


## Molecular Polarity

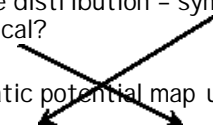


Predicting and Understanding  
the Behavior of Molecules

PGCC CHM 101 Sinex


## Molecular Polarity - How?

Lewis dot structure → geometry → bond polarity ( $\Delta EN$ ) and lone pairs → how is the charge distribution - symmetrical or asymmetrical?




Electrostatic potential map using Chime

N2



HCl



Chime activity - [Click here](#) Spartan 02

## Molecular Polarity - Why?

Interactions with other molecules and physical properties such as boiling point, surface tension, and solubility

Intramolecular interactions - within molecule such as proteins

Reaction mechanisms - where attacked

## An experimental measurement

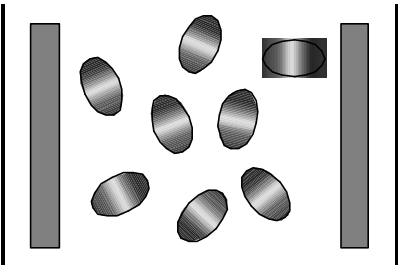
The dipole moment,  $\mu$ , is given by

$$\mu = Qd$$

where  $Q$  is the charge  
and  
 $d$  is the separation distance of the charge

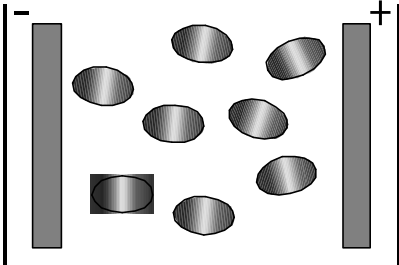
The unit is the debye, D.

### Measurement: Dipole Moment



No voltage applied on metal plates

### Measurement: Dipole Moment

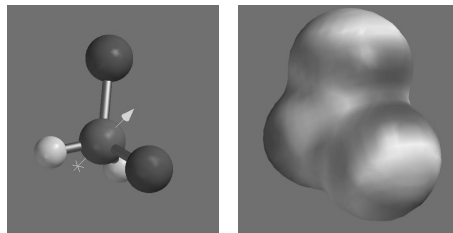


Voltage applied on metal plates

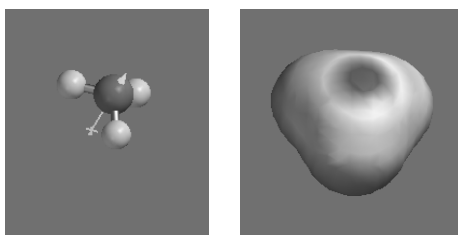
## Dipole Moments

| Hydrogen Halide | $\Delta EN$ | Bond length (pm) | $\mu$ (D) |
|-----------------|-------------|------------------|-----------|
| HF              | 1.9         | 92               | 1.82      |
| HCl             | 0.8         | 127              | 1.08      |
| HBr             | 0.6         | 141              | 0.82      |
| HI              | 0.3         | 161              | 0.44      |

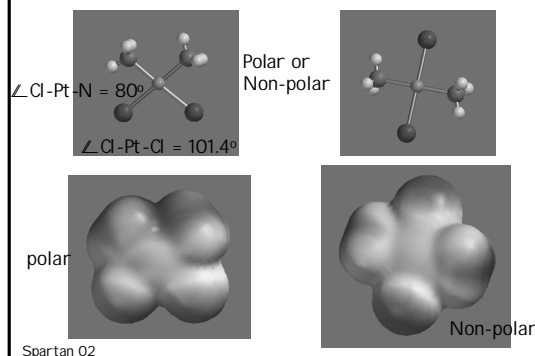
↑ Increasing polarity

Dichloromethane,  $CH_2Cl_2$  $\mu_{\text{calc}} = 1.50 \text{ D}$ 

Spartan 02

Ammonia,  $NH_3$  $\mu_{\text{calc}} = 1.85 \text{ D}$ 

Spartan 02

A square planar complex -  $Pt(NH_3)_2Cl_2$ 

Spartan 02

## Polar or non-polar molecules?

