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In nursing school, you will be required to show proficiency knowledge in drug dosage and calculations problems. In this article and video you will learn how to solve IV drug preparation problems. In the hospital setting, you may be requires to give Morphine 2 mg IV and the vial you are dispensed from pharmacy may say on it “4 mg/ml”. As a nurse, you will have to know how many ml you will need to draw up with your syringe before you give the medication to the patient. Dimensional analysis is an easy problem-solving method to help you determine how much of a medication you should give based on the doctor’s order. How to use Dimensional Analysis in Solving IV Drug Calculations Before watching the video, be sure to download the worksheet that correlates with the material in the video. You can solve the drug problems as Sarah works them.   Free Quizzes After you are done watching this video tutorial, test your knowledge by taking the IV bolus quiz. IV Bolus Dosage Problems Solved using Dimensional Analysis 1. MD orders Morphine 0.5 mg IV every 4 hours as needed for pain. The vial is labeled 2 mg/ml. How many mL will you give per dose? 0.5 mg x 1 ml = 0.5 = 0.25 ml/dose ? dose 2 mg 2 2. MD orders Versed 4 mg IV pre-procedural. The vial is labeled 1 mg/ml. How many mL will you give per dose? 4 mg x 1 ml = 4 = 4 ml/dose ? dose 1 mg 1 3. MD orders Heparin 100 units subq daily. The vial is labeled 50 units/mL. How many mL will you give per dose? 100 units x 1 ml = 100 = 2 ml/dose ? dose 50 units 50 4. MD orders Benadryl 25 mg IV as needed for itching. The vial is labeled 1000 mcg/ml. How many mL will you give per dose? 25 mg x 1,000 mcg x 1 ml = 25,000 = 25 ml/dose ? dose 1 mg 1,000 mcg 1,000 5. MD orders Digoxin 0.125 mg IV stat. The vial is labeled 500 mcg/2ml. How many mL will you give per dose? 0.125 mg x 1,000 mcg x 2 ml = 250 = 0.5 ml/dose ? dose 1 mg 500 mcg 500 Estimated Read Time: 9 minute(s)Common Topics: physical, dimensions, quantities, relationship, dimensionAs a university teacher and as a PF member, I have often noted that students are largely unaware of or not using dimensional analysis to help them in their pursuit of knowledge or to check their results. Several recent threads on PF have also highlighted this issue. The intent of this Insight is therefore to provide a basic introduction to the subject with several examples with which the reader may be familiar. The discussion on the Buckingham pi theorem is a bit more involved and can be skipped without missing the basic concepts.What is physical dimension?A common misconception when dimensional analysis is invoked is that students mix up the subject with several spatial dimensions, which is not what we want to discuss here. Instead, physical dimensions refer to the type of quantity we are dealing with. It is related to, but not the same as, what units we can use to describe a physical quantity. For example, a length can be measured in centimeters or inches, but an area cannot. Likewise, an area cannot be measured in centimeters or inches but must be measured in squared length units. It would be inconsistent to say that a table had an area of 42 cm, but it could have an area of 1.3 m##^2##. While a centimeter is not the same thing as an inch, they are both examples of units of length. In physics, the physical dimension of a quantity refers to the type of units that must be used to describe it. The basic construction blocks of dimensional analysis are the so-called base dimensions, this is a set of physical dimensions, which to an extent is a matter of convention, that can be used to build the physical dimension of any quantity. In the SI convention, there are seven base dimensions given in the following table:Base dimensionNotationLength##\mathsf{L}##Time##\mathsf{T}##Mass##\mathsf{M}##Temperature##\mathsf{\Theta}##Electric current##\mathsf{I}##Substance amount##\mathsf{N}##Luminous intensity##\mathsf{J}##In the rest of this Insight, we will mainly work with the first few of these, but it can be of interest to see the full table. In terms of notation, we will denote the physical dimension of a quantity ##q## as ##[q]##. For example, for a length ##\ell## we would have ##[\ell] = \mathsf L##.Note that other conventions may have other definitions of what base dimensions exist. For example, in natural units, there is only a single base dimension that may be taken to be either ##\mathsf M##, ##\mathsf L##, or ##\mathsf T##. We will not dig further into this issue here.The physical dimensions of quantitiesSo how do we actually deal with physical dimensions of a quantity? How do we figure out which physical dimension is appropriate? First of all, there are some ground rules that we must adhere to (the ##q_i## here refer to physical quantities):In order for a relationship between two physical quantities (##q_1 = q_2##, ##q_1 < q_2##, etc) to be meaningful, they must have the same physical dimension. In essence, you have to compare apples with apples.In order to add or subtract physical quantities, they must have the same physical dimension. For example, you cannot subtract an energy from a length. In other words, if ##[q_1] eq [q_2]##, then ##q_1 + q_2## is nonsensical.If you multiply two physical quantities, the resulting product is a new physical quantity with a physical dimension equal to the product of the dimensions of the original quantities, i.e., ##[q_1q_2] = [q_1][q_2]##. The same goes for ratios, ##[q_1/q_2] = [q_1]/[q_2]##.Any physical relationship will be a relationship between one or more physical quantities ##q_i##. The typical thing would be to write a physical relationship between these quantities as an equality of some sort, often in the form $$q_1 = f(q_2, q_3, \ldots).$$Example: For a resistor in an electric circuit, there is a relationship between the voltage ##V## across the resistor, the current ##I## through the resistor, and the resistance ##R## of the resistor. This relationship is Ohm’s law $$ V = IR, $$ which is of the form given above with ##q_1 = V##, ##q_2 = I##, ##q_3 = R## and ##f(q_2,q_3) = q_2 q_3##.In what follows, it will be convenient for us to rewrite any physical relationship between ##k## quantities as $$ g(q_1, \ldots, q_k) = 0, $$ where ##g## is dimensionless, i.e., its physical dimension is 1. Note that this is possible in our original definition by letting $$ g(q_1, \ldots, q_k) = \frac{f(q_2, \ldots, q_k)}{q_1} – 1. $$Using dimensional analysis to check your resultsDimensional analysis can be a very powerful tool in checking that the result of your computations makes sense. This is particularly useful to find errors caused by carelessness when you need long and complicated computations to arrive at a final result. You can do this check by checking that all of your sums and differences are sums and differences of physical quantities with the same dimension and that the dimensions match up in your final result.Example: For some reason, let us assume that you are doing introductory kinematics and after some computations end up with the relationship $$ s = v_0 t + \frac{a^2t^2}{2}, $$ where ##s## is the displacement, ##v_0## the initial speed, ##a## the acceleration, and ##t## the elapsed time. Having taken kinematics, most of you will realize that the acceleration ##a## should not be squared in the correct expression, but assuming that we did not already know this, how could we conclude that the relationship is wrong using dimensional analysis? Well, looking at the left-hand side of the relationship, we find that ##[s] = \mathsf L## so all of the terms on the right-hand side must also have dimension ##\mathsf L##. Checking each of the terms leads to $$ [v_0 t] = [v_0][t] = \frac{\mathsf L}{\mathsf T} \mathsf T = \mathsf L, \qquad \left[\frac{a^2t^2}{2}\right] = [a]^2 [t]^2 = \left(\frac{\mathsf L}{\mathsf T^2}\right)^2 \mathsf T^2 = \frac{\mathsf L^2}{\mathsf T^2} eq \mathsf L. $$ In other words, the second term on the right-hand side does not have the same dimension as the rest of the expression and we must go back and find our error.While the above example is rather rudimentary, similar considerations apply also to situations where it is not at all clear whether the expressions obtained are correct or not. Checking that the dimensions match up is then an invaluable tool.Using dimensional analysis to deduce physical relationshipsNot only can you use dimensional analysis to check your expressions, but it is also useful to deduce the possible form of relationships between physical quantities. This is best illustrated through an example:Example: Consider the kinetic energy ##E## and the mass ##m## of some object. A priori, these two quantities have different physical dimensions (##\mathsf{M L^2/T^2}## and ##\mathsf M##, respectively) and we cannot write down a relationship between them without involving other quantities. The missing quantity is the velocity ##v## at which the object travels, which has physical dimension ##[v] = \mathsf{L/T}##. Let us, therefore, see if we can find a product involving ##m## and ##v## that has the appropriate physical dimension to describe kinetic energy. Any such product will be on the form $$ E = k m^\alpha v^\beta, $$ where ##k## is some dimensionless constant that we will not be able to fix using dimensional analysis alone. For this relationship to make sense, we must have $$ [E] = \frac{\mathsf{M L^2}}{\mathsf T^2} = [m]^\alpha [v]^\beta = \frac{\mathsf{M^\alpha L^\beta}}{\mathsf T^\beta}. $$ Since the physical base dimensions are independent, we must therefore have $$ 1 = \alpha, \qquad 2 = \beta, \qquad -2 = -\beta, $$ from equating the powers of mass, length, and time on the left- and right-hand side of the expression. This has the unique solution ##\alpha = 1##, ##\beta = 2## and therefore $$ E = k m v^2. $$ Note again that we cannot determine ##k## from dimensional analysis, we only know that it is dimensionless. We need to look at the actual theory of dynamics to deduce that ##k = 1/2##. Physicists often expect that dimensionless quantities like this should not be much bigger or smaller than one.The Buckingham pi theoremArguably the most important result in dimensional analysis is the Buckingham pi theorem. It is stated as follows:Consider a physical relation ##f(q_1,\ldots,q_n) = 0##, where the dimensions of the variables ##q_i## can be constructed from ##k## independent physical dimensions. There then exists ##n-k## independent dimensionless products ##\pi_a## of the variables ##q_i## and the relation can be rewritten on the form ##F(\pi_1,\ldots, \pi_{n-k}) = 0##.Note that even if the dimensions of the variables include several base dimensions, how those appear may not be independent and so the number of independent physical dimensions may be less than the number of base dimensions.Example: Consider the relationship between force ##F##, mass ##m##, and acceleration ##a##. Although these quantities involve the base dimensions ##\mathsf M##, ##\mathsf L##, and ##\mathsf T##, they do so in a manner such that there are only two independent physical dimensions, which may be taken to be ##\mathsf M## and ##\mathsf{L/T^2}##. Since we have three physical quantities and two independent physical dimensions, we have a single independent dimensionless combination, which can be taken to be $$ \pi = \frac{ma}{F}. $$ The Buckingham pi theorem then states that a physical relationship among these quantities must take the form ##g(\pi) = 0##, i.e., ##\pi## must have a value ##\pi_0## that is a zero of the function ##g##. This means that $$ \pi = \frac{ma}{F} = \pi_0 \quad \Longrightarrow \quad \pi_0 F = ma. $$ As above, we cannot conclude that ##\pi_0 = 1## from dimensional analysis alone, but we know that the relation must take this form.So how do we arrive at the Buckingham pi theorem? First of all, let us order our quantities ##q_i## in such a way that the first ##k## all have independent physical dimensions. Since we only have ##k## independent physical dimensions, the remaining ##n-k## quantities have a physical dimension as some product of the first ##k##. In other words, we know that $$ [q_{a+k}] = \prod_{i=1}^k [q_i]^{\alpha_{ai}} $$ for all ##a \geq 1## and for some numbers ##\alpha_{ai}##. We now introduce the combinations $$ Q_a = \prod_{i=1}^k q_i^{\alpha_{ai}} $$ and note in particular that each ##Q_a## is a function only of the first ##k## quantities. Furthermore, we can construct the dimensionless combinations $$ \pi_a = \frac{q_{a+k}}{Q_a}. $$ Given that any physical relationship between the quantities must take the form ##f(q_1,\ldots,q_n) = 0## for a dimensionless function ##f##, we can replace the last ##n-k## quantities by the corresponding product ##q_{a+k} = \pi_a Q_a## and therefore define a new function ##F(q_1, \ldots, q_k, \pi_1,\ldots, \pi_{n-k})## according to $$ F(q_1, \ldots, q_k, \pi_1,\ldots, \pi_{n-k}) = f(q_1, \ldots, q_k, \pi_1 Q_1, \ldots, \pi_{n-k} Q_{n-k}) = 0. $$ Now, since the remaining ##q_i## have an independent physical dimension, any dependence on the ##q_i## is inconsistent with ##F## being a dimensionless function. It must therefore hold that $$ F(q_1, \ldots, q_k, \pi_1,\ldots, \pi_{n-k}) = F(\pi_1,\ldots, \pi_{n-k}) = 0, $$ i.e., we have arrived at the Buckingham pi theorem.One important special case of the Buckingham pi theorem occurs when we have one more physical quantity than we have independent physical dimensions. This was the case in our example above discussing Newton’s second law as well as our example of Ohm’s law. In this scenario, we will only have a single dimensionless combination ##\pi## and that combination must be equal to some constant (i.e., a zero of the function ##F##). However, it is important to remember that the Buckingham pi theorem is more general than this. For example, if there are two independent dimensionless combinations ##\pi_1## and ##\pi_2##, then the physical relationship is of the form $$ F(\pi_1, \pi_2) = 0, $$ i.e., the combination ##(\pi_1,\pi_2)## must lie on the zero level curve of ##F##. Determining this level curve then becomes the task of modeling and/or experimenting.Example: Let us go back to the kinematics example, where we were looking at a physical relationship between displacement ##s##, initial velocity ##v_0##, acceleration ##a##, and elapsed time ##t##. These quantities depend only on the base dimensions ##\mathsf L## and ##\mathsf T## and so two dimensionless combinations can be taken to be $$ \pi_1 = \frac{at}{v_0}, \quad \pi_2 = \frac{as}{v_0^2}. $$ If ##F(\pi_1, \pi_2)## is invertible for a fixed ##\pi_2##, the physical relationship can be written on the form $$ \pi_2 = \frac{as}{v_0^2} = G(\pi_1) \quad \Longrightarrow \quad s = \frac{v_0^2}{a}\, G(at/v_0). $$ Generally, the function ##G## here must be determined through modeling or experiment. However, we know that the result in this particular case is $$ G(\pi_1) = \pi_1 + \frac{\pi_1^2}{2}, $$ resulting in $$ s = v_0 t + \frac{at^2}{2}. $$ This relationship is illustrated in the following figure:Left: Displacement ##s## as a function of ##t## for randomly chosen ##v_0## and ##a## (arbitrary units). There is no clear and easily identifiable relationship. Right: The same data but with ##s## and ##t## replaced by the dimensionless quantities ##\pi_2## and ##\pi_1##. The physical relationship is clear and given by ##\pi_2 = \pi_1 + \pi_1^2/2##.I hope you enjoyed the read. If interested, you can read a bit more about dimensional analysis and modeling and reporting results using dimensional analysis in my book.Comment ThreadProfessor in theoretical astroparticle physics. He did his thesis on phenomenological neutrino physics and is currently also working with different aspects of dark matter as well as physics beyond the Standard Model. Author of “Mathematical Methods for Physics and Engineering” (see Insight “The Birth of a Textbook”). A member at Physics Forums since 2014. 0 – Pharmacology Course Introduction1 – NCLEX Must Knows2 – Math for Meds3 – Disease Specific Medications4 – Antianxiety Agents5 – Antiarrhythmics6 – Anticoagulants & Thrombolytics7 – Anticonvulsants8 – Antidepressants9 – Antidiabetic Agents10 – Antihistamines11 – Antihypertensives12 – Anti-Infectives13 – Antipsychotics14 – Autonomic Nervous System Meds15 – Bronchodilators & Respiratory Drugs16 – Diuretics17 – GI Meds18 – Hormone & Immune Related Drugs19 – Lipid Lowering Drugs20 – Mineral and Electrolyte Drugs21 – Mood Stabilizers22 – Non-Opioid Analgesics23 – OB Meds24 – Opioid Analgesics25 – Sedatives / Hyponotics26 – Steroids27 – Vasodilators28 – Vasopressors29 – Medications By Class30- Antineoplastics31 – Medication Infusion Prime Days and Prime Big Deal Days are new savings opportunities! But all these deals are for Prime Members only! Prime Days are July 16-17, this year Early Prime Deals are found here! Prime Day Deals are here! Prime Big Deal Days are an addition to Amazon’s Prime Days. This is another chance for Prime members to discover some of Amazon’s best deals of the season. Incredible deals and deep discounts await you — but only if you are an Amazon Prime member! If you are not a member yet, sign up for a Trial like these: Amazon Prime Free Trial Amazon Prime Student 6-Month Trial Prime Video Free trial Prime Video Channels free trial Head to the Nursing Resources page for specific recommendations. As an Amazon Associate, I earn from qualifying purchases – at NO extra cost to you. This extra income helps to support this website. Thank you! A Brief Introduction to Dimensional Analysis So what's the big idea anyway? 25 practice problems—find out what you can do. Review the Test with Complete Answers Learn dimensional analysis by working through the answers. Conversion Factors for Nursing Students Copy and make your own cheat-sheet. Abbreviations for Nursing Students Know'm and love'm. Med-Math Errors and the Nursing Student Be afraid, be very afraid. You could save a life. My Adventures in Med-Math Or how I came to post so much stuff on this Web site. A Guide to Dimensional Analysis The one-page all-you-really-need-to-know guide. A Critique of Clinical Calculations A unified approach, 4th ed. Dimensional Analysis for Everyone Else Some general examples here. More Examples of Dimensional Analysis Drug calculation quiz I took to get my first job. Palm files and programs you can use. When you're doing applied math numbers have units of measure, or "dimensions," attached to them. There are lots of formulas out there, but here's the big idea: when you plug values into a formula and pay close attention to what happens to the units as the formula is simplified, you'll see that all the units cancel out except those units that end up in your answer. This always happens if the formula is correct and you plug in the appropriate factors. So what someone figured out is that you don't need formulas at all. For every problem you can just take the factors associated with it and arrange them so all the units you don't want cancel out. You're then left with only the units you do want (the ones in your answer). This process is fairly trivial, and with only slight attention to detail, you always get the right answer, bing-bang-boom, every time. The technique has been taught to students of applied science for longer than I have been able to determine and for the sole reason that students using it make fewer mistakes. You pay attention to the units of measure and if they're not canceling out right, you know that you're doing something wrong and that your answer is guaranteed to be wrong. As nurses doing calculations, error is not an option. Passing med-math class may require getting only 80% of test problems right, but coming up with the right answer only four out of five times isn't good enough when real patients are at risk. While mistakes can still be made using any technique, dimensional analysis does the best job of minimizing them. The only fault lies in the name. Perhaps the Math-Weenie-No-Brainer technique would be more appropriate. At any rate, give dimensional analysis a try. At the end of a 12-hour shift, when you're tired, things are crazy, and you have to do a med-math calculation, you'll be glad you did. Eric Lee, RN Haven't read this, but there is a book now (Dimensional Analysis for Meds). If the publisher were to send me a copy, I'd be willing to review it. Visit our Zazzle store: Support this site: Visit our Zazzle store featuring ultra hi-res images of artworks, Hubble/ESA/NASA space images, Mandelbrot fractals, maps and more. Images up to 525 megapixels allow for fine printing at the largest sizes. Give a fine print as a gift that could hang around for a hundred years. Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. All the measurements such as quantity, length, and volume are given with a number and a unit. For example, 2.5 lb, 35 miles, 15 gallons and etc. Now, these units are familiar to you if you live in a country that uses the English system, but they may not be as evident for someone who is in a country where the metric system is used. Kilogram, centimeter, and Celsius which are the measuring units there are probably just as foreign to you. This issue of having inconsistent units spread to scientists too as they were not able to communicate their data accurately across research groups in different countries and therefore, the International System of Units (SI), was set to be the standard for communication. It is based on the metric system, and in today’s article, we will learn some strategies for converting different units including the metric ones. Dimensional Analysis The most common tool used for converting units is the dimensional analysis and it is a convenient approach for doing that. The only thing we need for dimensional analysis is what is called conversion factors and correctly picking them for our conversions. So, what is a conversion factor? These are essentially the ratios of the units for the given quantity. For example, we know that 1 ft is 12 in, and therefore, we can derive two conversion factors by simply getting the ratio of these units: Once we have the conversion factor, we can convert a quantity given in one unit into an equivalent quantity with a different unit by multiplying it with the correct factor. Let’s say we need to calculate how many inches 4.58 ft is. The first step is to write the conversion factors, and we have already got for the ft-in relationship: Step 2. Choose the correct conversion factor. The idea is that we need to cancel the original units into final units which means we need to pick the conversion factor where the initial unit is in the denominator. In this case, it is the second conversion factor since it allows to cancel the ft: All we need to do at this point is multiply the initial number with the conversion factor: Notice that we kept 3 significant figures even though 12 in has only two as written. The reason for this is the conversion factors have an infinite number of significant figures because they are not measured but rather set numbers. In other words, nobody is using a ruler with limited accuracy to tell how many significant figures they think it has. So, for your calculations, the number of significant figures is always going to be limited by the given number and not the conversion factors. Summarizing what we did, we can write the steps as follows: Below are some of the common conversion factors for the length that you are going to need in a general chemistry class: Let’s now try to convert 241 miles to ft. First, we find that 1 mi is 5280 ft, and therefore, the conversion factors are: Out of these, we need to pick the second one since it has the mi in the denominator, and we can cancel them with the initial data: Multi-Step Unit Conversion Sometimes, you may not be given a conversion factor between two units. For example, how many inches is 2.68 km? In these cases, you will need to link the units through in more than one conversion. We can find from the table that 1 km is 1000 m, and 1 m is 100 cm which in turn can be converted to inches because we find that 1 in = 2.54 cm. So, the plan is km → m → cm → in. A great thing about dimensional analysis is that we can combine all the steps in one operation by simply adding the correct conversion factors one by one. You can first write the initial number with the unit, and add a fraction with just units in the correct place: And once we know which units go to the denominator, we can write the correct conversion factors from the table: Another example, convert 1459 km to yards given that 1 m = 1.09361 yd. The plan here would be going from km to m, and m to yd. Keep in mind that there might be several ways of going about the same conversion depending on what factors we have. For example, if we did not have the m-yd conversion, we could go km → m → cm → in → ft → yd based on the data we have in the table. Converting Mass Units There is no difference in what units you are converting – dimensional analysis is always based on the same strategy. For example, how many kilograms is 6.85 lb? Here are some conversion numbers for mass units that we can use to pick suitable factors: Based on these, we can set up a plan lb → g → kg: Converting Volume Units Unlike the mass and the length, there are two types of units for the volume. In one of them, the volume is given in a simple unit such as L, mL, or gallon, which already presume a volume, and the other is when the volume is given cubes. This, in general, is referred to units raised to a power, and for volume, it is the cube. Let’s do an example with a simple volume unit conversion first. Using the conversion factors given below, calculate the volume of 5.26 L water in gallons. To find the correct conversion factors, first look for a unit that is correlated to liters. In this table, it is the qt which is then linked to gallons. Therefore, we can write a two-step conversion using dimensional analysis: Converting Units Raised to Power The most important thing you need to remember here is to raise both the number and unit to the given power. For example, if 1 in = 2.54 cm, then Do not confuse this when the problem says, for example, how many cm2 is 15 in2. You do not want to square 15 because that number whatever it was is already squared and it is the final number with the squared unit. So, to find this in cm2, we write: Converting Volume Units Raised to Power What is the volume of a textbook in cm3 if the sides are 10.5 and 7.90 in respectively and the thickness is 1.85 in? We can first calculate the volume in in3 by multiplying the sides and the thickness: V (in3) = 10.5 in x 7.90 in x 1.85 in = 153.46 in3 Next, we use dimensional analysis to convert in3 to cm3: Converting Quantitates with Two Units A good example of measurements with two units is the speed which is described by the ratio of distance over time. For example, 75 mi/h means the vehicle goes 75 mi per hour. So, let’s say we are asked to express this speed in m/s. This may look confusing at first, but don’t worry – we are going to follow exactly what we have been doing for converting one unit. The only difference is that we repeat the process for the two units as if we are converting separate units. It does not matter which you nit you start with, so we can go with the miles. The conversion plan for miles to meters would be mi → km → m, and therefore we can write the first part as: This part converts the miles to meters and next, we do the same for the hours-seconds by simply adding the conversion factors: So, the first part gets us to meters, and the second part converts the hours to seconds. Notice that because the hour is in the denominator, place it at the top and the minute at the bottom for the first conversion factor. Check Also 1. Perform each of the following conversions. a) 5.98 cm to millimeters b) 65 cm to meters c) 4.87 mm to inches (1 in = 2.54 cm, 1 cm = 10 mm) d) 2894 ft to kilometers (1 mi = 1.609 km) e) 6854 m to miles (1 mi = 1.609 km) f) 548 lb to kilograms g) 451 oz to kilograms h) 1564 mL to gallons (1 gal = 3.785 L) i) 659 mL to quarts j) 72 gal to milliliters k) 482 lb to grams l) 54 quarts to milliliters a) b) c) d) e) f) g) h) i) j) k) l) 2. How many dozen eggs are in 15,652 eggs? 3. How many years are in 5,489 days? 4. How many weeks are in 2.5 centuries? (1 yr. = 52 weeks) 5. Perform each of the following conversions. a) 45 cm2 to in2 b) 59 mm2 to ft2 c) 995 ft2 to m2 d) 2.54 dm3 to in3 (1 dm = 10 cm) e) 4.22 gallons to cm3 (1 L = 1000 cm3) f) 5.64 L to ft3 a) b) c) d) e) f) 6. Would 550 m2 of fabric be enough to upholster 200 chairs if each requires 35.4 ft2 fabric? 7. Convert 16.4 cubic decimeters (16.4 dm3) to gallons, using the following conversion factors: 2.54 cm = 1 in, 231 in3 = 1 gallon, 1 dm = 10 cm 8. 8) Perform each of the following conversions. a) 195 cm/s to mi/h b) 55 km/h to yd/min (1 m = 1.094 yd) c) 45 mi/h to m/s a) b) c) 9. The world record for 100-m dash is 8.58 s. Calculate the average speed of the athlete in mi/h. 10. Assuming constant speed, how long will it take for the athlete to run 500. m if she runs the 100-yard dash in 12.0 s? 11. Ho many liters of soda will be needed for 50 guests if each of them drinks 10. fl. oz. of soda? 12. What is the speed of a car in cm/s if it goes 25 mi/h? 13. Would a car traveling at a constant speed of 62 km/h violate a 40 mi/h speed limit? 14. A kilogram of mandarin costs 1.45 euros. Given the exchange rate of 1 euro = 1.18 dollars, how many lb of mandaring can you by with 5.00 dollars? 15. A 20.0-mL sample of a liquid has a mass of 17.8 g. What is the liquid’s density in grams per milliliter? 16. A sample containing 31.25 g of metal pellets is poured into a graduated cylinder initially containing 11.9 mL of water, causing the water level in the cylinder to rise to 18.7 mL. Calculate the density of the metal. 17. What is the mass of a 2.85 L sample of a liquid that has a density of 0.954 g/mL? 18. What is the volume of 100. g bromine in milliliters if it has a density of 3.10 g/cm3? 19. Complete the missing data for the density, mass, and volume in the following table: Mass Volume Density 2.35 g 0.035 L X g/mL X lb 356 mL 1.56 g/cm3 14.6 kg X gal 4.81 g/mL a) b) c) 20. How many kilograms of honey with a density of 1.40 kg/L are there in a gallon container? 21. The density of iron is 8.96 g/cm3. What is its density in pounds per cubic inch (lb/in3)? 22. The density of iron is 7.86 g/cm3. What is the volume of 5.24 lb of iron expressed in cubic inches? 23. A plastic cylinder has a length of 7.25 in, a radius of 1.26 in, and a mass of 841 g. What is the density of the plastic in g/cm3? 24. What is the radius of a steel sphere that has a mass of 65.0 g and a density of 7.86 g/cm3? You are using an out of date browser. It may not display this or other websites correctly.You should upgrade or use an alternative browser. Insights Fermat's Last Theorem The following downloadable modules (just right click on them and you should be able to save them in Word or PowerPoint format) give a quick review/overview of the process and some practice problems.