

### Intermolecular forces vs Intramolecular forces

Intermolecular Forces	Between macromolecules
Intramolecular Forces	happen within

### IMFs to explain membranes

Hydrophilic heads	in water (polar)
Hydrophobic tails	away from water (nonpolar)

### Electroneg. diff. vs bond polarity -> ions

The larger the electronegativity difference, the more polar the bond

When electroneg. greater bonding e spend most time close to nonmetals, ionic bond instead of shared e covalent bond than 2

### Predicts behavior protein in solvents

Side with most compatible IMFs w/solvent	will be on outside if dissolves (polar)
Oils (hydrocarbons)	opposite water (nonpolar)

### PP polymer to degree cross linking chains

Additives (alter properties)	Substances added to polymeric materials
Cross-linking	2 or more molecules together with covalent bond or connecting with ionic
Physical properties	highly increased by degree cross-linking
Low degree cross-linking	More flexible, more soluble
High degree cross-linking	more rigid, higher mp, bp

### Predict charges Polyatomic ions

Polyatomic ions	Ionic compounds
ions in lattice	Molecular ions (several atoms covalently bonded)

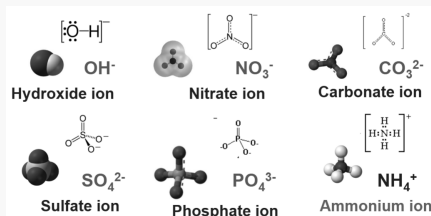
OH<sup>-</sup> NO<sub>3</sub><sup>-</sup> CO<sub>3</sub><sup>2-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, NH<sub>4</sub><sup>+</sup>

Charges balance out

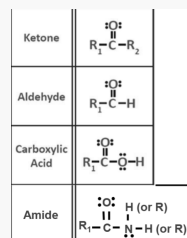
### Identify monomers to form Polymers

Monomers	building blocks of polymers
Addition formation	link up amide formation combining carboxylic acid + amine = amine to N
Type of polymerization	impacts final structure

### Ionic compound nomenclature



### Common Functional groups



### Unit cell

Repeating units that build the crystal lattice



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### Strength + #C influence mixing

A mixture will only mix if it meets atleast one of the two criteria

- Mixed version has more configurations
- Mixed version has lower  $E_p$  (thermodynamics)

Exothermic reactions desired      Loose energy, don't require energy to occur

Temperature can impact

Bottom right on PEC diagram

### Polarizability and Molecular Geometry impacts IMFs

Larger      More dispersion, because more space for IMFs interactions

Distortion from polarizability (electron cloud distorted by external electric field)      causes temporary dipoles that induce dispersion forces.

Polarizability increases      Dispersion increases

### PP. Ionic compounds vs electrostatic interactions

Ionic compounds tend to be solids with high melting and boiling points, because ion-ion electrostatic forces are strong

### Size cat. + an. periodic trends, coulombs law

Cations      Smaller because they lose electrons

Anions      Large because gain electrons

If isoelectric ions (all same electron configuration)      greatest protons has greatest charge and lowest melting point because smaller radius because electron pulled closer

Coulomb's law       $F = \frac{kq_1q_2}{r^2}$

### Dispersion

Dispersion      IMFs that are always present

Induced dipoles

major contributor to IMFs

Relationships

Larger      More dispersion

Higher bp and mp      More dispersion

More polarizable      Stronger dispersion

### Hydrogen bonding

Definition      Hydrogen atoms covalently bonded to NOF

These bonds have a large electronegativity difference which creates large bond dipoles and large partial charges.

electron deficient hydrogen in one molecule gets close with electron rich NOF in another

Stronger electrostatic interactions are more likely

### Dipole-Dipole Forces

Only occur in polar molecules

Permanent dipole

Definition      Polar molecules have opposite parallel charges, opposite partial charges interacting with partial charges of other molecules create dipole-dipole forces

### Predictions of solubility

Soluble if      charge is less than 4

Large radius      More soluble

### Electrostatic interactions vs atomic structure

Structure of ionic compounds maximizes electrostatic attraction with overall charge neutrality

Solid close together



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### Strong, weak electrolytes

Strong electrolytes	Soluble, Charges less than 4, atoms move more freely, conducts electricity
Weak electrolytes	Slightly or nonsoluble, dont conduct electricity, charges greater than 4

### Charge neutrality -> formula ionic compounds

Charges =0	
cross multiply	reduce

### Features ionic comp. influence solubility

If product of charges greater than 4	Insoluble
The large the ion	more soluble b/c weaker IMFs

### Ionic charge vs period. trend e config.

Electronegativity	Increases to top right
E- nuclear attraction	increases to top right
Cations	Smaller than og, b/c loose e-
Anions	Large than o.g, b/c gain e-
Charge ions acquire when they react	determined by e configuration driven by stability of full outer shell
electrons go from	metal to nonmetal

### IMFs to explain protein structure

Protein	Natural polymer by combo of smaller molecules (monomers)
Primary structure	Unique sequence amino acids
Secondary structure	Localized folding proteins
Tertiary	3D strucute of a peptide chain formed by interactions between R-groups

### Strength of IMFs explain protein folding

Protein folding is determined by strength of IMFs.	
Polar folds	toward water
Intermolecular interactions with H2O and Intramolecular interactions between amino acid residues	folding into structural confirmation that is most energetically stable in the environment
Intra	specific chain folding
Looks for like places to bond to	
Strong stabilizes	

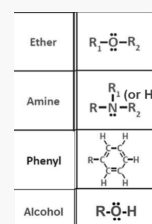
### Properties by chain length, branching

Chain length and branching impact chain shape and interactions	
Longer	More density, more IMFs
Shorter, More branching	less rigid, weaker IMFs, lower density

### Functional groups relate to IMFs

Add unique characteristics to each monomer
Each has distinct IMFs

### Common Functional groups



### Funct. groups of polymer chains vs interactions

Functional groups impact	how molecules interact with eachother and other suvstances
Functional groups	predict interactions



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### Structural Formulas and Line Structures

Double bond	Two parallel lines
Carbons	Bends and Ends
Hydrogen	Fulfill octet rule for carbons

### Physical P. strength IMFs + molecular structure

Physical properties	Emerge from IMFs among millions of molecules
IMFs arise because of	uneven changing charge
Stronger IMFs	More Energy required to separate
Physical properties	determined by polarity and polarizability and possibility of hydrogen bonding
Physical Properties of carbon based compounds	determined by molecular shape, size and functionality

### Periodic trends of IMFs

Stronger IMFs	Higher mp and bp
Stronger IMFs	Lower vapor pressure and viscosity
Polarizability	Tendency to develop temporary dipoles
Large molecule, Stronger IMFs	more polarizable

### Strength of IMFs

Dispersion	Stronger with larger molecules/ more e-
Increases	Dispersion, Dipole-Dipole, Hydrogen bonding, Ion-Dipole
Stronger IMFs	Higher bp

### Types of IMFs Present

All have dispersion forces	
Polar	Dipole-Dipole forces
H+N,O,F	Hydrogen Bonding
Ionic compound + polar molecule	Ion-dipole

### Relative Energy Range

Intermolecular interactions weaker than	Covalent bonds
Sharing e is a stronger attraction, more stable higher E because e closer to nucleus	



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