SCIENCE FOUNDATIONS

Gram-to-mole conversions

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how a chemist weighs out exactly the right amount of an ingredient for a reaction, by turning grams on a scale into the counting unit (see Avogadro's number) that recipes for reactions use. A pharmacist making a compound medicine measures grams but thinks in moles, because the reaction only cares about how many particles there are. A water treatment plant doses chemicals by the same idea, weighing out a bulk amount that matches a counted amount. Knowing this conversion tells you how to turn a weight you can measure into a count of particles you cannot see.



Rule

Gram-to-mole conversions: moles = $\dfrac{\text{mass}}{\text{molar mass}}$.

The mass must be in grams and the molar mass in grams per mole.

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Worked examples

EXAMPLE 1

Q Convert 36.0 g of water to moles (molar mass 18.0 g/mol).

SOLUTION

Write the rule:

moles = mass ÷ molar mass

Substitute:

moles = 36.0 ÷ 18.0 = 2.0 mol

Write the answer in moles.

The result is 2.0 moles of water.

EXAMPLE 2

Q Convert 88.0 g of carbon dioxide to moles (molar mass 44.0 g/mol).

SOLUTION

Write the rule:

moles = mass ÷ molar mass

Substitute:

moles = 88.0 ÷ 44.0 = 2.0 mol

Write the answer in moles.

The result is 2.0 moles of carbon dioxide.

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Practice questions

1. Convert 54.0 g water (18.0 g/mol) to moles.

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2. Convert 2.5 mol of CO2 to grams (molar mass 44.0 g/mol).

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3. Convert 58.5 g of NaCl (58.5 g/mol) to moles. Then convert that many moles of water (18.0 g/mol) to grams.

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4 **Convert 20.0 g NaCl (58.5 g/mol) to moles, to 2 decimal places.**

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5 **Formula for moles from mass?**

A Molar mass divided by mass

B Mass times molar mass

C Mass divided by molar mass

D Moles times molar mass

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6 **A 20.0 g sample is 0.5 mol. What is its molar mass?**

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7 How many moles of oxygen atoms are in 32.0 g of O2 (32.0 g/mol)?

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8 A student has 2.0 mol of Ca and 2.0 mol of water. Which has the greater mass?

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9 Convert 100.0 g of water (18.0 g/mol) to moles. Then state how many moles of hydrogen atoms are in that sample. Give your answer to 2 decimal places.

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10 **If moles are 2 and molar mass is 18.0, what mass?**

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ANSWER KEY

1. 3.0 moles

2. 110.0 g

3. 18.0 g

4. 0.34 moles

5. Mass divided by molar mass

6. 40.0 g/mol

7. 2.0 moles

8. Ca

9. 11.11 moles

10. 36.0 g

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