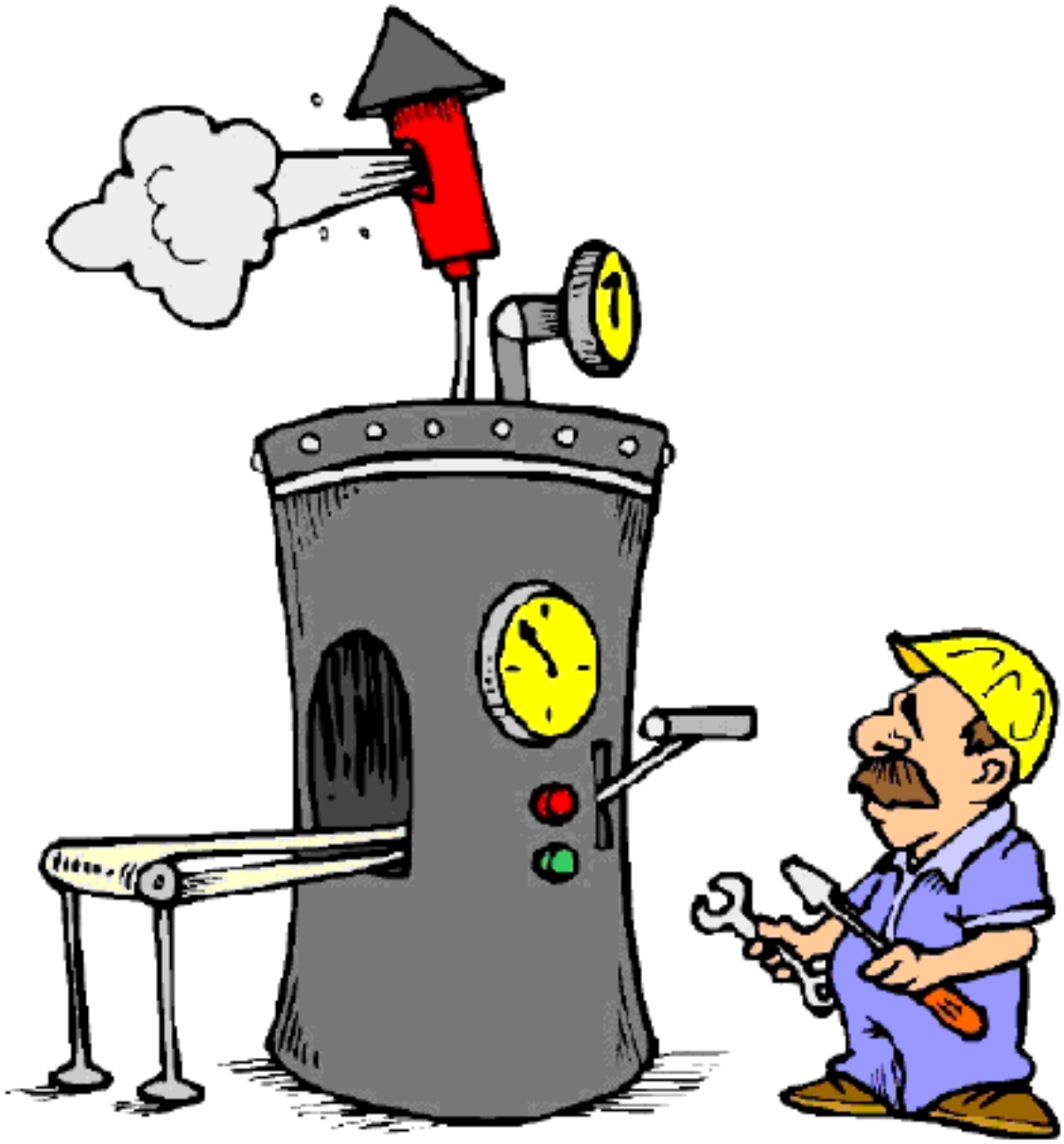
Simple Machines



Name _____

Date _____

Simple Machines

A simple machine is any tool or device that helps to make our everyday life easier. Simple machines make work easier. Most people think of machines as large and bulky like large engines. Large machines would not be possible without the basic simple machines. The basic machines are very simple tools. They do not appear as machines.

The traditional list of simple machines is:

- The inclined plane
- The wedge
- The screw
- The wheel and axle
- The pulley
- The lever

All machines are tools. A tool is any device that helps complete a task. Simple machines work by applying force. Applying force to make something to move is called work, in the science of physics. Pushing, lifting, dragging, and pulling are some of the common forms of work.

Read the questions below. Write you answers on the lines.

1. What are some of the things you would use to push something very heavy? _____

_____

_____

2. What are some of the things you would use to lift something very heavy? _____

_____

_____

Inclined Plane

We will explore the inclined plane first. You will see that the only simple machines that do not use the design of an inclined plane are the wheel and the lever.

The inclined plane is very simple. It is the most simple of all the machines. Inclined planes make it easy to move heavy things to a higher level. Plane means a flat surface. When a person is trying to move a freezer, piano, or some other large and heavy thing into a truck, they use a ramp (plane). When a ramp is lying on the ground it is flat. When the ramp is slanted up to the truck it is inclined. The item can then be rolled, or pushed up the ramp.

Think about a wheelchair ramp. The chair starts at the part that is low on the ground and is pushed or rolled up the ramp. If the end is high, the ramp needs to be long so the slant up will not be too steep for the wheelchair.

Other ways the incline plane or ramp is used are surprising. A long winding road up a mountain is really an inclined plane even though it is not straight. It is believed that the Egyptians used inclined planes to move the blocks of stone up the pyramids. The ramps wound around the pyramids from top to bottom. Furniture movers and those who deliver large things use ramps to get them onto their trucks.

When a plane is inclined it becomes a simple machine.

Simple Machines

Look at a playground. Can you see how the shape of the slide is an inclined plane? A winding slide lets the body move down faster for more fun.

A ramp is not just used to bring things up the slope or gradient. Imagine unloading a truck without a ramp.

The long part of the plane is called the run. The height straight up that you want to move is called the rise. When you compare the two distances, you get the slope or grade (also called gradient.)

Inclined planes were used in early science to help understand the ideas of speed and gravity. Two objects made of the same material and weighing the same would be released at the same time down ramps of different grades. Of course, the one on the higher grade would finish first. It's speed was faster because it had a shorter distance to go. Scientists such as the Greek, Archimedes and the Italian, Galileo found this very interesting.

Inclined planes are also used to move boats through canals. The boat sails into a box of water and the door is closed behind it. The entire box is pulled up or down an inclined plane using ropes and a power machine. When the box gets to the other side of the canal, the front door is opened and the boat can sail out at the new water

Read the word below. Write the definition on the lines.

1. gradient _____

_____

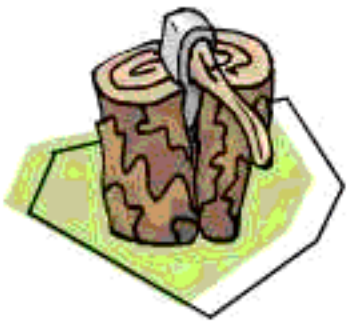
_____

Simple Machines

A wedge is an inclined plane used to push things apart. Metal wedges have been used for centuries to split logs and large pieces of wood into smaller pieces. The wedge is placed in a crack and then hit with a hammer type tool to force it farther in and press the pieces farther apart.

Wedges are also used to hold things in place. A doorstop is a good example. The wedge fits between the door and the floor. The slope keeps the door from moving.

If you have ever looked at the very center stone on an arch or arched bridge, you would notice that it is wedge shaped. This is called the keystone. It allows the other stones to rest against it and keep their places.



Almost all things that are used to cut are wedges. Axes and hatchets have a wedge-shaped edge. Even the knife your mom uses in the kitchen or your dad uses to clean fish is a thin wedge with a handle.

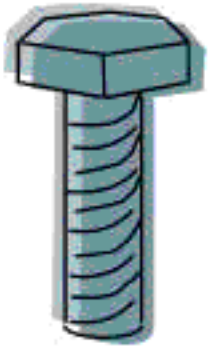
Read the sentences below. Fill in the missing words.

1. Almost all things that are used to cut are _____.

2. The center stone on an arch is _____ shaped.

Simple Machines

Screw



A screw is a round shape with a wedge strip wrapped around it. The twirling shape the wedge makes around the cone is called a helix. If the round shape is a cone, it is a simple screw. A bolt is a screw that has the shape of a cylinder instead of a cone.

Screws and bolts are used to hold things together. The head keeps it from going all the way through. The screw forms an incline plane in the object as it goes into the object. A nut, which screws onto the end of a bolt has the threads on the inside.

Screws are easier to use than nails in many cases because a screw or bolt can be removed and used again. Most screws are tightened by turning them to the right. A left-handed screw may be used if the things being held together are going to be moving in a way to make them come apart.

Draw a picture of something that has screws in it.

Wheel and Axle

The wheel is one of the most important inventions ever made. There are wheels on cars, bicycles, skateboards, toys, boats, lawn mowers, tractors, clocks and many other things.

No one knows who invented the wheel. People learned by experimenting. It is believed the present day Iraq which was called Sumer thousands of years ago was one of the first places in the world to use the wheel.

A wheel and axle is made of a circle shape attached to a fixed bar. There may be one or two wheels attached to the axle. When the axle turns, the wheel must turn. When the wheel turns, the axle must turn. A small amount of force used to turn the axle will move the wheel a long distance. This is especially important when in a race. On a bicycle, one full circle with the pedals (the force) makes the wheel and axle turn many times to go a long distance on a flat surface.

Looking at it in another way, moving the wheel will give a lot of power to the axle. This was the way that people used to grind wheat, coffee beans, and cut lumber.

A water wheel is a very good example of the wheel providing the power. Wheels were also used to be turned in a constant circle by horses or even human slaves pushing or pulling the spokes to produce power.

Simple Machines

Pulley

A pulley is a wheel with a groove cut down the center. A rope is laid in the groove to attach to something that needs to be lifted. Pulling on the rope lifts the object. When the object is really heavy or needs to be lifted and moved at the same time, a system may be used that has two or more pulleys working together. This is called a block and tackle assembly.

A pulley may have a fixed axle. That means the whole pulley is one piece. This is called a first-class pulley. A fixed axle pulley is often used to move a belt around and around on the same path like in a factory.

A flagpole is a good example of the use of a pulley. Usually a flagpole has a pulley at the top and one at the bottom of the pole. Each pulley has a rope running through it. You can pull the flag up by pulling on one side. You can pull the flag down by pulling on the other side. The pulley is a very simple machine.

a. Write the definition for each word below. b. Use it in a sentence

1a. machine _____

_____

1b. _____

_____

2a. groove _____

_____

2b. _____

_____

Simple Machines

A very simple way to describe a lever is a bar used to push something. The lever is placed against the bottom of an object. A fulcrum is needed to give the lever power. A fulcrum is an object placed between the point where the lever and object meet and the end where the force will be applied. The closer the fulcrum is to the down end of the lever, the less force is needed to move the object.

Example

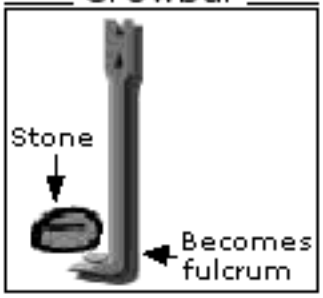
If the object needs to be moved for a distance, the fulcrum helps to keep the object from returning to where it was. Of course, a wedge would come in handy for that, too.

Think about a see-saw. If one person is a lot bigger than the other, the big person sits on the short end. The fulcrum is the place that separates the long and short sides, where the board touches the stand. The longer side gives the small person more power. The shorter side makes it easier to move the bigger person.

Draw and design a machine using at least 3 of the simple machines. Draw an arrow and write the name of each simple machine used.

Simple Machines

Crowbar



A crowbar is a type of lever. It usually has a bend at one end that becomes the fulcrum. If the object to be moved is too heavy for the length of the crowbar, a rock or brick might be used to give more room to push on the free end. As force is applied to the free end of the lever or crowbar, the object moves.

The claw end of a hammer is also a lever. A nail is pulled out by using the wedge shaped ends to get under it. The hammer is then pulled back or pushed down as a lever. The hitting side of the hammer (head) may then become the fulcrum to give more force.

If all else fails to explain a lever, remember the Roadrunner cartoons. The coyote was always trying to drop boulders by moving them with a lever.

Any machine you look at will have at least one of these simple but marvelous helpers in it. Just imagine life with out these simple machines.

Answer each sentence in a complete sentence.

1. What is a fulcrum? _____

_____

_____

2. Why are these six simple machines so important? _____

_____

_____

Simple Machines

WORD UNSCRAMBLE

Unscramble each word and print the word on the line.

1. hnicame _____

2. evcied _____

3. deweg _____

4. dielcnni _____

5. mpra _____

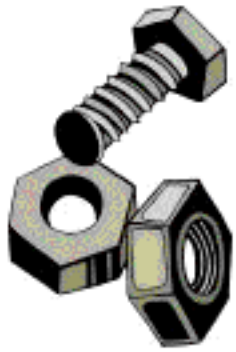
6. rcorwba _____

Simple Machines

Spelling

Print the correct spelling word on the line.

1. macchin
   machine
   machiin _____



2. device
   divice
   divcce _____

3. remp
   rimp
   ramp _____

4. wedge
   weege
   wewge _____

5. coowbar
   crowbar
   cnowbar _____

Simple Machines

WORD FIND

Find and circle these words. They run down, across, and diagonally.

compound	device	wheel	ramp
tool	wedge	pulley	groove
machine	screw	inclined	crowbar

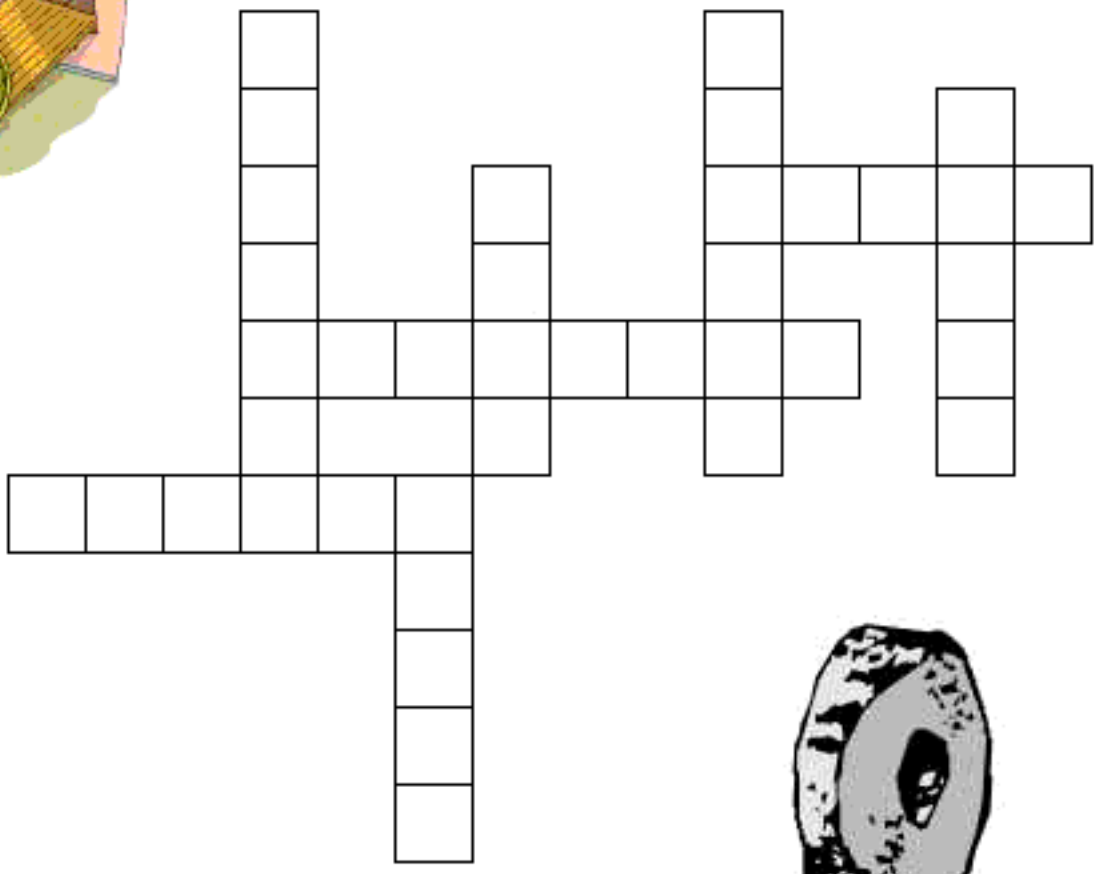
m	a	c	h	i	n	e	e	n	s	o	t	t	b	l
t	h	u	h	e	t	n	b	a	f	x	m	l	l	d
m	o	w	h	w	e	d	g	e	q	y	c	i	u	d
a	e	o	r	u	b	t	y	m	y	g	r	g	b	e
m	l	m	l	a	i	n	c	l	i	n	e	d	b	v
m	s	i	m	s	p	b	u	e	p	n	b	t	e	i
a	c	g	c	l	u	a	g	r	o	o	v	e	r	c
l	r	r	t	y	l	i	c	d	s	s	k	i	j	e
s	e	r	a	v	l	s	m	o	a	i	f	q	s	s
f	w	t	a	w	e	a	w	h	a	l	k	o	p	n
d	b	e	n	m	y	n	t	s	i	w	h	e	e	l
p	r	i	v	s	p	b	x	c	r	o	w	b	a	r
d	c	o	m	p	o	u	n	d	i	p	p	e	r	w

Simple Machines

CRISS CROSS

Can you fit these words into the criss cross?
Use a pencil so you can erase if you need to.

machine	wheel	pulley	screw
lever	axle	wedge	inclined



Simple Machines

WORD UNSCRAMBLE

Unscramble each word and print the word on the line.

1. hnicame machine

2. evcied device

3. deweg wedge

4. dielcnni inclined

5. mpra ramp

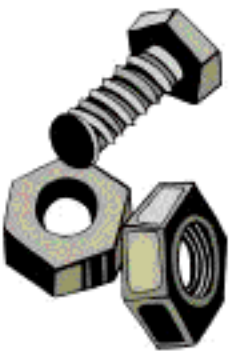
6. rcorwba crowbar

Simple Machines

Spelling

Print the correct spelling word on the line.

1. macchin
   machine
   machiin _____machine_____



2. device
   divice
   divcce _____device_____

3. remp
   rimp
   ramp _____ramp_____

4. wedge
   weege
   wewge _____wedge_____

5. coowbar
   crowbar
   cnowbar _____crowbar_____

Simple Machines

WORD FIND

Find and circle these words. They run down, across, and diagonally.

compound	device	wheel	ramp
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m	a	c	h	i	n	e	e	n	s	o	t	t	b	l
t	h	u	h	e	t	n	b	a	f	x	m	l	l	d
m	o	w	h	w	e	d	g	e	q	y	c	i	u	d
a	e	o	r	u	b	t	y	m	y	g	r	g	b	e
m	l	m	l	a	i	n	c	l	i	n	e	d	b	v
m	s	i	m	s	p	b	u	e	p	n	b	t	e	i
a	c	g	c	l	u	a	g	r	o	o	v	e	r	c
l	r	r	t	y	l	i	c	d	s	s	k	i	j	e
s	e	r	a	v	l	s	m	o	a	i	f	q	s	s
f	w	t	a	w	e	a	w	h	a	l	k	o	p	n
d	b	e	n	m	y	n	t	s	i	w	h	e	e	l
p	r	i	v	s	p	b	x	c	r	o	w	b	a	r
d	c	o	m	p	o	u	n	d	i	p	p	e	r	w

Simple Machines

CRISS CROSS

Can you fit these words into the criss cross?
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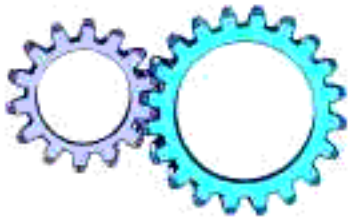
machine	wheel	pulley	screw
lever	axle	wedge	inclined

		M				P				
		A				U			W	
		C			A	L	E	V	E	R
		H			X	L			D	
		I	N	C	L	I	N	E	D	G
		N			E			Y		E
W	H	E	E	L	S					
					C					
					R					
					E					
					W					

A Thematic Unit about



Simple Machines