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Isaac Newton is the one who formulated a great definition of inertia. Also known as Newton's first law of motion or law of inertia, Newton restated Galileo's idea. The spinning top in the video will keep spinning if there was no friction. Below is what Newton said in simple terms: If an object is already moving, it will keep moving in a straight line at constant speed unless a force stops it. If an object is at rest, it will remain at rest unless a force moves it. In other words, Newton is saying that an object will keep its uniform motion if no force tries to stop it and it will not start moving unless some external force makes it move.This was an important discovery because Aristotle believed that if an object keeps moving, then some force is being applied to it.Aristotle did not say that an object can start moving on its own. He believed that force must be applied to get something to move.However, he also believed that as soon as this force is removed, the object will seek its natural state that is rest.This view of motion was accepted for about 2000 years until Galileo challenged it with an experiment. Galileo's Experiments on Inertia Galileo used the two planes you see below. Then, he rolled a ball down the incline. He noticed that the ball will continue to move until it reaches almost the same height on the other side. The less friction there is on the plane, or the smoother the plane is, the higher the ball will move to reach nearly the same height. This is interesting because when the ball reaches the bottom of the incline, there is no more gravity to keep the ball moving.The ball thus kept its natural state of motion. The second experiment is similar to the first one except that the other plane is longer and the plane is inclined at a smaller angle. The ball still nearly reached the same height, but this time traveled a longer distance.What if the other plane was completely horizontal? Again, in the absence of external forces such as friction or gravity, the ball will keep rolling with a constant speed. The ball will not come to rest as Aristotle said. Examples of Inertia in Real Life A great example of inertia is when somebody is not wearing a seat belt while driving. The car collides with a tree and the person flies. The body was just trying to keep the same speed before impact. Now you know why you should always put your seat belt. Inertia could kill you!A soccer ball keeps moving after it has been kicked.A sofa is not moving because no one is pushing it with a force.A car continues to move on an icy road even after you applied the break.A shopping cart is not moving because no one is pushing it. In the absence of forces or friction, an object already in motion will keep moving indefinitely.An object at rest remains at rest unless a force is applied to the object. If you are taking a physics class, your teacher may use an air table to demonstrate inertia to you and your classmates. An air table has many tiny holes where blasts of air are coming out. It does not reduce friction completely, but reduces it tremendously. Newton's second law of motion In physics, the term “inertia” is the tendency for an object to stay in the same state of motion (including no motion) unless something external changes it. This is commonly stated as: An object in motion tends to stay in motion unless stopped or changed by a force, and An object at rest tends to stay at rest unless changed (moved) by a force. In this context it is not an object that has inertia, but a person’s attention, thinking, or movement. Autistic people tend to stay on one task (or no task at all) unless stopped (or started) by a major outside force or tremendous act of will. It applies both to getting started on a task or focus as well as stopping once engaged in something. Autistic inertia may be related to other conditions that are part of autism or often accompany it, such as anxiety, executive dysfunction or catatonia. Some people experiencing inertia-type problems may prefer one of these terms to describe it. Inertia can affect very small movements, as well as broad areas. Someone with inertia may get “stuck” halfway through a movement such as pouring, causing them to spill. They also may get stuck in repetitive movements or thoughts. Inertia can be hyperfocus, such as a major topic of interest, or fixation on the fine details in the texture of an object. Inertia can include difficulties with: “getting going”, starting a task, getting one’s body in motion,changing activity and/or focus,adjusting movements to rapidly changing surroundings,performing a task without full understanding of what needs to be done and why,stopping attention on desired focus (i.e. attention itself is “in motion”), starting and stopping movements,changing subject of focus,changing tasks,doing something despite knowing how and wanting to. Inertia can be one of the most disabling characteristics for an otherwise very able autistic person. Despite being intelligent and motivated, inertia can make it difficult to impossible to get anything done. It can even be the primary barrier to independent living. On the other hand, inertia can have benefits. The ability to hyper-focus allows one to work for extended periods of time – often work through the night and ongoing for several days. Topic-oriented inertia can lead to a great depth of understanding of a particular subject. When inertia is focused in the desired direction, it can be nearly unstoppable. If the disabling aspects can be accommodated or overcome, inertia can be a great asset. I am working on gathering evidence that this is a real problem for autistic people. In the meantime, if this affects you or someone you know, try to be understanding. Blaming the autistic person will only make it even harder to do things. Acting as if the trouble is to do with voluntary control of movement usually works better than strategies which are supposed to motivate. Seeing the difficulties as disability related rather than a character flaw allows for a different and gentler and more supportive approach. Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. Explore the world of mathematics with our comprehensive resources. From basic mathematics to pre-algebra, geometry, statistics, and algebra, our website is designed to guide learners of all levels. Whether you're seeking a basic introduction or aiming for advanced understanding, our carefully curated content will help you master essential mathematical concepts and operations.Instructions are carefully sequenced to follow a logical order. Concepts are presented in clear, simple terms. Furthermore, each time a concept is introduced, an example or two that illustrate the concept will be provided. Factor the quadratic: $x^2 + 5x + 6 = (x + ?\ (x + 2)$ Learning math can be a daunting task when you do not have the right tools or the right materials, especially if you grew up believing that math is hard and that you will never understand it. The very first lesson I can teach is to get rid of any negative thinking that either your teachers, friends, or even a caring relative helped you build over the years and start believing in yourself. Math is like a pyramid. Every new skill requires an understanding of prerequisites to do well. For instance, before, one can learn how to add numbers with 3 digits, such as 256 + 128, it is important to know how to add numbers with just one digit or two such as 1 + 5 or 24 + 50. By the same token, before learning pre-algebra, a good understanding of basic mathematics is important. And before learning algebra, a solid understanding of pre-algebra is a must. My goal and also my desire is to teach you math, but above all I want to teach you to be free and to be your best teacher. You will notice that when I teach a lesson, I explain a lot. I do this to give you a deep understanding of basic mathematics and algebra. Therefore, if you are looking for a quick shortcut, my website is not for you because it is designed to challenge you and teach you to a great extent. In the end, your basic mathematics knowledge will be strong and you will be very much prepared to handle algebra or any other higher level math courses! The following tips are just my advice; They are not absolute. Choose those that will best fit you.Plan a regular time to studyChoose a quiet place where you will not be distracted.When you study, try to study an entire lesson, or an entire chapter. When you finish a whole lesson or a whole chapter, it may leave you with a great feeling of accomplishmentWhen you feel sleepy, take a short break; you will not learn much, if anything if you are not alert.You are now ready to experience the most rewarding endeavor right here in this website. Inertia is a concept in Physics that is defined as the tendency of an object to resist a change in its motion. In other words, Inertia acts as a resistance to any change in the velocity of any physical object. What is Inertia? Inertia is defined as the force which keeps stationary objects to stay still (remain at rest) or moving objects in motion at the same speed and in the same direction unless it is stopped by an external force. It can also be defined as the resistance of an object to resist change by remaining in its state of rest or in motion. Law of Inertia and Newton’s First Law of Motion The concept of inertia lies in Newton’s first law of motion, which is also termed as the “Law of Inertia.” According to this law- An object will continue to be in the state of rest or in a state of motion unless an external force acts on it.” Let’s look at an example to understand the concept of inertia in a better way. Let’s say a person is pedaling a bike and suddenly hits the front brakes. In this case, his/her body continues to move, and they fly over the handlebars. Here, the force applied on the front brakes acts as an external force. Types of Inertia There are three types of Inertia namely: A. Inertia of Rest Inertia of Rest can be defined as the inability of an object or body to change its state of rest by itself. For example, when a car is suddenly started, the passengers in it fall backward. Ever wondered why that happens? Well, the lower part, which is in contact with the car, comes in motion, whereas the upper part remains in rest due to inertia of rest. B. Inertia of Motion Inertia of motion can be defined as the inability of an object or body to change its state of motion by itself. For example, if we reverse the first example, we will understand the inertia of motion. Let’s say that you are in a moving car, and when it suddenly stops, all the passengers fall forward. That’s because the lower part of the body, which is in contact with the car is at rest, whereas the upper part tends to remain in motion due to inertia of motion. C. Inertia of Direction Inertia of direction can be defined as the inability of any physical object to change its direction of motion by itself. For example, when a car moves along a round curve, the passengers sitting inside are thrown outwards. It happens due to the inertia of direction in order to maintain the direction of motion. Examples of Inertia in Daily Life (i). Satellites A satellite is an object in space that circles or moves around a larger object. Do you know how it keeps moving around the bigger object without getting stopped? It’s due to the inertia of motion, which keeps it moving in a circular motion. (ii). Falling of fruits and leaves Have you ever wondered why the fruits or leaves fall down when the branches of a tree are shaken? It’s due to the inertia of rest. Before shaking, the branch is at rest, but when the tree is shaken, the branch starts moving, whereas the fruits and the leaves remain in their initial state of rest. Thus, they fall down. (iii). Dusting a carpet Do you know what makes the dust particles fall off the carpet? It’s all due to the magic of inertia. When you beat the carpet with a stick, the carpet starts moving but the dust particles in it remain in their initial state of inertia of rest. The repeated beating of the carpet causes the dust particles to drop, thus, giving you a clean carpet. (iv). Falling forward while getting down from a moving bus Have you ever tried getting down from a moving bus? Well, if you have then you must know the result, but did you ever wonder why you fall forward and not backward? This is again due to the inertia of motion. When a passenger gets down from a moving bus, their upper body is still in motion, and when it comes in contact with the ground which is at rest, their body topples forward due to the inertia of motion. (v). The continued swirling of milk after the stirring is stopped Ever noticed the continued swirling of milk even after you have stopped stirring a spoonful of sugar or cocoa in your milk? Magic, isn’t it? It would not be wrong to say that it is due to the magic of inertia of motion, which keeps the milk moving inside the glass. (vi). Running of an athlete before taking a long jump You must have seen athletes running before taking a long jump but have you ever pondered on why they do so? Well, they do it to bring themselves in the inertia of motion from the inertia of rest. It makes it easier for them to take a long jump. Isn’t it fascinating? (vii). An object thrown outside a moving train Have you ever noticed why an object, when thrown outside a moving train, moves in the opposite direction and with an equal velocity to that of the train? Well, it’s again due to the concept of the inertia of rest. (viii). Driving along a curved road While driving along a curved road, you must have felt like you are flying out of the car. It’s because of the inertia of direction, which tends to keep your motion in a straight line. (ix). Falling of a coin into the glass You must have experienced this trick of putting a coin into the glass without actually touching it. It happens because when you suddenly pull the cardboard on which the coin is placed, it falls into the glass as it tends to remain in the state of rest. (x). Seatbelts Well, car seatbelts are there to keep you safe during an accident. It acts as an external force to keep your body intact when your vehicle collides with any external object. In this case, the upper part of your body, which is in the state of motion, tries to move forward due to the inertia of motion, but the seatbelt comes into your rescue and cancels the effect of inertia. Inertia is a fundamental concept in physics that describes the resistance of an object to any change in its state of motion. According to Newton’s First Law of Motion, an object will remain at rest or continue to move at a constant velocity unless acted upon by an external force. This property of matter means that a stationary object will not start moving on its own, and a moving object will not stop or change direction without an external influence. Inertia depends solely on the mass of the object: the greater the mass, the greater the inertia. This principle explains why heavier objects are more difficult to accelerate or decelerate compared to lighter ones. Inertia is the tendency of an object to resist changes in its motion. According to Newton’s First Law of Motion, an object at rest stays at rest, and an object in motion continues moving at a constant speed in a straight line unless acted upon by an external force. The greater the object’s mass, the greater its inertia. The formula for inertia is often associated with the moment of inertia (I), which measures an object’s resistance to rotational motion around an axis. The moment of inertia depends on the object’s mass distribution relative to the axis of rotation. The general formula is: $I=\sum m_i r_i^2$ where: I is the moment of inertia. m_i is the mass of each particle in the object. r_i is the distance of each particle from the axis of rotation. The unit of inertia, particularly the moment of inertia, is expressed in terms of mass and distance squared. In the International System of Units (SI), the unit for moment of inertia is: SI Unit = kilogram metre squared ($kg \cdot m^2$) In the imperial or US customary units, the unit for moment of inertia is: pound-foot-second squared ($lbf \cdot ft \cdot s^2$) These units reflect the dependence of the moment of inertia on both the mass of the object and the square of the distance from the axis of rotation. Car Braking: When a car suddenly stops, passengers lurch forward due to their bodies’ inertia, which resists the change from moving to stopping. Tablecloth Trick: Quickly pulling a tablecloth from under dishes without moving them demonstrates inertia. The dishes remain in place because they resist the sudden change in motion. Space Travel: In the vacuum of space, a spacecraft will continue moving in a straight line at a constant speed until acted upon by an external force, such as thrusters or gravitational pull. Books on a Table: A stack of books remains at rest on a table until a force, like a push, causes them to move. The books resist this change in motion due to their inertia. Sports: A soccer ball will remain stationary on the field until kicked. Once in motion, it will continue moving until friction with the ground and air resistance slows it down. Train Movement: When a train starts moving, passengers feel pushed back into their seats due to their bodies’ inertia resisting the acceleration. Riding a Bicycle: When you suddenly stop pedaling, the bicycle continues to move forward due to inertia until friction and other forces slow it down. Swinging a Hammer: When you swing a hammer to hit a nail, the hammerhead continues its motion due to inertia, driving the nail into the wood even after you stop applying force. Bumper Cars: In an amusement park, when bumper cars collide, the passengers continue moving in the direction they were going due to inertia, causing them to jolt forward or sideways upon impact. Earth’s Rotation: The Earth keeps rotating on its axis due to inertia. Without external forces like gravitational pulls from other celestial bodies, it would continue spinning indefinitely at a constant speed. Turning a Car: When a car makes a sharp turn, passengers feel pushed outward. This happens because their bodies resist the change in direction due to inertia. Pendulum Swing: A pendulum continues to swing back and forth due to inertia, maintaining its motion until friction gradually slows it down. Tightrope Walker: A tightrope walker uses a long pole to balance. The inertia of the pole helps stabilize their movements, making it easier to maintain balance. Bouncing Ball: When you drop a ball, it bounces back up due to inertia. Each bounce gets smaller as energy is lost, but the initial motion is due to the ball’s resistance to changing its state. Earth’s Orbit: The Earth continues to orbit the Sun due to inertia, maintaining a nearly constant speed and path unless acted upon by another force, like gravity from other celestial bodies. Roller Coaster: As a roller coaster goes over a hill, passengers feel lifted from their seats due to inertia. Their bodies continue to move upwards while the coaster starts descending. Sliding Hockey Puck: A hockey puck glides across the ice due to inertia. It continues moving in a straight line until friction or an obstacle stops it. Hanging Objects: An object hanging from a string remains stationary due to inertia until an external force, like wind or a push, sets it in motion. Kickstarting a Scooter: When you kickstart a scooter, the scooter resists the initial push due to inertia until the force is strong enough to overcome this resistance and start the engine. Basketball Free Throw: When shooting a basketball, the ball travels in a straight line towards the hoop due to inertia. It only changes direction if acted upon by external forces like gravity or air resistance. Inertia of Rest Definition: The tendency of an object to remain at rest unless acted upon by an external force. Examples: Book on a Table: A book remains stationary on a table until someone applies a force to move it. Ball on the Ground: A soccer ball will stay in place on the ground until kicked. Sleeping Person: A person sleeping will remain in that position until woken up by an external force, like an alarm clock or someone shaking them. Inertia of Motion Definition: The tendency of an object to continue moving in a straight line at a constant speed unless acted upon by an external force. Examples: Car Coasting: A car moving on a highway at a constant speed continues to move forward even when the driver takes their foot off the accelerator until friction and air resistance gradually slow it down. Rolling Ball: A ball rolling on the ground keeps moving in the same direction until it is stopped by friction or an obstacle. Runner: A sprinter continues moving forward after crossing the finish line due to inertia until they slow down gradually by applying force with their muscles. Inertia of Direction Definition: The tendency of an object to resist a change in its direction of motion. Examples: Turning a Car: When a car makes a sharp turn, passengers feel pushed outward because their bodies resist the change in direction due to inertia. Swinging a Hammer: When you swing a hammer to hit a nail, the hammerhead continues its forward motion due to inertia, making it easier to drive the nail into the wood. Cyclist: When a cyclist makes a sudden turn, they have to lean into the turn to counteract the inertia that wants to keep them moving in a straight line. Stability in Structures: Example: Buildings and bridges are designed with inertia in mind to ensure they remain stable and resist sudden movements caused by wind or earthquakes. Predictable Motion: Example: In sports, understanding inertia helps athletes predict the motion of balls and other equipment, improving accuracy and performance. Safety Mechanisms: Example: Seat belts in cars take advantage of inertia by restraining passengers and preventing them from continuing to move forward in the event of a sudden stop. Efficient Motion: Example: In outer space, spacecrafts use inertia to travel long distances without continuous propulsion, saving fuel and resources. Mechanical Systems: Example: Flywheels in engines and machinery store rotational energy due to inertia, providing a smooth and continuous energy supply. Difficulty in Stopping: Example: Large vehicles like trucks have significant inertia, making them harder to stop quickly and increasing the risk of accidents. Resistance to Change: Example: In industrial settings, machines with high inertia take longer to start and stop, reducing efficiency and responsiveness. Safety Hazards: Example: In sports like football, players can suffer injuries due to the inertia of their own bodies or equipment, leading to high-impact collisions. Control Challenges: Example: Pilots and drivers must account for inertia when maneuvering vehicles, requiring skill and training to manage effectively. Energy Loss: Example: In roller coasters and amusement park rides, overcoming inertia requires significant energy input, resulting in higher operational costs. Mass is directly proportional to inertia; objects with more mass have greater inertia and are harder to accelerate or decelerate. When a car suddenly stops, passengers lurch forward due to their body’s inertia, which resists the change in motion. Inertia is an object’s resistance to changes in motion, while momentum is the product of an object’s mass and velocity, describing its motion. Newton’s First Law, or the law of inertia, states that an object will remain at rest or in uniform motion unless acted upon by an external force. Seat belts restrain passengers, preventing them from continuing forward motion due to inertia when a car abruptly stops. An object with no net external force will maintain its current state of rest or constant velocity due to inertia. Inertia depends on mass distribution and the object’s shape in rotational motion, but for linear motion, only mass matters. Inertia affects how athletes start, stop, and change direction, influencing their performance and the design of sports equipment. In space, where there’s minimal external force, objects continue moving indefinitely in a straight line due to inertia. A heavy object has more inertia, requiring more force and time to change its motion compared to a lighter object. Add Tone Friendly Formal Casual Instructive Professional Empathetic Humorous Serious Optimistic Neutral 10 Examples of Public speaking 20 Examples of Gas lighting Choose the correct answer The resistance of an object to change its temperature The tendency of an object to remain at rest or in uniform motion The ability of an object to conduct electricity The force required to move an object Which physical quantity is directly related to inertia? Choose the correct answer What is an example of inertia in everyday life? Choose the correct answer A car accelerating on a highway A book lying on a table remaining stationary A bicycle going downhill with increasing speed A ball being thrown into the air How does inertia affect a moving object in space? Choose the correct answer The object will stop moving The object will keep moving in the same direction at a constant speed The object will accelerate The object will change direction Why do passengers lurch forward when a car suddenly stops? Choose the correct answer Which of the following statements is true about inertia? Choose the correct answer Inertia only applies to objects at rest Inertia only applies to objects in motion Inertia applies to both objects at rest and in motion Inertia is not related to mass What is the effect of increasing mass on the inertia of an object? Choose the correct answer It has no effect on inertia It changes the direction of inertia Which of the following is an example of inertia in motion? Choose the correct answer A ball rolling on a flat surface coming to a stop A person pushing a stationary car A spacecraft moving in outer space without engine power A leaf falling to the ground What does Newton's first law of motion state about inertia? Choose the correct answer Objects at rest will always move Objects in motion will eventually stop An object will remain at rest or in uniform motion unless acted upon by an external force Force is proportional to acceleration How is inertia related to Newton's second law of motion? Choose the correct answer Inertia is the same as acceleration Inertia is not related to Newton's second law Inertia provides resistance that affects acceleration Inertia determines the force needed to accelerate Inertia is a concept in Physics that is defined as the tendency of an object to resist a change in its motion. In other words, Inertia acts as a resistance to any change in the velocity of any physical object. What is Inertia? Inertia is defined as the force which keeps stationary objects to stay still (remain at rest) or moving objects in motion at the same speed and in the same direction unless it is stopped by an external force. It can also be defined as the resistance of an object to resist change by remaining in its state of rest or in motion. Law of Inertia and Newton’s First Law of Motion The concept of inertia lies in Newton’s first law of motion, which is also termed as the “Law of Inertia.” According to this law- An object will continue to be in the state of rest or in a state of motion unless an external force acts on it.” Let’s look at an example to understand the concept of inertia in a better way. Let’s say a person is pedaling a bike and suddenly hits the front brakes. In this case, his/her body continues to move, and they fly over the handlebars. Here, the force applied on the front brakes acts as an external force. Types of Inertia There are three types of Inertia namely: A. Inertia of Rest Inertia of Rest can be defined as the inability of an object or body to change its state of rest by itself. For example, when a car is suddenly started, the passengers in it fall backward. Ever wondered why that happens? 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Well, they do it to bring themselves in the inertia of motion from the inertia of rest. It makes it easier for them to take a long jump. Isn’t it fascinating? (vii). An object thrown outside a moving train Have you ever noticed why an object, when thrown outside a moving train, moves in the opposite direction and with an equal velocity to that of the train? Well, it’s again due to the concept of the inertia of rest. (viii). Driving along a curved road While driving along a curved road, you must have felt like you are flying out of the car. It’s because of the inertia of direction, which tends to keep your motion in a straight line. (ix). Falling of a coin into the glass You must have experienced this trick of putting a coin into the glass without actually touching it. It happens because when you suddenly pull the cardboard on which the coin is placed, it falls into the glass as it tends to remain in the state of rest. (x). Seatbelts Well, car seatbelts are there to keep you safe during an accident. It acts as an external force to keep your body intact when your vehicle collides with any external object. In this case, the upper part of your body, which is in the state of motion, tries to move forward due to the inertia of motion, but the seatbelt comes into your rescue and cancels the effect of inertia. Last Updated on May 18, 2025 by Muhamed Elmesery The principle of inertia is one of the fundamental principles in classical physics that are still used today to describe the motion of objects and how they are affected by the applied forces on them. Inertia comes from the Latin word, iners, meaning idle, sluggish. In this article, we will discuss inertia, its concept and will focus on the examples of law of inertia in everyday life. Inertia is a passive property and does not enable a body to do anything except oppose such active agents as forces and torques. On the surface of the Earth, inertia is often masked by gravity and the effects of friction and air resistance, both of which tend to decrease the speed of moving objects (commonly to the point of rest). This misled the philosopher Aristotle to believe that objects would move only as long as force was applied to them. try The principle of inertia with best physics virtual lab now What is Inertia of Motion? From Newton’s first law of motion, it is clear that a body has a tendency to remain at rest or in uniform motion. This property of the body is known as inertia. Thus inertia is that property of a body due to which it opposes or resists any change in its state of rest or uniform motion. The term inertia may be referred to as “the amount of resistance of an object to a change in velocity” or “resistance to change in motion.” This includes changes in the speed of the object or the direction of motion. One aspect of this property is the tendency of things to continue to move in a straight line at a constant speed, when no forces are affecting them. There are Two Numerical Measures of the Inertia of a Body: 1- The Body Mass: which governs its resistance to the action of a force. Mass is the measure of inertia of the body; i.e., greater the mass, greater will be inertia. Thus inertia of a body depends upon its mass. That is, massive objects possessed more inertia than lighter ones. E.g., Mass of a stone is more than a mass of a rubber ball for the same size. Therefore, the inertia of the stone is more than that of a rubber ball. Notes: The inertial mass is a measure of the tendency of an object to resist acceleration. The more mass something has, the more it resists acceleration. There is also gravitational mass, which as far as we can tell experimentally is identical to inertial mass. 2- The Body Moment of Inertia about a Specified Axis: The Moment of Inertia is a measure of an object’s resistance to changes to its rotation. Also it can be defined as the capacity of a cross-section to resist bending. It measures its resistance to the action of a torque about the same axis and it must be specified with respect to a chosen axis of rotation and It is usually quantified in m4 or kgm2. Moment of inertia Moment of inertia is the name given to rotational inertia, the rotational analog of mass for linear motion. It appears in the relationships for the dynamics of rotational motion. The moment of inertia must be specified with respect to a chosen axis of rotation. For a point mass, the moment of inertia is just the mass times the square of perpendicular distance to the rotation axis, $I = mr^2$. That point mass relationship becomes the basis for all other moments of inertia since any object can be built up from a collection of point masses. Since the moment of inertia of an ordinary object involves a continuous distribution of mass at a continually varying distance from any rotation axis, the calculation of moments of inertia generally involves calculus, the discipline of mathematics which can handle such continuous variables. Since the moment of inertia of a point mass is defined by The moment of inertia plays the same role in angular motion as the mass in linear motion. It may be noted that moment of inertia depends not only on mass m but also on r^2. The Concept of Inertia The concept of inertia is a fundamental concept in physics. It is bounded with other fundamental concepts as: The concept of state: the state of the system can be mechanical (statical, kinematical, dynamical and of deformation), thermodynamic, electromagnetic, etc. The state of a system is defined by the state parameters. The concept of interaction. The concept of process (transformation): Depending on the nature of the system,. The process consists in the transition of a system from a state to another. Given the causality principle, the process is the effect of interaction. Depending on the nature of the systems and the nature of the states implied there are many types of processes: mechanical (equilibrium, motion and deformation), electromagnetic, gravitational, chemical, thermodynamic etc. Visit Our Virtual labs and Experience a Virtual World of Science Education Try PraxiLabs Virtual Lab For FREE! Types of Inertia with Examples An object stays where it is placed, and it will stay there until you or something else moves it. The property of a body to oppose any change in its state of rest is known as inertia of rest. Examples of Inertia of Rest in Our Daily Life Now we will show some examples of law of inertia If an index card is placed on top of a glass with a penny on top of it, the index card can be quickly removed while the penny falls straight into the glass, as The cardboard moves away due to the force applied by the finger but the coin remains at its position due to inertia of rest and hence falls into the glass. When a bus or a train starts suddenly, the passenger standing inside it falls backward: It happens because the feet of the passenger being in contact with the floor of the bus come in motion along with the bus but the upper part of the body remains at rest due to inertia of rest. Hence the passenger falls backward. When a tree is vigorously shaken, some of the leaves fall from the tree: When the branch of a tree is vigorously shaken, the branch comes in motion as the force is applied on the branch. But the leaves want to remain at rest due to inertia of rest and fall down. The carpet is beaten with a stick to remove the dust particles: When carpet is beaten with stick, the carpet comes in motion but the dust particles remain at rest due to inertia of rest. A pile of a carom coins remains intact when the lowest coin in the pile is struck quickly by a striker. An object will continue at the same speed until a force acts on it. The property of a body to oppose any change in its state of uniform motion is known as inertia of motion. Praxilabs Virtual Labs includes a range of online science experiments in physics, chemistry and biology experiments .. Try now! Get Started Praxilabs For FREE Examples of Law of Inertia in Everyday Life (Inertia of Motion) When the bus stops suddenly, people fall forward. When the driver of a bus brakes suddenly, the lower part of the body comes to rest as the bus comes to rest but the upper part of the body continues to move forward due to inertia of motion. As a result, a forward force is exerted on the body and we fall in the forward direction. The electric fan continues to move for a period after the electricity is turned off. The blades of the fan were in motion. Hence, they will take time to come to rest after being switched off. If you are on a train and the train is moving at a constant speed, a toy tossed into the air will go straight up and then come down. This is because the toy has inertia like the train and you. Luggage is usually tied with a rope on the roof of a bus. When the bus stops suddenly, the luggage kept on the roof may fall from the roof of the bus due to inertia of motion therefore, it is advised to tie any luggage kept on the roof of a bus with a rope. An object will stay moving in the same direction unless a force acts on it. The property of a body to oppose any change in its direction of motion is known as inertia of direction. 5 Examples of Inertia of Direction If you jump from a car or bus that is moving, your body is still moving in the direction of the vehicle. When your feet hit the ground, the grounds act on your feet and they stop moving. You will fall because the upper part of your body didn’t stop, and you will fall in the direction you were moving. The water particles sticking to the cycle tire are found to fly off tangentially whenever a driver is negotiating a curve; the passengers experience a force acting away from the center of the curve. When a bus driver is negotiating a curve on the road, passengers fall towards the center of the curved road. Whenever a driver is negotiating a curve, the passengers experience a force acting away from the center of the curve; it happens due to the tendency of the passengers to continue moving in a straight line. When you stir coffee or tea and stop, the swirling motion continues due to inertia. Satellites (that establish orbit around the earth) continue on their trajectory due to inertia. Explanatory Video for Examples of law of inertia in Every day Life Importance of Inertia in Our Daily Life – Law of Inertia Examples The inertia of an object enables us to maintain patterns of functioning, maintain relationships, and get through the day without questioning everything. There are many examples of law of inertia that reflect several and important uses: The design of safety devices for vehicles, including but not limited to seat belts, that can provide an external force to stop a body’s motion in the event of a sudden change in the physics of the immediate environment. In space travel, for example, once a device escapes Earth’s gravity, it will continue on its given trajectory until it encounters another gravitational field or object. Space probes can be sent great distances without any additional fuel required other than that needed to “escape” Earth, enact minor navigational changes or land on another object. Examples of the Law of Inertia in Sports One of good examples of law of inertia in daily life is the body of a player quickly sprinting down the field will tend to want to retain that motion unless muscular forces can overcome this inertia. A skater gliding on ice will continue gliding with the same speed and in the same direction, barring the action of an external force. In gymnastics, athletes are constantly changing their body configuration. By increasing the radius from the axis of rotation, the moment of inertia increases thus slowing down the speed of rotation. If an athlete wants to increase the speed of rotation, then they must decrease the radius by bringing the segments of the body closer to the axis of rotation thus decreasing the radius and moment of inertia. Limitations of Law of Inertia There are many limitations of the law of inertia, as this law was given three and a half centuries ago. Some of the limitations of this law are: Limited to Non-Relativistic Speeds: The Law of Inertia is only valid for objects moving at non-relativistic speeds i.e., speed not closer to the speed of light. At very high speeds, close to the speed of light, the laws of physics change, and the concept of inertia is no longer applicable. Only Applicable in Inertial Frames: The Law of Inertia is only applicable in inertial frames of reference, which are frames that are not accelerating. In other words, the Law of Inertia doesn’t hold for non-inertial frames of Reference. Neglects Friction and Other Forces: The Law of Inertia assumes that there are no external forces acting on an object, but in reality, there are always some forces acting on an object. Friction, air resistance, and other forces can significantly affect the motion of an object and are not taken into account in the Law of Inertia. Applicability at Microscopic Level: As the size of the particle goes to the microscopic, atomic, or subatomic scale, then also the law of inertia fails to hold as there are various other forces that come into play that don’t have any effect on everyday objects. Source: GeeksforGeeks (2024) Inertia: Law of inertia, examples, and faqs, GeeksforGeeks. Available at: (Accessed: 04 August 2024). Unleashing Innovation: Dive into Mechanical Physics with PraxiLabs! PraxiLabs the digital science lab enable you to conduct various laboratory experiments in physics, chemistry, and biology online anytime and anywhere. Try the virtual labs in mechanics that explain Newton’s laws of motion and more: Free Fall Motion on Inclined Surface Ballistic Pendulum Newton’s Second Law Create your free account and try our virtual labs in mechanics! Try 3D Virtual Labs Now Inertia Demystified: FAQs Illustrated with Examples What is Inertia Definition? Inertia refers to “resistance to change in motion.” or “the amount of resistance of an object to a change in velocity” This includes changes in the direction of the object or the speed of motion. In simple words, inertia is the property that describes the tendency of objects to continue to move in a straight line at a constant speed, when no forces are affecting them. There are 3 types of Inertia: Inertia of rest. Inertia of motion. Inertia of direction. What is Law of Inertia? The law of inertia is Newton’s first law, which states that “An object at rest will stay at rest, and an object in motion will stay in motion unless acted on by a net external force”. This means that if a body is moving at a constant speed in a straight line or at rest, it will keep moving in a straight line at constant speed or remain at rest unless it is acted upon by an unbalanced force. What are 5 examples of the law of inertia? Satellites that establish orbit around the Earth, keep moving in a circular motion. The electric fan continues to move for a period after the electricity is turned off. Falling forward in a bus when sudden breaks are applied. A skater gliding on ice will continue gliding with the same speed and in the same direction, barring the action of an external force. An athlete taking a short run before a jump. What are the 10 examples of inertia of direction? Jumping from a moving car or bus. When your feet hit the ground, the grounds act on your feet and they stop moving. You will fall because the upper part of your body didn’t stop (still moving in the direction of the vehicle), and you will fall in the direction you were moving. When a bus driver is negotiating a curve on the road at high speed, passengers fall towards the center of the curved road. The mud from the wheels of a moving vehicle flies off tangentially. Stirring coffee or tea and then stopping, the swirling motion continues due to inertia. Bags and things on the bus can be thrown sideways during a turn (if not tied) due to inertia of direction. Satellites continue on their trajectory due to inertia. On flowing water, if you place a rotating wheel ,particles of water fly of tangentially due to inertia of direction. When you turn a bicycle, your body naturally wants to continue moving in a straight line. During swimming, when you change your direction, your body initially tends to keep moving in the direction you were going due to inertia of direction, requiring you to adjust your stroke to change course. When a skateboarder turns, their body tends to continue moving in the direction he was initially moving, requiring them to adjust his balance and lean to maintain equilibrium. What is an example of inertia in real life? If you jump from a car or bus that is moving, your body is still moving in the direction of the vehicle. When your feet hit the ground, the ground acts on your feet and they stop moving. You will fall because the upper part of your body didn’t stop, and you will fall in the direction you were moving. What are 5 examples of Newton’s first law? The concept of car airbags. The motion of a ball falling through the atmosphere. The motion of a model rocket launched into the atmosphere. A book on the table stays in place unless it is dislodged. While riding a bike, you fly forward away from the bike when you hit a rock or anything else that suddenly stops the bike. You can try PraxiLabs virtual lab for online Physics experiments … Subscribe now and select your plan