

# Difference Between Monoxide and Dioxide

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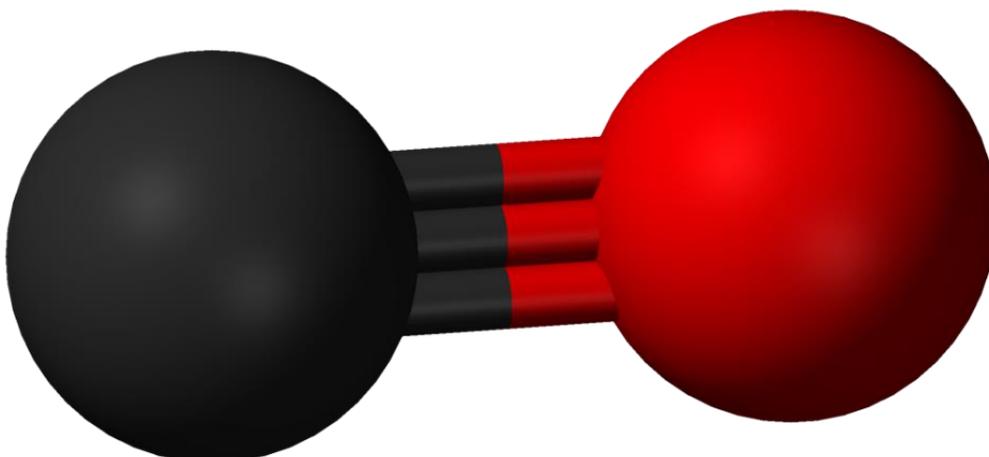
## Key Difference - Monoxide vs Dioxide

The terms monoxide and dioxide are used in the [nomenclature](#) of [oxide compounds](#). An oxide is any chemical compound containing at least one [oxygen atom](#) bonded to another element. Sometimes the term oxide is used to name the oxide anion ( $O^{2-}$ ). Most of the elements can be found naturally in their oxide compound form. Some elements form different oxide compounds based on their [oxidation](#) states. The term monoxide is used to name a compound having one oxygen atom bonded to another element. Hence, the term dioxide expresses the presence of two oxygen atoms. Some elements form oxides with more than two oxygen atoms. The **key difference** between monoxide and dioxide is that **monoxide compounds contain one oxygen atom bonded to another element whereas dioxide compounds contain two oxygen atoms bonded to the same atom of a different element.**

## What is Monoxide?

The term monoxide is used to name compounds containing one oxygen atom bonded to another element. when considering the [anion](#), the term monoxide refers to the oxide anion ( $O^{2-}$ ). However, in monoxide compounds, the only oxygen atom can be bonded to one atom of the other element or two atoms of it, but not more than two. That is because oxygen atom can form only two [covalent](#) chemical bonds in its stable condition.

Group 1 elements of the periodic table can have only the +1 oxidation state. But the oxide anion have -2 oxidation state. Then, the monoxide of group 1 elements have two atoms bonded to the same oxygen atom. but in the case of group 2 elements, their stable oxidation state is +2. Then, one oxygen atom binds to one atom (of group 2 element) to form the monoxide.



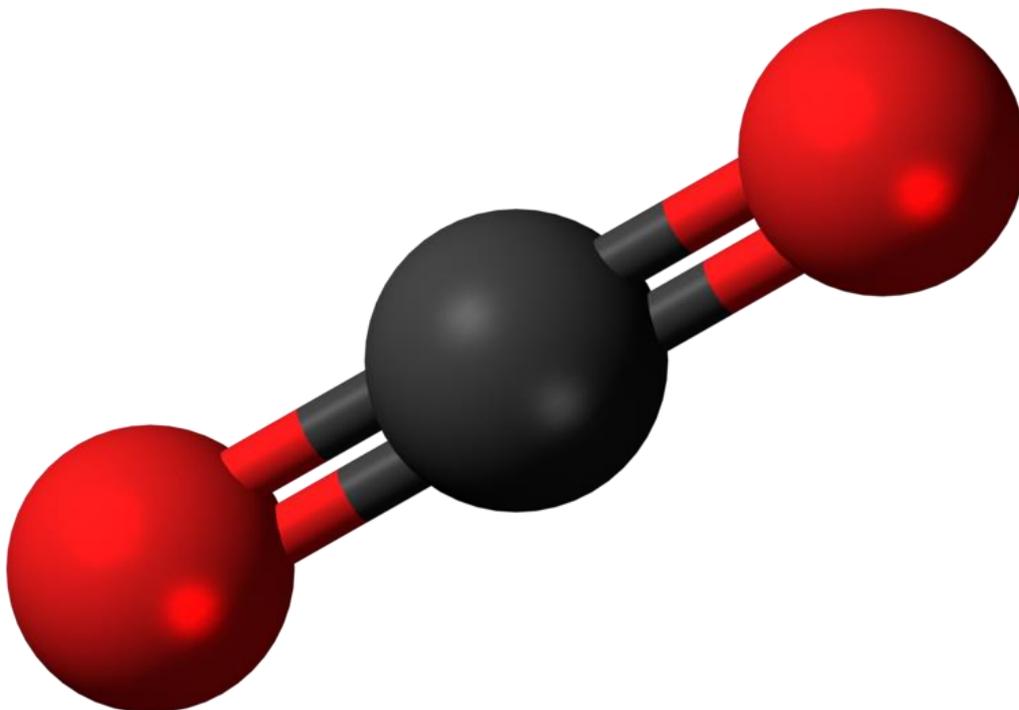
**Figure 01: A monoxide has one oxygen atom (in red) bonded to another element.**

There is a wide variety of monoxide compounds. Some examples are given below.

Category	Name of the monoxide	Chemical formula
Group 1 elements	Sodium monoxide	$\text{Na}_2\text{O}$
	Potassium monoxide	$\text{K}_2\text{O}$
Group 2 elements	Calcium monoxide	$\text{CaO}$
	Magnesium monoxide	$\text{MgO}$
Other elements		
- Hydrogen	Water molecule (dihydrogen monoxide)	$\text{H}_2\text{O}$
- Carbon	Carbon monoxide	$\text{CO}$

## What is Dioxide?

The term dioxide is used to name compounds containing two oxygen atoms bonded to a different element. These compounds are essentially composed of two oxygen atoms. Most of the times these two oxygen atoms are bonded to the same atom (of the different chemical element).



**Figure 02: A dioxide has two oxygen atom (in red).**

There are various dioxide compounds. Some examples are given below.

- Carbon dioxide ( $\text{CO}_2$ )
- Nitrogen dioxide ( $\text{NO}_2$ )
- Sulfur dioxide ( $\text{SO}_2$ )
- Barium dioxide ( $\text{BaO}_2$ )
- Silicon dioxide ( $\text{SiO}_2$ )

Although  $\text{H}_2\text{O}_2$  is also composed of two oxygen atoms, it is not considered as a dioxide. It is known as hydrogen peroxide. The reason is, to call an oxide containing two oxygen atoms, a dioxide, the oxidation state of the oxygen atom in that compound should be in its stable state (-2 oxidation state). In  $\text{H}_2\text{O}_2$ , oxygen is in -1 oxidation state, thus, it is known as a [peroxide](#).

## What is the Difference Between Monoxide and Dioxide?

Monoxide vs Dioxide	
The term monoxide is used to name compounds containing one oxygen atom bonded to another element.	The term dioxide is used to name compounds containing two oxygen atoms bonded to a different element.

## Oxygen Atoms

Monoxides have one oxygen atom.

Dioxides have two oxygen atoms.

## Summary - Monoxide vs Dioxide

Monoxide and dioxide are terms used to name different oxides based on the oxygen atoms present in their chemical structure. The difference between monoxide and dioxide is that monoxide compounds contain one oxygen atom bonded to another element whereas dioxide compounds contain two oxygen atoms bonded to the same atom of a different element.

### Reference:

1. "Monoxide." Wikipedia, Wikimedia Foundation, 31 Dec. 2017. [Available here](#)
2. "GCSE Chemistry - Oxygen and oxides - Revision 5." BBC Bitesize, BBC. [Available here](#)

### Image Courtesy:

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APA: Difference Between Monoxide and Dioxide.(2018 February 19). Retrieved (date), from <http://differencebetween.com/difference-between-monoxide-and-vs-dioxide/>

MLA: "Difference Between Monoxide and Dioxide" Difference Between.Com. 19 February 2018. Web.

Chicago: "Difference Between Monoxide and Dioxide." Difference Between.Com. <http://differencebetween.com/difference-between-monoxide-and-vs-dioxide/> accessed (accessed [date]).



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