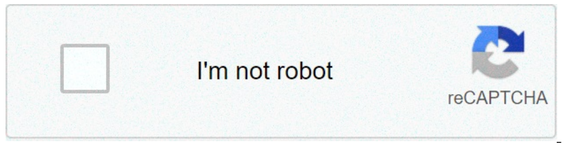

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Bolt torque calculation formula metric

"Whoa, you really went from zero to sixty there!" Have you ever heard someone use the idiom "zero to sixty" like I did in the above example? When someone says something went from "zero to sixty," they’re really saying that things accelerated very quickly. Acceleration is the amount by which the velocity of something changes over a set period of time. In this article, we’ll be talking all about acceleration: what it is and how to calculate it. Buckle up! What Is Acceleration? Acceleration is the rate of change of velocity over a set period of time. You need to have both velocity and time to calculate acceleration. Many people confuse acceleration with velocity (or speed). First of all, velocity is simply speed with a direction, so the two are often used interchangeably, even though they have slight differences. Acceleration is the rate of change of velocity, meaning something is getting faster or slower. What Is the Acceleration Formula? You can use the acceleration equation to calculate acceleration. Here is the most common acceleration formula: $$a = {Δv}/{Δt}$$ where $Δv$ is the change in velocity and $Δt$ is the change in time. You can also write the acceleration equation like this: $$a = {v(f) - v(i)}/{t(f) - t(i)}$$ In this acceleration equation, $v(f)$ is the final velocity while is the $v(i)$ initial velocity. $T(f)$ is the final time and $t(i)$ is the initial time. Some other things to keep in mind when using the acceleration equation: You need to subtract the initial velocity from the final velocity. If you reverse them, you will get the direction of your acceleration wrong. If you don’t have a starting time, you can use “0”. If the final velocity is less than the initial velocity, the acceleration will be negative, meaning that the object slowed down. Now let’s breakdown the acceleration equation step-by-step in a real example. How to Calculate Acceleration: Step-by-Step Breakdown Now we’ll breakdown the acceleration formula step-by-step using a real example. A race car accelerates from 15 m/s to 35 m/s in 3 seconds. What is its average acceleration? First, write the acceleration equation. $$a = {v(f) - v(i)}/{t(f) - t(i)}$$ Next, define your variables. a = what we are solving for $$V(f) = 35 m/s$$ $$V(i) = 15 m/s$$ $$T(f) = 3 s$$ $$T(i) = 0 s$$ Now, plug your variables into the equation and solve: $$A = {{(35 - 15)m}/{s}/{(3 - 0)s}$$ $$A = {(35 - 15)}/{(3 - 0)} m/s^2$$ $$A = {20/3} m/s^2$$ $$A = 6.66 m/s^2$$ Let’s try another example. A cyclist traveling at 23.2 m/s comes to a complete stop in 1.5 s. What was her deceleration? First, write the acceleration equation. $$a = (v(f) - v(i)) ÷ (t(f) - t(i))$$ Next, define your variables. a = what we are solving for $$V(f) = 0 m/s$$ $$V(i) = 23.2 m/s$$ $$T(f) = 1.4 s$$ $$T(i) = 0 s$$ Now, plug your variables into the equation and solve: $$A ={{(0 - 23.2)m}/s}/{(1.4 - 0)s}$$ $$A = {0 - 23.2}/{1.4 - 0} m/s^2$$ $$A = -23.2/1.4 m/s^2$$ $$A = -16.57 m/{s^2}$$ 2 Other Common Acceleration Formulas Wondering how to calculate acceleration using a different formula? There are several other common acceleration formulas. Angular Acceleration Formula Angular acceleration is the rate at which the angular acceleration of a rotating object changes with respect to time. Here is the angular acceleration equation: $$a = {\change \in \angular \velocity}/{\change \in \time}$$ Centripetal Acceleration Formula Centripetal acceleration is the rate of motion of an object inwards towards the center of a circle. Here is the centripetal acceleration equation: $$a(c) = {v^2}/r$$ $a(c) $= acceleration, centripetal v = velocity r = radius Key Takeaways Acceleration is the rate of change of velocity over a set period of time. You calculate acceleration by dividing the change in velocity by the change in time. What's Next? Looking for other science explanations? We break down electrical energy and how to identify the different types of clouds with our expert guides. Working on a research paper but aren't sure where to start? Then check out our guide, where we've collected tons of high-quality research topics you can use for free. Need help with English class—specifically with identifying literary devices in texts you read? Then you'll definitely want to take a look at our comprehensive explanation of the most important literary devices and how they're used. PV Calculator (Click Here or Scroll Down) Present Value (PV) is a formula used in Finance that calculates the present day value of an amount that is received at a future date. The premise of the equation is that there is "time value of money". Time value of money is the concept that receiving something today is worth more than receiving the same item at a future date. The presumption is that it is preferable to receive $100 today than it is to receive the same amount one year from today, but what if the choice is between $100 present day or $106 a year from today? A formula is needed to provide a quantifiable comparison between an amount today and an amount at a future time, in terms of its present day value. Use of Present Value Formula The Present Value formula has a broad range of uses and may be applied to various areas of finance including corporate finance, banking finance, and investment finance. Apart from the various areas of finance that present value analysis is used, the formula is also used as a component of other financial formulas. An individual wishes to determine how much money she would need to put into her money market account to have $100 one year today if she is earning 5% interest on her account, simple interest. The $100 she would like one year from present day denotes the C1 portion of the formula, 5% would be r, and the number of periods would simply be 1. Putting this into the formula, we would have When we solve for PV, she would need $95.24 today in order to reach $100 one year from now at a rate of 5% simple interest. Alternative Formula The Present Value formula may sometimes be shown as Return to Top Damien Scogin/Demand Media In the theory of mechanics, torque is a twisting force applied to an object. The force is applied by a lever which can be real or imaginary; the longer the lever or greater the force, the greater the torque. You express the units of torque as the length of the lever times force, with examples being foot-pounds or newton-meters. Gears are useful for multiplying or dividing torque, whether the gears mesh directly or through a belt or chain; the ratio of the size of the gears determines whether they increase or decrease torque. To calculate gear ratios and the effect they have on torque, you need the size of each gear and the torque acting on the first gear, which mechanics call the “driver.” Multiply the force acting on the first gear by the first gear's radius. If, for instance, a force of 4,000 newtons acts on the gear, and it measures 0.15 meters in radius, 4,000 x 0.15 = 600. The gear turns with 600 newton-meters of torque. Divide the second gear's radius by the first gear's. If the second gear, for instance, measures 0.3 meters in radius: 0.3 / 0.15 = 2. The system's gear ratio is 2-to-1. Multiply the gear ratio by the input torque that you calculated in Step 1: 2 x 600 = 1,200 newton-meters. This is the gearbox's output torque. car wheel wrench image by Christopher Dodge from Fotolia.com Rotational torque measures a force's tendency to rotate an object. To calculate it, you need to know how large the force is and the length between the axis and the point of force application. Convert force to Newtons (N). To convert pounds to Newtons, multiply by 4.45. For example, if force equals 100 lbs.: 100 * 4.45 = 445 N 100 lbs. of force is equal to 445 Newtons. Convert length to meters. To convert feet to meters (m), multiply by 0.3. For example, if length equals 2 feet: 2 * 0.3 = 0.6 meters 2 feet of length is equal to 0.6 meters. Multiply force by length to calculate torque, which is measured in Newton meters (Nm): 445 * 0.6 = 267 Nm bolt image by martini from Fotolia.com Manufacturers of bolts and/or machines establish torque specifications for their components and the nuts and bolts that hold them together. Bolt torque, the amount of force required to tighten a bolt, is listed according either to the Society for Automotive Engineers (SAE), which uses U.S. measurements, or to metric units. Metric bolt sizes are listed according to diameter, distance between threads and length. A bolt might be listed as 12 x 1.75 x 30. This indicates that the bolt has a diameter of 12 mm, that the distance between each bolt thread is 1.75 mm and that the bolt is 30 mm long. In the metric system, bolts are given grades according to its size, composition and design. The grades, or classes, include such common ones as Class 8.8 and Class 10.9. Different bolt sizes and grades have different torque specifications. For example, 6 mm bolts with a 10.9 grade have a maximum torque value of 10 foot-pounds, while the same-size bolts with a 12.9 grade have a maximum torque value of 12 foot-pounds. Consult your shop manual for the most precise listings. To determine torque yourself, follow the formula T = K x U x D x P, where T is torque, K is 1.33, U is the coefficient of friction, D is diameter and P is preload. Use 0.2 as the coefficient of friction for un-lubed bolts and 0.09 for lubed bolts. To determine preload, take the published ultimate strength of the bolt, multiply it by the bolt's thread area and by 2/3. torque wrench in box image by Christopher Dodge from Fotolia.com Properly setting the torque on a nut or bolt requires you to use a torque wrench. The nuts or bolts you are working with, though they are steel or metal, are designed to stretch when tightened. A specific amount of torque applied to them will stretch them to the required amount, keeping them tight. Torque is used on fasteners from lug nuts to bolts in the engine or interior of your car. Applying that torque properly is critical to the success of the fastener in its intended use. Locate the torque specification for the fastener you are working with. In most applications, the manufacturer will supply these specs and publish them in repair or owner's manuals. The specification may be in foot-pounds, inch-pounds or a metric equivalent. Make sure you have a torque wrench to fit your needs. Set your torque wrench to the specified torque. On most modern torque wrenches, the torque is set by turning the handle of the wrench until the top edge lines up with a mark on the barrel of the wrench. The torque wrench may be marked in standard and metric units, so double check the scale you are using on the wrench or you may over-torque the fastener. Choose an appropriate-size socket to fit the fastener you are working with and install it on the torque wrench. Snap the socket onto the square drive of the torque wrench just like you would on a ratchet. Make sure the socket fits the fastener correctly, as applying torque will damage or strip the fastener. Place the socket and torque wrench on the fastener and tighten the bolt, holding the torque wrench by the handle at the end of the wrench. Rotate the torque wrench slowly and smoothly, continuing through the arc until the wrench clicks. The click indicates that you have reached the desired torque. Do not tighten beyond this point or damage with occur to the fastener.
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