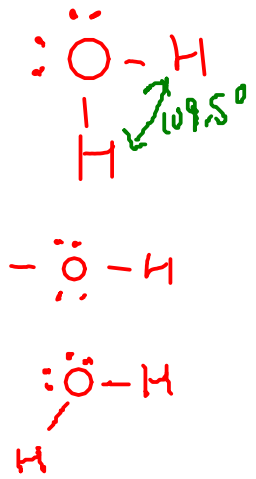
EXAMPLES

Water, H_2O

H: 2 x 1

O: 6

8



Shape: BENT. Four groups around the central oxygen, but only two are atoms.

Polarity? POLAR. O-H bonds are polar, and oxygen is able to pull electrons through to its "side" of the molecule

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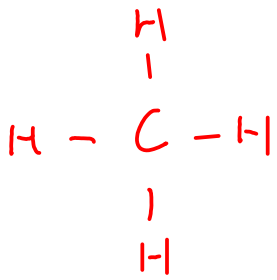
methane, CH_4

C: 4

H: 4 x 1

8



Shape? TETRAHEDRAL. Four groups (all of which are atoms) around a central carbon atom.

Polarity? C-H bonds are NONPOLAR, so the molecule is nonpolar.

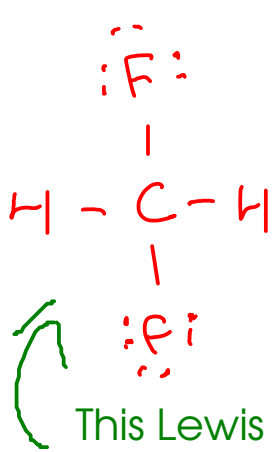
CH_2F_2

C: 4

H: 2 x 1 = 2

F: 2 x 7 = 14

20

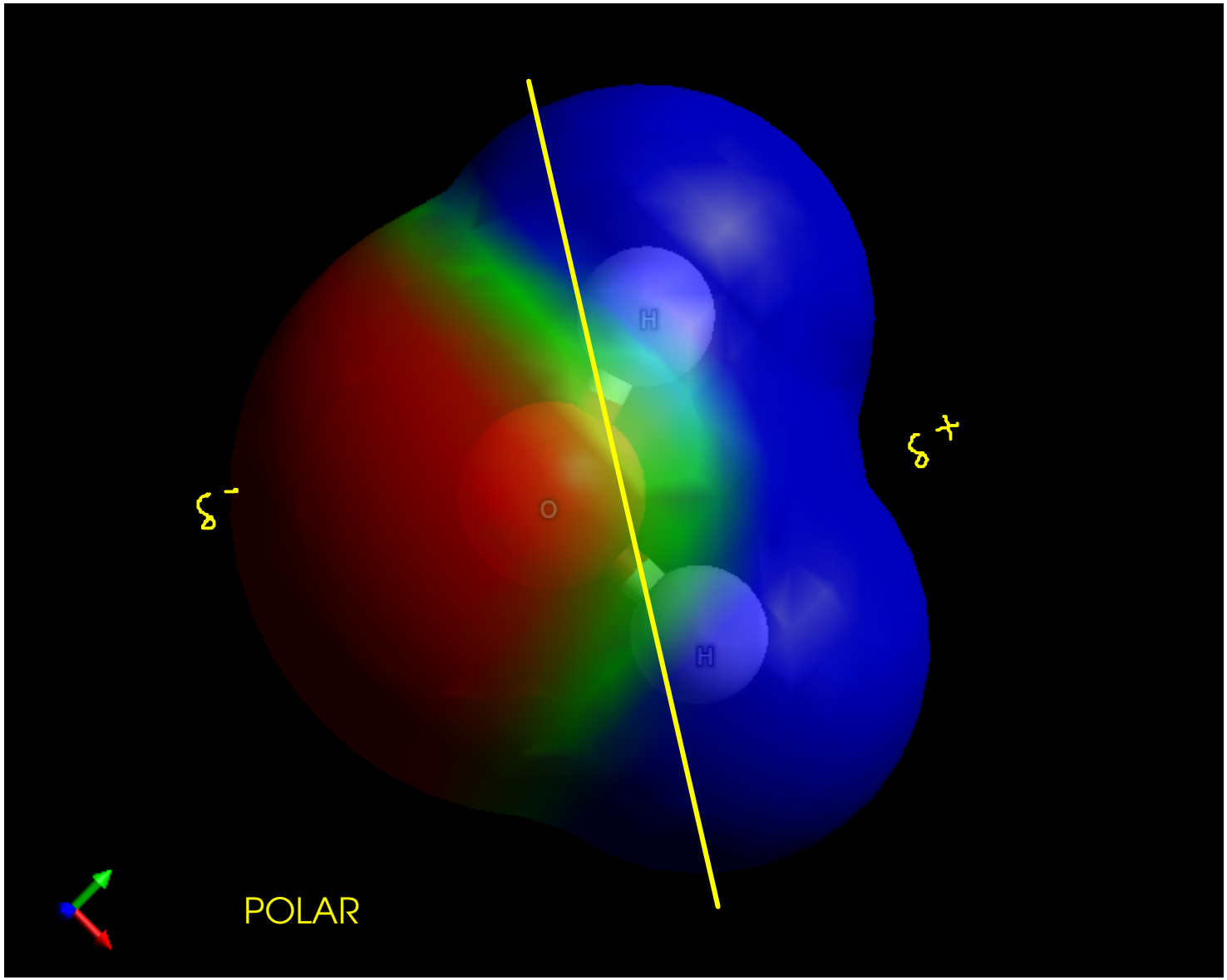


Shape? TETRAHEDRAL. Four groups (all of which are atoms) around a central carbon atom.

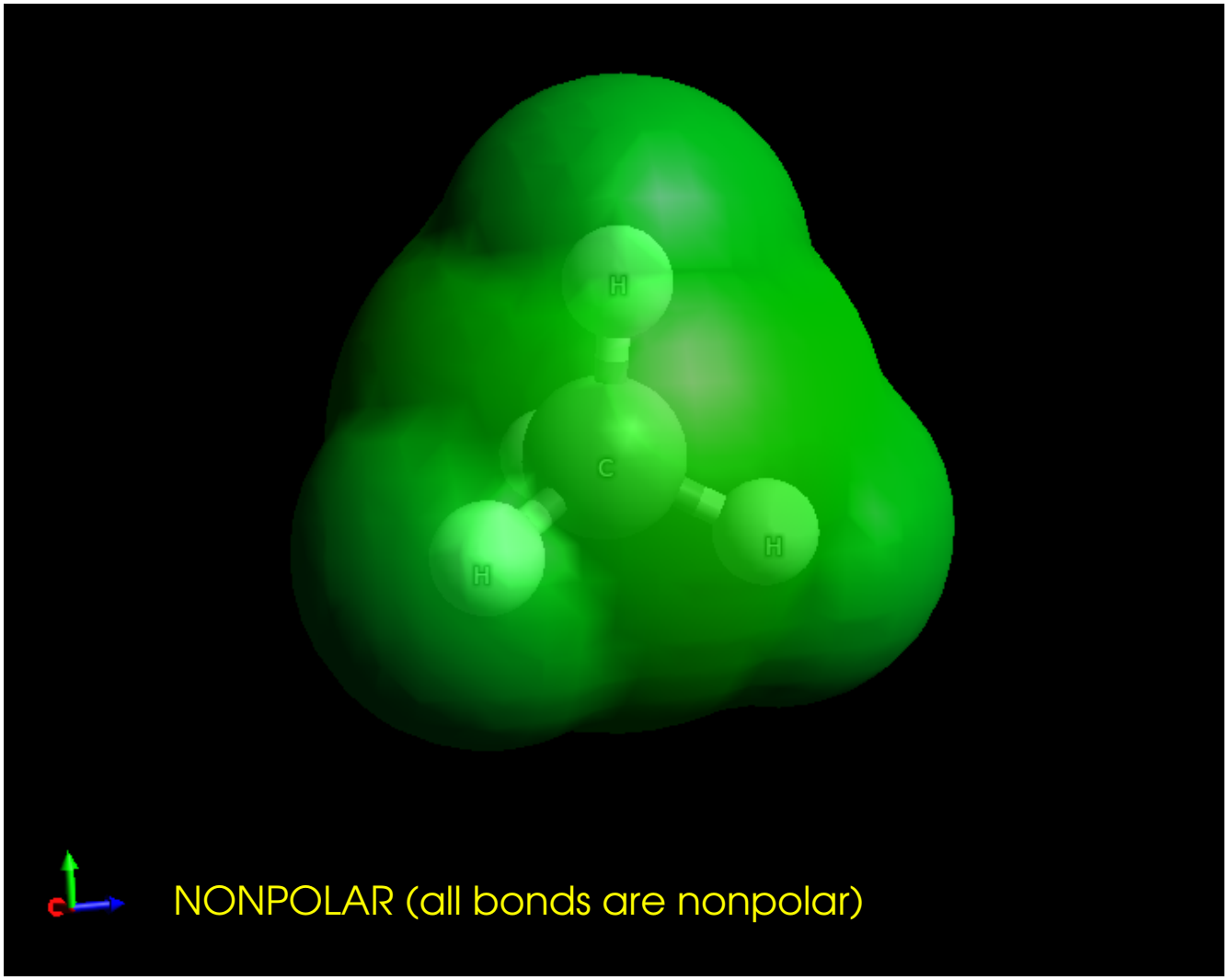
Polarity? C-H bonds are nonpolar, but C-F bonds are polar. The molecule is POLAR, since electrons are pulled towards the fluorine "side" of the molecule.

This Lewis strcuture is correct, but deceptive. In three dimensions, the two fluorines are on a separate side of the molecule from the two hydrogens.

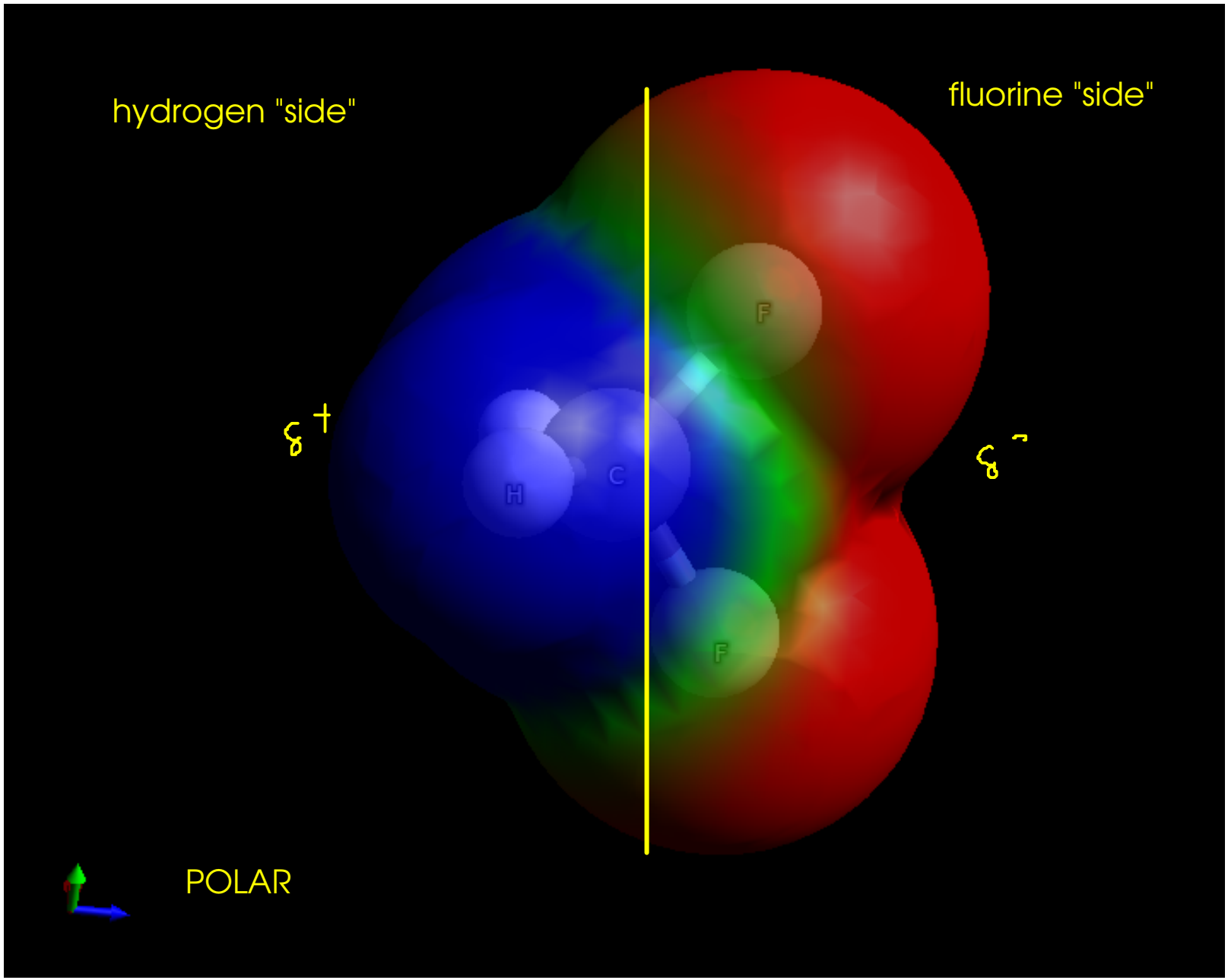
H_2O



CH_4



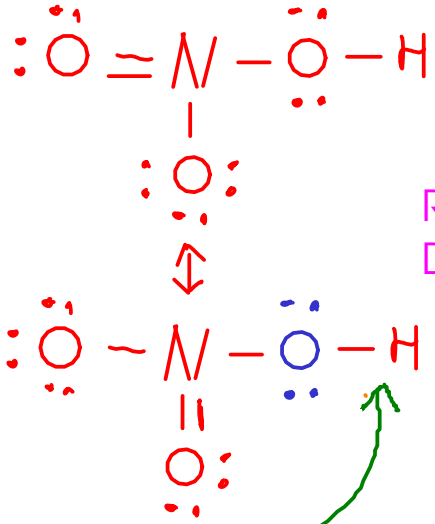
CH_2F_2



HNO_3

H : 1
N : 5
O : 6 x 3
24

Start drawing skeleton by recognizing that this compound is an OXYACID .... hydrogen attached to a polyatomic ion.



Resonance structures. The oxygen bonded to the nitrogen have a DELOCALIZED bond.

Shape? The nitric acid molecule has TWO "central" atoms - nitrogen and one oxygen, so we should describe the shape around each one. Around the NITROGEN, the shape is TRIGONAL PLANAR. The molecule is BENT around the OXYGEN atom (in blue)

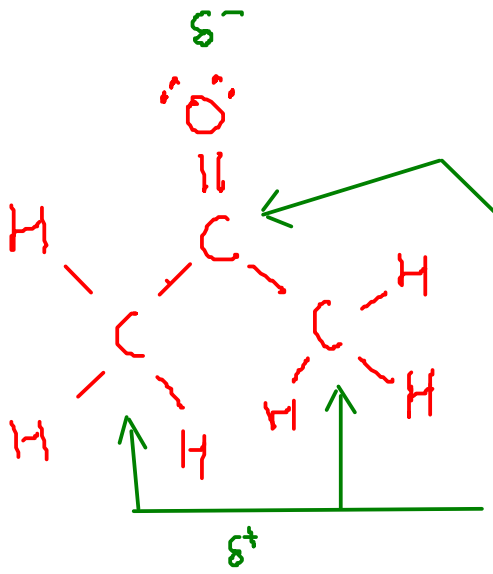
Polar? We expect a polar molecule because electron density will be pulled away from the acidic HYDROGEN atom, giving that side of the molecule a slight positive charge.

In water, the acidic hydrogen can be pulled off of the molecule by a water molecule, losing its shared electrons to the oxygen atom!

CH_3COCH_3 (acetone)

C: 4 x 3
H: 1 x 6
O: 6
2H

Look at the formula of acetone. The way it's written gives us a clue to the structure. There are THREE carbon centers in this molecule!



Shape? Describe the shape around each carbon center.

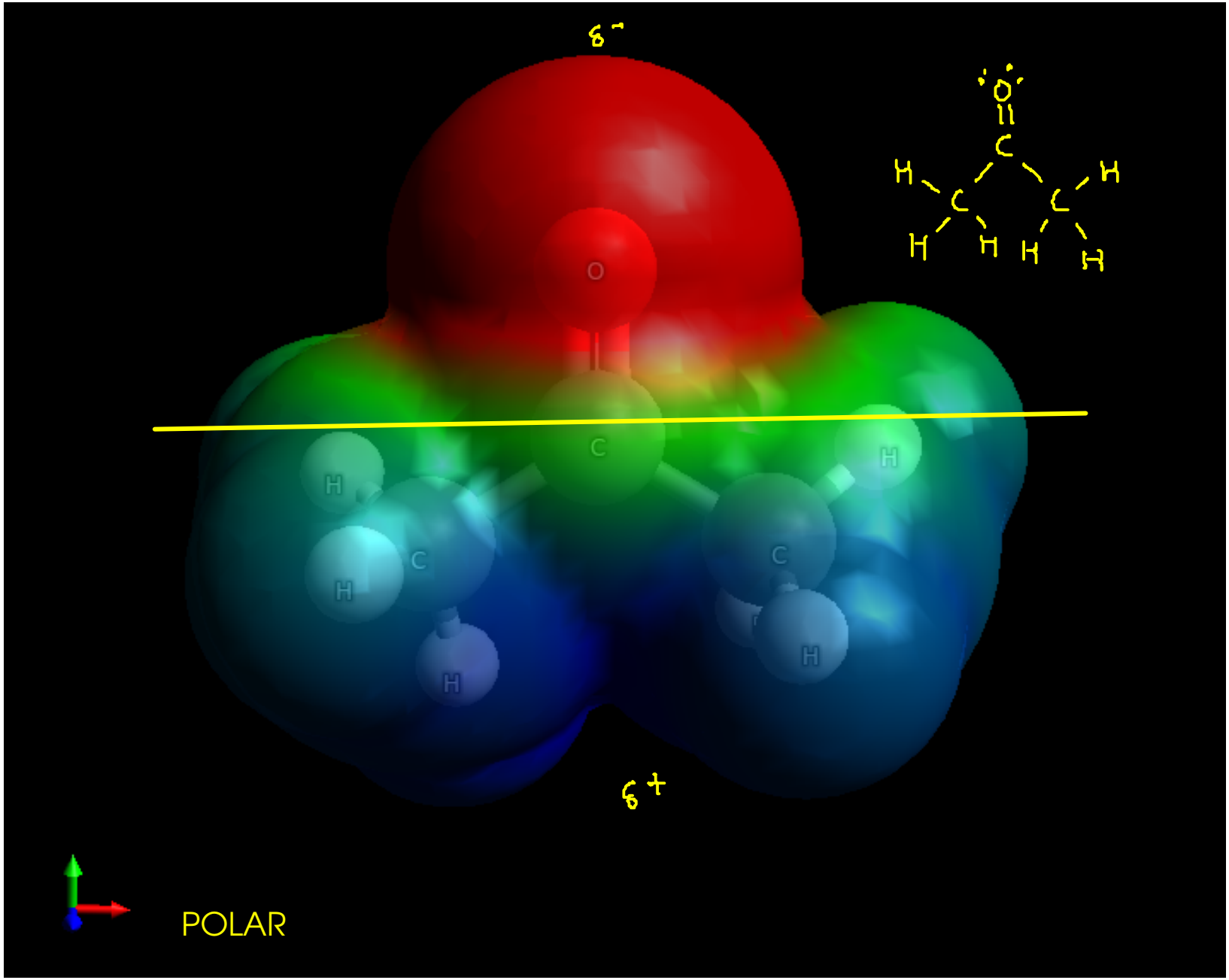
this carbon has a TRIGONAL PLANAR shape, since it's surrounded by three atoms and no lone pairs.

These two carbon atoms are TETRAHEDRAL, since each is surrounded by four atoms.

Polar? C-H bonds are nonpolar, but C=O bonds are polar. Electron density should be pulled towards the oxygen atom, creating a POLAR molecule

Experimentally, we find that acetone mixes very well with polar solvents like WATER.

CH_3COCH_3 "acetone"



POLARITY AND MOLECULAR PROPERTIES

- POLAR MOLECULES have
  - higher boilng points and melting points that comparably sized nonpolar molecules.
  - higher solubility in polar solvents like water than nonpolar molecules

"LIKE DISSOLVES LIKE"

- NONPOLAR MOLECULES have
  - lower boilng points and melting points that comparably sized polar molecules.
  - higher solubility in nonpolar solvents like carbon tetrachloride or oils