

## Announcements – Lecture XV – Wednesday, June 12<sup>th</sup>

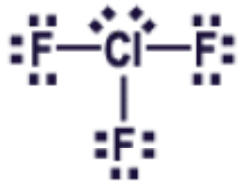

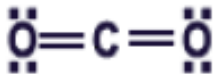

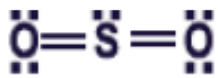

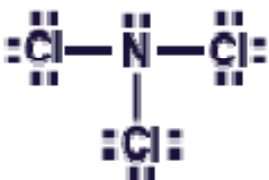
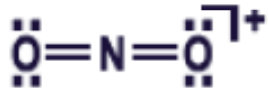
EXAM II: FRIDAY, JUN 14<sup>th</sup>, IN CLASS.

5<sup>th</sup> LAB : TUE, JUN 18<sup>th</sup>.



## Quiz 12

Last Name: \_\_\_\_\_

<p>A</p> 	<p>B</p> 	<p>C <math>AX_2E_0</math></p> 	<p>D</p> 
<p>E <math>AX_2E_1</math></p> 	<p>F <math>AX_3E_0</math></p> 	<p>G <math>AX_3E_1</math></p> 	<p>H <math>AX_2E_0</math></p> 

1. The **Electron Pair Geometry** of C:

LINEAR

2. The **Molecular Geometry** of G:

TRIGONAL PYRAMID

3. The **Bond Angle** around S in E:

$\sim 120^\circ$

4. The **molecule(s)** with a bond angle of  $180^\circ$ :

C, D, H


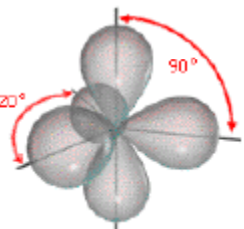

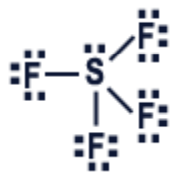
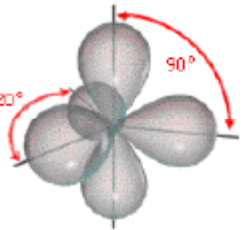

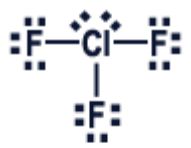
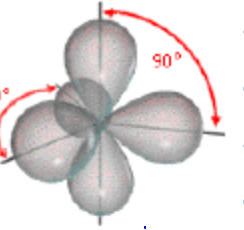
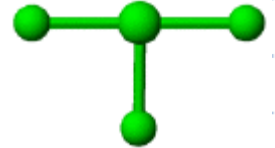


## 8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape

### B: Electron Pair Geometries – Molecular Geometries

#### Trigonal Bipyramid

$$X + E = 5$$


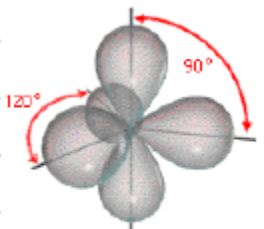

Lewis Structure	Class	Electron Pair Geometry	Molecular Geometry	Bond Angles
$\text{PF}_5$ 	$\text{AX}_5\text{E}_0$	 <p>TRIGONAL BIPYRAMID</p>	 <p>TRIGONAL BIPYRAMID</p>	$120^\circ/90^\circ$
$\text{SF}_4$ 	$\text{AX}_4\text{E}_1$	 <p>TRIGONAL BIPYRAMID</p>	 <p>SEESAW</p>	$120^\circ/90^\circ$
$\text{ClF}_3$ 	$\text{AX}_3\text{E}_2$	 <p>TRIGONAL BIPYRAMID</p>	 <p>T-SHAPED</p>	$90^\circ$

## 8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape

### B: Electron Pair Geometries – Molecular Geometries

#### Trigonal Bipyramid

$$X + E = 5$$

Lewis Structure	Class	Electron Pair Geometry	Molecular Geometry	Bond Angles
$\text{XeF}_2$ 	$\text{AX}_2\text{E}_3$	 TRIGONAL BIPYRAMID	 LINEAR	$180^\circ$


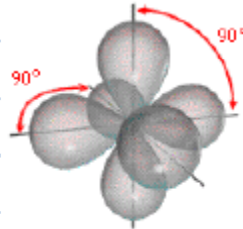
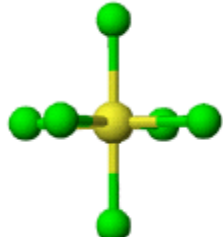

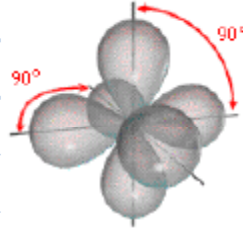
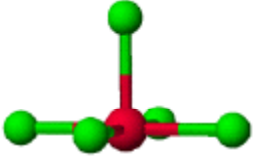

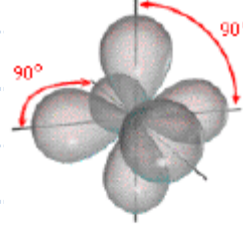



## 8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape

### B: Electron Pair Geometries – Molecular Geometries

#### Octahedron

$$X+E=6$$

Lewis Structure	Class	Electron Pair Geometry	Molecular Geometry	Bond Angles
$\text{SF}_6$ 	$\text{AX}_6\text{E}_0$	 OCTAHEDRON	 OCTAHEDRON	$90^\circ$
$\text{BrF}_5$ 	$\text{AX}_5\text{E}_1$	 OCTAHEDRON	 SQUARE PYRAMID	$90^\circ$
$\text{XeF}_4$ 	$\text{AX}_4\text{E}_2$	 OCTAHEDRON	 SQUARE PLANAR	$90^\circ$



## 8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape

### B: Electron Pair Geometries – Molecular Geometries

#### Summary

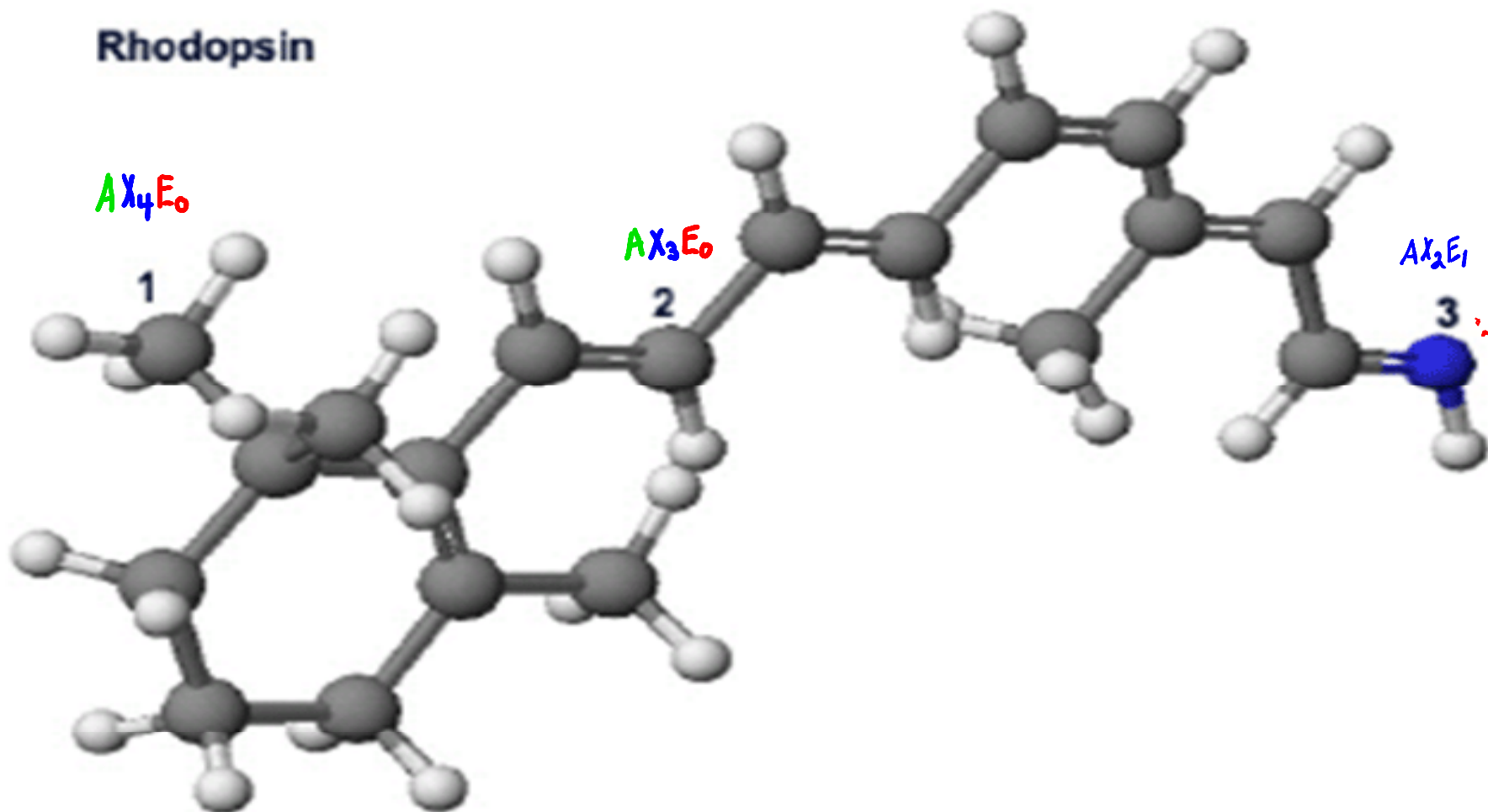
X+E	Electron Pair Geometry (Parent)	Molecular Geometry (Offspring)
3	TRIGONAL PLANAR	<ul style="list-style-type: none"> <li>E<sub>0</sub>: TRIGONAL PLANAR</li> <li>E<sub>1</sub>: ANGULAR/BENT (120°)</li> </ul>
4	TETRAHEDRON	<ul style="list-style-type: none"> <li>E<sub>0</sub>: TETRAHEDRON</li> <li>E<sub>1</sub>: TRIGONAL PYRAMID</li> <li>E<sub>2</sub>: ANGULAR/BENT (109°)</li> </ul>
5	TRIGONAL BIPYRAMID	<ul style="list-style-type: none"> <li>E<sub>0</sub>: TRIGONAL BIPYRAMID</li> <li>E<sub>1</sub>: SEESAW</li> <li>E<sub>2</sub>: T-SHAPED</li> <li>E<sub>3</sub>: LINEAR</li> </ul>
6	OCTAHEDRON	<ul style="list-style-type: none"> <li>E<sub>0</sub>: OCTAHEDRON</li> <li>E<sub>1</sub>: SQUARE PYRAMID</li> <li>E<sub>2</sub>: SQUARE PLANAR</li> </ul>



## 8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape

### Bond Angles in Organic Molecules

Rhodopsin



C-1: ~109°

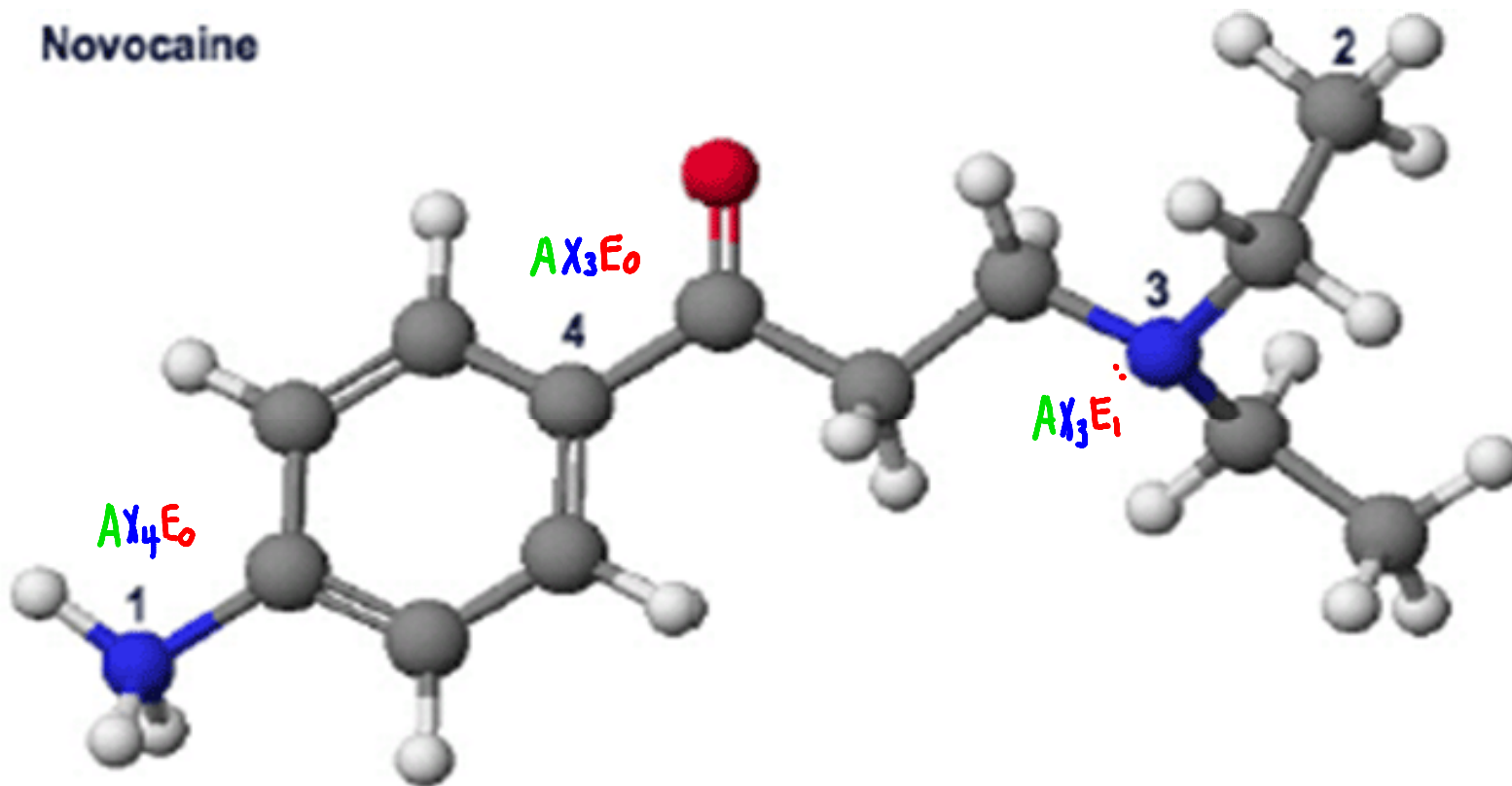
C-2: 120°

N-3: 120°



## 8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape Bond Angles in Organic Molecules

Novocaine



N-1:  $\sim 109^\circ$

N-3:  $\sim 109^\circ$

C-4:  $120^\circ$





## 8.5 Valence-Shell Electron-Pair Repulsion and Molecular Shape Bond Angles

Which of the following molecules has the smallest bond angle?

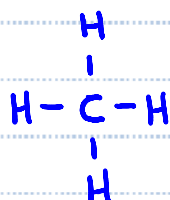
a)  $\text{CH}_4$

b)  $\text{NO}_2^+$

c)  $\text{NH}_3$

d)  $\text{H}_2\text{O}$

$\text{CH}_4$ :



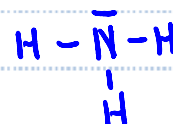
$\text{AX}_4\text{E}_0$

TETRAHEDRON

TETRAHEDRON

$\sim 109^\circ$

$\text{NH}_3$ :



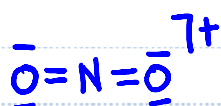
$\text{AX}_3\text{E}_1$

TETRAHEDRON

TRIGONAL PYRAMID

$\sim 109^\circ$

$\text{NO}_2^+$ :



$\text{AX}_2\text{E}_0$

LINEAR

LINEAR

$180^\circ$

$\text{H}_2\text{O}$ :



$\text{AX}_2\text{E}_2$

TETRAHEDRON

ANGULAR/BENT

$\sim 109^\circ$

$\text{H}_2\text{O}$ ! ... lone pair electrons have a larger spatial requirement, the more lone pairs the smaller the bond angle.