Mole Conversions
Chem Worksheet 11-3

It is important to be able to convert units from and into units of moles. The mole is a unit for count, as is the dozen. A dozen is 12 items, but a mole is 602 000 000 000 000 000 000 000, or 6.02 × 10^{23} particles. Using the periodic table we can find the molar mass, or the mass of a mole of a substance. The molar volume is the volume of a mole of substance. All gases have the same molar volume when measured at standard temperature and pressure (STP) : 22.4 L/mol. These values allow the conversion of grams, liters, or particles into moles.

### Mole Conversion Strategy

<table>
<thead>
<tr>
<th>Mass (grams)</th>
<th>molar mass (g/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of gas (liters)</td>
<td>22.4 L/mol</td>
</tr>
<tr>
<td>Amount (moles)</td>
<td></td>
</tr>
<tr>
<td>Particles (atoms, molecules, formula units)</td>
<td>6.02 × 10^{23} particles/mol</td>
</tr>
</tbody>
</table>

### example

How many molecules are present in a sample of calcium chloride CaCl_2 with a mass of 1.62 grams?

- develop a strategy: grams → moles → molecules
- write ‘given’ and unknown units: 1.62 g / 1 mol CaCl_2 = molecules
- fill in conversion factors: 1.62 g / 1 mol CaCl_2 × 1 mol CaCl_2 / 110.98 g = molecules
- solve: (1.62 g / 1 mol CaCl_2) × 6.02 × 10^{23} molecules / 1 mol = 8.79 × 10^{21} molecules

### Answer the following questions.

1. A sample of neon has a volume of 75.8 L at STP. How many moles are present?
2. What is the mass in grams of a 8.4 mole sample of iron?
3. Convert 0.45 g of sodium hydroxide, NaOH to moles.
4. How many molecules are present in a sample of carbon dioxide, CO_2 with a mass of 168.2 g?
5. How many moles of potassium nitrate, KNO_3 are present in a sample with a mass of 85.2 g?
6. What is the mass in grams of 0.94 moles of sodium bicarbonate, NaHCO_3?
7. Convert 7.8 liters of carbon tetrafluoride CF_4 to grams.
8. A gold coin contains 3.47 × 10^{23} gold atoms. What is the mass of the coin in grams?
9. What is the volume in liters of 7500 g of helium atoms. Assume STP conditions.
10. A teaspoon of salt, NaCl has a mass of about 5.0 g. How many formula units are in a teaspoon of salt?
11. What is the mass of 500 trillion (5.0 × 10^{14}) molecules of water?
12. One component of smog is nitrogen monoxide, NO. A car produces about 8 g of this gas per day. What is the volume at STP?