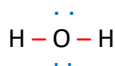


Ch. 9.3 VSEPR

- valence shell electron pair repulsion
- used to determine a molecule's shape and bond angle(s)
- as electrons have the same (negative) charge, there is a repulsive force,
 - so the shape / bond angle(s) of the molecule is to minimize these repulsive forces
 - so shape / bond angle(s) of the molecule is to maximize the distance between the electron pairs
 - electron pair = **bonding pair** or **non-bonding pair** of electrons on the central atom
 - example: H₂O



- to apply VSEPR to a molecule, need to know the molecule's Lewis structure

1

Molecule's shape / bond angle(s) depends on the number of pair of **bonding** and **non-bonding** electrons on the central atom

Number of Electron Domains	Electron-Domain Geometry	Bonding Domains	Nonbonding Domains	Molecular Geometry	Example
2	Linear	2	0	Linear	CO_2
3	Trigonal planar	3	0	Trigonal planar	BF_3
		2	1	Bent	$[\text{NO}_2]^-$
4	Tetrahedral	4	0	Tetrahedral	CH_4
		3	1	Trigonal pyramidal	NH_3
		2	2	Bent	H_2O

convention:

* solid / thick line = "in front of the plane"

* dotted / broken = "in the back of the plane"

source: https://sites.lps.org/sputnam/LHS_IB/IBChemistry/Chemistry_Brown_12th.pdf

2

continue

Number of Electron Domains	Electron-Domain Geometry	Bonding Domains	Nonbonding Domains	Molecular Geometry	Example
5	Trigonal bipyramidal	5	0	Trigonal bipyramidal	PCl_5
		4	1	Seesaw	SF_4
		3	2	T-shaped	ClF_3
		2	3	Linear	XeF_2

source: https://sites.lps.org/sputnam/LHS_IB/IBChemistry/Chemistry_Brown_12th.pdf

3

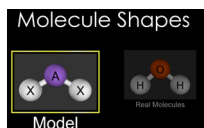
continue

Number of Electron Domains	Electron-Domain Geometry	Bonding Domains	Nonbonding Domains	Molecular Geometry	Example
6	Octahedral	6	0	Octahedral	SF_6
		5	1	Square pyramidal	BrF_5
		4	2	Square planar	XeF_4

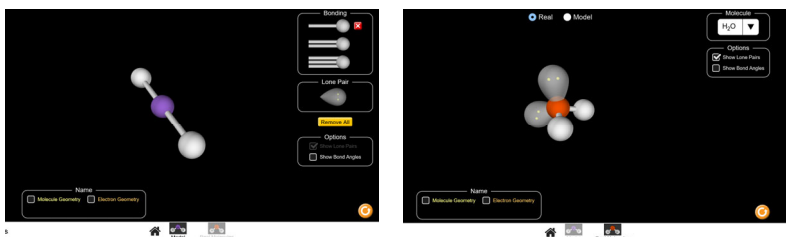
source: https://sites.lps.org/sputnam/LHS_IB/IBChemistry/Chemistry_Brown_12th.pdf

4

resource:



source: https://phet.colorado.edu/sims/html/molecule-shapes/latest/molecule-shapes_en.html



5

“Steps” to get a molecule’s shape / bond angle(s)

1. Obtain the molecule’s Lewis structure
2. Determine the number of bonding and non-bonding pair of electrons on the central atom
3. “match” to preceding tables

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