Is Sulfur Difluoride a Polar or Nonpolar Molecule?

Step 1: Create it's Lewis Structure

But what is a Lewis Structure?

The molecule's Lewis Structure is a 2D representation of the individuals that comprise the molecule and the intramolecular bonds that exist between them
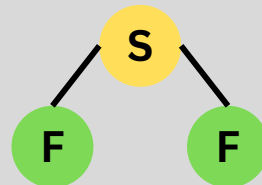
$$SF_2$$

Generally, we take the first molecule as our central atom. In this case, our central atom will be Sulfur
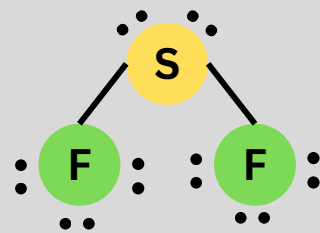
Then add the remaining elements around our central atom. We will add 2 Fluoride atoms
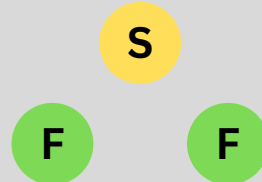
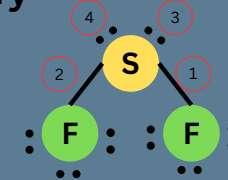Create bonds between the periphery atoms and the central atom, ensuring you fulfill the octet rule for each atom.

Add lone pairs of electrons around each atom to achieve the octet rule

Step 2: Determine Molecular Geometry

Given the Lewis Structure for Sulfur Difluoride, we need to count the number of electron domains (Bonds / Lone Pairs) on our central atom, Sulfur

From reference to the Molecular Geometry table, we see that Sulfur Difluoride is Tetrahedral since it has 4 Electron Domains
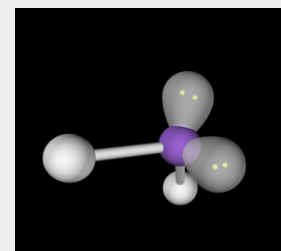
4	4	0	Tetrahedral	Tetrahedral	109.5°	CH_4	
	3	1	Tetrahedral	Trigonal pyramidal	< 109.5°	NH_3	
	2	2	Tetrahedral	Bent	< 109.5°	H_2O	

Step 3: Electron Geometry

Out of the electron domains, count how many are lone pairs to determine the molecular shape in the presence of lone pairs of atoms
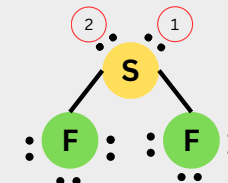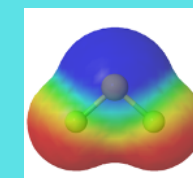
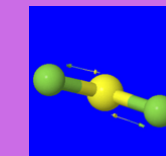Thus, Sulfur Difluoride has the Bent configuration because of its 2 lone pairs

Step 4: Consider it's Bond Dipoles

Each atom has an intrinsic electronegative property that determines how strong the negative charge is on that atom (noted as partial positive or partial negative) derived from the Pauli table of electronegativity

For sulfur difluoride, each fluoride atom is partially positive while the Sulfur atom is partially negative

Additionally, because the bonds are oriented in a bent configuration, each vector points towards sulfur with a net dipole oriented in the +Z axis relative to Sulfur

Individual Dipoles

Sum to

Net Dipole Vector

Step 5: Determine Polarity of Sulfur Difluoride

Polarity is simply determined whether or not there exists a nonzero net dipole vector

Since Sulfur Difluoride has a nonzero net dipole vector oriented in the +Z axis, the molecule is polar. The Molecular Electrostatic Potential is shown below