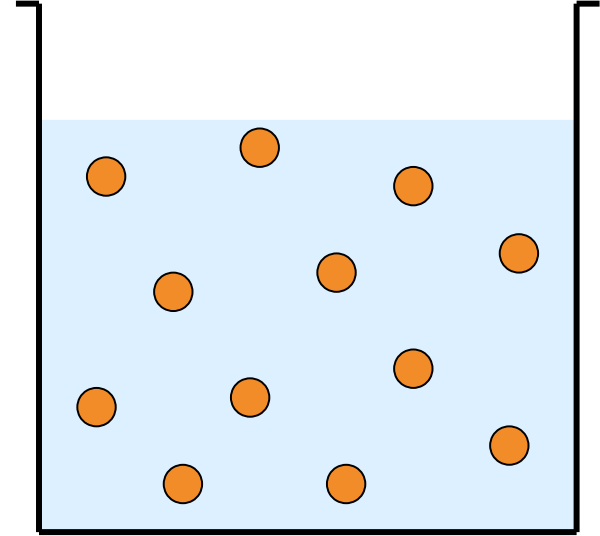


Essential Question

Why do some substances dissolve and others don't?

Solute and Solvent

- Solute: what dissolves
- Solvent: what it dissolves in (usually more of it)
- Water as solvent → aqueous (aq)



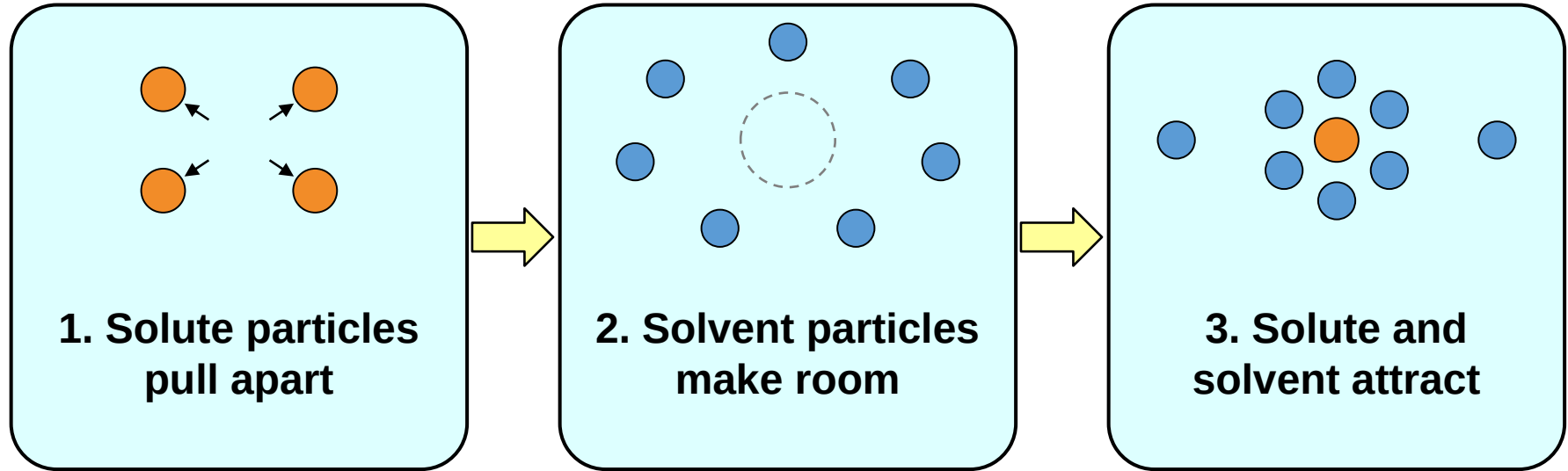
sugar dissolved in water

Like Dissolves Like

- Similar intermolecular forces → likely to dissolve or mix

	Water (polar)	Hexane (nonpolar)
Ionic or polar solute	Dissolves	Does not dissolve
Nonpolar solute	Does not dissolve	Dissolves

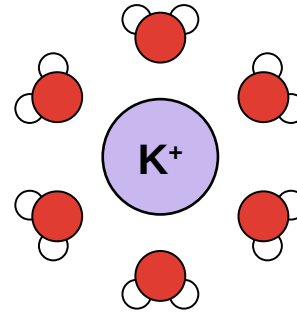
Dissolving: Break and Form Attractions



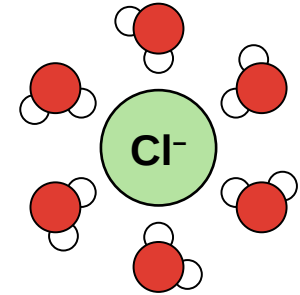
Dissolves well when the new attractions are as strong as the ones broken

Ionic Compounds in Water

- Water: O is δ^- , H is δ^+
- O end faces cations
- H end faces anions
- Ion-dipole attractions



cation

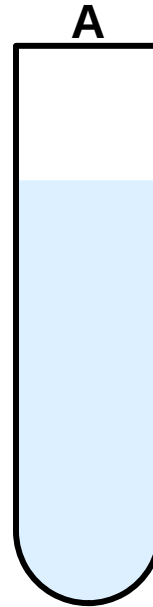


anion

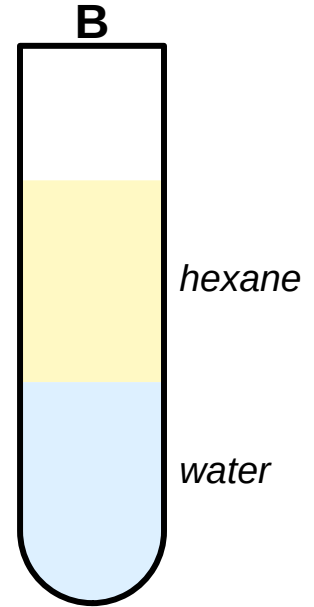


Miscible or Immiscible?

- Miscible: liquids mix in any amount (one layer)
- Immiscible: liquids form separate layers



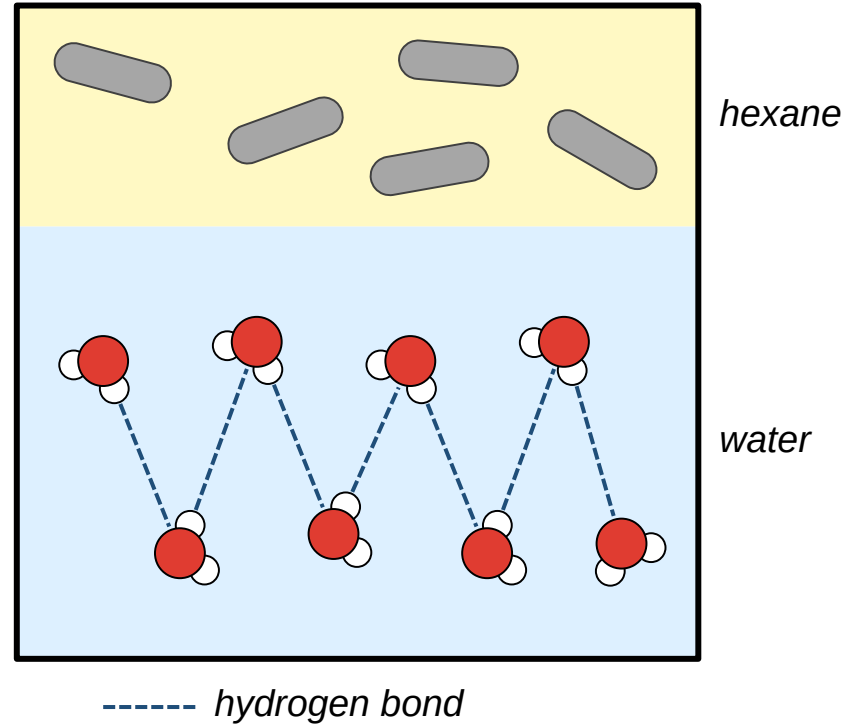
water + ethanol



water + hexane

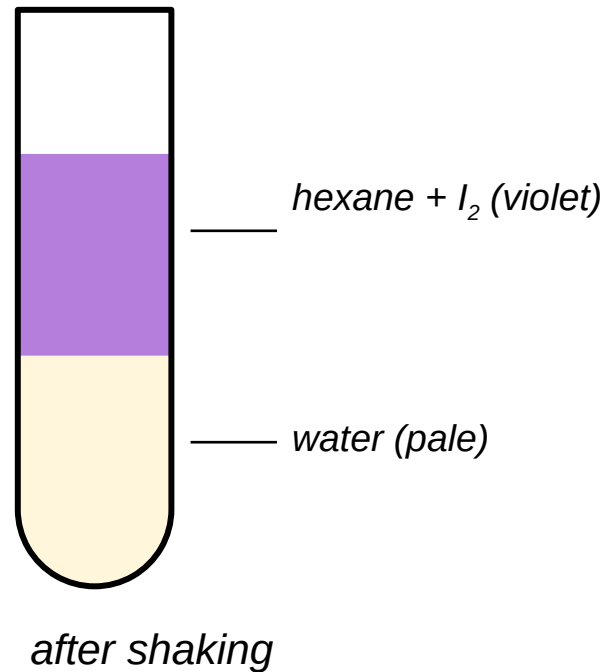
Why Oil and Water Separate

- Water molecules H-bond to each other
- Hexane has only weak LDFs
- Water stays together, hexane is pushed out



Nonpolar Solvents

- I_2 is nonpolar (LDFs only)
- Dissolves well in hexane
- Barely dissolves in water



Alcohols: Polar and Nonpolar Parts

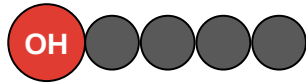
- OH group: H-bonds with water
- Carbon chain: nonpolar (LDFs only)
- Longer chain → less soluble in water

methanol



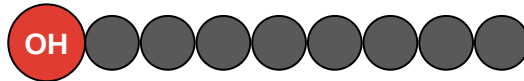
mixes completely

1-butanol



partly soluble

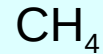
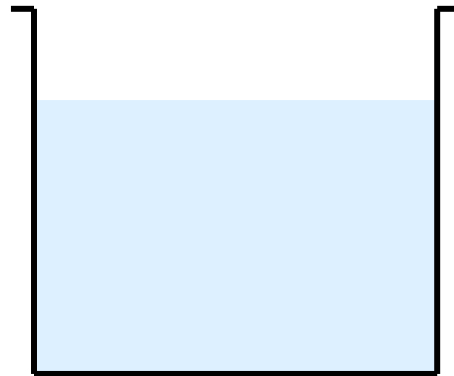
1-octanol



barely soluble

Example: Comparing Solubility in Water

Which is more soluble in water, NH_3 or CH_4 ? Justify your answer using intermolecular forces.



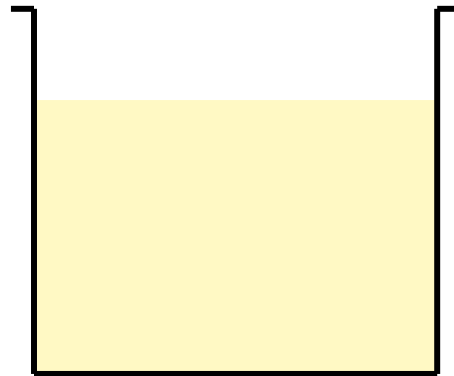
water

Example: Choosing a Solvent

Which is more soluble in hexane, CCl_4 or KBr ? Justify your answer.

CCl_4

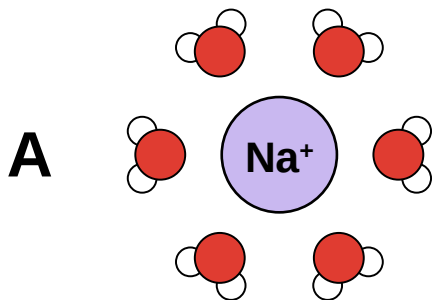
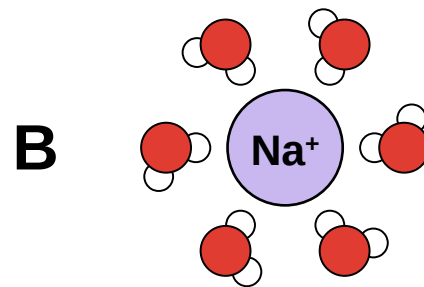
KBr



hexane

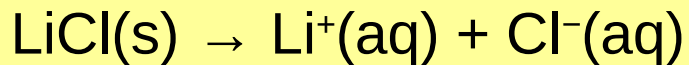
Example: Ion-Dipole Diagrams

Which diagram correctly shows water molecules around a Na^+ ion? Explain.



Example: Attractions Broken and Formed

When LiCl(s) dissolves in water, which attractions are broken and which are formed?



Broken

Formed

Big Ideas

- Like dissolves like: similar IMFs mix
- Dissolving: break, then form attractions
- Ions in water: ion-dipole attractions
- Longer nonpolar chain → less soluble

