

teach me about newton's 3rd law



Okay! To start, can you tell me your age or grade level? This will help me tailor the explanation to be just right for you. Also, have you studied physics before, or is this a completely new topic?

i am in 8th standard



Great! Newton's Third Law is a fundamental concept in physics. Let's break it down.

First, I'll explain it at a beginner level. Then, I'll use an analogy to make it super clear. After that, I'll ask you a quick question to check your understanding, and we'll go from there!

Here we go:

Explanation (Beginner Level):

Newton's Third Law basically says that for every action, there is an equal and opposite reaction. Imagine you push against a wall. You are applying a force (the action). The wall is also pushing back on you with the exact same amount of force (the reaction). You might not feel the wall pushing back, but it is!

The important thing is that these forces act on *different* objects. You push on the wall, and the wall pushes on *you*.

Now, let's solidify that with an analogy!



sure





Analogy (Age-Appropriate):

Imagine you're on a skateboard, and you jump off.

- **Action:** You push backward against the ground with your legs (that's the action).
- **Reaction:** The ground pushes you forward (that's the reaction), sending you rolling on your skateboard.

See? You pushed on the ground, and the ground pushed back on *you*, causing you to move. The action is your legs pushing backward on the ground. The reaction is the ground pushing your body forward.

Now, a quick question to check your understanding:

If you are standing on ice and you throw a heavy ball forward, what will happen to you according to Newton's Third Law?

i will move backwards



Exactly! You got it.

- **Action:** You exert a force on the ball, throwing it forward.
- **Reaction:** The ball exerts an equal and opposite force on you, pushing you backward.

Since you're on ice, there's very little friction to stop you, so you'll slide backward.

Now, would you like a slightly more detailed, intermediate-level explanation, or would you prefer to try some practice questions to really nail this down?

Okay, let's dive into a more intermediate-level explanation.

Explanation (Intermediate Level):

Newton's Third Law states that when one body exerts a force on another, the second body simultaneously exerts a force equal in magnitude and opposite in direction on the first. These forces act along the same line.

Mathematically, we can represent this as:

$$\mathbf{F}_{12} = -\mathbf{F}_{21}$$

Where:

- \mathbf{F}_{12} is the force exerted by object 1 on object 2
- \mathbf{F}_{21} is the force exerted by object 2 on object 1

The negative sign indicates that the forces are in opposite directions.

Important points to remember:

- **Equal in Magnitude:** The forces have the same strength.
- **Opposite in Direction:** The forces act in exactly opposite directions.
- **Act on Different Objects:** This is crucial! The action and reaction forces always act on *different* objects. They do not cancel each other out because of this.
- **Simultaneous:** The forces occur at the same time.

Let's use another example: A bird flying. The bird's wings push down and back on the air (action). The air pushes up and forward on the bird's wings (reaction), allowing it to fly.

Now, let's check your understanding with another question:

A book is resting on a table. Identify the action-reaction forces in this scenario. Be specific about which force acts on which object.

book give a downward force on the table



That's part of the answer! You've correctly identified one force. That's the action:

- **Action:** The book exerts a downward force on the table due to its weight.

Now, what is the reaction force? Remember, the reaction force must be:

- Equal in magnitude (same strength)
- Opposite in direction
- Acting on a *different* object

What object is experiencing the reaction force, and in what direction is that force acting?

table give force in upward direction



Yes, exactly!

- **Reaction:** The table exerts an upward force on the book.

That upward force from the table is called the "normal force." It's equal in magnitude to the book's weight, but it acts in the opposite direction, preventing the book from falling through the table.

So, to summarize:

- **Action:** Book exerts a downward force (weight) on the table.
- **Reaction:** Table exerts an upward force (normal force) on the book.

You're doing great! Would you like to try some more practice questions, or would you like to move on to an even more advanced explanation that involves momentum and impulse?

give more questions that we can discuss



Okay, here's another question that we can discuss:

A 70 kg astronaut is floating in space near a 30 kg tool. The astronaut pushes the tool away with a force of 10N for 0.5 seconds.

- a) What is the impulse experienced by the tool?
- b) What is the impulse experienced by the astronaut?
- c) What is the final velocity of the tool?
- d) What is the final velocity of the astronaut?
- e) What is the total momentum of the system (astronaut + tool) before and after the push?

a bit easier questions please



You got it. Let's try a conceptual question that's a bit easier, then.

Imagine a tug-of-war between two teams. Team A is pulling with a force of 500N, and Team B is also pulling with a force of 500N in the opposite direction.

1. Describe the action-reaction forces in this scenario. What object is exerting a force on what other object?
2. What is the net force on the rope?
3. If the forces are balanced, why do the players need to keep pulling? What would happen if they stopped?

net force is zero

