

The multiple forms of oxygen

Mineralogists think of oxygen in its 2- oxidation state in minerals, and geochemists additionally think about it as elemental diatomic oxygen (O₂) in redox geochemistry. However, that's just a beginning if one additionally considers chemical processes in the atmosphere. As the table at right shows with its blue region, atmospheric chemistry additionally deals with ozone, with peroxide, and with oxide gases. The interaction of the less-reduced forms of oxygen with the not-fully-oxidized gases (SO₂, NO, NO₂, etc.) provides much entertainment in atmospheric chemistry.

One very important point to note here is the difference between OH, the highly reactive hydroxyl radical, and the hydroxide ion OH⁻, the entity found in water that we can think of as dissociated H₂O. In the table at right, the OH representing the peroxide radical has a "0" superscript to remind readers of its overall neutral charge, but most authors and printers leave it simply as an unadorned "OH". Thus the names and chemical symbols for OH and OH⁻ look much alike, but the two chemical entities are very different.

	← Fully-reduced oxygen	Not-fully-reduced oxygen; unstable at some time scale →	
Nominal oxidation number	-2	-1	0
Name of state	Oxide		
Examples	Oxide minerals e.g., MgO Oxysalt minerals e.g., CaCO ₃ & MgFeSiO ₄ Hydroxide minerals e.g., Al(OH) ₃ Hydroxide ion OH⁻ Water & its vapor H₂O Oxide gases e.g., CO, CO ₂ , SO ₂ N ₂ O, NO, & NO ₂	Hydroxyl radical OH⁰ Hydrogen peroxide H₂O₂ Hydroperoxyl radical HO₂	Diatomic oxygen O₂ Ozone O₃ Atomic oxygen O
	<i>Mineralogy</i>	<i>Aqueous/redox geochemistry</i>	<i>Atmospheric chemistry</i>

Significant in the upper atmosphere (>85 km)

One O⁰ & one O⁻

C	N	O	F	Ne
Si	P	S	Cl	Ar
	As	Se	Br	Kr