## **Video-Bill Nye Simple Machines**

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Simple machines change \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and direction of forces.
2. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can change the direction of a force.
3. A catapult is a kind of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
4. The part of a lever around which it moves is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
5. Your forearm is/is not an example of a lever.
6. Stairways function as a combination of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and a ladder.
7. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ allows you to easily achieve a certain height but you must walk a longer distance.
8. The force you need to pull something up a ramp is equal to/smaller than the force needed to lift it.
9. A spiral staircase functions as a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
10. A screw is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ wrapped around a rod.
11. The distance between the threads on a screw is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
12. A prosthetic elbow is based around a(n)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
13. Pulleys make moving things easier/harder because they spread the work.
14. When using a pulley, the more rope you have, the less \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ you need to lift a load.
15. Make a list of the simple machines discussed in the video and the names of specific devices or machines based on these simple machines.

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| Simple Machines | Devices or Machines Made from Simple Machines |
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**Simple Machines Background**

How did the Egyptians build the Great Pyramids thousands of years ago? Could you build a pyramid using 9,000-kilogram (~10-ton or 20,000-lb) blocks of stone with your bare hands? That's like trying to move a large elephant with your bare hands! How many people might it take to move a block that big? It would still be a challenge to build a pyramid today even with modern tools, such as jackhammers, cranes, trucks and bulldozers. But without these modern tools, how did Egyptian workers cut, shape, transport and place enormous stones? One key to accomplishing this amazing and difficult task was the use of simple machines.

Simple machines are devices with no, or very few, moving parts that make work easier. Many of today's complex tools are really just more complicated forms of the six simple machines. By using simple machines, ordinary people can split huge rocks, hoist large stones, and move blocks over great distances.

Simple machines are everywhere; we use them everyday to perform simple tasks. Simple machines have also been in use since the early days of human existence. While simple machines take many shapes, they come in six basic types:

* **Wedge**: A device that forces things apart.
* **Wheel and axle**: Used to reduce friction.
* **Lever**: Moves around a pivot point to increase or decrease mechanical advantage.
* **Inclined plane**: Raises objects by moving up a slope.
* **Screw**: A device that can lift or hold things together.
* **Pulley**: Changes the direction of a force.

We use simple machines because they make work easier. The scientific definition of *work* is the amount of *force* that is applied to an object multiplied by the distance the object is moved.  (Work = Force x Distance)

***Consider this:*** *If a student moves a book from one desk to another, is this work by the scientific definition? (Yes, this is work.) You are applying force for a certain distance. Is doing homework work by the scientific definition? (No, homework is not work.) Pushing a book across a desk is work because you are applying a force (a push) on a book for a certain distance (the length of the desk). You are not pushing homework anywhere.*

Work consists of force and distance. Each job takes a specific amount of work to finish it, and this number does not change. Thus, the force times the distance always equals the same amount of work. This means that if you move something a smaller distance you need to exert a greater force. On the other hand, if you want to exert less force, you need to move it over a greater distance. This is the force and distance trade off, or mechanical advantage, which is common to all simple machines. With mechanical advantage, the longer a job takes, the less force you need to use throughout the job. Mechanical advantage of simple machines means we can use less force to move an object, but we have to move it a longer distance. A good example is pushing a heavy object up a ramp. It may be easier to push the object up a ramp instead of just lifting it up to the right height, but it takes a longer distance. A ramp is an example of the simple machine called an inclined plane.

A compound machine is a device that combines two or more simple machines. For example, a wheelbarrow combines the use of a wheel and axle with a lever. Using the six basic simple machines, all sorts of compound machines can be made. There are many simple and compound machines in your home and classroom. Some examples of the compound machines you may find are a can opener (wedge and lever), exercise machines/cranes/tow trucks (levers and pulleys), shovel (lever and wedge), car jack (lever and screw), wheel barrow (wheel and axle and lever) and bicycle (wheel and axle and pulley).

Adapted from TeachEngineering.org