Meaning of elongation in physics

Elasticity is a measure of how much an object deforms (strange) when a given stress is applied (force). Identify properties of elastic objects Key key key points Elasticity is a measure of the deformation of an object when a force is applied. Very elastic objects such as rubber have a high elasticity and stretch easily. Stress is force over the area. The strain is the change in length compared to the original length. Deformation of key terms: A transformation; change of form. We now move from the consideration of forces that influence the movement of an object (such as friction and drag) to those who affect the form of an object. If a bulldozer pushes a car into a wall, the car will not move once it hits the wall, but it will greatly change the shape. A change of form due to the application of a force is a deformation. Even very small forces are known to cause some deformation. Two important features are observed for small deformations. First, the object returns to its original form when the force is removed, that is, deformation is elastic for small deformations. Secondly, the size of deformation is proportional to force — that is, for small deformations, Hooke's law is obeyed. In the form of equation, Hooke's law is given by [latex]\text{F} = \text{k} \Delta \text{L}[/latex], where [latex]\Delta \text{L}[/latex] is the length change. Elasticity is a measure of how difficult it is to stretch an object. In other words it is a measure of how small [latex]\text{k}[/latex] is. Very elastic materials such as rubber have small [latex]\text{k}[/latex] and so it stretches a lot with only a small force. Stress is a measure of force placed on the object above the area. Strain is the change of length divided by the original length of the object. The experiments havethat length change (Î "l) only depends on a few variables. As noted, Î "L is proportional to force F and depends on the substance from which the object is made. Moreover, length change is At the original length L0 and inversely proportional to the transversal area of the wire or auction. For example, a long guitar string stretches more than a short one, and a thick string stretches less than a thin. Voltage / Compression: Voltage: The auction is stretched a length Î "L When a force is applied parallel to its length. b) Compression: The same auction is compressed by forces with the same magnitude in the opposite direction. For very small deformations and uniform materials, Î "L is approximately the same for the same magnitude of voltage or compression. For larger deformations, the transversal area changes as the auction is compressed or elongated. The fracture is caused by a voltage placed on such an object to deform over its elastic limit and breaks. Relate the fracture with the elastic limit of a Key Takeaways material Most objects behave elastically for small strains and return to their original shape after being folded. If the voltage on an object is greater than the elastic limit of the object, it deforms permanently or possibly fracture. The fracture force is a measure of the force needed to break an object. Key terms: the amount for which a material deforms under stress or strength, given as a report of deformation to the initial size of the material and typically symbolized by Îµ is defined the engineering effort. The real strain is defined as a natural logarithm of the ratio of the final dimension to the initial dimension. elastic: capable of elongation; In particular, capable of elongation so as to return to an original shape or size when the force is released. Materials cannot lengthen forever. When a voltage is applied to an elastically proportional deform material to the applied force. However, after having deformed some quantity, the object can no longer take the tension and breaks or breaks. area where you bend under stress is called the elastic region. In that region the object bends and thenIn its original shape when the force is demolished. After that point, if more strain is added, the object can definitively deform and finally fracture. The strength of the fracture, also known as a breaking force, is the stress in which a specimen fails through fracture. This is usually determined for a specific specimen from a voltage test, which graph the effort curve. The registered final point is the strength of the fracture. Fracture: This is a deformation chart Ãž "l against the applied force F. The straight segment is the linear region in which the law of hooke is obeyed. The slope of the straight region is 1k. For larger forces , the chart is curved but the deformation is still elastic ... l will return to zero if the force is removed. The even greater forces permanently deform the object until finally fracture. The shape of the curve near the fracture depends on From different factors, including the Force F. Note that in this chart the slope increases shortly before fracture, indicating that a small increase of F is producing a large increase in the fracture. The bones, overall, Not the fracture due to voltage or compression. Rather, generally fracture due to the impact or side folding, with consequent cutting of bones or shots. The behavior of tension and compression bones is important because Deter Mina The load that bones can transport. The bones are classified as supporting structures such as columns in buildings and trees. Weight weight structures have special features; Columns in the building have steel reinforcement rods while trees and bones are fibrous. The bones in different parts of the body serve different structural functions and are prone to different stresses. Therefore, the bone in the upper part of the femur is placed in thin sheets separated from the marrow while, in other places, the bones can be and full of marrow or simply solid. Overweight people have a tendency towards bone damage due to compressions sustained in bone joints and tendons. At the end of thisYou will be able to: explain the concepts of stress and tension in describing elastic deformations of materials describe the types of elastic deformation of objects and materials A model of a rigid body is an idealized example of an object that does not deform under the actions of external forces. It is very useful when analyzing mechanical systems... and many physical objects are really rigid to a large extent. The extent to which an object can be perceived as rigid depends on the physical properties of the material from which it is made. For example, a ping-pong ball made of plastic is fragile, and a tennis ball made of rubber is elastic when acted by crushed forces. However, in other circumstances, both a ping-pong ball and a tennis ball can bounce well as rigid bodies. Similarly, someone who designs prosthetic limbs can be able to approximate the mechanics of human limbs by modeling them as rigid bodies; However, the actual combination of bones and tissues is an elastic medium. For the rest of this chapter, we pass from the consideration of the forces that influence the movement of an object to those who influence the form of an object. A change of form due to the application of a force is known as deformation. Even very small forces are known to cause some deformation. Deformation is lived by physical objects or media under the action of external forces - for example, this could be overwhelming, squeeze, tear, twist, faint or pull objects apart. In the language of physics, two terms describe the forces on objects subjected to deformation: stress and tension. Stress is a quantity that describes the size of forces that cause deformation. Stress is generally defined as force per unit. When forces pull on an object and cause its stretching, such as stretching of an elastic band, we call itTraction stress. When the forces cause an object's compression, we call it a compressed stress. When an object is crushed by allas a submarine in the depths of an ocean, we call this type of stress a mass of stress (or volume stress.) In other situations, active forces cannot be either transile or compressed, and still produce an obvious deformation. For example, suppose to hold a tight book between the palms of the hands, then with one hand you press-e-pull on the front cover away from you, while with the other hand you press-e-pull on the back cover towards you. In this case, when deforming forces act tangential to the surface of the object, we call them "feel" forces and the stress they cause is called cutting effort. The SI stress unit is the pascal (Pa.) When a new force tone presses on a unit surface of a square meter, the resulting stress is a pascal: a pascal=1.0Pa=1.0N1.0m2.one pascal=1.0Pa=1.0N1.0N1.0m2 In the imperial unit system, the stress unit is 'psi', which stands for 'pound per square inch' lb/in2). Another unit that is often used for mass stress is atm (atm). Conversion factors are 1psi=6895Paand1Pa=1.450×10−4psi1atm=1.013×105Pa=14.7psi.1psi=6895Paand1Paand1Pa=1.450×10−4psi1atm=1.013×105Pa=14.7psi An object or a medium under stress becomes deformed. The amount describing this deformation is called tension. The strain is given as a fractional change in both lengths (under traction stress) or volume (under mass stress) or geometry (under cutting stress). Therefore, tension is a number without size. The strain under a transile stress is called transile tension, the tension under the mass stress is called mass tension (or volume stress,) and which caused by the stress of the cut is called cutting strain. The greater the stress, the greater the strain; However, the relationship between tension and stress does not need to be linear. Only when stress is low enough is deformation that causes indirect to the value of stress. the constant proportionality in this relationship is called the elastic module. in the linear limit of low stress stressThe general relationship between stress and deformation is stress = (elastic module) Ã £ -Ceppo.stress = (elastic module) Ã £ - ACPO. As we can see from the dimensional analysis of this report, the elastic module has the same physical stress unit because the voltage is dimensional. We can also see from equation 12.33 that when an object is characterized by a large value of the elastic module, the effect of stress is small. On the other hand, a small elastic module means that stress produces great efforts and obvious deformations. For example, a stress on an elastic produces a larger strain (deformation) compared to the same stress on a steel band of the same size because the rubber elastic module is two sort orders lower than the elastic steel module . The elastic module for tension stress is called a module of young people; that the loose module is called for loose stress; And that for cutting stress is called the cutting module. Note that the relationship between stress and deformation is an observed report, measured in the laboratory. The elastic modules for various materials are measured in various physical conditions, such as the variable temperature and collected in the engineering data tables for reference (Table 12.1). These tables are valuable references for industry and for those involved in engineering or construction. In the next section, we discuss stress-stress relationships beyond the linear limit represented by the equation 12.33, in the complete range of stress values up to a fracture point. In the rest of this section, we study the linear limit expressed by equation 12.33. Material Young ModulusÃƒ-1010paÃƒ-1010pa bulk modulusÃƒ-1010paÃƒ-1010pa shear moduleusid-1010paƒ-1010pa aluminum 7.0 7.5 2.5 bone (voltage) 1.6 0.8 8.0 oss bone (compression) 0.9 brass 9.0 6.0 3.5 brick 1.5 concrete 2.0 copper 11.0 14.0 4.4 Crown Glass 6.0 5.0 2.5 Granite 4.5 4.5 2.0 Hair (Human) 1.0 1.5 1.0 Iron 21.0 16.0 7.7 Cable 1.6 4.1 0.6 Marble 6.0 7.0 2.0 Nickel 21.0 17.0 7.8 Polystyrene 3.0 Silk Silk spider thread 3.0 steel 20.0 16.0 7.5 acetone 0.07 ethanol 0.09 glycerin 0.45 mercury 2.5 water 0.22 table 12.1 elastic approximate modules for selected materials tension or compression occurs when two equal antiparallele forces act on an object along one of its size, so that the object does not move. Figure 12.18 shows a way to imagine such a situation. a segment of rod is stretched or pressed by a couple of forces acting along its length and perpendicular to its cross section. the net effect of such forces is that the rod changes its length from the original length l0l0 which had before the forces appeared, to a new length l which has under the action of the forces. This change in length ΔL=L−L0ΔL=L−L0 may be or stretch (when the length is larger than the original L0)L0) or contraction (when the length is smaller than the original l0.) l0.) the stress and tension of the traction occur when the forces are stretching an object, causing its stretching, and the change in length ΔLΔLΔLΔL=L is positive. stress and compression tension occur when forces are contracting an object, causing its shortening, and change of length ΔLΔL is negative. in one of these situations, we define stress as the ratio of the F'F forza deformation force to the transverse area to the deformed object. the F'F simbolo symbol that we reserve for the deformation force means that this force acts perpendicularly to the transversal section of the object. forces acting parallel to the cross section do not change the length of an object. the definition of traction stress is the stress of traction=F diA.tensile stress=F.A. 12.34 traction voltage is the measurement of the deformation of an object under traction stress and is defined as the fractional change of the length of the objectthe object experiences the stress of traction =ΔLL0.tensile strain=ΔLL0. 12.35 compressed stress and tension are defined by the same formulas, equation 12.34 and12.35, respectively. The only difference from the traction situation is that of stress and compressed tension, we take absolute values of the right sides in equation 12.34 and equation 12.35. Figure 12.18 When an object is in tension or compression, the net force on it is zero, but the object deforms by changing the original length l 0. L 0. (a) Voltage: the barrel is elongated by Î "l. Î "l. (b) compression: the rod is contracted by Î "l. "l. In both cases, the deformation force acts along the length of the rod and perpendicular to its cross section. In the linear range of low stress, the cross section area of the auction does not change. The Y-Young module is the elastic module when deformation is caused by a tensile or compressed stress and is defined by equation 12.33. Dividing this equation by tensile voltage, we obtain the expression for the module of young people: y = stress-voltage = fâš ¥ / aî "l / l0 = fâš ¥ al0î" ly = stress tension tension tension tension tension tension tension tension tension tension tension tension clindrical = fâš ¥ / aî "L / l0 = fâš weigh ¥ al0î" l The cross section area of the pillar is 0.20 m20.20 m2 and is made of granite with a mass density of 2700 kg / m3.2700 kg / m3. Find the compressed stress in the cross section located at 3.0 m below the top of the pillar and the value of the compressed strain of the Top 3.0-M segment of the pillar. Figure 12.19 Nelson column in Trafalgar Square, London, England. (Credit: change of work by Cristian Bortes' strategy) First we find the weight of the section above 3.0 m-long of the pillar. The normal force acting on the cross section located at 3.0 m upwards is the sum of the weight of the pillar and the weight of the sculpture. Once we havenormal force, we ointment equation 12.34 to find stress. to find the compressed strain, we find the value of the module of young's granite module in table 12.1 and reverse equation 12.36. solution solution solutionVolume of the pillar segment with height H = 3.0 MH = area from 3.0 ME transverse a = 0.20m2a = 0.20m2 Ã ̈ V = AH = (0.20 m 2) (3.0 m) = 0.60 m 3. v = a h = (0.20 m 2) (3.0 m) = 0.60 m 3. with granite density Ã ̄ = 2.7Ãƒ-103kg / m3, Ã ̄ = 2.7Ãƒ-103kg / m3, the mass of the pillar segment is m = Ã ̄ v = (2.7 Ãƒ- 10 3 kg / m 3) (0.60 m 3) = 1.60 Ãƒ- 10 3 kg. m = Ã ̄ v = (2.7 Ãƒ- 10 3 kg / m 3) (0.60 m 3) = 1.60 Ãƒ- 10 3 kg. The weight of the pillar segment is wp = mg = (1.60 Ãƒ- 10 3 kg) (9.80 m / s 2) = 1,568 Ãƒ- 10 4 N. wp = mg = (1.60 ã ƒ- 10 3 kg) (9.80 m / s 2) = 1.568 Ãƒ- 10 4 N. The weight of the sculpture is WS = 1.0Ãƒ-104N, WS = 1.0Ãƒ-104N, then the normal force On the surface of the cross-section located at 3.0 m under the sculpture is f Ã ¢ Ã ¢ Ã ¥ = wp + ws = (1.568 + 1.0) Ãƒ- 10 4 n = 2.568 Ãƒ- 10 4 No. f Ã ¢ Ã¡ ¥ = wp + ws = (1.568 + 1.0) Ãƒ- 10 4 n = 2.568 Ãƒ- 10 4 n. therefore, stress is stress = f Ã ¢ Ã ¥ a = 2.568 ƒ- 10 4 n 0.20 m 2 = 1,284 Ãƒ- 10 5 Pa = 128.4 kPa. Stress = f Ã ¢ å¡ ¥ a = 2.568 Ãƒ- 10 4 n 0.5 m 2 = 1.284 Ãƒ- 10 5 pa = 128.4 kPa. The Young's modulus module for granite is y = 4.5Ãƒ-1010pa = 4.5Ãƒ-107kpa.y = 4.5Ãƒ-1010pa = 4.5Ãƒ-107kpa. Therefore, the compressive strain in this position is strain = stress y = 128.4 kPa 4.5 Ãƒ- 10 7 kPa = 2.85 Ãƒ- 10 Ã ¢ '6. stress = stress y = 128.4 kPa 4.5 Ãƒ- 10 7 kPa = 2.85 Ãƒ- 10 Ã ¢ '6. Meaning note that the normal force that acts on the area of the cross section of the pillar is not constant along its length, but varies from its smallest value to its larger value in the lower part of the pillar. So if the pillar has a uniform cross-sectional area along its length, stress is larger at its base. Find the compressive stress and the effort at the base of the Nelson column. Stretching an auction a 2.0 m-long steel rod has a transverse area of 0.30 cm2.0.30cm2. The auction is a part of a vertical support that contains a heavy 550 kg platform that hangs attached to the Lower of the cane. Ignoring the weight of the auction, what is traction stress in the auction and e extension of the rod under stress? Strategy First we compute the stress of traction in the rod under the weight of the platform in accordance with Equation 12.34. Then we reverse the equation 12.36 to find the length of the rod, using L0=2.0m. 1,8 × 10.0 × 10.0 χ 1,8 × 1,8 × 1,8 × 1,8 × 10.0 × 10.0 × 10.0 x 1,8 χ 1,8 χ 1,8 χ 1,8 χ 1,8 χ 1,8 χ 1,8 χ 1,8 χ 1,8 χ 1,8 m Unlike the previous example, however, if the weight of the rod is taken into consideration, the stress in the rod is larger up and smaller at the bottom of the bar where the equipment is attached. A 2,0 m long wire stretches 1.0 mm when subjected to a load. What is the tension of traction in the wire? Objects can often experience both compression stress and traction stress at the same time Figure 12.20. An example is a long shelf loaded with heavy books that sag between the end supports under the weight of books. The upper surface of the shelf is in compression pressure and the lower surface of the shelf is in tension. Similarly, long and heavy beams are sag under their weight. In modern construction, such bending strains can be almost eliminated with the use of I-beams Figure 12.21. Figure 12.20 (a) An object that bends down experiences the transile stress (stretching) in the upper section and compression stress (compression) in the lower section. (b) Elite weight lifters often fold iron bars temporarily during lifting, as in the 2012 Olympic competition. (credit b: change of Oleksandr's workFigure 12.21 I-rays Steel are used in the construction to reduce bending strains. (Credit: modification of the work of Ã ¢ â,¬ Å "US Army Corps of Engineers Europe DistrictÃ ¢ â,¬ / Flickr) A heavy box rests on a table supported by three columns. View this demonstration to move the box to see how compression (or voltage) in the columns is interested when the box changes its position. When you immerse yourself in the water, you feel a force that I press on every part of your body from all directions. What you are experiencing, then it's bulk stress, or in other words, pressure. Wholesale stress always tends to decrease the volume enclosed by the surface of a submerged object. The forces of this Ã ¢ â,¬ Å "squeezing" are always perpendicular to the submerged surface figure 12.22. The effect of these forces is to decrease the volume of the submerged object by an amount Ãž "vî ±" V Compared to the V0V0 volume of the object in the absence of bulk stress. This type of deformation is called mass effort and is described by a volume change relative to the original volume: wholesale voltage = Ãž "VV0.Bulk strain = Ãž "VV0. 12.37 Figure 12.22 An object under the increasing bulk stress always suffers a decrease in its volume. The equal forces perpendicular to the surface act from all directions. The effect of these forces is to reduce the volume for quantity Ãž "v Ãž" v compared to the original volume, v 0. v 0. The sudden voltage results from the loose stress, which is a force fÃ ¢ Ã ¥ ¥ ¢ Ã ¥ normal to a surface that presses On the surface of the unit to a submerged object. This type of physical quantity or pressure P, Ã ¨ Defined as pressure = pÃ, â¡fÃ ¢ Ã ¥ a.pressure = pÃ, â € œâ € ¢ Ã â ¥ a. 12.38 We will study the pressure in fluids in greater detail in fluid mechanics. An important feature of the pressure is that it is a scalar quantity and has no particular direction; ie, the pressure acts In all possible directions. When you dive your hand in water, perceive the same quantity of pressure acting on the upper surface of the hand as on the bottom background or on the lateral surface, or on the skin surface between the fingers. what you are feeling in this case is an increase in pressure on what you are oated to feel when your hand is not immersed in water. what you feel when your hand is not immersed in water is the normal pressure p0p0 of an atmosphere, which acts as a reference point. wholesale stress is this increase in pressure, or î "p, î" p, beyond normal level, P0.P0. when wholesale stress increases, bulk voltage increases in response, in accordance with equation 12.33. the constant of proportionality in this relationship is called the bulk form, b, or b = stress flux = â 'pî v / v0 = â'â'î pv0î vb = â "" pv0î "vb = bulk stressbulk strain = â'î" pî "v / v0 = â'î" pv0î "v. the sign less that appears in the equation 12.39 quantity is to guarantee Note that the minus sign (â€ ") (â€") is necessary because an increase in pressure (a positive amount) always causes a decrease of the "Vα" v in volume and decrease of the volume is to negative amount the reciprocal flux module is called compressed k, k or k = 1b = â'" v / v0 " P.K = 1b = â€ * " fluids characterized by a great compressibility are relatively easy to compress. For example, the compressibility of water is 4.64Ã-10 '5 / atm4.64Ã-10â '5 / atm and the compression of acetone is 1,45Ã-10 '/ atm.1.45Ã-10â'4 / atm. This means that under an increase of pressure from 1.0-ATM of pressure, the relative decrease of the volume is about three times larger for acetone as it is for water. hydraulic press in a hydraulic press figure 12.23, a 250 litre oil volume is subjected to an increase in pressure2300 PSI. If oil compression is 2.0Ãƒ-10 / '5 / atm, 2.0Ãƒ-10Ã ¢' 5 / ATM, finds the mass voltage and the absolute decrease in oil volume when printing is TO Figure 12.23 In a hydraulic press, when a small piston is moved down, the pressure in the oil is transmitted through the oil to the large piston, causing the large piston to move up. A small force applied to a small piston causes a great pressing force, which the large piston exercises on an object that is raised or pressed. The device acts as a mechanical lever. Strategy We must reverse equation 12.40 to find the mass. First, we convert the pressure increase from psi to atm, Δp=2300psi=2300/14.7atm≈160atm,Δp=2300psi=2300/14.7atm≈160atm, Δ Δ V=250L.V0=250L. Δ V = 0.0032 V = 0.0032 V = 0.032 = 0.032 L = 0 If the normal force acting on each face of a piece of cubic steel 1.0-m31.0-m3 has changed by 1.0×107N,1.0×107N, find the resulting change in the volume of the piece of steel. The concepts of stress and tension of the belt concern only solid objects or materials. Roof buildings and plaques are examples of objects that can be subjected to cutting stress. In general, these concepts do not apply to fluids. The deformation of the shears occurs when two equal-sized antiparallel forces are applied tangential to opposite surfaces of a solid object, without causing deformations in the transverse direction to the force line, as in the typical example of the cutting stress illustrated in Figure 12.24. The deformation of the belt is characterized by a gradual shift ΔxΔx of layers in the tangent direction to theForces. This gradation in ΔxΔx occurs in the transverse direction along a certain distance L0. L0. The cut strain is defined by the ratio of the largest shift ΔxΔx to the transverse distance L0L0 cutting strain=ΔxL0.shear strain=ΔxL0.41 The strain is caused by stress. The stress for shears is due to forces acting parallel to the surface. We use the F.F. symbol for such forces. The F diF superficie magnitude for surface A where the cutting force is applied is the measurement of stress cutting stress = F=A.shear stress=F.A. 12.42 The cutting module is the constant proportionality in the Equation 12.33 and is defined by the stress to stress ratio. The cutting module is commonly denoted by S: S=shear stressshear strain=F di/AΔx/L0=F.AL0Δx. S = cutting stress strain=F di/AΔx/L0=F.AL0Δx. Figure 12.24 An object under cutting effort: two equal magnitude antiparallele forces are applied tangentially to opposite parallel surfaces of the object. The contour of the dotted line depicts the resulting deformation. There is no change in the transversal direction to the forces of action and the transversal length L 0 L 0 is not affected. The deformation of the shears is characterized by a gradual shift Δ x Δ x of layers in the tangent direction to the forces. An old book A cleaning person tries to move an old heavy library on a carpeted floor pushing tangential on the surface of the shelf much higher. However, the only obvious effect of this effort is similar to that seen in Figure 12.24, and disappears when the person stops pushing. The bookcase is 180.0 cm high and 90.0 cm wide with four shelves of 30.0 cm, all partially loaded with books. The total weight of the bookcase and books is 600.0 N. If the person gives the upper shelf a 50.0-N push that moves the upper shelf horizontally 15,0 cm compared to the lower shelf, find thecutting the library. strategy the only relevant information is the physical size of the library, the value of theTangential force, and moving this force causes. we identify F di=50.0N,Δx=15.0cm,F,=50.0N,Δx=15.0cm, L0=180.0cm,L0=180.0cm, and A=(30.0 cm)(90.0 cm)=2700.0cm2,A=(30.0 cm)(90.0 cm)=2700.0cm2, and we oiamo equation 12.43 to calculate the cutting module. replace the numbers in the equations, we obtain for the cutting module s = f di a l 0 Δ x = 50.0 n 2700.0 cm 2 180.0 cm . 15.0 cm . = 2 9 n cm 2 = 2 9 × 10 4 n m 2 = 20 9 × 10 3 pa = 2.222 kpa. s = f . a l 0 x = 50.0 n 2700.0 cm 2 180.0 cm. we can also find the stress and stress of the barrel, respectively: f di a = 50.0 n 2700.0 cm 2 = 5 27 kpa = 185.2 pa Δ x l 0 = 15.0 cm 180.0 cm = 1 12 = 0.083 . f ∥ a = 50.0 n 2700.0 cm 2 = 5 27 kpa = 185.2 pa Δ x l 0 = 15.0 cm 180.0 cm = 1 12 = 0.083 imported if the person in this example has given the healthy hem much the same cutting mechanism is responsible for faults of dams and levers filled with earth; and, in general, for landslides. explain why the concepts of the young module and the cutting module do not apply to fluids. fluids.

what is elongation in physics. what is the meaning of elongation. what does elongation mean. what is meant by elongation