

# Nitrogen Cycle Cheatsheet (Chronological Order)

Step	Process	Main Players	Core Equation (simplified)	Oxidation state of N	What it does
<b>Fixation</b>	$N_2 \rightarrow NH_3/NH_4^+$	Nitrogen-fixing bacteria (Rhizobium, free-living), lightning, Haber process	$N_2 + 8H^+ + 8e^- \rightarrow 2NH_3 + H_2$	$0 \rightarrow -3$	Converts inert $N_2$ into usable reduced N
<b>Ammonification</b>	Organic N $\rightarrow NH_3/NH_4^+$	Decomposers	$R-NH_2 + H_2O \rightarrow NH_3 + \text{other products}$	$-3 \text{ stays } -3$	Recycles N from organic matter
<b>Nitrification (1)</b>	$NH_4^+ \rightarrow NO_2^-$	<i>Nitrosomonas</i>	$NH_4^+ + 1.5O_2 \rightarrow NO_2^- + 2H^+ + H_2O$	$-3 \rightarrow +3$	First oxidation step in soil
<b>Nitrification (2)</b>	$NO_2^- \rightarrow NO_3^-$	<i>Nitrobacter</i>	$NO_2^- + 0.5O_2 \rightarrow NO_3^-$	$+3 \rightarrow +5$	Produces nitrate (main plant source)
<b>Assimilation</b>	$NO_3^- / NH_4^+ \rightarrow \text{Organic N}$	Plants, microbes	$NO_3^- (+5) + 8e^- + 10H^+ \rightarrow NH_4^+ (-3) \rightarrow \text{amino acids}$	$+5/-3 \rightarrow -3$	Incorporation into biomass
<b>Denitrification</b>	$NO_3^- \rightarrow N_2$	Facultative anaerobes ( <i>Pseudomonas</i> )	$2NO_3^- + 10e^- + 12H^+ \rightarrow N_2 + 6H_2O$	$+5 \rightarrow 0$	Returns $N_2$ to atmosphere