

**Grade Level:** 4 - 5

**Curriculum:** Explorations, ADST, Science

**Title of Lesson:** Simple Machines: Working Together!

**Learning Goals/Objectives:**

- The choice of technology and tools depends on the task.
- Designs can be improved with prototyping and testing.
- Energy can be transformed.
- Machines are devices that transfer force and energy.

**Materials Needed:**

- Pencil and Paper

**Activity Instructions: (Step by Step)**

- Watch the following video and answer the questions on the following page
  - [https://youtu.be/bWtkbedwh\\_k](https://youtu.be/bWtkbedwh_k)

**Extensions (Optional):**

- After completing the activities below, try taking it a step further, and using recycled materials from around the house, make a contraption using simple machines!

What do all simple machines do?

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How do work, force and distance relate to each other? (hint:  $W=FxD$ )

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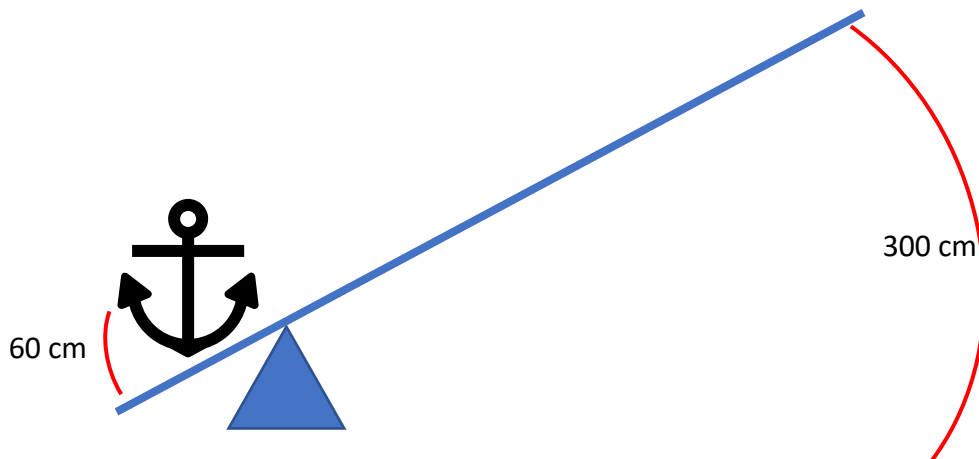
If the **Input force** of a simple machine has to be equal to the force applied to it, multiplied by the distance it moves, and the **Output force** has to be equal to the force applied to it, multiplied by the distance *it* moves, how can simple machines make out work easier?

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It takes 150 pounds of pressure to move a large boat anchor 2 feet, and your lever moves 10 feet in order to do the work. How much work do both sides of the lever need to do? How much force do you need to apply to your end of the lever in order to move the anchor? Fill in the blanks below to help solve the problem.



_____	x	_____	=	_____
Force	x	Distance	=	Work

_____	x	_____	=	_____
Force	x	Distance	=	Work

Describe what mechanical advantage is.

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What is a compound machine?

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How do we calculate the mechanical advantage of a compound machine?

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Using what you know about compound machines, imagine a device that could help you to complete a task (this could be lifting a heavy object, cutting a hard substance, moving something quickly, etc.) while requiring the least amount of input work possible. Draw a sketch of your machine and label each of the simple machines you use! Try to use at least one of each simple machine (inclined plane, lever, pulley, wheel & axle).

For example:

I want to create a machine that allows me to chop onions quickly, so that they don't make me cry. I pull on a rope which goes through a fixed pulley. The rope also wraps around a moveable pulley, and as I pull on the rope, it moves towards the fixed pulley. The moveable pulley is connected to rope, which wraps around a wheel and axle, and as the pulley moves, it pulls the rope, and spins the wheel. This wheel is connected to another wheel by a belt. When the two belted wheels spin together, they move a third wheel. This wheel connects to a rod, which connects to a lever, with its fulcrum in the middle. The other end of the lever connects to an inclined plane (a knife!) which chops my onions!

Look at the next page to see the sketch of this contraption!

