

## Group A: Simple Lewis Dot Structures

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
F <sub>2</sub>	$\text{:}\ddot{\text{F}}-\ddot{\text{F}}\text{:}$	linear	linear	no
O <sub>2</sub>	$\text{:}\ddot{\text{O}}=\ddot{\text{O}}\text{:}$	"	"	"
N <sub>2</sub>	$\text{:}\ddot{\text{N}}\equiv\ddot{\text{N}}\text{:}$	"	"	"
HF	$\begin{array}{c} \text{H}-\ddot{\text{F}}\text{:} \\ \longleftarrow \end{array}$	"	"	yes
CO	$\begin{array}{c} \text{:}\ddot{\text{C}}\equiv\ddot{\text{O}}\text{:} \\ \longleftarrow \end{array}$	"	"	yes
CO <sub>2</sub>	$\begin{array}{c} \ddot{\text{O}}=\text{C}=\ddot{\text{O}} \\ \longleftarrow \quad \longrightarrow \end{array}$	"	"	no

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
NO <sub>2</sub> <sup>+</sup>	$\left[ \overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{O}}} = \text{N} = \overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{O}}} \right]^+$	linear	linear	-----
CH <sub>4</sub>	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{C}-\text{H} \\   \\ \text{H} \end{array}$	tetrahedral	tetrahedral	no
SiH <sub>4</sub>	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{Si}-\text{H} \\   \\ \text{H} \end{array}$	"	"	"
NH <sub>3</sub>	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{N}-\text{H} \\   \\ \text{H} \end{array}$	"	trigonal pyramidal	yes
PH <sub>3</sub>	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{P}-\text{H} \\   \\ \text{H} \end{array}$	"	"	"
H <sub>2</sub> O	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{O}-\text{H} \\   \\ \text{H} \end{array}$	"	bent	"
H <sub>2</sub> S	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{S}-\text{H} \\   \\ \text{H} \end{array}$	"	"	"

Group B: Resonance

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
O <sub>3</sub>	$\begin{array}{c} \ddot{O} = \ddot{O} - \ddot{O} : \\ \updownarrow \\ : \ddot{O} - \ddot{O} = \ddot{O} \end{array}$	Trigonal Planar	bent	no
N <sub>2</sub> O	$\begin{array}{c} \ddot{N} = N = \ddot{O} \\ \updownarrow \\ \ddot{N} \equiv N - \ddot{O} : \\ \updownarrow \\ :\ddot{N} - N \equiv \ddot{O} : \end{array}$	linear	linear	yes
NO <sub>2</sub> <sup>-</sup>	$\begin{array}{c} [ : \ddot{O} - \ddot{N} = \ddot{O} ]^- \\ \updownarrow \\ [ \ddot{O} = \ddot{N} - \ddot{O} : ]^- \end{array}$	trigonal planar	bent	-----
NO <sub>3</sub> <sup>-</sup>	$\begin{array}{c} [ \ddot{O} - N = \ddot{O} ]^- \leftrightarrow [ \ddot{O} = N - \ddot{O} ]^- \\ \updownarrow \\ [ \ddot{O} - N - \ddot{O} ]^- \\ \updownarrow \\ [ \ddot{O} = N - \ddot{O} ]^- \end{array}$	trigonal planar	Trigonal planar	-----
CO <sub>3</sub> <sup>2-</sup>	$\begin{array}{c} [ O - C = O ]^- \leftrightarrow [ O = C - O ]^- \\ \updownarrow \\ [ O - C - O ]^- \\ \updownarrow \\ [ O = C - O ]^- \end{array}$	"	"	-----
OCN <sup>-</sup>	$\begin{array}{c} [ \ddot{O} = C = \ddot{N} ]^- \\ \updownarrow \\ [ \ddot{O} - C \equiv \ddot{N} ]^- \\ \updownarrow \\ [ \ddot{O} \equiv C - \ddot{N} : ]^- \end{array}$	linear	linear	-----

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
CNO <sup>-</sup>	$\begin{array}{c} \left[ \overset{\cdot\cdot}{\text{C}} = \overset{\cdot\cdot}{\text{N}} = \overset{\cdot\cdot}{\text{O}} \right] \\ \updownarrow \\ \left[ \overset{\cdot\cdot}{\text{C}} \equiv \overset{\cdot\cdot}{\text{N}} - \overset{\cdot\cdot}{\text{O}} \right]^- \\ \updownarrow \\ \left[ \overset{\cdot\cdot}{\text{C}} - \overset{\cdot\cdot}{\text{N}} \equiv \overset{\cdot\cdot}{\text{O}} \right]^- \end{array}$	linear	*linear	-----
HNO <sub>3</sub>	$\begin{array}{c} \text{H} - \overset{\cdot\cdot}{\text{O}} - \overset{\cdot\cdot}{\text{N}} - \overset{\cdot\cdot}{\text{O}} \\ \quad \quad \quad \parallel \\ \quad \quad \quad \text{O} \\ \updownarrow \\ \text{O} - \overset{\cdot\cdot}{\text{N}} - \text{O} - \text{H} \\ \quad \quad \quad \parallel \\ \quad \quad \quad \text{O} \end{array}$ <p>+ others</p>	trigonal planar (@ N)	trigonal planar	yes
HCO <sub>3</sub> <sup>-</sup>	$\left[ \text{H} - \overset{\cdot\cdot}{\text{O}} - \overset{\cdot\cdot}{\text{C}} - \overset{\cdot\cdot}{\text{O}} \right]^-$ <p style="margin-left: 40px;">   O</p> <p>+ others</p>	" @ Carbon	"	-----
C <sub>3</sub> H <sub>5</sub> <sup>+</sup>	$\left[ \begin{array}{c} \text{H} \quad \quad \text{H} \\   \quad \quad   \\ \text{C} \equiv \text{C} - \text{C} - \text{H} \\   \quad \quad   \\ \text{H} \quad \quad \text{H} \end{array} \right]^+$ <p style="margin-left: 40px;">↑</p> $\left[ \begin{array}{c} \text{H} \quad \quad \text{H} \\   \quad \quad   \\ \text{C} = \text{C} = \text{C} \\   \quad \quad   \\ \text{H} \quad \quad \text{H} \end{array} \right]^+$	-----	-----	-----

Group C: Expanded Octet

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
PCl <sub>5</sub>		Trigonal bipyramidal	trigonal bipyramidal	NO
PF <sub>6</sub> <sup>-</sup>		octahedral	octahedral	-----
SF <sub>4</sub>		Trigonal bipyramidal	seesaw	yes
SF <sub>6</sub>		octahedral	octahedral	no
ClF <sub>3</sub>		Trigonal bipyramidal	T-shaped	yes
I <sub>3</sub> <sup>-</sup>		Trigonal bipyramidal	linear	-----

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
$\text{IF}_4^-$		octahedral	square planar	-----
$\text{IF}_5$		octahedral	square pyramidal	yes
$\text{XeF}_2$		Trigonal Bipyramidal	linear	no
$\text{XeF}_4$		octahedral	square planar	no

Group D: Radicals and Electron-Deficient Species

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
BH <sub>3</sub>	$\begin{array}{c} \text{H}-\text{B}-\text{H} \\   \\ \text{H} \end{array}$	Trigonal planar →		no
NO	$\overset{\cdot\cdot}{\text{N}}=\overset{\cdot\cdot}{\text{O}}$	linear →		yes
NO <sub>2</sub>	$\begin{array}{c} \overset{\cdot\cdot}{\text{O}}=\overset{\cdot}{\text{N}}-\overset{\cdot\cdot}{\text{O}} \\ \downarrow \\ \overset{\cdot\cdot}{\text{O}}-\overset{\cdot}{\text{N}}=\overset{\cdot\cdot}{\text{O}} \end{array}$	trigonal planar	bent	yes
B <sub>2</sub> H <sub>6</sub>	$\begin{array}{ccccc} & \text{H} & & \text{H} & \\ &   & &   & \\ \text{H} & -\text{B} & - & \text{B} & -\text{H} \\ &   & &   & \\ & \text{H} & & \text{H} & \end{array}$	X	X	X
BF <sub>3</sub>	$\begin{array}{c} \overset{\cdot\cdot}{\text{F}}-\text{B}-\overset{\cdot\cdot}{\text{F}} \\   \\ \overset{\cdot\cdot}{\text{F}} \end{array}$	Trigonal Planar →		no
Al <sub>2</sub> Br <sub>6</sub>	$\begin{array}{ccccc} \overset{\cdot\cdot}{\text{Br}} & & \overset{\cdot\cdot}{\text{Br}} & & \overset{\cdot\cdot}{\text{Br}} \\ & \diagdown & / & \diagdown & / \\ & \text{Al} & - & \text{Al} & \\ & / & \diagup & / & \diagdown \\ \overset{\cdot\cdot}{\text{Br}} & & \overset{\cdot\cdot}{\text{Br}} & & \overset{\cdot\cdot}{\text{Br}} \end{array}$	X	X	X

Group E: Expanded Octet and Resonance

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
SO <sub>2</sub>	$\begin{array}{c} \text{:}\ddot{\text{O}}-\ddot{\text{S}}=\ddot{\text{O}} \\ \downarrow \\ \text{:}\ddot{\text{O}}=\ddot{\text{S}}-\ddot{\text{O}}\text{:} \end{array}$	trigonal planar	bent	yes
SO <sub>3</sub>	$\begin{array}{c} \text{:}\ddot{\text{O}}=\ddot{\text{S}}=\ddot{\text{O}} \\ \uparrow \\ \text{:}\ddot{\text{O}}=\ddot{\text{S}}=\ddot{\text{O}}\text{:}^* \\ \downarrow \\ \text{:}\ddot{\text{O}}\text{:} \end{array}$	"	trigonal planar	no
SO <sub>4</sub> <sup>2-</sup>	$\left[ \begin{array}{c} \text{:}\ddot{\text{O}} \\ \text{:}\ddot{\text{O}}=\ddot{\text{S}}=\ddot{\text{O}} \\ \text{:}\ddot{\text{O}} \end{array} \right]^{2-} \text{ and others}$ $\left[ \begin{array}{c} \text{:}\ddot{\text{O}} \\ \text{:}\ddot{\text{O}} \\ \text{:}\ddot{\text{O}} \\ \text{:}\ddot{\text{O}} \end{array} \right]^{2-}$	tetrahedral	tetrahedral	-----
HSO <sub>4</sub> <sup>-</sup>	$\left[ \begin{array}{c} \text{:}\ddot{\text{O}} \\ \text{:}\ddot{\text{O}}=\ddot{\text{S}}=\ddot{\text{O}} \\ \text{:}\ddot{\text{O}} \\ \text{H} \end{array} \right]^{-} \text{ and others}$	"	"	-----
POCl <sub>3</sub>	$\begin{array}{c} \text{:}\ddot{\text{O}} \\ \text{:}\ddot{\text{Cl}}-\text{P}-\ddot{\text{Cl}}\text{:} \\ \downarrow \\ \text{:}\ddot{\text{Cl}}\text{:} \end{array} \text{ and others}$	tetrahedral	→	yes
ClO <sub>4</sub> <sup>-</sup>	$\left[ \begin{array}{c} \text{:}\ddot{\text{O}} \\ \text{:}\ddot{\text{O}}=\ddot{\text{Cl}}=\ddot{\text{O}} \\ \text{:}\ddot{\text{O}} \end{array} \right]^{-} \text{ and others}$	"	→	-----