

11.4 The Nature of Intermolecular Forces

8.6 – Molecular Polarity – Chem 111 Review! – Bond Polarity

Requirement: All you need is a polar covalent bond. That is a bond in which the constituent atoms have different electronegativities.



C-O bond is polar as there is a difference in electronegativity between C and O. Oxygen is more electronegative than carbon.



N-N bond is nonpolar. There is no difference in electronegativity.

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Molecule polar if Σ Polar bonds > 0 ... vector sum ... the molecule has a **Dipole Moment**.

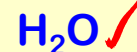
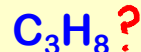
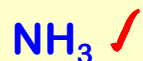
Simplifying Molecular Polarity with 3 simple questions – note that this is an over simplification.

Q1: Does the molecule have a polar bond?
No: Nonpolar Yes: On to question 2.

Q2: Does the central atom have a lone pair(s)?
No: On to question 3. Yes: Polar *1 *1: True if the central atom obeys the Octet Rule. Take care if the central atom is beyond the octet.

Q3: Are the terminal atoms around the central atom all the same?
No: Polar *1 Yes: Nonpolar

How many of the following molecules are polar?



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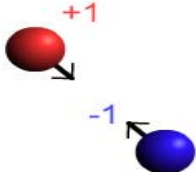
The Glue that Holds Molecules Together – Coulomb's Law – Ion – Ion

Coulomb's Law

stationary ion
+1

mobile ion
-1

See Class Web Site



Force of Attraction = 3.7×10^{-9} N
Distance = 2.50 Å

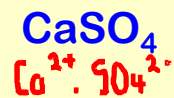
FA :- Force of Attraction.

$$FA \propto \frac{Z_1 Z_2}{d^2}$$

Qualitative :

- Magnitude of the charges.
- Distance between them.

Which of the following salts would have the greatest force of attraction assuming the distance is the same?



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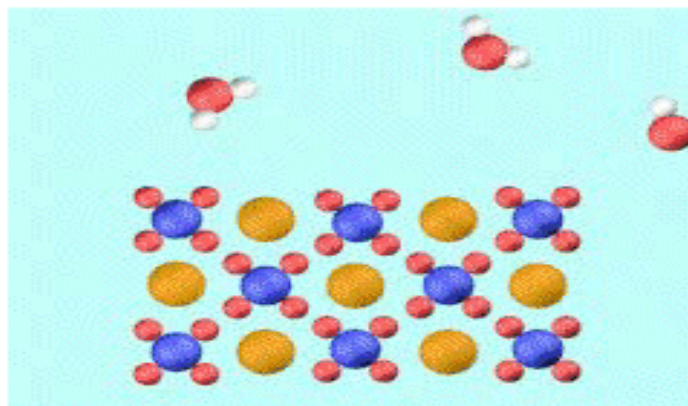
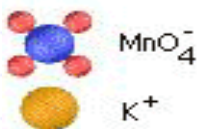
Ion – Dipole – The Dissolution Process



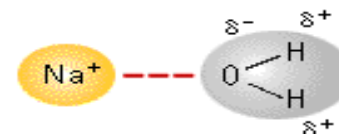
Macroscopic Scale

$H_2O(l)$ $KMnO_4(s)$

Enthalpy of Hydration: A measure of the ion/dipole glue – the amount of energy given off when an ion is surrounded (usually by 6) by water molecules.



Nano Scale



	Cation	Ion Radius pm	Enthalpy of Hydration kJ
a ✓	Li^+	90	-515
b	Na^+	116	-405
c	K^+	152	-312
d	Rb^+	166	-296
e	Cs^+	181	-263



Which of the above cations has the greatest Ion/Dipole interaction – strongest binding glue!