One pager Two must be completed:

Use the following as a checklist create a one pager for **FORCE AND MOTION.**

★ Use unlined white paper

★ Title the one pager Motion and Forces.

★ Use colored pens, pencils, or markers

★ Fill the entire page

★ Have a plan for how it will be laid out

★ Two quotations from the passage on Motion and Forces.

★ 3 visual images, either drawn or printed from a computer, as the central focus of your page.

★ Choose 5 important vocabulary words and place them around the page

★ Write the main ideas surrounding Motion and Forces. (This could be your summary)

★ Create a symbolic (represents the topic Motion and Forces border around the edge of the page (in color)
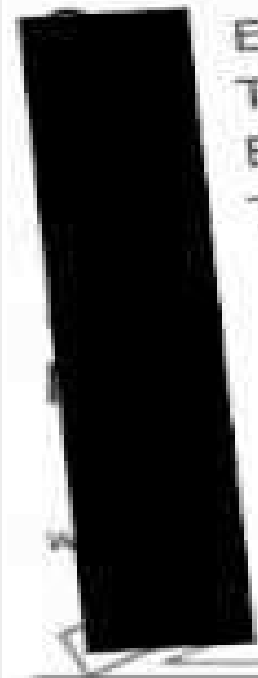
★ Your name goes on the back.

DO: I will be able to explain the relationship between forces, work, and the effect of using simple machines.

EQ:

1. How do simple machines make work easier?

2. Why would a compound machine be used?

Have a knife the wedge cutting deep, distance of force increased

Easier

The work that machines have made

Easier

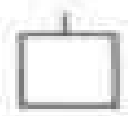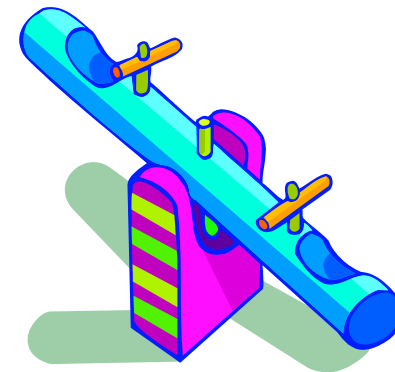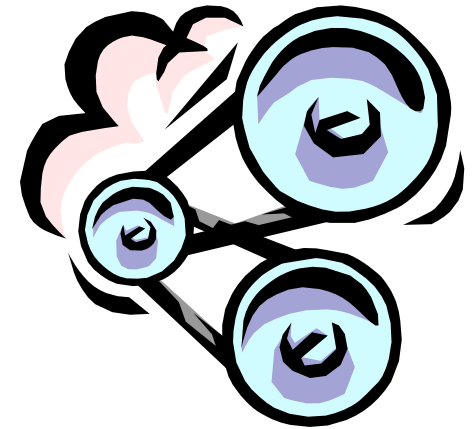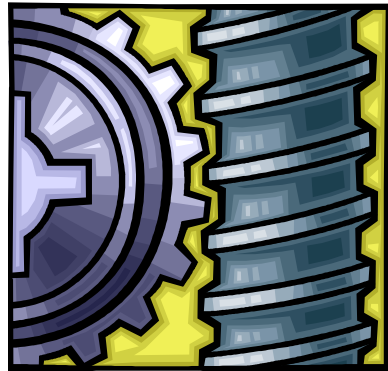The work that machines have made

LEVER

PULLEY

INCLINED PLANE

WEDGE

SCREW

Hypothesize

- Why do we use machines?

- What are the simple machines we use in our daily life?

Simple Machines

Forces and Motion

- Force is a push or a pull.

- The amount of force you have to use on an object depends on its mass.

- Motion is a change in position.

- Every motion is started by a force.

- Speed is *how fast* something moves over a certain distance.

Gravity

- Gravity is the force that pulls objects toward each other. $9.8 m/s^2$

- The more mass each object has the more gravity pulls them to each other.

- Weight is how we measure the pull of gravity on an object.

Work

- <u>Work</u> is the measure of force it takes to *move* an object a certain distance.

- Scientifically work is done *only* when an object is moved through a distance.

- Work=Force * Distance

- Joules= Newton * Meter

Machines DO NOT save work
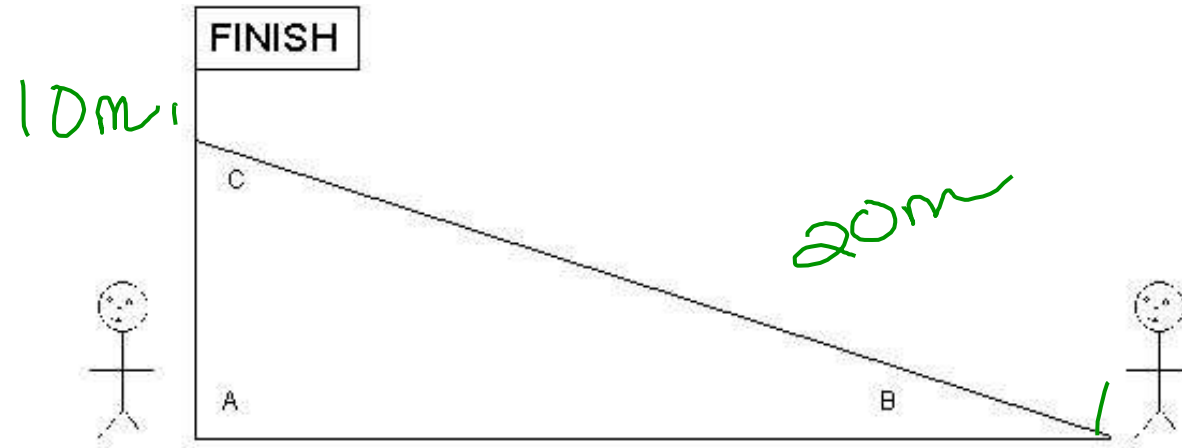
How is it that the path from A-C takes the same amount of work as path B-C? In A-C we have to exert a lot of force to get up the vertical side, but we don't have to go very far. Let's suppose that the force required is 100 Newtons and the distance is 4 meters, the amount of work done is 400 Joules:

$$W = F \cdot d$$
$$W = 100 \text{ N} \cdot 4 \text{ m}$$
$$W = 400 \text{ J}$$

Getting from **B-C** does not require near as much force as **A-C**, but we do have to move a considerably longer distance. In fact, the actual force and distance are 25 Newtons and 16 meters. Calculating the work gives:

$$W = 25 \text{ N} \cdot 16 \text{ m}$$

$$W = 400 \text{ J}$$

Mechanical Advantage

Some machines can increase force more than others. A machine's mechanical advantage tells you how many times the machine multiplies force. Use the following equation to find mechanical advantage:

Input force = 50 N
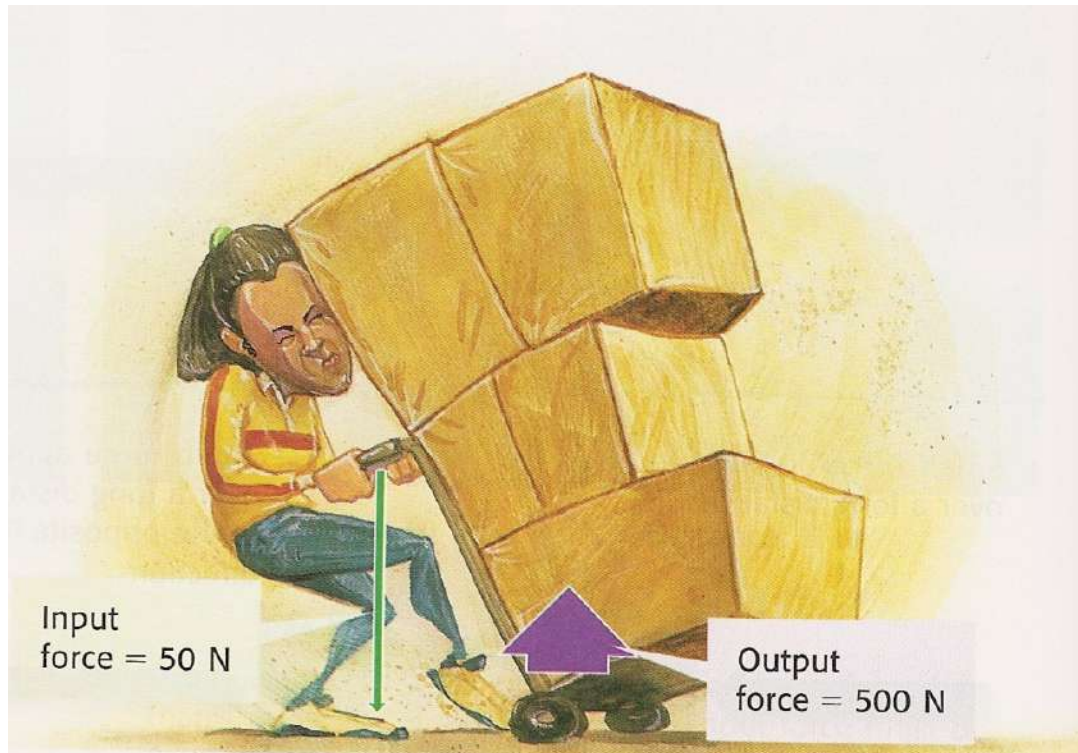
Output force = 500 N

$$MA = \frac{output\ force}{input\ force}$$

Mechanical Efficiency

The less work a machine has to do to overcome friction, the more efficient it is. Mechanical efficiency is a comparison of a machine's work output with the work input. Use the following equation:

$$Mechanical\ Efficiency = \frac{output\ force}{input\ force} \bullet 100$$

The 100 in the equation means that mechanical efficiency is expressed as a percentage.

If a machine could be made that had 100 percent mechanical efficiency, it would be called an ideal machine.

Quick Questions

1. Why is the work output for a machine always less than the work input?

2. You and a friend together apply a force of 1,000 N to a 3,000 N automobile to make it roll 10m in 1 minute and 40 seconds. How much work did you and your friend do together? What was your combined power?

3. Mechanical Advantage is to cents as mechanical efficiency is to _____.

Types of Machines

1. **Lever**
   a. First Class Lever
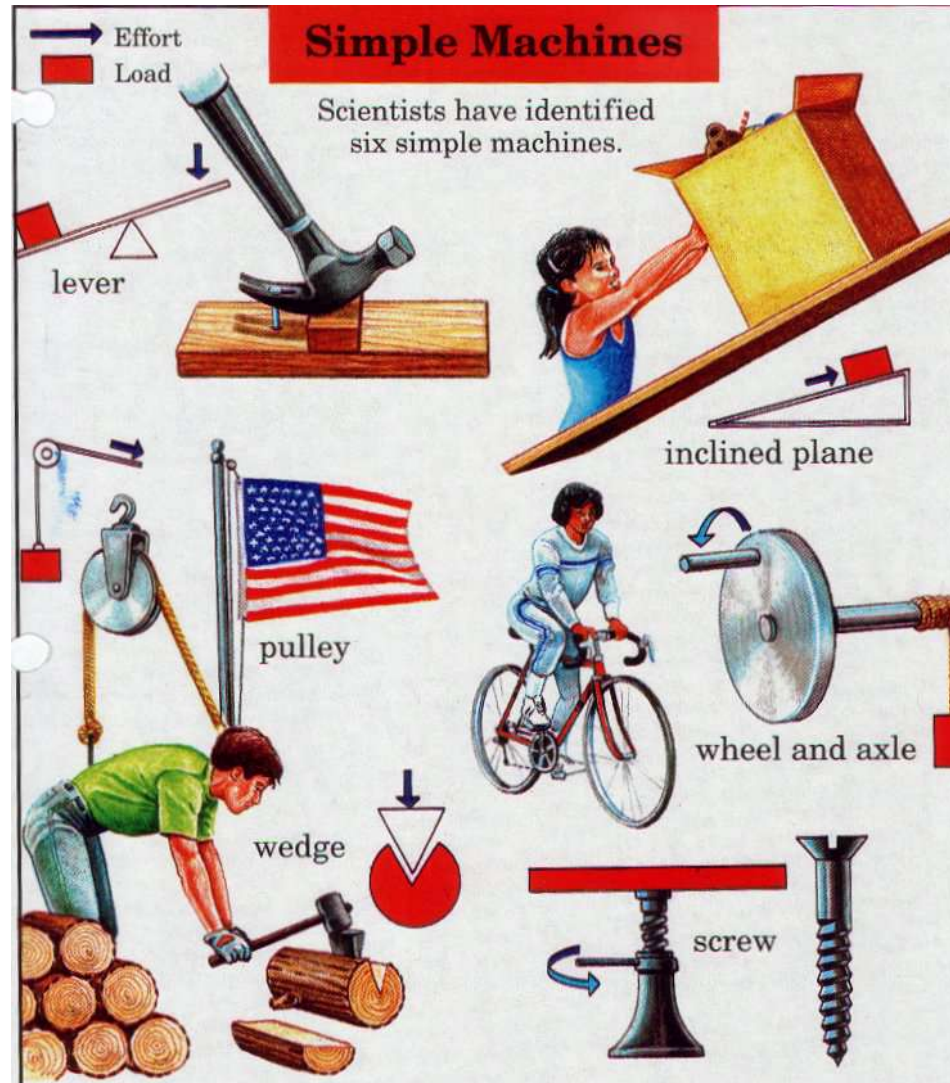   b. Second Class Lever
   c. Third Class Lever

2. **Inclined Plane**

3. **Wedge**

4. **Screw**

5. **Wheel and Axle**

6. **Pulley**

Simple Machines

→ Effort
■ Load

Scientists have identified six simple machines.
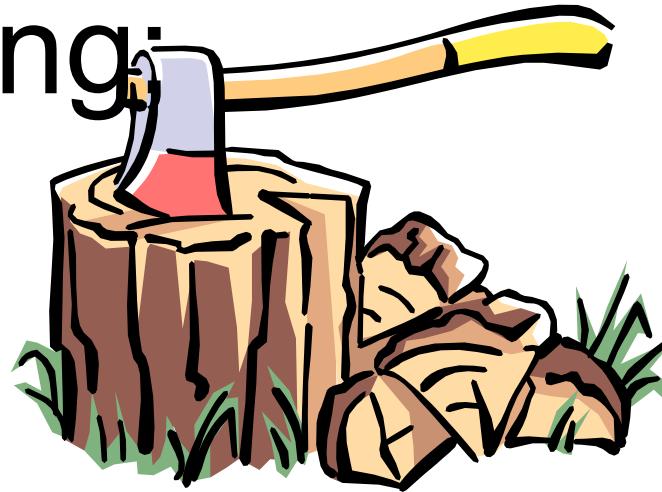
lever

inclined plane

pulley

wheel and axle
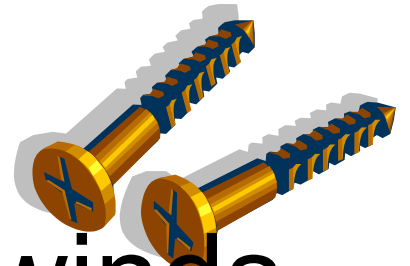
wedge

screw

Wedge
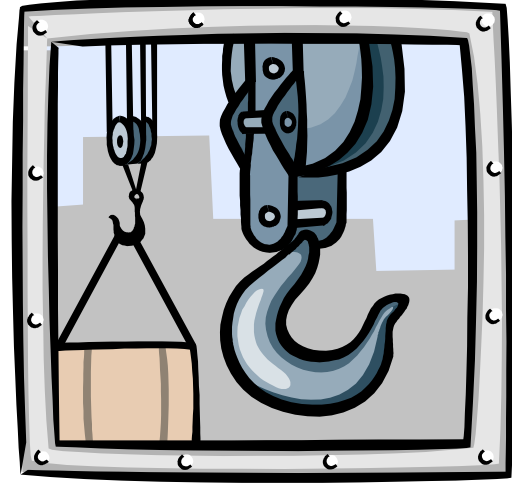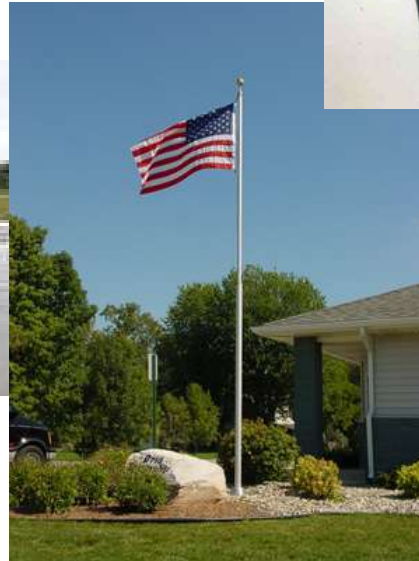
Machine used for slicing,

lifts, splits, and holds

Screw

A screw is a machine with grooves that winds round and round in a spiral; a screw can also bring or hold materials together.
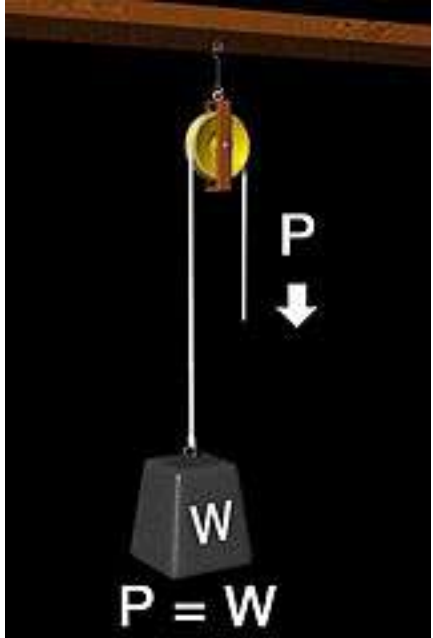
Pulley

- A special kind of wheel that changes the direction of the force.

- When you pull down the object goes u
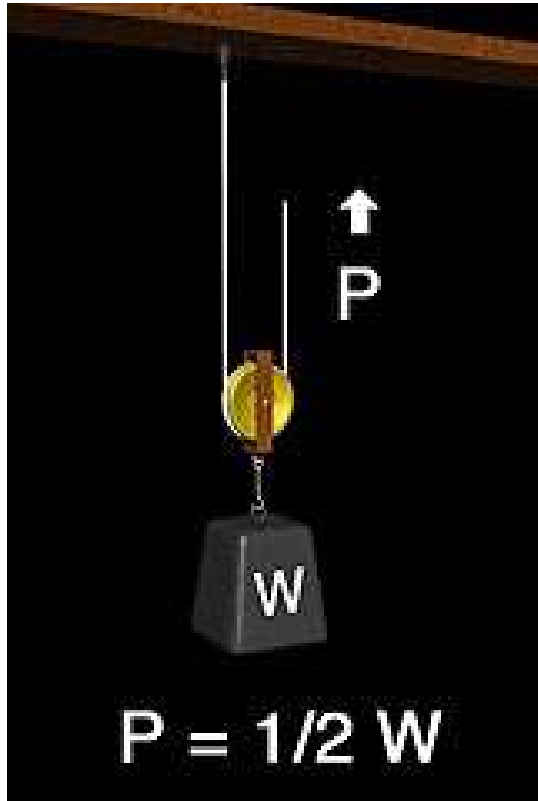
- ve items up, down, or across.

Fixed Pulleys

P

W

P = W

- This is a fixed pulley. It doesn't move when the rope is pulled. It is fixed to the upper bar.

- You can pull down on the rope in order to lift the load up.

- A fixed pulley only spins. Therefore, there's a mechanical advantage of 1.

Movable Pulleys

P = 1/2 W

• This is a movable pulley. As the rope is pulled up, it can also move up. The weight is attached to this moveable pulley. Each side of the rope is supporting the weight, so each side carries only half the weight.

• The force needed to hold up the pulley in this example is 1/2 the weight!

• The mechanical advantage of this system is 2. It is the weight (output force) divided by 1/2 the weight (input force).

More on Pulleys…

- When a fixed pulley and a movable pulley are used together, the pulley system is called a **block and ta**

50 Lbs

50 Lbs

50 Lbs

50 Lbs

↓ 100 Lbs

100 Lbs

©2000 How Stuff Works
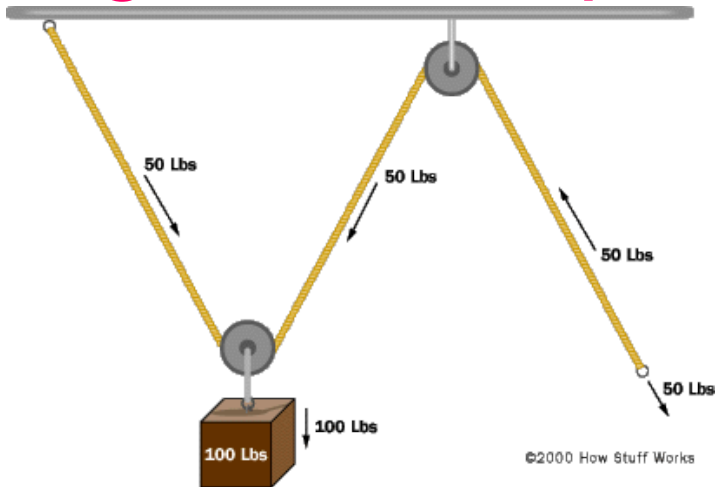
You can see that the weight is now suspended by two pulleys rather than one. That means the weight is split equally between the two pulleys, so each one holds only half the weight, or 50 pounds (22.7 kilograms). That means that if you want to hold the weight suspended in the air, you only have to apply 50 pounds of force (the ceiling exerts the other 50 pounds of force on the other end of the rope).

Wheel and Axle
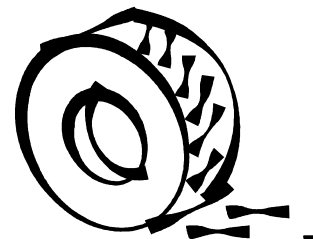
- Wheels are round, and they turn to make things go.

- The wheel and axel moves loads. It is one of our most important inventions, essential to transportation.
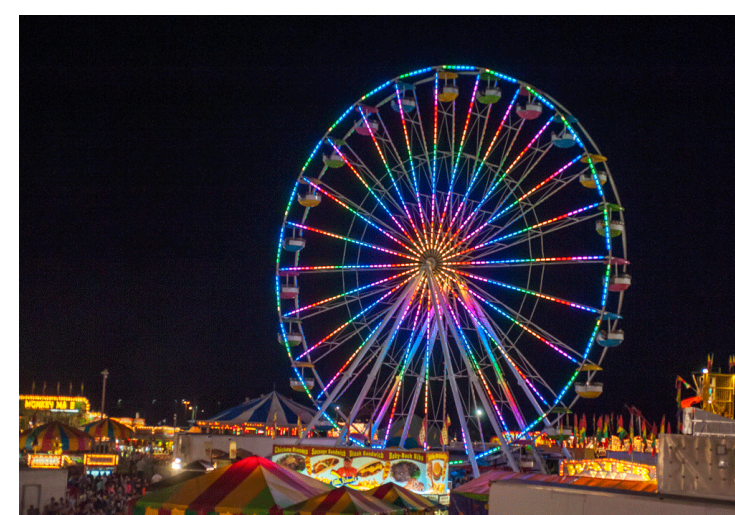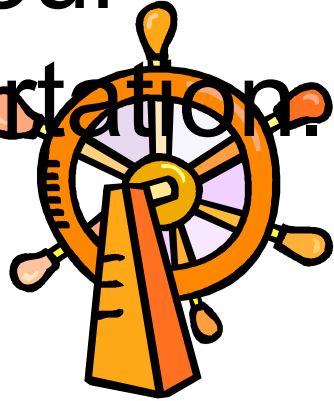
Inclined Plane (ramp or stairs)

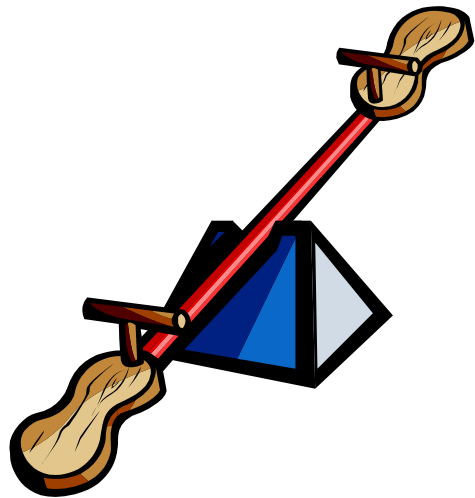A surface, often flat, set at an angle to another surface.
Allows items to move up or dov

QUICK QUESTIONS

1. Why is a set of stairs classified as an inclined plane?

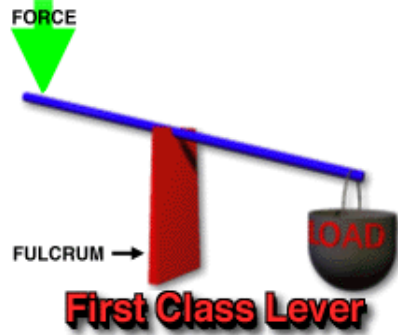2. Name and classify at least four simple machines found in a kitchen.

Lever

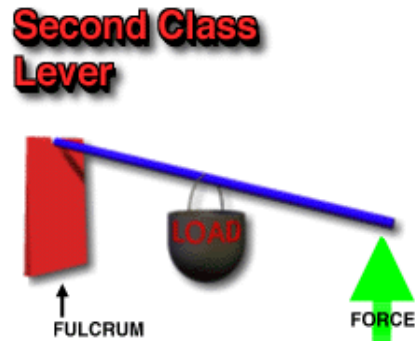- a bar that moves on or around a fixed point; lifts or moves loads

Levers

A lever is a simple machine consisting of a bar that pivots at a fixed point, called a fulcrum. Levers are used to apply force to a load. The three classes of levers are based on the locations of the fulcrum, the load, and the input force.

FORCE

FULCRUM →

LOAD

First Class Lever

Second Class Lever

FULCRUM

LOAD

FORCE

Third Class Lever

FORCE

LOAD

FULCRUM

When the fulcrum is exactly in the middle, the MA is exactly 1.

2nd Class lever has a mechanical advantage of greater than 1.

Resistance

Effort

Fulcrum
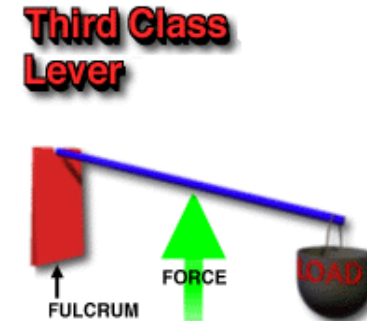
A 3rd Class lever has a mechanical advantage of less than 1.

Questions

1. A third class lever has a mechanical advantage of less than 1. Explain why it is useful for some tasks.

2. If you could choose to be a 2nd class lever, what would you be? What would your job be? How does that feel?

3. How is a hammer both a first class lever and a third class lever?

4. True or False? A large stick used to move a heavy rock is a simple machine.

5. Classify each of the following as 1st, 2nd, or 3rd class levers: garden shovel, wheelbarrow, seesaw, broom, baseball bat

Compound Machines

Compound machines are made of two or more simple machines.

Can you identify simple machines within a compound machine?
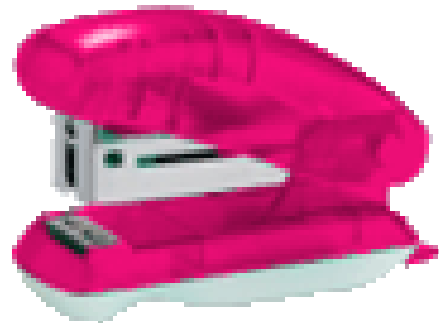
Answers…

Item Name	Types of simple machines that make it up
Can opener	Inclined plane, wedge, wheel and axle
Pencil sharpener	Inclined plane, screw, wedge, wheel and axle
Scissors	Inclined plane, wedge, first class lever
Stapler	Inclined plane, wedge, second class lever
Bicycle	Wheel and axle, levers, pulleys, screws
Block and Tackle	2 or more pulleys

Complex Machines-
Find the Simple Machines Within

HOMEWORK

- Find and write down an example of each simple machine in something that you use at home.

Answer the EQs:

1. How do simple machines make work easier?

2. Why would a compound machine be used?