

Explore the application of Newtons third law in daily life

Zeqin Lan

Zhangzhou Liren School, Zhangzhou, Fujian, 363000

ABSTRACT

Newtons third law not only reveals the interaction relationship between objects, but also is the basic basis for analyzing the force situation of objects. To learn Newtons third Law is to understand the content of the laws, to clarify the difference between forces and reaction and a pair of equilibrium forces, and to be able to explain the physical phenomena according to Newtons third Law. This paper mainly explores the wide application of Newtons third law in daily life, through the analysis of different life scenarios, reveals the importance of the law for our understanding and interpretation of daily phenomena. From the operation of transportation to the development of sports, from daily home activities to recreation projects, Newtons third law is everywhere. In-depth study of its application can not only help senior three students to better understand physics knowledge, but also cultivate students ability to use physics principles to solve practical problems, improve students scientific literacy, let students have a deeper understanding of the close connection between physics and life, and stimulate students interest and enthusiasm in physics learning.

KEYWORDS

Newtons third law; daily life; action force and reaction force; physics teaching

As one of the important cornerstones of classical mechanics, Newtons third law has a very wide and profound application in our daily life. It points out that, for each force, there is a reaction force of equal size, opposite direction, and acting on the same straight line. From our daily walking, sitting and lying, to the operation of various vehicles, and then to the development of various sports, Newtons third law is quietly playing a role. In three physics learning stage, explore the application of Newtons third law in daily life, not only can help students better understand the abstract laws of physics, also can let students feel the physical knowledge and real life, so as to improve students interest in learning physics and enthusiasm, cultivate students ability to use physical knowledge to solve practical problems. The following are three aspects of Newtons third law in daily life.

1 The application of Newtons third Law in transportation

1.1 Driving principle of the car

Newtons third law plays a key role in the cars ability to drive on the road. When the engine of the car drives the wheel to rotate, the wheels will give the ground a backward friction, according to Newtons third law, the ground will give the wheels a reaction force of equal size, forward direction, this reaction force is the power to push the car forward. Without the forward reaction force of the wheels on the ground, the car cannot move forward even if the engine works and the wheels rotate.

Newtons third law also works as the car accelerates, slows and turns. For example, when the car accelerates, the power output by the engine is transmitted to the wheel through the transmission system, which increases the backward friction of the wheel to the ground and the ground increases the direction of the wheel, and the friction between the wheel and the ground becomes forward, and the reaction force of the ground to the wheel becomes backward, so that the car slows down and stops.

1.2 The mystery of bicycle cycling

When riding a bicycle, people push the pedal so the chain drives the rear wheel, and the rear wheel creates a backward friction on the ground. According to Newtons third law, the ground gives the rear wheel an forward force in equal direction, which pushes the bike forward. At the same time, the front wheel in the process of rotation will also be affected by the ground friction, but the direction of the front wheel friction on the opposite and the rear wheel, is backward, it has the effect of bicycle, but it is the driving force of the rear wheel and the front wheel resistance and other force, makes the bicycle can keep balance and stability. In addition, in the braking process of the bicycle, the brake device causes friction between the wheel and the brake pad, the rotation of the wheel is hindered, the direction of the friction of the wheel to the ground will change, and the direction of the reaction of the ground to the wheel will also change, so that the bicycle slows down until it stops.

1.3 The flight principle of the aircraft

Aircraft can fly in the air, and Newtons third law is one of its important theoretical foundations. The planes engine produces high-pressure gases by burning fuel and pumping them back at high speed. According to Newtons third law, when the gas shoots back, it will give the plane an upward reaction force of equal size and forward direction, which is the thrust of the plane flying forward. Moreover, the planes wings produce lift during flight, which is an indirect reflection of Newtons third law. The upper surface of the wing is curved and the lower surface is flat. When the plane flies forward, the air flows through the wing. Because the velocity of the air on the upper surface of the wing is fast and the lower surface is slow, according to Bernoulli principle, the pressure on the upper surface of the wing is less than that of the lower surface, thus generating upward lift. In the flight of an aircraft, the force of air on the wing and the reaction force of the wing on the air are also a pair of interaction forces, which jointly maintain the flight attitude and balance of the aircraft.

1.4 Navigation principle of the ship

Newtons third Law also plays an important role when ships sail on the water. When the ships propeller rotates, the propeller pushes the water backward, giving the water a backward force. According to Newtons third law, water gives the propeller an equal size, forward reaction force that pushes the ship forward. At the same time, the ship will also be affected by the resistance of water and wind and other forces in the navigation process, the rudder of the ship can change the direction of the action force of the current on the rudder, so as to produce a reaction force to make the ship turn, and realize the steering of the ship. In addition, when the ship stops at the dock, the crew tied the cable to the dock, the ship has a pull on the cable, the cable has an equal size on the ship in the opposite direction, so that the ship to stably dock on the dock.

2 The application of Newtons Third Law in sports

2.1 Mechanistic principles in running and jumping

When running, the athletes feet push back, giving the ground a backward force. According to Newtons third law, the ground gives the athletes foot an equal sized, forward reaction force, that pushes the athlete forward. Moreover, during running, the stride length, frequency and strength of the athletes will affect the reaction force on the ground, thus affecting the speed and efficiency of running. In jumping sports, such as long jump, high jump and pole vault, the athletes will kick the ground to give the ground a downward force, the ground will give the athletes an equal size, directional upward reaction force, this reaction force makes the athletes to get the initial speed and kinetic energy, so as to jump off the ground. For example, in the long jump, the athlete obtains a certain speed by running up, and pushes off the ground during the jump, so that the ground gives the athlete as much reaction as possible, so that the athlete can jump farther.

2.2 Mechanics mystery in ball games

The application of Newtons third law can also be seen everywhere in various ball games. For example, in football, when a player plays, the foot exerts a force on the ball to make the ball fly forward, while giving the foot an equal size reaction force in the opposite direction, which hurts the players feet. Moreover, during the flight process, the ball will interact with the air, and the force of the air on the ball and the reaction force of the ball on the air will also affect the flight trajectory and speed of the ball. In basketball, players shooting, hand on basketball exert an upward force, basketball will give the hand a equal size, the direction of the downward reaction, at the same time the basketball rebound on the rebound or basket, basketball on the rebound or basket force and rebound or basket of basketball reaction will make basketball change the direction of movement. In table tennis, the force of the racket on the ball, the reaction force of the ball and the rotation, speed and flight direction of the ball.

2.3 Mechanical analysis in swimming and rowing

While swimming, the swimmers arms and legs paddle backwards to give the water a backward force. According to Newtons Third Law, water gives a swimmers arm and leg an equal-direction reaction force, which pushes the swimmer forward. Moreover, the stroke action and strength of the swimmer are different, and the reaction force and direction of the water to the swimmer will be different, which affects the speed and direction of swimming. In the rowing movement, the blade strokes backward to give the water a backward force, while the water gives the blade a reaction force of equal size and forward direction. This reaction force is transmitted to the ship through the handle of the paddle to push the ship forward. At the same time, the frequency, intensity and Angle of the rower will affect the magnitude and direction of the

reaction force to the ship, thus affecting the navigation speed and direction of the ship.

2.4 Mechanistic embodiment in gymnastics and martial arts

Newtons Third Law also has important applications in sports such as gymnastics and martial arts. For example, in gymnastics events such as vault, uneven bars and rings, athletes need to complete various movements and maintain balance through the interaction and reaction forces between the body and the apparatus. In martial arts techniques such as boxing, legs and wrestling, athletes can exert interaction and reaction forces with their opponent or object when punching, kicking and falling. When the athlete makes a fist, the fist applies a force to the target object, and the target object gives the fist a reaction force of equal size and opposite direction. This reaction force will make the athlete feel pain and stress on the fist, and also affect the punch effect and action stability of the athlete. In the fall, the opponent loses his balance and falls through the rotation and force of the body. In this process, the interaction force and reaction force between the athlete and the opponent will also affect the effect and safety of the fall.

3 The application of Newtons third Law in daily life home

3.1 Mechanical principles in sitting and standing and walking

As we sit in a chair, our bodies apply a downward gravity to the chair, and by Newtons Third Law, the chair gives our bodies an equal size, directional upward support force that balances the gravity of our bodies, allowing us to sit comfortably in the chair. If the support of the chair is less than the gravity of our body, we feel uncomfortable or unstable; if the support is greater than the gravity of our body, we feel the chair is too hard or has upward elasticity. When walking, our feet exert a backward friction force on the ground, and the ground will give our feet an equal size, directional forward reaction force that pushes us forward. Whats more, as we walk, the center of gravity of the body is constantly changing, and the friction and reaction between the feet and the ground are constantly adjusted to maintain the balance and stability of the body.

3.2 The mystery of mechanics in opening and closing doors

When opening and closing the door, we will apply a force on the door to rotate the door around the door axis. When we push the door, our hand exerts an outward force on the door, and the door gives our hand an equal size, inward reaction force, which makes our hand feel the resistance and pressure of the door. At the same time, in the process of rotation, the door shaft will produce a friction force on the door, which is opposite to the rotation direction of the door, playing a role in hindering the rotation of the door. According to Newtons third law, the door will also give the door axis an equal size, opposite direction of friction, this friction will make the door shaft wear and fatigue. When closing the door, our hand applies an inward force to the door, and the door gives our hand an outward reaction force in the same size and direction. This reaction force will make our hand feel the resistance and pressure of the door, but also affect the speed and strength of the door.

3.3 Use the mechanical analysis in the tools

In our daily life, we often use various tools, such as hammers, scissors, pliers, etc. The use of these tools involves Newtons third law. For example, when we use a hammer to nail a nail, our hand exerts a downward force on the hammer, the hammer will give the nail a downward impact, making the nail into the object. At the same time, the nail will give the hammer an equal sized, upward reaction force, which will make our hands feel the rebound and vibration of the hammer. When using scissors to cut things, our hands exert an inward force on the scissors, and the blade of the scissors applies a shear force on the object, so that the object is cut off. At the same time, the object will give the blade of the scissors an equal size, the outward direction of the reaction force, which will make our hands feel the resistance and pressure of the scissors. When using the clamp, our hand applies an inward force on the pliers, and the jaw of the pliers applies a clamp force on the object, so that the object is clamped. At the same time, the object will give the jaw of the pliers an equal size reaction force, outward direction, this reaction force will make our hands feel the resistance and pressure of the pliers.

3.4 Mechanistic embodiment in household cleaning

In home cleaning, Newtons third Law also has a widely used. For example, when we use a mop to mop the floor, our hands apply a forward force on the mop, and the mop applies a forward friction on the dirt and stains on the ground, making the dirt and stains be dragged away. At the same time, the ground will give the mop an equal reaction force in the

same direction, which will make our hands feel the resistance and pressure of the mop, and we need to constantly push the mop to continue to mop the floor. When cleaning the ground with a vacuum cleaner, the motor of the vacuum cleaner generates a negative pressure by rotating the blade, inhaling the air and dust into the vacuum cleaner. According to Newton's third law, air and dust will give the blade of the vacuum cleaner the opposite direction of the reaction force, which will make the blade of the vacuum cleaner wear and fatigue, and the blade needs to be replaced regularly. When using the rag to wipe the table, our hands apply a forward force on the cloth, the rag will apply a forward friction on the dust and stains on the table, so that the dust and stains are wiped off. At the same time, the table will give the cloth an equal size, the direction of the reverse force, the reaction force will make our hands feel the resistance and pressure of the cloth, we need to constantly push the rag to continue to wipe the desk.

4 Summary

Newton's third law is widely used in daily life, covering transportation, sports, home life and other aspects. Through the exploration of these applications, we can further understand the connotation and essence of Newton's Third Law, and we can also feel the close connection between physical knowledge and real life more truly. For senior three students, this kind of inquiry not only helps to deepen the understanding and mastery of physical knowledge, but also can cultivate students' ability to observe life, analyze problems and solve problems, and improve students' scientific literacy and innovative thinking. In the future physics teaching, teachers should pay more attention to guiding students to pay attention to the application of physics knowledge in daily life, so that students can feel the charm of physics in real life, stimulate students' interest and enthusiasm in learning physics, so as to better cultivate students' core literacy of physics.

References

- [1] Husna N , Sahyar. The Analysis of Magnetic Electricity Physics Teaching Materials Based on Environment in Senior High School[J]. IOP Conference Series: Earth and Environmental Science,2024,1425(1):12006.
- [2] Erukhimova T. 2024 David Halliday and Robert Resnick Award for Excellence in Undergraduate Physics Teaching Lecture: It's not business, it's personal. Teaching large classes, one student at a time[J]. American Journal of Physics,2024,92(12):910-917.
- [3] Zhenghan J. A Brief Discussion on the Problems and Reform Suggestions of Physics Experiment Teaching in Colleges and Universities[J]. Education Reform and Development,2024.
- [4] Henan W ,Yingshuang L ,Junru J , et al. Research on the Application of New Media Technology in College Physics Teaching[J]. Education Reform and Development,2024,6(10):254-259.
- [5] Yin S , Wei L , Xiangyu S , et al. Reform and Practice of University Physics Experimental Teaching Based on OBE Concept[J]. Journal of Contemporary Educational Research,2024,8(10):287-293.
- [6] Chen Yunyi. Attach importance to the teaching of "Newton's Third Law" to promote the implementation of the core literacy of physics [J]. Middle school physics teaching reference, 2020,49(7): 27-30.
- [7] Dong Xuan Zhu. On the interpretation and application of Newton's Third Law [J]. Mathematics, Physics and Chemistry for middle school students (teaching and learning), 20 20(12): 88.
- [8] Han Xiaofan. On the understanding and Application of Newton's Third Law [J]. Scientific Consulting (Science and Technology · Management), 20 20(1): 102-103.