

# Balanced and Unbalanced Forces

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How do balanced and unbalanced forces affect an object's motion?

# What is inertia?

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**Inertia** is the resistance of any physical object to any change in its state of motion, including changes to its speed and direction.

**Inertia** tells us that we need a **force** to get an object to move or stop an object from moving.

# Discuss!

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- Did any of the stations demonstrate inertia?

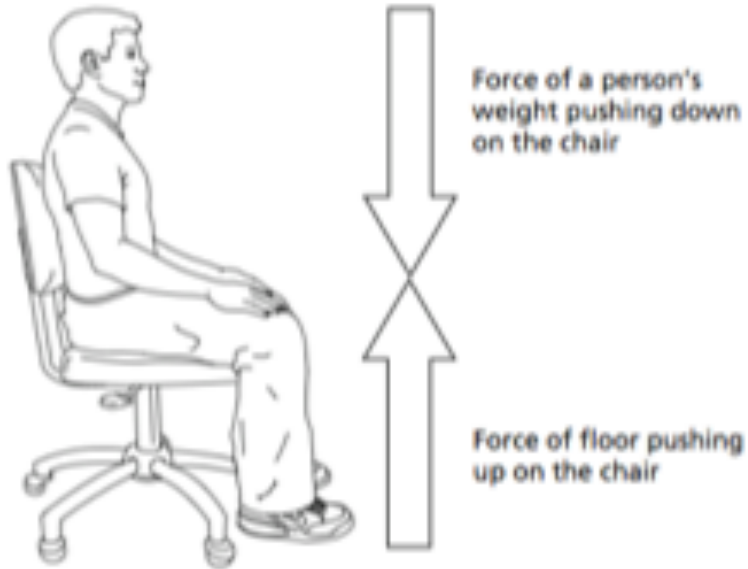
# What is a force?

- In science, a force is a **push** or a **pull**.
- All forces have two properties:

**Direction** and **Size**

- A **newton** (N) is the unit that describes the **size** of a force.

# What is a force



A person sitting on a chair.

- The student is **pushing** down on the chair, but the chair does not move.
- The floor is **balancing** the force by pushing on the chair.

# Combining Forces

- More than one **force** often acts on an **object**.
- When all the forces acting on an object are **added** together, you determine the **net force** on the object.
- An object with a net force more than **0** N on it will change its state of **motion**.

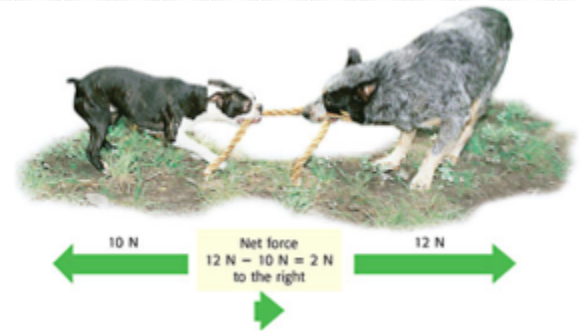
# Forces in the Same Direction

- When **forces** are applied in the **same** direction, they are **added** to determine the **size** of the net force.



# Forces in Different Directions

- When two forces act in opposite directions, you subtract the smaller force from the larger force to determine the net force.
- The net force will be in the same direction as the larger force.





# Balanced Forces

- When the forces on an object produce a net force of **0** N, the forces are **balanced**.
- There is **no change** in the **motion** of the object.

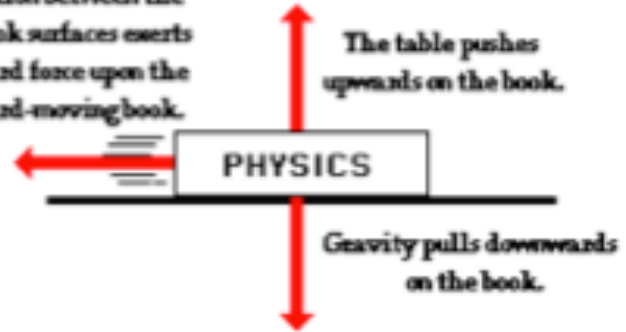


# Unbalanced Forces

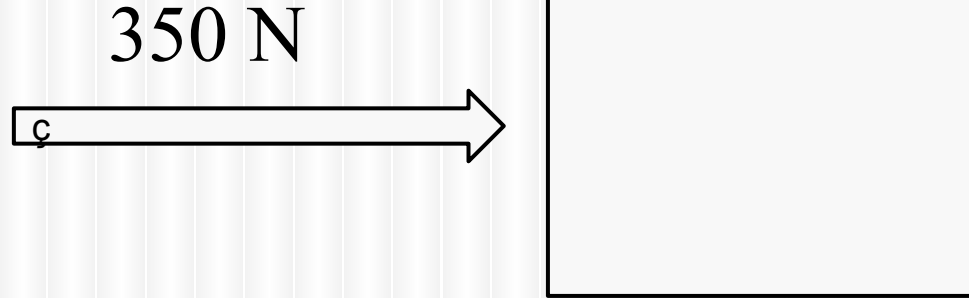
- When the net force on an object is **not 0 N**, the forces on the object are **unbalanced**.
- Unbalanced forces produce a **change in motion** of an object.

The forces acting on the book are not balanced.

The friction between the table/book surfaces exerts a leftward force upon the rightward-moving book.



# Let's Practice!



Net Force \_\_\_\_\_

# Let's Practice



200 N



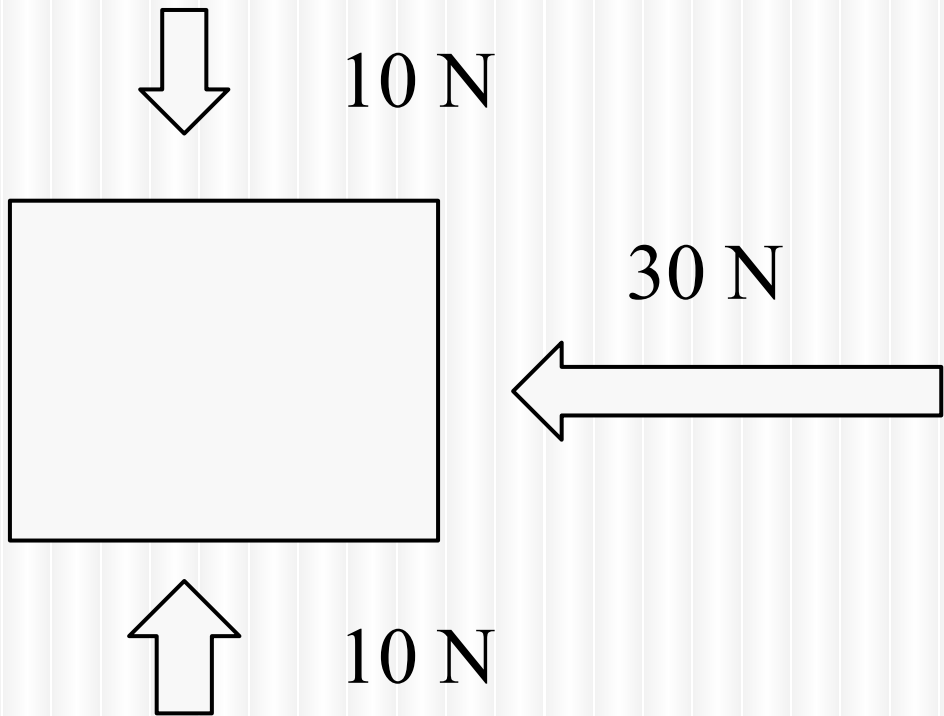
Net Force: \_\_\_\_\_

# Let's Practice



Net Force \_\_\_\_\_

# Let's Practice



Net Force: \_\_\_\_\_

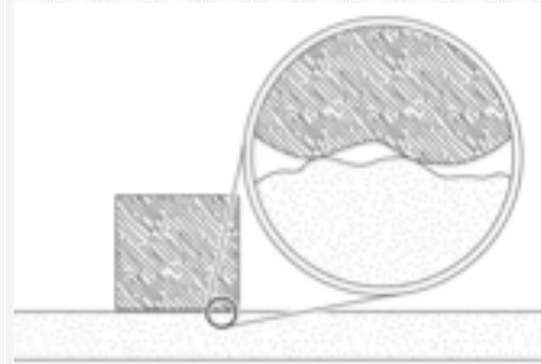
# Exploring Forces

We will look at three examples of forces:

- Friction
- Gravity
- Magnets

# Friction

- **Friction** is the force that **opposes** the **motion** between two **surfaces** that **touch**.
- The **surface** of any object is **rough**.
- Even an object that feels **smooth** is covered with tiny **hills** and **valleys**.
- The **contact** between the hills of valleys of two surfaces causes them to **stick**, resulting in friction.





# Friction

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- The amount of friction depends on:
  - Roughness of the surfaces
  - Force pushing the surfaces together

# Types of Friction

**Kinetic friction** occurs when **force** is applied to an object and the object **moves**.

Examples:

**Sliding Friction:** pushing an object across a surface

**Rolling Friction:** between wheels and a surface

**Fluid Friction:** opposes the motion of objects traveling through a fluid (air or water)

# Types of Friction

Static friction occurs when force applied to an object does not cause the object to move.



# Reducing Friction

- To reduce the amount of friction, apply a lubricant between two surfaces.

Ex) Motor oil, wax, and grease

- Friction can also be reduced by rolling, rather than pushing, an object.

# Increasing Friction

- Friction increases when the surface area of an object increases.
- Friction increases as surfaces are made rougher.
- Friction increases when the force between two objects increases.

# Discuss!

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- How does friction affect an object's movement?
- How can friction be beneficial?
- How can friction be a problem?
- Which stations demonstrated friction at work?

# Gravity

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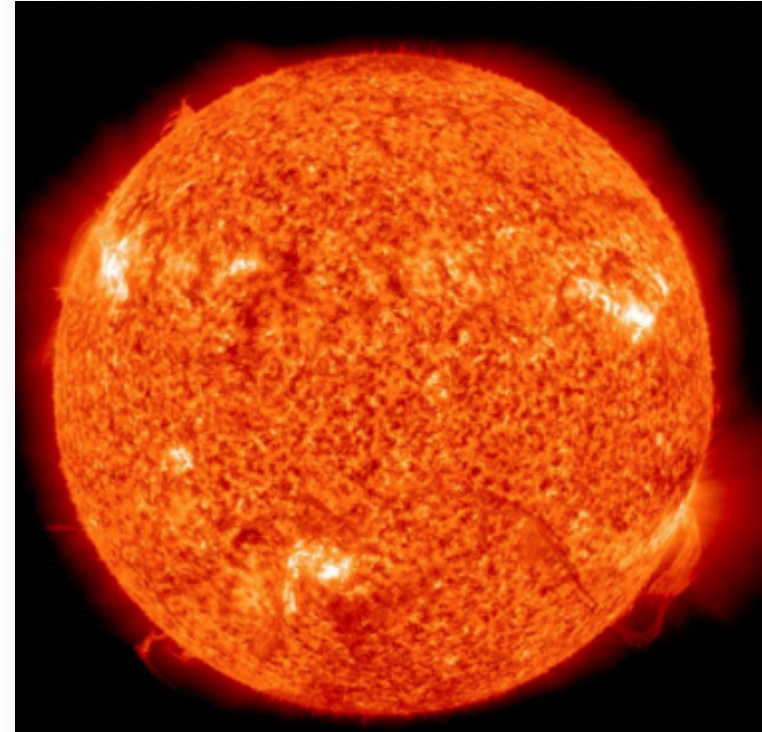
Gravity is the force of attraction between matter.

Gravity depends on:  
mass and distance

# Mass and Gravity

The more massive an object the more it can attract objects to itself.

For example, the Sun has a larger gravitational effect than the Earth.





# Distance and Gravity

The farther  
away objects get  
from one another,  
the less  
gravitational  
attraction can be  
found.



# Discuss!

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- How does gravity affect an object's motion?
- Is gravity balanced, unbalanced, or both?  
Give evidence to support your answer.
- Was gravity at play in any of the stations?

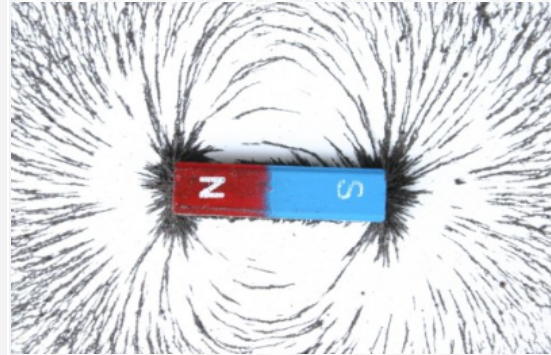
# Magnets

A **magnet** is an object with a north and south pole that produces a magnetic field and exerts a magnetic force.



# Magnets

A **magnetic field** is the force field that surrounds the magnet.

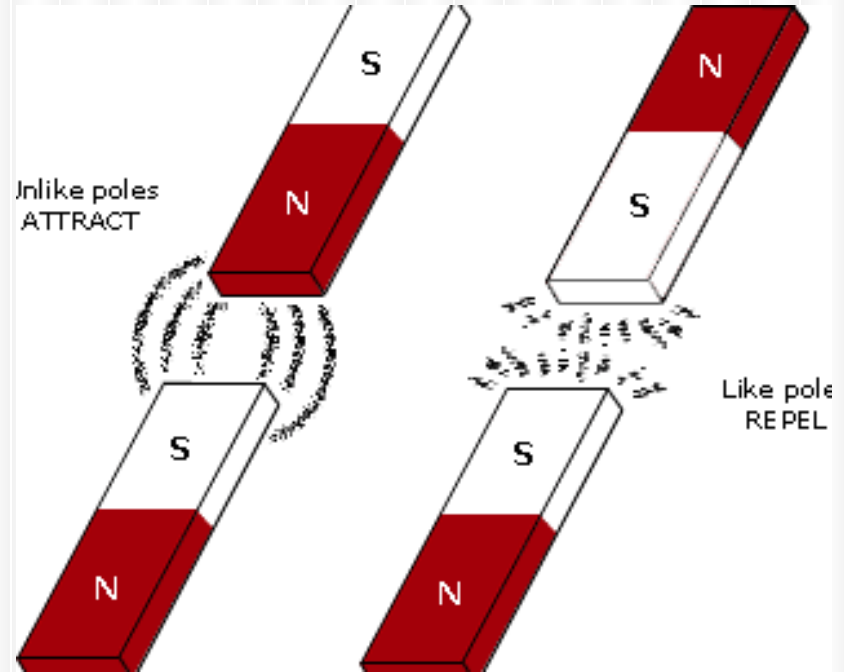


A **magnetic force** can cause objects to *attract* or *repel* without needing to touch the magnet!

# Poles

**Like** poles will repel or move **away** from one another.

**Opposite** poles will **attract** or move towards one another.



# Compass

A compass uses the Earth's magnetic field and magnets to help a person determine direction. The magnet's poles will line up with the Earth's north magnetic pole and south magnetic pole.



# Discuss!

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- How do magnets affect an object's motion?
- What happens to an object's motion if no forces are acting on it?