

Using The Laws Of Physics In Life Situations

Tatyana Alekseyevna Orlova

Scientific Supervisor, Doctor of Pedagogical Sciences (DSc)
Acting Associate Professor, Tashkent State Pedagogical University
named after Nizami

Muniraxon Ergasheva

1st year Master's student
Tashkent State Pedagogical University named after Nizami

ABSTRACT

Physics plays a key role in explaining the phenomena we encounter daily, from the motion of cars to the operation of our smartphones. Modern technologies largely depend on discoveries in the field of physics. This article highlights not only the importance of physical laws in everyday life but also the role of continuous education in their study and application.

Keywords:

Physics, everyday life, physical laws, continuous education, technology, energy, motion, light, sound.

The laws of physics describe the interaction of objects, the motion of bodies, the transfer of energy, and many other phenomena. Our daily activities, such as using household appliances, driving a car, listening to music, or watching television, are made possible through the application of fundamental physical laws. This article presents how the laws of mechanics, thermodynamics, electromagnetism, optics, and acoustics find practical application in everyday situations. Lifelong learning plays a key role in mastering the laws of physics, enabling their application both in professional activities and in daily life.

1. Laws of Mechanics

The laws of mechanics form the foundation for understanding how objects interact and move under the influence of forces

Newton's First Law (Law of Inertia): A body remains at rest or moves in a straight line at constant speed unless acted upon by an external force [1]. For example, when we are riding in a car and the driver suddenly brakes,

we are pushed forward because our body tends to maintain its previous speed. In everyday life, this principle is also observed when objects on an inclined surface do not move unless acted upon by an external force due to inertia. Understanding this law is made possible through systematic study of mechanics as part of lifelong education. Newton's Second Law is described by the equation.

$$F=ma \quad (1)$$

This law explains why pressing the gas pedal causes a car to accelerate, and braking causes it to decelerate. The greater the mass of the car, the more force is required to accelerate or decelerate it. In the sport of rugby, when players push against each other, it is harder to move a heavier player because more force is needed to overcome their mass.

Newton's Third Law (Action and Reaction Law) is formulated as: "For every action, there is an equal and opposite reaction." For example, when we jump off a boat onto the shore, the

boat is pushed in the opposite direction. This law explains how jet engines work: the expulsion of gases backward creates a force that propels the aircraft forward. In daily life, this law also explains how we move while walking—by pushing against the ground with our feet, we receive an equal and opposite reaction that moves us forward.

Law of Conservation of Momentum: In a closed system, the total momentum remains constant if no external forces act on it. For example, in bowling, the momentum of the ball is transferred to the pins, causing them to fall.

Archimedes' Principle: Any body submerged in a fluid experiences an upward buoyant force equal to the weight of the fluid displaced. For example, metal ships float on water due to the shape of their hulls, which allows them to displace a sufficient volume of water to generate lift. The same principle is used in the

waterproofing of life jackets: the vests provide buoyant force, allowing a person to stay afloat. This principle is especially important in engineering fields, where lifelong learning helps improve ship and hydraulic structure design skills [2].

Frictional Force: Friction helps us stay in place while walking and prevents vehicles from skidding on wet roads. Sports shoes use special soles to improve grip. In cars, braking systems are used to control friction and safely stop the vehicle.

2. Laws of Thermodynamics

The laws of thermodynamics are applied in many areas

The First Law of Thermodynamics (Law of Conservation of Energy) states that energy cannot be created or destroyed; it can only be transformed from one form to another. This law can be expressed by the equation:

$$\Delta U = Q - W \quad (2)$$

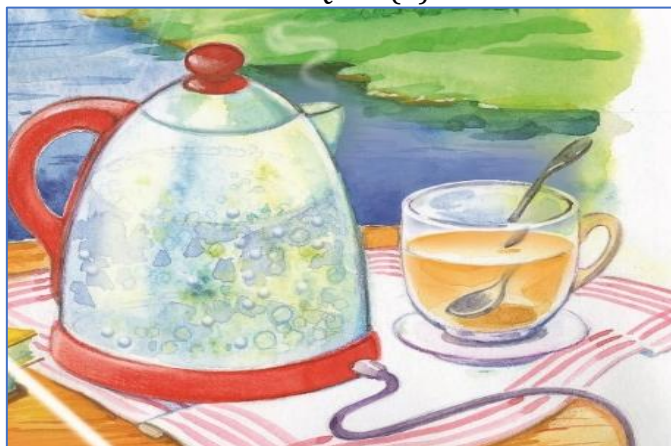


Fig. 1. Example of heat transfer and water evaporation

In everyday situations, when we boil water in a kettle, electrical energy is converted into thermal energy, heating the water. In automobiles, the engine transforms the chemical energy of fuel into mechanical work, which makes the car move (Fig. 1).

The Second Law of Thermodynamics states that heat spontaneously flows only from a hotter body to a colder one, not the other way around. This principle is used in refrigerators: they operate by extracting heat from an enclosed space and releasing it outside, which requires the compressor to perform work. In daily life, this explains why we seek shade on a

hot day—our bodies radiate heat, and the greater the temperature difference, the faster the heat is transferred.

Convection is one method of heat transfer that occurs in liquids and gases. This process is based on the movement of particles, where warm particles rise and cooler particles sink.

Boyle's Law describes the behavior of ideal gases at a constant temperature: the volume of a gas is inversely proportional to its pressure. The formula:

$$PV = \text{const} \quad (3)$$

For example, rubber balloons compress when inflated and will expand if taken to a high altitude where atmospheric pressure is lower. This law is applied in aerosol cans: when the volume decreases, the pressure increases, forcing the contents out.

The Law of Thermal Conductivity (Fourier's Law) defines the rate of heat transfer through a material:

$$Q = -k \frac{\Delta T}{\Delta x} A t \quad (4)$$

This law explains why houses need to be insulated in winter to reduce heat loss [4].

3. Electromagnetism and Electricity

Electromagnetic phenomena are at the core of most modern technologies. For example, Ohm's Law describes the relationship between electric current I , voltage V , and resistance R :

$$V = IR \quad (4)$$

In homes, we use resistors to regulate the current, preventing overloads in the electrical network [5].

Joule-Lenz Law defines the amount of heat produced by conductors carrying current:

$$Q = I^2 R t \quad (5)$$

This law explains why electric heaters and irons become hot. The current passing through a wire with high resistance causes heat to be generated in the electrical heating device. This formula also explains why electric heating devices require wires with a larger cross-sectional area. In everyday life, this concept is applied in electric heaters and incandescent lamps.

4. Optics and Light Phenomena

The laws of optics explain the behavior of light and form the basis of various technologies we use daily.

Law of Reflection of Light: The angle of incidence is equal to the angle of reflection. This principle is used in mirrors, which reflect light at the same angle it strikes the surface. In cars, rear-view mirrors allow drivers to see what is behind them by directing light rays into

their eyes. Mirror optics are also important in devices such as telescopes and laser scanning systems.

Law of Refraction (Snell's Law): This law describes the change in direction of light when it passes from one medium to another with a different density. The equation:

$$n_1 \sin \theta_1 = n_2 \sin \theta_2 \quad (6)$$

For example, a spoon placed in a glass of water appears bent due to the refraction of light. In everyday life, this principle is used in eyeglasses, which correct vision, and in video cameras, where lenses refract light to form an image. Without physics programs, understanding complex optical principles would remain inaccessible to most professionals [7].

Reflection and Refraction in Lenses: Lenses in cameras, microscopes, and telescopes use light refraction to focus images. In eyeglasses, converging lenses correct farsightedness, while diverging lenses help with nearsightedness. A magnifying glass is a simple example of using a converging lens to enlarge the image of an object.

Light Dispersion: This phenomenon explains the splitting of white light into a spectrum of colors when it passes through a prism. Dispersion is observed in a rainbow that appears after rain when sunlight is scattered by water droplets. In scientific laboratories, this phenomenon is used to study the spectrum of light waves and to determine the composition of substances [8].

5. Acoustics and Sound

Acoustic laws explain the nature of sound waves, their propagation, and how they are perceived by humans.

Resonance occurs when the frequency of external influence matches the natural frequency of an object, causing an increase in vibration amplitude. Musical instruments use resonance to amplify sound. In construction, resonance effects are considered to prevent buildings from collapsing during earthquakes.

The Doppler Effect describes the change in sound frequency when the source of the sound and the observer are moving relative to each

other. We hear how the pitch of a police siren changes as it approaches and moves away. This effect is used in radar systems to measure vehicle speed and in medical equipment, such as Doppler ultrasound devices used to monitor blood flow [9,10].

Conclusion

Physics is inseparable from our daily lives. The laws discussed in this article explain many processes—from mechanical motion to the operation of modern gadgets. Understanding how physics works around us allows for a deeper comprehension of the world and the application of this knowledge to improve modern technologies. It is through lifelong education that the laws of physics continue to be actively applied and refined in both professional and everyday life, driving innovation in modern society.

References

1. Ivanov, Sergey Petrovich. *Mechanics in Action*. Moscow, Russia: Nauka, (2008), pp. 45–67.
2. Sannikov, Igor Viktorovich. *Physics and Its Applications in Life*. Saint Petersburg, Russia: Piter, (2009), pp. 101–120.
3. Petrov, Alexey Konstantinovich. *Fundamentals of Thermodynamics*. Yekaterinburg, Russia: UralTech, (2015), pp. 56–78.
4. Khuzhanov, E.B. *Scientific and Methodological Foundations for Studying "Transport Phenomena in Gases" in Molecular Physics*. Physics, Mathematics and Informatics – Tashkent, 2024 – No. 3 – pp. 3–11.
5. Khuzhanov, E.B. *Methodology for Teaching the Topic "Ideal Gas and Its Properties" Based on the Principle of Consistency in Pedagogical Higher Education Institutions*. Lifelong Education. – Tashkent, 2024 – No. 1 – pp. 11–16.
6. Romanov, Dmitry Ivanovich. *Electrical Systems in Everyday Life*. Omsk, Russia: Omsk State University, (2011), pp. 75–92.
7. Vasiliev, Nikolai Andreevich. *Modern Optics*. Saint Petersburg, Russia: St. Petersburg State University Publishing House, (2018), pp. 112–134.
8. Kudryashov, Pavel Mikhailovich. *Optical Technologies in the Modern World*. Tomsk, Russia: Tomsk Polytechnic University, (2016), pp. 44–65.
9. Timofeev, Evgeny Grigoryevich. *Quantum Technologies and Their Applications*. Yekaterinburg, Russia: Ural Federal University, (2019), pp. 60–81.
10. Voronov, Alexey Sergeevich. *Physics in Information Technologies*. Moscow, Russia: TechnoProgress, (2022), pp. 98–115.