How to Calculate the Formula Weight

The periodic table provides you with individual atomic masses and not the masses of molecules/compounds. However, if you know the number and type of atoms in a molecule/compound you can add up the individual masses to find the molecule’s/compound’s mass. This is known as its formula weight.

✓ **Step One** – List the symbols of the different types of atoms that make up the molecule/compound.

   \[ \text{Example 1 - } H_2O_2 \]
   \[ \begin{align*}
   H & \rightarrow \\
   O & \rightarrow
   \end{align*} \]

✓ **Step Two** – List the total number of each type of atom next to the symbols.

   \[ \begin{align*}
   H & \rightarrow 2 \\
   O & \rightarrow 2
   \end{align*} \]

✓ **Step Three** – Using your periodic table, find the mass of the listed atoms and write them down next to the appropriate symbol.

   \[ \begin{align*}
   H & \rightarrow 2 \times 1 \text{ amu (} \mu \text{)} \\
   O & \rightarrow 2 \times 16 \text{ amu (} \mu \text{)}
   \end{align*} \]

✓ **Step Four** – Multiply the number of atoms present by its appropriate atomic mass.

   \[ \begin{align*}
   H & \rightarrow 2 \times 1 \text{ amu (} \mu \text{)} = 2 \text{ amu (} \mu \text{)} \\
   O & \rightarrow 2 \times 16 \text{ amu (} \mu \text{)} = 32 \text{ amu (} \mu \text{)}
   \end{align*} \]

✓ **Step Five** – Add all of the atomic masses together.

   \[ \begin{align*}
   H & \rightarrow 2 \times 1 \text{ amu (} \mu \text{)} = 2 \text{ amu (} \mu \text{)} \\
   O & \rightarrow 2 \times 16 \text{ amu (} \mu \text{)} = 32 \text{ amu (} \mu \text{)} \\
   & \quad 34 \text{ amu (} \mu \text{)}
   \end{align*} \]

One molecule of hydrogen peroxide weighs in at 34 amu (\( \mu \)).
**Example 2**

The formula weight of calcium phosphate, \( \text{Ca}_3(\text{PO}_4)_2 \) would be calculated like this.

The molecule has 3 calcium (Ca) atoms, 2 phosphate (P) atoms, and 8 oxygen (O) atoms in it. Stop and verify this for yourself. The Ca has a subscript 3 with it. The P has an assumed 1 and the O has a 4. However the \( \text{PO}_4 \) group has a set of brackets around it with a subscript 2. The 2 means multiply everything inside the brackets by 2. So we end up with the 2 P and 8 O atoms.

\[
\begin{align*}
\text{Ca} & \rightarrow 3 \times 40 \text{ amu} = 120 \text{ amu} \\
\text{P} & \rightarrow 2 \times 31 \text{ amu} = 62 \text{ amu} \\
\text{O} & \rightarrow 8 \times 16 \text{ amu} = 128 \text{ amu} \\
\end{align*}
\]

One molecule of calcium phosphate weighs 310 amu (\( \mu \)).

Try this one on your own.

What is the formula weight of \( \text{C}_6\text{H}_{12}\text{O}_6 \)?