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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. In our daily life, we see many objects around us such as a see-saw in the park, spoons in the kitchen, scissors, bottle openers, joints in the human body.What is Lever?The lever is a rigid bar that allows a heavier or a steadfast object to lie on the fixed point with a smaller force.Three different types of levers exist, depending on where the input force, fulcrum, and load are.A first-class lever has the fulcrum (fixed point) between the input force and load.A second-class lever has the load between the fulcrum (pivot) and the input force.A third-class lever is a lever that has the input force in the middle of the fixed point and the load.On this page, we shall learn the following things:What are simple machines?Fulcrum, Lever, Effort, LoadFirst-class, second-class and third-class leverMechanical advantage (MA)Examples (Real-life)What are Simple Machines?The word machine has come from the Greek word which means "to help make things easier."Energy remains conserved because machines can't do more work than the energy we put in. The lever is nothing, but a rod andThe thing we encounter in day-to-day life having a rod-like function is "Lever." Lever has a fixed point through which it is easy to rotate it about that point. Such as a bottle opener, scissors, pliers, stapler, nut-Cracker; etc.Lets Talk About Basic Definitions:Load (L): A resistive force that is to be overcome by a machine is called the Load. S.I. The unit is Newton (N).Effort (E): An external force applied to a simple machine to overcome a load is called Effort. S.I. The unit is Newton (N).Fulcrum (Pivot, F): The point on which something turns or is supported.Mechanical advantage (MA): The ratio of Load (L) to overcome the magnitude of Effort (E).Where MA is nothing but the ratio of the Effort arm to the Load arm, which we would be discussing in the class of Levers.MA = Effort Arm (E) / Load Arm (L)Effort Arm (E) = The distance between the effort (force) and the Fulcrum (pivot)Load Arm (L) = The distance between the Load and the Fulcrum (pivot)Types of LeversFirst-Class LeverHere, it is a first-class lever.In this, we can see that we have to apply an effort (force) against gravity.Like, in a garage, a screw jack is fixed at the bottom and as we start rotating the jack, the car moves upwards, here we applied little force, and the car applied that force to move upward.Second-Class LeverDid you notice that when you try to tear the paper into equal parts manually, it takes much time?If you use scissors, then the time would be saved, though the effort applied was less, the work got done in speed.Which means the speed is increased here to get the job done earlier.Third-Class LeverYou might've been to villages, where peopledepending upon the well as a water resource, they apply their effort upward in pulling out the water from the well via the bucket attached to the string, but it is easy to use a pulley, then the effort would've been downwards (towards the gravity). Hence the effort applied would be less.Classification of Levers based on MAS.noTypes of LeverMechanical AdvantageAttribute1.First-class leverGreater than 1Force multiplier2.Second-class leverLess than 1Speed multiplier3.Third-class leverEqual to 1Change in direction of the effortIt can work as a force multiplier, speed multiplier and in changing the direction of Effort As well (Depending on the value of MA)Lets Understand:This is a first-class lever, it has Fulcrum (pivot) in the middle, Load at one end, and effort on the other.Examples of the First-class leverHere, in this case:The Fulcrum (pivot) is between the Load and the Effort such thatLength of Load Arm (La) = Length of Effort Arm (Ea).]MA (Mechanical advantage) = Ea / LaAs Ea = LaMA = 1Which means the change in direction.2. PliersHere, Ea > La, as you can see in the image above that the Effort Arm is greater than the Load Arm.As we know, MA = Ea/ La,Here, Ea > La, MA > 1Therefore, it works as a Force Multiplier.3. Scissors In the above image of scissors, we can see that the Length Arm > Effort Arm:As, MA = Ea / LaAnd, Ea < LaSo, MA < 1Here, it works as a Speed MultiplierExample of a second-class leverIn the above image, La > Ea.So, MA < 1, therefore works as aSpeed Multiplier.Example of a third-class leverHere, La > EaMA = Ea / LaAs, Ea < La, implies that MA < 1Change in DirectionVelocity ratio:= Distance traveled by effort (m) / Distance traveled by Load (m)Work Input:= Effort (E) * distance traveled by an Effort (n)Efficiency (p):= Work output / work Input= Mechanical advantage / Velocity ratio= M.A. / V.R.Summary:We call levers simple machines because they have only two parts - Fulcrum and the Handle, where the handle or bar of the lever is called the Arm, and Fulcrum is the point on which the lever rotates.Short Question answers:Q1: The efficiency of a machine is 60 %. If 500 Joule of energy is given to the machine. What is its output?Sol: Efficiency (p) = 60%, Input (i) = 500 JOutput = p * i= 60/100 * 500Therefore, Output = 300 JQ2: Explain why scissors for cutting cloth may have blades longer than the handles but shears for cutting metals have short blades and long handles?Ans: A pair of scissors used to cut a piece of cloth has blades longer than the handles so that the blades move longer on the cloth than the movement at the handles. While shears used for cutting metals have short blades and long handles because it enables us to overcomelarge resistive force by a small effort.Q3: A pair of scissors has its blades 10 cm long, while its handles are 2.5 cm long. What is its mechanical advantage?Ans: Effort Arm (Ea) = 2.5 cmLength Arm = 20 cmM.A. = Ea/ La= 2.5/ 10Therefore, M.A. = 0.25 Lever and its TypeThe lever can be defined as a machine that is quite simple in its arrangement and is composed of a rigid rod or a beam that is put on a fixed hinge which is called the fulcrum. This, the fulcrum is the point where the lever is placed and this either turns or supports it. This is then used to transfer a force to a load which is advantageous mechanically. The lever is a structure that can rotate in itself at a point. There are 3 types of this structure, namely that-class lever, second class and third-class lever. They are classified according to the fulcrum, the force and the load.The main use of levers is mechanical advantage which is defined as the quantity a special machine multiplies a force applied. This can be calculated or found out by considering the location of load, effect and fulcrum which in turn gives the type of lever and the amount of mechanical advantage the machine has. When the effort is in a longer distance from the fulcrum then the load becomes easier to move. It is equal to the ratio of the effort of the load and the distance from the effort of fulcrum to the load of the fulcrums distance. If the distance of effort to the fulcrum is larger than the load of the fulcrums distance then there is a mechanical advantage in the lever. Thus, the ratio of the two distances will be greater than one which means that when there is a long distance from fulcrum to the effort and a short distance from the fulcrum to the load then a small effort will move a heavy or large load. The lever is one of the fundamental simple machines of mechanics, along with the inclined plane, wheel and axle, screw wedge and pulley, according to the University of Houston's Simple Machines Learning Site. People use levers in everything from throwing a ball to a seesaw. While the many advantages of levers are well known, the system has several disadvantages as well. At its most basic, a lever is a straight, rigid object that pivots on a fulcrum to ease lifting by using a small force applied over a large distance. There are three types of levers. Type 1 is a rigid bar with the fulcrum centered like a seesaw. A Type 2 lever has the load before the fulcrum and the force applied in front of the load, such as a wheel barrel. The final type has the load at the end, with the fulcrum placed before the force, such as the human arm. Levers have significant weights applied at various points around their fulcrums. Over time, the weight and movement causes wear near the fulcrum point, leading to bending and eventual breaking. Bending of the rigid arm leads to an inefficient lever and reduces the mechanical advantage. The third type of lever has the disadvantage of reducing the force exerted on the system. The force is between the load and the fulcrum. While it does create a mechanical advantage, it reduces the overall force, leading to inefficiency in the system. In the case of an arm, the bicep produces the force, and the elbow is the fulcrum. In a perfect world, the rigid arm is perfectly rigid. However, in reality, no substance is perfectly rigid. The rigid arm bends depending on the weigh of the load. This can lead to imprecise measurements. Cooper, Brock. "Mechanical Disadvantages Of A Lever System" sciencing.com, . 24 April 2017. APA Cooper, Brock. (2017, April 24). Mechanical Disadvantages Of A Lever System. sciencing.com. Retrieved from Chicago Cooper, Brock. Mechanical Disadvantages Of A Lever System last modified March 24, 2022. Simple machine consisting of a beam pivoted at a fixed hingeThis article is about the simple machine. For other uses, see Lever (disambiguation).LeverLevers can be used to exert a large force over a small distance at one end by exerting only a small force (effort) over a greater distance at the other.ClassificationSimple machineComponentsfulcrum or pivot, load and effortExamplessee-saw, bottle opener, etc.A lever is a simple machine consisting of a beam or rigid rod pivoted at a fixed hinge, or fulcrum. A lever is a rigid body capable of rotating on a point on itself. On the basis of the locations of fulcrum, load, and effort, the lever is divided into three types. It is one of the six simple machines identified by Renaissance scientists. A lever amplifies an input force to provide a greater output force, which is said to provide leverage, which is mechanical advantage gained in the system, equal to the ratio of the output force to the input force. As such, the lever is a mechanical advantage device, trading off force against movement. The word "lever" entered English around 1300 from Old French: levier. This sprang from the stem of the verb lever, meaning "to raise". The verb, in turn, goes back to Latin: levare,[1] itself from the adjective levis, meaning "light" (as in "not heavy"). The word's primary origin is the Proto-Indo-European stem legwh-, meaning "light", "easy", or "nimble", among other things. The PIE stem also gave rise to the English-language antonym of "heavy", "light".[2]Autumn Stanley argues that the digging stick can be considered the first lever, which would position prehistoric women as the inventors of lever technology.[3] The next earliest known cultural evidence of the application of the lever mechanism dates back to the ancient Egypt c.5000 BC, when it was used in a simple balance scale.[4] In ancient Egypt c.4400 BC, a foot pedal was used for the earliest horizontal frame loom.[5] In Mesopotamia (modern Iraq) c.3000 BC, the shadouf, a crane-like device that uses a lever mechanism, was invented.[4] In ancient Egypt, workmen used the lever to move and uplift obelisks weighing more than 100 tons. This is evident from the recesses in the large blocks and the handling bosses that could not be used for any purpose other than for levers.[6] The earliest remaining writings regarding levers date from the third century BC and were provided, by common belief, by the Greek mathematician Archimedes, who famously stated "Give me a lever (long enough and a fulcrum on which to place it), and I shall move the world". (The Greek usually attributed to Archimedes does not include details about length of lever or fulcrum, i.e., .) That statement has given rise to the phrase "an Archimedean lever" being adopted for use in many instances, not just regarding mechanics, including abstract concepts about the successful effect of a human behavior or action intended to achieve results that could not have occurred without it.[7]A lever in balanceA lever is a beam connected to ground by a hinge, or pivot, called a fulcrum. The ideal lever does not dissipate or store energy, which means there is no friction in the hinge or bending in the beam. In this case, the power into the lever equals the power out, and the ratio of output to input force is given by the ratio of the distances from the fulcrum to the points of application of these forces. This is known as the law of the lever.The mechanical advantage of a lever can be determined by considering the balance of moments or torque, T, about the fulcrum. If the distance traveled is greater, then the output force is lessened. T 1 = F 1 a , T 2 = F 2 b {\displaystyle {\begin{aligned}T_{1}&=F_{1}a,\quad \\T_{2}&=F_{2}b\!\end{aligned}}} where F1 is the input force to the lever and F2 is the output force. The distances a and b are the perpendicular distances between the forces and the fulcrum.Since the moments of torque must be balanced, T 1 = T 2 {\displaystyle T_{1}=T_{2}\!} . So, F 1 a = F 2 b {\displaystyle F_{1}a=F_{2}b\!} .The mechanical advantage of a lever is the ratio of output force to input force. M A = F 2 F 1 = a b . {\displaystyle MA={\frac {F_{2}}{F_{1}}}={\frac {a}{b}}.\!} This relationship shows that the mechanical advantage can be computed from ratio of the distances from the fulcrum to where the input and output forces are applied to the lever, assuming a weightless lever and no losses due to friction, flexibility, or wear. This remains true even though the "horizontal" distance (perpendicular to the pull of gravity) of both a and b change (diminish) as the lever changes to any position away from the horizontal.Three classes of leversThe three classifications of levers with examples of the human bodyLevers are classified by the relative positions of the fulcrum, effort, and resistance (or load). It is common to call the input force "effort" and the output force "load" or "resistance". This allows the identification of three classes of levers by the relative locations of the fulcrum, the resistance and the effort:[8] Class I Fulcrum is located between the effort and the resistance: The effort is applied on one side of the fulcrum and the resistance (or load) on the other side. For example, a seesaw, a crowbar, a pair of scissors, a balance scale, a pair of pliers, and a claw hammer (pulling a nail). With the fulcrum in the middle, the lever's mechanical advantage may be greater than, less than, or even equal to 1. Class II Resistance (or load) is located between the effort and the fulcrum: The effort is applied on one side of the resistance and the fulcrum is located on the other side, e.g. a wheelbarrow, a nutcracker, a bottle opener, a wrench, a pair of bellows, and the brake pedal of a car. Since the load arm is smaller than the effort arm, the lever's mechanical advantage is always greater than 1. It is also called a force multiplier lever. Class III Effort is located between the resistance and the fulcrum: The resistance (or load) is applied on one side of the effort and the fulcrum is located on the other side, e.g. a hoe, a pair of tweezers, a hammer, a pair of tongs, a fishing rod, and the mandible of a human skull. Since the effort arm is smaller than the load arm, the lever's mechanical advantage is always less than 1. It is also called a speed multiplier lever.These cases are described by the mnemonic fre 123 where the f fulcrum is between r and e for the 1st class lever, the r resistance is between f and e for the 2nd class lever, and the e effort is between f and r for the 3rd class lever.Main article: Compound lever A compound lever comprises several levers acting in series: the resistance from one lever in a system of levers acts as effort for the next, and thus the applied force is transferred from one lever to the next. Examples of compound levers include scales, nail clippers, and piano keys.The malleus, incus, and stapes are small bones in the middle ear, connected as compound levers, that transfer sound waves from the eardrum to the oval window of the cochlea.See also: Mechanical advantage LeverThe lever is a movable bar that pivots on a fulcrum attached to a fixed point. The lever operates by applying forces at different distances from the fulcrum, or a pivot.As the lever rotates around the fulcrum, points farther from this pivot move faster than points closer to the pivot. Therefore, a force applied to a point farther from the pivot must be less than the force located at a point closer in, because power is the product of force and velocity.[9]If a and b are distances from the fulcrum to points A and B and the force FA applied to A is the input and the force FB applied at B is the output, the ratio of the velocities of points A and B is given by a/b, so the ratio of the output force to the input force, or mechanical advantage, is given by: M A = F B F A = a b . {\displaystyle MA={\frac {F_{B}}{F_{A}}}={\frac {a}{b}}.} This is the law of the lever, which was proven by Archimedes using geometric reasoning.[10] It shows that if the distance a from the fulcrum to where the input force is applied (point A) is greater than the distance b from fulcrum to where the output force is applied (point B), then the lever amplifies the input force. On the other hand, if the distance a from the fulcrum to the input force is less than the distance b from the fulcrum to the output force, then the lever reduces the input force.The use of velocity in the static analysis of a lever is an application of the principle of virtual work.A lever is modeled as a rigid bar connected to a ground frame by a hinged joint called a fulcrum. The lever is operated by applying an input force FA at a point A located by the coordinate vector rA on the bar. The lever then exerts an output force FB at the point B located by rB. The rotation of the lever about the fulcrum P is defined by the rotation angle in radians.Archimedes lever, Engraving from Mechanics Magazine, published in London in 1824Let the coordinate vector of the point P that defines the fulcrum be rP, and introduce the lengths a = | r A r P | , b = | r B r P | , {\displaystyle a=|\mathbf {r}_{A}-\mathbf {r}_{P}|,\quad b=|\mathbf {r}_{B}-\mathbf {r}_{P}|,} which are the distances from the fulcrum to the input point A and to the output point B, respectively.Now introduce the unit vectors eA and eB from the fulcrum to the point A and B, so r A r P = a e A , r B r P = b e B . {\displaystyle \mathbf {r}_{A}-\mathbf {r}_{P}=a\mathbf {e}_{A},\quad \mathbf {r}_{B}-\mathbf {r}_{P}=b\mathbf {e}_{B}.} The velocity of the points A and B are obtained as v A = a e A , v B = b e B , {\displaystyle \mathbf {v}_{A}={\dot {\theta }}a\mathbf {e}_{A}^{\perp },\quad \mathbf {v}_{B}={\dot {\theta }}b\mathbf {e}_{B}^{\perp },} where eA and eB are unit vectors perpendicular to eA and eB, respectively.The angle is the generalized coordinate that defines the configuration of the lever, and the generalized force associated with this coordinate is given by F = F A v A F B v B = a (F A e A) b (F B e B) = a F A b F B , {\displaystyle F_{\theta }=\mathbf {F}_{A}\cdot {\frac {\partial \mathbf {v}_{A}}{\partial {\dot {\theta }}}}-\mathbf {F}_{B}\cdot {\frac {\partial \mathbf {v}_{B}}{\partial {\dot {\theta }}}}=a(\mathbf {F}_{A}\cdot \mathbf {e}_{A}^{\perp })-b(\mathbf {F}_{B}\cdot \mathbf {e}_{B}^{\perp })=aF_{A}-bF_{B},} where FA and FB are components of the forces that are perpendicular to the radial segments PA and PB. The principle of virtual work states that at equilibrium the generalized force is zero, that is F = a F A b F B = 0. {\displaystyle F_{\theta }=aF_{A}-bF_{B}=0.\,\!} Simple lever, fulcrum, and vertical postsThus, the ratio of the output force FB to the input force FA is obtained as M A = F B F A = a b , {\displaystyle MA={\frac {F_{B}}{F_{A}}}={\frac {a}{b}},} which is the mechanical advantage of the lever.This equation shows that if the distance a from the fulcrum to the point A where the input force is applied is greater than the distance b from fulcrum to the point B where the output force is applied, then the lever amplifies the input force. If the opposite is true that the distance from the fulcrum to the input point A is less than from the fulcrum to the output point B, then the lever reduces the magnitude of the input force.Applied mechanics Practical application of mechanicsBalance lever couplingbasculeLinkage (mechanical) Assembly of systems connected to manage forces and movementMechanism (engineering) Device which converts input forces and motion to output forces and motionOn the Equilibrium of Planes Mechanical treatise by ArchimedesSimple machine Mechanical device that changes the direction or magnitude of a force^ Chisholm, Hugh, ed. (1911). "Lever". Encyclopdia Britannica. Vol.16 (11thed.). Cambridge University Press. p.510.^ "Etymology of the word "lever" in the Online Etymological". Archived from the original on 2015-05-12. Retrieved 2015-04-29.^ Stanley, Autumn (1983). ""Women Hold Up Two-Thirds of the Sky: Notes for a Revised History of Technology."". In Rothschild, Joan (ed.). Machina Ex Dea: Feminist Perspectives on Technology. Pergamon Press.^ a b Paipetis, S. A.; Ceccarelli, Marco (2010). The Genius of Archimedes -- 23 Centuries of Influence on Mathematics, Science and Engineering: Proceedings of an International Conference held at Syracuse, Italy, June 8-10, 2010. Springer Science & Business Media. p.416. ISBN9789048190911.^ Bruno, Leonard C.; Olendorf, Donna (1997). Science and technology firsts. Gale Research. p.2. ISBN9780787602567. 4400 B.C. Earliest evidence of the use of a horizontal loom is its depiction on a pottery dish found in Egypt and dated to this time. These first true frame looms are equipped with foot pedals to lift the warp threads, leaving the weaver's hands free to pass and beat the weft thread.^ Clarke, Somers; Engelbach, Reginald (1990). Ancient Egyptian Construction and Architecture. Courier Corporation. pp.8690. ISBN9780486264851.^ Alsop, Jon, Trump, Musk, and the Limits of Attention, Columbia Journalism Review, January 23, 2025^ Davidovits, Paul (2008). "Chapter 1". Physics in Biology and Medicine (3rded.). Academic Press. p.10. ISBN978-0-12-369411-9. Archived from the original on 2014-01-03. Retrieved 2016-02-23.^ Uicker, John; Pennock, Gordon; Shigley, Joseph (2010). Theory of Machines and Mechanisms (4thed.). Oxford University Press USA. ISBN978-0-19-537123-9.^ Usher, A. P. (1929). A History of Mechanical Inventions. Harvard University Press (reprinted by Dover Publications 1988). p.94. ISBN978-0-486-14359-0. OCLC514178. Archived from the original on 26 July 2020. Retrieved 7 April 2013. {{cite book}}: ISBN / Date incompatibility (help)Wikimedia Commons has media related to Levers.Look up lever in Wiktionary, the free dictionary.Lever at Diracdelta science and engineering encyclopediaA Simple Lever by Stephen Wolfram, Wolfram Demonstrations Project.Levers: Simple Machines at EnchantedLearning.comRetrieved from " The greengrocer 'De Buyskool' FineDictionary.com 2012 - 2025 Forms and templates by dexform.com Lever What is Lever? Types, Uses, Principle & Examples :- A lever is referred to as a simple machine which is made of a rigid beam and a fulcrum. The effort which is made and is known as the input force and the load which is the output force are both applied to any of the either end of the beam. The fulcrum is known to be the point at which the beam pivots. Whenever an effort is found to be applied to any one end of the lever, the load is applied at the other end of the lever. It is also found to be a gained mechanical advantage in any mechanical system which is found to be one amongst the six simple machines that are found to be identified by the scientists. A lever is that mechanical device which is mainly found responsible for amplifying the input force in order to provide a greater output force which is intended to provide leverage. The ratio of the output force to that of the input force is termed as the mechanical advantage of the lever. The lever is commonly found to be a mechanical benefit device which is used to balance the amount of force against the movement. The point at which the lever is found to rotate is known to be the Fulcrum.The Input force which is also termed as the effort by the force applied to the lever.Output force which is also termed as the load by the force applied by the lever to move the load. Various experiments tell that there are two equal forces which are found acting in the opposite directions to each other which is clockwise and in anti- clockwise direction, and are thus applied in a uniform lever at an equal distance from the fulcrum counteract with respect to each other so that a state of equilibrium, or balance, in the lever is established. It has been shown that there are found to be two unequal forces which are found acting in the opposite directions. This is responsible for bringing the magnitude of a force whenever the magnitude is found to be in one force. The effort which is made by the arm or lever arm is found to be equal to the product of the magnitude of the other force as well as the effort arm. In technical terms the product of a force is referred to as the moment of force with respect to its effort. The theory of moments, states wherein equilibrium is known to be established whenever the sum of the moments of the forces which are found to be acting in an anti clockwise direction is found to be equal to the sum of the moments of the forces acting in a clockwise direction. As a result in order to overcome a very large force at a large distance along with a very small force at a large distance from the fulcrum. There are three types of levers which are found to be known to human kind. These are as follows: first-class, second class and third class. The main difference between the three is found to be depending upon side from where the force is approaching, where the fulcrum is and where the load is. First Class Lever First-class levers are referred to as those which are found to have the fulcrum between the force and the load. In short it can be termed that a first-class lever is known as the effort or force which moves over a large distance in order to move the load a smaller distance and as the fulcrum is within the force and the load. The fulcrum which is within the effort and the resistance is referred to as the force which is applied on one side of the fulcrum and load at the other side. Here are some of the examples of first-class levers which are as follows: PliersScissorsCrowbarClaw hammerSee-sawWeighing balanceThe hand pushing objects or seesaws, crowbars.Using scissors shows the use of first-class levers.A wheel and an axle.Pulling a nail out of a wooden plank. In a first-class lever, the force if found to move over a larger distance in order to move the load a smaller distance and the fulcrum is found within the force and the load. Second Class Lever Considering the case of a second class lever, then it must be said that the load is found to be present within the effort that is the force and the fulcrum. The second class lever is the one wherein the effort is found to move over a large distance in order to raise the load a small distance. It is important to note that the length of the effort arm is found going all the way till the fulcrum and always exceeds the length of the load arm in the second-class lever. In second class levers, the load is found to be present between the force and the fulcrum. One of the most common example of a second class lever is a wheelbarrow wherein the effort if found to move a larger distance in order to lift any heavy loaded material accompanied with the axle and wheel as the fulcrum. It is also noted that the effort which moves over a large distance is responsible for raising the load a small distance. WheelbarrowCrowbarNutcrackerBottle openerBrake pedal of a carNail clippers Third Class Lever In the third-class levers, the force is found to be present within the load and the fulcrum. For instance considering the example of a barbecue tongs can be best. It is important to note that the length of the load arm goes all the way to the fulcrum which is found always exceeding the length of the effort arm in the third-class levers. In addition to this the third-class levers are found to be loaded in the same direction as the effort. Because of to the effect of location on the effort in reference to the fulcrum, a bearing tool or any other tool is most commonly required in order to place the beam as it pivots. The force is responsible for finding the pull to arm from the arm. An alternative configuration is responsible to round up the arm. Whereas, it may still require a bearing in order to prevent the arm from falling to the ground. Looking at the examples of third-class levers, the force is found to be in between the load and the fulcrum like in the barbecue tongs. Some other examples of the third-class levers can be a broom, a fishing rod, woomera and some more which are mentioned below. TweezersStaplerMousetrapBroomHockey stick Popularly known there are found to be only three types or classes of levers which are known to mankind, here the load and force are found to be located in relation with the fulcrum. The first-class levers are found to be an integer within the effort and load whereas the second-class levers are the ones where the load between the force and fulcrum. And finally talking about the third-class levers they are between load and fulcrum. A lever is the one which is usually responsible to either moving or lifting the object. Many a times it is found being used in order to push it against any object, but not to actually move them. The levers are found having some of the main functions wherein it can be used to exert a large force over a small distance at one end by exerting only a small force. Levers are responsible for making it easy to lift heavy materials, remove tight objects, and cut objects.Hammer claws are referred to as the common levers which are responsible for helping you in removing the nails which are embedded in wood or other hard surfaces.Wheel bars are referred to as those which are helpful in day to day life as they allow you to transport the loads which are found to be too heavy or heavy.Tweezers and tweezers can be considered as the examples of levers which are found in making it easy to lift or remove the items, even if the items are not that heavy.Scissors is found to be one more example of a lever which is found responsible for using the force in order to cut or separate any of the required material. By now you are done with the major classifications and details about levers. Now talking about its class then you must know that there are three basic classes of levers which have been known to mankind so far. Levers are the devices which are classified by the relative positions of the fulcrum, force and resistance which can also be known as load. Commonly it can be said that the input force, the effort can be found equal to the output force, load or the resistance. This is the factor which is mainly responsible and also allows the proper identification of three classes of levers by the relative locations of the fulcrum, the resistance and the effort. In the class I type the fulcrum within the effort and resistance, the effort which is found to be applied on one side of the fulcrum and the resistance on the other side. One can consider an example of a seesaw, a crowbar or a pair of scissors, a common balance, a claw hammer. These all are the perfect examples of class-I levers. A scissors and a pair of pliers are considered to be the example of double class I lever. It is important to note that the mechanical advantage may be greater than, less than, or equal to 1. In the class II type the resistance (or load) within the effort and fulcrum, is referred to as the effort which is applied on one side of the resistance and the fulcrum is found to be present on the other side. One can consider an example of a wheelbarrow, a nutcracker, a bottle opener or the brake pedal of a car wherein the load arm is found to be quite smaller than the effort arm. It is important to note that in such classes of levers the mechanical advantage is always found to be greater than 1. This is the reason why it is also called force multiplier lever. In the class III type the efforts within the fulcrum and resistance, is referred to as the resistance (or load) which is to be present on one side of the effort. For instance, considering an example of a pair of tweezers, a hammer, a pair of tongs, fishing rod, common balance or the mandible of our skull. It is important to note that in such classes of levers mechanical advantage is always less than 1. This is the reason why it is also called speed multiplier lever. These classes and cases are the ones which are clearly described by the mnemonic fre 123 wherein the f fulcrum is within r and e for the 1st class lever, the r resistance is within f and e for the 2nd class lever, and the e effort is within f and r for the 3rd class lever. It is important for an individual to get a knowledge about all these factors as these play a very vital role when it comes to usage at the real time. Most of the people are found complaining about the usage of a lever, but it becomes difficult as they lack proper knowledge about it. Therefore, reading this would have cleared all your doubts and would have been knowledgeable. Image Source :- rbcphoto, eschooltoday, Pre-Engineering Tutorials Levers are the simple machine devices, designed to do tasks with minimum effort. A lever improves an input force to produce a higher output force, resulting in leverage. Machines were created and made by humans to reduce human effort. A simple machines is a device that change the direction or magnitude of a force and make the work easier. There are numerous sorts of levers based on the position of the a pivot, force, and weight. Levers help us move things with less effort. By changing the direction or size of the force we apply, they make difficult tasks possible. They're also used to gain speed or distance in movement.In this article, we will learn in detail about types of levers along with their example. We will also learn what is lever and how they are classified using mechanical advantage.What is a Lever?A lever is a simple machine consisting of a rigid bar or beam that is capable of rotating around a fixed point called a fulcrum. Levers are commonly used to amplify or redirect force, allowing for easier movement or manipulation of objects. Levers are of three types, first class levers, second class levers, and third class levers. Before proceeding to types of levers, let's learn terms related to levers.Terms related to lever are discussed below:Load (L): Load is a resistive force that has to be overpowered by simple machines. The S.I. unit of Load is Newton (N).Effort (E): Effort is the external force used to pull off a load on a simple machine. The S.I. unit of effort is Newton (N).Pivot: It is the support given at a point.Mechanical Advantage (MA): It is the ratio of the Effort arm to the Load arm. It is given as MA = Effort Arm (E)/Load Arm (L) Effort Arm: The distance between the effort (force) and the Fulcrum (pivot)Load Arm: The distance between the Load and the Fulcrum (pivot)Types of LeverA lever is a stiff bar that rests on a fixed point with less force. The three different types of levers exist, depending on where the input force, fulcrum, and load are. The fulcrum, or fixed point, of a first-class lever is situated between the load and the input force.The load on a second-class lever is situated between the input force and the fulcrum, or pivot.A lever classified as third-class has the input force positioned midway between the load and the fixed point.The three class or types of lever are mentioned below:First Class LeverSecond Class LeverThird Class LeverLet's learn them in detail.First Class LeverFirst Class Lever is a type of lever with the pivot located between the weight and the force generated. Its order is denoted as force-fulcrum-weight. This is the simplest class of lever. When force is applied to one end of the lever, the other end exerts force on the resistance, resulting in a mechanical advantageExamples of First Class LeverThe examples of first class levers are mentioned below:Seesaw: A classic example of a first-class lever, where the fulcrum is placed between the applied force (the children sitting on either end) and the resistance (the weight of the children).Crowbar: When trying open a heavy object like a lid or a door, the fulcrum (the point where the crowbar rests) serves as the pivot, the force is applied at one end of the crowbar, and the resistance is at the other end.Scissors: In a pair of scissors, the pivot serves as the fulcrum, the force is applied at one handle, and the resistance is encountered at the cutting edge.Pliers: Pliers work on the same principle as scissors, where the fulcrum is at the joint, the force is applied at one handle, and the resistance is encountered at the jaws, enabling gripping and manipulation of objects.Second-Class LeverIn second class lever pivot is at one end and the force is applied on the other end. The load is situated in the middle of these two. The order of this would be pivot-load-force. Examples of Second Class LeverThe examples of second lever are discussed below:Wheelbarrow: A wheelbarrow is a second-class lever where the load is placed between the pivot (fulcrum) and the force (handles), allowing for easier lifting of heavy loads.Nutcracker: In a nutcracker, the nut serves as the fulcrum, the force is applied at one end by squeezing the handles together, and the resistance is the shell of the nut, which breaks due to the applied force.Bottle Opener: When opening a bottle using a bottle opener, the fulcrum is the edge of the bottle cap, the force is applied at one end of the opener, and the resistance is provided by the cap, which is lifted off.Door: A door can also be considered a second-class lever, where the hinges act as the fulcrum, the force is applied at the edge of the door handle, and the resistance is encountered at the point where the latch or the door's weight resists opening.Third Class LeverThird Class Lever are the levers in which the fulcrum is at one end and the force is applied in the middle and the weight is on the other end. The order is represented as a weight-force-fulcrum. In this case, we have to apply more energy to displace the weight to a longer distanceExamples of Third Class LeverThe examples of third class lever are mentioned below:Tweezers: In tweezers, the fulcrum is the point where the two arms meet, the force is applied at one end by squeezing the handles, and the resistance is encountered at the tips where objects are gripped.Hockey Stick: In hockey, the stick serves as a third-class lever, with the hands as the fulcrum, the force applied by the player's hands, and the resistance provided by the puck when striking it.Shovel: When digging with a shovel, the fulcrum is the point where the shovel blade meets the ground, the force is applied at the handle, and the resistance is the soil being dug.Fishing Rod: In fishing, the rod acts as a third-class lever, with the hands serving as the fulcrum, the force applied by the angler's hands, and the resistance provided by the tension of the fishing line when casting or reeling in a fish.Baseball Bat: A baseball bat can also be considered a third-class lever, with the hands acting as the fulcrum, the force applied by the batter's hands when swinging, and the resistance provided by the impact with the baseball.Types of Lever based on Mechanical AdvantageMechanical advantage is a measure of the effectiveness or efficiency of a machine in amplifying or redirecting force to accomplish a specific task. It quantifies the ratio between the output force or load and the input force or effort applied to the machine. It is given as Mechanical Advantage = Output Force(Load)/Input Force(Effort). The classification of levers based on mechanical advantage is tabulated below:S. No.Types of LeverMechanical AdvantageAttribute1.First Class LeverGreater than 1Force Multiplier2.Second Class LeverLess Than 1Speed Multiplier3.Third Class LeverEquals to 1Change in direction of effortConclusionThe main use of levers is mechanical advantage which is defined as the quantity a special machine multiplies a force applied. This can be calculated or found out by considering the location of load, effect and fulcrum which in turn gives the type of lever and the amount of mechanical advantage the machine has. When the effort is in a longer distance from the fulcrum then the load becomes easier to move. It is equal to the ratio of the effort of the load and the distance from the effort of fulcrum to the load of the fulcrums distance. If the distance of effort to the fulcrum is larger than the load of the fulcrums distance then there is a mechanical advantage in the lever. Thus, the ratio of the two distances will be greater than one which means that when there is a long distance from fulcrum to the effort and a short distance from the fulcrum to the load then a small effort will move a heavy or large load.Also, CheckWhat is the Principle of Moments?What is Torque?Types of Forces In lever, there are three different ways of arranging effort, load, and fulcrum. Therefore, depending on the relative positions of the fulcrum, the load, and the effort there are three different types of levers. We also call these three different types or three orders of levers.These three types or orders of levers are:Class I or first-order leversClass II or second-order leversClass III or third-order levers.Types of LeversClass-I or First-Order LeverIn class I or first-order liver, the fulcrum is in between the load and the effort.In the lever of the first order, the effort arm may be equal to or less than or more than the load arm.We require a small effort to move the load if the effort arm is more than the load arm. However, if the effort arm is less than the load arm, a large effort is required to move a load. Therefore, based on the length of the load arm and the effort arm, the mechanical advantage can be more than 1, equal to 1, or less than 1. Examples of first-order levers are a see-saw, a crowbar, a claw hammer, a hand pump, a beam balance, etc. Two such levers which share the same fulcrum form a pair of scissors or pliers.Four examples of a first-order lever see-saw, beam balance, crowbar, and hand pumpBack to the topClass-II or Second-Order LeverIn class II or second-order lever, the load is in between the fulcrum and the effort.In the lever of the second order, the load arm is always smaller than the effort arm. Thus, always less effort is required to move a heavy load. Consequently, the mechanical advantage is always more than 1 as the effort arm is longer than the load arm. We also call the second-order lever an effort or force multiplier lever. Nutcrackers, wheelbarrows, mango cutters, etc., are some examples of second-order levers.Three examples of a second-order lever wheelbarrow, nutcracker, and mango cutterBack to the topClass-III or Third-Order LeverIn class III or third-order lever, the effort is in between the fulcrum and the load.In the lever of third-order, the effort arm is always smaller than the load arm. Therefore, we have to apply more effort to lift a lighter load. Thus, the mechanical advantage is always less than 1 as the effort arm is shorter than the load arm. We also call the third-order lever a speed multiplier lever as the load moves through a larger distance as compared to the effort. Some examples of third-order levers are sugar tongs, bread knives, fire tongs, etc.Two examples of a third-order lever sugar tong and bread knifeBack to the topDifferences between first, second, and third orderThere are three important differences between first-order, second-order, and third-order levers. These are:The most important difference between the three types of levers is the relative position of fulcrum, load, and effort with respect to each other. In the first-order lever, the fulcrum is in between the load and the effort arm, whereas in the second-order lever, the load is in between the fulcrum and the effort arm. Subsequently, in the third-order lever, the effort is in between the fulcrum and the load arm.In the first-order lever, the effort arm can be smaller, equal to, or larger than the load arm. Whereas, in the second-order lever, the effort arm is always larger than the load arm, and in the third-order lever, the effort arm is always smaller than the load arm.The mechanical advantage of the first-order lever is greater than, equal to, or less than 1. Whereas, in the second-order lever, the mechanical advantage is always greater than 1 and in the third-order levers, the mechanical advantage is always less than 1.Difference between first, second, third order leversBack to the topPlease go through the below video from NGScience to learn more about various types of levers. Courtesy NGScienceA lever is a simple machine that consists of a stick, a beam, or a plane and a balance point. Typically, when a force is applied at one point of the plane, it causes the load present at another point of the plane to move. The movement of the load takes place through the fulcrum. Hence, the fulcrum acts as a balance point in a simple lever machine. Classes of Lever Simple MachineThe position of the three points, namely, force, load, and the fulcrum, is responsible to decide the class of the lever. The following are the three classes of a lever simple machine:1. First ClassIn this class of the lever, the fulcrum is located in the middle of the plane. The force is applied at one end of the plane, whereas the load is kept at the other end. For example, seesaw, scissors, plier, etc.2. Second ClassIn the second class of lever, the load is present at the middle of the