7th grade ELA

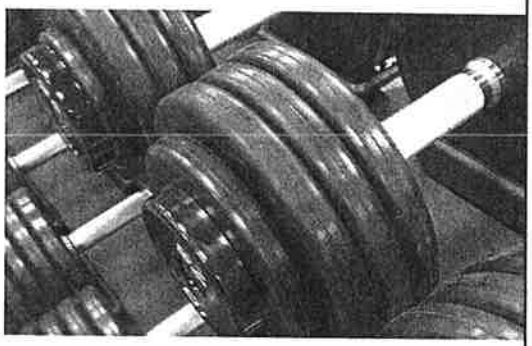
LEAP 2025 7th

Pretest

Session 1: Research Simulation Task

Read the passage. Then, answer the questions that follow.

The Mathematics of Work



1 A weight lifter goes into a training room where there are two barbells. One is a 150 N barbell and the other is 200 N. The SI unit for force is the newton, N. This means that it should take 150 N of vertical force to lift one of the barbells and 200 N to lift the other. The weight lifter lifts up one, places it down, and then lifts the other. Which lift caused the lifter to do more work?

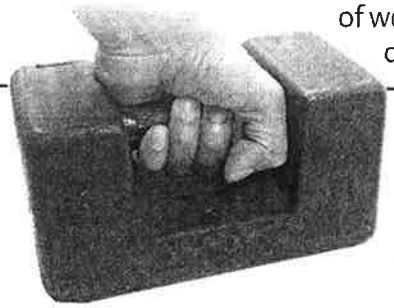
2 It might seem logical to say the heavier weight caused more work to be done because more force would be needed to lift it. But from a scientific point of view, you do not have enough information to answer the question. Until you know how far each barbell was lifted, you really don't know how much work has been done. To figure this out mathematically, you multiply the force used (F) by the distance (d) the force caused the object to travel. It is important to remember that the distance traveled must be in the same direction as the force applied.

3 Force is expressed in newtons, and distance in the metric system is expressed in meters, so it makes sense that one way to describe units of work would be in newton-meters. Another name for these units is the joule (J). If the weight lifter in our last example lifted both barbells, a distance of 2 m, these would be the calculations that expressed the amount of work being done:

Work Calculations

$W = F \times d$	$W = F \times d$
$W = 150\ N \times 2\ m$	$W = 200\ N \times 2\ m$
$W = 300\ J$	$W = 400\ J$

4 As expected, more work took place lifting the 200 N barbell, when both barbells were lifted the same distance. So increasing the amount of force applied increases the amount of work done. Don't forget about distance, though. Increasing the distance the object moves should also increase the work done.



1. **Part A**

According to the passage, the SI unit for force is called a –

(a) joule.
(b) meters.
(c) newton.
(d) newton-meter.

Part B

How is distance expressed when using the metric system?

(a) inches
(b) meters
(c) yards
(d) feet

RI.1, DOK 1

2. **Part A**

Read this sentence from paragraph 1.

"A weight lifter goes into a training room where there are two barbells."

The author's purpose for including this sentence in the text is to –

(a) encourage people to lift weights.
(b) show how hard it is to lift barbells.
(c) teach people how to lift weights.
(d) provide a scenario that sets up the work calculations.

Part B

Underline at least **eight** symbols, formulas, words, or phrases that would be considered mathematical or scientific domain related words and phrases.

RI.6, RI.4, L.4, DOK 2

3. **Part A**

You can't know how much work has been done until you know how far something was –

(a) lifted.
(b) moved.
(c) thrown.
(d) dropped.

Part B

Which paragraph supports the answer to Part A?

(a) paragraph 4
(b) paragraph 3
(c) paragraph 2
(d) paragraph 1

RI.1, DOK 1

4. **Part A**

Distance in the metric system can be expressed in which **two** ways?

(a) joule
(b) meters
(c) newton
(d) newton-meter
(e) force

Part B

Which paragraph supports the answer to Part A?

(a) paragraph 4
(b) paragraph 3
(c) paragraph 2
(d) paragraph 1

RI.1, DOK 1

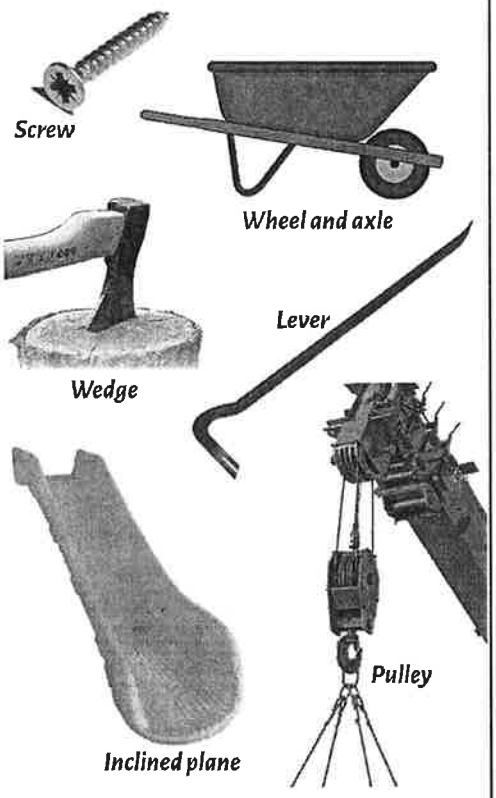
How Machines Help Make Our Lives Easier

1 You are riding home in your parents' car from an after-school event. Suddenly, you hear a loud BOOM and realize that the car has blown a tire. Dad says to go to the trunk and get out the jack. You realize that your dad needs the jack (machine) to help him lift the car because the car would be too heavy to lift by hand.

2 A machine is something that makes work easier by changing the size or direction of a force. A simple machine is any device that only requires the application of a single force to work. They are called "simple" because most of them don't have any moving parts.

3 When you combine more than one simple machine, you have a complex machine (can openers, scissors, a doorknob, a car jack). Do simple machines reduce the amount of work? Actually, no. A simple machine reduces the amount of effort (force) needed to move something, so the work seems easier. Let's look at four of the simplest simple machines.

4 **Inclined planes** are also called ramps. Ramps help us move things to a higher elevation with less effort. There is a trade-off, though, and that is we have to move them farther. Think about it this way: if you wanted to put a heavy box on the roof of your school, you could use a ladder (and use a lot of force or effort climbing each step) or you could use a very long ramp.



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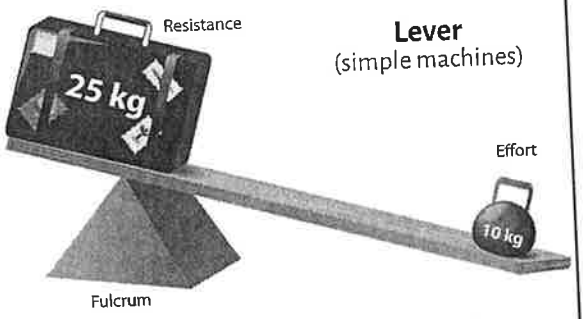
Using a ramp decreases the force that you must apply, but it increases the distance that you have to move the object.

5 A **wedge** is a double inclined plane. However, wedges have a different purpose than the inclined plane. Instead of helping you move things to higher elevations, wedges help you push things apart. The blade of an axe or knife is a wedge. How do they make work seem easier? The narrower the wedge (or the sharper the blade end of a wedge), the easier it is to drive it into something and push things apart.

6 **Screws** are usually used to hold things together, like pieces of wood, metal, or concrete. You may not have thought of this before, but a screw is really an inclined plane wrapped around a cylinder, with a wedge at the sharp, pointed end. The inclined plane going up the cylinder of a screw is called the threading. Turning the screw allows the threading to bite into the surrounding material and forces the wedge tip through the material. The wider the threads of a screw, the harder it is to turn. Narrower threads make the screw easier to turn, but there are more of them. This means you will have to turn the screw more times to force the wedge tip completely into the object you are trying to put together.

7 Our next simple machine is the **lever**. Two things must be considered when using a lever—the length of the arms and the place where it pivots. The point on which the lever pivots is called the **fulcrum**. A crowbar pivots on the very end, but a see-saw usually pivots in the middle. By changing where you put the fulcrum, you make it easier or harder to lift a heavy load. The closer to the load you put the fulcrum, the easier the load is to lift. Where's the trade-off? Lengthening the lifting arm without moving the fulcrum (that is, getting a longer stick) also makes the load easier to lift. The longer the lifting arm becomes, the greater the distance you must move it to lift the object.



Lever
(simple machines)

8 By now, you have realized that not all machines are the same. Some machines make it easier to do work than others—they offer a greater advantage. This advantage is called mechanical advantage. How do we measure mechanical advantage? If you think of a machine as having an input force (the force you put into it) and an output force (the force the machine applies to move an object), then the mechanical advantage of the machine (mathematically) is the output force divided by the input force.

5. **Part A**
Look at the dictionary definition of the word **pivot**.

1 : a shaft or pin on which something turns
2 a : a person, thing, or factor having a major or central role, function, or effect
b : a key player or position; *specifically* : an offensive position of a basketball player standing usually with back to the basket to relay passes, shoot, or provide a screen for teammates
3: the action of pivoting; *especially* : the action in basketball of stepping with one foot while keeping the other foot at its point of contact with the floor

Part B
Read this sentence from paragraph 7.

"Two things must be considered when using a lever—the length of the arms and the place where it pivots."

Which dictionary meaning defines the word pivots as it is used in the sentence?

(a) 1
(b) 2a
(c) 2b
(d) 3

RI.4, L.4, DOK 2

6. **Part A**
According to the passage, what is the difference between a ramp and a wedge? Use information from the passage to support your answer.

_____

_____

_____

Part B
After reading the passages, "The Mathematics of Work" and "How Machines Help Make Our Lives Easier", what is the connection between math and science?

(a) Math can be used to calculate how long it will take to move a heavy object.
(b) Math can be used to calculate the force needed to lift a heavy object.
(c) Math can be used to calculate the strength required to lift a heavy object.
(d) Math can be used to calculate the amount of work required to move a heavy object.

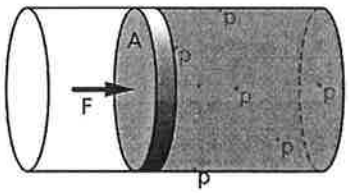
RI.1, RI.3, DOK 3

Read this passage. Then, answer the questions that follow.

Pascal's Law

Other types of machines do work by applying force on fluids in containers. Fluids are liquids and gases. If a fluid is in a container, the collisions of the particles against the surface of the container cause the fluid to exert pressure everywhere in the fluid and upon the container. Pressure is a force (push or pull) applied evenly over an area.

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$



The unit for pressure is a Pascal (Pa). One Pascal is equal to the force of 1 Newton over an area of 1 m2. By placing a fluid in a container, a force can be applied to change its pressure. As the force applied to a fluid increases, its pressure also increases.

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This is explained using Pascal's Law, which states: Pressure applied to a contained fluid is transmitted equally in all directions throughout the fluid and to the surface of the container. Pascal's Law is the basis of hydraulic machines that are used to create a mechanical advantage. A hydraulic machine is a machine that uses fluids to transmit force. The basic idea is this: when a fluid is in a partially closed container, the force applied to one area is transmitted to another area using an incompressible fluid (like water or oil). You are probably familiar with some hydraulic machines without even realizing it. Some examples include bulldozers, forklifts, cranes, and even amusement park rides. These machines are big and can do a lot of work.

7. **Part A**

What is the meaning of the word collisions as it used in the passage?

(a) destruction

(b) forces

(c) accidents

(d) shock

Part B

What is an antonym for the word collisions?

(a) contact

(b) impact

(c) strike

(d) avoidance

RI.4, L.4, DOK 2

8. Read the writing prompt.

After reading these three passages, you have learned how math is used to calculate the amount of force needed to lift heavy objects, how machines help people move and lift heavy objects, and how pressure affects liquid as explained in Pascal's Law.

Write a 3-4 paragraph essay comparing and contrasting the three passages. How does each passage use explanations, graphics, examples, math equations, demonstrations, experiments, and descriptions to express the idea that math can be used to calculate force and how science (machinery) is used to make people's lives easier? Use details from the passages to support your response.

RI.1, RI.2, RI.5, W.2, DOK 3