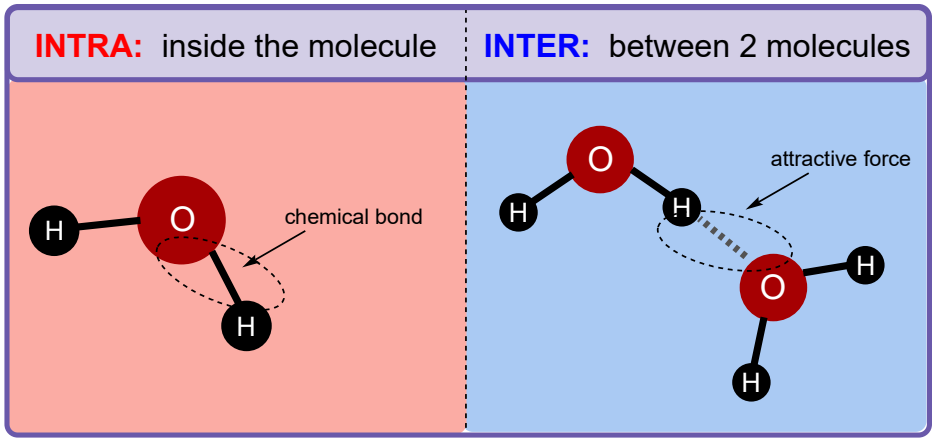
CONCEPT: INTERMOLECULAR FORCES

- **2 Major Attractive (Electrostatic) Forces:** *Intramolecular* and *Intermolecular Forces*.
  - □ **Intramolecular Forces:** exist _____ a molecule, bond atoms together, and influence _____ properties.
    - Chemical bonds: ionic and covalent
    - Stronger than *Intermolecular forces*
  - □ **Intermolecular Forces:** exist _____ molecules and influence _____ properties.
    - Hold liquid and solid molecules together



EXAMPLE: Identify the type of force involved in the situations below as either intermolecular or intramolecular.

a) condensation of water vapor _____

b) the formation of NH_3 through the combination of N_2 and H_2 _____

c) sugar dissolves in water _____

d) Water flowing up the veins of a plant due to capillary action _____

PRACTICE: The dominant forces between molecules (intermolecular forces) are ____ in origin.

a) electrostatic b) electrodynamic c) electromagnetic d) gravitational e) magnetic

PRACTICE: Intermolecular forces are:

a) between molecules and weaker than a chemical bond

b) between two atoms within a molecule and weaker than a chemical bond

c) between molecules and stronger than a chemical bond

d) between two atoms within a molecule and stronger than a chemical bond.

e) between electrons within an atom and stronger than a chemical bond

CONCEPT: INTERMOLECULAR FORCES

Types of Intermolecular Forces

- There are 5 types of Intermolecular forces that _____ molecules together.
  - □ *Polarity* of compounds plays a big role in the type of force present.

Types of Intermolecular Forces

Type of Force	Exists Between	Strength	Example
Ion-Dipole	Ions and _____ compounds	_____	$NaCl$ & H_2O
Hydrogen Bonding	Compounds containing ___ directly bonded to **F**, **O** or **N**	_____	H_2O & NH_4
Dipole-Dipole	Two _____ covalent compounds	_____	HCl & SO_2
Dipole/Induced-Dipole	_____ covalent and _____ covalent compounds	_____	HCl & CCl_4
London Dispersion (van der Waals)	Dominant between two _____ covalent compounds	_____ • Increases in strength with increasing mass	CH_4 & CCl_4

- □ _____ force is present between **ALL** types of compounds.

EXAMPLE: Identify the major type of intermolecular force between the particles of each of the following:

a) N_2 b) CH_3OH c) CH_4 & H_2O d) CH_3Cl e) KCl & CH_3OH

_____ _____ _____ _____ _____

CONCEPT: INTERMOLECULAR FORCES

PRACTICE: Which of the following intermolecular forces are found in ALL molecules?

a) Ionic forces b) Ion-dipole forces c) Hydrogen bond forces

d) Dipole-dipole forces e) Dipole/Induced-Dipole forces f) London dispersion forces

PRACTICE: Which of these molecules exhibit the highest number of different intermolecular forces?

a) $CH_3CH_2CH_3$ b) CH_3CH_2OH c) CH_2O d) Li_2CO_3

PRACTICE: It is common to add Epson salts to bath water when one has been over exercising and has sore muscles. What is the primary intermolecular force that exists between magnesium sulfate, the primary in Epson salts, and the water in the bathtub?

a) dipole-dipole forces b) ion-dipole forces c) London forces

d) Hydrogen bonding e) ionic forces d) dipole/induced-dipole

PRACTICE: Which species is expected to have the largest dispersion forces?

a) CH_4 b) CH_3CH_3 c) $CH_3CH_2CH_3$ d) $C_{12}H_{26}$