**Lesson Question**



**?**

**W**

**2K**

advantage.

what it does.

.

is and

**Calculate**

**Calculate**

**Describe** what a

.

**Explain** how machines make work

**Lesson Goals**

F. a device that makes work easier

mechanical advantage

\_\_\_\_\_

E. the ratio of output work to input work expressed as a percentage

machine

\_\_\_\_\_

D. the ratio of output force to input force

efficiency

\_\_\_\_\_

C. the amount of something that comes out of a machine or system

ratio

\_\_\_\_\_

B. the amount of something put into a machine or system

\_\_\_\_\_ output

A. a comparison of two amounts calculated by dividing one amount by the other

input

\_\_\_\_\_

**Words to Know**

*Write the letter of the definition next to the matching word as you work through the lesson. You may use the glossary to help you.*



# Work

* Work is done by a on an object.
* For work to be done, the object must in the direction of the force.
* The formula for work is .
* Work is measured in (J).

**2**

**5**

over which a force is exerted.

* the

of force exerted.

* the

of a force.

* the

by changing:

* A machine makes work

.

* Output work is the amount of work the machine does on an

.

* Input work is the amount of work done on a

force.

* The force the machine applies on an object is the

force.

**Inputs and Outputs**

* The force applied to a machine is the

**Slide**

done.

* Machines do not change the amount of

.

* Machines change the way a force is

is any device that makes work easier.

* A

**Machines and Work**

**Slide**

output force

mechanical advantage =

input force

of output force to input force.

* Mechanical advantage is the

amount by the other.

is the comparison of two amounts calculated by dividing one

* A

**Mechanical Advantage**

* The number of times a machine increases the input force is known as its

.

**5**

MA =

the hammer exerts a force of 90 N on a nail. What is the mechanical advantage of

the hammer?

of 15 N. The claw end of

Nina pulls on the handle of a hammer with a

**Mechanical Advantage: Example**

**Slide**

input force =

of 1,350 N?

needed to create an

* **Example:** A machine has a mechanical advantage of 2.7. What input force is
* When mechanical advantage and output force are known, the

force can be calculated.

**Input and Output Forces**

* When mechanical advantage and input force are known, the force can be calculated.

**7**

**10**

friction.

by reducing the amount of

* The output work can be

uses some of the input work.

•

than the input work.

* The output work of a machine can never be

**Machines and Friction**

**Slide**

× 100%

output work

input work

efficiency =

.

than

* Some work is always lost to friction, so efficiency is always

.

* Efficiency is expressed as a

.

**Efficiency**

* The ratio of the output work to input work is the machine’s

**10**

**Efficiency: Example**

An Olympic bicyclist does 7,500 J of work on his bike while the bike does 7,350 J of work. What is the efficiency of the bike?

efficiency =

How do machines make work easier?

**Lesson Question**

**Slide**

**?**

**Review: Key Concepts**

•

•

Machines make work easier by changing the way a

A machine can change:

is applied.

* the

of a force.

* the

of force applied.

* the

over which a force is applied.

* Machines do not change the amount of

done.

**Answer**

**2**

|  |  |  |
| --- | --- | --- |
|  | **Definition** | **Equation** |
| Mechanical advantage | The ratio of a machine’s output force to input force | Mechanical advantage = |
| Efficiency | The ratio of a machine’s output work to input work expressed as a percentage | efficiency = |

*Use this space to write any questions or thoughts about this lesson.*