



Mole Conversions

Video Workbook with Dr. B

More guides at
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Moles to Grams, Grams to Moles

To learn this, **first** learn the quick way using the mnemonic.

Moles to Grams : Mole-tipty by Molar Mass

Grams to Moles : Divide by Molar Mass

Example: Convert 3.23 moles of H₂O to grams.

$$3.23 \cancel{\text{mol}} \times 18.02 \frac{\text{g}}{\cancel{\text{mol}}} = 58.2 \text{ g}$$

3.23 mol is a number I made up for the problem. 18.02 g/mol is the [molar mass of H₂O](#). Note that mol is on the top and bottom and cancels out, leaving us with grams.

Example: Convert 58.2 grams of H₂O to moles.

$$\frac{58.2 \cancel{\text{g}}}{18.02 \cancel{\text{g/mol}}} = 3.23 \text{ mol}$$

58.2 g is a number I made up for the problem. 18.02 g/mol is the molar mass of H₂O. Note grams cancel out leaving moles.

 [Finding Molar Mass](#)

For both examples, note that the units cancel out to leave the one we are looking for. If they do not, you did something wrong!

You can also use the formula :

$\text{g} = \text{mol} \times \text{Molar Mass}$
but it is a bit slower.

Practice with Video Explanations

Moles to Grams

Convert 1.24 moles AgNO₃ to grams.
<https://youtu.be/zltkMVbyna0>

Convert 0.73 mol Ba(NO₃)₂ to grams.
<https://youtu.be/wNimUEF64EU>

Convert 2.31 mol NH₄Cl to grams.
<https://youtu.be/g-Fe0cFYm5Q>

Grams to Moles

Convert 27.23 g H₂O to Moles
<https://youtu.be/wCrCBulu-Os>

Convert 72.1 g O₂ to Moles
https://youtu.be/DALvr-B_8ic

Convert 23.4 g CO₂ to Moles
<https://youtu.be/pZ-iB1GE3QU>

More Practice

Convert 42.5 mol CaCl₂ to grams.
https://youtu.be/KRrEswl_WsU

Convert 0.62 g Cu(NO₃)₂ to Moles
<https://youtu.be/n4Z-LjdiyKg>

Convert 42.5 mol CaCO₃ to grams.
<https://youtu.be/-3VMoXw75HI>

Answers Below (Note, depending how you round you may get a slightly different answer.)



1.24 mol AgNO₃ = 210.64g
 0.73 mol Ba(NO₃)₂ = 190.79g
 2.31 mol NH₄Cl = 53.50g

27.23 g H₂O = 1.508 mol
 72.1 g O₂ = 2.25 mol
 23.4 g CO₂ = 0.532 mol

42.6 g CaCl₂ = 0.383 mol
 0.62 mol Cu(NO₃)₂ = 16.29g
 2.29 mol CaCO₃ = 229.21 g

Moles to Molecules, Molecules to Moles

Moles to Molecules : Mole-tiply by 6.022×10^{23}

Molecules to Moles : Divide by 6.022×10^{23}

Example: Convert 0.52 moles to CO₂ to molecules.

$$0.52 \cancel{\text{mol}} \times 6.022 \times 10^{23} \frac{\text{molecules}}{\cancel{\text{mol}}} = 3.1 \times 10^{23} \text{ molecules}$$

Note that moles cancel out leaving molecules.

Example: Convert 1.7×10^{23} atoms of Fe to moles.

$$\frac{1.7 \times 10^{23} \cancel{\text{atoms}}}{6.022 \times 10^{23} \frac{\cancel{\text{atoms}}}{\text{mole}}} = 0.28 \text{ moles}$$

Note that we have atoms instead of molecules here. It doesn't matter, the calculations are the same. Atoms cancel out and we have moles.

1 mole

=

6.022×10^{23} Particles

(some teachers use 6.02×10^{23})

Atoms, molecules, and ions are considered "Particles" for mole conversions.

When converting moles to molecules (or to atoms) you **do not** use molar mass in the calculation.

Practice with Video Explanations

Moles to Molecules

Convert 0.3 moles NH₃ to molecules.
https://youtu.be/Czp2rfu_KBk

Convert 1.2 mol H₂O to molecules.
<https://youtu.be/KplrH5Mscj8>

Convert 2.9 mol CH₄ to molecules.
<https://youtu.be/n6meLmsfJPA>

Molecules to Moles

Convert 3.25×10^{22} molecules N₂ to moles.
https://youtu.be/zbnZ_AJSeP8

Convert 12.31×10^{15} molecules CO₂ to moles.
<https://youtu.be/JrcxR2eJi3Y>

Convert 7.52×10^{27} atoms of He to moles.
<https://youtu.be/rfMD90Jlh>

More Practice

Convert 4.72×10^{19} molecules H₂O to moles.
<https://youtu.be/lpuY3PyBLus>

Convert 2.9 moles CH₄ molecules.
<https://youtu.be/n6meLmsfJPA>

Convert 0.77×10^{24} molecules to moles.
https://youtu.be/9IEjuK_9d0c

Answers Below (Note, depending how you round you may get a slightly different answer.)



0.3 mol NH₃ = 1.8 × 10²³ molecules
 1.2 mol H₂O = 7.2 × 10²³ molecules
 2.9 mol CH₄ = 17.5 × 10²³ molecules

3.25 × 10²² molecules N₂ = 0.054 mol
 12.31 × 10¹⁵ molecules CO₂ = 2.04 × 10⁻⁸ mol
 7.52 × 10²⁷ atoms of He = 1.25 × 10⁴ mol

4.72 × 10¹⁹ molecules H₂O = 0.784 × 10⁻⁴ mol
 2.9 moles CH₄ = 1.75 × 10²⁴ molecules
 0.77 × 10²⁴ molecules = 1.28 mol

Moles to Liters, Liters to Moles

This only applies to gases like O₂, N₂, CH₄, H₂, CO₂ and the Nobel Gases (He, Ne, Ar ...). It is a good approximation for these gases.

Moles to Liters : Mole-tipty by 22.4

Liters to Moles : Divide by 22.4

Example: Convert 3.2 moles of O₂ gas to liters.

$$3.2 \cancel{\text{mol}} \times \frac{22.4 \text{ L}}{1 \cancel{\text{mol}}} = 71.7 \text{ L}$$

Example: Convert 7.8 L of CH₄ to moles.

$$\frac{7.8 \cancel{\text{L}}}{22.4 \cancel{\text{L}} \text{ mol}^{-1}} = 0.35 \text{ mol}$$

1 mole of an ideal gas

=

22.4 Liters

Gases must be at STP (Standard Temperature and Pressure). If the temp or pressure is different, this approximation doesn't work as well.

This doesn't work well with non-ideal gases like H₂O vapor, NH₃ gas, or HCl gas.

Practice with Video Explanations

Moles to Liters

Convert 4.1 moles O₂ to liters.

<https://youtu.be/sJBOOTD2GdQ>

Convert 2.2 moles H₂ to liters.

<https://youtu.be/ZDpMZAjZkig>

Convert 7.5 moles CH₄ to liters.

https://youtu.be/n_VpeZ9lfz8

Liters to Moles

Convert 22.6 liters CO₂ gas to moles.

<https://youtu.be/t78vqUw7zWg>

Convert 32.6 liters N₂ gas moles.

<https://youtu.be/wYvUAzAN3IA>

Convert 9.6 liters Ar gas moles.

<https://youtu.be/Hggm2HdFDTA>

More Practice

Convert 1.3 mol N₂ gas to liters.

<https://youtu.be/3qHOckwekw4>

Convert 7.2 liters He gas to moles.

<https://youtu.be/7zrWirssGOw>

Convert 24.4 L CH₄ to moles.

<https://youtu.be/wTmVe7jvu4c>

Answers (Note, depending how you round you may get a slightly different answer.)

4.1 mol O₂ = 91.8L
 2.2 mol H₂ = 49.3L
 7.5 mol CH₄ = 168.0L

22.6 L CO₂ = 1.01 mol
 32.6 L N₂ = 1.46 mol
 9.6 L Ar = 0.43 mol

1.3 mol N₂ = 29.1L
 7.2 L He = 0.32 mol
 24.4 L CH₄ = 1.09 mol

