Dipole Moment

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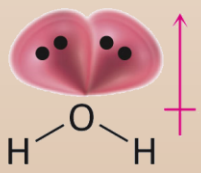
Dipole Moment

- This indicates whether a molecule is polar or not.
- Dipole moment **(μ)** is when a molecule can move in presence of an electric current. The higher the polarity of the molecule the higher the dipole moment.
- Ionic compounds are inherently polar because of the presence of ions.
- Diatomic molecules of the same atom (H_2, Cl_2, I_2) are non polar – there is no difference is electronegativity.
- Any molecule that has polar covalent bonds can have dipole moment depending on its shape.
- Read up on polar covalent bond from chapter 1 power point

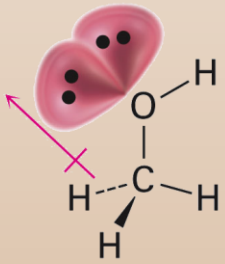
Determining Dipole Moment

These are the steps to figure out dipole moment.

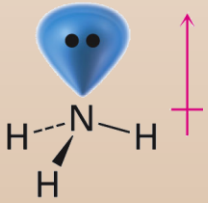
1. Write the Lewis structure
2. Determine the shape of the molecule
3. Identify the polar covalent bonds in the molecule
4. See if there is asymmetric pull in the molecule.



Water
(μ = 1.85 D)



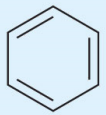
Methanol
(μ = 1.70 D)



Ammonia
(μ = 1.47 D)

Dipole Moments of Some Compounds

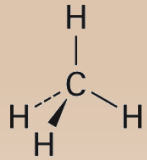
Table 2.1 Dipole Moments of Some Compounds

Compound	Dipole moment (D)	Compound	Dipole moment (D)
NaCl	9.00	NH_3	1.47
CH_2O	2.33	CH_3NH_2	1.31
CH_3Cl	1.87	CO_2	0
H_2O	1.85	CH_4	0
CH_3OH	1.70	CH_3CH_3	0
CH_3CO_2H	1.70		0
CH_3SH	1.52	Benzene	

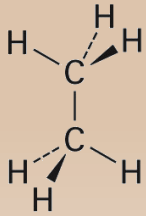
Non Polar Molecules (no μ)

- In symmetrical molecules, the dipole moments of each bond have one in the opposite direction thus canceling the dipoles.

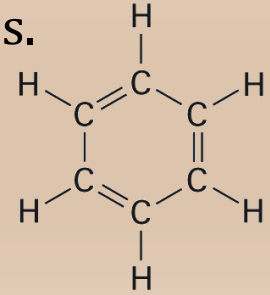
Carbon dioxide
(μ = 0)



Methane
(μ = 0)



Ethane
(μ = 0)



Benzene
(μ = 0)

Purpose of Dipole Moment

- Polarity of molecules determine the physical properties of the molecule.
  - **Solubility**: polar molecules dissolve polar substances; most organic substances are non polar and do not dissolve in water which has a high dipole moment.
  - **Boiling and melting point**: more polar molecules will have a higher boiling and melting points e.g. NaCl is ionic and therefore polar hence has a very high melting point; naphthalene (moth balls) is non polar hence has a very low melting point.
  - **Vaporization**: this is dependent on boiling point; the lower the boiling point the more the substance will vaporize. For this reason most organic compounds are highly volatile.

Continue to Intermolecular Forces….

Dipole moment helps in determining what kind of intermolecular forces are present in substances. This helps in determining physical properties of substances.