Activity 08-13 Moles to Mass - Using Molar Mass to Find Mass

Converting Amount to Mass

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

Hydrogen (molar mass = 2.02 g/mole H_2) is the most common element in the universe, and it is usually found in the molecular form H_2. Determine the mass in grams of 7.50 mole of molecular hydrogen.

SOLUTION

Step 1: **List the given and unknown values.**

      Given: amount of hydrogen = 7.50 mole H_2

      molar mass of hydrogen = 2.02 g/mole H_2

      Unknown: mass of hydrogen = ? g

Step 2: **Write down the conversion factor that converts moles of molecular hydrogen to grams.** The conversion factor you choose should have what you are trying to find (grams of H_2) in the numerator and what you want to cancel (moles of H_2) in the denominator.

$$\frac{2.02 \text{ g } H_2}{1 \text{ mole } H_2}$$

Step 3: **Multiply the amount of hydrogen in moles by the conversion factor you have chosen, and solve.**

$$\frac{7.55 \text{ moles } H_2}{} \left| \frac{2.02 \text{ g } H_2}{1 \text{ mole } H_2} = 15.3 \text{ g } H_2 \right.$$

PRACTICE

1. Uranium (molar mass = 238.03 g/mole U) has the largest molar mass of any element naturally found on Earth.

   What is the mass of 7.50 moles of uranium, U?

2. Ruthenium (101.07 g/mole Ru) is used as a catalyst and to improve titanium's resistance to corrosion. It is also one of the rarest elements in Earth's crust, making up less than one ten-millionth of the crust's total mass. Calculate the mass of 37.0 moles of ruthenium, Ru.

3. Large deposits of manganese (54.94 g/mole Mn), a metal used to form many different types of alloys, have been found on the floors of oceans and large lakes. Suppose one of these deposits contains 383 moles of manganese. What is the mass of the manganese, Mn, deposit?

4. Sodium chloride (58.44 g/mole NaCl), commonly known as table salt, is the most common type of salt. What is the mass of 29.0 moles of sodium chloride, NaCl?

5. Oxygen gas is most often found as O_2 (molar mass = 32.00g/ mole O_2). However, under certain conditions, a compound called ozone, O_3 (molar mass = 48.00 g/mole O_3) is formed. Ozone, which is highly reactive and unstable, is formed when O_2 is exposed to ultraviolet radiation. Ozone is able to absorb other ultraviolet radiation, protecting life on Earth's surface from this harmful radiation.

   a. What is the mass of 17 moles of O_2?

   b. What is the mass of 17 moles of O_3?

6. After oxygen, silicon is the most common element found in Earth's crust. Both elements are found in silicon dioxide (molar mass = 60.09 g/mole SiO_2), which is the main component in sand. Suppose you have 893 moles of silicon dioxide in a sample of sand. What is the mass of the silicon dioxide, SiO_2?

7. Carbon dioxide (molar mass = 44.01 g/mole CO_2) is an inert gas that plants need for photosynthesis.

   a. Calculate the mass of 893 moles of carbon dioxide, CO_2.

   b. How does the mass you obtained in part (a) compare with the mass of 893 moles of silicon dioxide, SiO_2?

8. Both marble and limestone contain the same mineral, calcite, which consists of the compound calcium carbonate (molar mass = 100.09 g/mole $CaCO_3$). What is the mass of a block of calcite if it contains 37 moles of calcium carbonate, $CaCO_3$?