**Lesson Question**



**?**

**W**

**2K**

advantage of a simple

simple machines.

machine.

machine.

to

human

**Compare** parts of the

**Explain** how two or more simple machines can be

combined to form a

**Calculate** the

types of simple machines

and their uses.

**Identify** the

**Lesson Goals**

C. to move force or energy from one medium or part of a mechanism to another

compound machine

\_\_\_\_\_

B. one of six devices that have few or no moving parts and make work easier

\_\_\_\_\_ transmit

A. a device that consists of two or more simple machines operating together

simple machine

\_\_\_\_\_

**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.*



**W**

**2K**

B. a calculation of how much a machine multiplies a force, or the ratio of output force to input force

\_\_\_\_\_ spiral

A. to coil around an axis or an object

mechanical advantage

\_\_\_\_\_

**Words to Know**

of force times distance

* Is the

of the force.

* The motion is in the

, no work is done.

* If there is no
* Occurs when force acts over a

.

or a

* A force is a

**Work**

* Is caused by a

**Slide**

•

and axle

•

•

•

(doorstop)

•

(ramp)

* Inclined

easier.

parts. They make work

have few or no

**Six Simple Machines**

**2**

.

done is the

* The amount of

.

* The distance is greater, but the amount of force used is

objects.

* Inclined planes make it easier to

surface, such as a ramp.

**Inclined Plane**

* An inclined plane is a

**Slide**

planes placed back to back.

* The wedge looks like two

end.

* The force is concentrated on a smaller area at the

area of the wedge.

is applied to the

•

is used to split things apart.

**Wedge**

* A

**2**

**4**

lifts a car by using a large screw.

* A car

things.

* Large screws are also used to

the outside of the screw.

around

* The threading on a screw looks like an inclined plane

grips materials.

can hold things together. The

**Screw**

* A

**Slide**

is needed.

* Moving the position of the fulcrum affects how much

of a force.

* A lever can change the

to the other end.

* Force applied at one end is

be used to lift heavy objects.

, or fixed point. It can

**Lever**

* A lever is a strong bar that turns about a

**4**

force is needed to move it.

, but less

* When the axle is turned, the wheel moves a greater

the wheel and lets the wheel turn.

that goes through

, is a

* The smaller-diameter object, the

connected.

that are

**Wheel and Axle**

* A wheel and axle consists of two circular objects of different

**Slide**

has a pulley at the top.

* A

.

* A construction crane uses a series of

on the rope lifts objects.

* Pulling

.

and a

* A pulley consists of a grooved

of a force.

changes the

**Pulley**

* A

**4**

**6**

.

and axles. The pedals and the gearshift are

are wheels

is a compound machine. The bicycle

* A

machines used every day are compound machines.

•

machines operating together.

machine is a device that consists of two or more

* A

**Compound Machines**

**Slide**

input force

MA = output force

.

* Mechanical advantage is abbreviated as

.

makes it to do

**Mechanical Advantage**

* Mechanical advantage is a calculation that tells you how much easier a machine

**8**

2.5 times at the

The force applied to the top of the wedge is bottom of the wedge.

input force 0.1 m

MA = output force = 0.25 m =

* A short wedge with a wide angle requires more force than a long wedge with a

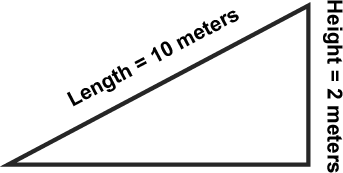
angle.

)

**The Mechanical Advantage of a Wedge**

* MA of a wedge = slope/thickness (

**Slide**



is multiplied 5 times using this inclined plane.

The

2 m

MA = 10 m =

move an object up it.

or effort is needed to

the ramp, the less

* The

/height

* MA of an inclined plane =

**The Mechanical Advantage of an Inclined Plane**

**8**

**10**

**Example:**

threads = 5 per cm circumference = 3 cm

**Step 1:** Divide 1 by the number of threads: 1 ÷ 5 =

**Step 2:** Divide 3 cm (circumference) by the result above: 3 cm ÷ 0.2 cm =

The mechanical advantage is 15.

.

* The circumference of the screw is measured in the same

.

between the

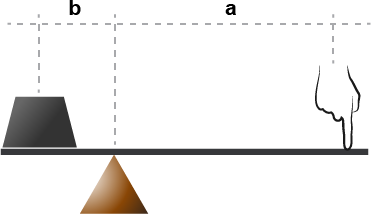
* To find the mechanical advantage of a screw, you need to know the distance

/(1/number of threads)

* MA of a screw =

**The Mechanical Advantage of a Screw**

**Slide**



The mechanical advantage of the lever is 2.

0.5 m

MA = 1 m =

* The length of the lever on the side where the force is being is labeled as *b*.

**Example:**

𝑎 = 1 m

𝑏 = 0.5 m

.

as

* The length of the lever on the side where the force is applied is labeled

**The Mechanical Advantage of a Lever**

* MA of a lever =

**10**

**12**

MA = 10 cm =

2 cm

The mechanical advantage of the lever is 5.

𝑟𝑎𝑑𝑖𝑢𝑠 𝑜𝑓 𝑤ℎ𝑒𝑒𝑙 = 10 cm

𝑟𝑎𝑑𝑖𝑢𝑠 𝑜𝑓 𝑎𝑥𝑙𝑒 = 2 cm

**Example:**

)

radius (

* MA of a wheel and axle =

)

radius (large

**The Mechanical Advantage of a Wheel and Axle**

**12**

**15**

.

into

that cuts

* When you bite down, the tapered shape transmits the

.

– your incisors – act as

* Your front

**Incisors as Wedges**

.

* In this lever, the fulcrum is at one end, not near the

.

* The hand is the

, or pivot point.

* The elbow is the

.

, between the elbow and the wrist, is the

* The

**Arms as Levers**

**Slide**

force.

force is the same as the

the load is moving, but the

* The pulley changes the

.

**The Mechanical Advantage of a Pulley**

* A pulley has a mechanical advantage of

What are simple machines?

**Lesson Question**

**Slide**

**?**

**Review: Key Concepts**

**APPLICATIONS OF SIMPLE MACHINES**

**Answer**

**2**

|  |  |
| --- | --- |
| **Simple Machine** | **Applications** |
|  | Wheelchair ramp, truck loading ramp, highway ramp |
|  | Axe, incisor |
|  | Screw, nut and bolt, jar lid |
|  | Seesaw, crowbar, forearm, jaw |
|  | Bicycle, steering wheel |
|  | Flagpole, fishing pole, blinds |

**Slide**

# Review: Key Concepts

**MECHANICAL ADVANTAGE**

**2**

|  |  |
| --- | --- |
| **Simple Machine** | **Mechanical Advantage** |
| Inclined plane | MA = length/ |
| Wedge | MA = slope/thickness ( ) |
| Screw | MA = /  (1/number of threads) |
| Lever | MA = length of side/length of  side |
| Wheel and axle | MA = (large wheel)/radius (axle) |
| Pulley | MA = |

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