

Key!

Ch. 11 Intermolecular Forces

The state of matter depends on what?

Kinetic energy & the energy of attraction

* influenced by temperature and pressure.

List the states of matter increasing in kinetic energy

Solid < Liquid < Gas

→ Kinetic energy increases

What is the difference between a crystalline solid and an amorphous solid?

Crystalline solid - ex: Diamond ; highly ordered, repeating atomic structure.

Amorphous solid - ex: Glass ; lack long-range order ; random arrangement of atoms

Fill in the table and list examples:

Type of Solid	Interaction
Ionic Metal & Nonmetal	Ex: NaCl / Ionic / high melting point Brittle ; Hard
Molecular Nonmetal & Nonmetal	Ex: CO ₂ / Hydrogen bonding / low - melting point H ₂ / Dipole - Dipole / non conducting London dispersion
Metallic Metal + Metal	Ex: Fe / Metallic bonding / Conductors Mg
Network	Ex: diamond / Covalent bonding / High - melting point quartz / non - conducting

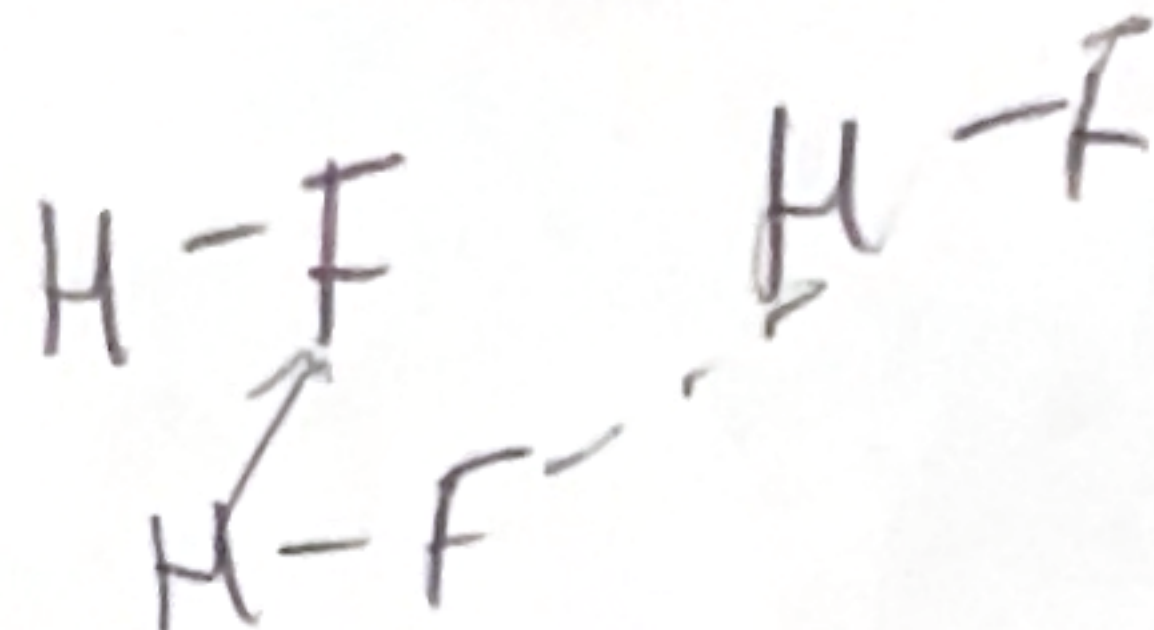
What is the fundamental difference between states of matter?

Strength of intermolecular forces

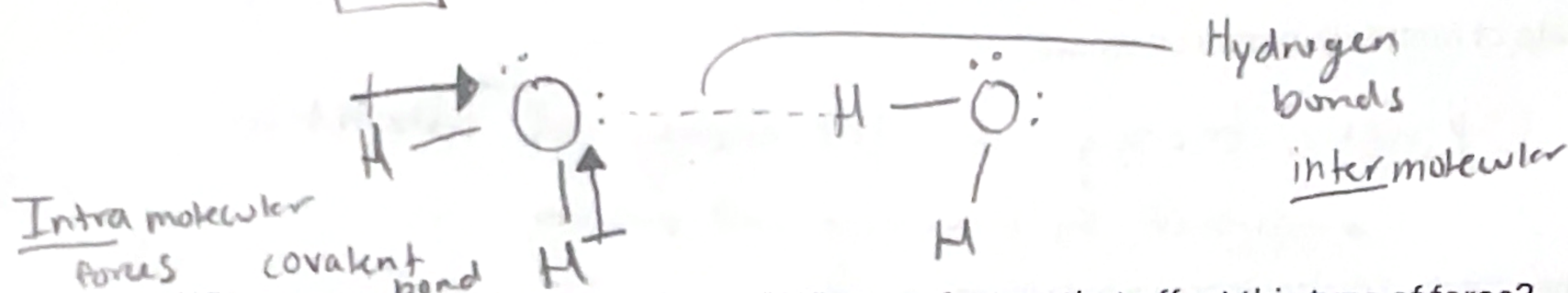
What is the difference between intermolecular and intramolecular forces?

Intermolecular (between molecules)

Intramolecular (inside ; within molecule)



Show the intermolecular and intramolecular forces between two atoms of water. H_2O



What are London Dispersion forces? What are factors that affect this type of force?

transient dipole-induced dipole interaction

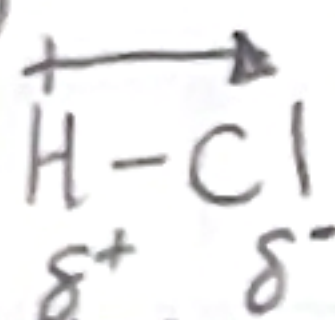
* present in ALL molecules no matter if they're polar or nonpolar

- ① number of e^- in an atom ($\uparrow e^- = \uparrow$ dispersion force) ② molecule/mass = $\uparrow$ dispersion force

③ shapes are similar = less dispersion

What are Dipole - Dipole forces?

Between Polar molecules specifically between the positive & negative end of another molecule.



What is a special type of dipole -dipole force? What element(s) cause this type of intermolecular forces?

Hydrogen bonding. Any time Hydrogen pairs with the F, O, N sisters.

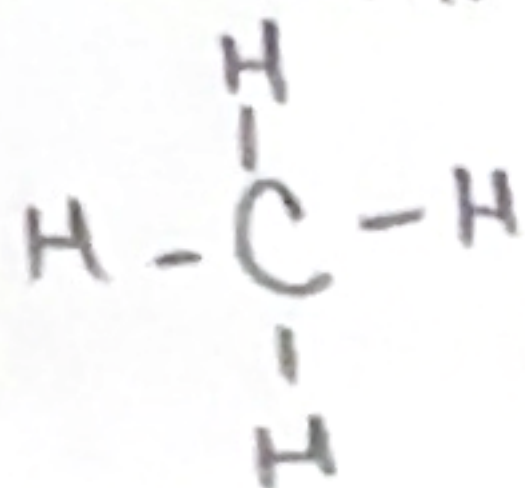
	Nonpolar	Polar	Special Bonds (OH, NH, or HF)	Ionic Compounds
London Dispersion	✓	✓	✓	✓
Dipole- Dipole		✓	✓	
Hydrogen Bonding			✓	
Ion- Dipole interactions				✓

What is the order of intermolecular forces from lowest to highest boiling point?

London Dispersion < Dipole-Dipole < Hydrogen bonding < Ionic compounds

Give the nomenclature and identify the main intermolecular force acting between the following molecules:

1.) CH_4 = Methane
 $4 + 1(4) = 8$

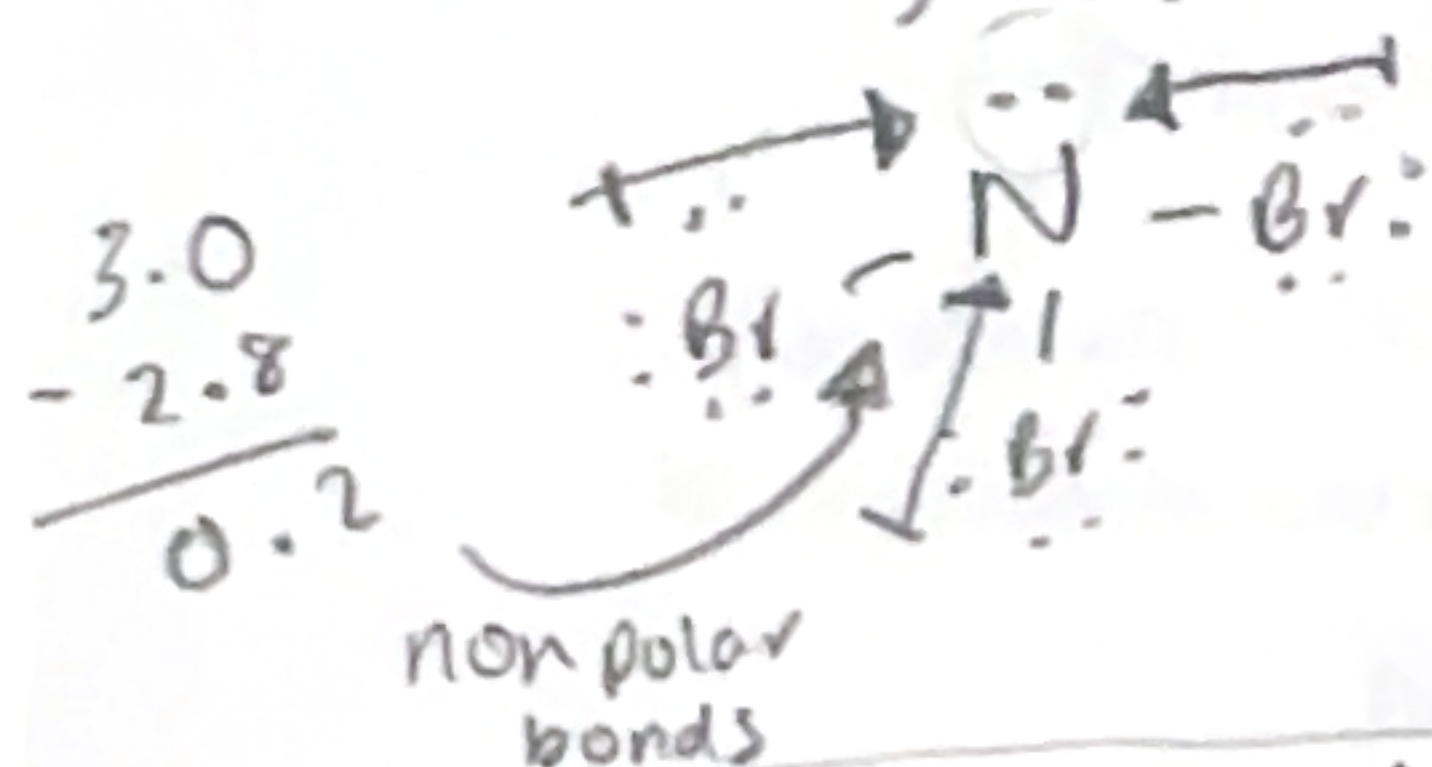


Molecular Geometry
Tetrahedral

Non-Polar
(symmetrical)

- London Dispersion

2.) NBr_3 = Nitrogen tribromide
 $5 + 7(3) = 26$

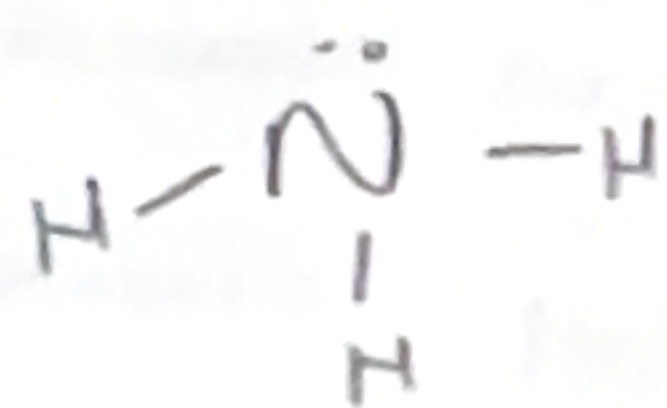


trigonal
pyramidal

Polar
molecule

- Dipole - Dipole

3.) NH_3 = Ammonia
 $5 + 1(3) = 8$



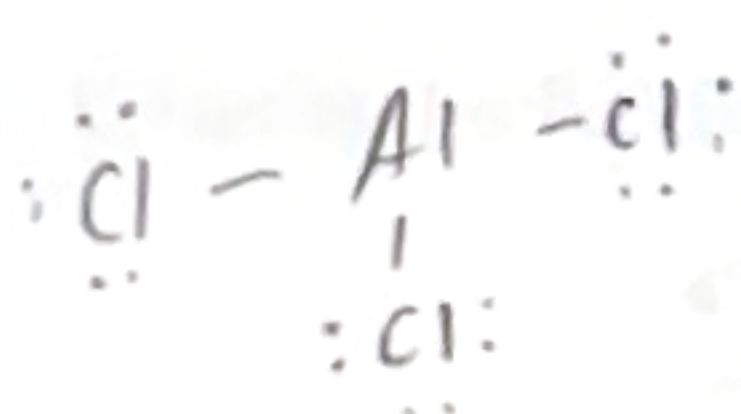
Trigonal
Pyramidal

Polar
molecule

- Hydrogen Bonding

. London dispersion
. Dipole - Dipole

4.) AlCl_3 = Aluminum trichloride
 $3 + 7(3) = 24$

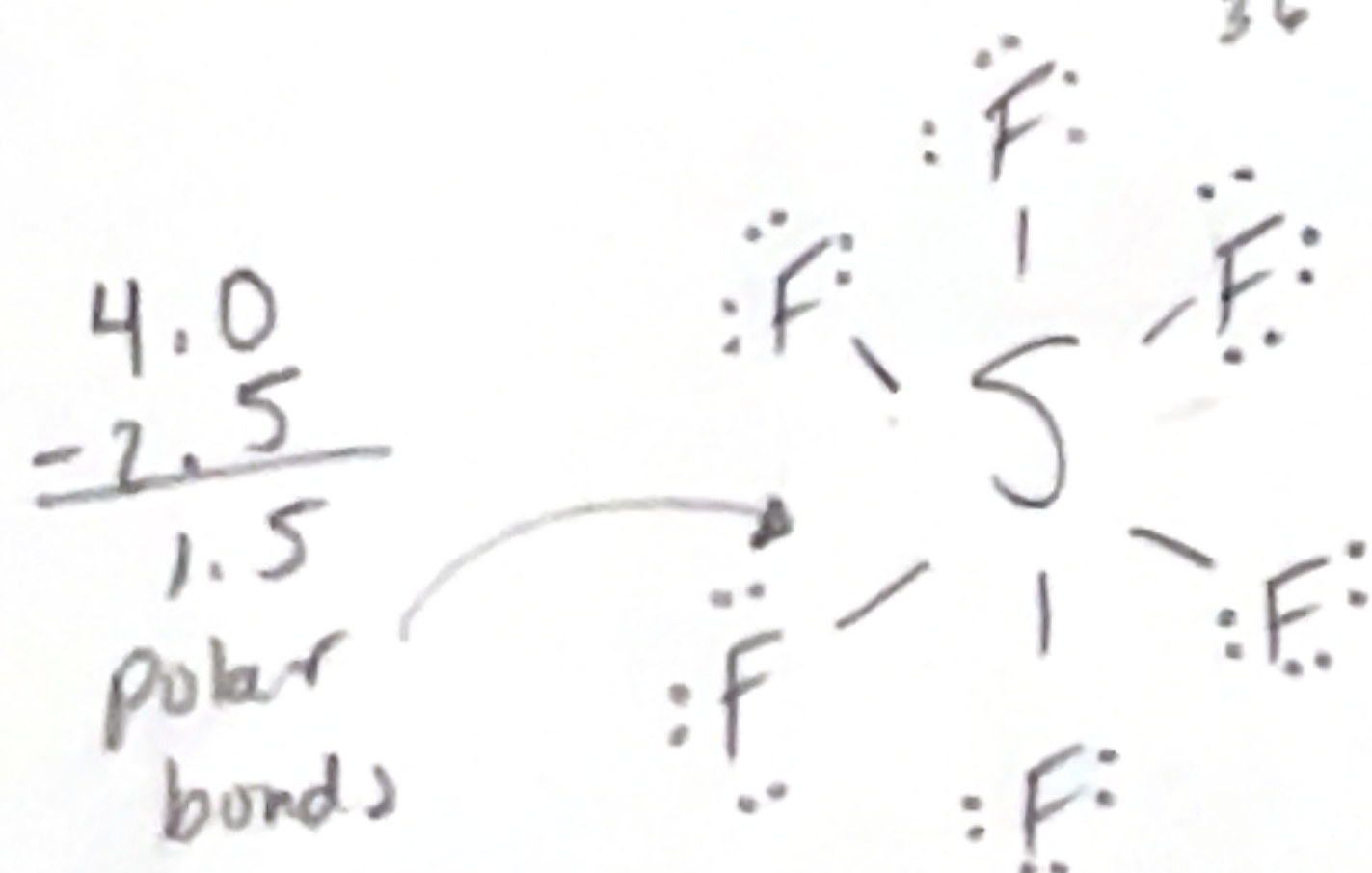


Trigonal
Planar

Non Polar
molecule

- London Dispersion.

5.) SF_6 = Sulfur hexafluoride
 $6 + 7(6) = 48$
 $\frac{-12}{36}$



Octahedral - Non Polar - London Dispersion