Intermolecular Forces (IMFs)

↳ force of attraction between 2 molecules (not within a single molecule)

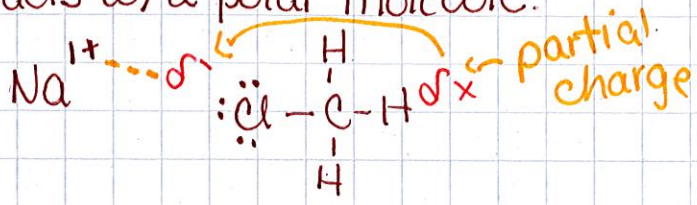
↳ weak forces compared to ionic & covalent intramolecular bonds
↳ within a single molecule)

4 types

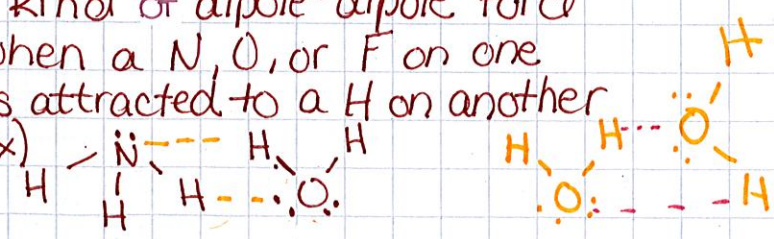
1) London dispersion forces (LDFs)
   - weakest of the IMFs
   - occur in every molecule
   - temporary attraction that occurs when valence e⁻ momentarily shift to one side of a molecule, creating temporary poles (DIPOLES)

2) Dipole-dipole force (d-d)
   - stronger than LDFs
   - occur in polar molecules - the partial negative charge on one molecule is attracted to the partial positive charge on another molecule.

3) Ion-dipole force (i-d)
   - stronger than dipole-dipole force
   - occurs when an ion (+ or −) interacts w/ a polar molecule.

&) 

4) Hydrogen bonding
   - strongest IMF
   - special kind of dipole-dipole force
   - occurs when a N, O, or F on one molecule is attracted to a H on another molecule

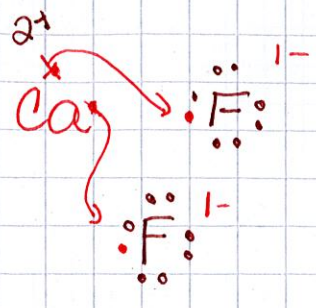
&) 

The stronger the IMF, the higher the melting & boiling point of the substance

Warm Up

SIT NEXT TO PEOPLE WHO WILL NOT DISTRACT YOU

(1) Draw e⁻ dot diagrams to show the transfer of e⁻ & formation of an ionic bond b/w



CaF_2

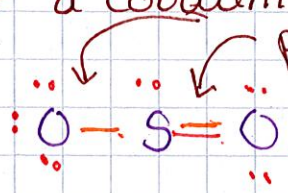
(2) Draw a Lewis structure to show the sharing of e⁻ & formation of a covalent bond in

SO_2

1(6e⁻) + 2(6e⁻)

6e⁻ + 12e⁻

18e⁻/2 9 prs e⁻ - 2 = 7 lone prs



polar covalent

3.5
2.5
1.0

what type of covalent bond occurs between S & O?

Polar Molecules

(the molecule as a whole, not just a bond w/i the molecule)

You can tell if a molecule is polar if:

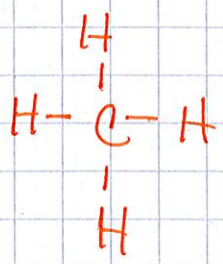
- ↳ it has lone pairs of e^- on the center atom
  OR
- ↳ it's end atoms are not all the same, ∴ one-three end atoms has a very different electronegativity than the others.

Ex) CH_4

$4e + 4(1e^-)$

$= \frac{8e^-}{2} = 4$ prs e^-

$\frac{4}{0}$

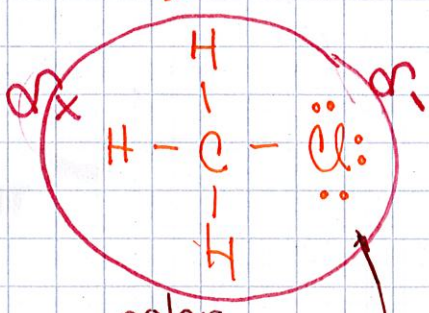


nonpolar molecule

CH_3Cl

$4e^- + 3(1e^-) + 7e^-$

$= \frac{14e^-}{2} = 7$ prs $- 4 = 3$



polar molecule

different from other end atoms

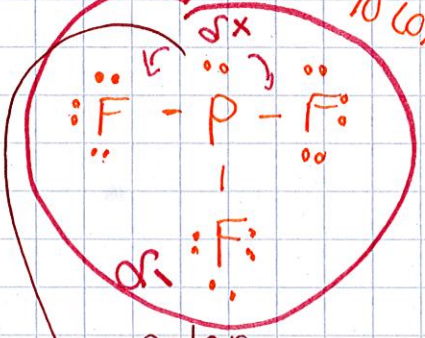
PF_3

$5e + 3(7e)$

$\frac{26e^-}{2} = 13$ prs e^-

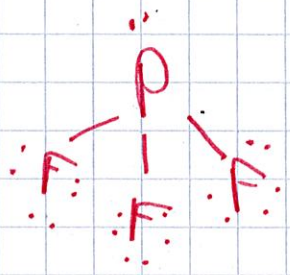
-3

10 lone prs



polar molecule

lone pairs on the center atom



CW/HW Polar Molecules & IMFs

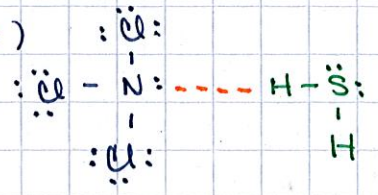
1) Determine if these molecules are polar or nonpolar

(A) CO_2 (B) $SiCl_3H$ (C) NH_3

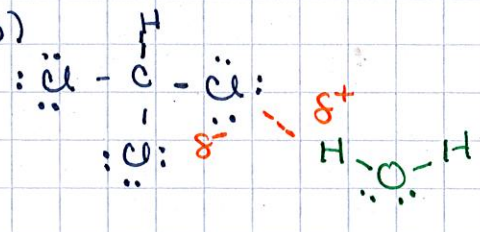
2) What is the weakest IMF? the strongest?

3) What type of IMF is represented below?

(A)



(B)



4) How are IMFs different than ionic and covalent bonds?

5) Water undergoes hydrogen bonding while PCl_3 undergoes dipole-dipole forces, which molecule has the lowest boiling point?