

Math Skills

Converting Mass to Amount

After you study each sample problem and solution, work out the practice problems on a separate sheet of paper. Write your answers in the spaces provided.

PROBLEM

Lithium (molar mass = 6.94 g/mol) is so light that a 0.001 m³ (1 L) volume of it has a mass of only 534 g. What is the amount in moles represented by this mass of lithium?

SOLUTION

Step 1: List the given and unknown values.

Given: mass of lithium = 534 g Li
molar mass of lithium = 6.94 g/mol Li

Unknown: amounts of lithium = ? mol

Step 2: Write down the conversion factor that converts grams to moles.

The conversion factor you choose should have what you are trying to find (moles of Li) in the numerator and what you want to cancel (grams of Li) in the denominator.

$$\frac{1 \text{ mol Li}}{6.94 \text{ g Li}}$$

Step 3: Multiply the mass of lithium in grams by this conversion factor, and solve.

$$534 \text{ g Li} \times \frac{1 \text{ mol Li}}{6.94 \text{ g Li}} = 76.9 \text{ mol Li}$$

PRACTICE

- The price of gold (molar mass = 196.97 g/mol) has varied so much over the last 30 years that with \$100 you could buy as much as 2.6 troy ounces (81 g) of gold or as little as 0.13 troy ounces (4.0 g). Calculate the amount in moles that these two masses of gold represent.**

- Aluminum (molar mass = 26.98 g/mol) is the most common metal in Earth's crust. But before the discovery in 1886 of the process that allowed it to be cheaply extracted from bauxite, aluminum was expensive to process. In 1852, a pound of aluminum cost \$545; in 1887 the price was \$0.30. At those prices, \$100 would buy only 83.2 g of aluminum in 1852 but 1.51×10^5 g in 1887. Determine the amount in moles that these two masses of aluminum represent.

Math Skills *continued*

3. Osmium (molar mass = 190.23 g/mol) and iridium (molar mass = 192.22 g/mol) have the highest densities of any elements. A cubic centimeter of either element has a mass of around 22.6 g. Determine the amount in moles of 22.6 g of each element.
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4. **Tungsten (molar mass = 183.84 g/mol), whose high melting point makes it suitable for light bulb filaments and certain types of steel, is one of the heavier elements; its name even means “heavy stone” in Swedish. What is the amount in moles contained in a 500.0 g sample of tungsten?**
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5. Carbon (molar mass = 12.01 g/mol) and lead (molar mass = 207.2 g/mol) are the lightest and heaviest members of their elemental group, respectively. Determine the amount in moles represented by 245 g of carbon and by 245 g of lead.
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6. Potassium chloride (molar mass = 74.55 g/mol) is a fairly common salt. Although it is fatal in high doses, potassium chloride can be safely consumed in small quantities. It is often mixed in small proportions with sodium chloride to produce “low-sodium” table salt. Determine the amount in moles in 150 g of potassium chloride.
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7. **Sulfur dioxide (molar mass = 64.7 g/mol), which is formed when heated sulfur is oxidized, is a pollutant that irritates lung tissue and makes it more sensitive to dust and other particles inhaled from the outside air. Determine the amount in moles that would be represented by 27 kg of sulfur dioxide.**
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8. **Aluminum quickly oxidizes when it is exposed to air, so there is always a thin layer of aluminum oxide (molar mass = 101.96 g/mol) on any aluminum surface. This oxide layer protects the aluminum from further corrosion. If the aluminum oxide on several aluminum surfaces has a mass of 79 g, what amount in moles would be represented by this mass?**
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9. Sulfuric acid (molar mass = 98.09 g/mol) is widely used as a corrosive reactant. It is also used in making fertilizer, detergents, drugs, explosives, and paints, and in the production of other chemicals. The usefulness of sulfuric acid is so great that it is the most widely produced chemical in the United States. What is the amount in moles in a sample of sulfuric acid that has a mass of 165 g?