WKS 8-4 – Chem H
Polarity

NAME Answer Key
Period _____ **Date** _____

Bond Polarity

1. What is electronegativity and how is it used to determine bond polarity?
   Electronegativity is the relative tendency of an atom to attract electrons in a bond. The difference in electronegativity of the two atoms in a bond indicates the polarity of the bond.

2. What is a non-polar covalent bond and what ΔEN indicates this? Give two examples.
   A non-polar bond has an even distribution of elections, and is indicated by a $\Delta EN \leq 0.4$. Some examples are C–H, N–Cl, C–S & P–H.

3. What is a polar covalent bond and what ΔEN indicates this? Give two examples.
   A polar covalent bond has uneven sharing of electrons, with $0.4 < \Delta EN \leq 2.0$. Some examples include C–O, C–F, C–Cl, O–H, N–H, H–F.

4. What electronegativity difference (ΔEN) indicates an ionic bond? $\Delta EN > 2.0$

5. For the following bonds, use the electronegativity table to indicate ΔEN for each bond (SHOW WORK!) and indicate its polarity. **If the bond is polar covalent, indicate the presence of the dipole using either the arrow or the δ+/δ– symbols. If it is ionic, put in the charges.** (2 pts each)

(a) N—F ΔEN= 4.0 – 3.0 = 1.0
Polarity: Polar Covalent

(b) N—C (δ– on N, δ+ on C) EN= 3.0 – 2.5 = 0.5
Polarity: Polar Covalent

(c) O—I (δ– on O, δ+ on I) ΔEN= 3.5 – 2.5 = 1.0
Polarity: Polar Covalent

(d) P—H ΔEN= 2.1 – 2.1 = 0.0
Polarity: Nonpolar Covalent

(e) K—F ΔEN= 4.0 – 0.8 = 3.2
Polarity: Ionic

(f) O—Si ΔEN= 3.5 – 1.8 = 1.7
Polarity: Polar Covalent

(g) Cl—N ΔEN= 3.0 – 3.0 = 0.0
Polarity: Nonpolar Covalent

(h) O—Mg ΔEN= 3.5 – 1.2 = 2.3
Polarity: Ionic

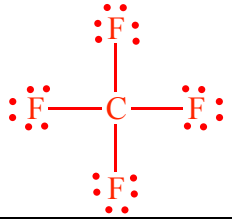
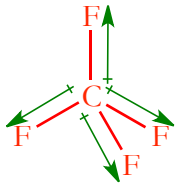
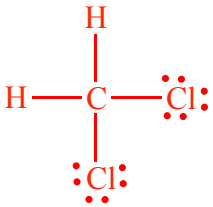
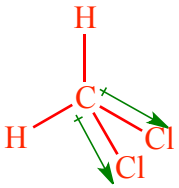
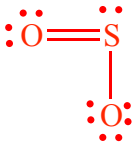
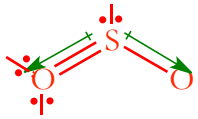
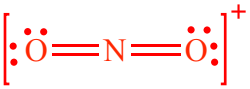
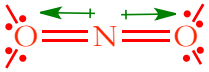
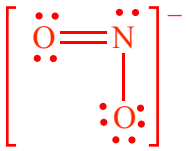
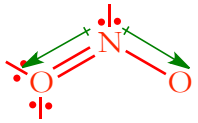
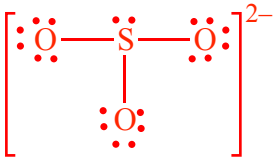
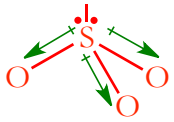
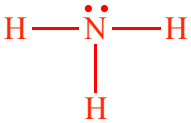
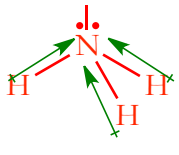
Molecular Polarity

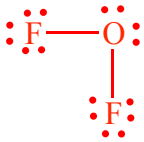
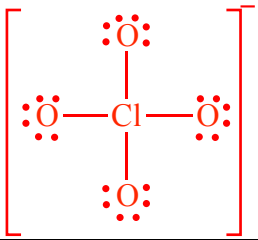
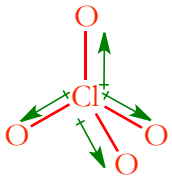
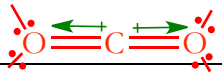
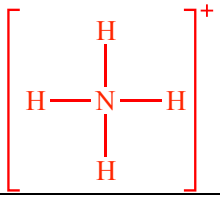
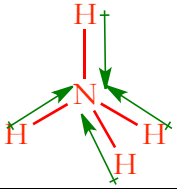
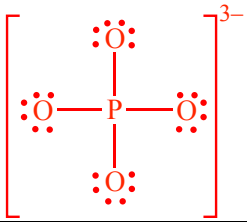
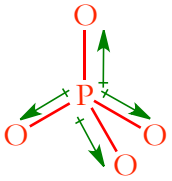
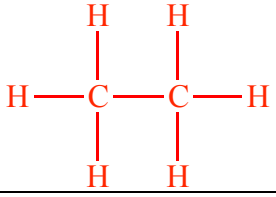
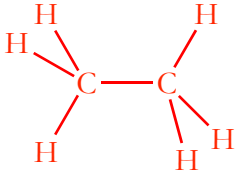
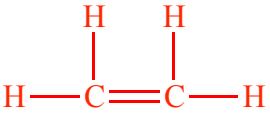
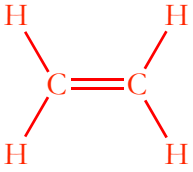
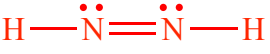
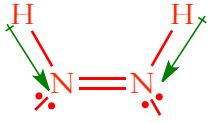
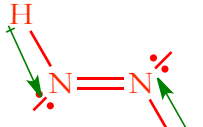
6. What two properties are needed for overall molecular polarity?
   - The presence of at least one polar covalent bond
   - A molecule with an asymmetric geometry (indicated by the presence of at least one different electron region.

7. How is molecular polarity determined?
   - Bond polarity is determined and bond dipoles indicated.
   - The symmetry is evaluated to determine if the dipoles cancel. In an asymmetric molecule, dipoles will not cancel and the molecule is polar.

8. Go back to the VSEPR worksheet and label all polar bonds with either the dipole arrow or the δ+/δ– symbols for, then indicate whether the molecule is polar or nonpolar. With N_2H_2 determine the polarity for both configurations.

Determine the Electron & Molecular Geometries & draw a 3D diagram of the following molecules:

Molecule	Lewis Structure (from previous WKS)	Electron & Molecular Geometries	3D Drawing
a. F_2		Linear Linear	 Nonpolar
b. CF_4		Tetrahedral Tetrahedral	 Nonpolar
c. CH_2Cl_2		Tetrahedral Tetrahedral	 Polar
d. N_2		Linear Linear	 Nonpolar
e. SO_2		Trigonal Planar Bent	 Polar
f. NO_2^+		Linear Linear	 Nonpolar
g. NO_2^-		Trigonal Planar Bent	 Polar
h. SO_3^{2-}		Tetrahedral Trigonal Pyramidal	 Polar
i. NH_3		Tetrahedral Trigonal Pyramidal	 Polar

Molecule	Lewis Structure (from previous WKS)	Electron & Molecular Geometries	3D Drawing
j. OF_2		Tetrahedral Bent	 Polar
k. ClO_4^-		Tetrahedral Tetrahedral	 Nonpolar
l. CO_2		Linear Linear	 Nonpolar
m. CO		Linear Linear	 Polar
n. CN^-		Linear Linear	 Polar
o. NH_4^+		Tetrahedral Tetrahedral	 Nonpolar
p. PO_4^{3-}		Tetrahedral Tetrahedral	 Nonpolar
q. C_2H_6		Tetrahedral Tetrahedral	 Nonpolar
r. C_2H_4		Trigonal Planar Trigonal Planar	 Nonpolar
s. C_2H_2		Linear Linear	 Nonpolar
t. N_2H_2		Trigonal Planar Bent	 or  "cis" Polar "trans" Nonpolar