Milwaukee Public Schools
Science Assessment – Grade 4
Simple Machines - Reading

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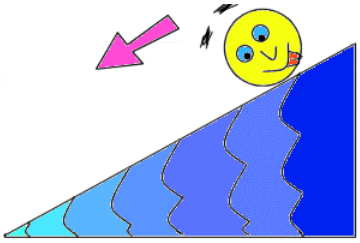
Student Task: Read the selection for each simple machine. After each selection, list an example of that type of simple machine. Your examples can be from something you have seen at home, school, or anywhere. Use examples other than any examples given in the reading selection.



The Inclined Plane The inclined plane is the simplest of simple machines because to make it work, nothing moves. ***You*** move! Another name for an inclined plane is a ramp. It can be as simple as a handicapped ramp in front of a building or as sophisticated as the staircase in the Empire State Building. A ramp works by helping you lift things more easily up to a higher level. It can be really difficult to carry a box of stuff up a ladder. But carrying that same box up a staircase is an easier job, and carrying it up a smooth ramp is even easier.

Remember, there's always a trade-off. The way an inclined plane works is that to save effort, you must move things a greater distance. If you compare the length of a ladder to that of a staircase going to the same height, you'll find the ladder is much shorter. But it takes a lot more effort to climb a ladder than to simply walk up a flight of stairs. The ancient Egyptians figured this out over 3,000 years ago when they built their pyramids. They used long, shallow ramps to help them move the heavy stones to the top!

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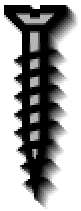
The Wedge

A wedge is really an inclined plane turned on its side. But instead of helping you move things to a higher level, a wedge helps you push things apart. The blades of a knife or a shovel are both wedges. A wedge can also be round, like the tip of a nail, or the tines on your fork. Basically, the wedge works just like a ramp: The narrower the wedge (or the sharper the point of a wedge), the easier it is drive it in and push things apart. But here's the trade-off: To split something apart really wide, you have to push the wedge a long distance.

Example: _____



The Screw

The screw is really an inclined plane in the round with a wedge at the tip. Think of a typical screw. The wedge is the pointed end. The inclined plane is the thread that wraps around the screw. Screws are used in many different places to hold things together.

Basically, a screw is like the ramp — and the width of the thread is like the angle of an inclined plane. The wider the thread of a screw, the harder it is to turn it. And here's the trade-off: If you've ever had to put in a screw with really narrow threads, you've probably found that you have to turn it a really long time to get it to go anywhere. Just like in a ramp, the easier the effort, the longer the distance you have to move something!

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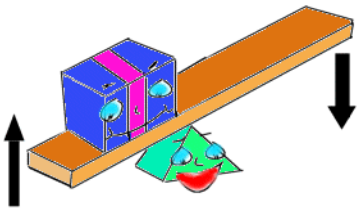
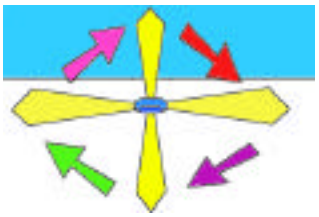
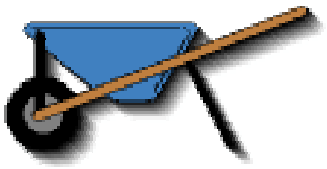
The Lever



In its simplest form, a lever is a stick that is free to pivot or move back and forth at a certain point. Levers are probably the most common simple machine because just about anything that has a handle on it has a lever attached. The point on which the lever moves is called the fulcrum. By changing the position of the fulcrum, you can gain extra power with less effort. A good example of a lever is a see-saw. Let's say that you're really light, and you want to lift a really heavy person on the opposite side. If you put the fulcrum in the middle, you won't have a chance. But if you slide the fulcrum closer to the heavy person, it will be easier to lift. Where's the trade-off? Well, to get this helping hand, your side of the see-saw is much longer (and higher off the ground), so you have to move it a much greater distance to get the lift.

Example: _____





The Wheel and Axle

A wheel and axle is really two machines in one because you can use each part in different ways. The first way is to roll something along. Wheels help you move an object across the ground because they cut down on the amount of friction between what you're trying to move and the surface you're pulling it against. (The axle is the object that attaches the wheel to the object it's moving.) Since only the very bottom of the wheel touches the ground, there is less surface area to rub — and less friction. Imagine pulling a little red wagon without any wheels! Generally speaking, the bigger the wheel, the easier it is to make something roll.

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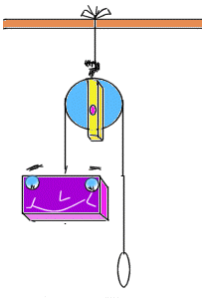
The second way of using a wheel is like a lever in the round. A door knob or a faucet on a sink are really round levers, and the "fulcrum" is in the middle where the axle turns. Imagine if a door knob was replaced with a little rod. It would be much harder to open the door! Once again, there's a trade-off: The larger the diameter of the wheel, the less effort you need to turn it, but you have to move the wheel a greater distance to get the same work done.

Example: _____



The Pulley

The pulley is really a wheel and axle with a rope or chain attached. A pulley makes work seem easier because it changes the direction of motion to work with gravity. Let's say you have to lift a heavy load, like a bale of hay, up to the second floor of a barn. You could tie a rope to the bale of hay, stand on the second floor, and pull it straight up. Or you could put a pulley at the second floor, stand at the first floor, and lift the bale of hay by pulling straight down. It would be the exact amount of work in either case, but the action of pulling down feels easier because you're working with the force of gravity.

A pulley really saves effort when you have more than one pulley working together. By looping a rope around two, three, or even four pulleys, you can really cut down on the effort needed to lift something. The trade-off? Well, as you increase the number of pulleys, you also increase the distance you have to pull the rope. In other words, if you use two pulleys, it takes half the effort to lift something, but you have to pull the rope twice as far. Three pulleys will result in one-third the effort — but the distance you have to pull the rope is tripled!

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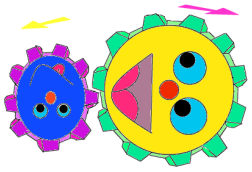
Gears



Gears are merely wheels with teeth. They can be used to change the direction of a force, or to increase torque. You need torque (sort of like strength) when you are climbing an elevated area. Most of us use gears quite often, especially when riding our bikes up a steep hill, or while riding in your family car

Example: _____

*The reading selections were adapted from the following web site:

Dirtmeisters – Science Reporters: Simple Machines
for Teachers, Kids and Parents
http://teacher.scholastic.com/dirtrep/simple/invest.htm

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Teacher Page

Science Content Standards:
The lever, inclined plane, pulley, wedge, gear and wheel and axle, are simple machines.
Simple machines can reduce the force needed to perform work.
Simple machines are used in many tasks and occupations.
Science Process Skill:
Communicate understanding of science content and process skills in a variety of ways.
Language Arts Grade Level Expectations:
Read to acquire information.
Identify and summarize main ideas and key points from literature, informational tests, and other print and non-print sources.

Materials: A writing utensil, the student sheet for this assessment.

Timeframe: Students should be able to complete this assessment within a 50 minute time period.

Student Task: This assessment measures how well the student can apply their knowledge of simple machines to the real world. Read the selection for each simple machine. After each selection, list an example of that type of simple machine. Your examples can be from something you have seen at home, school, or anywhere. Use examples other than any examples given in the reading selection.

Scoring:
4 = Student is able to give accurate examples for all seven selections.
3 = Student is able to give accurate examples for six selections
2 = Student is able to give accurate examples for four or five selections.
1 = Student is able to give accurate examples for three selections.
0 = Student is able to give accurate examples for two or less selections.

*It is completely acceptable for students with certain disabilities to have the selections read to them or to dictate their responses to an adult in keeping with the student's IEP.