

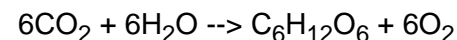
The chemical composition of Earth's atmosphere II: the big two

Mole %	Name	Chemical formula	Residence Time
78.084	Nitrogen	N₂	10⁶-10⁷ years
20.948	Oxygen	O₂	3000-10,000 years
0.934	Argon	Ar	Forever
0.004 - 4	Water vapor	H ₂ O	~10 days
0.0385 (385 ppm)	Carbon dioxide	CO ₂	2-10 years
0.001818 (18.18 ppm)	Neon	Ne	Forever
0.000524 (5.24 ppm)	Helium	He	~10 ⁶ years
0.00017 (1.7 ppm)	Methane	CH ₄	2-10 years
0.000114 (1.14 ppm)	Krypton	Kr	Forever
0.00005 - 0.0010	Stratospheric ozone	O ₃	
0.000055 (0.55 ppm)	Hydrogen	H ₂	4-8 years
0.000033 (0.33 ppm)	Nitrous oxide	N ₂ O	5-200 years
0.0000050 - 0.0000200	Carbon monoxide	CO	60-200 days
0.0000087 (87 ppb)	Xenon	Xe	Forever
0.0000010 - 0.0000500	Tropospheric ozone	O ₃	
0.0000005 - 0.0000020	NMHC	C _x H _y	
0.0000000540 (540 ppt)	CFC12	CF ₂ Cl ₂	>80 years
0.00000005 (500 ppt)	Carbonyl sulfide	OCS	~ 2 years
0.0000000265 (265 ppt)	CFC11	CFCl ₃	~80 years
0.00000001 - 0.000001	Hydrogen peroxide	H ₂ O ₂	1 day
0.00000001 - 0.0000001	Formaldehyde	CH ₂ O	5-10 days
0.0000000098 (98 ppt)	Carbon tetrachloride	CCl ₄	≥ decades
0.0000000065 (65 ppt)	Methylchloroform	CH ₃ CCl ₃	~7 years
0.000000001 - 0.0001	Nitrogen oxides	NO _x	A few days
0.000000001 - 0.0000001	Ammonia	NH ₃	A few days
0.000000001 - 0.0000001	Sulfur dioxide	SO ₂	hours to weeks
0.000000001 - 0.00000001	Dimethyl sulfide	CH ₃ SCH ₃	<1 day
0.0000000001 - 0.00000003	Carbon disulfide	CS ₂	~40 days
0.0000000005 - 0.00000005	Hydrogen sulfide	H ₂ S	<5 days
0.0000000002 (2 ppt)	Hydroperoxyl radical	HO ₂	
0.000000000005 (0.05 ppt)	Hydroxyl radical	OH	≤ a few seconds

99% of Earth's atmosphere is just two components, N₂ and O₂. They are both so abundant because of biological processes.

N₂ is abundant because denitrifying bacteria in soils and seawater reduce the N of nitrate to produce N₂ (and, to a lesser extent, N₂O). These bacteria are called "denitrifying" from the standpoint of the ecology of nutrients, in that the denitrifying bacteria remove nitrate, commonly a critical nutrient, from ecosystems.

O₂ is abundant because it is produced as a byproduct of photosynthesis. As photosynthesizers produce organic matter by the reaction



they reduce oxidized carbon to make carbohydrate and thus must leave behind O as O₂. The persistence of oxygenic photosynthesis for at least two billion years has produced our modern O₂-rich atmosphere.

Another way to view this is to consider how the ocean-atmosphere would evolve without biology. Inorganic chemical equilibrium would dictate that, under the present atmosphere, seawater would have a nitrate (NO₃⁻) concentration ten orders of magnitude (ten billion times) greater than it is. That remarkable disequilibrium is a testimony to the power of Earth's biota to control the chemistry of the exosphere.