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## Why this course? What are the Principles of Science?



Every day, hidden forces work quietly behind the scenes—cooling your laptop, connecting your wireless devices, and transforming ice cubes into water faster than you expect.

Let me ask you a few questions:

1. Why does your phone get hot after long use?
2. How do wireless signals pass through solid walls?
3. What happens at the atomic level when you use soap to clean a greasy pan?

All of these are everyday phenomena... but they're actually powered by scientific principles. Today's lesson is about understanding how science hides in the most ordinary moments—and powers the devices we use every day.

- A phone slowing down in extreme cold
- Hand sanitizer evaporating instantly
- Anti-fog mirror in action

You probably used at least one of these things—but did you ever stop to think about the science behind them?

This course is your guide to unpacking the science behind everyday actions. We'll uncover the physics in motion, the chemistry in cleaning, the invisible waves in communication, and the reactions powering your devices. It's not just about learning concepts—it's about discovering how science is already woven into your daily life and future tech career.

### What is Science?

So far, we've been talking a lot about science, but before we go further, let's pause for a moment and ask a simple but important question: What is science, really? Is it just a subject in school? A bunch of formulas and theories? Or is it something much bigger?

To truly understand the journey we're about to take, we need to get to the heart of what science actually is. Let's watch a short video that helps us explore this idea.



Think about waking up in the morning. The alarm clock uses electricity and magnetism to wake you up. The water you use to brush your teeth is a chemical compound. Even the toast you eat involves a chemical reaction!

Science is everywhere, and understanding it can make you more aware of the world around you. It helps you make informed decisions about your health, your environment, and the technologies you use every day.

### Why Should I, a Computer Science Student, Learn This?

Think of science as the foundation upon which technology is built. Just as a building needs a strong foundation, computer science relies on physics and chemistry. Understanding these scientific principles will make you a more innovative and effective computer scientist.

Imagine you're designing a new smartphone. Knowing how memory devices, batteries, and sensors rely on physics and chemistry can help you optimize their performance and even invent new solutions. It's like understanding the ingredients in a recipe – you can't truly master cooking without knowing what each ingredient does!

This connection between science and everyday technology becomes even clearer when we look around us. Now, let's take a closer look at the topics covered in this course, starting with a breakdown of the first module.

### Module #1: Science in Daily Life

As computer science students, it's important to understand the science behind the technology we use daily. This knowledge helps you connect real-world phenomena with the devices and systems you work with.

**1. Heat and Temperature in Daily Life** This topic explores how heat and temperature affect our everyday activities. From cooking food to feeling the warmth of sunlight, understanding heat transfer and temperature changes helps explain many common phenomena around us.

**2. Chemistry in Daily Life** Chemistry is all around us—in the food we eat, the medicines we take, and the materials we use. This topic shows how chemical reactions and compounds play a crucial role in daily products and processes.

**3. States of Matter and Changes** Everything around us exists in different states—solid, liquid, or gas. This topic covers how matter changes state (like ice melting or water boiling) and why these changes happen, helping us understand natural and artificial processes.

**4. Chemistry of Cleaning and Cosmetics** This topic focuses on the science behind cleaning agents like soaps and detergents, and cosmetics like creams and shampoos. It explains how their chemical composition makes them effective and safe for daily use.

## Module #2: Fundamentals of Physics

Physics provides the basic principles such as electricity, magnetism, and light, which form the foundation of all computing hardware. A solid grasp of these concepts enables you to better understand how devices function.

Imagine you are pushing a swing. *Physics* is the science that explains how that swing moves. It looks at everything from how things move (**mechanics**) to how energy works. Let's explore some basic concepts:



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- **Mechanics and Motion:** This explains how objects move and interact. Think about throwing a ball. Mechanics helps us understand how the ball travels through the air, how fast it goes, and where it lands. It's all about understanding movement!
- **Forces and Motion:** Understanding forces helps explain why things speed up, slow down, or change direction. Imagine pushing a box. The harder you push (the more force you apply), the faster it will move. If you stop pushing, friction (another force) will slow it down.
- **Work, Energy, and Power:** Energy makes things happen, and power tells us how quickly that energy is used. Think of a light bulb. It uses electrical energy to produce light. The power of the bulb tells you how bright it is, or how much energy it uses per second.
- **Momentum and Impulse:** These concepts are essential for understanding collisions and impacts. Imagine two cars colliding. Momentum is a measure of how much "oomph" a moving object has. Impulse is the change in momentum during a collision. These concepts help us understand how much damage might occur.
- **Gravitation:** The force that keeps us grounded and planets in orbit. It's what makes an apple fall from a tree instead of floating away. The bigger the object, the stronger its gravitational pull. That's why the Earth keeps us on the ground and the sun keeps the planets in orbit.
- **Rotational Motion and Angular Momentum:** Explains the spinning of objects, like wheels and gears. Think about a spinning top. Rotational motion describes how it spins, and angular momentum is a measure of

So, we've seen how physics explains motion, forces, energy, collisions, and gravity. Now, let's see how these principles are used in the devices we use every day.

## Module #3: Physics in Computing Devices

Studying physics specifically in computing devices helps you understand how physical laws apply to components like processors, memory, and circuits, improving your ability to design and troubleshoot hardware systems.

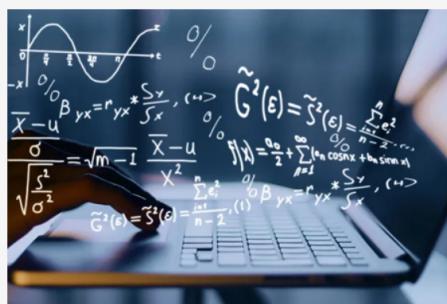


Image Credits: [LinkedIn](#)

Think about your smartphone. It's packed with physics principles that make it work. From the screen you touch to the signals it sends and receives, physics is the foundation.

- **Waves in Technology:** Understanding waves is crucial for communication technologies. Your phone uses **electromagnetic waves** to send and receive calls and data. These waves are like ripples in a pond, but they travel at the speed of light!
- **Sound Waves in Audio Devices:** How speakers and microphones work. When you speak into your phone, the microphone converts your

voice into electrical signals. These signals are then converted back into sound waves by the speaker at the other end of the line, so the other person can hear you.

- **Energy Transfer and Forces in Cooling Systems:** Keeping your devices from overheating. Your phone gets warm when you use it because the **electronic components** inside generate heat. Cooling systems, like heat sinks, use physics principles to transfer this heat away from the components and keep them from overheating.
- **Momentum and Impulse in Data Transmission:** Ensuring data is transmitted correctly. Data is transmitted as tiny packets of information. Physics helps ensure these packets are transmitted quickly and accurately.
- **Gravitational Forces and Satellite Communication:** Connecting you to the world through satellites. Satellites stay in orbit around the Earth because of gravity. They use electromagnetic waves to send and receive signals to and from your phone, allowing you to communicate with people all over the world.
- **Electromagnetic Waves in Wireless Communication:** Enabling wireless connections. Wi-Fi and Bluetooth use electromagnetic waves to connect your phone to the internet and other devices. These waves allow you to browse the web, stream music, and share files without using any wires.

We've seen how physics makes our smartphones work. Now let's shift gears and explore the world of chemistry.

## Module #4: Fundamentals of Chemistry

Chemistry teaches you about the materials and chemical reactions involved in making electronic components. This fundamental knowledge is essential for understanding how devices are built and how they work at the material level.



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Imagine baking a cake. *Chemistry* is what explains why the ingredients change when you mix and bake them. It's the science of matter and its properties.

- **Structure of Atom and Periodic Table Basics:** Understanding the building blocks of matter. All matter is made up of **atoms**, which are tiny particles. The periodic table is a chart that organizes all the known elements (types of atoms) based on their properties.
- **Chemical Bonds and Molecular Interactions:** Explains how atoms combine to form molecules. Atoms can join together to form **molecules**. For example, two hydrogen atoms (H) can combine with one oxygen atom (O) to form a water molecule (H<sub>2</sub>O). These bonds determine the properties of the resulting substance.
- **Acids, Bases, and pH Scale:** Knowing how acidic or basic a substance is. Acids and bases are two types of chemicals with opposite properties. The **pH scale** is used to measure how acidic or basic a substance is. For example, lemon juice is acidic, while baking soda is basic.
- **Chemical Reactions and Energy Changes:** Reactions that release or absorb energy. A chemical reaction is a process that involves the rearrangement of atoms and molecules. Some reactions release energy (**exothermic**), like burning wood. Others absorb energy (**endothermic**), like melting ice.
- **Redox Reactions and Electrochemistry:** Chemical reactions involving electron transfer. **Redox reactions** involve the transfer of electrons between atoms and molecules. These reactions are used in batteries to generate electricity.
- **Catalyst and its reaction mechanism:** Substances that speed up chemical reactions. A **catalyst** is a substance that speeds up a chemical reaction without being consumed in the reaction. For example, enzymes in our bodies act as catalysts to speed up biological reactions.

So, chemistry is about understanding matter, how it's put together, and how it changes. Now let's look at how chemistry is used in computing devices.

## Module #5: Chemistry in Computing Devices

This topic focuses on the chemistry behind computing materials like semiconductors, batteries, and conductive elements, giving you insight into how these materials impact device performance and innovation.





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Think about the battery in your laptop. *Chemistry* is the key to understanding how it stores and releases energy. Chemistry plays a significant role in making computers work.

- **Semiconductor in Computing Hardware:** Materials that control the flow of electricity. **Semiconductors** are materials that can conduct electricity under some conditions but not others. They are used to make transistors, which are the building blocks of computer chips.
- **Battery Chemistry in Laptops and Mobiles:** Powering your devices. Batteries use chemical reactions to store and release energy. Different types of batteries use different chemical reactions, each with its own advantages and disadvantages.
- **Corrosion and Surface Protection in Hardware:** Preventing devices from rusting. **Corrosion** is the process by which metals are degraded by chemical reactions with their environment. Surface protection techniques, like painting or coating, are used to prevent corrosion and protect the metal components in electronic devices.
- **Plastics and Polymers in Device Design:** Materials used to build various components. **Plastics** and **polymers** are large molecules made up of repeating units. They are used to make a wide variety of components in electronic devices, from the casing to the insulation on wires.
- **Etching and Deposition in Microchip Fabrication:** Creating tiny circuits. **Etching** is a process that uses chemicals to remove material from a surface. **Deposition** is a process that adds a thin layer of material to a surface. These techniques are used to create the tiny circuits on microchips.
- **Cleanroom Chemistry: Contaminant Control:** Keeping manufacturing environments pure. Microchips are manufactured in cleanrooms, which are environments that are designed to be free of contaminants. Chemistry is used to control the levels of contaminants in cleanrooms and ensure that microchips are manufactured properly.

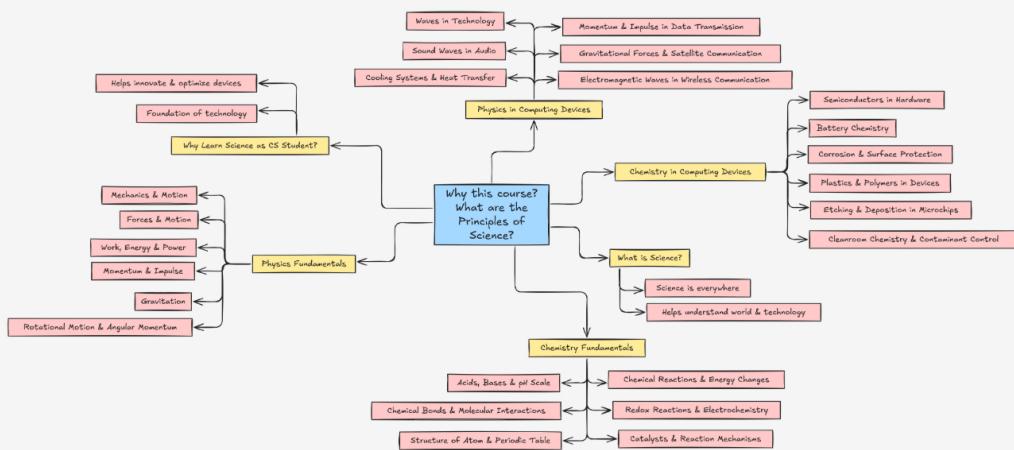
We have now explored how chemistry is essential in computing devices.

## Summary

In this lesson, you've taken a quick tour of how science, including physics and chemistry, is present in our daily lives and technologies. We've looked at why this course is important and explored how scientific principles underpin everything from the devices we use to the food we eat.

What other everyday phenomena can you think of that are governed by scientific principles?

Here is a **mind map** for the lesson to provide a quick recap. Please zoom in to clearly view the content of the mind map.



## Bonus content

This section is optional, and learners who want to explore the topics covered so far can utilize the materials provided below.

- [Physics- Khanacademy](#)
- [Chemistry - Khanacademy](#)

It's Quiz Time

Well-done, You've passed this quiz. Try retaking the quiz to see if you can do better.

Get 60% or more

60m

Best Score  
3/5

[Retake Quiz →](#)

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Heat and Temperature in Daily Life →