Solubility & Intermolecular Forces

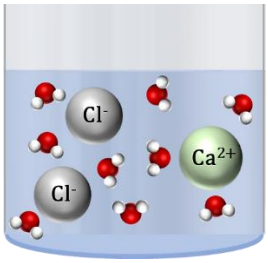
Example One

What type of solute to solvent interaction is present in each of the following dissolving scenarios?

a. HCl in H_2O
b. LiF in H_2O
c. CH_2Cl_2 in Benzene C_6H_6
d. Methanol (CH_3OH) in H_2O
e. HCl in CCl_4

Example Two

Calcium chloride, $CaCl_2$ will readily and exothermically dissolve in water as shown in the diagram below. Upon solution formation, which particle attraction will be the strongest.

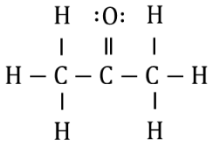


a. The hydrogen bonding interactions between water molecules.
b. The ionic bonding interactions between Ca^{2+} and Cl^-.
c. The ion-dipole-interactions between the dissolved Ca^{2+} ions and the oxygen atom on the water.
d. The ion-dipole-interactions between the dissolved Cl^- ions and the oxygen atom on the water

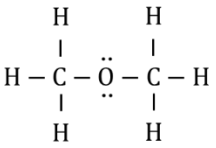
Example Three

Which of the following pairs of liquids is expected to be immiscible?
(a) C_5H_{12} and C_8H_{18}
(b) CH_3NH_2 and CH_3CH_2OH
(c) H_2O and CH_3OH
(d) CH_3OH and C_8H_{18}

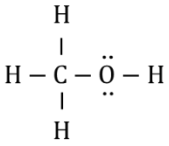
Example Four
Which of the following substances would be most attracted to a polar solvent?



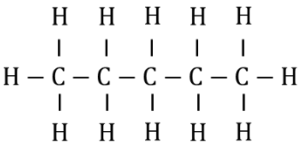
Acetone



Dimethyl Ether



Methanol



Pentane

a. Acetone
b. Dimethyl ether
c. Methanol
d. Pentane

Example Five
Which of the substances below will most likely dissolve in benzene C_6H_6? Justify your answer.

a. CH_3OH
b. C_5H_{12}
c. NaCl

Example Six

What types of substances generally dissolve in nonpolar solvents? Select all that apply.

a. Network covalent materials
b. Ionic Compounds
c. Metals
d. Nonpolar molecular compounds
e. Polar molecular compounds

Example Seven

NH_2Cl dissolves readily in water whereas NCl_3 does not. Describe the particle interactions of both molecules with water and explain the observed solubility