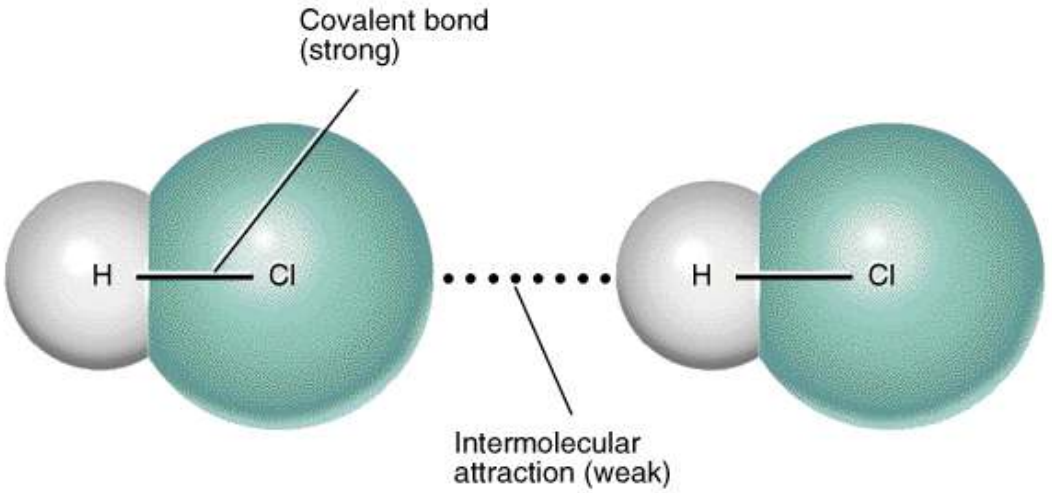
Intermolecular Forces Notes

Intermolecular Forces

- Intermolecular Forces: attraction *between* molecules
- Much weaker than chemical bonds



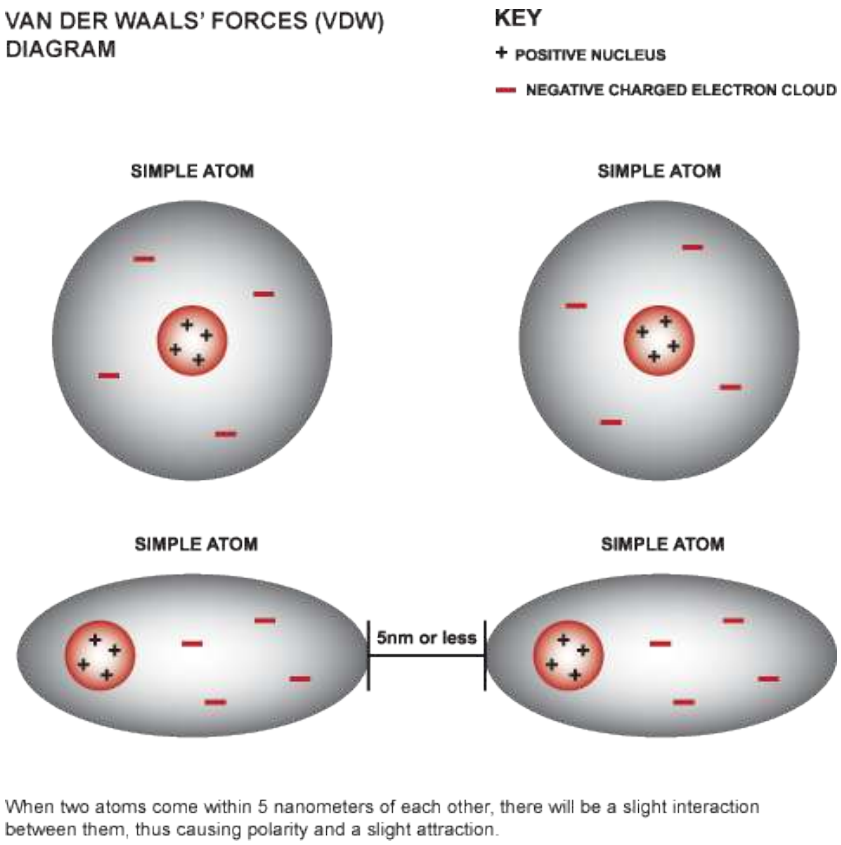
Strength of Forces

- STRONGEST
- Covalent Bonds (400 kcal)
- Hydrogen Bonding (12-16 kcal)
- Dipole-Dipole Interactions (0.5-2 kcal)
- London Dispersion Forces (<1 kcal)
- WEAKEST

- kcal = kilocalorie (unit of energy stored in chemical bonds)

London/Van der Waals

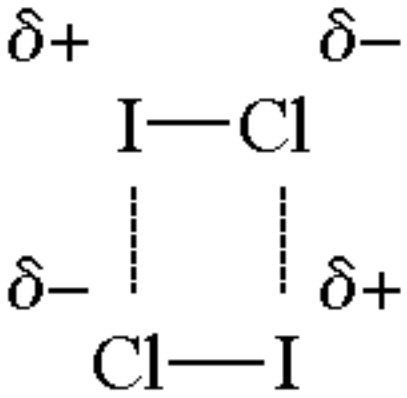
- London Dispersion Forces:
  - Attraction due to the constant motion of electrons
    - Will cause temporary concentration of charge on one side of an atom/molecule
  - Exist between ALL molecules



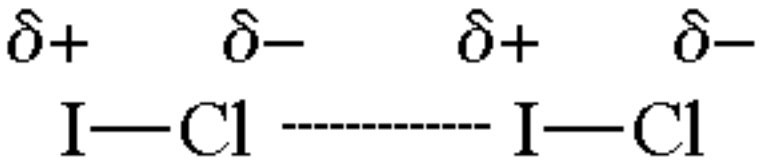
Dipole

- Dipole-dipole:
  - Attraction between polar molecules

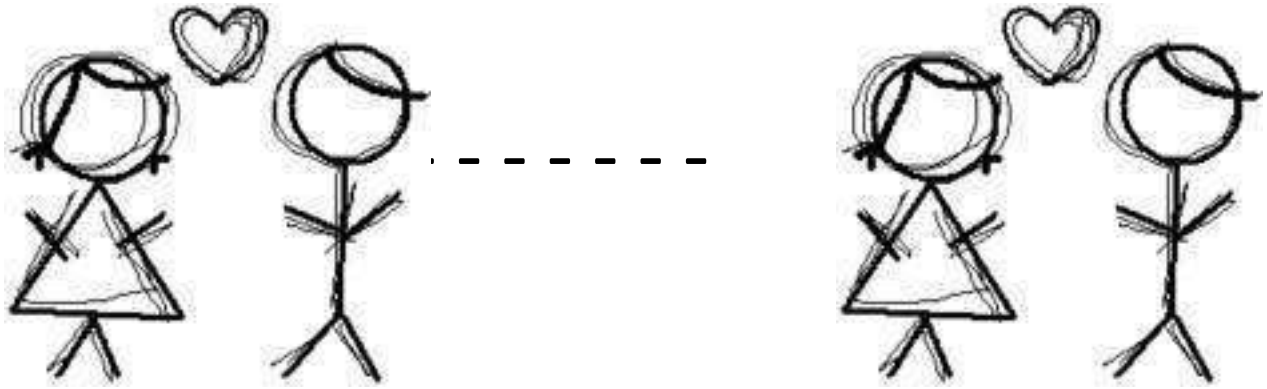
The squiggly symbol means a partial charge.



or

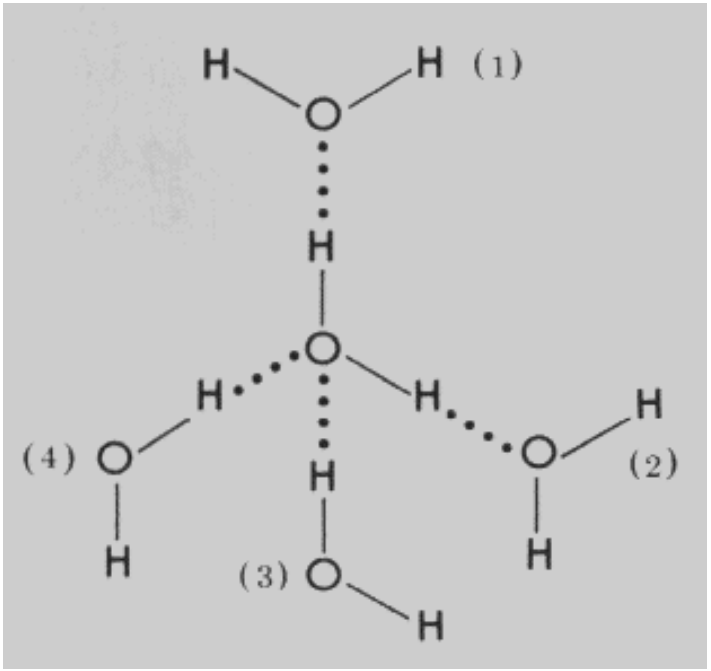


An Analogy

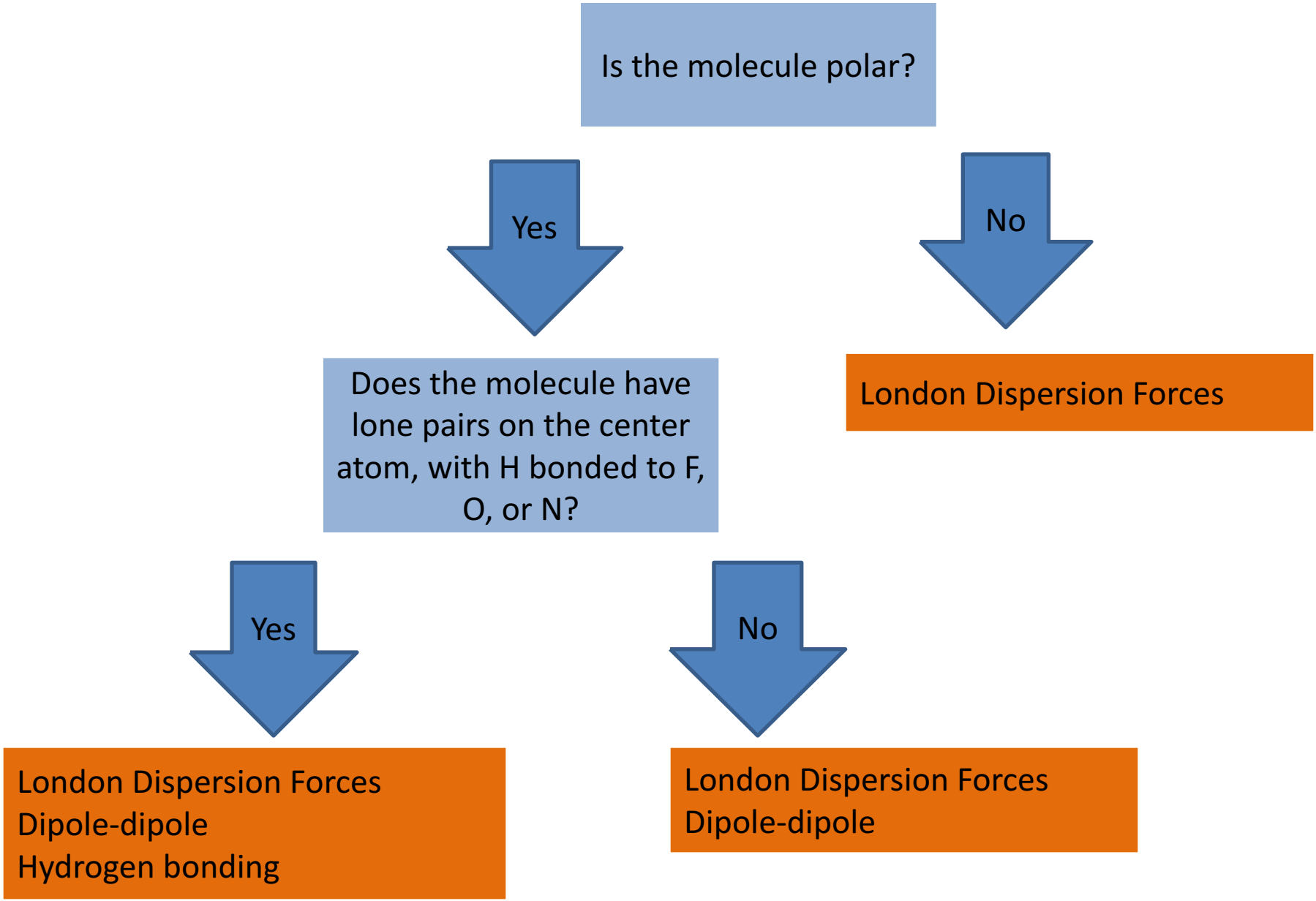
- Dipole-dipole attraction
- 
- The two couples are very happy with each other, but the guy is attracted to the other girl.

Hydrogen

- Hydrogen Bonding:
  - Stronger type of dipole-dipole interaction
  - Occurs only between molecules with lone pairs on center atom AND hydrogen bonded to F, O, or N
    - Hydrogen bonding is FON!

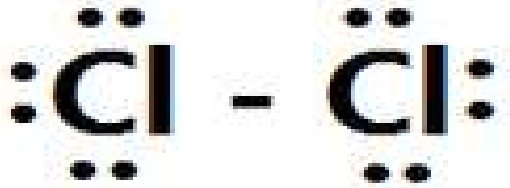


Intermolecular Forces



Intermolecular Forces Examples

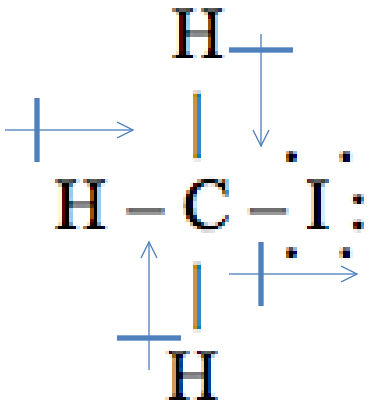
Cl_2



- The molecule is **nonpolar.**
- This molecule has **London Dispersion Forces**.

Intermolecular Forces Examples

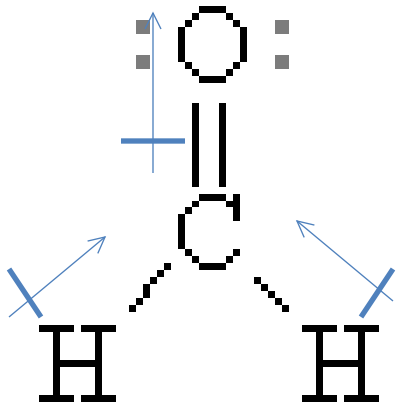
- CH_3I



- The molecule is **polar**.
- The central atom does not have lone pairs, and H is not bonded to F, O, or N.
- The molecule has **London and Dipole-dipole forces**.

Intermolecular Forces Examples

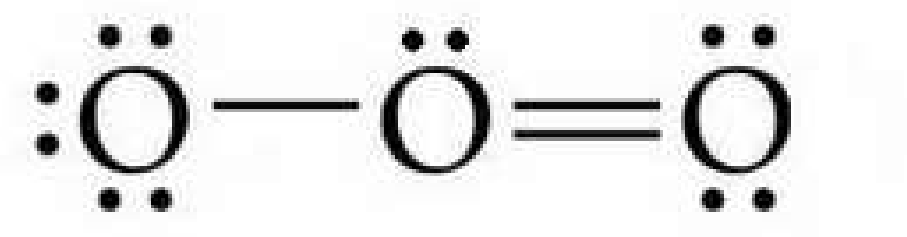
- CH_2O



- The molecule is **polar**.
- The central atom does not have lone pairs, and H is not bonded to F, O, or N.
- The molecule has **London** and **Dipole-dipole forces**.

Intermolecular Forces Examples

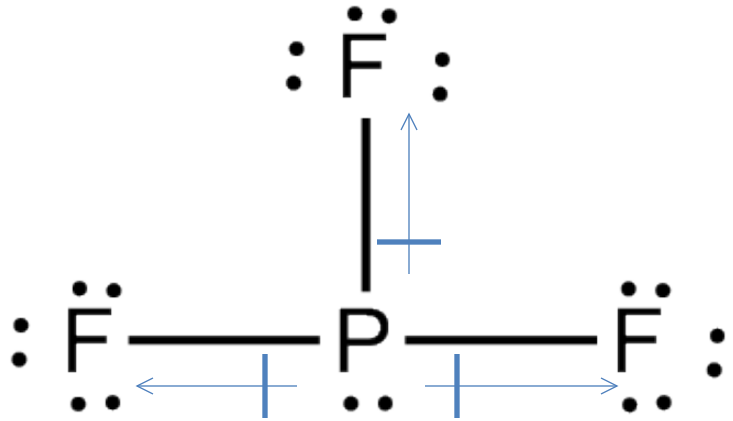
- O_3



- The molecule is **polar.**
- The central atom has a lone pair, but does not have H bonded to F, O, or N.
- The molecule has **London** and **Dipole-dipole forces**.

Intermolecular Forces Examples

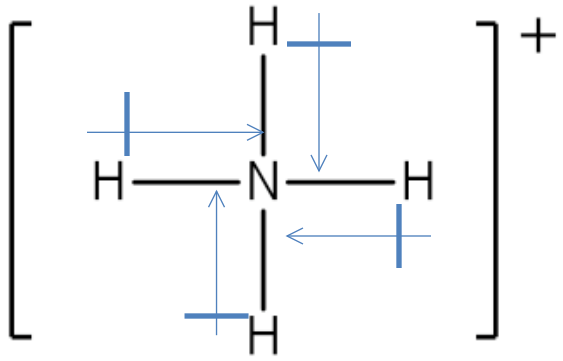
- PF_3



- The molecule is **polar.**
- The central atom has a lone pair, but does not have H bonded to F, O, or N.
- The molecule has **London** and **Dipole-dipole forces**.

Intermolecular Forces Examples

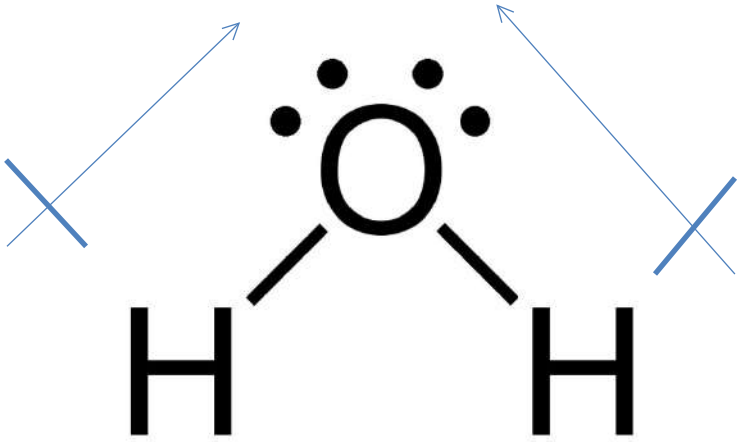
- NH_4^+



- The molecule is **nonpolar…**
- So even though H is bonded to N…
- This molecule has only **London Dispersion forces.**

Intermolecular Forces Examples EXTRA

- H_2O



- The molecule is **polar.**
- There is a lone pair.
- Hydrogen is bonded to F, O, or N.
- This molecule has **London, Dipole-Dipole forces AND hydrogen bonding.**