

Name: _____ Period: _____

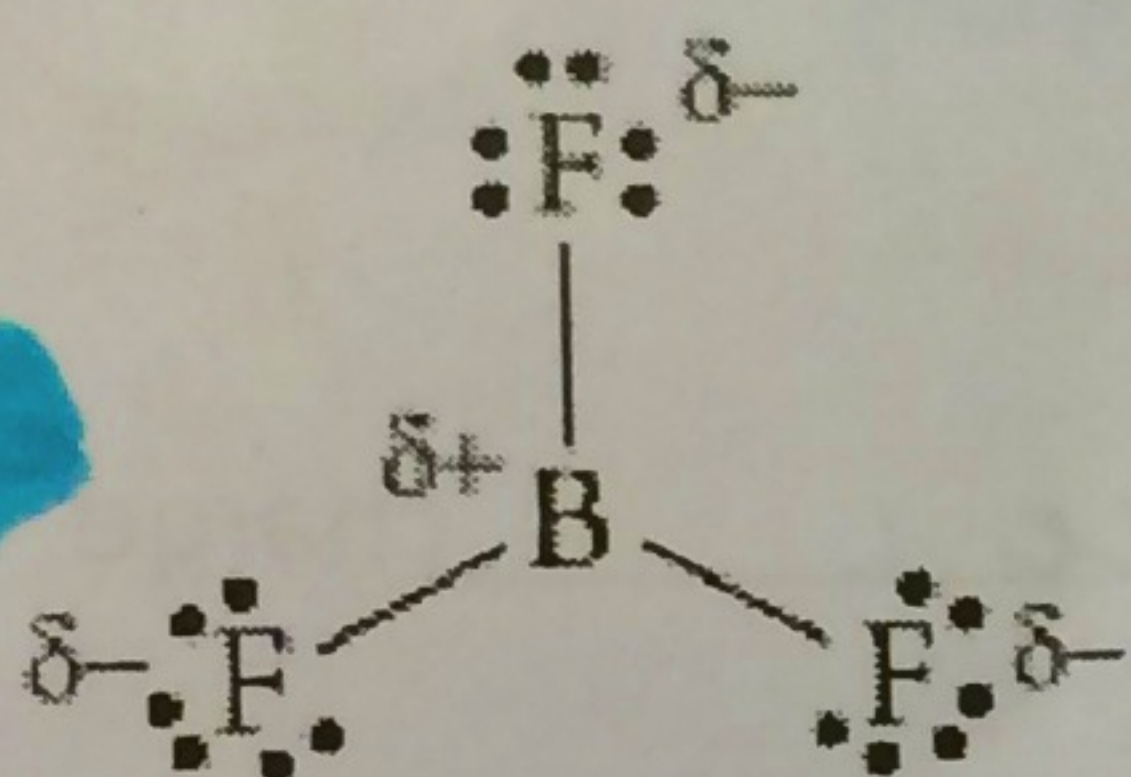
You will be held responsible for the following material. Read and answer the questions that are throughout the reading. When asked, you must cite where you found your answer.

Polarity:

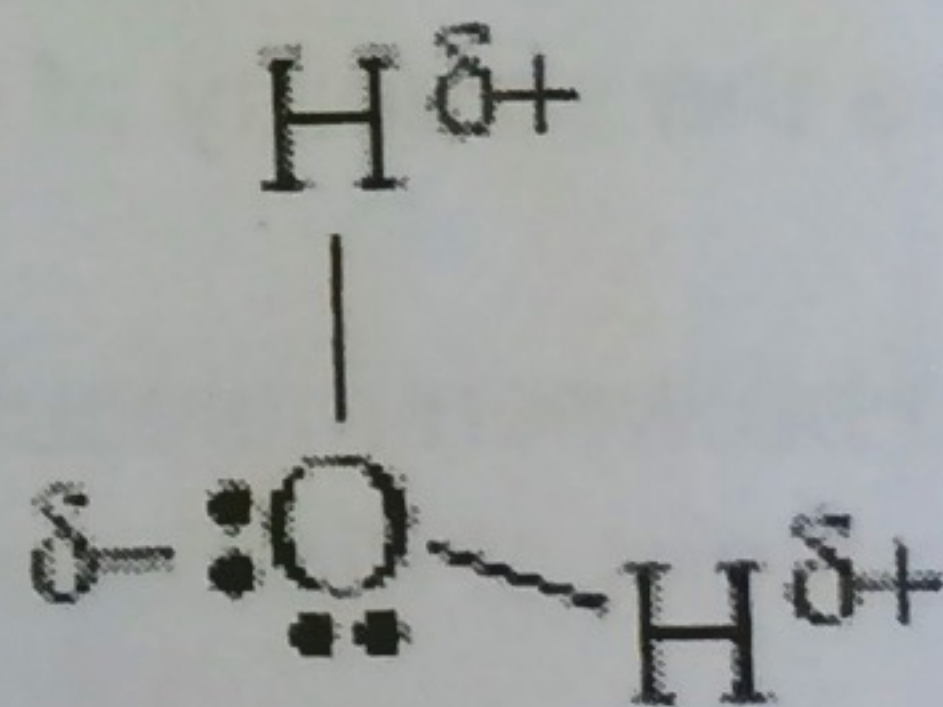
A polar covalent bond is between two atoms in which electrons are shared unequally. This is caused when there is a difference in electronegativity between the two atoms. The more electronegative atom attracts electrons more strongly and gains a slightly negative charge. The less electronegative atom has a slightly positive charge. This creates a dipole molecule, which is a molecule that has two poles.

When there are no polar bonds in a molecule, there is no permanent charge difference between one part of the molecule and another, and the molecule is nonpolar. For example, the Cl_2 molecule has no polar bonds because the electron charge is identical on both atoms. It is therefore a nonpolar molecule.

A molecule can possess polar bonds and still be nonpolar. If the polar bonds are evenly (or symmetrically) distributed, the bond dipoles cancel and do not create a molecular dipole. For example, the three bonds in a molecule of BF_3 are significantly polar, but they are symmetrically arranged around the central boron atom. No side of the molecule has more negative or positive charge than another side, and so the molecule is nonpolar:



A water molecule is polar because (1) its O-H bonds are significantly polar, and (2) its bent geometry makes the distribution of those polar bonds asymmetrical. The side of the water molecule containing the more electronegative oxygen atom is partially negative, and the side of the molecule containing the less electronegative hydrogen atoms is partially positive.



Questions:

1. When is it possible to have a molecule with polar bonds that is non-polar?

When the polar bonds are symmetrical
or equal.

Highlight where you found your answer.

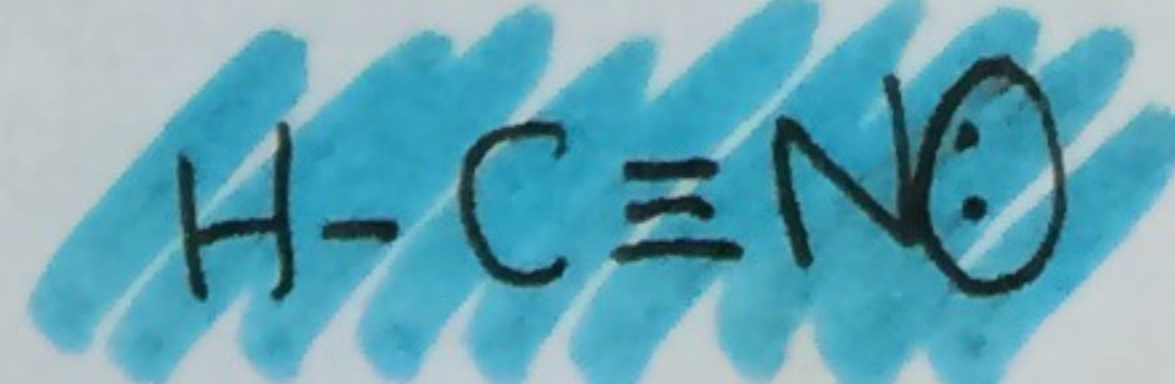
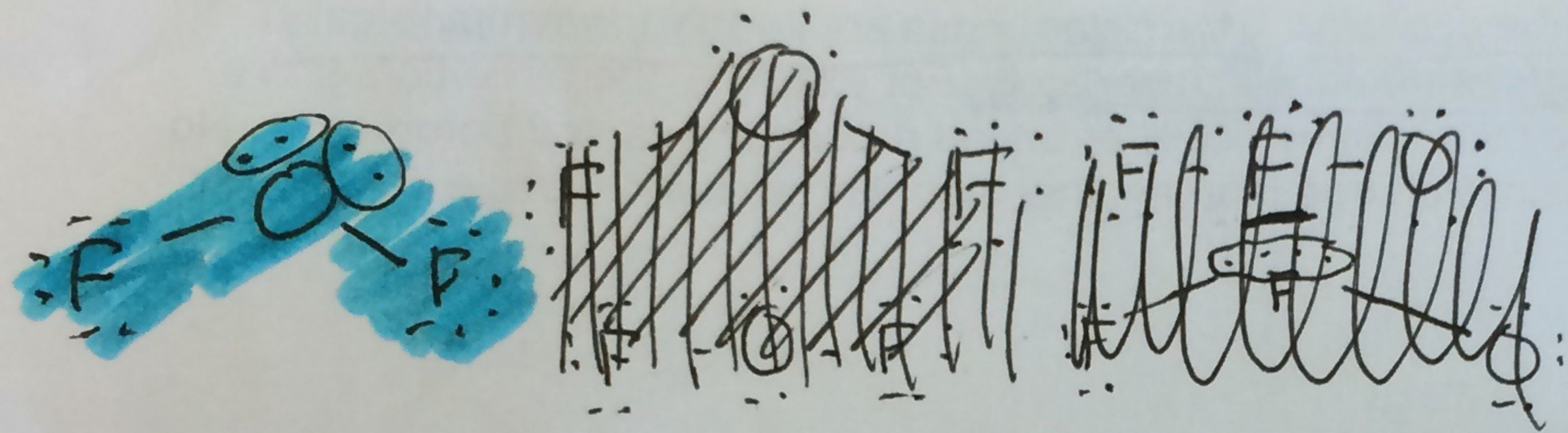
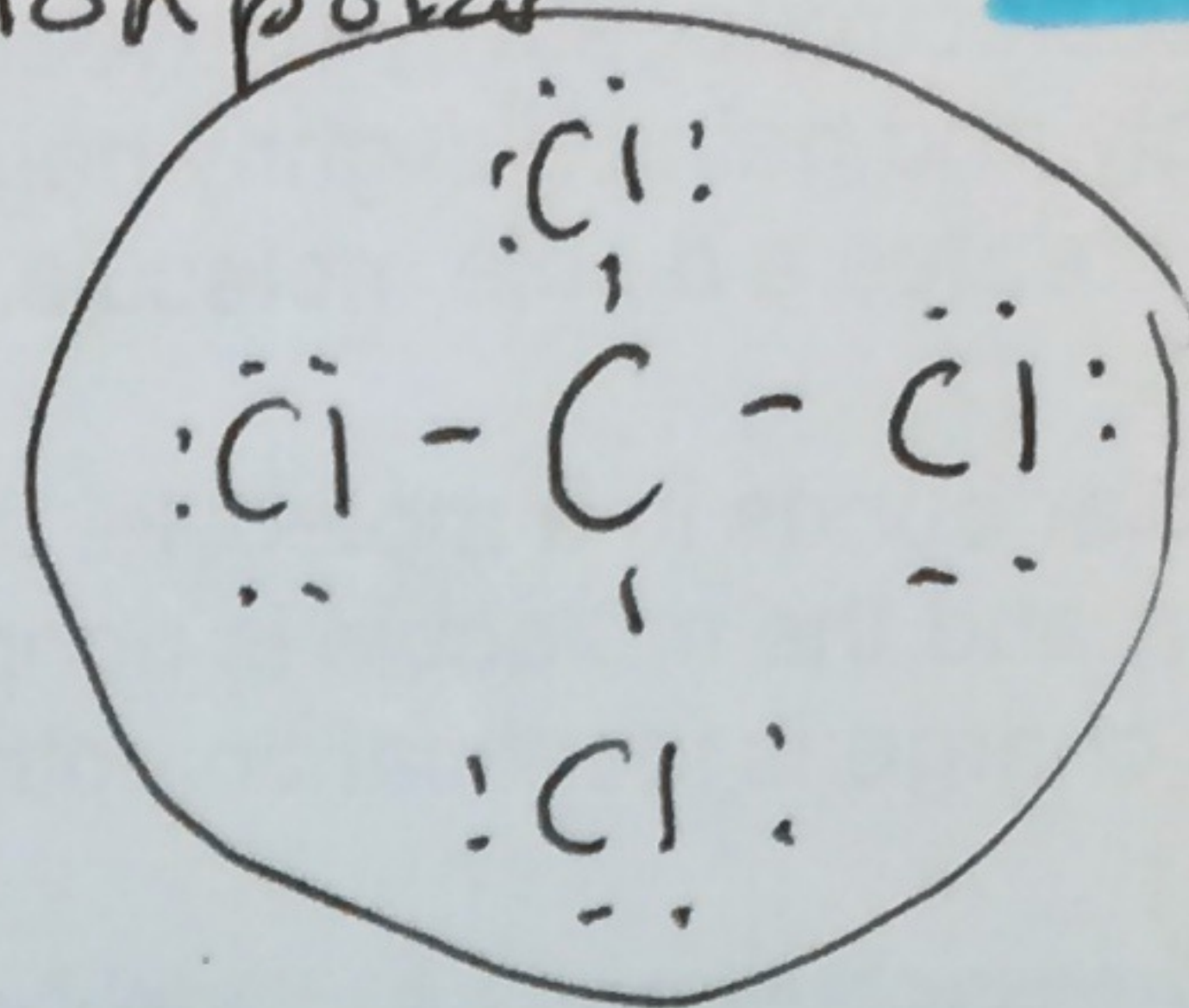
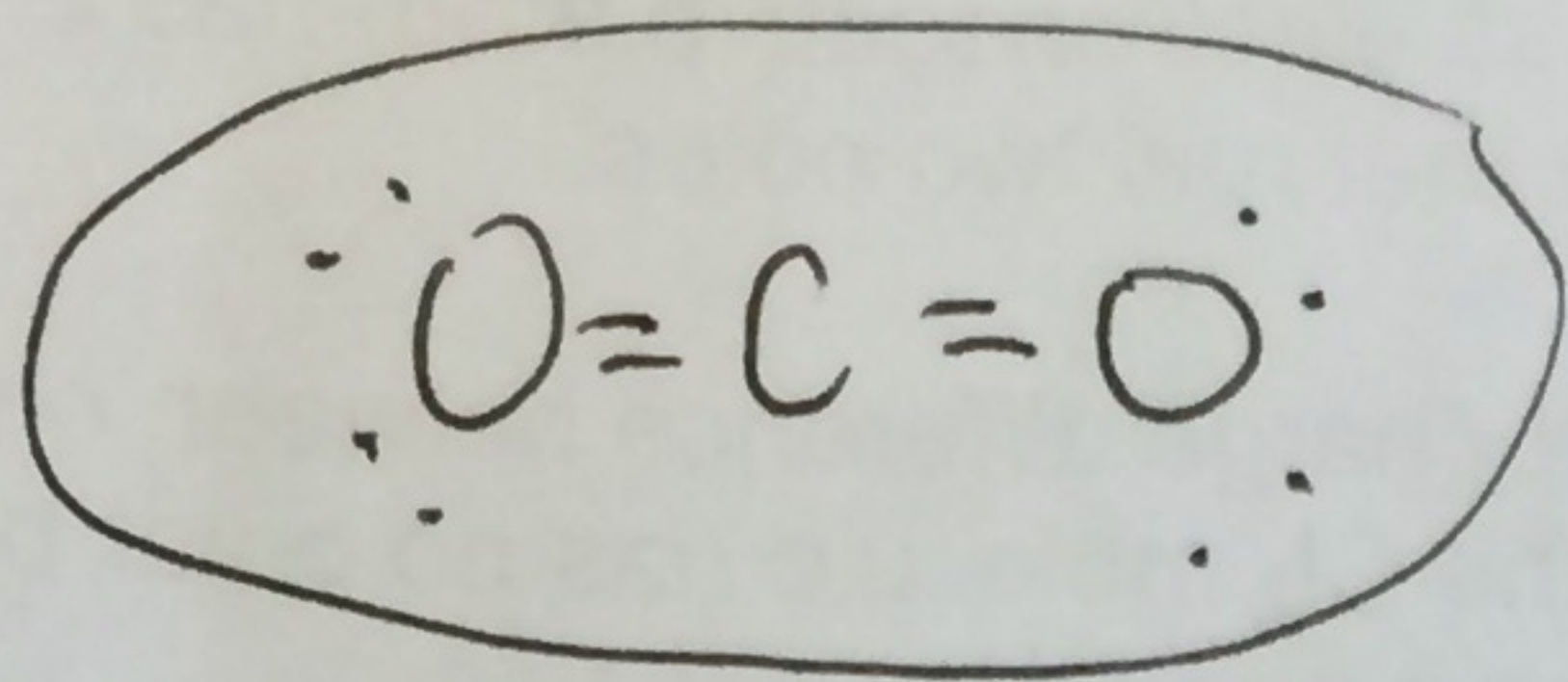
2. Polar bond are created when one atom is significantly more polar than the other. Circle where you found your answer in the paragraph.

3. How would an unshared pair of electrons on the central atom affect the molecule's polarity?

An unshared pair on a central atom usually makes it polar. This happens b/c it shrinks the bond angle.

4. Decide whether the molecules represented by the following formulas are polar or nonpolar. (You may need to draw Lewis structures to do so)

a. CO₂ b. OF₂ c. CCl₄ d. HCN

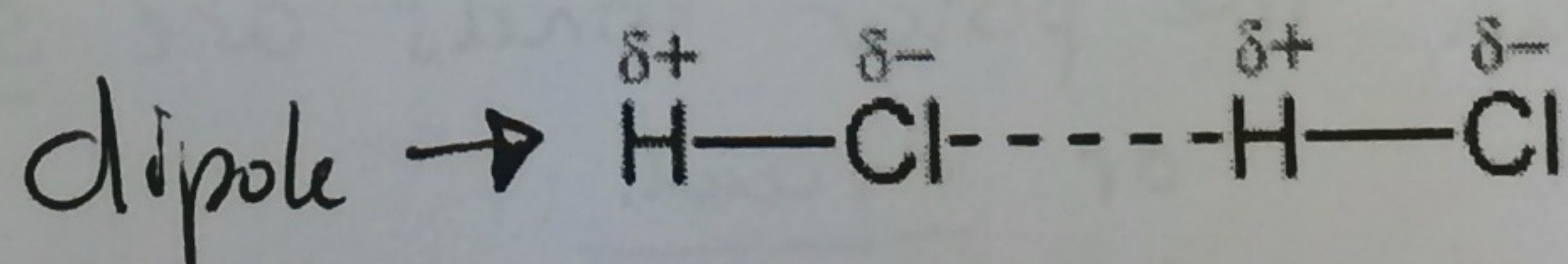


5. In a polar compound, the more electronegative atom has a slightly negative charge. This is caused by its pull for the electrons.

Intermolecular forces are the forces of attractions that exist between molecules in a compound. These cause the compound to exist in a certain state of matter: solid, liquid, or gas; and affect the melting and boiling points of compounds as well as the solubility of one substance in another.

The weakest attractions between molecules are collectively called van der Waals forces, named after a Dutch chemist. These forces consist of dipole interactions and dispersion forces.

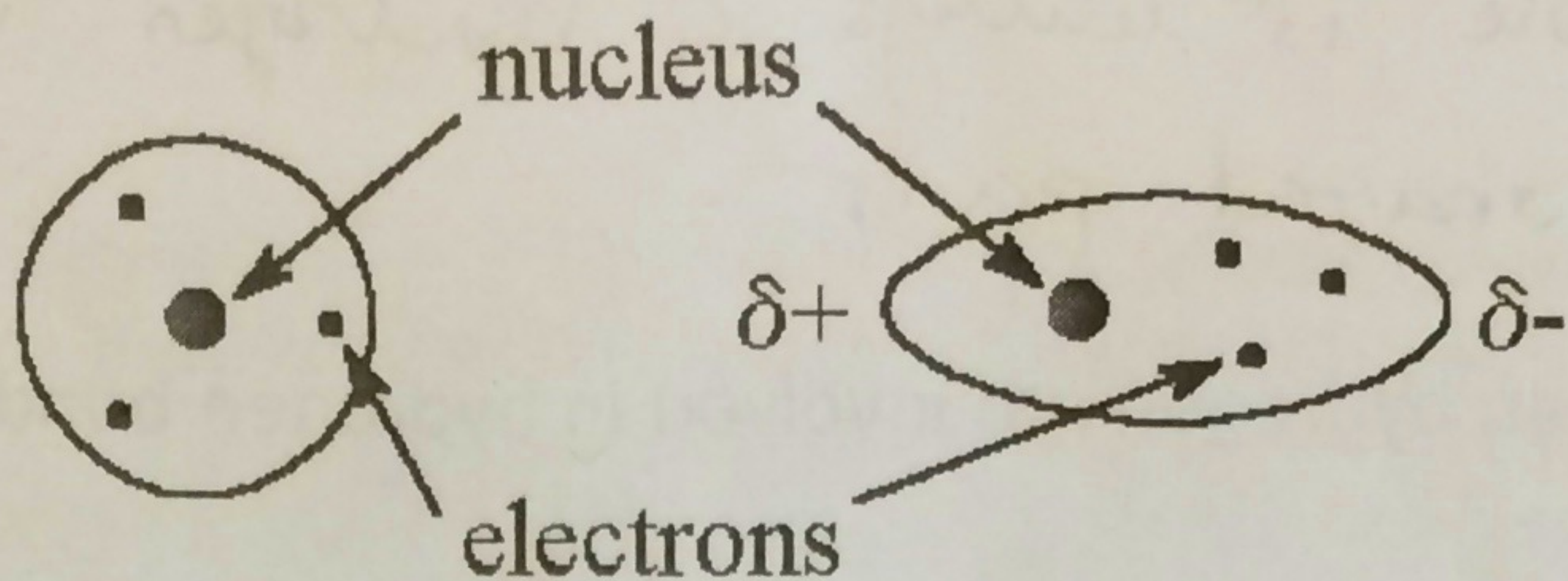
Dipole-dipole forces are attractive forces between the positive end of one polar molecule and the negative end of another polar molecule. They are much weaker than ionic or covalent bonds and have a significant effect only when the molecules involved are close together (touching or almost touching).



The dispersion force (often called London dispersion force) is the weakest intermolecular force. The London dispersion force is a temporary attractive force that results when the electrons in two adjacent atoms occupy positions that make the atoms form temporary dipoles. This force is sometimes called an induced dipole-induced dipole attraction. **London forces are the attractive forces that cause nonpolar substances to condense to liquids and to freeze into solids when the temperature is lowered sufficiently.**

When they come close to an atom or molecule, an atom or molecule can develop a temporary (instantaneous) dipole when its electrons are distributed unsymmetrically about the nucleus because of electron repulsion causes the electrons to move as far away as possible from the other electrons.

London



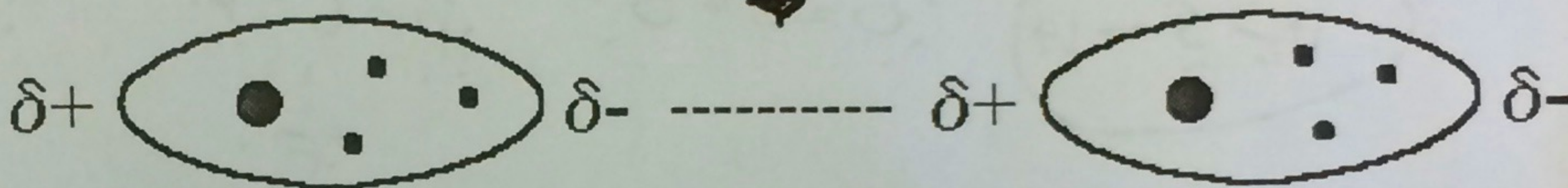
symmetrical distribution

unsymmetrical distribution

A second atom or molecule, in turn, can be distorted by the appearance of the dipole in the first atom or molecule (because electrons repel one another) which leads to an electrostatic attraction between the two atoms or molecules.

Dispersion forces are present between any two molecules when they are almost touching.

London Dispersion



Answer the following questions AND highlight where you find your answers.

6. What are intermolecular forces?

forces between two molecules

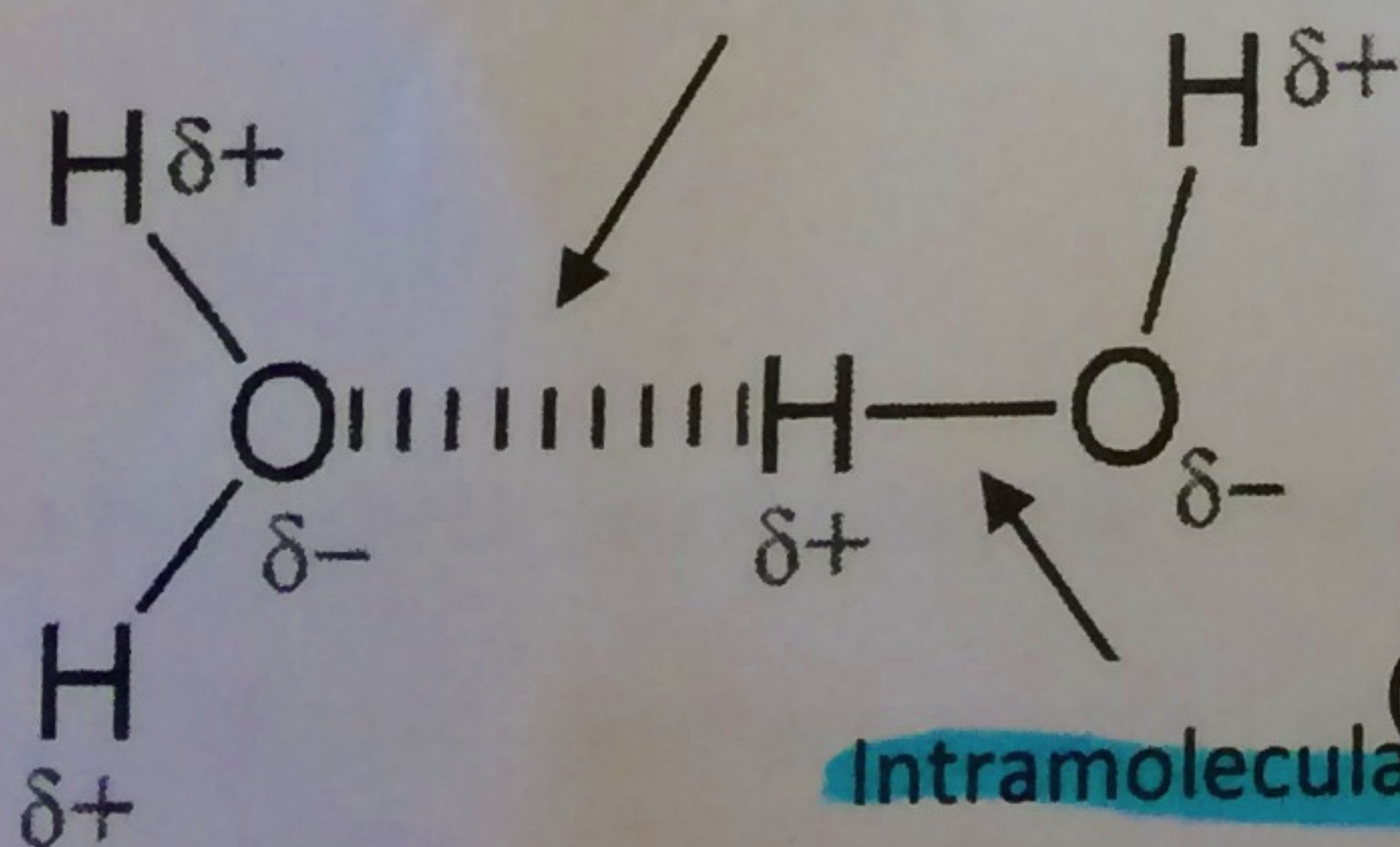
7. When do dipole interactions occur?

when a negative pole is attracted to a positive pole of another molecule

8. Describe IN YOUR OWN WORDS how dispersion forces occur.

nic

Intermolecular



Hydrogen Bonding: The hydrogen bond is really a special case of dipole forces. A hydrogen bond is the attractive force between the hydrogen attached to an electronegative atom of one molecule and the unshared p of electrons on an electronegative atom of a different molecule. Always t electronegative atom is oxygen, nitrogen, or fluorine. These are very strong bonds and are highly polar.

In the graphic above, the hydrogen is partially positive and attracted to the partially negative charge on the oxygen or nitrogen. Because oxygen has two lone pairs, two different hydrogen bonds can be made to each oxygen. This is a very specific bond as indicated. Some combinations which are not hydrogen bonds include hydrogen to another hydrogen or hydrogen to a carbon.