

# User Manual

Do you know the value for the density of water in moles per liter? What about in kilograms per cubic meter? Need to know what 1 joule is in btu? This site has you covered. Lunar Alpha will help anybody make quick conversion calculations between different units and can compute some fluid mechanics equations.

## Homepage

Once you pull up the site, you reach the homepage. This page hosts the entire project and all the calculations are computed here. The page is divided into three main sections based on the type of function.

**LUNAR ALPHA**  
TEAM RETURN(AWESOME)

### Unit Converter

Unit Category: Energy ▼

1 [input] = 1 [input]

Joules (J) ▼ Joules (J) ▼

Convert!

All unit conversions are accurate to 0.0001%.

Go to favorite! Set favorite! Remove favorite!

### Constants

Constant: Universal Gas Constant, R ▼ = 1.987 Btu/lbmol·°R ▼

Copy to Clipboard

Go to favorite! Set favorite! Remove favorite!

### Formula Calculator

Choose a formula: Ideal Gas Law,  $PV = nRT$  ▼

IDEAL GAS LAW:  $PV = nRT$  (use SI units only.)

Enter three known values and click *Calculate!* to calculate the unknown variable.

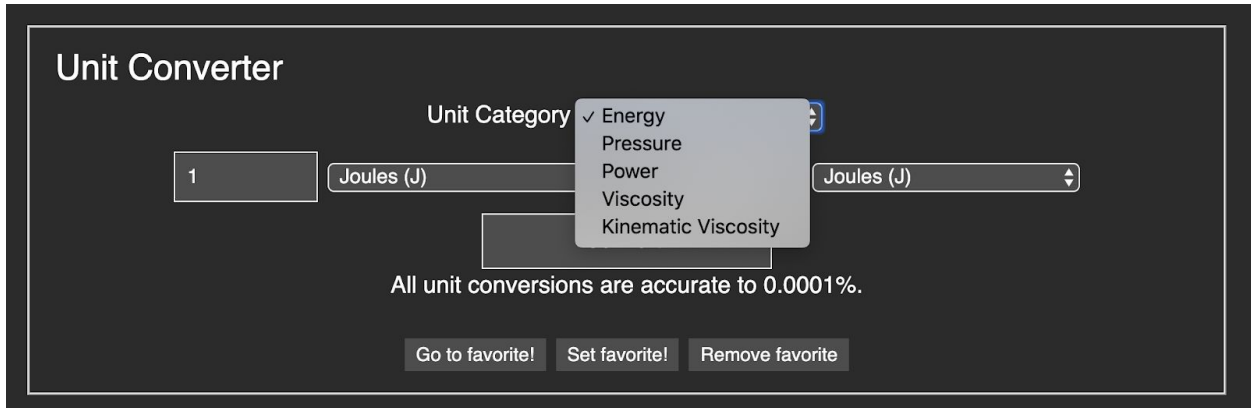
P: [input] V: [input] = n: [input] R (J/mol·K): 8.314 T: [input]

Calculate!

Go to favorite! Set favorite! Remove favorite!

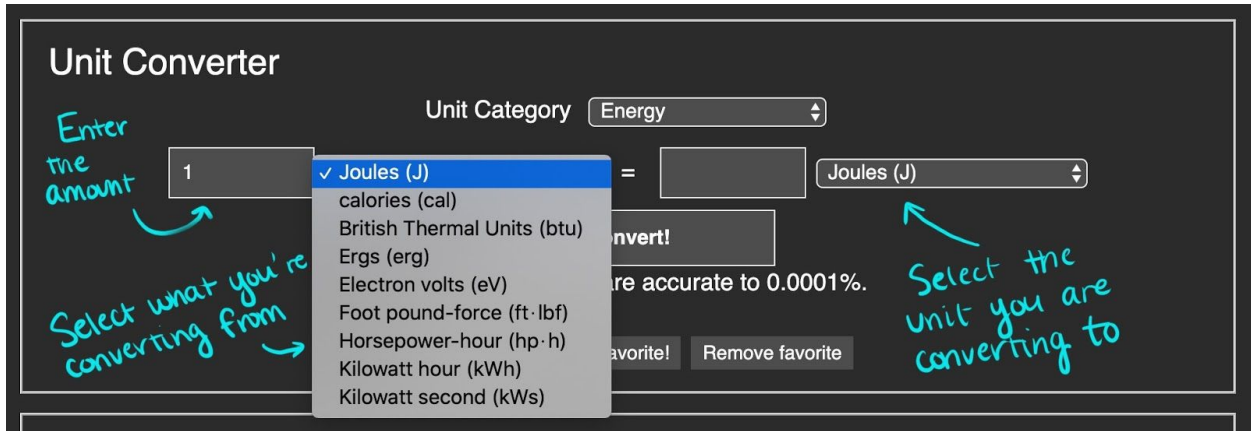
# Unit Conversions

The first box is for unit conversions. There are 5 different categories of conversions you are able to choose from. Click the unit category drop down list and then select the type of units you would like to convert between.



The screenshot shows the 'Unit Converter' interface. On the left, there is a text input field containing the number '1'. To its right is a dropdown menu currently displaying 'Joules (J)'. Further right is a 'Unit Category' dropdown menu which is open, showing a list of categories: Energy (checked), Pressure, Power, Viscosity, and Kinematic Viscosity. To the right of the category menu is another dropdown menu also displaying 'Joules (J)'. Below these elements, a message states 'All unit conversions are accurate to 0.0001%'. At the bottom, there are three buttons: 'Go to favorite!', 'Set favorite!', and 'Remove favorite!'.

After you select a unit category, you can select the unit you are converting from in the left drop down menu. In the text box to the far left, enter the amount of the unit. Then, in the right drop down menu select the unit you are converting to.



This screenshot shows the 'Unit Converter' interface with handwritten annotations in green. The 'Unit Category' dropdown is set to 'Energy'. The left dropdown menu is open, showing a list of energy units: Joules (J) (checked), calories (cal), British Thermal Units (btu), Ergs (erg), Electron volts (eV), Foot pound-force (ft·lbf), Horsepower-hour (hp·h), Kilowatt hour (kWh), and Kilowatt second (kWs). A handwritten note 'Enter the amount' with an arrow points to the text input field containing '1'. Another note 'Select what you're converting from' with an arrow points to the left dropdown menu. A third note 'Select the unit you are converting to' with an arrow points to the right dropdown menu, which is set to 'Joules (J)'. The 'Convert!' button is visible, along with the accuracy message and the 'Set favorite!' and 'Remove favorite!' buttons.

After the units have been selected and the amount inputted into the left text-field, click the *CONVERT!* button. The output in the unit you selected will be automatically output to the textbox field to the right.

Unit Converter

Unit Category: Energy

3 British Thermal Units (btu) = 3165.1675 Joules (J)

**Convert!**

All unit conversions are accurate to 0.0001%.

Go to favorite! Set favorite! Remove favorite!

Each time you change the units or the amount of the unit, you can either click the **CONVERT!** button or simply select a new unit from the drop down menu to calculate your answer.

## Constants

In the drop down menu select the constant you would like to know. Then, in the drop down menu on the right select the units for the constant.

The output field auto-populates whenever you chose the units for the constant. If you will be using this constant for another calculation, you can click the **COPY TO CLIPBOARD** button which will copy the value to your clipboard on your device to make for easy future calculations. Selecting a new unit for a constant will repopulate the solution box.

Constants

Constant: **Density of Water ( $\rho$ )**

62.3 kg/m<sup>3</sup>

Remove favorite

Formula Calculator

Law, PV = nRT (use SI units only.)

## Formula Calculator

In the drop down menu, select the formula you would like to use. The text fields will automatically change to match the formula selected. All values must be input in SI units.

### ***Ideal Gas Law $PV = nRT$***

P = pressure, V = volume, n = number of moles, and T = temperature (K).

For this formula, the user must input 3 variables and leave one blank. The one that the user leaves blank is the one that will be calculated by the program. After you input the values into the corresponding fields, click the *CALCULATE!* button and the blank field will be populated with the calculated value.

For example, you can input values for P, V, T and the program will find the number of moles (n) after clicking convert.

### ***Reynold's Number***

D = diameter of the fluid, v = velocity,  $\gamma$  = kinematic viscosity

For this formula, all input fields must be filled out. After all the fields have been filled, click the *CALCULATE!* button and the value for Reynold's number will auto populate in textbox with the green outline.

### ***Reynold's Number***

D = diameter of the fluid, v = velocity,  $\rho$  = density,  $\mu$  = viscosity

For this formula, all input fields must be filled out. After all the fields have been filled, click the *CALCULATE!* button and the value for Reynold's number will auto populate in textbox with the green outline.

### ***Bernoulli's Equation***

Given the number of Bernoulli's Equation and complexity that some of these problems involve there are several fields available, however, not all of them are required.

The two different cases for Bernoulli's equation are based on how the fluid is moving out of the tanks. If the fluid is flowing from the tank into the atmosphere, it is the first case. If the fluid is from one tank into another tank, then it is the second case. Each case slightly changes the equation to account for the difference.

$p_1$  = initial pressure,  $p_2$  = final pressure,  $z_1$  = initial height,  $z_2$  = final height,  
 $dw/dm$  = work done by the flow per unit of mass

If you desire to solve for any one of these fields, leave it blank and fill in the rest.  
You can also solve for  $\Delta p$  or  $\Delta z$  by leaving both  $p_1$  &  $p_2$  or  $z_1$  &  $z_2$  blank respectively. Additionally, when solving for one of these variables leave the  $\gamma$  and  $\epsilon$  fields blank.

$L$  = length (sometimes represented as  $\Delta x$ ),  $v$  = velocity,  $D$  = diameter of the pipe  
fluid is moving through,  $f$  = friction factor,  $\rho$  = the density of the fluid at all points  
in the fluid,  $\gamma$  = kinematic viscosity,  $K$  = constant for each type of fitting or valve,  
 $\epsilon$  = surface roughness

When solving for  $v$ , leave  $v$  and  $f$  blank and populate the rest of the fields.

Formula Calculator

Choose a formula: 

Bernoulli's Equation

Bernoulli's Equation.  
Enter K values separated by commas.

Cases:  
☐ Fluid Flowing from tank into the atmosphere ☒ Fluid flowing between tanks

p1:

p2:

z1:

z2:

w:

L:

v:

D:

f:

$\rho$ :

$\gamma$ :

K:

$\epsilon$ :

Calculate!

Go to favorite!

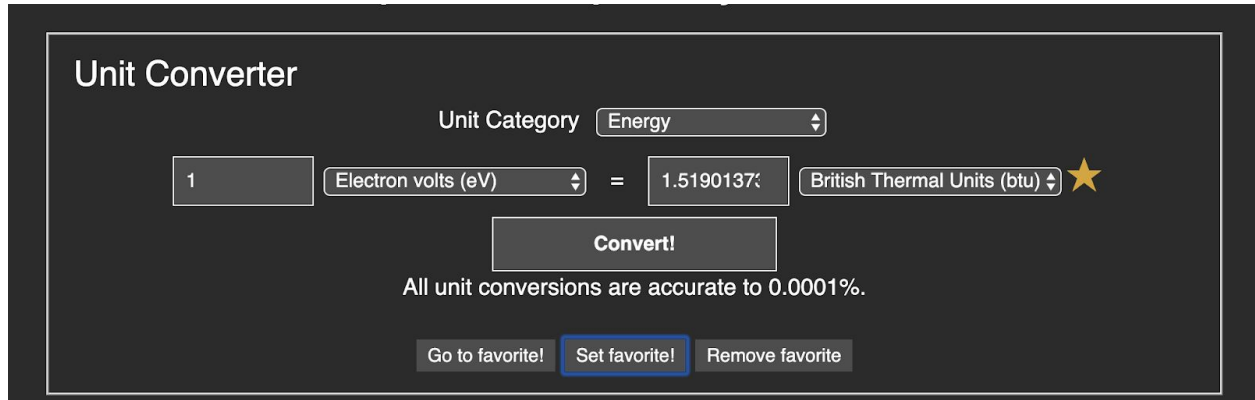
Set favorite!

Remove favorite

After clicking calculate, the formula calculator will compute the answer. When solving for  $v$ , it will work iteratively utilizing the friction factor equation and the equation for Reynold's Number until it arrives at a difference of the friction factor less than or equal to 0.00001.

## Favorites

If you are going to be performing the same calculation often you can make that conversion or formula a favorite. To make a calculation a favorite, click the button *SET FAVORITE!* and a gold star will appear next to the calculation to indicate that it is a favorite. Choosing a favorite make this calculation the new default when relaunching the app in your browser.



The screenshot shows a 'Unit Converter' interface with a dark background. At the top left, the title 'Unit Converter' is displayed. Below it, the 'Unit Category' is set to 'Energy'. The main conversion area shows '1' in a text input field, followed by a dropdown menu for 'Electron volts (eV)', an equals sign, a text output field showing '1.5190137', and another dropdown menu for 'British Thermal Units (btu)'. A gold star icon is positioned to the right of the 'btu' dropdown. Below the conversion area is a 'Convert!' button. Underneath the button, a note states 'All unit conversions are accurate to 0.0001%.' At the bottom, there are three buttons: 'Go to favorite!', 'Set favorite!' (which is highlighted with a blue border), and 'Remove favorite'.

If at any time you want to use this favorite calculation click the *GO TO FAVORITE!* Button. If you want to change your favorite, click the *REMOVE FAVORITE* button. Only one calculation per section can be favorited at a time.