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By definition, a force is a push or pull on an object, which has both magnitude and direction.In physics and other sciences, a force is a push or pull on a mass that can change the object’s motion. Force is a vector quantity, meaning it has both magnitude and direction. The symbol for force is the capitol letter F. A famous example of an equation for force is Newton’s second law:F = m*aHere F is force, m is mass, and a is acceleration. This law states that a net force equals the rate of the change of its momentum with time. Assuming mass is constant, the object’s acceleration (change in velocity) is directly proportional to the force and in the direction of the force.The SI unit of force is the newton (N), which is a kilogram meter per second squared (kg·m/s2). Other common units include:dynekilogram-force (kilopond)poundalkippound-forceThe Greek philosophers Aristotle and Archimedes studied force, but believed constant motion requires a constantly applied force. Galileo Galilei and Sir Isaac Newton corrected this misperception and described force mathematically. Galileo’s inclined plane experiment (1638) mathematically described naturally accelerated motion. Newton’s three laws of motion (1687) describe force under ordinary conditions. Einstein’s theory of relativity expands the describes phenomena occurring close to the speed of light.In a nutshell, Newton’s three laws of motions are:A body in motion stays in motion at a constant velocity unless acted upon by an external force. Similarly, a body at rest stays at rest unless acted upon by an external force.The force on an object equals the object’s mass multiplied by its acceleration.When one object exerts a force on another object, the second object exerts an equal and opposite force on the first.Forces exist all around us in the everyday world. For example:Friction is a force that opposes motion.Applied force is the force applied to an object by a person or other object.Centripetal force is a force acting on a body moving in a circular path that is directed toward the center of the circle.Centrifugal force is an apparent force that acts outward on a rotating body.The normal force is the force exerted upon an object that is in contact with a surface.The force of gravity is the attractive force between two masses. Weight is the acceleration due to gravity multiplied by an object’s mass.The tension force is the force that pulls equally on two objects connected by a string, wire, or robe.Spring force is the force exerted by a stretched or compressed spring.The Coriolis force acts perpendicular to the direction of motion and axis of rotation on a mass moving in a rotating system.The electromagnetic force is the attraction between opposite electrical charges or magnetic poles, or repulsion of like charges or magnetic poles.The four fundamental forces of nature are gravity, electromagnetism, the strong interaction, and the weak interaction.Gravity is the attractive force between two masses. It acts over an infinite distance, but is the weakest of the fundamental forces.Electromagnetism describes the attraction and repulsions of electrical charges and magnets. Like gravity, it is effective over an infinite distance.The weak interaction affects some nuclear phenomena, like beta decay. Its effective range is only about 10-18 meters, so it acts on the atomic scale.The strong interaction is very powerful, but it only acts over a range of about 10-15 meters. Among other things, it binds protons and neutrons together within the atomic nucleus.Corben, H.C.; Stehle, Philip (1994). Classical Mechanics. New York: Dover Publications. ISBN 978-0-486-68063-7.Cutnell, John D.; Johnson, Kenneth W. (2003). Physics (6th ed.). Hoboken, New Jersey: John Wiley & Sons Inc. ISBN 978-0471151838.Hellingman, C. (1992). “Newton’s third law revisited”. Phys. Educ. 27 (2): 112–115. doi:10.1088/0031-9120/27/2/011Newton, Isaac (1999). The Principia Mathematical Principles of Natural Philosophy. Berkeley: University of California Press. ISBN 978-0-520-08817-7.Sears, F.; Zemansky, M.; Young, H. (1982). University Physics. Reading, Massachusetts: Addison-Wesley. ISBN 978-0-201-07199-3.Related Posts transitive verb 1 : to do violence to especially : rape 2 : to compel by physical, moral, or intellectual means 3 : to make or cause especially through natural or logical necessity the last minute goal forced overtime 4 a : to press, drive, pass, or effect against resistance or inertia b : to impose or thrust urgently, importunately, or inexorably force unwanted attentions on a coworker 5 : to achieve or win by strength in struggle or violence: such as a : to win one's way into forced the mountain passes b : to break open or through 6 a : to raise or accelerate to the utmost b : to produce only with unnatural or unwilling effort c : to wrench, strain, or use (language) with marked unnaturalness and lack of ease 7 a : to hasten the rate of progress or growth of b : to bring (plants) to maturity out of the normal season forcing lilies for Easter 8 : to induce (a particular bid or play by another player) in a card game by some conventional act, play, bid, or response 9 a : to cause (a runner in baseball) to be put out on a force-out b : to cause (a run) to be scored in baseball by giving a base on balls when the bases are full Force is push or pull. Unbalanced forces make an object accelerate Forces on an object are usually balanced: forces in one direction are equal to forces in the opposite direction: Examples of Balanced Forces No acceleration. The cables pull downwards equally to the left and right, and that is balanced by the tower's upwards push. (Does the tower push? Yes! Imagine you stand there instead of the tower.) We can model the forces like this: By putting them head-to-tail we see they close back on themselves, meaning the net effect is zero: The forces are in balance. But when forces are unbalanced the object accelerates. Examples of Unbalanced Forces. There is acceleration. Kicking a ball is an unbalanced force that makes it accelerate very quickly. Once it loses contact with your foot that force (and its acceleration) stops. The ball would continue to travel in a straight line at a fixed velocity, except that other forces act on the ball: Gravity is now an unbalanced force that makes the ball accelerate downwards. Air resistance is also an unbalanced force which gradually reduces the velocity of the ball. Acceleration: an increase or decrease in velocity A decrease in velocity can also be called deceleration. Force and Acceleration are linked. The more force, the more acceleration. But objects with more mass are harder to accelerate The more mass, the less acceleration. Imagine trying to kick a stone ball: The famous formula is: Dividing both sides by m makes it clearer: The idea that mass resists acceleration is called inertia. Inertia means the object wants to continue to do what it does. If it is at rest (in relation to us), it continues to be at rest. If it is moving East at 20 m/s, it continues moving East at 20 m/s. etc. This oil tanker has a large inertia. It is: hard to speed up hard to slow down when it is moving (can take many kilometers to stop) hard to change direction It seems that mass doesn't like being pushed around! In honor of Sir Isaac Newton the unit of force is the Newton (abbreviation is N). A Newton is the force it takes to make 1 kg change its velocity by 1 m/s every second. In other words:1 kg changes its velocity by 1 m/s every second Or:1 kg changes 1 m/s per second Or:1 kg m/s /s The two lots of "/s" (per second) become "/s2" (per second squared), so: 1 Newton is 1 kg m/s2 (kilogram meter per second squared) The acceleration is 15 m/s over 5 seconds, or 15 m/s 5 s = 3 m/s s = 3 m/s2 Now let's calculate the force: F = ma = 2000 kg × 3 m/s2 = 6000 kg m/s2 = 6000 N = 6 kN The force is 6 kN (6 kiloNewtons). Forces are Interactions Sir Isaac Newton (translated from Latin): To every action, there is always opposed an equal reaction; or, the mutual actions of two bodies upon each other are always equal, and directed to contrary parts. In other words: For every action there is an equal and opposite reaction He also gave this example: "If you press a stone with your finger, the finger is also pressed by the stone." Force has magnitude and direction. So it is a vector: Acceleration also has magnitude and direction. So it too is a vector. Calculations Read the page devoted to Force Calculations Note: when we say something is "at rest" or "moving at 4 m/s" we forget to say "in relation to me" or "in relation to the ground", etc. Think about this: are you really standing still? You are on planet Earth which is spinning at 40,075 km per day (about 1675 km/h or 465 m/s), and moving around the Sun at about 100,000 km/h, which is itself moving through the Galaxy. It is all relative! Force is a push or pull Forces on an object can be balanced or unbalanced Unbalanced forces make an object accelerate More force, more acceleration More mass, less acceleration (inertia) For every action there is an equal and opposite reaction Back in 1687 Newton wrote three laws about motion, which in summary are: First Law: Inertia (force is needed to change an object's velocity) Second Law: F = ma Third Law: Every action has an equal and opposite reaction 11923, 11924, 11925, 11926, 11927, 11928, 11929, 11930, 11931, 11932 A force is a push or a pull acting on an object due to its interaction with another object. It causes a stationary object to move and a moving object to come to a stop. Force is a vector quantity that has both magnitude and direction. How to Find Force The force equation can be derived by using Newton’s Second Law, which states that the force (F) acting on an object is given by the product of its mass (m) and acceleration (a). F = ma Acceleration is defined as velocity (v) over time (t). F = mv/t SI Unit of Force: Newtons or N (kg.m.s-2) Dimension of Force: [MLT-2] Here are some facts, characteristics, and properties of a force. Defined as the interaction between two objectsChanges the motion (magnitude and direction) of an objectChanges the shape of an objectVector quantity – Resultant force on an object is the vector sum, which gives rise to balanced force and unbalanced force. Generally, forces can be classified into two types based on their application. They are contact and non-contact forces. A contact force is defined as the force between two objects that are in physical contact. Here are some types of contact force. When an object lies on a surface, the surface exerts an equal and opposite force. The component of this force that is perpendicular to the surface is called the normal force. Example: The force exerted by the table on a book lying on it. The forces applied to an object in order to displace or deform it is called the applied force. Example: The force with which a person pushes a cart. The tension or tension force is a force experienced by a rope, string, or cable pulled from the opposite end. Example: The force experienced by a rope when a person pulls a bucket of water from a well. The friction force is the force of resistance to an object’s motion. There are two main types of friction force. A. Static Friction Static friction arises when the applied force is such that an object remains stationary relative to the surface. Example: The resistance offered by a stationary box when a person tries to push it. B. Kinetic Friction Kinetic friction arises when the applied force is such that it displaces an object, which then moves relative to the surface. Kinetic friction is of two types. i. Sliding Friction: It is the resistance offered by the surface when the object is sliding Example: The resistance force offered by the floor when a person pushes a box over it. ii. Rolling Friction: It is the resistance offered by the surface when the object is rolling Example: The resistance offered by the floor when a person pushes a cart over it. There is another type of friction called fluid friction. It is the resistance to an object’s motion in a fluid. Example: A person swimming in the water. The force of resistance offered by air to an object moving through it is called air resistance. Example: The resistance offered by air when a ball falls through it. The force exerted by a spring when compressed or extended is called spring force. Example: The force used to measure weight with a weighing scale. When an object is immersed in a fluid, wholly or partially, the fluid exerts an upward force opposite its weight. This phenomenon is known as buoyancy, and the upward thrust is known as the buoyant force. Example: Boat sailing on the river. When an object moves through a fluid, like air or water, it experiences a drag force, also known as drag resistance. Example: A car driving on a highway. Types of Forces A non-contact force is defined as the force between two objects that are not in physical contact. It is also called a field force. Here are the different types of non-contact forces. The force of attraction between astronomical objects is called the gravitational force. The force of attraction between the Earth and any other object on its surface is called gravity. The force due to gravity can be measured using a spring balance. Example: (Gravitational Force) The force of attraction between the Sun and the Earth. (Gravity) The force experienced by a person standing on the surface of the Earth. The electrostatic force is the force of attraction or repulsion between two charged particles. It is also called Coulomb’s force or Coulomb’s interaction. Example: The force with which electrons are held together by the nucleus. The force experienced by an object in the presence of a magnet is called magnetic force. Example: The force of attraction between a bar magnet and an iron nail. Q.1 What are the four main types of resistance forces? Ans. The four main types of resistance forces are friction, gravity, air resistance, and buoyancy. Q.2. What are the four types of fundamental forces of nature? Ans. The four fundamental forces of nature are gravitational force, electromagnetic force, strong nuclear force, and weak nuclear force. Article was last reviewed on Thursday, March 23, 2023 Aristotle famously represented a force as anything that causes an object to undergo “unnatural motion”. Sir Isaac Newton was one of the first scientists to study gravity and force. Any kind of force is just a push or a pull. It can be described as a push or pull on an object. Push or pull of an object is considered a force. Push and pull come from the objects interacting with one another. Terms like stretch and squeeze can also be used to denote force. In Physics, force is defined as: The push or pull on an object with mass causes it to change its velocity. Force is an external agent capable of changing a body’s state of rest or motion. It has a magnitude and a direction. The direction towards which the force is applied is known as the direction of the force, and the application of force is the point where force is applied. The Force can be measured using a spring balance. The SI unit of force is Newton(N). Common symbols: \(\begin{array}{l}\vec F , \, F \end{array} \) SI unit: Newton In SI base units: kg·m/s2 Other units: dyne, poundal, pound-force, kip, kilo pond Derivations from other quantities: F = m a Dimension: LMT-2 In physics, motion is defined as the change in position with respect to time. In simpler words, motion refers to the movement of a body. Typically, motion can either be described as: Change in speed Change in direction The Force has different effects, and here are some of them. Force can make a body that is at rest to move. It can stop a moving body or slow it down. It can accelerate the speed of a moving body. It can also change the direction of a moving body along with its shape and size. Force Videos You may also want to check out these topics given below! The quantity of force is expressed by the vector product of mass (m) and acceleration (a). The equation or the formula for force can mathematically be expressed in the form of: Where, m = mass a = acceleration It is articulated in Newton (N) or Kgm/s2. Acceleration a is given by a = v/t Where v = velocity t = time taken So Force can be articulated as: F = mv/t Inertia formula is termed as p = mv which can also be articulated as Momentum. Therefore, Force can be articulated as the rate of change of momentum. F = p/t = dp/dt Force formulas are beneficial in finding out the force, mass, acceleration, momentum, velocity in any given problem. In the centimeter gram second system of unit (CGS unit) force is expressed in dyne. In the standard international system of unit (SI unit) it is expressed in Newton (N). Force is a physical cause that can change an object’s state of motion or dimensions. There are two types of forces based on their applications: Contact Force Non-Contact Force Put your understanding of this concept to test by answering a few MCQs. Click ‘Start Quiz’ to begin! Select the correct answer and click on the “Finish” buttonCheck your score and answers at the end of the quiz Visit BYJU’S for all Physics related queries and study materials 0 out of 0 arewrong 0 out of 0 are correct 0 out of 0 are Unattempted View Quiz Answers and Analysis