

LEVERS, PULLEYS AND SIMPLE MACHINES

Levers - A lever is like a long stick or a bar that helps you lift or move something heavy. Think of a seesaw on a playground. If you push down on one side, the other side goes up. A lever has three parts:

- Fulcrum: The point where the stick rests and pivots.
- Effort: The part where you push or pull.
- Load: The heavy thing you're trying to move.

Pulleys - A pulley uses a rope and a wheel to help lift things. Imagine pulling up a bucket of water from a well. The pulley makes it easier because it reduces how much effort you need to lift the bucket.

Simple Machines - Simple machines help us do the same job with less effort. They save time and energy. E.g.: Inclined Plane, Wedge

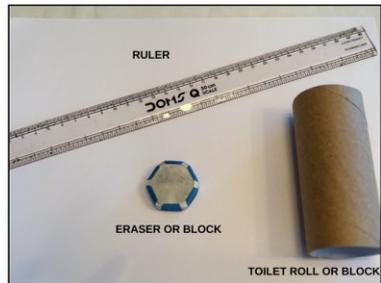
Experiment 1 - Lever Experiment

Material

- Ruler
- Small Block/Toilet roll
- Small object like a toy or block

Step-by-Step Instructions

1. Place a ruler over a toilet roll or small block (as the fulcrum).
2. Place a weight (e.g. toy) on one side of the ruler.
3. Push down on the opposite side and adjust the fulcrum's position to see how much force is needed to lift the weight.



Concept Explanation

Levers reduce the effort needed to lift heavy objects. Moving the fulcrum closer to the weight decreases the force required. This is because the distance from the force applied to the pivot is higher. Torque is distance from the force to the pivot multiplied by the force. So, as the distance increases, the force required is lesser to generate the same torque to lift the weight.



Reflection Questions

What happens when the fulcrum is closer to the weight? Does it increase or decrease the effort needed to lift the weight?

Fun Facts & Extensions

Scissors and seesaws are examples of levers. Scissors are a form of double lever, with the pivot point (fulcrum) located where the blades are joined. Each blade acts as a separate lever arm, and the handles provide the input force.

Real life uses of Lever

Seesaw: A classic example of a lever where children balance and pivot.

Crowbar: Helps lift heavy objects by amplifying force.

Wheelbarrow: The handles act as levers to lift and transport heavy loads.

Bottle Opener: Uses a lever to pry open bottle caps easily.



CROWBAR



BOTTLE OPENER



WHEELBARROW



SEESAW



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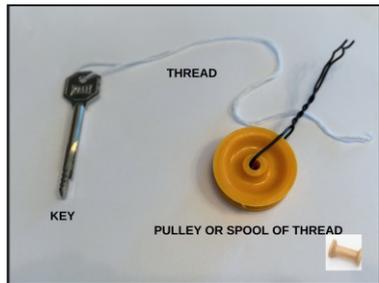
Experiment 2- Pulley System

Materials

- Thread
- Small basket/weight
- Spool/Toy wheel

Step-by-Step Instructions

1. Thread a string over a spool of thread(or toy wheel).
2. Attach one end of the string to a small basket/weight and the other to your hand.
3. Add weights to the basket and lift it by pulling the string.



Concept Explanation

The spool or wheel acts as an axle. Now, the force required is lessened due to the pulley system and much heavier weights are able to be lifted compared to how much could be lifted conventionally. The force required is lessened through a pulley system by distributing the load across multiple segments of rope or cable.



Reflection Questions

Was it easier to lift the weight with or without the pulley?

How does adding more pulleys change the effort needed? Does it increase or decrease?

Fun Facts & Extensions

Pulleys are used in cranes and elevators. In elevators, a pulley system with a counterweight and motor reduces the effort needed to raise the cabin by balancing the weight. This allows smooth and controlled movement. In cranes, pulleys multiply the lifting force by using multiple loops of rope or cable, enabling the crane to hoist heavy objects with less input force.

Real life uses of Pulley

Construction Cranes: Pulleys help lift heavy building materials to high places.

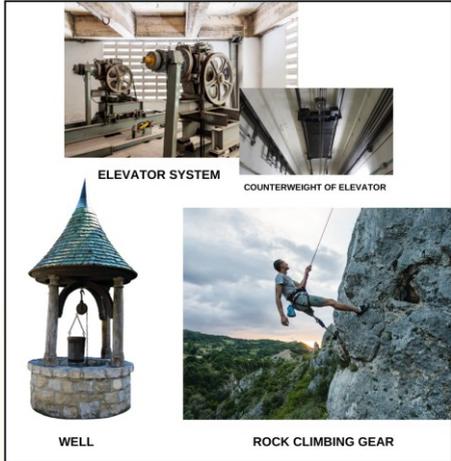
Wells: Buckets are pulled up using a pulley system to fetch water.

Elevators: Use multiple pulleys to lift the cabin smoothly.

Theatre Curtains: Pulleys are used to raise and lower stage curtains.

Rock Climbing Gear: Pulleys reduce the force needed to hoist climbers or equipment.

Sailboats: Use pulley systems to adjust sails easily.



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Igniting Curiosity, One Experiment at a Time

Experiment 3 - Wheel and Axle with a Rolling Pin

Materials

- 2 rolling pins or Toilet rolls
- A hard bound book

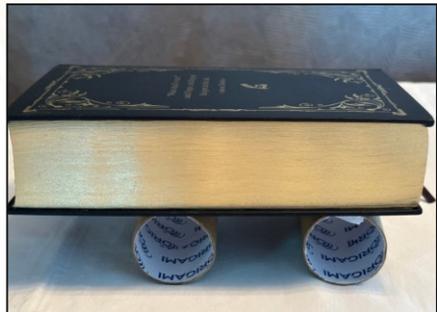
Step-by-Step Instructions

1. Place a heavy book on a flat surface. Try to drag it across and see how much effort is needed
2. Slide the rolling pin underneath the book and roll it forward.
3. Observe how much easier it is to move the book using the rolling pin.



Explanation

The rolling pin acts as a wheel and axle, reducing friction and making it easier to move the book compared to sliding it directly. The rolling pin reduces friction by converting sliding friction into rolling friction. Sliding friction occurs when two flat surfaces rub against each other, which requires more effort to overcome. In contrast, rolling friction occurs when a round object rolls over a surface, which involves less contact area and less resistance.



Reflection Questions

1. How does the rolling pin reduce friction, and why does this make it easier to move the book compared to sliding it directly on the surface?
2. How might this principle of the wheel and axle be applied in real-life situations, such as transporting heavy objects?

Fun Facts & Extensions

The wheel and axle is one of the six classical simple machines identified by ancient scientists, and it forms the basis of modern inventions like cars, bicycles, and even conveyor belts!

Real life uses of wheel and axle

Cars and Bicycles: Wheels and axles allow vehicles to move efficiently.

Shopping Carts: Wheels and axles make it easy to push heavy loads.

Door Knobs: The knob (wheel) and the rod inside (axle) work together to open doors.

Windmills: The blades (wheel) turn the axle to generate power.

Fans: The fan blades spin on an axle to circulate air.

Roller Skates: Wheels and axles help skaters glide smoothly.



ROLLER SKATES



SHOPPING CART



CARS



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