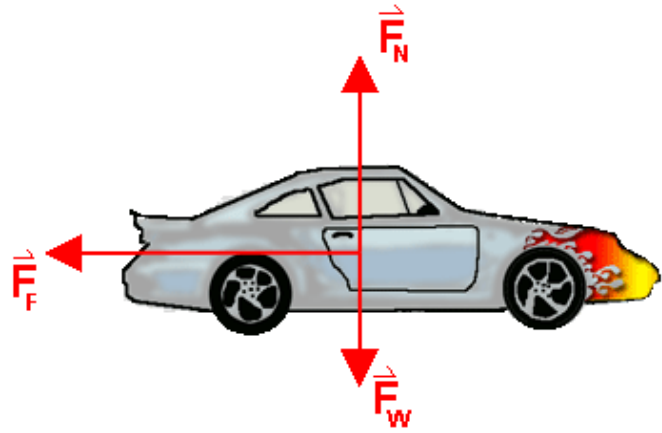


Forces and Friction



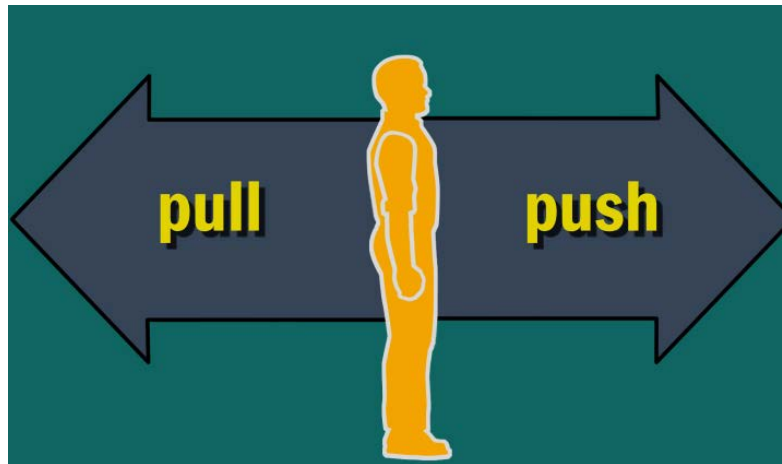
What is a force?

How do forces combine?

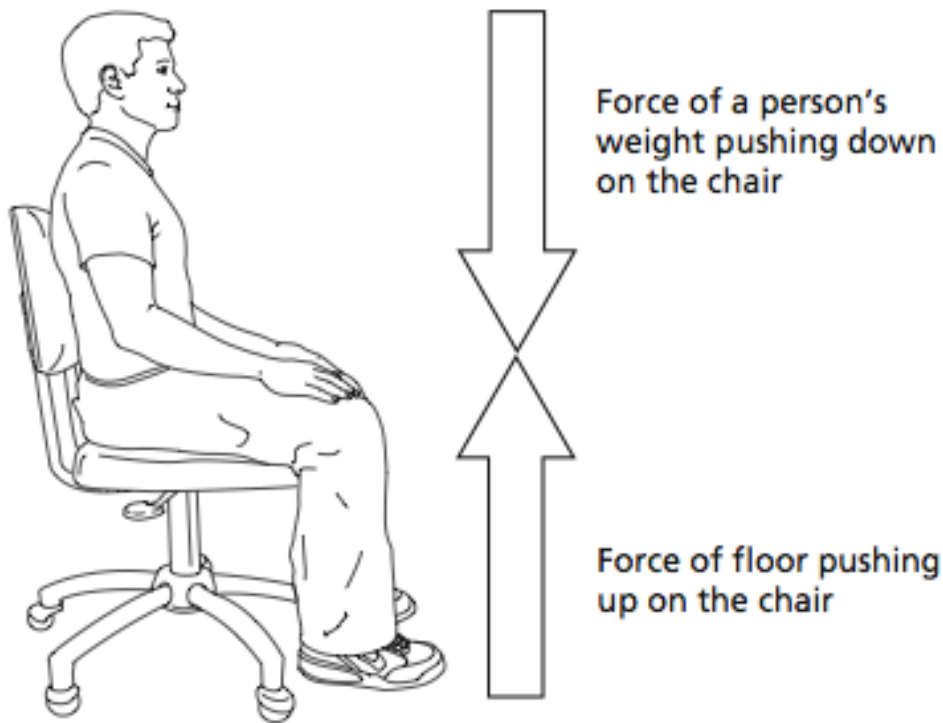
How does friction affect motion?

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?

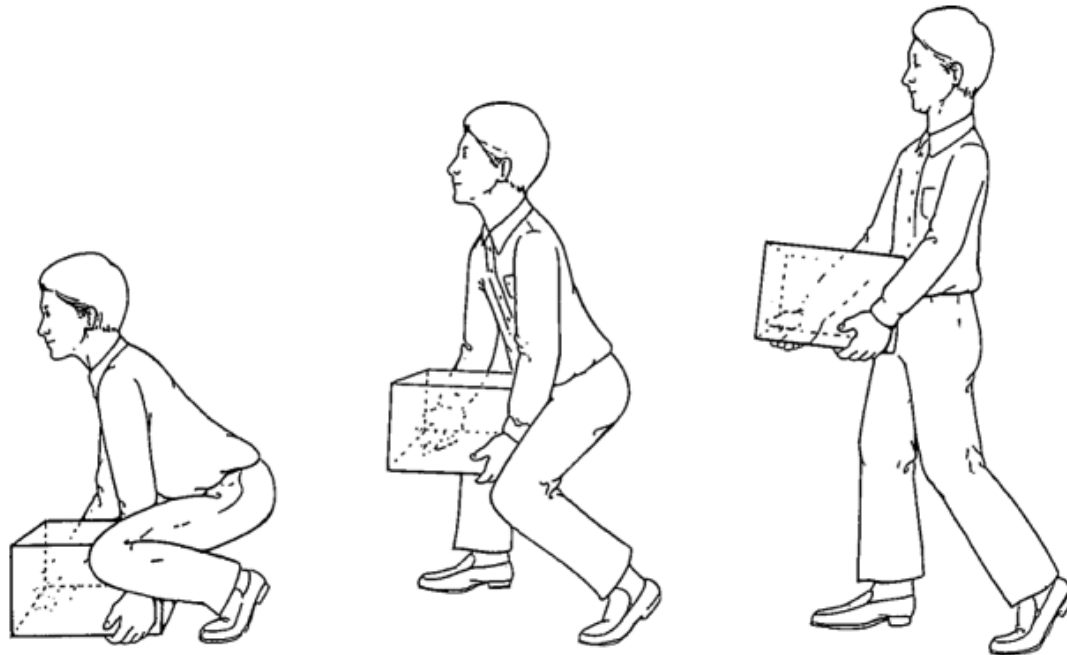


A person sitting on a chair.

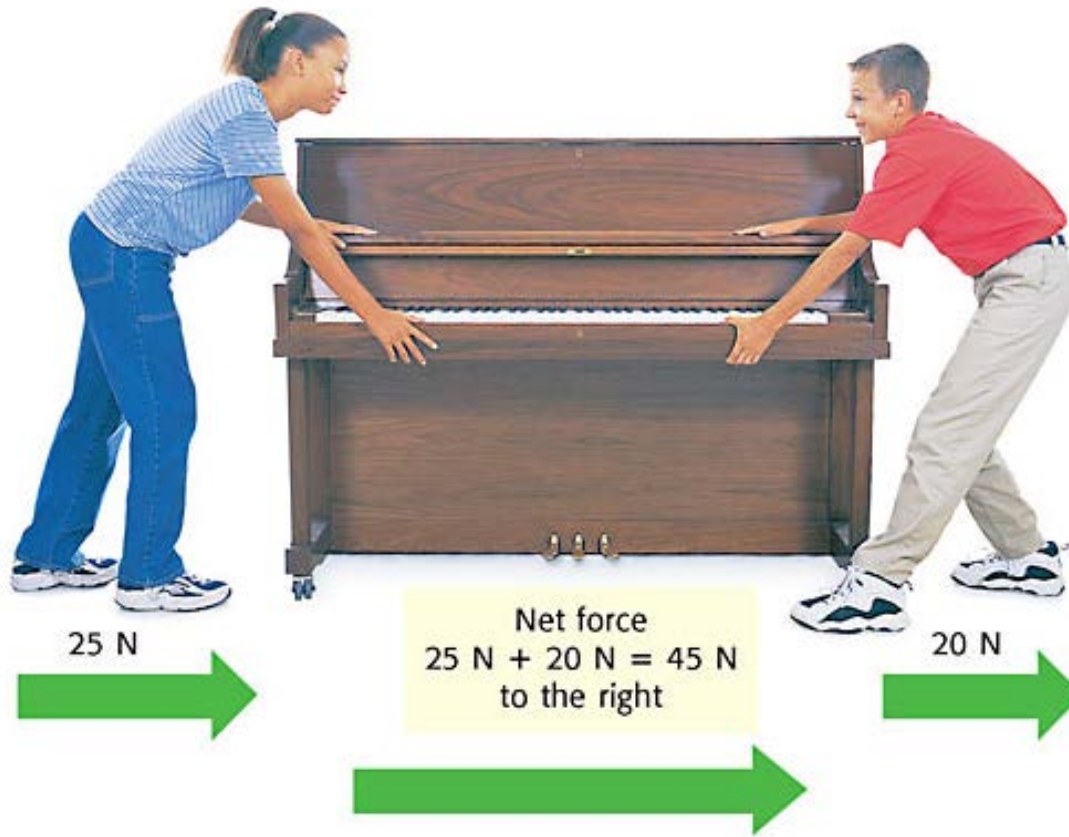
- The student is pushing down on the chair, but the chair does not move.
- The floor is balancing the force by pushing on the chair.

How do Forces Combine?

- 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**.

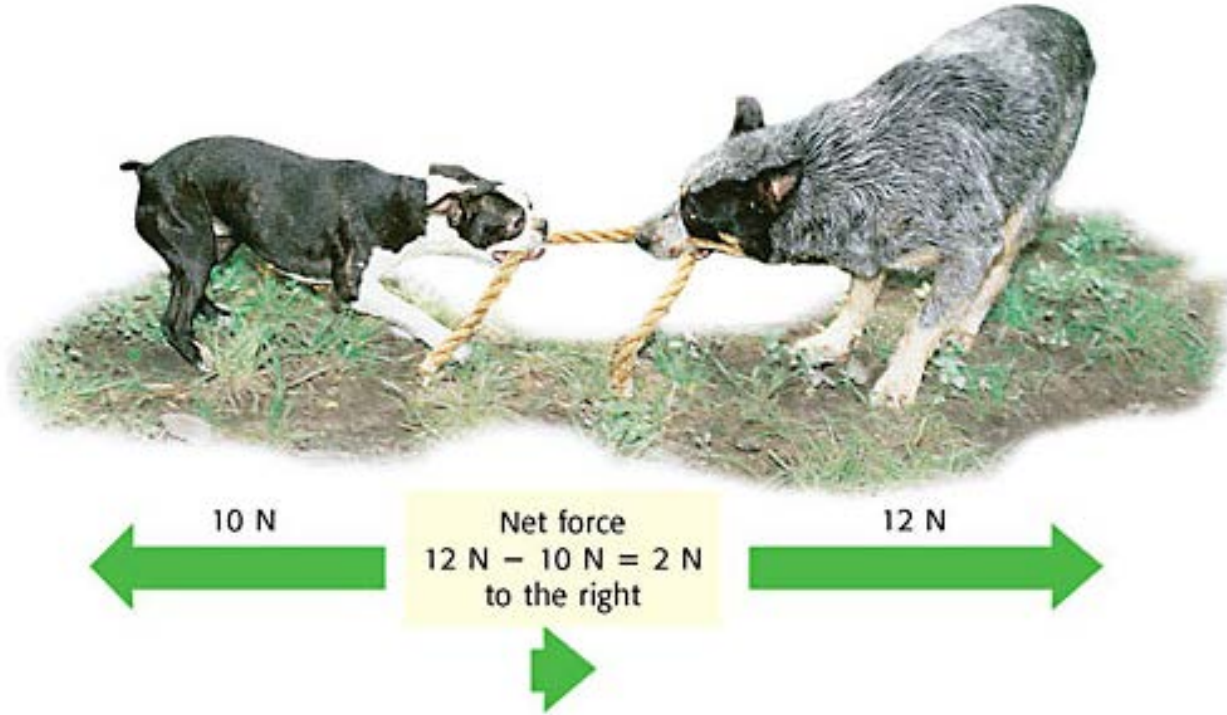


Forces in the Same Direction



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

Forces in Different Directions

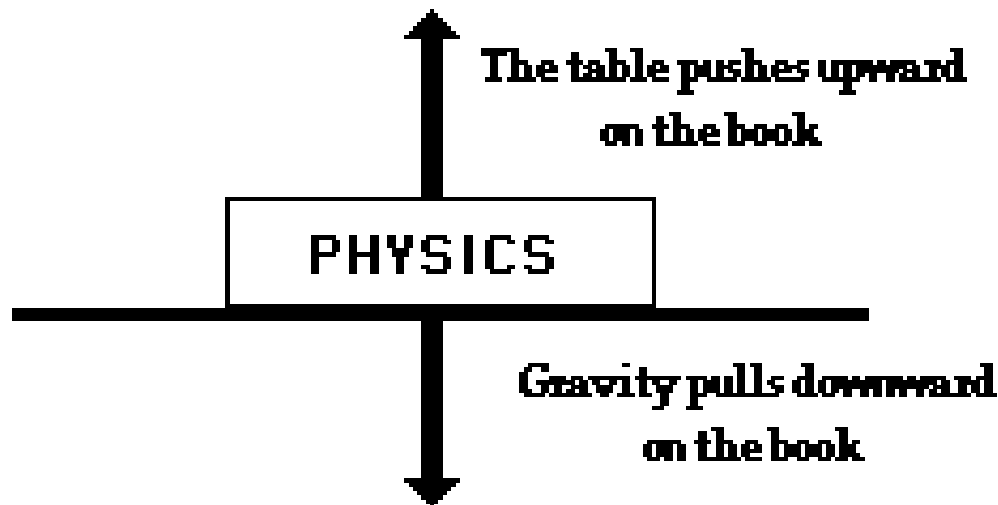


- When two forces act in **opposite** directions, you subtract the **smaller** force from the **larger** force to determine the net force.
- The net force will be in the same **direction** as the **larger** force.

Balanced and Unbalanced 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.

The forces on the book are balanced.



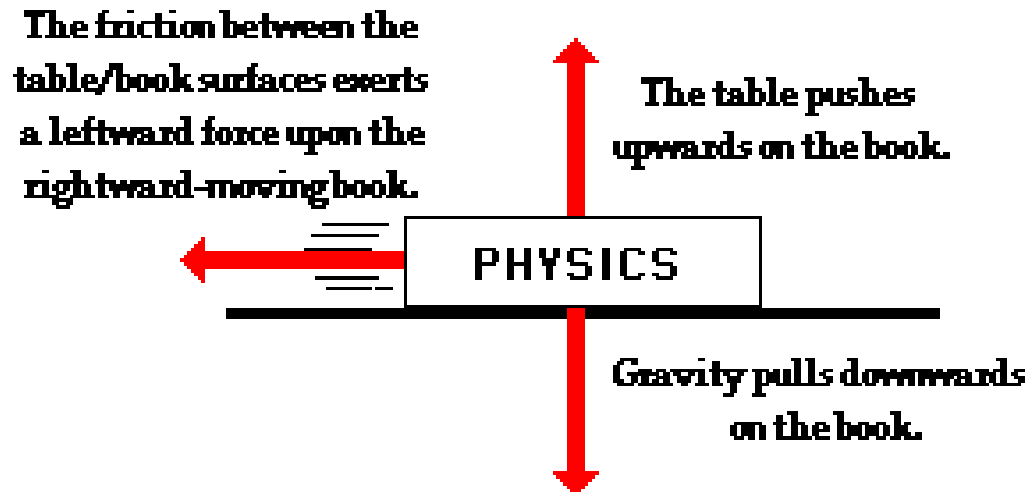
The forces on the person are balanced.



Balanced and 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.

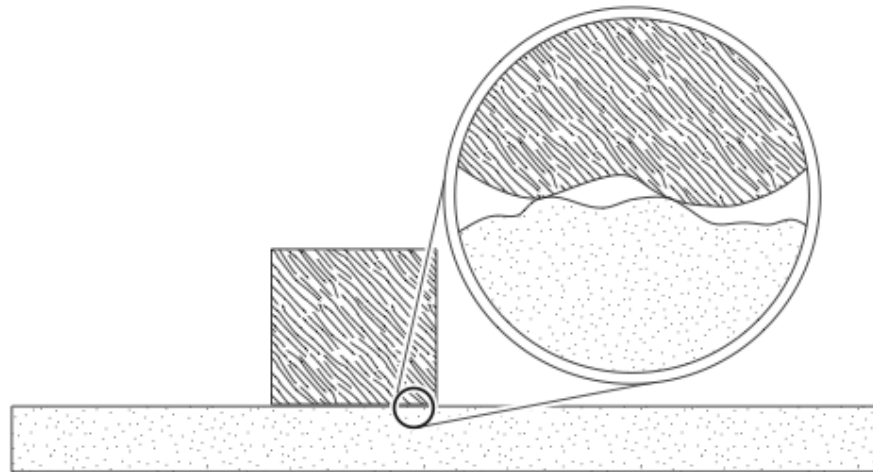


Balanced and Unbalanced Forces



What Causes 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 and valleys of two surfaces causes them to **stick**, resulting in friction.



What Causes Friction?

- 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

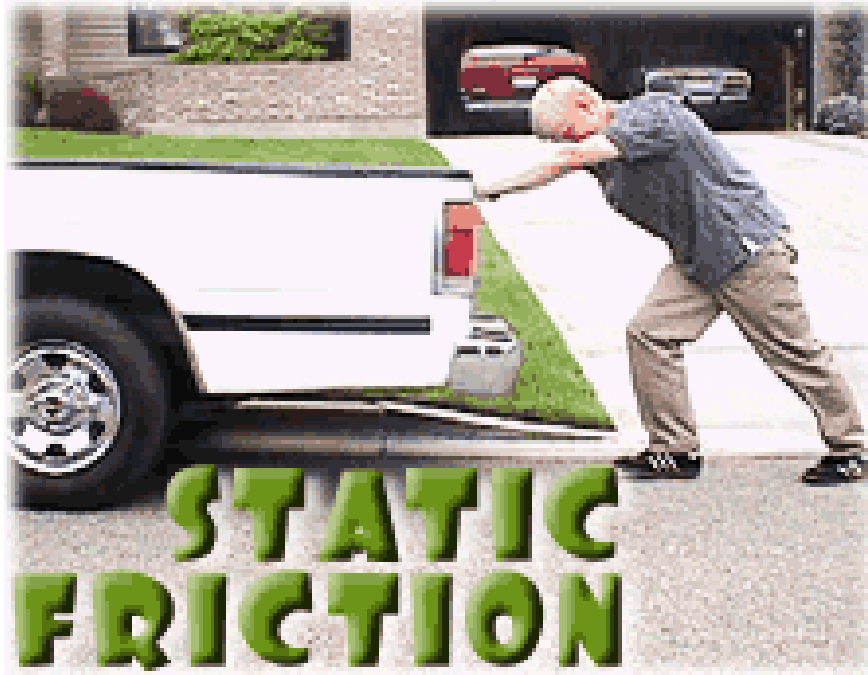
Rolling Friction: between **wheels** and a surface

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



Types of Friction

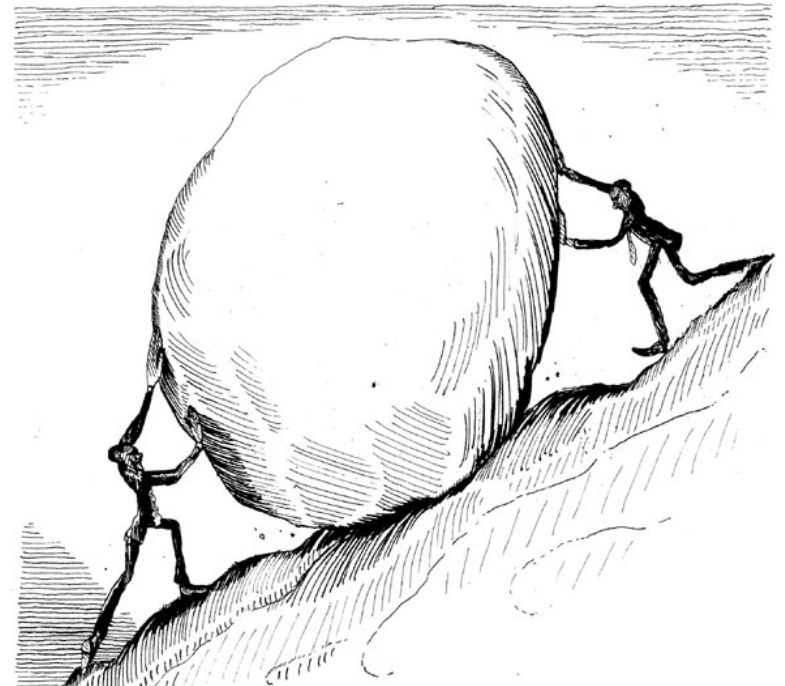
- **Static** friction occurs when force **applied** to an object does **not** cause the object to **move**.





Affecting Friction

- To reduce the amount of friction, apply a lubricant between two surfaces.
- Motor oil, wax, and grease are examples.
- Friction can also be reduced by rolling, rather than pushing, an object.



Affecting Friction

- Friction increases as surfaces are made **rougher**.
- Friction increases when the **force** between two objects is **increased**.



