The number of dispersion forces is related to solubility in a nonpolar solvent ${\rm C_2H_{6'}~CH_{4'}~C_3H_8}$ CH₄ - only has LF as IMF, and least amount of London Forces Solubility (lowest number of protons and electrons) of the three particles ${\rm CH_4}$ - forms relatively least amount of attractions to the nonpolar C_2H_6 solvent C₃H₈ - since solubility is based on amount of IMF, with greater solubility occurring with greater attractions between Highest solute and solvent particles, methane will have the lowest Solubility solubility

Lowest
Solubility

Ctl. - only has LF as MF, and least amount of London Forces (lowest number of protons and electrons) among these 3 particles
-forms relatively least amount of Iffif with greater subuliny countries with greater structions between slotled and solvent particles.

Ctl. C₃H₈

C₄H₈

C₅H₈

C₆H₈

C₇H₈

C₇H₈

C₇H₈

C₈H₈

C

The number of dispersion forces is related to solubility in a nonpolar solvent

C2H₆, C4H₆, C3H₈

C4L, - only has LF as IMF, and least amount of London Forces (lowest number of protons and electrons) among these 3 particles

- increasobility is bade on amount of IMF, with greater solubility cocurring with greater attractions between solute and solvent particles, methane will have the lowest solubility

C3H₈

C3H₈

C3H₈

Highest

Solubility

C3H₈ — has more LF than methane, but less LF than propane

- forms more attractions with the nonpolar solvent

- forms more attractions with the nonpolar solvent than methane, but less LF than propane

- forms more attractions with the nonpolar solvent than methane, but less than propane

- since solubility is based on amount of IMF, ethane will have a greater solubility than methane and a lower solubility then propane

The net polarity of a molecule is related to it solubility in a polar compound. ${\rm CH_3Br,\,CH_3F,\,CH_3Cl}$

Lowest Solubility the greater the net dipole, the stronger the dipole-dipole attraction that can occur between two polar molecules

- all three molecules have the same shape, with fluorine being the most EN and Br the least

CH₃Br CH₃Cl CH₃F

Highest Solubility therefore, CH₃F has the overall greatest net polarity of the three molecules, this means that is would form the strongest attractions to the polar solvent, giving it the greatest solubility The net polarity of a molecule is related to it solubility in a polar compound. $\mathsf{CH_3Br},\,\mathsf{CH_3F},\,\mathsf{CH_3Cl}$

Lowest Solubility the greater the net dipole, the stronger the dipole-dipole attraction that can occur between two polar molecules
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CH₃Br CH₃Cl CH₃F

 CH₃Br has the overall lowest net polarity of the three molecules, this means that is would form the weakest attractions to the polar solvent, giving it the lowest solubility

Highest Solubility

The net polarity of a molecule is related to it solubility in a polar compound. ${\rm CH_3Br,\,CH_3F}$

Lowest Solubility - the greater the net dipole, the stronger the dipole-dipole attraction that can occur between two polar molecules - all three molecules have the same shape, with fluorine being the most EN and Br the least

 therefore, CH₂F has the overall greatest net polarity of the three molecules, this means that is would form the strongest attractions to the polar solvent, giving it the greatest solubility

CH₃Br CH₃Cl CH₃F

Highest Solubility CH,Br has the overall lowest net polarity of the three molecules, this means that is would form the weakest attractions to the polar solvent, giving it the lowest solubility

- $\mathrm{CH_3Cl}$ has the overall net polarity lower than $\mathrm{CH_3F}$ but greater than $\mathrm{CH_3Br:}$

 this means that is would form the weaker attractions to the polar solvent than CH₃F, but greater attractions to the polar solvent than CH₃Br,

 therefore, its solubility would place it in the middle of the three molecules The number of hydrogen bonds formed is related to solubility in a polar solvent. CH₃CH₂OCH₂CH₃, HOCH₂CH₂CH₂CH₂CH₃COCOCH₃

Lowest Solubility

CH₃CH₂OCH₂CH₃ CH₃COOCOCH₃ HOCH₂CH₂CH₂CH₂OH

Highest Solubility

- for a molecule to form a hydrogen bond, it must have a hydrogen atom bonded to a nitrogen, oxygen, or fluorine

 for a molecule to receive a hydrogen bond it has to contain an oxygen, nitrogen, or fluorine with a lone pair of electrons

 if a molecule can just receive a hydrogen bond (has a N/O/F), it is called a one-way hydrogen bond

 if a molecule can both form a hydrogen bond (has a H bonded to N / O / F) and can receive a hydrogen bond (has a N / O / F) than it is called a two-way hydrogen bond The number of hydrogen bonds formed is related to solubility in a polar solvent. $\mathsf{CH_3CH_2OCH_2CH_3}, \mathsf{HOCH_2CH_2CH_2CH_2CH_2CH_3}.$

Lowest Solubility

CH₃CH₂OCH₂CH₃

CH₃COOCOCH₃ $\mathsf{HOCH_2CH_2CH_2CH_2OH}$

Highest Solubility

 $\mathsf{HOCH_2CH_2CH_2CH_2OH}$

- this molecule has a H bonded to an O so it can form a HB and because it contains an O it can also receive HB : therefore a two-way HB can form between it and a polar solvent
- has two spots that can for HB, therefore, it will form the strongest attractions with a polar solvent; particularly a polar solvent that can also form and receive HB - as a result it will have the highest solubility

The number of hydrogen bonds formed is related to solubility in a polar solvent. $\mathsf{CH_3CH_2OCH_2CH_3},\,\mathsf{HOCH_2CH_2CH_2CH_2OH},\,\mathsf{CH_3COOCOCH_3}$

- HODI,CI,CI,CI,OI,OII

 this molecule has a H bonded to an O so it can form HB and because it contains an O it can also receive HB: therefore a bur-way. HB can form between it and the solvent
 has two spots that can for HB, therefore, it will form the strongest attractions with a polar solvent; particularly spots solvent that can form and receive HB
 as a result it will have the highest solubility

CH₃CH₂OCH₂CH₃ CH₃COOCOCH₃ $\mathsf{HOCH_2CH_2CH_2CH_2OH}$

Highest Solubility

Lowest Solubility

 $\mathrm{CH_3COOCOCH_3}$ and $\mathrm{CH_3CH_2OCH_2CH_3}$

- both molecules contain oxygen atom(s) so they can receive HB, but neither have H bonded to a O so they
- this means their solubility will be lower than the first molecule as they will only have a one-way HB
- because $\mathrm{CH_3COOCOCH_3}$ contains more O atoms than CH₃CH₂OCH₂CH₃, the first molecule will have more possibilities for a one-way HB, resulting in it forming greater attractions to the polar solvent

lonic solutes, polar solutes, and nonpolar solvents have different solubility's in polar and nonpolar solvents ${\rm C_4H_{10}}$, NaCl, ${\rm C_4H_9OH}$

Solubility

- a polar molecule has a slightly positive and a slightly negative end

C4H10 C₄H₉OH NaCl

- when a dipole-dipole attraction forms, the $\delta\text{+ve}$ end of one molecule is attracted to the $\delta\text{-ve}$ of another

- the greater the overall polarities of the molecule, the greater the attraction between the $\delta\text{+ve}$ and $\delta\text{-ve}$ ends of the adjacent molecules

Highest Solubility

Ionic solutes, polar solutes, and nonpolar solvents have different solubility's in polar and nonpolar solvents C₄H₁₀, NaCl, C₄H₉OH Solubility C_4H_{10} C₄H₉OH NaCl Highest Solubility

lonic solutes, polar solutes, and nonpolar solvents have different solubility's in **polar** and nonpolar solvents $C_4H_{10}, \, \text{NaCl}, \, C_4H_9\text{OH}$

Lowest Solubility - a polar molecule has a slightly positive and a slightly negative end

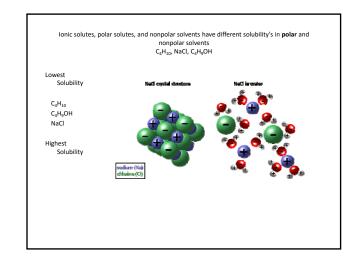
 ${
m C_4H_{10}}$ ${
m C_4H_9OH}$ NaCl when a dipole-dipole attraction forms, the δ+ve end of one molecule is attracted to the δ-ve of another
 the greater the overall polarities of the molecule, the greater the attraction between the δ+ve and δ-ve ends of the adjacent

Highest Solubility molecules

unlike polar molecules that are partial charges, and ionic compound consists of full charges

compound consists of full charges

these full charges can establish a stronger electrostatic attraction between the ions of the ionic compound, and the δ+νe and δ-νe ends of the polar molecule



lonic solutes, polar solutes, and nonpolar solvents have different solubility's in **polar** and nonpolar solvents $C_{qH_{10}} \ \text{NaCl}, \ C_{qH_{20}} \ \text{H}_{20} \ \text{H}$

Lowest Solubility

 C_4H_{10}

this is a nonpolar molecule, only capable fo forming weak LF with the polar solvent
the polar solvent however will form LF and DD attractions

C₄H₁₀ C₄H₉OH NaCl

with itself
therefore, the polar solvent will be more attracted to itself

than to the nonpolar solute C₄H₁₀

Highest Solubility - due to the weak attractions, C_4H_{10} will have really low solubility in the polar solvent

lonic solutes, polar solutes, and nonpolar solvents have different solubility's in **polar** and nonpolar solvents $C_dH_{10}, NaCl,\ C_dH_9OH$

Lowest

est دواها Solubility c

 C_iH_{i0} this is a nonpolar molecule, only capable fo forming weak LF with the polar solvent the polar solvent however will form LF and DD attractions with itself therefore, the polar solvent will be more attracted to Itself than to the nonpolar solute C_iH_{i0} will have really low solubility in the polar solvent to the weak attractions, C_iH_{i0} will have really low solubility in the polar solvent

C₄H₁₀ C₄H₉OH NaCl

NaCl

- this is an ionic compond, containing full charges

Strong electrostatic attractions will form bewteen the polar solvent and the ions in the ionic compound

Highest Solubility

due to these strong attractions between the full ions and the partial charges in the polar solvent, NaCl will have the highest solubility of the three molecules

Ionic solutes, polar solutes, and nonpolar solvents have different solubility's in **polar** and C₄H₁₀, NaCl, C₄H₉OH Lowest Solubility C₄H₁₀ C₄H₀OH NaCl C_4H_9OH Highest this is an polar molecule capable of forming LF and DD Solubility attractions with the polar solvent
- as a result C₄H₉OH has a stronger attraction than C₄H₁₀ to the polar solvent, but a weaker attraction than the NaCl the weaker attractions between $\mathrm{C_4H_9OH}$ and the polar solvent is due to them both containing partial charges compared to $% \left(1\right) =\left(1\right) \left(1\right) \left$ the full charges in the NaCl

lonic solutes, polar solutes, and nonpolar solvents have different solubility's in polar and C₄H₁₀, NaCl, C₄H₉OH Lowest - A nonpolar solvent can only form weak LF with a Solubility potential solute NaCl NaCl - has high electrostatic attractions between its anions C₄H_oOH and cations, C_4H_{10} only has weak attractions with the nonpolar solvent since NaCl is more attracted to itself than to the nonpolar solvent, it has a very low solubility in a Highest Solubility nonpolar solvent

Ionic solutes, polar solutes, and nonpolar solvents have different solubility's in polar and nonpolar solvents C₄H₁₀, NaCl, C₄H₉OH A nonpolar solvent can only form weak LF with a potential solute Solubility NaCl C₄H₉OH C₄H₁₀ C_4H_9OH this is a polar molecule capable of forming LF, DD, and HB attractions with other C₄H₉OH molecules Highest Solubility only has weak attractions with the nonpolar solvent - therefore, it is more attracted to itself than to the nonpolar solvent, it has a very low solubility in a since it consists of partial charges, its attractions to itself are less than NaCl, so it will have a high solubility in the nonpolar solvent than NaCl

Ionic solutes, polar solutes, and nonpolar solvents have different solubility's in polar and nonpolar solvents C_qH_{10} , NaCl, C_qH_qOH Lowest

A nonpolar solvent can only form weak LF with a potential solute

Solubility

NaCl

In the high electrostatic attractions the between its arions and cations,
only have seal attractions with enopolar solvent

only have seal attractions with enopolar solvent

is size NaCl is more attracted to itself than to the enopolar solvent, it has a very low solubility in a nonpolar solvent

Cq. HyOH

Cq. HyOH

Cq. HyOH

Cq. HyOH

In this is a polar molecule capable of forming LF, Db, and its attractions with other Cyt,OH molecules to the low seal attractions with enopolar solvent

in the form a structure of the intellight to the enopolar solvent, in has a very low solubility in a nonpolar solvent

solubility

Cq. HyO

This is a nonpolar solvent than NaCl, so it will have a high solubility in the repopular solvent than NaCl

Ct. HyO

This is a nonpolar molecule, so it can only form LF with itself

it will form LF with the nonpolar solvent

since there are equivalent attractions between Cq. HyO and the nonpolar solvent, it will have the highest solubility

Solutes that contain both polar and nonpolar parts are soluble in both **polar** and nonpolar solvents. $CH_3OH, C_3H_3OH, C_5H_{11}OH$

Lowest Solubility - a molecule with both a polar and nonpolar portion can be soluble in both a polar and nonpolar solvent

 $C_5H_{11}OH$ C_3H_7OH CH_3OH if the nonpolar region of the molecule is large enough, it can interfer with the dipole-dipole attractions that will form between the polar part of the solute and the polar solvent

Highest Solubility if the nonpolar region of the molecule is large enough, it can overcome the attractions between the polar solute particles, and increasing the degree of the LF between the solute and the solvent Solutes that contain both polar and nonpolar parts are soluble in both **polar** and nonpolar solvents.

 CH_3OH , C_3H_7OH , $C_5H_{11}OH$

Lowest Solubility

CH₃OH

this is a polar molecule without a nonpolar region, capable of forming LF, DD, and two-way HB with a polar solvent

 these strong IMF between CH₃OH and the polar solvent results in it having the highest solubility out of the three molecules

CH₃OH
Highest
Solubility

 $C_5H_{11}OH$

C₂H₇OH

C₅H₁₁OH

 although this molecule can form LF, DD, and HB with a polar solvent, it has the largest nonpolar region

 this results in C₅H₁₁OH having the greatest interference in the formation of DD, and potential HB, with the polar solvent as the long CH-chain will only form weak LF with the polar solvent

 Therefore, C₅H₁₁OH will have the weakest attractions with the polar solvent and thus the lowest solubility

Solutes that contain both polar and nonpolar parts are soluble in both **polar** and nonpolar solvents. $CH_3OH, C_3H_3OH, C_3H_{11}OH$

Lowest

Solubility

his is a polar molecule without a nonpolar region, capable of forming LF, DD, and two-way HB with a polar

solvent

these strong IMF between CH₃OH and the polar solvent results in it having the highest solubility out of the three molecules

C₅H₁₁OH C₃H₇OH CH₃OH

Cyt, OH

although this molecule can form LF, DD, and HB with a polar solvent, it has the largest nonpolar region
this results in Cyt, QOH having the greatest interference in the formation of DD, and potential HB, with the
polar solvent as the long CH-chain will only from weak LF with the polar solvent and
Therefore, Cyt, QOH will have the weakest attractions with the polar solvent and thus the lowest solubility

Highest Solubility

C₃H₇OH

 has a longer nonpolar region than CH₃OH, but a shorter nonpolar region than C₅H₁₁OH

- ${\rm C_3H_7OH}$ nonpolar region will prevent the formation of DD, and possibly HB, between itself and the polar solvent less than ${\rm C_5H_{11}OH}$ but more than ${\rm CH_3OH}$

 this results in C₃H₇OH having a solbility in a polar solvent greater than C₅H₁₁OH but less than CH₃OH Solutes that contain both polar and nonpolar parts are soluble in both polar and nonpolar solvents. $\mathsf{CH_3OH, C_3H_7OH, C_5H_{11}OH}$

Solubility

- the larger the nonpolar region in a molecule with both a polar end and a nonpolar end, the greater the LF that can occur between the nonpolar end of the molecule and a

CH₃OH C₃H₇OH

C₅H₁₁OH

CH₃OH

Highest Solubility St. St.

this is a polar molecule, forming LF, DD, and HB with itself CH₃OH will only form weak LF with the nonpolar solvent

 since CH₃OH is more attracted to itself than to the nonpolar solvent, it will have the lowest solubility in the nonpolar solvent out of the three molecules

Solutes that contain both polar and nonpolar parts are soluble in both polar and **nonpolar** CH₃OH, C₃H₇OH, C₅H₁₁OH Lowest Solubility C₅H₁₁OH CH₃OH this molecule, the largest with a long nonpolar has the C₂H₇OH strongest LF attraction with the nonpolar solvent out of the $C_5H_{11}OH$ three molecules due to the long nonpolar region interfering with the DD and Highest HB attractions between $\mathrm{C_5H_{11}OH}$ molecules, it will have the Solubility lowest polar attractions out of the three molecules these two factors results in C₅H₁₁OH having the strongest attraction to the nonpolar solvent out of the three molecules and therefore the highest solubility

Solutes that contain both polar and nonpolar parts are soluble in both polar and **nonpolar** CH₃OH, C₃H₇OH, C₅H₁₁OH Lowest Solubility $4_{\rm h}{\rm OH}$ this molecule, the largest with a long nonpolar has the strongest LF attraction with the nonpolar solvent out of the three molecules of the three molecules of the control of the three molecules. We have the lowest polar attractions out of the three molecules will have the lowest polar attractions out of the three molecules where the polar polar control of the three molecules and therefore the highest solubility ${\rm CH_3OH}$ C₂H₇OH $C_5H_{11}OH$ C₃H₇OH Highest Solubility has a longer nonpolar region than CH₃OH, but a shorter nonpolar region than $C_5H_{11}OH$ C_3H_7OH nonpolar region will prevent the formation of DD, and possibly HB, between itself less than C₅H₁₁OH and the LF attractions between the nonpolar solvent and the nonpolar region of ${\rm C_3H_7OH}$ will be less than between ${\rm C_5H_{11}OH}$ and the nonpolar solvent this results in C₃H₇OH having a solubility in a nonpolar solvent greater than CH_3OH but less than $C_5H_{11}OH$