How to Perform Mole Calculations

Question 1

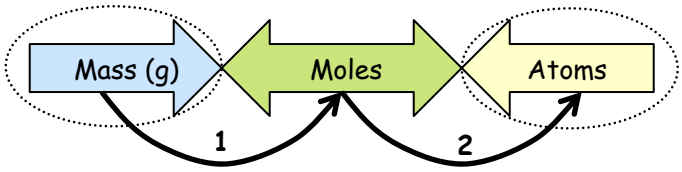
How many atoms are in 37 grams of Oxygen?

Step 1: Read the question and identify the starting point and the final destination.

In this case the starting point is 37 grams of Oxygen and the final destination is atoms.

Step 2: Using your "Mole Road Map," determine how many fractions (not including the starting point) it will take to get from the starting point to the final destination.

In this case, it will take two fractions to get from the starting point to the final destination.



Step 3: Take your starting point and place it over 1.

$$\frac{\text{37 grams of Oxygen}}{1}$$

Step 4: Multiply between fractions and make sure that the unit on the bottom of the new fraction is the same as the unit on the top of the previous fraction.

$$\frac{\text{37 grams of Oxygen}}{1} \times \frac{\qquad\qquad}{\text{grams of Oxygen}}$$

Step 5: Create a relationship between the starting point and the first stop. For some problems, the first stop will be the final destination.

In this case your first stop is at moles; therefore, you want to create a relationship between grams of Oxygen and moles of Oxygen. Whenever you create a relationship between grams and moles, it is necessary to use your periodic table to determine the molar mass. If this were a molecule (i.e. – H_2O) it would be necessary for you to use your periodic table to calculate its molar mass.

$$\frac{37 \text{ grams of Oxygen}}{1} \times \frac{1 \text{ mole of Oxygen}}{16 \text{ grams of Oxygen}}$$

Step 6: Create a relationship between the first stop and the final destination.

In this case it is necessary to create a relationship between moles of Oxygen and atoms of Oxygen. Whenever you create a relationship between moles and atoms (molecules, particles, etc.) it is necessary to use 1 mole = 6.02 X 10^{23}.

$$\frac{37 \text{ grams of Oxygen}}{1} \times \frac{1 \text{ mole of Oxygen}}{16 \text{ grams of Oxygen}} \times \frac{6.02 \times 10^{23} \text{ atoms of Oxygen}}{1 \text{ mole of Oxygen}}$$

Step 7: Cancel all possible units. This should leave only the units that represent the final destination.

$$\frac{37 \text{ ~~grams of Oxygen~~}}{1} \times \frac{1 \text{ ~~mole of Oxygen~~}}{16 \text{ ~~grams of Oxygen~~}} \times \frac{6.02 \times 10^{23} \text{ atoms of Oxygen}}{1 \text{ ~~mole of Oxygen~~}}$$

Step 8: Multiply all numbers on the top. Multiply all numbers on the bottom. Divide the product of the top by the product of the bottom.

$$\frac{(37))(1)(6.02 \times 10^{23} \text{ atoms of Oxygen})}{(1)(16)(1)} = \frac{2.23 \times 10^{25} \text{ atoms of Oxygen}}{16} = 1.39 \times 10^{24} \text{ atoms of Oxygen}$$

Question 2

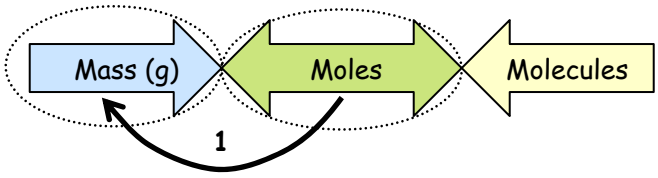
What is the mass of 2 moles of H_2O?

Step 1: Read the question and identify the starting point and the final destination.

In this case the starting point is 2 moles of H_2O and the final destination is mass (g).

Step 2: Using your "Mole Road Map," determine how many fractions (not including the starting point) it will take to get from the starting point to the final destination.

In this case, it will take one fraction to get from the starting point to the final destination.



Step 3: Take your starting point and place it over 1.

$$\frac{2 \text{ moles of } H_2O}{1}$$

Step 4: Multiply between fractions and make sure that the unit on the bottom of the new fraction is the same as the unit on the top of the previous fraction.

$$\frac{2 \text{ moles of } H_2O}{1} \times \frac{\qquad\qquad}{\text{moles of } H_2O}$$

Step 5: Create a relationship between the starting point and the first stop. For some problems, the first stop will be the final destination.

In this case your first (and only) stop is at mass (g); therefore, you want to create a relationship between moles of H_2O and grams of H_2O. Whenever you create a relationship between grams and moles, it is necessary to use your periodic table to determine the molar mass. Since H_2O is a molecule it is necessary for you to use your periodic table to calculate its molar mass as opposed to just locating its molar mass on the periodic table.

H→ 2 atoms x 1 amu = 2 amu or 2 grams/mole

\+ O → 1 atom x 16 amu = 16 amu or 16 grams/mole

H_2O has a mass of **18 grams/mole**

$$\frac{2 \text{ moles of } H_2O}{1} \times \frac{18 \text{ grams of } H_2O}{1 \text{ mole of } H_2O}$$

Step 6: Cancel all possible units. This should leave only the units that represent the final destination.

$$\frac{2 \text{ ~~moles of } H_2O~~}{1} \times \frac{18 \text{ grams of } H_2O}{\text{~~1 mole of } H_2O~~}$$

Step 7: Multiply all numbers on the top. Multiply all numbers on the bottom. Divide the product of the top by the product of the bottom.

$$\frac{(2)(18 \text{ grams of } H_2O)}{(1)(1)} = \frac{36 \text{ grams of } H_2O}{(1)} = 36 \text{ grams of } H_2O$$