

Molar Conversions

Background: The **mole** (abbreviated mol) is a unit of measurement that is used in chemistry to express the counting amount of particles (like atoms and compounds). It is an especially important unit because it makes a connection between the counting amount of particles, the gram amount of particles and sometimes even the liter amount of particles.

Scientists have found that if they measured out exactly 12.0 grams of carbon (carbon's molar mass), that in that 12.0 grams of carbon would be 602 000 000 000 000 000 000 atoms of carbon (or 6.02×10^{23} atoms - good thing for scientific notation). This very large number is known as Avogadro's number. They further discovered that this held true for all of the other elements; where the molar mass (mass of 1 mole) of an element contains 6.02×10^{23} atoms. The mole is one of the base units in the International System of Units (SI).

Review: Use the "grid" to solve for the number of seconds in 10 years.

Just as we used the "grid" to convert from years to seconds, we can use the "grid" to convert between moles, atoms, and grams. The unit equality between mole, gram, and Avogadro's number is given below.

1.0 mole of an element = 6.02×10^{23} atoms of that element = molar mass of that element

Mole-Atom Practice

1. How many atoms of sodium are in 5 moles of sodium?
2. How many atoms of potassium are in 0.42 moles of potassium?
3. How many moles of magnesium are in 1.25×10^{23} atoms of magnesium?
4. How many moles of boron are in 3.14×10^{25} atoms of boron?

Mole-Gram Practice

In order to convert between moles and grams of an element, you must determine the molar mass of the element. Use the periodic table to find the molar mass.

molar mass of an element = mass from periodic table (round to two decimal places)

Determine the molar mass of each element below:

5. Iron, Fe

7. Calcium, Ca

6. Phosphorus, P

8. Barium, Ba

Now let's convert between moles and grams.

9. How many grams of iron are in 2.9 moles of iron?

11. How many moles of calcium are in 62.45 grams of calcium?

10. How many grams of phosphorus are in 5.23 moles of phosphorus?

12. How many moles of barium are in 196.84 grams of barium?

Mixed Practice

13. How many grams of copper (Cu) are in 7.3 moles of copper?

14. How many atoms of lead (Pb) are in 6.755 moles of lead?

15. How many moles of sulfur (S) are in 152.1 grams of sulfur?

16. How many moles of mercury (Hg) are in 4.50×10^{12} atoms of mercury?

17. What is the mass in grams of silver (Ag) in 1.00 moles of silver?