

Name: _____

Homeroom: _____

Introduction to Machines and Engineering

LO: Explore the relationship between force and distance in doing work. SLE: Meet NGSS.

(1) From the unit we just finished, what is the mathematical definition of work? Include the units for each part of this equation.

(2) An example of calculating work: to lift a box a vertical distance of 1 meter, I applied a force of 10 Newtons. The total work I did was _____ Joules.

Now consider this definition of a **machine**:

“A machine makes work ‘easier’ by reducing the force OR the distance required to do the work.”

Note that machines do NOT reduce the amount of work done!

(3) It is often said that there are six types of simple machines. Write down these six types here. They are listed and described in pages 106-111 of your textbook, and also in David Newman’s “Simple Machines” song (<https://www.youtube.com/watch?v=l1Fhs8pXGxM>).

Type of Simple Machine	Sketch	Example

(4) Let's say I use some sort of simple machine, like a pulley, to lift the box from problem #2 above.

(a) If the work is the same as before, but I only apply a force of 5 Newtons, what is the distance over which I will apply that force?

(b) If the work is the same as before, but I only apply the force over a distance of 0.5 meters, what is the force that I will apply over that distance?

(c) Explain how Figure 3 on page 102 of your *Forces, Motion, and Energy* textbook illustrates the inverse relationship between force and distance when doing work.

(d) Summary of what you've learned from (4a), (4b), and (4c):

- For a constant amount of work...
 - When the force goes _____, the distance goes _____ and vice versa.
 - Can the force and distance both be reduced at the same time?

(5) From your textbook, write definitions of the following terms:

(a) input force

(b) output force

(c) mechanical advantage

(6) What is the range of possible values for mechanical advantage? (Can it be greater than 1? Less than 1? Less than 0?)