

Table 12.2. Oxides of nitrogen

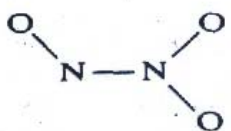
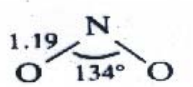
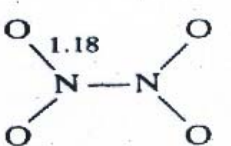
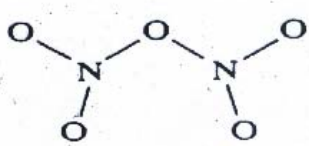
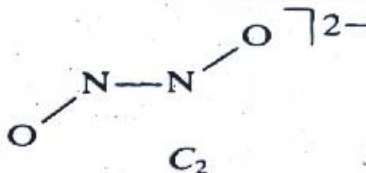
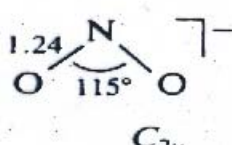
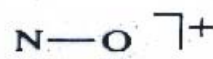
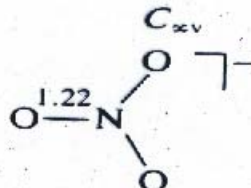
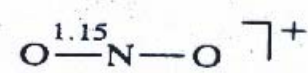
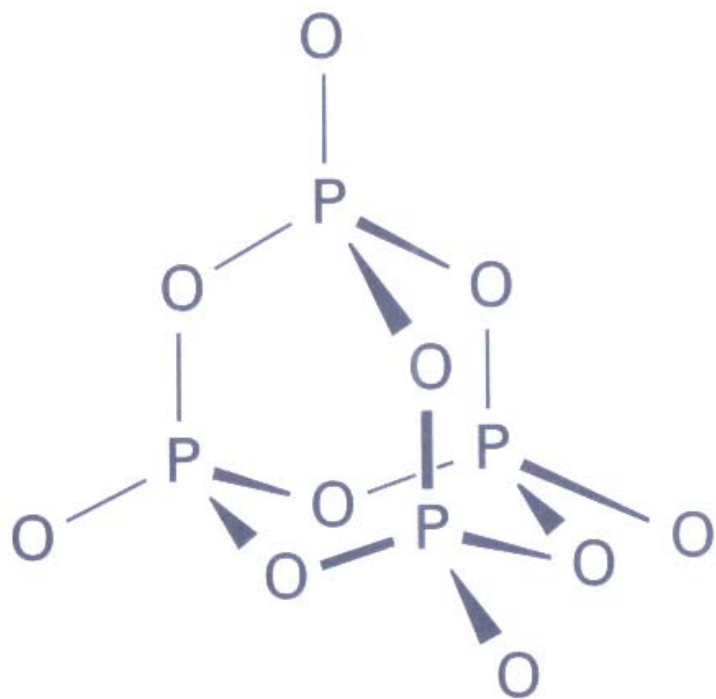
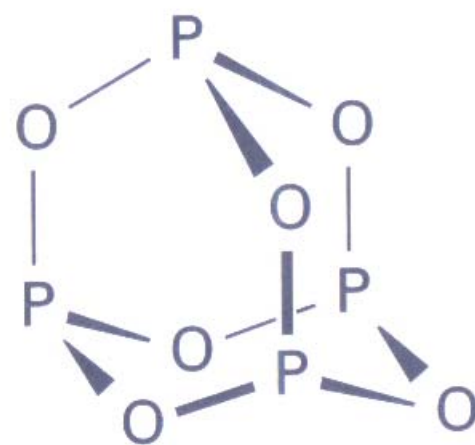
Oxidation number	Formula	Name	Structure (gas phase)	Remarks
+1	N_2O	Nitrous oxide (Dinitrogen oxide)	$N \overset{1.19}{-} N - O$ $C_{\infty v}$	Colorless gas, not very reactive
+2	NO	Nitric oxide (Nitrogen monoxide)	$N \overset{1.15}{-} O$ $C_{\infty v}$	Colorless, paramagnetic gas
+3	N_2O_3	Dinitrogen trioxide	 Planar, C_s	Forms blue solid (m.p. $-101^\circ C$) and dissociates into NO and NO_2 in the gas phase
+4	NO_2	Nitrogen dioxide	 C_{2v}	Brown, reactive, paramagnetic gas
	N_2O_4	Dinitrogen tetroxide	 Planar, D_{2h}	Forms colorless liquid (m.p. $-11^\circ C$); in equilibrium with NO_2 in the gas phase
+5	N_2O_5	Dinitrogen pentoxide	 Planar, C_{2v}	Colorless ionic so- lid $[NO_2][NO_3]$ (m.p. $32^\circ C$); unstable in gas phase

Table 12.3. Nitrogen oxoions

Oxidation number	Formula	Name	Structure	Remarks
+1	$\text{N}_2\text{O}_2^{2-}$	Hyponitrite		Usually acts as a reducing agent
+3	NO_2^-	Nitrite		Weak base; as an oxidizing and a reducing agent
+3	NO^+	Nitrosonium		Oxidizing agent and Lewis acid
+5	NO_3^-	Nitrate	 <p>Planar, D_{3h}</p>	Very weak base; an oxidizing agent
+5	NO_2^+	Nitronium	 <p>Linear, $D_{\infty h}$</p>	Oxidizing agent, nitrating agent, and a Lewis acid



12 P₄O₁₀, *T_d*

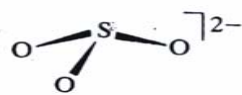
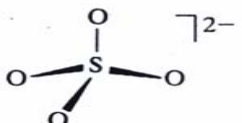
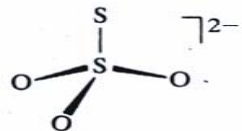
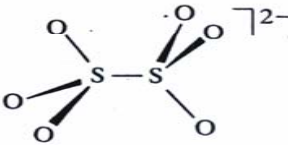
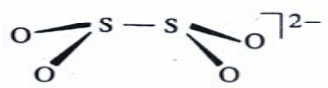
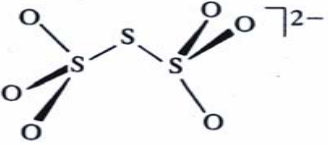


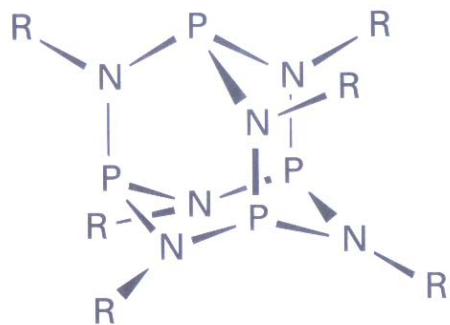
13 P₄O₆, *T_d*

Table 12.5. Some phosphorus oxoanions

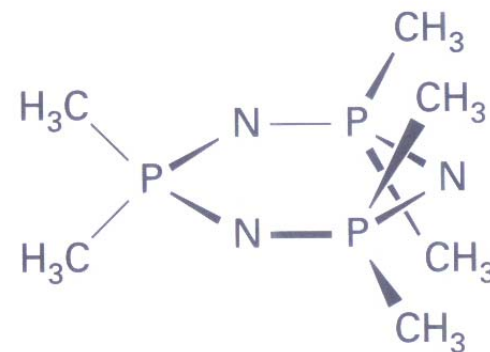
Oxidation number	Formula	Name	Structure	Remarks
+1	H_2PO_2^-	Hypophosphite (dihydrodioxophosphate)		Facile reducing agent
+3	HPO_3^{2-}	Phosphite (hydrotrioxophosphate)		Facile reducing agent
+4	$\text{P}_2\text{O}_6^{4-}$	Hypophosphate		Basic
+5	PO_4^{3-}	Phosphate		Strongly basic
+5	$\text{P}_2\text{O}_7^{4-}$	Pyrophosphate		Basic; longer-chain analogs are known

Table 12.7. Some sulfur oxoanions

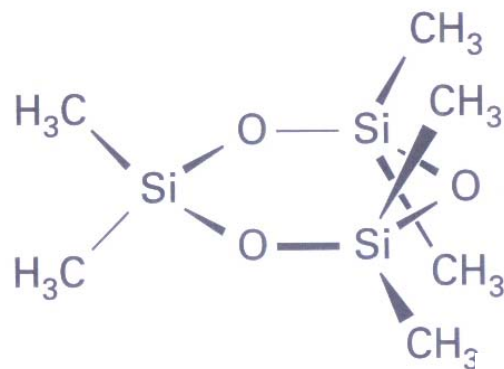
Oxidation number	Formula	Name	Structure	Remarks
<i>One S atom</i>				
+4	SO_3^{2-}	Sulfite		Basic, reducing agent
+6	SO_4^{2-}	Sulfate		Weakly basic
<i>Two S atoms</i>				
+2	$\text{S}_2\text{O}_3^{2-}$	Thiosulfate		Mild reducing agent
+3	$\text{S}_2\text{O}_4^{2-}$	Dithionite		Strong and facile reducing agent
+5	$\text{S}_2\text{O}_6^{2-}$	Dithionate		Resists oxidation and reduction
<i>Polysulfur oxoanions</i>				
Variable	$\text{S}_n\text{O}_6^{2-}$ $3 \leq n \leq 20$	$n = 3$, Trithionate		



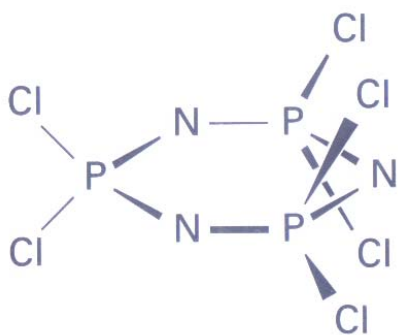
14 $P_4(NR)_6$



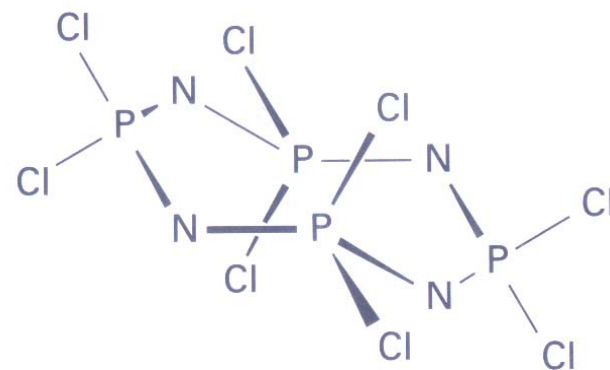
15 $[(CH_3)_2PN]_3$



16 $[CH_3)_2SiO]_3$

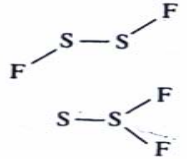


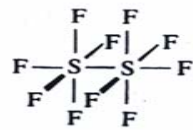
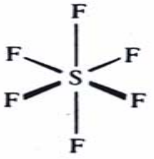


17 $[Cl_2PN]_3$, D_{3h}



18 $[Cl_2PN]_4$

Table 12.6. Some halides of sulfur, selenium, and tellurium

Oxidation number	Formula	Structure	Remarks
+ $\frac{1}{2}$	TeX (X = Br, I)	Halide bridges	Silver-gray
+1	S ₂ F ₂	Two isomers: 	Reactive Reactive
+2	S ₂ Cl ₂ Tel		Reactive
+4	SF ₄		Gas
	SeX ₄ (X = F, Cl, Br) TeF ₄ (X = F, Cl, Br, I)		SeF ₄ liquid TeF ₄ solid
+5	S ₂ F ₁₀ Se ₂ F ₁₀		Reactive
+6	SF ₆ , SeF ₆ TeF ₆		Colorless gases Liquid (b.p. 36°C)