Click to verify

Can someone please tell me how to use this feature? For example, I try putting in weights of things I personally way and the mass goes back to whatever. Just want to be accurate with my component weights, not what is calculated by Rocksim. Must be in the settings but I cannot figure it out. I can't make any sense at all out of the Rocksim "Help" manual. Thanks. Have not used Rocksim, but in Open Rocket it is pretty simple. Double click on the component (e.g., Nose Cone) to open the dialog box. In the box, Override is the third tab from the left. Click on Override, check Override Mass, enter the desired weight, then click Close. Rocksim must be similar. Good luck! First make sure mass overide is not on for the complete rocket. Then in the component list click on your component, edit, enter the weighed mass in the overide section, make sure you have overide checked. The calculated mass will remain the same, but the over all mass will change(total rocket mass) according to the mass you entered. Hello, I'm designing a scale model and I'm trying to figure out the maximum volume for an effective separation using standard Aerotech E-G motors without additional pyrotechnics. Is there a formula or rule of thumb to use for such designs. Thanks, Keith per the DMS instructions...2. Installing the Ejection Charge and Ejection Cap2.1 Open the supplied igniter and ejection charge kit and remove the contents.2.2 Place the ejection charge baffle washer into theejection charge well of the motor bulkhead.2.3. WARNING: Do not smoke and ensure thatthere are no open flames or heat sources nearbywhen installing the ejection charge. Open theejection charge vial and dispense the desiredamount of black powder ejection charge into theejection charge well of the motor bulkhead. Useabout of the contents of the vial for 2.6” diameterrockets andsmaller, and theentire vial for 3”and largerrockets. Note:additionalejection chargemay be requiredfor rocketsexceeding Tony 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. 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. Hi, Maybe this is a super simple question but I havent been able to find a direct answer yet. I'm building my first dual deployment kit and have understood the basics, but the one thing I havent been able to figure out is with the ejection charge that comes with the motors. I assume with a drogue charge and the main charge set up that you're just removing it from the motor set up? Not finding a direct answer is understandable. There's not really One Way to go about it You can remove it if you want and use it for the drogue charge. (folks that retain their motors through the forward closure will do this) (And if the motor's delay isn't long enough to reach apogee, definitely take it out)Many folks will just leave it in with the full length delay and use it as a kind of backup if their apogee charge fails. Many use altimeter based dual deployment because of better accuracy and control of deployment . Specifically,you can set drogue deployment at apogee or a few seconds later. Also, if you use 2 BP drogue charges, one can be set to fire before the other to more ensure deployment via this redundancy. In addition, depending upon conditions (e.g. high winds or not) you can set the main deployment at a lower altitude to prevent too much wind based drift. When relying on motor ejection only (single deployment), unless you have experience with drilling the ejection charge, the ejection charge is approximate and if too early can cause shredding of parachutes and if too late, a hard possibly damaging landing. Some commercial motors have long delays that even with drilling are too delayed to sustain a safe recovery. Some also do altimeter based deployment and also utilize the motor ejection as a back up to the altimeter based drogue deployment. I hope this helps. Fred, L2ICBM,S.C.KG4YGP Not finding a direct answer is understandable. There's not really One Way to go about it You can remove it if you want and use it for the drogue charge. (folks that retain their motors through the forward closure will do this) (And if the motor's delay isn't long enough to reach apogee, definitely take it out)Many folks will just leave it in with the full length delay and use it as a kind of backup if their apogee charge fails. that's what I do, use the full length motor delay as a backup. That means it's the drogue in the bottom with the main on top which seems counterintuitive but it's fine. If the drogue deploys at apogee you'll see a puff of smoke from the motor sometime later depending on the delay.if the altimeter fails to deploy the drogue at least you have a fighting chance getting your rocket back in salvageable state. I always use the motor as backup if possible. (Later than apogee, usually full delay.) I use more BP in the backup motor charge than I use in the apogee charge to make sure it separates if nothing else. Last edited: Oct 27, 2019 $24.99 Model Rocketry: Americas Hobby in the Cold War 19601980 Amazon.com $14.99 DEWALT Safety Goggles, Clear, Anti-Fog, DPG84 - Insulator Amazon.com Rocketry - The Nambi Effect $14.99 Rocketry: The Nambi Effect Amazon.com Services LLC $13.61 $199.00 History of rocketry & space travel Better World Books: South $28.69 $32.50 Modern High-Power Rocketry 2 MyPrepbooks I never use the motor as back up. I just leave the powder out when flying DD. I agree. Too many inaccuracies in terms of ejecting at apogee +/-. I am going with a fully redundant Altimeter setup, but my Level 2 rocket is 4 diameter so I have quite a bit of room to deal with. If you decide to skip the motor charge you still put the delay element in the motor; just skip pouring in the powder. Without the delay element you have an open path at the top of your motor and very bad things will happen. I always use the motor charge as a backup. If you decide to skip the motor charge you still put the delay element in the motor; just skip pouring in the powder. Without the delay element you have an open path at the top of your motor and very bad things will happen. I always use the motor charge as a backup. Agreed on the delay grain! Im using a plugged forward closure. Otherwise theres a hole between the motor casing and the parachute area of your booster, no? Hi, Maybe this is a super simple question but I havent been able to find a direct answer yet. I'm building my first dual deployment kit and have understood the basics, but the one thing I havent been able to figure out is with the ejection charge that comes with the motors. I assume with a drogue charge and the main charge set up that you're just removing it from the motor set up? As long as the motors ejection charge goes off near the apogee or after, theres nothing to worry about. i fly motor back up and as others have said, typically have it "set" to go off well after apogee as to not risk two simultaneous charges. a motor back up saved my Caliber ISP a few weeks ago. failure to re-arm the altimeter after taking the rocket off the pad was 100% my fault. resulted in a small zipper as the event was WELL after apogee, but it surely saved the rocket. Agreed on the delay grain! Im using a plugged forward closure. Otherwise theres a hole between the motor casing and the parachute area of your booster, no? I was going to recommend the plugged forward closure and as advised from this forum I would install the delay element so there is no gap in your forward closure to cause some type of CATO I was going to recommend the plugged forward closure and as advised from this forum I would install the delay element so there is no gap in your forward closure to cause some type of CATO Thats correct. Build the motor as recommended by AT or CTI including the delay grain, just omit using the black powder ejection charge (theres no place for it anyway with a plugged forward enclosure).The plugged forward closure ensures that no gasses can escape into the booster of your rocket since the delay grain is a pyrotechnic, which could damage your parachute. Last edited: Dec 15, 2019 And sometimes the rockets especially min diameter designs out fly the delay element time delay and must use electronic dual deployment only without the motor ejection. Thats correct. Build the motor as recommended by AT or CTI including the delay grain, just omit using the black powder ejection charge (theres no place for it anyway with a plugged forward enclosure).The plugged forward closure ensures that no gasses can escape into the booster of your rocket since the delay grain is a pyrotechnic, which could damage your parachute. Fill the powder well with grease & tape closed.. Use the delay element, but seal it up. That's what I've been told. Done it once earlier this year with no adverse effects.. east coast, which means nowhere to fly MD to it's fullest potential. I just leave em in and go long....pops long after apogee, but hey...if your altimeter doesn't you still have a chance... Fill the powder well with grease & tape closed.. Use the delay element, but seal it up. That's what I've been told. Done it once earlier this year with no adverse effects.. I may be in the minority with my opinion, and Im certainly not saying that anyone is wrong. In my opinion this gets into risk mitigation. Its betting against enough thermal energy getting to and liquefying the grease, and then penetrating the booster section. Will this idea work? Most of the time perhaps.For me, Im betting on my sealed forward closure. Last edited: Dec 15, 2019 Dont even need grease. Fill it with dog barf and seal with tape. I remove the BP from CTI reloads and don't use it in Aerotech reloads. Fully redundant electronics (2 altimeters) is the best way to go. Just looking at my GForce rocket from Aerotech that I built a couple of years ago and I haven't flown it yet. I'm looking at it and I built it without the cooling mesh but did put the baffle in and used a chute protector. I am wondering if the elastic shock cord can take the heat from the hot ejection gases? It is attached to the baffle so that may be a point where it could fail. what are your thoughts about the shock cord? A piece of Kevlar shock cord would be better, at least to just above the top of the BT. I watched a G-Force shock cord break at ejection. The nose cone drifted off under the chute and the rest of the rocket went through the windshield of a pickup. Made a nice 4" diameter imprint in the dash. I know some used a long drill to put a hole through CRs. Then a smaller stiff wire to pull the Kevlar through to the bottom and knot the Kevlar to keep it from pulling back out. This also allows replacement later if needed. Just don't skimp on the BP in your ejection charges. I've seen more G-Forces than any other rocket just pop the nosecone and never eject the chute and then end up tilting down and lawndarting. I know the G-Force was designed for HobbyLine 29/40-120 G motors, but it always seemed to me that the 0.75g of BP in the reloads was marginal for the BT volume of the G-Force.Good luck with the G-Force. That should still be a Class 1 rocket so could be a park flyer on those Hobbyline Gs. Now that all the soccer fields are empty with the stay at home orders, there's even more places to fly Class 1 rockets. A piece of Kevlar shock cord would be better, at least to just above the top of the BT. I watched a G-Force shock cord break at ejection. The nose cone drifted off under the chute and the rest of the rocket went through the windshield of a pickup. Made a nice 4" diameter imprint in the dash. I know some used a long drill to put a hole through CRs. Then a smaller stiff wire to pull the Kevlar through to the bottom and knot the Kevlar to keep it from pulling back out. This also allows replacement later if needed. Just don't skimp on the BP in your ejection charges. I've seen more G-Forces than any other rocket just pop the nosecone and never eject the chute and then end up tilting down and lawndarting. 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A piece of Kevlar shock cord would be better, at least to just above the top of the BT. I watched a G-Force shock cord break at ejection. The nose cone drifted off under the chute and the rest of the rocket went through the windshield of a pickup. Made a nice 4" diameter imprint in the dash. I know some used a long drill to put a hole through CRs. Then a smaller stiff wire to pull the Kevlar through to the bottom and knot the Kevlar to keep it from pulling back out. This also allows replacement later if needed. Just don't skimp on the BP in your ejection charges. I've seen more G-Forces than any other rocket just pop the nosecone and never eject the chute and then end up tilting down and lawndarting. I know the G-Force was designed for HobbyLine 29/40-120 G motors, but it always seemed to me that the 0.75g of BP in the reloads was marginal for the BT volume of the G-Force.Good luck with the G-Force. That should still be a Class 1 rocket so could be a park flyer on those Hobbyline Gs. Now that all the soccer fields are empty with the stay at home orders, there's even more places to fly Class 1 rockets. I happen to have 18 ft of tubular nylon so I will use that and get a short length of Kevlar. I will only need maybe 4 inches if that. I use Kevlar for everything these days, even LPR. I buy in bulk in different sizes to keep the cost reasonable. I coat the edge of the BT with CA to stiffen it and do successive layers of heat shrink plastic on the shock cord at the body tube junction to avoid zippers. Easy, peasy. Then Dog barf or chute protector depending on BT diameter. FWIW, I've got two Aerotech rockets built stock with the cooling mesh and the elastic, and have yet to have a problem on either after years and dozens of flights. Many people are worried about the mesh, the elastic, the baffle on rockets that have one, and the piston on rockets that have one, but I think they are all generally workable.That said, make whatever changes you want, they all have pluses and minuses but are generally fine too. My own experience is that kevlar has its own problems (lots more shock, zippering, etc.) and that elastic for smaller rockets has unfairly gotten a bad reputation in some cases (though snapback is always an issue and vendors often don't give you enough.) I use Kevlar for everything these days, even LPR. I buy in bulk in different sizes to keep the cost reasonable. I coat the edge of the BT with CA to stiffen it and do successive layers of heat shrink plastic on the shock cord at the body tube junction to avoid zippers. Easy, peasy. Then Dog barf or chute protector depending on BT diameter. What size of Kevlar would I need? I can get .026" with a strength of 140 lbs, .045" strength of 225 lbs or .1" strength of 1500 lbs If you are going with kevlar, I would use the 1/8" tubular Kevlar. It's plenty strong, and easy to use. I use it as main and drogue cords on several L1 rockets. If you build AeroTech kits per the instructions you should not have any problems with flying them. The plastic used for the baffle is not heat resistant and some testing that was done at AeroTech with the baffle system not having the mesh caused the plastic to melt and the screw eye to pull out.Try to put the cooling mesh back in. The system has always worked well for me. I recently ordered some 5/8 tubular nylon for the GForce, not realizing how heavy duty it is. Is it supposed to be simply tied on, or is there a better way to create a loop in the end of the cord?Attempting dual deployment on this rocket and not able to find the factory style elastic cord. You can tie it on and save the weight of the quick links. Although with the weight of that heavy of nylon, I'm not sure it makes much difference.When I use nylon close to the ejection charges, I wrap it in electrical tape 10 pack for $6.19 at Harbor Freight. When that even starts to look bad, I remove it and re-tape. It keeps the nylon undamaged. Vector quantity describing mass flow rate through a given areaIn physics and engineering, mass flux is the rate of mass flow per unit of area. Its SI units are kgs1m2. The common symbols are j, J, q, Q, , or (Greek lowercase or capital Phi), sometimes with subscript m to indicate mass is the flowing quantity. This flux quantity is also known simply as "mass flow".[1] "Mass flux" can also refer to an alternate form of flux in Fick's law that includes the molecular mass, or in Darcy's law that includes the mass density.[2]Less commonly the defining equation for mass flux in this article is used interchangeably with the defining equation in mass flow rate.[a] Mathematically, mass flux is defined as the limit j m = lim A 0 I m A , {\displaystyle j_{m}=\lim _{A\to 0}{\frac {I_{m}}{A}},} where I m = lim t 0 m t = d m d t {\displaystyle I_{m}=\lim _{\Delta t\to 0}{\frac {\Delta m}{\Delta t}}={\frac {dm}{dt}}} is the mass current (flow of mass m per unit time t) and A is the area through which the mass flows.For mass flux as a vector jm, the surface integral of it over a surface S, followed by an integral over the time duration t1 to t2, gives the total amount of mass flowing through the surface in that time (t2 t1): m = t 1 t 2 S j m n ^ d A d t . {\displaystyle \Delta m=\int _{t_{1}}^{t_{2}}\iint _{S}\mathbf {j} _{m}\cdot \mathbf {\hat {n}} \,dA\,dt.} The area required to calculate the flux is real or imaginary, flat or curved, either as a cross-sectional area or a surface.For example, for substances passing through a filter or a membrane, the real surface is the (generally curved) surface area of the filter, macroscopically - ignoring the area spanned by the holes in the filter/membrane. The spaces would be cross-sectional areas. For liquids passing through a pipe, the area is the cross-section of the pipe, at the section considered.The vector area is a combination of the magnitude of the area through which the mass passes through, A, and a unit vector normal to the area, n ^ {\displaystyle \mathbf {\hat {n}} } . The relation is A = A n ^ {\displaystyle \mathbf {A} =A\mathbf {\hat {n}} } .If the mass flux jm passes through the area at an angle to the area normal n ^ {\displaystyle \mathbf {\hat {n}} } , then j m n ^ = j m cos {\displaystyle \mathbf {j} _{m}\cdot \mathbf {\hat {n}} =j_{m}\cos \theta } where is the dot product of the unit vectors. That is, the component of mass flux passing through the surface (i.e. normal to it) is jm cos . While the component of mass flux passing tangential to the area is given by jm sin , there is no mass flux actually passing through the area in the tangential direction. The only component of mass flux passing normal to the area is the cosine component.Consider a pipe of flowing water. Suppose the pipe has a constant cross section and we consider a straight section of it (not at any bends/junctions), and the water is flowing steadily at a constant rate, under standard conditions. The area A is the cross-sectional area of the pipe. Suppose the pipe has radius r = 2 cm = 2 102 m. The area is then A = r 2 . {\displaystyle A=\pi r^{2}.} To calculate the mass flux jm (magnitude), we also need the amount of mass of water transferred through the area and the time taken. Suppose a volume V = 1.5 L = 1.5 103 m3 passes through in time t = 2 s. Assuming the density of water is = 1000 kg m3, we have: m = V m 2 m 1 = (V 2 V 1) m = V {\displaystyle {\begin{aligned}\Delta m&=\rho \Delta V\\m_{2}-m_{1}&=\rho (V_{2}-V_{1})\\m&=\rho V\\\end{aligned}}} (since initial volume passing through the area was zero, final is V, so corresponding mass is m), so the mass flux is j m = m A t = V r 2 t . {\displaystyle j_{m}={\frac {\Delta m}{A\Delta t}}={\frac {\rho V}{\pi r^{2}t}}.} Substituting the numbers gives: j m = 1000 (1.5 10 3) (2 10 2) 2 2 = 3 16 10 4 , {\displaystyle j_{m}={\frac {1000\times \left(1.5\times 10^{-3}\right)}{\pi \times \left(2\times 10^{-2}\right)^{2}\times 2}}={\frac {3}{16\pi }}\times 10^{4},} which is approximately 596.8kg s1 m2.Using the vector definition, mass flux is also equal to:[4] j m = u {\displaystyle \mathbf {j} _{\rm {m}}=\rho \mathbf {u} } where: = mass density,u = velocity field of mass elements flowing (i.e. at each point in space the velocity of an element of matter is some velocity vector u).Sometimes this equation may be used to define jm as a vector.In the case fluid is not pure, i.e. is a mixture of substances (technically contains a number of component substances), the mass fluxes must be considered separately for each component of the mixture.When describing fluid flow (i.e. flow of matter), mass flux is appropriate. When describing particle transport (movement of a large number of particles), it is useful to use an analogous quantity, called the molar flux.Using mass, the mass flux of component i is j m , i = i u i . {\displaystyle \mathbf {j} _{{\rm {m}},\,i}=\rho _{i}\mathbf {u} _{i}.} The barycentric mass flux of component i is j m , i = (u i u) , {\displaystyle \mathbf {j} _{{\rm {m}},\,i}=\rho \left(\mathbf {u} _{i}-\langle \mathbf {u} \rangle \right),} where u {\displaystyle \langle \mathbf {u} \rangle } is the average mass velocity of all the components in the mixture, given by u = 1 i i u i = 1 i j m , i {\displaystyle \langle \mathbf {u} \rangle ={\frac {1}{\rho }}\sum _{i}\rho _{i}\mathbf {u} _{i}={\frac {1}{\rho }}\sum _{i}\mathbf {j} _{{\rm {m}},\,i}} where = mass density of the entire mixture,i = mass density of component i,ui = velocity of component i.The average is taken over the velocities of the components.If we replace density by the "molar density", concentration c, we have the molar flux analogues.The molar flux is the number of moles per unit time per unit area, generally: j n = c u . {\displaystyle \mathbf {j} _{\rm {n}}=c\mathbf {u} .} So the molar flux of component i is (number of moles per unit time per unit area): j n , i = c i u i {\displaystyle \mathbf {j} _{{\rm {n}},\,i}=c_{i}\mathbf {u} _{i}} and the barycentric molar flux of component i is j n , i = c (u i u) , {\displaystyle \mathbf {j} _{{\rm {n}},\,i}=c\left(\mathbf {u} _{i}-\langle \mathbf {u} \rangle \right),} where u {\displaystyle \langle \mathbf {u} \rangle } this time is the average molar velocity of all the components in the mixture, given by: u = 1 n i c i u i = 1 c i j n , i . {\displaystyle \langle \mathbf {u} \rangle ={\frac {1}{n}}\sum _{i}c_{i}\mathbf {u} _{i}={\frac {1}{c}}\sum _{i}\mathbf {j} _{{\rm {n}},\,i}.} Mass flux appears in some equations in hydrodynamics, in particular the continuity equation: j m + t = 0 , {\displaystyle abla \cdot \mathbf {j} _{\rm {m}}+{\frac {\partial \rho }{\partial t}}=0,} which is a statement of the mass conservation of fluid. In hydrodynamics, mass can only flow from one place to another.Molar flux occurs in Fick's first law of diffusion: j n = D n {\displaystyle abla \cdot \mathbf {j} _{\rm {n}}=-abla \cdot Dabla n} where D is the diffusion coefficient.Mass-flux fractionFluxFick's lawDarcy's lawWave mass flux and wave momentumDefining equation (physical chemistry)Momentum density^ For example, Fluid Mechanics, Schaum's et al [3] uses the definition of mass flux as the equation in the mass flow rate article.^ "ISO 80000-4:2019 Quantities and units - Part 4: Mechanics". ISO. Retrieved 2024-10-02.^ "Thesaurus: Mass flux". Retrieved 2008-12-24.[permanent dead link]^ Fluid Mechanics, M. Potter, D.C. Wiggart, Schuam's outlines, McGraw Hill (USA), 2008, ISBN978-0-07-148781-8^ Vectors, Tensors, and the basic Equations of Fluid Mechanics, R. Aris, Dover Publications, 1989, ISBN0-486-66110-5Retrieved from " Calculators6 Calculators22 Calculators2 Calculators5 Calculators4 Calculators8 Calculators11 Calculators5 Calculators5 Calculators14 Calculators21 Calculators17 Calculators10 Calculators6 Calculators7 Calculators Are mass flux and mass flow rate interchangeable? I know mass flux is (rho)(A)(r) and mass flow rate is (rho)(V)(A). How are they related to conservation of mass in terms of a SRM? Are mass flux and mass flow rate interchangeable? I know mass flux is (rho)(A)(r) and mass flow rate is (rho)(V)(A). How are they related to conservation of mass in terms of a SRM? Mass flow rate is in units of mass per second, such as kg/sec. Mass flux is in units of mass per second per area, or kg/sec*m^2. Mass flux is the mass flow per cross-sectional area in the grain core or nozzle throat. If you know the burn rate (rb), the exposed propellant surface area (Ab), and propellant density, you can get total mass flow: (rho)(Ab)(rb). This would be the flow after the bottom grain. Mass flux is through a reference area, such as the core of the motor or nozzle throat. If you want to estimate mass flux worse case, just take the mass flow rate and divide by the bottom grain's core area. If you want to see what it is at any position in the core, modify the mass flow by including only the burn surface above that point in the core. -John In industries ranging from chemical processing and oil & gas to food manufacturing and pharmaceuticals, accurately measuring fluid flow is critical. Engineers and technicians often rely on two key parameters to describe how a fluid moves through a system: volumetric flow rate and mass flow rate. While they are related, each serves a unique purpose depending on the application, the type of fluid being measured, and the desired output of a process.What Is Volumetric Flow Rate?Volumetric flow rate is the measure of the volume of fluid that passes through a given cross-sectional area per unit of time. It tells you how much space the fluid occupies as it moves through a system.Definition:Volumetric flow rate is typically represented by the symbol Q and is measured in units such as:Cubic meters per second (m/s)Liters per minute (L/min)Gallons per minute (GPM)Why It Matters:Volumetric flow rate is especially useful in systems where fluid density is relatively constant, such as water distribution systems or air ventilation systems. For example, if youre filling a tank, its more important to know how fast its filling in terms of volume rather than mass.What Is Mass Flow Rate?Mass flow rate is the measure of the mass of fluid that passes through a given point per unit of time. Instead of focusing on how much space the fluid takes up, it measures how much material is actually moving.Definition:Mass flow rate is commonly represented by the symbol (m-dot) and is measured in units like:Kilograms per second (kg/s)Pounds per hour (lb/hr)Grams per minute (g/min)Why It Matters:Mass flow rate becomes critical in applications where fluid density changes due to temperature or pressure, such as in chemical reactions, combustion engines, or gas flow measurement. Many engineering calculations, including energy balances and process efficiencies, rely on mass flow, not volume.Volumetric vs. Mass Flow Rate: Key Differences and SimilaritiesThough both volumetric and mass flow rates describe the movement of fluids, they differ in several important ways.FeatureVolumetric Flow RateMass Flow RateDefinitionVolume of fluid per unit timeMass of fluid per unit timeSymbolQ (m-dot)Unitsm/s, L/min, GPMkg/s, lb/hr, g/minDepends onFlow area and velocityFlow area, velocity, and densitySensitive to Density?NoYesUse Case ExamplesWater flow in a pipe, HVACFuel combustion, chemical dosingSimilarities:Both are measures of fluid flow over time.Both are essential in designing and analyzing fluid systems.Both can be measured using various flow meters, depending on the application.How to Calculate Volumetric Flow RateThe formula for volumetric flow rate is:Q=AvQ = A \times vQ=AvWhere:Q = volumetric flow rate (m/s)A = cross-sectional area of the pipe (m)v = velocity of the fluid (m/s)Example:If water flows through a pipe with a diameter of 0.2 meters at a velocity of 3 m/s:Area, A = (d/2) = 3.1416 (0.1) = 0.0314 mQ = 0.0314 3 = 0.0942 m/sThis means 0.0942 cubic meters of water pass through the pipe every second.How to Calculate Mass Flow RateThe mass flow rate depends on both volumetric flow rate and fluid density (). The formula is:m=Q\dot{m} = \rho \times Qm=QWhere: = mass flow rate (kg/s) = fluid density (kg/m)Q = volumetric flow rate (m/s)Example:Using the previous example where Q = 0.0942 m/s and assuming water density () = 1000 kg/m: = 1000 0.0942 = 94.2 kg/sSo, 94.2 kilograms of water are flowing every second. Conversion Between Volumetric and Mass Flow RateThe relationship between volumetric and mass flow rate is straightforward:m=Q\dot{m} = \rho \times Qm=QTo convert volumetric flow rate into mass flow rate, multiply the volumetric flow rate by the fluids density.Conversely, to convert mass flow rate into volumetric flow rate:Q=mQ = \frac{\dot{m}}{\rho}Q=mImportant Notes:This conversion assumes a constant fluid density. For gases or fluids under varying temperatures/pressures, youll need real-time density measurements.For gases, you may need to factor in the ideal gas law or use specific gas constants.Application Examples in IndustryWater TreatmentIn municipal water systems, volumetric flow meters (like turbine or electromagnetic meters) are often used to monitor how much water is moving through pipelines.Chemical ManufacturingIn chemical dosing systems, the amount of material matters more than volume, making mass flow meters (like Coriolis or thermal mass meters) essential.Fuel Injection SystemsCombustion engines require precise control of mass flow of fuel to maintain air-fuel ratios for optimal efficiency and emissions control.Choosing the Right Flow Measurement MethodWhen deciding whether to use volumetric or mass flow measurement, consider the following:Fluid Type: Is it a gas or a liquid? Gases are compressible and sensitive to temperature and pressure.Process Sensitivity: Is your process sensitive to weight or energy content (mass-based), or is volume sufficient?Accuracy Requirements: Mass flow meters typically provide higher accuracy in dynamic conditions.Cost and Maintenance: Volumetric meters are often more affordable and easier to maintain but may lack the accuracy needed for sensitive applications.Final ThoughtsUnderstanding the difference between volumetric flow rate and mass flow rate is essential for engineers, technicians, and anyone involved in fluid system design or operation. While both metrics describe how fluid moves, they provide different insights based on the application.Use volumetric flow rate when measuring how much space a fluid occupies.Use mass flow rate when the actual amount of material matters, especially in processes involving reactions, combustion, or precise dosing.Knowing how to calculate and convert between the two allows for better design decisions, increased process efficiency, and more accurate system performance. Whether youre managing water flow through pipes or dosing critical chemicals in pharmaceutical production, the right flow measurement makes all the difference.Need precision flow meters for your industrial application? Whether youre working with gas, cryogenic liquids, or anything in between, Turbines, Inc. offers industry-proven flow meters tailored for your needs. Contact our team today to get started. Vector quantity describing mass flow rate through a given areaIn physics and engineering, mass flux is the rate of mass flow per unit of area. Its SI units are kgs1m2. The common symbols are j, J, q, Q, , or (Greek lowercase or capital Phi), sometimes with subscript m to indicate mass is the flowing quantity. This flux quantity is also known simply as "mass flow".[1] "Mass flux" can also refer to an alternate form of flux in Fick's law that includes the molecular mass, or in Darcy's law that includes the mass density.[2]Less commonly the defining equation for mass flux in this article is used interchangeably with the defining equation in mass flow rate.[a] Mathematically, mass flux is defined as the limit j m = lim A 0 I m A , {\displaystyle j_{m}=\lim _{A\to 0}{\frac {I_{m}}{A}},} where I m = lim t 0 m t = d m d t {\displaystyle I_{m}=\lim _{\Delta t\to 0}{\frac {\Delta m}{\Delta t}}={\frac {dm}{dt}}} is the mass current (flow of mass m per unit time t) and A is the area through which the mass flows.For mass flux as a vector jm, the surface integral of it over a surface S, followed by an integral over the time duration t1 to t2, gives the total amount of mass flowing through the surface in that time (t2 t1): m = t 1 t 2 S j m n ^ d A d t . {\displaystyle \Delta m=\int _{t_{1}}^{t_{2}}\iint _{S}\mathbf {j} _{m}\cdot \mathbf {\hat {n}} \,dA\,dt.} The area required to calculate the flux is real or imaginary, flat or curved, either as a cross-sectional area or a surface.For example, for substances passing through a filter or a membrane, the real surface is the (generally curved) surface area of the filter, macroscopically - ignoring the area spanned by the holes in the filter/membrane. The spaces would be cross-sectional areas. For liquids passing through a pipe, the area is the cross-section of the pipe, at the section considered.The vector area is a combination of the magnitude of the area through which the mass passes through, A, and a unit vector normal to the area, n ^ {\displaystyle \mathbf {\hat {n}} } . The relation is A = A n ^ {\displaystyle \mathbf {A} =A\mathbf {\hat {n}} } .If the mass flux jm passes through the area at an angle to the area normal n ^ {\displaystyle \mathbf {\hat {n}} } , then j m n ^ = j m cos {\displaystyle \mathbf {j} _{m}\cdot \mathbf {\hat {n}} =j_{m}\cos \theta } where is the dot product of the unit vectors. That is, the component of mass flux passing through the surface (i.e. normal to it) is jm cos . While the component of mass flux passing tangential to the area is given by jm sin , there is no mass flux actually passing through the area in the tangential direction. The only component of mass flux passing normal to the area is the cosine component.Consider a pipe of flowing water. Suppose the pipe has a constant cross section and we consider a straight section of it (not at any bends/junctions), and the water is flowing steadily at a constant rate, under standard conditions. The area A is the cross-sectional area of the pipe. Suppose the pipe has radius r = 2 cm = 2 102 m. The area is then A = r 2 . {\displaystyle A=\pi r^{2}.} To calculate the mass flux jm (magnitude), we also need the amount of mass of water transferred through the area and the time taken. Suppose a volume V = 1.5 L = 1.5 103 m3 passes through in time t = 2 s. Assuming the density of water is = 1000 kg m3, we have: m = V m 2 m 1 = (V 2 V 1) m = V {\displaystyle {\begin{aligned}\Delta m&=\rho \Delta V\\m_{2}-m_{1}&=\rho (V_{2}-V_{1})\\m&=\rho V\\\end{aligned}}} (since initial volume passing through the area was zero, final is V, so corresponding mass is m), so the mass flux is j m = m A t = V r 2 t . {\displaystyle j_{m}={\frac {\Delta m}{A\Delta t}}={\frac {\rho V}{\pi r^{2}t}}.} Substituting the numbers gives: j m = 1000 (1.5 10 3) (2 10 2) 2 2 = 3 16 10 4 , {\displaystyle j_{m}={\frac {1000\times \left(1.5\times 10^{-3}\right)}{\pi \times \left(2\times 10^{-2}\right)^{2}\times 2}}={\frac {3}{16\pi }}\times 10^{4},} which is approximately 596.8kg s1 m2.Using the vector definition, mass flux is also equal to:[4] j m = u {\displaystyle \mathbf {j} _{\rm {m}}=\rho \mathbf {u} } where: = mass density,u = velocity field of mass elements flowing (i.e. at each point in space the velocity of an element of matter is some velocity vector u).Sometimes this equation may be used to define jm as a vector.In the case fluid is not pure, i.e. is a mixture of substances (technically contains a number of component substances), the mass fluxes must be considered separately for each component of the mixture.When describing fluid flow (i.e. flow of matter), mass flux is appropriate. When describing particle transport (movement of a large number of particles), it is useful to use an analogous quantity, called the molar flux.Using mass, the mass flux of component i is j m , i = i u i . {\displaystyle \mathbf {j} _{{\rm {m}},\,i}=\rho _{i}\mathbf {u} _{i}.} The barycentric mass flux of component i is j m , i = (u i u) , {\displaystyle \mathbf {j} _{{\rm {m}},\,i}=\rho \left(\mathbf {u} _{i}-\langle \mathbf {u} \rangle \right),} where u {\displaystyle \langle \mathbf {u} \rangle } is the average mass velocity of all the components in the mixture, given by u = 1 i i u i = 1 i j m , i {\displaystyle \langle \mathbf {u} \rangle ={\frac {1}{\rho }}\sum _{i}\rho _{i}\mathbf {u} _{i}={\frac {1}{\rho }}\sum _{i}\mathbf {j} _{{\rm {m}},\,i}} where = mass density of the entire mixture,i = mass density of component i,ui = velocity of component i.The average is taken over the velocities of the components.If we replace density by the "molar density", concentration c, we have the molar flux analogues.The molar flux is the number of moles per unit time per unit area, generally: j n = c u . {\displaystyle \mathbf {j} _{\rm {n}}=c\mathbf {u} .} So the molar flux of component i is (number of moles per unit time per unit area): j n , i = c i u i {\displaystyle \mathbf {j} _{{\rm {n}},\,i}=c_{i}\mathbf {u} _{i}} and the barycentric molar flux of component i is j n , i = c (u i u) , {\displaystyle \mathbf {j} _{{\rm {n}},\,i}=c\left(\mathbf {u} _{i}-\langle \mathbf {u} \rangle \right),} where u {\displaystyle \langle \mathbf {u} \rangle } this time is the average molar velocity of all the components in the mixture, given by: u = 1 n i c i u i = 1 c i j n , i . {\displaystyle \langle \mathbf {u} \rangle ={\frac {1}{n}}\sum _{i}c_{i}\mathbf {u} _{i}={\frac {1}{c}}\sum _{i}\mathbf {j} _{{\rm {n}},\,i}.} Mass flux appears in some equations in hydrodynamics, in particular the continuity equation: j m + t = 0 , {\displaystyle abla \cdot \mathbf {j} _{\rm {m}}+{\frac {\partial \rho }{\partial t}}=0,} which is a statement of the mass conservation of fluid. In hydrodynamics, mass can only flow from one place to another.Molar flux occurs in Fick's first law of diffusion: j n = D n {\displaystyle abla \cdot \mathbf {j} _{\rm {n}}=-abla \cdot Dabla n} where D is the diffusion coefficient.Mass-flux fractionFluxFick's lawDarcy's lawWave mass flux and wave momentumDefining equation (physical chemistry)Momentum density^ For example, Fluid Mechanics, Schaum's et al [3] uses the definition of mass flux as the equation in the mass flow rate article.^ "ISO 80000-4:2019 Quantities and units - Part 4: Mechanics". ISO. Retrieved 2024-10-02.^ "Thesaurus: Mass flux". Retrieved 2008-12-24.[permanent dead link]^ Fluid Mechanics, M. Potter, D.C. Wiggart, Schuam's outlines, McGraw Hill (USA), 2008, ISBN978-0-07-148781-8^ Vectors, Tensors, and the basic Equations of Fluid Mechanics, R. Aris, Dover Publications, 1989, ISBN0-486-66110-5Retrieved from " flux is an important concept in the study of fluid dynamics. Engineers, physicists, and mathematicians all use mass flux formulas to help them discover the ways fluids (including gases) behave.Yet, the equations to make these predictions and the concepts underlying them can be difficult to grasp. To take the confusion out of conversions, use our handy mass flux calculator.Below, you'll find a comprehensive guide to mass flux. By the time you're done reading it, you'll be an expert on everything mass flux, including it's formula and applications. Before going over the concept of mass flux, let's focus in on the fluid definition.FluxFlux is a term seen commonly in physics and mathematics, and in general, it refers to a quantity of something passing through a surface or substance. That quantity can be air, water, or any other liquid.Note that we're including both air and water here. We commonly think of these things as two separate states of matter: gas and liquid. While that's true, scientists consider them both fluids. That's because they can both flow.Now, let's go over the concept of flux and see how it relates to transport phenomena.What is transport phenomena?It sounds more complex than it really is. Transport phenomena observe the exchange of things like:MassEnergyChargeMomentumAngular momentumIt's basically anything that involves mass transfer, heat transfer, or liquid flow (fluid dynamics).Within this framework, flux is a vector quality.It describes the magnitude and direction of the flow of any of these substances or properties.Mass FluxFlux can be thought of as the flow per unit area. It measures the movement of some quantity (like mass, heat, or a liquid) per time.Mass flux, then, is the rate of mass flow per unit area.If you have the area of your object figured out, you can use equations to figure out how much mass is passing through it and how long it's taking the mass to do so.In short, mass flux aims to measure the amount of liquid or gas passing in or out of a control volume, per unit of time.Remember that mass flux measures the flow of mass across a unit area.The standard measurement is kg/h m2 (kilograms per hour meter squared).There are other units that you can use to measure mass flux depending on the size or purpose of the project.Let's be honest. There's a reason people use computational models to figure out mass flux.In fact, there's a whole field of study learning how fluid dynamics can be done with computers. It's called computational fluid dynamics (CFD).But that doesn't mean you can't do it yourself. Let's give it a try here.Step One: Control VolumeThe first thing you have to do to figure out mass flux is define the control volume. Your matter is in a space, called a volume.Its size is constant and predetermined, which is why it's a control volume. It could be a pipe or any other enclosed thing.Remember, also, the principle of the conservation of matter. It cannot be destroyed or created.That means the amount of mass you have in your predetermined volume will remain constant.Mass flux measures the amount of this matter passing in or out of your control volume in time.Step Two: Cross SectionNext, you need to know what your matter is passing through. This will be a cross-sectional area of your control volume.You also need to know the velocity of your matter as it passes through this area.Your final piece of information is the density of the mass flowing through that cross-sectional area. Sometimes the density isn't immediately available, and you have to measure it. Other times, it's assumed.Step Three: SolveThe equation for mass flux is as follows:where,Mathematically, we can define mass flux as the limit.The flow of mass is m, and the unit of time is t. A is the area the mass is flowing through.You can also add in other variables, such as surface integrals or vector areas. The flux equations then grow quickly in complexity!Sometimes you have to convert your units of measurement before you do your equation.In the next section, let's see why.It's necessary to convert mass flux when you want to use a different measurement than the standard of kilograms.That's because different fluids may need smaller or larger flux units. Maybe instead of kilograms, you need grams.Either way, you're still measuring the mass flux of the fluid.While the equations for this are fairly straightforward, it's always a good idea to reference a conversion calculator. Why not try ours today?It's important for scientists to know how fluids behave. And, remember, by fluids, we mean both gases and liquids.FlightIt seems counterintuitive, then, but understanding fluid dynamics makes flight possible. In the simplest terms, it helps us understand how airplanes fly through the air (which, again, is a fluid).SeafaringThe study of fluid dynamics also allows us to predict how ships and submarines move through water.And, it helps us learn about the flow of ocean currents as well as the Earth's weather.That's because not only water but also air and clouds are fluids.Molecular DiffusionMass flux, in particular, allows us to understand diffusion processes. Think molecular diffusion or turbulent flows (turbulent diffusion).In fact, we have to include mass flux in any computational dynamics model where there is conservation of mass across a control volume. Chemistry and BiologyIt's also incredibly useful when there is a flow through a porous medium (like a filtration system).Finally, in biology, mass flux can help describe how mass is transported across a semi-permeable membrane.As you can see, then, fluid dynamics in general and mass flux, in particular, are useful in many different fields. ** Please note: if you are viewing our site for the first time, the e-mail and print pop-ups may be blocked. You may need to allow pop-ups and refresh the page to generate your reports. Thank you and stay awesome!

Mass flow vs mass flow rate. Mass flow vs volume flow. What is mass flow rate. Mass flux vs mass flow rate.