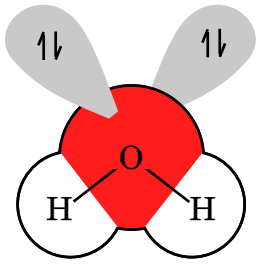
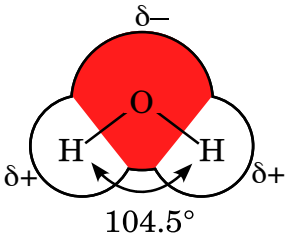
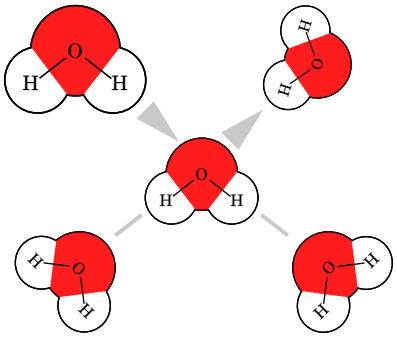
Structure and Properties of Water

Compound	Molecular weight (Da)	Melting point (°C)	Boiling point (°C)
Methane	16.04	-182.6	-161.4
Ammonia	17.03	-77.7	-33.35
Water	**18.02**	**0**	**100**
Methanol	32.04	-93.9	64.7







Ionic interactions

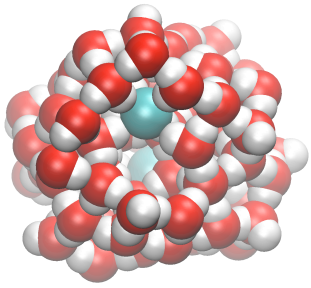
$$F = \frac{kq_1q_2}{\varepsilon r^2}$$

k = 8.99 x 10^9 J•m/C^2
q_1 & q_2 = charge
r = distance
ε = dielectric constant

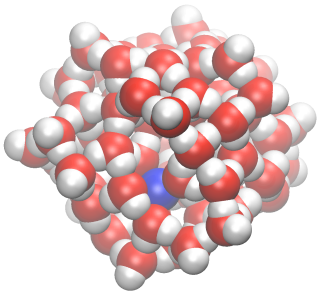
Solute	ΔH_{solute}	ΔS_{solute}	ΔH_{water}	ΔS_{water}
Ion				

Hydration Spheres

Chloride

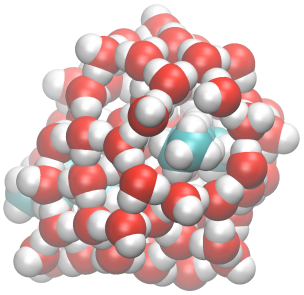


Sodium



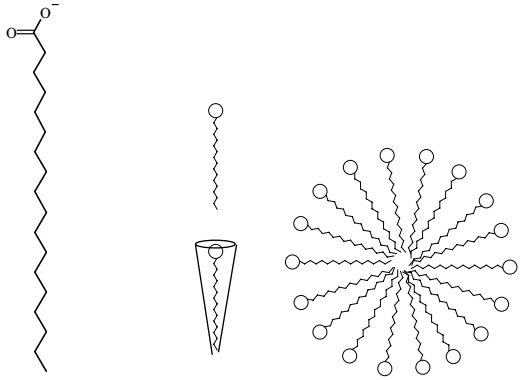
Solute	ΔH_{solute}	ΔS_{solute}	ΔH_{water}	ΔS_{water}
Polar				
Solute	ΔH_{solute}	ΔS_{solute}	ΔH_{water}	ΔS_{water}
Non-polar				

Clathrate –

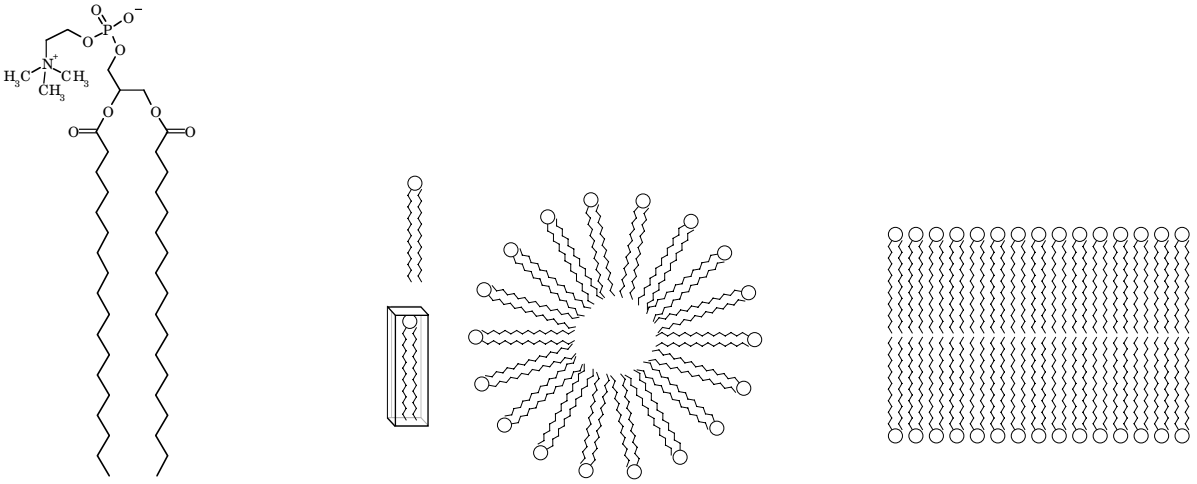


Hydrophobic effect – $V = \frac{4}{3}\pi r^3$ $A = 4\pi r^2$

Amphipathic molecules –



Critical Micellar Concentration (CMC) –



Dissociation of water

$$H_2O \rightleftharpoons \overset{\oplus}{H} + \overset{\ominus}{OH}$$

$$K = \frac{[H^+][OH^-]}{[H_2O]}$$

Strong Acids –

Weak acids –

$$K = \frac{[H_3O^+][A^-]}{[HA][H_2O]} \qquad K[H_2O] = K_a = \frac{[H_3O^+][A^-]}{[HA]}$$

$$[H_3O^+] = K_a \frac{[HA]}{[A^-]} \qquad pH = pK_a - \log \frac{[HA]}{[A^-]} \qquad pH = pK_a + \log \frac{[A^-]}{[HA]}$$