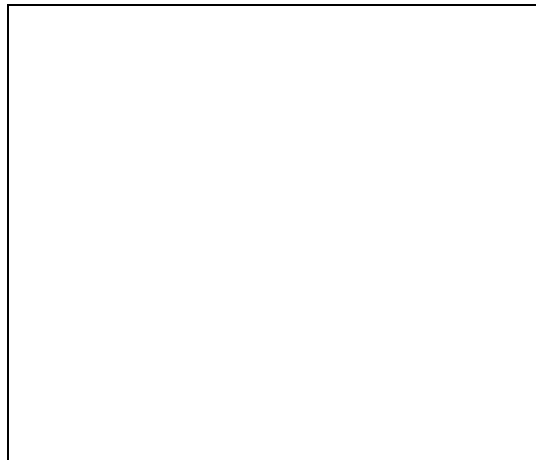
**GRIP**



**LIFT**



**HOLD TIGHT**



## Appendix J

### Lifting with Levers

Use a lever to see how many units one unit can lift.

You will need:

A ruler

A fulcrum

15-20 units such as color tiles or pennies

Put the fulcrum under the ruler at 6 inches. Put a unit on each side. They should about balance each other. Move the fulcrum to 5 inches. Add units to the 1-inch side. How many does it take until it lift the one unit? Record this on the table. Continue moving the fulcrum and adding units to fill the table.

Units	Fulcrum at
	6 inches
	5 inches
	4 inches
	3 inches
	2 inches

What did you find out? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Why do you think that happened? \_\_\_\_\_

\_\_\_\_\_

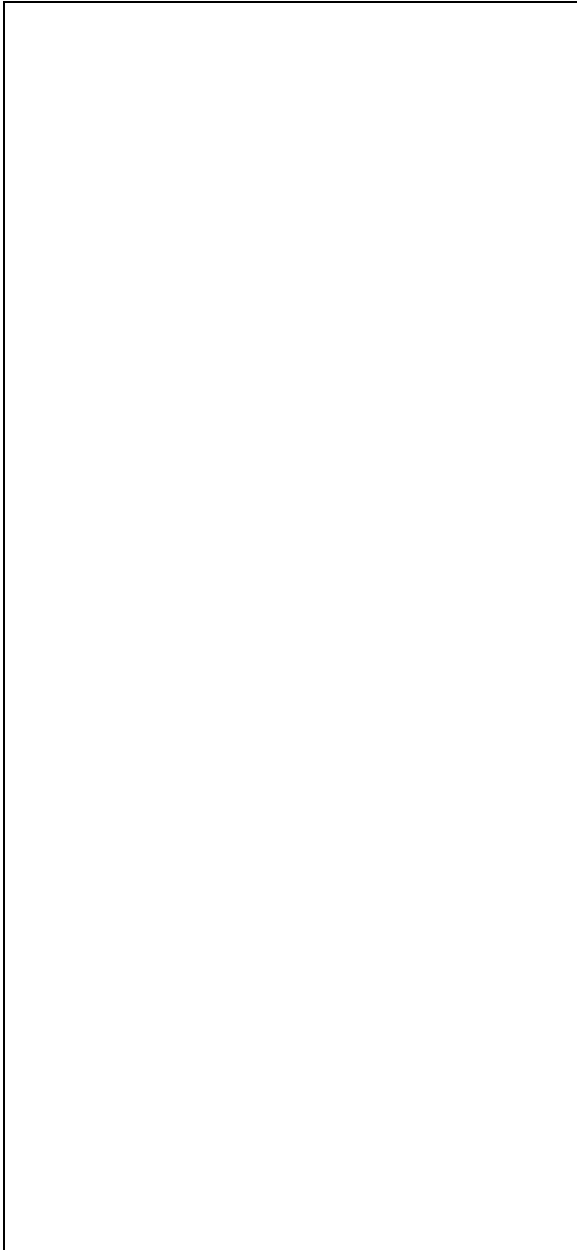
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## Appendix K

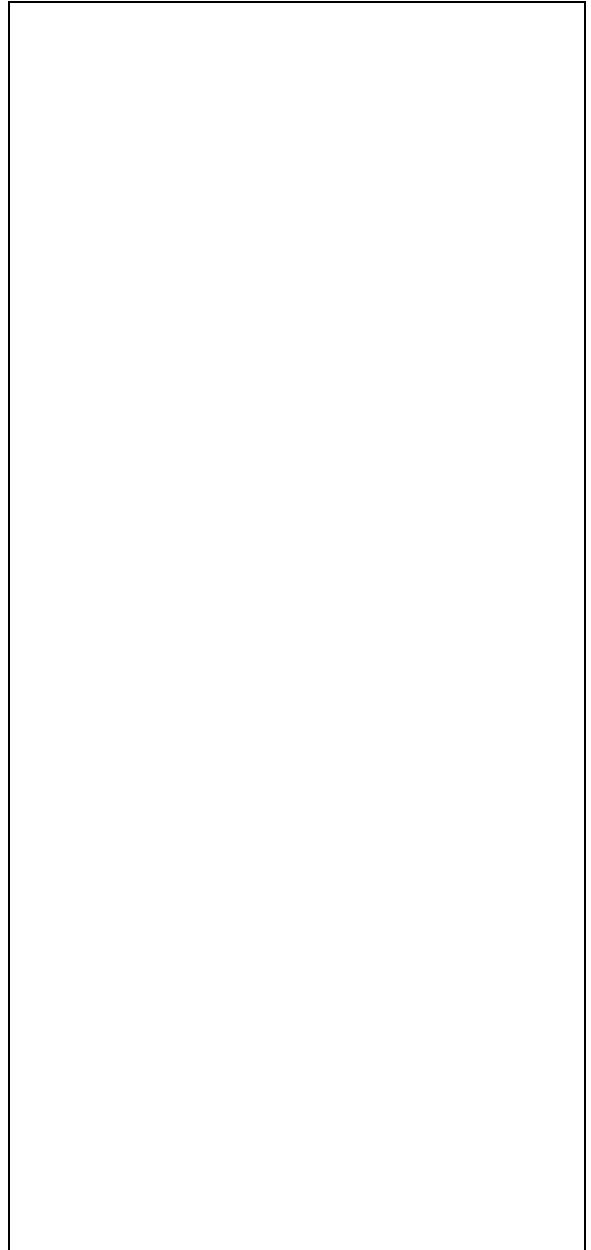
### Which Ones are Wheels and Axles?

Look at each picture. Decide if it is a wheel and axle. Cut it out and glue it in the correct space.

Wheel and axle

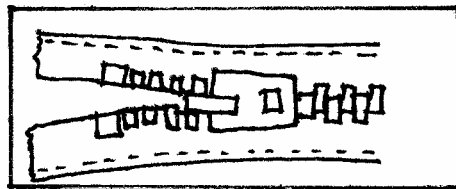
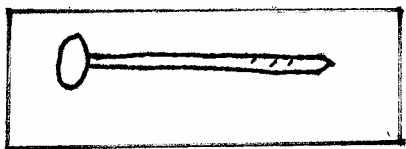
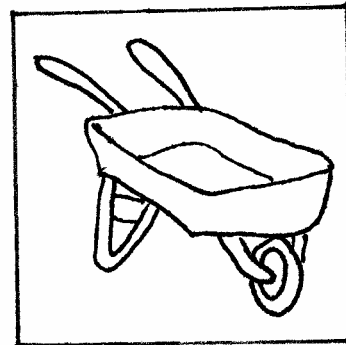
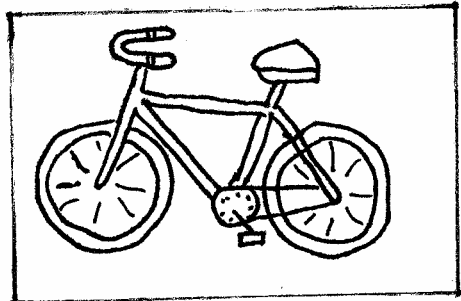
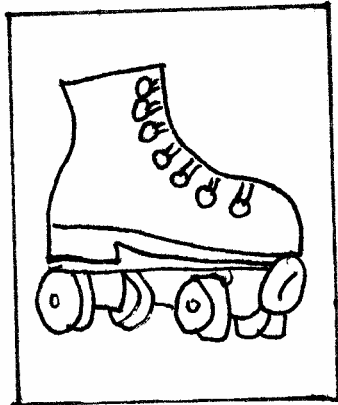
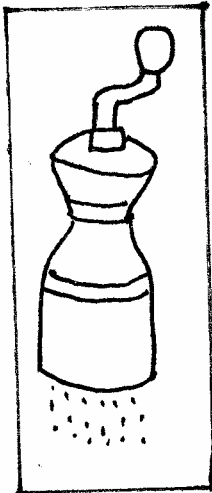
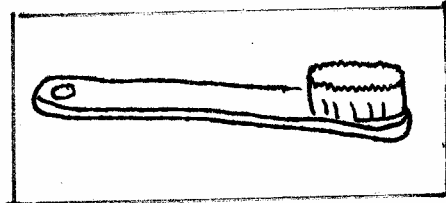
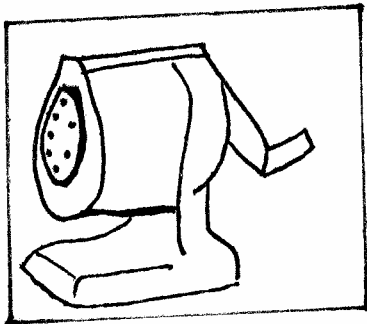
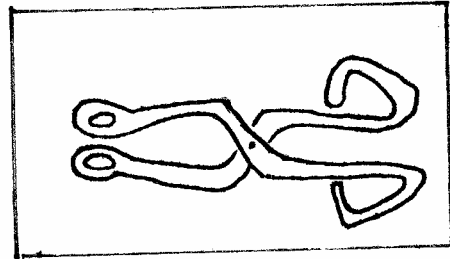
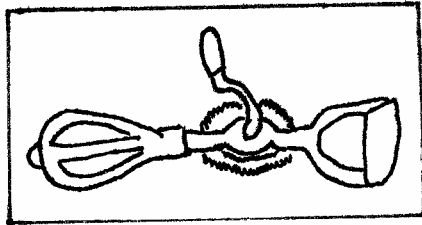


Not a wheel and axle



# Appendix L

## Wheel and Axle Picture Page



## Appendix M

### Pulling with Pulleys

Is it easier to lift something up by pulling down? Let's find out.

Pick up the gallon milk jar full of water. About how high can you lift it? Was lifting it easy or hard? Now use the block and tackle to lift the jar. Was it easier or harder? Did it take more time or less time?

Record your answers and draw pictures below. Be sure to use complete sentences.

Describe what it was like to lift the jug on your own.

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Lifting the jug by myself



Describe what it was like to lift the jug with the block and tackle.

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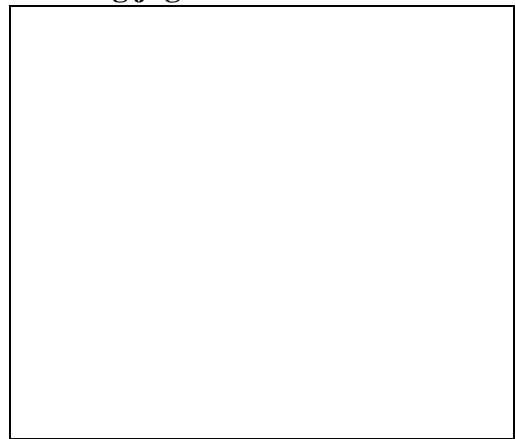
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Lifting jug with block and tackle



I learned that \_\_\_\_\_

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Appendix N

Name \_\_\_\_\_

**Simple Machines Folder**

- \_\_\_/30    Cover (1 point each: simple machine, definition, picture, label)**
- \_\_\_/6     What Simple Machine is It?**
- \_\_\_/35    Inclined Plane Investigation**
- \_\_\_/7     Working with Wedges**
- \_\_\_/8     Scrutinizing Screws**
- \_\_\_/10    Lifting with Levers**
- \_\_\_/10    Which Ones are Wheels and Axles?**
- \_\_\_/10    Pulling with Pulleys**
  
- \_\_\_/116   Total**

\_\_\_\_\_ **Grade**

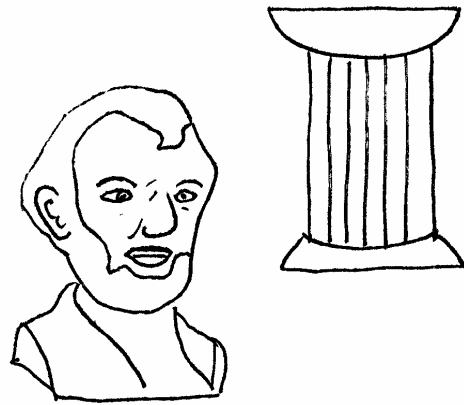
## Appendix O

### Which Simple Machine Should I Use?

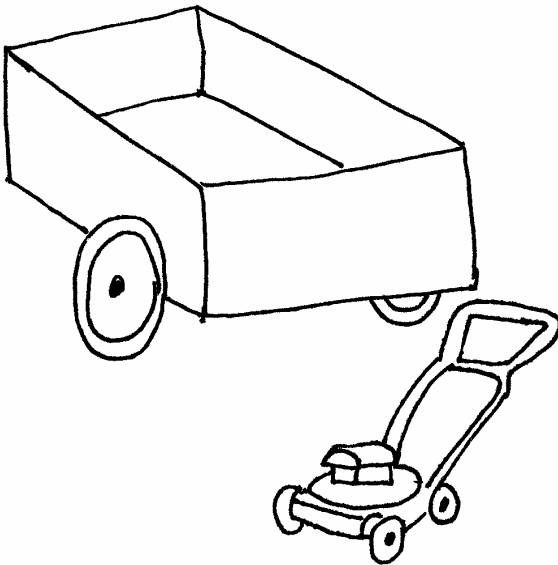
to take the bricks over to where the men are working?



to put the statue of Abraham Lincoln on the pedestal?



to put the lawnmower the in cart?



to plant the tree?



## Appendix P

### Which Simple Machine Should I Use Rubric?

	4 Excellent	3 Acceptable	2 Needs Work	1 Doesn't have
Topic sentence	Topic sentence grabs one's attention	Contains a topic sentence	Topic sentence is incomplete	Contains no topic sentence
Supporting details	Details contain many adjectives	Contains necessary supporting details	Few supporting details	Contains no supporting details
Concluding sentence	Conclusion contains a conclusion word	Contains a concluding sentence	Conclusion is incomplete	Contains no concluding sentence
Choice of machine	Choice of simple machine shows creativity	Simple machine chosen is correct	Simple machine chosen is not correct	No simple machine given
Description of task	Description contains several adjectives	Contains a description of the task	Description of task is incomplete or unclear	No description of task
Total				/20

Comments:

## Appendix Q, page 1

### Vocabulary and Actions

<u>Lesson</u>	<u>Word</u>	<u>Definition</u>	<u>Actions</u>
One	MACHINE	something that makes work easier, faster, or better	easier: make a muscle and smile, faster: jog, better: A-OK symbol
One	WORK	when a force moves an object	mimic picking something up and moving it
One	FORCE	a push or pull	just like it says
Two	PLANE	any flat surface	point to desk, floor, wall, etc.
Two	INCLINED PLANE	a plane that has one end higher than the other	hold arms out at an oblique angle
Three	WEDGE	two inclined planes that come to a point to make lifting or splitting easier	bring hands together in a wedge, turn sideways and lift, then raise overhead, chop
Four	SCREW	an inclined plane wrapped around a pole	form inclined plane, wrap arms around body
Five	LEVER	a bar that pivots around a fulcrum	use one arm as a bar and pivot it across the other
Five	FULCRUM	the point on which a lever rests	point to the arm that is being used as one
Six	WHEEL AND AXLE	a wheel with an axle through its center to move loads	make a circle with thumb and forefinger of one hand, put forefinger of other in center for axle

## Appendix Q, page 2

Six	FRICTION	a force that slows objects down when they rub against each other	rub hands together quickly and then more slowly
Six	GEARS	wheels with teeth that fit together	interlace fingers end-to-end, roll them like wheels in opposite directions
Seven	PULLEY	a wheel with a groove for a rope that is used for lifting	mimic pulling down on a rope

**Appendix R**

**SIMPLE MACHINES REPORT**

**Answer in complete sentences.**

**What I made.** \_\_\_\_\_

\_\_\_\_\_

**The simple machines I used.** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**How the simple machines work.** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**What materials I used.** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**How I made it.** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Appendix S, page 1

SIMPLE MACHINES TEST

Fill in the blank: Write the correct word from the box on the line.

Machine	Gears	Friction	Force	Bearings	Lever
Fulcrum	Plane	Gravity	Work	Energy	Lifting

1. \_\_\_\_\_ is a push or pull.
2. A \_\_\_\_\_ is the point on which a lever rests.
3. \_\_\_\_\_ are wheels with teeth that fit together.
4. A \_\_\_\_\_ is something that makes work better, easier, or faster.
5. \_\_\_\_\_ results when a force moves an object.
6. \_\_\_\_\_ is a force that slows objects down when they rub against each other.
7. A \_\_\_\_\_ is any flat surface.

Matching: Draw a line from the item in column A that matches the item in column B.

A	B
A screw	is two inclined planes that come to a point to make lifting or splitting easier.
A wheel and axle	is a bar that pivots around a fulcrum.
A pulley	is an inclined plane wrapped around a pole.
An inclined plane	is a plane that has one end higher than the other.
A wedge	is a wheel with an axle around its center to move loads.
A lever	is a wheel with a groove for a rope that is used for lifting.

Appendix S, page 2

**True or False: Write T beside each true statement and F beside each false statement.**

1. \_\_\_ Machines make a job easier.
2. \_\_\_ A light bulb is a kind of lever.
3. \_\_\_ A screwdriver is kind of wheel and axle.
4. \_\_\_ An inclined plane makes work harder.
5. \_\_\_ A nail is an example of a wedge.
6. \_\_\_ A hammer is a kind of lever.
7. \_\_\_ A pencil sharpener is a kind of pulley.
8. \_\_\_ A car is an example of an inclined plane.
9. \_\_\_ The flag is raised and lowered with a pulley.
10. \_\_\_ Some objects are more than one kind of simple machine.

**Write the name of each simple machine under its picture.**

Screw	Wheel and axle	Lever	Pulley	Inclined plane	Wedge
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\_\_\_\_\_



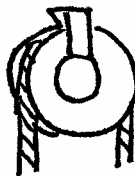
\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_

**Extra credit: Label the fulcrum on the machine that has one.**

Appendix S, page 3

Answer each question:

1. Name two things that reduce friction.
  1. \_\_\_\_\_
  2. \_\_\_\_\_
  
2. What two simple machines are in a pair of scissors?
  1. \_\_\_\_\_
  2. \_\_\_\_\_
  
3. Name two things that have gears in them.
  1. \_\_\_\_\_
  2. \_\_\_\_\_
  
4. What simple machine would you use to get up on a slide? \_\_\_\_\_
  
5. What simple machine would you use to chop down a tree? \_\_\_\_\_
  
6. What simple machine would you use to open a door? \_\_\_\_\_
  
7. What simple machine would you use to take the flag down? \_\_\_\_\_
  
8. What simple machine would you use to get a big rock off the bike path? \_\_\_\_\_
  
9. What simple machine would you use to hold two boards together? \_\_\_\_\_
  
10. What simple machine would you use to keep a door from shutting? \_\_\_\_\_

**Think of what simple machines you would use to do the following job. Tell how you would do it. Please answer in complete sentences.**

**You want to build a jump for your bike. Your dad said you can use the pile of dirt out behind the garage for it.** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Appendix T, page 1**  
**Test Key**

**Fill in the blank**

1. force
2. fulcrum
3. gears
4. machine
5. work
6. friction
7. plane

**Matching**

**A screw is an inclined plane wrapped around a pole.**

**A wheel and axle is a wheel with an axle around its center to move loads.**

**A pulley is a wheel with a groove for a rope that is used for lifting.**

**An inclined plane is a plane that has one end higher than the other.**

**A wedge is two inclined planes that come to a point to make lifting or splitting easier.**

**A lever is a bar that pivots around a fulcrum.**

**True or False**

1. T
2. F
3. T
4. F
5. T
6. T
7. F
8. F
9. T
10. T

**Labels for pictures**

**Row 1: wheel and axle, screw, inclined plane**

**Row. 2: wedge, pulley, lever**

**Extra credit: Students should have drawn an arrow to the tip of the triangular part of the lever and labeled it fulcrum.**

**Answer each question**

1. **Two things that reduce friction**
  1. rollers (or wheels and axles)
  2. lubricants
2. **Two simple machines in a pair of scissors**
  1. lever
  2. wedge
3. **Name two things that have gears in them.**

**Answers will vary. Accept any reasonable answer.**

**Appendix T, page 2**  
**Test Key continued**

- 4. inclined plane**
- 5. wedge**
- 6. wheel and axle**
- 7. pulley**
- 8. lever**
- 9. screw**
- 10. wedge**

**Answers will vary but will probably include using a wheelbarrow (wheel and axle) and shovel (lever and wedge) to move the dirt and perhaps some slanted boards (inclined planes) for the jump. Accept any reasonable answer.**