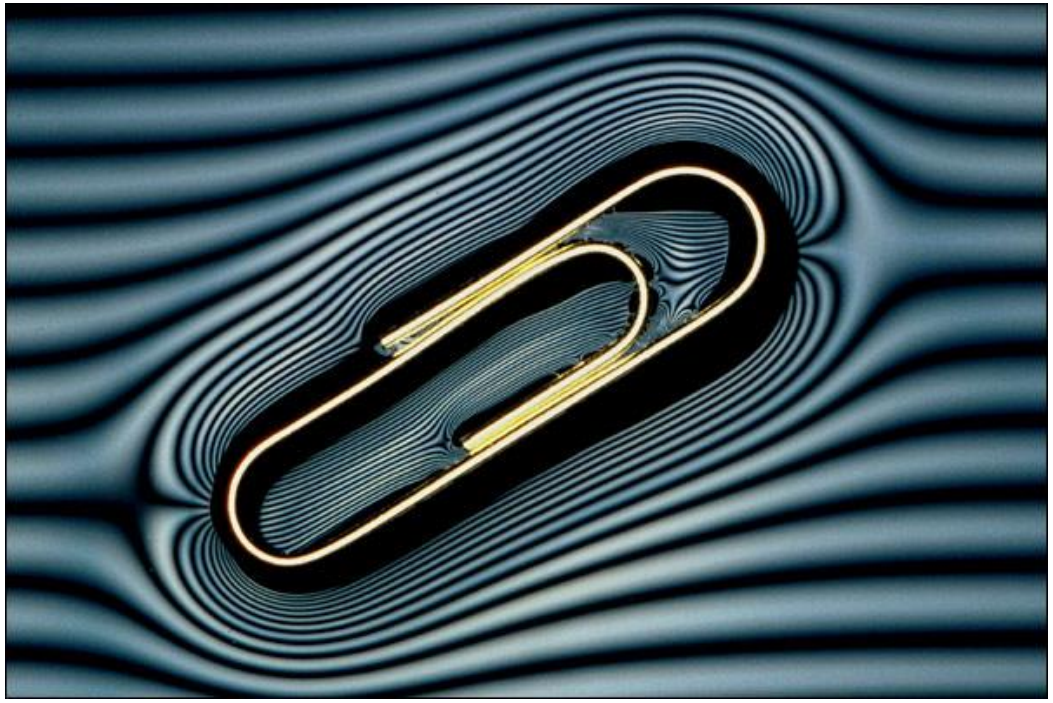
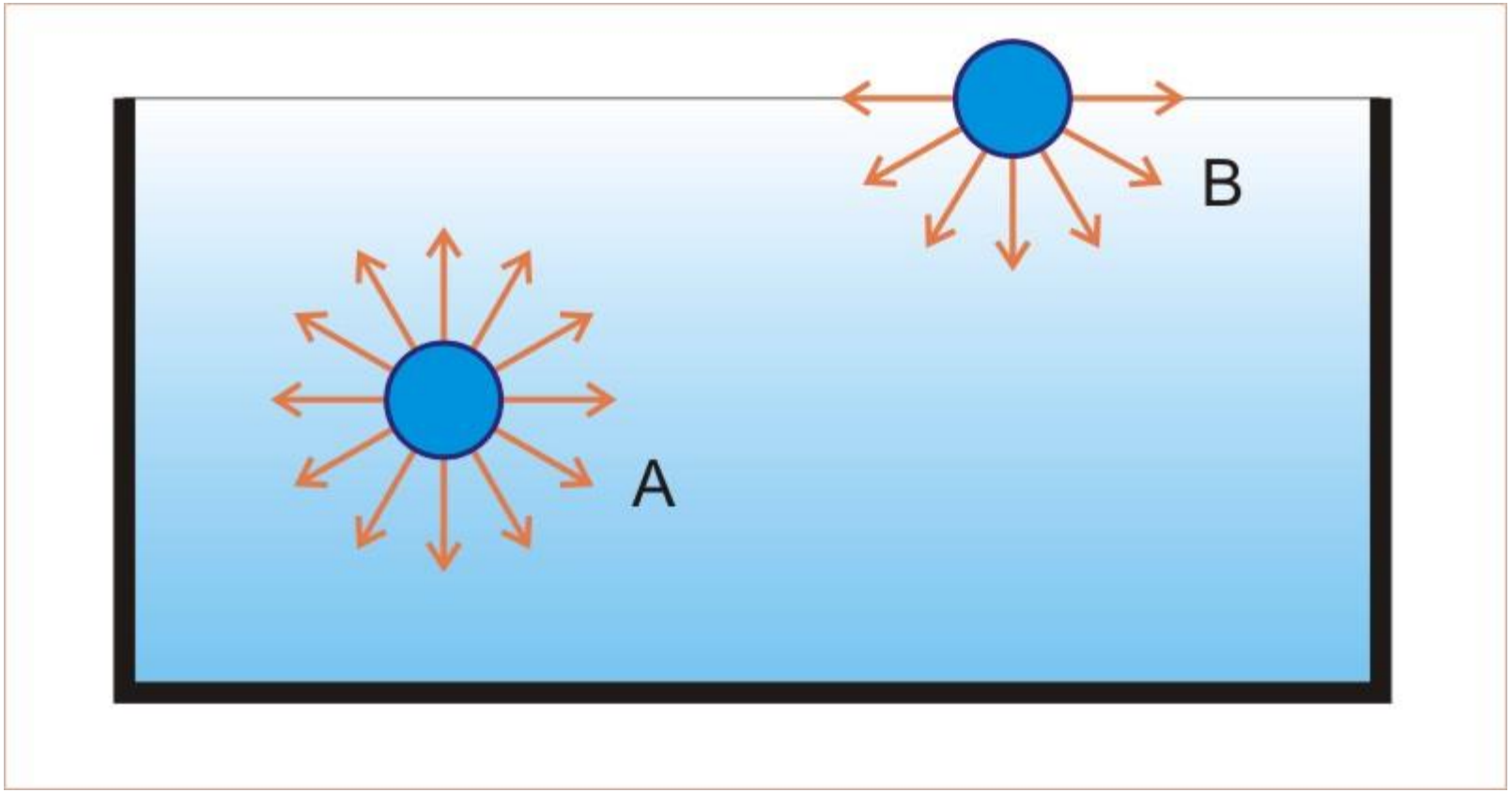
FORÇAS INTERMOLECULARES

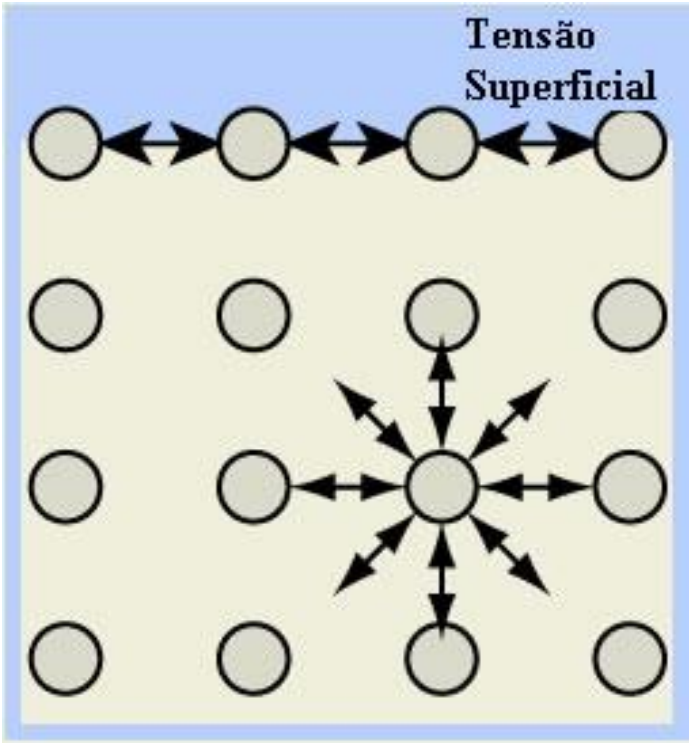
Parte 2

Estado Líquido

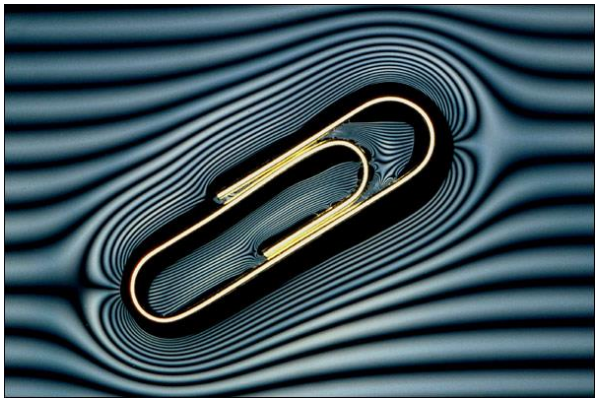


TENSÃO SUPERFICIAL

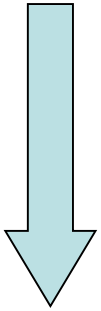




Menor área superficial



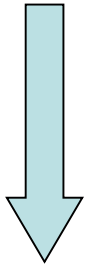
Líquidos



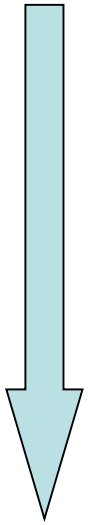
gotas

Esfera  **Menor relação área superficial/volume**

Forças coesivas e adesivas



Molhabilidade



Capilaridade

Forças coesivas → **Forças entre o líquido**

Forças adesivas → **Forças entre o líquido e a superfície**

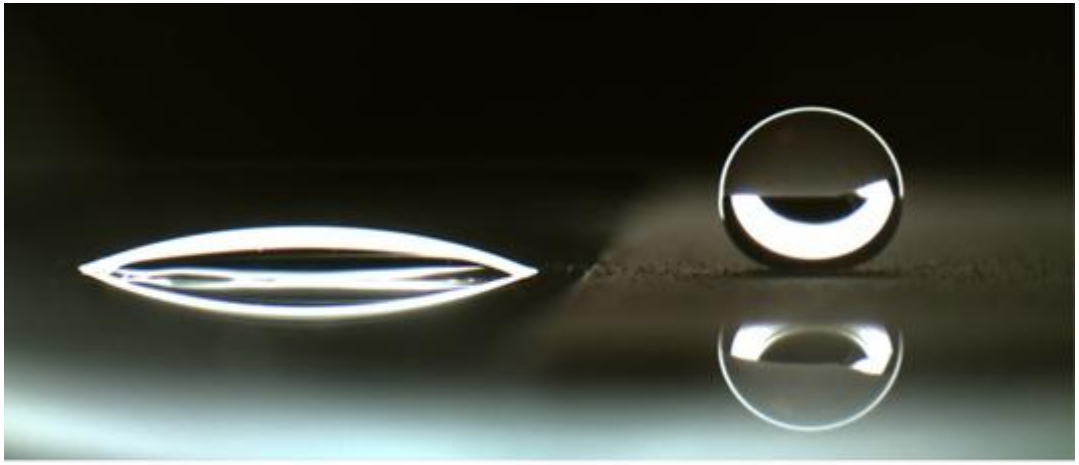
Forças coesivas > Forças adesivas

Mantém a forma esférica da gota

Forças adesivas > Forças coesivas

Espalhamento do líquido

Molhabilidade



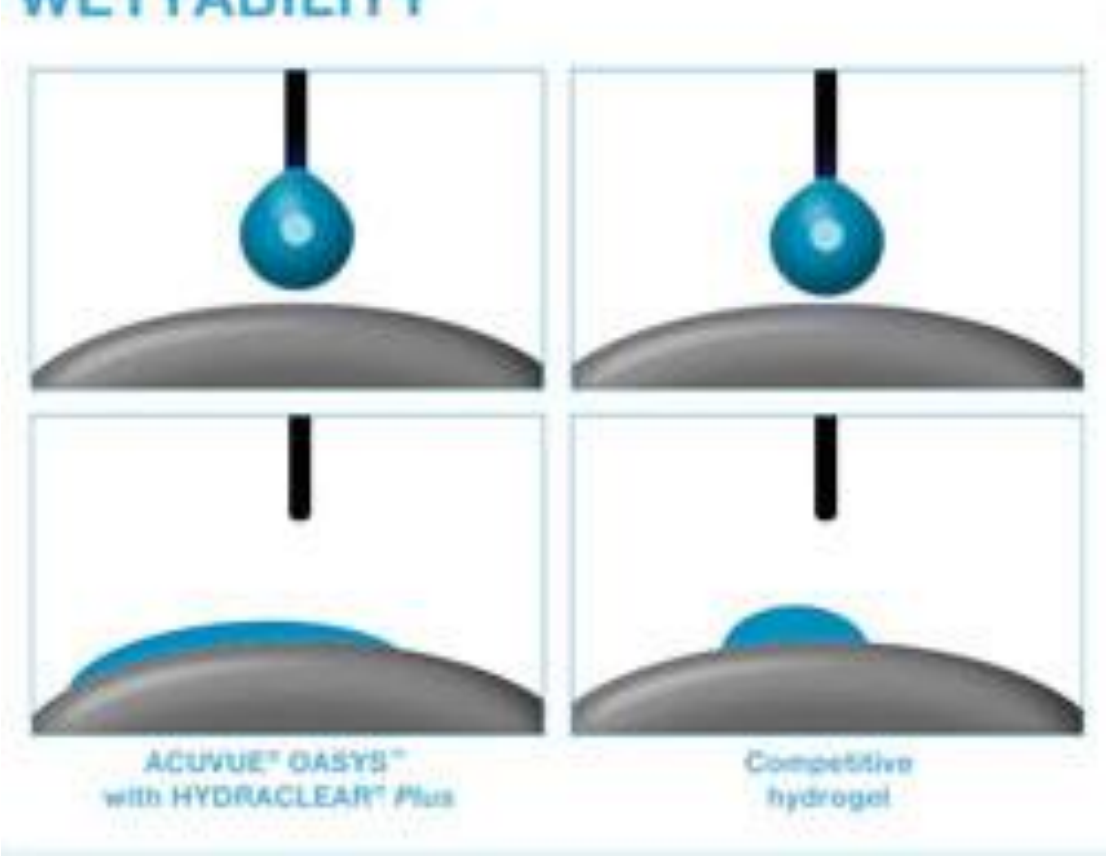
Oxygen Plasma-Treated
SU-8 Region

Superhydrophobic
Micropatterned Area

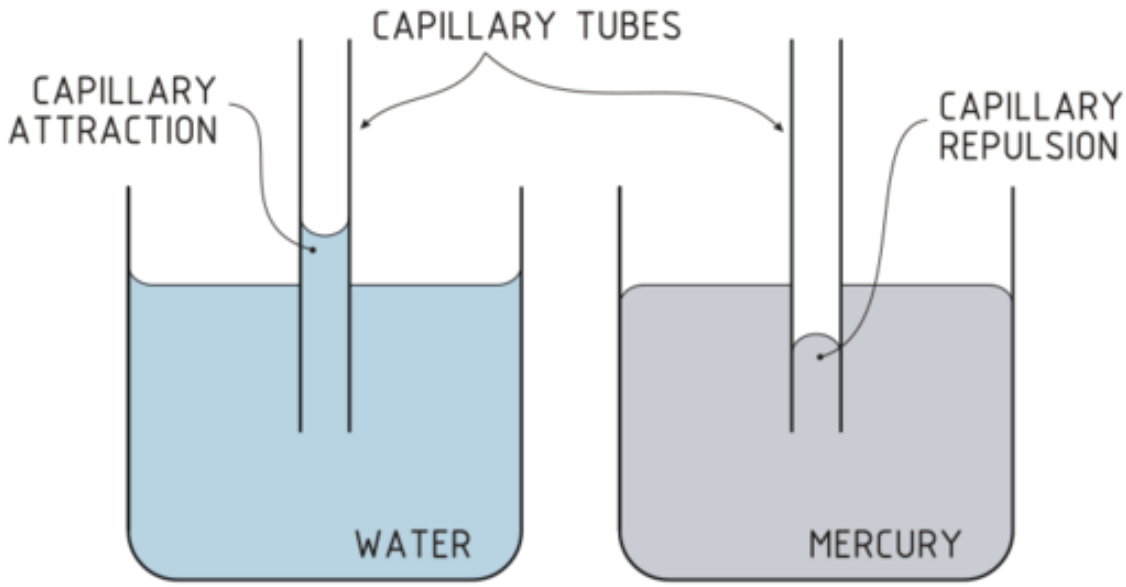
Superfície Polar

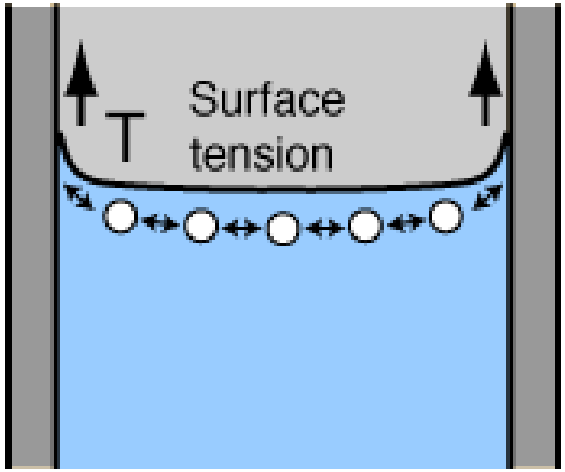
Superfície Apolar

WETTABILITY

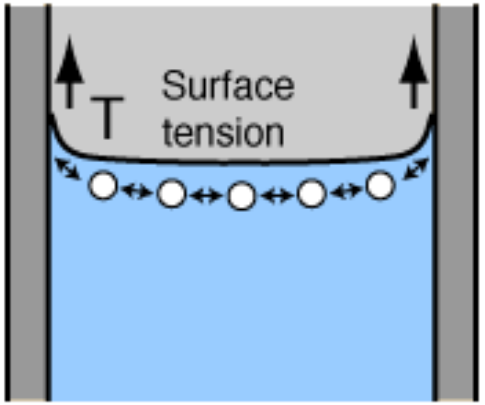


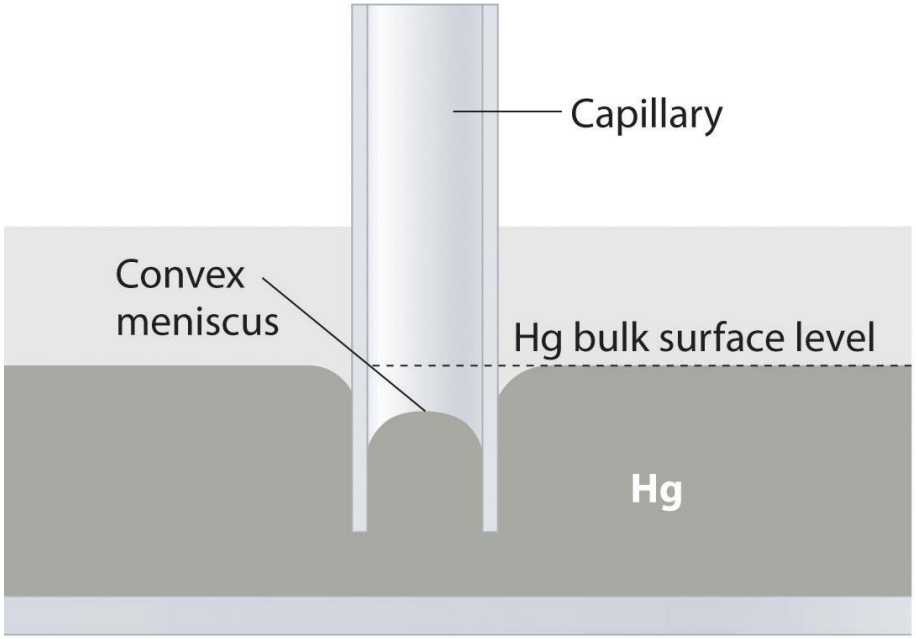
Capilaridade



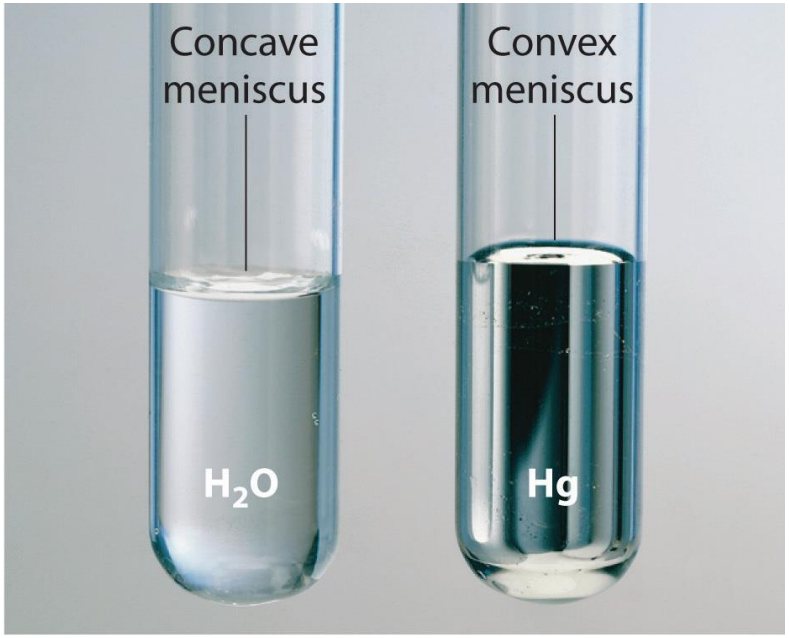

T
Surface
tension

Formato menisco



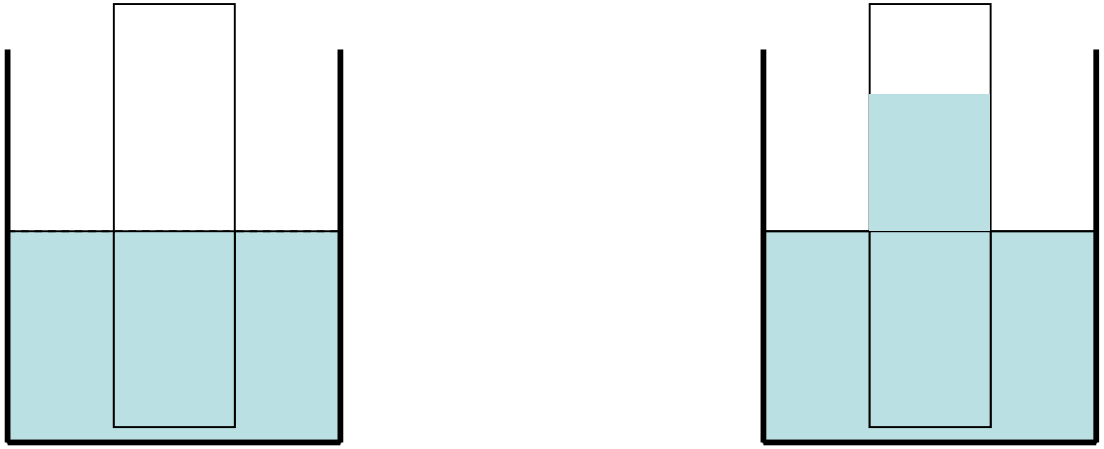


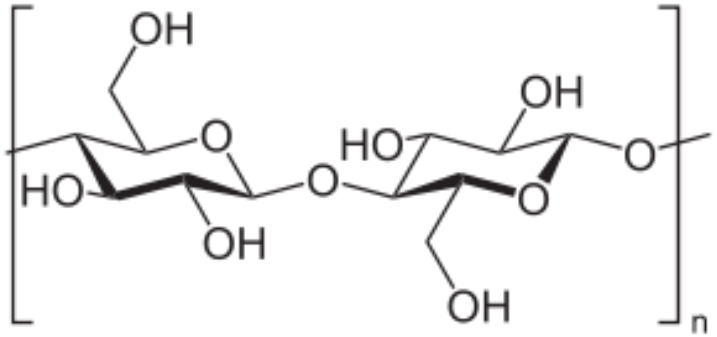
(a)



(b)

Capilaridade em papel



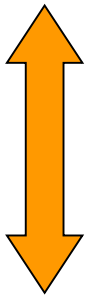


Celulose

Ligação H:

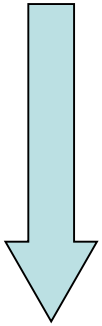
-OH::::::H_2O

Moléculas Surfactantes



Tensão Superficial

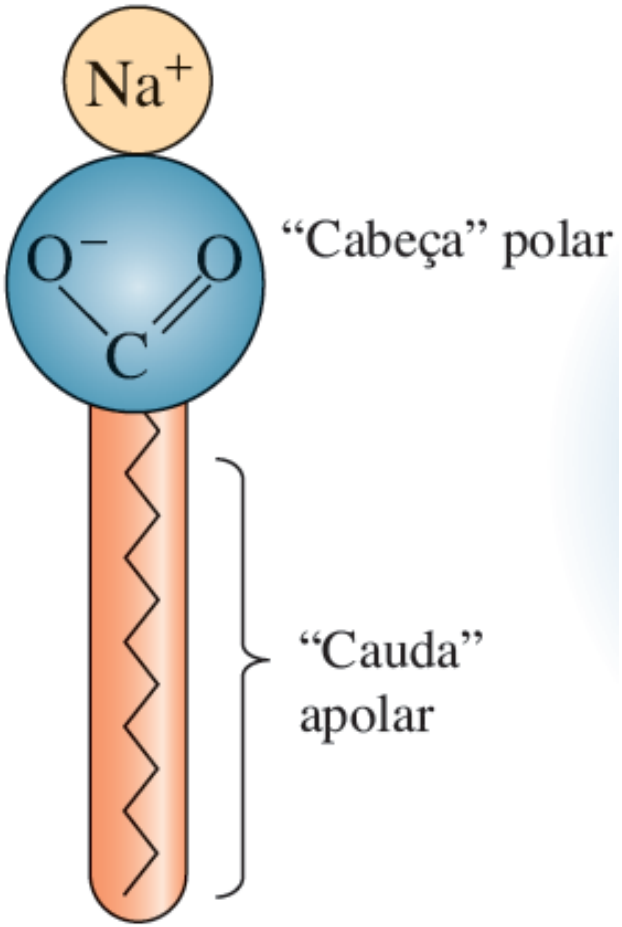
Surfactantes



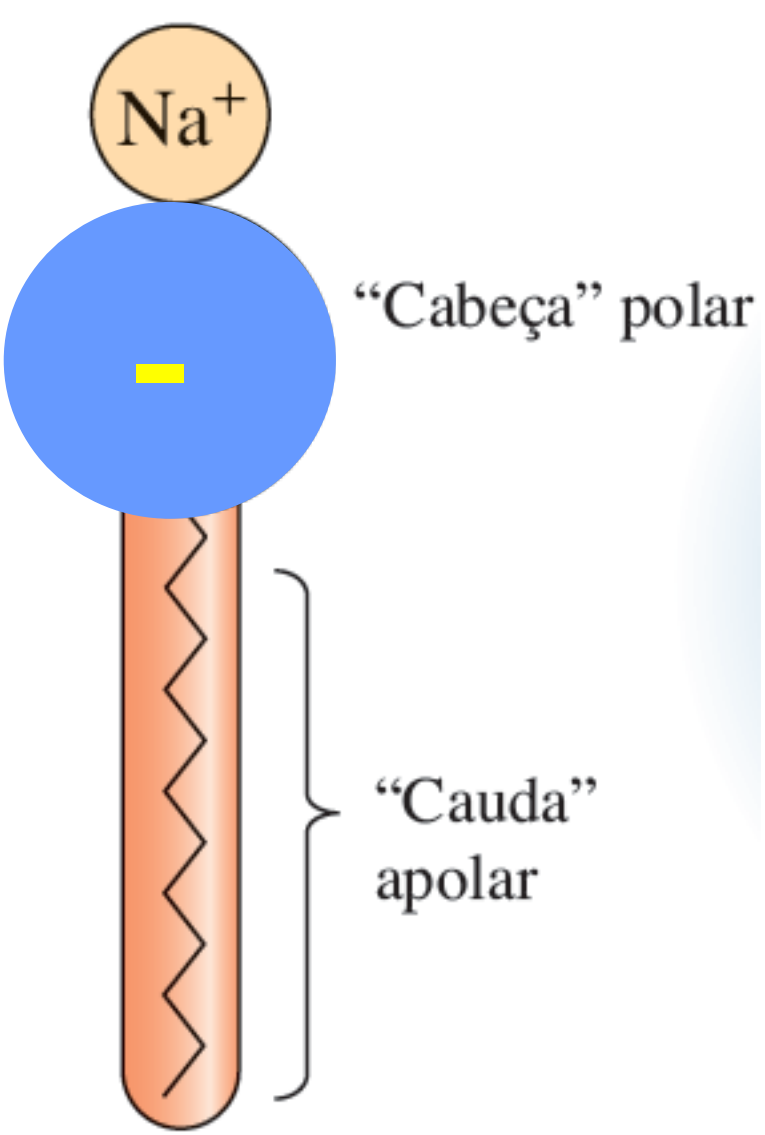
Sistemas Micro-heterogêneos

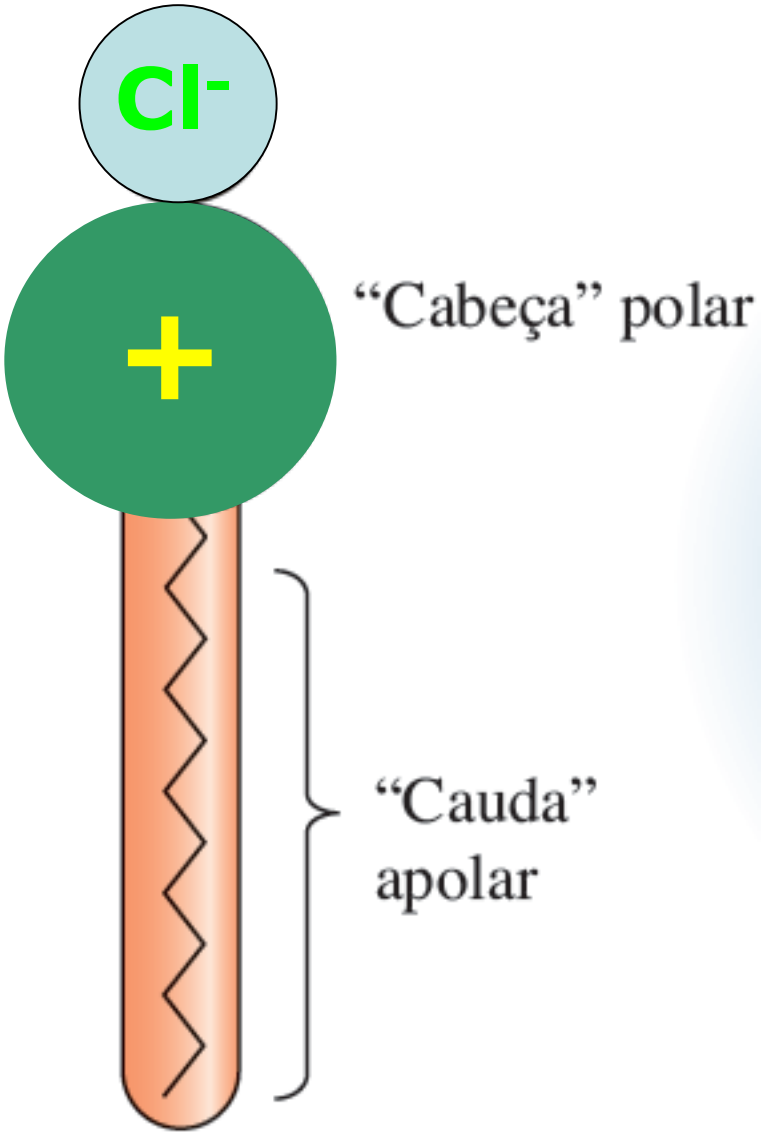
Molécula surfactante

Molécula Anfifílica

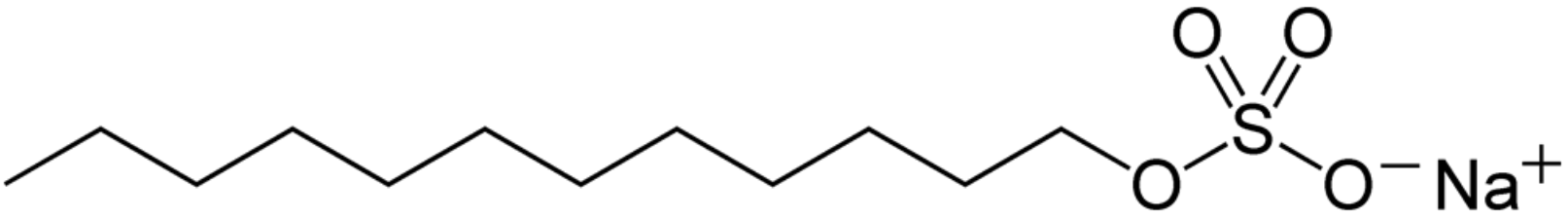


Sabão

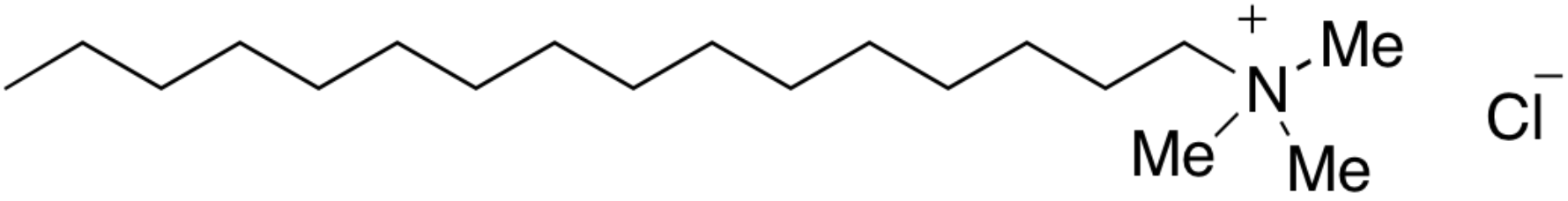

Na^+
-
"Cabeça" polar
"Cauda" apolar


Cl^-
+
"Cabeça" polar
"Cauda" apolar

Detergentes

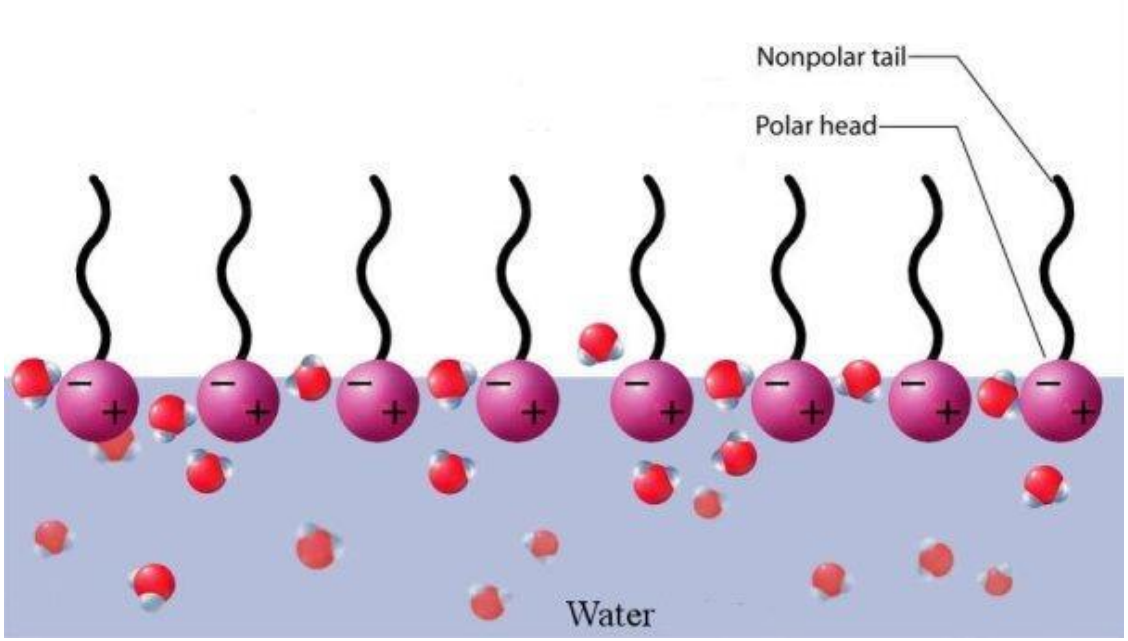


SDS: Sódio dodecil sulfato



CTAB: Cloreto de Cetil Trimetil-Amônio

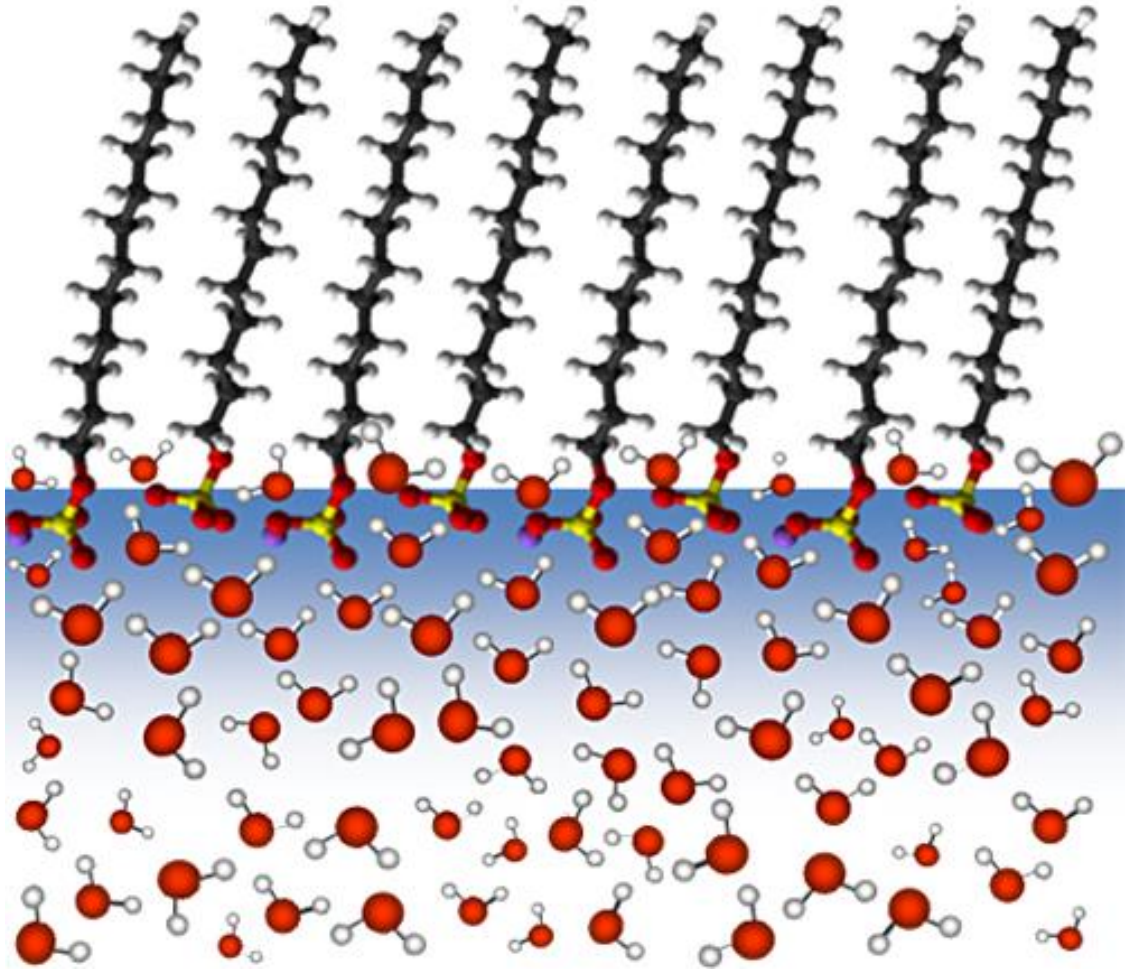
Orientação das Moléculas Anfílicas Interface Ar-Água



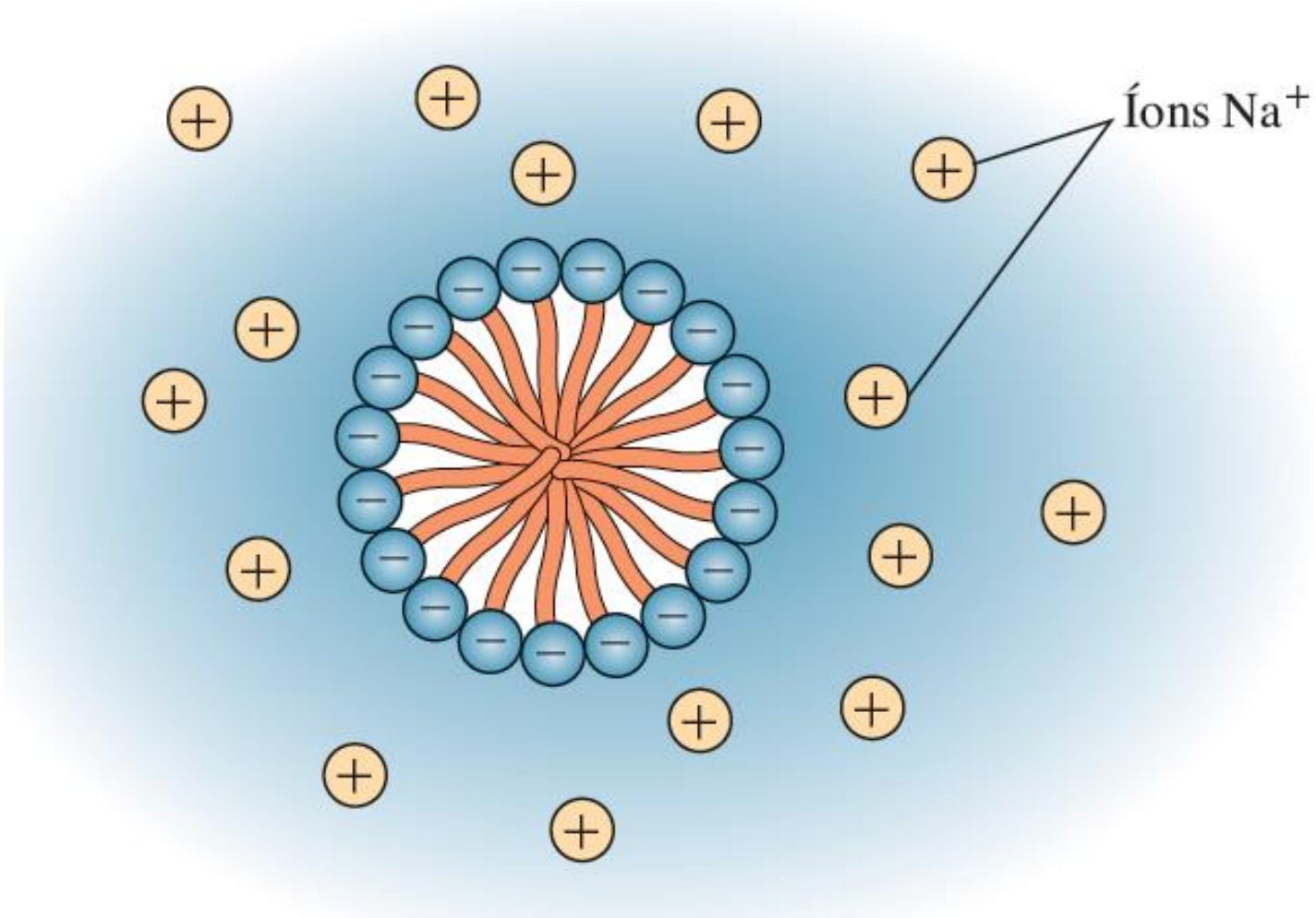
??????

Filmes sobre superfícies sólidas

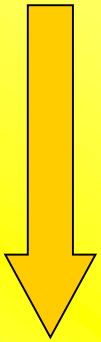
Langmuir-Blodgett



Aumento da concentração do surfactante - CMC



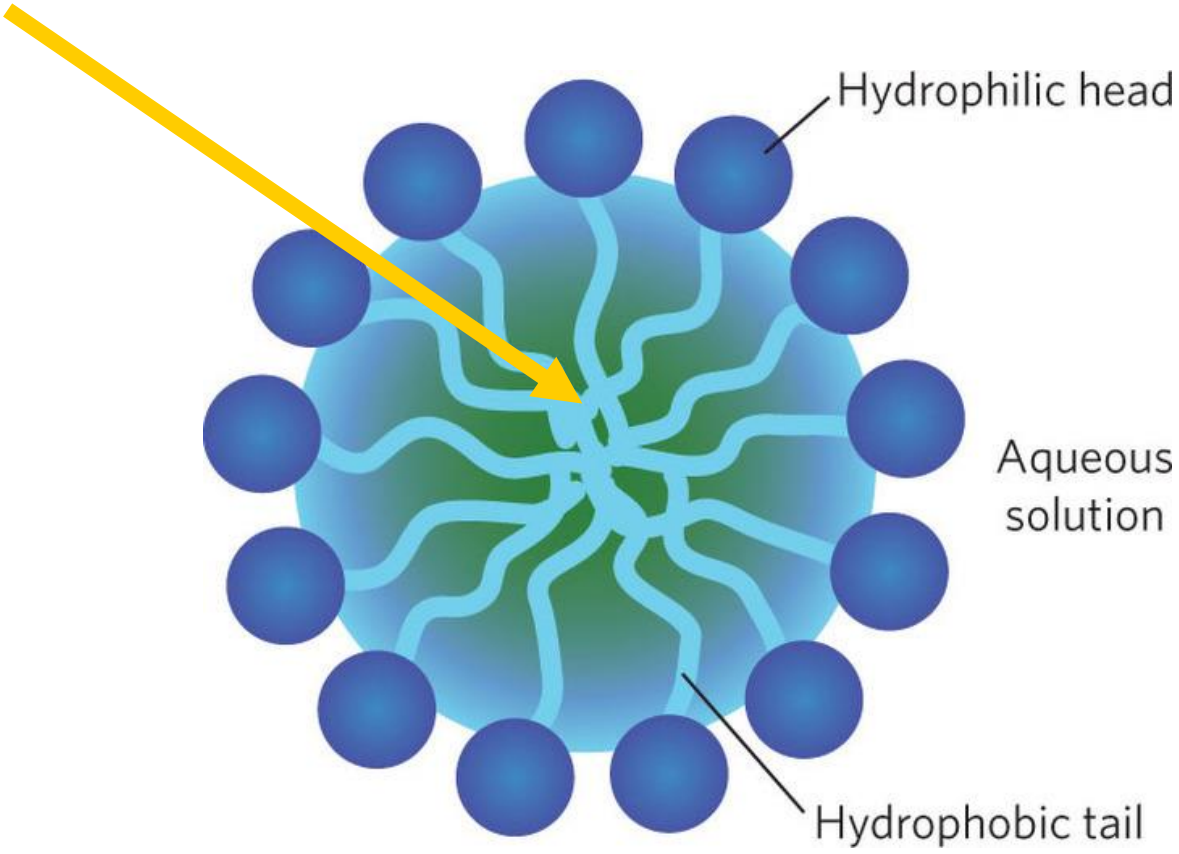
CMC



Concentração Micelar Crítica

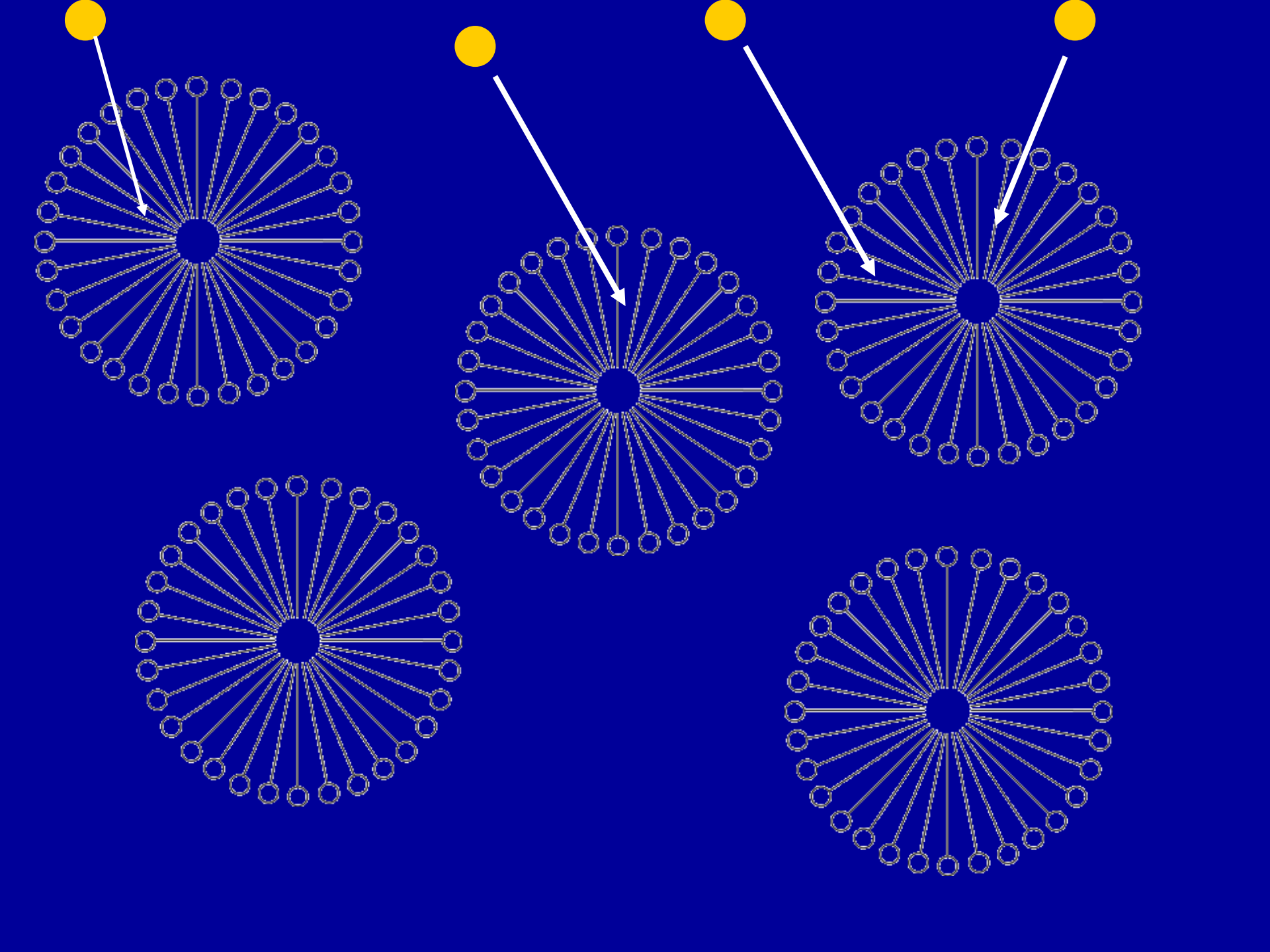
Micelas

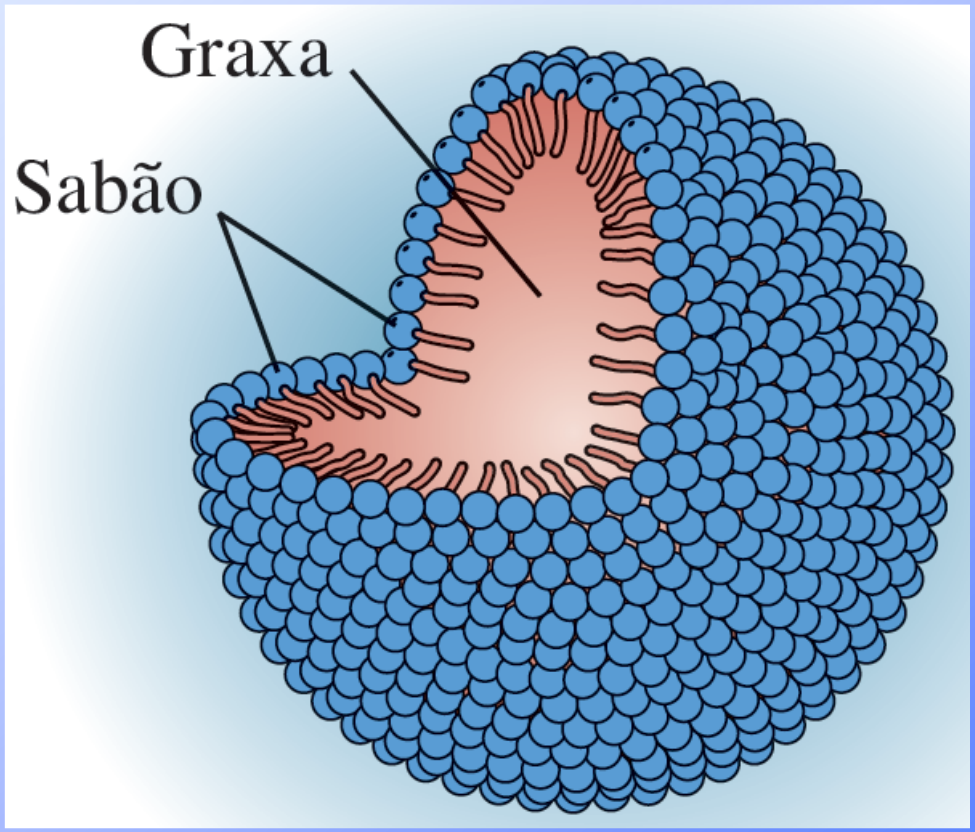
Apolar



Sistema Micro-Heterogêneo

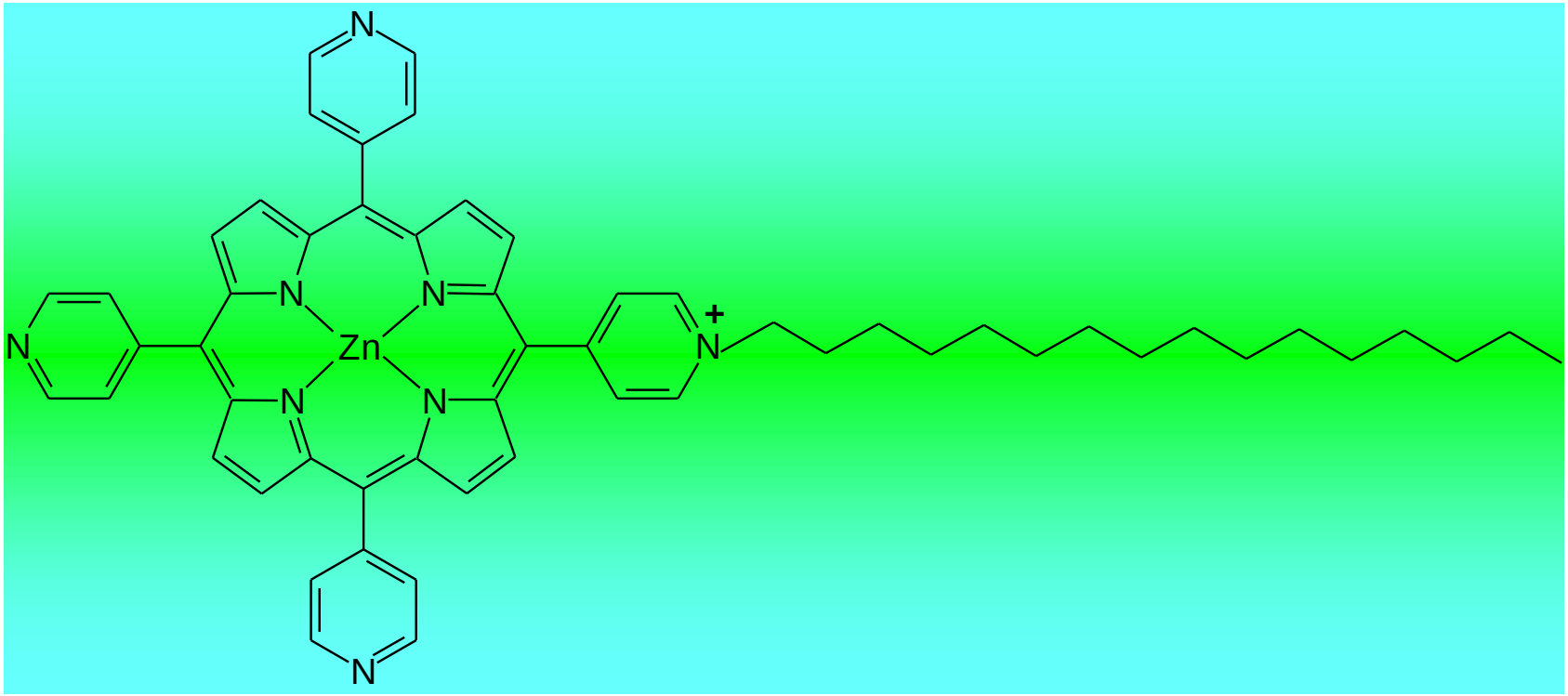
Micelas e Solubilidade

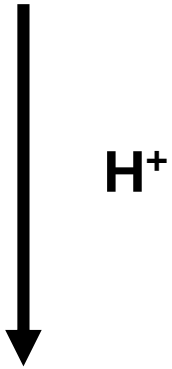


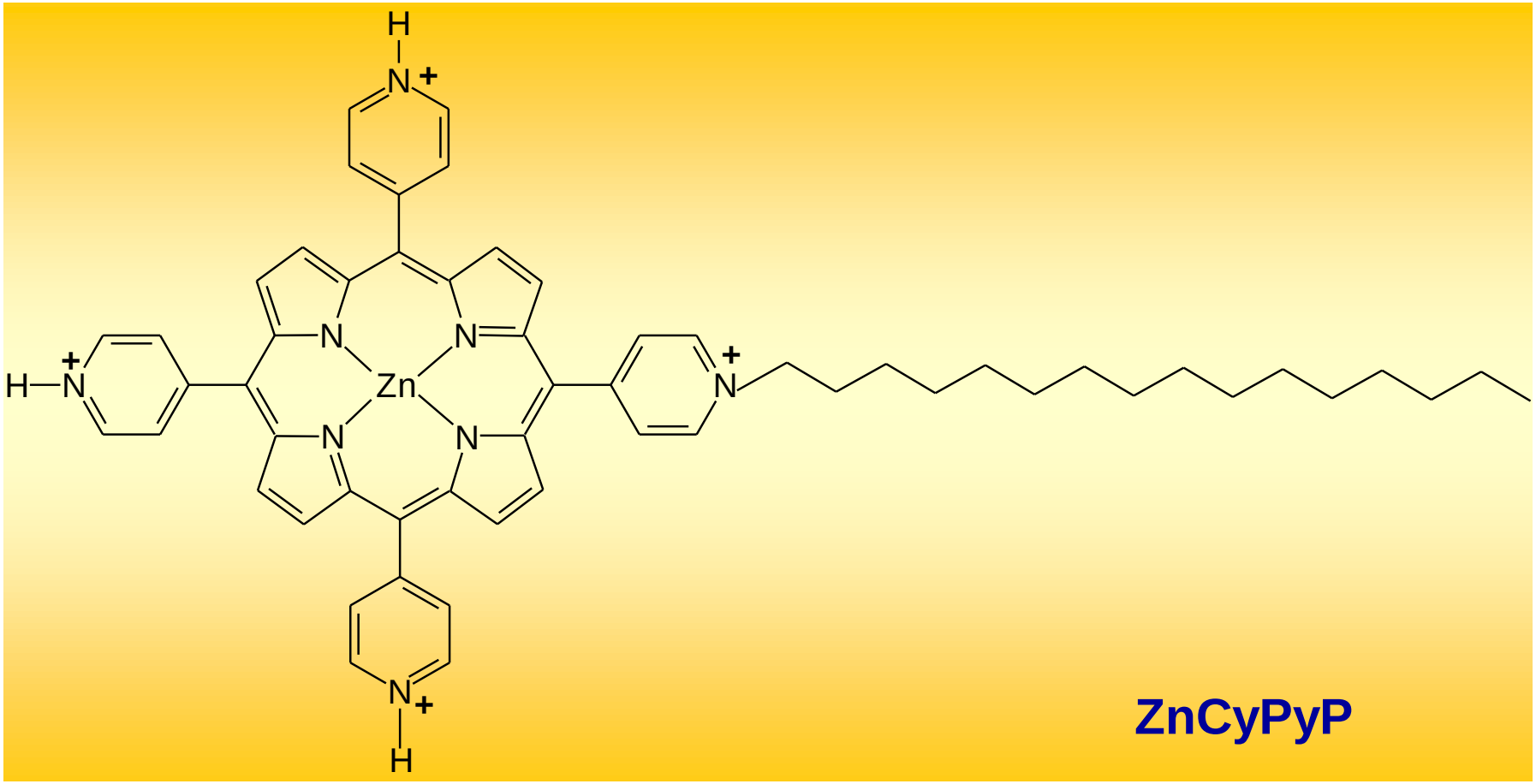

Graxa
Sabão

COMO SE PODE DETERMINAR A CMC DE UMA

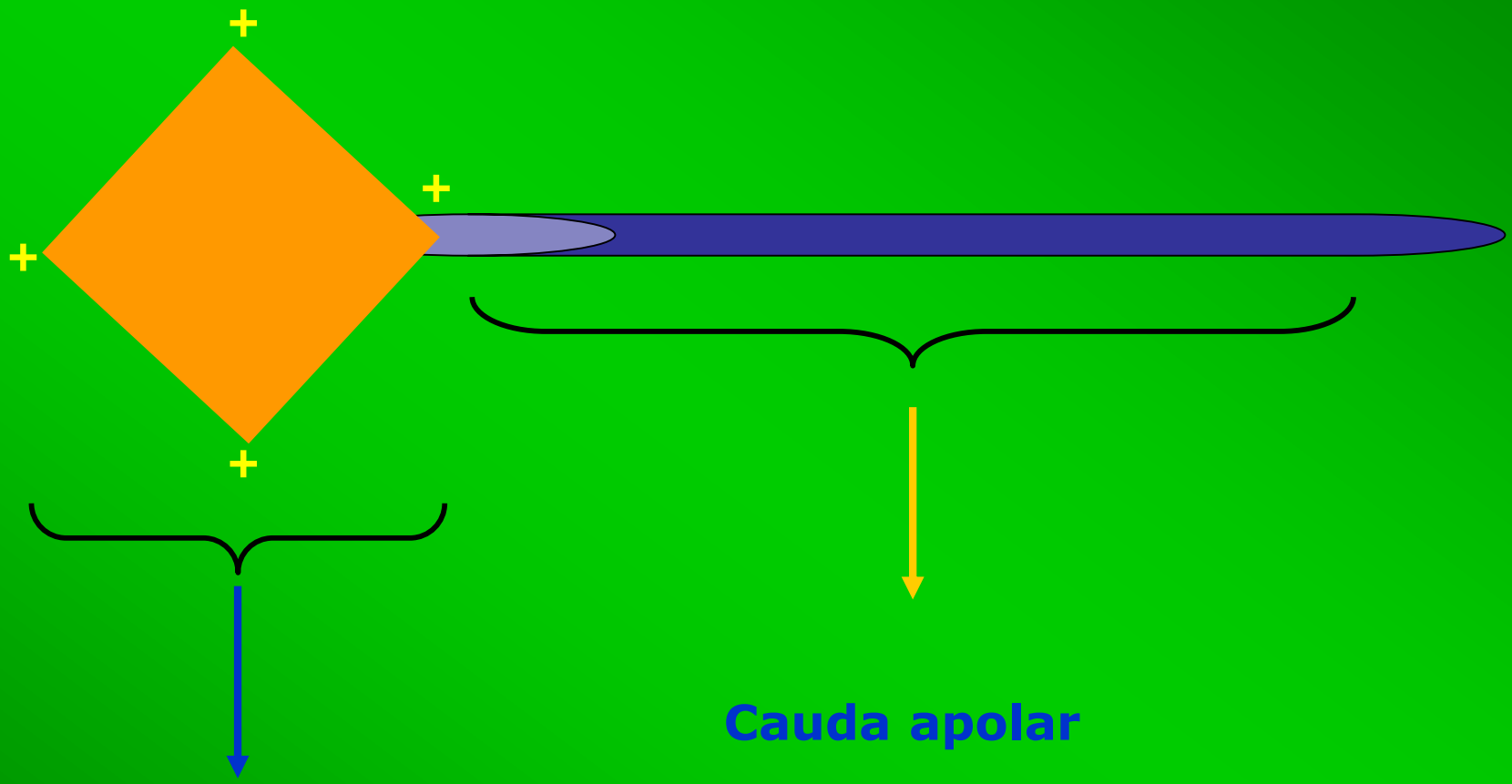
MOLÉCULA SURFACTANTE????

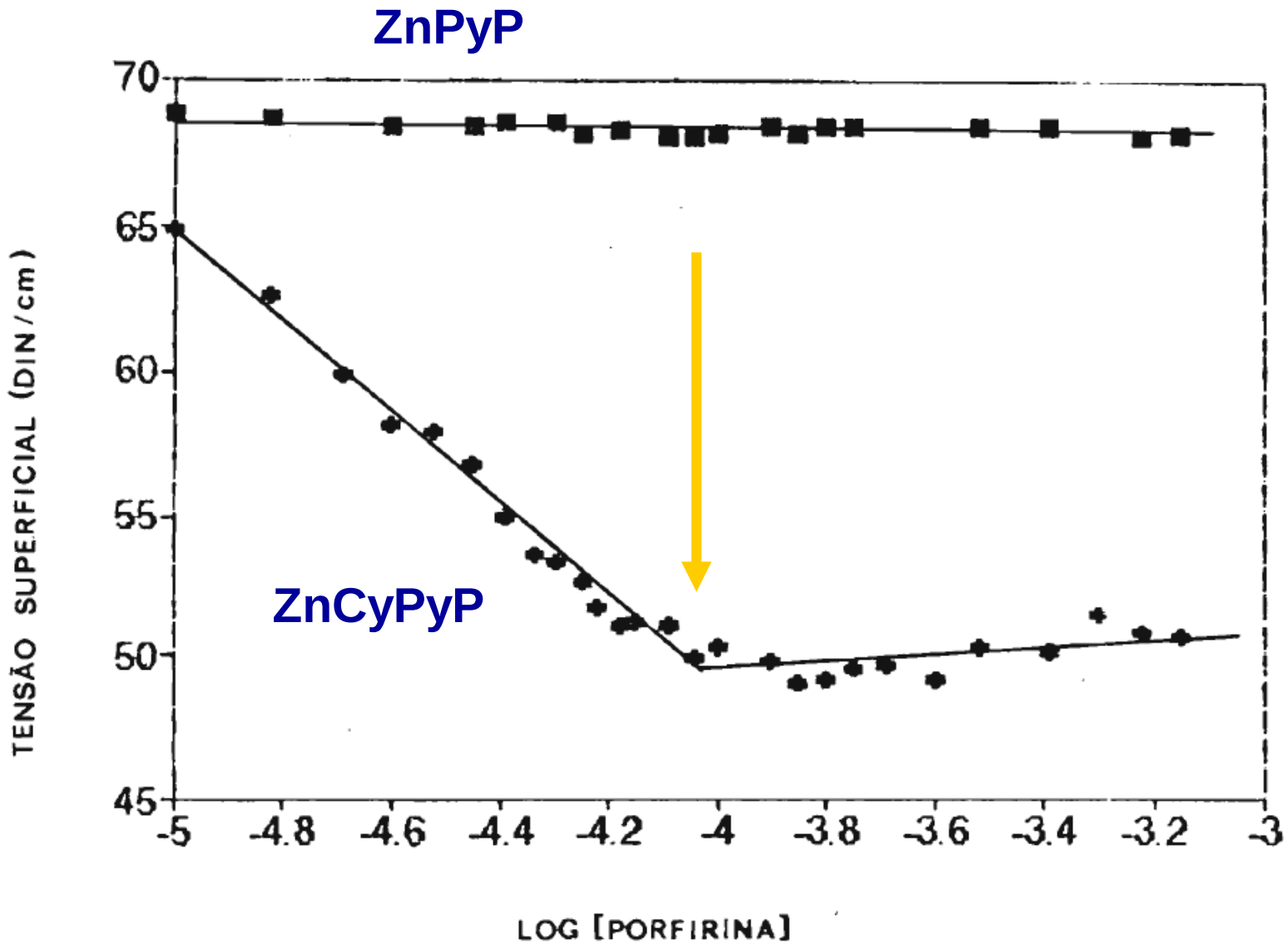

N
N
N
Zn
N
N
N
N
+
N
N


H+

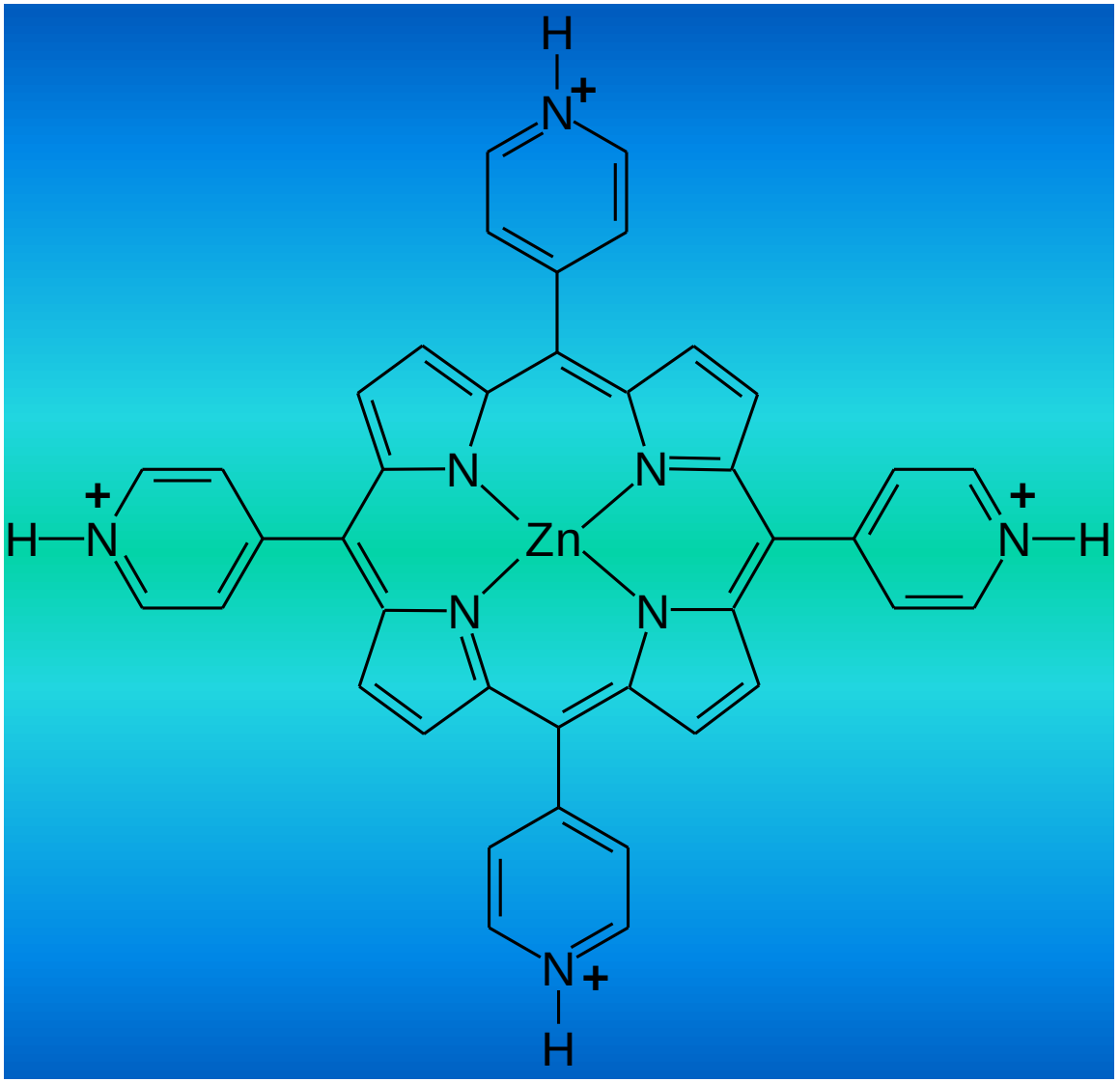


ZnCyPyP


+
+
+
+
Cauda apolar
Cabeça polar

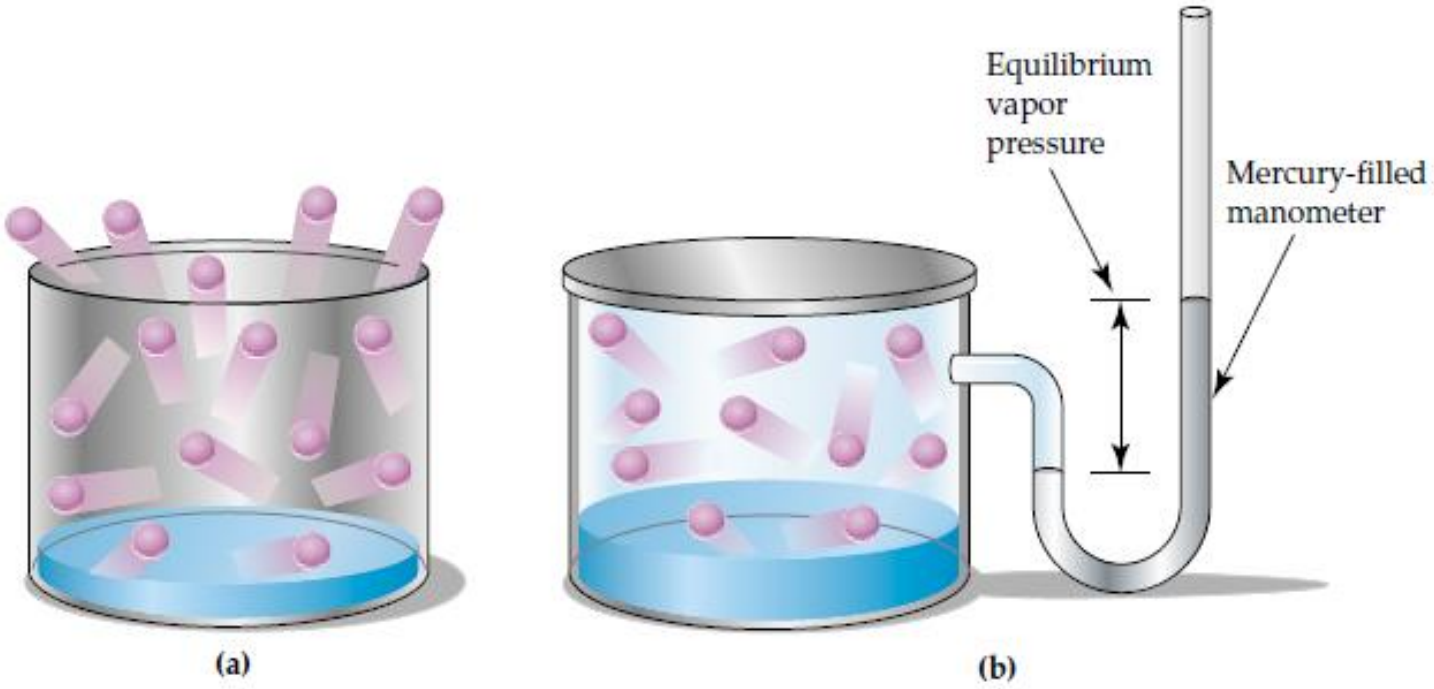

ZnPyP
ZnCyPyP
TENSÃO SUPERFICIAL (DIN/cm)
70
65
60
55
50
45
-5
-4.8
-4.6
-4.4
-4.2
-4
-3.8
-3.6
-3.4
-3.2
-3
LOG [PORFIRINA]

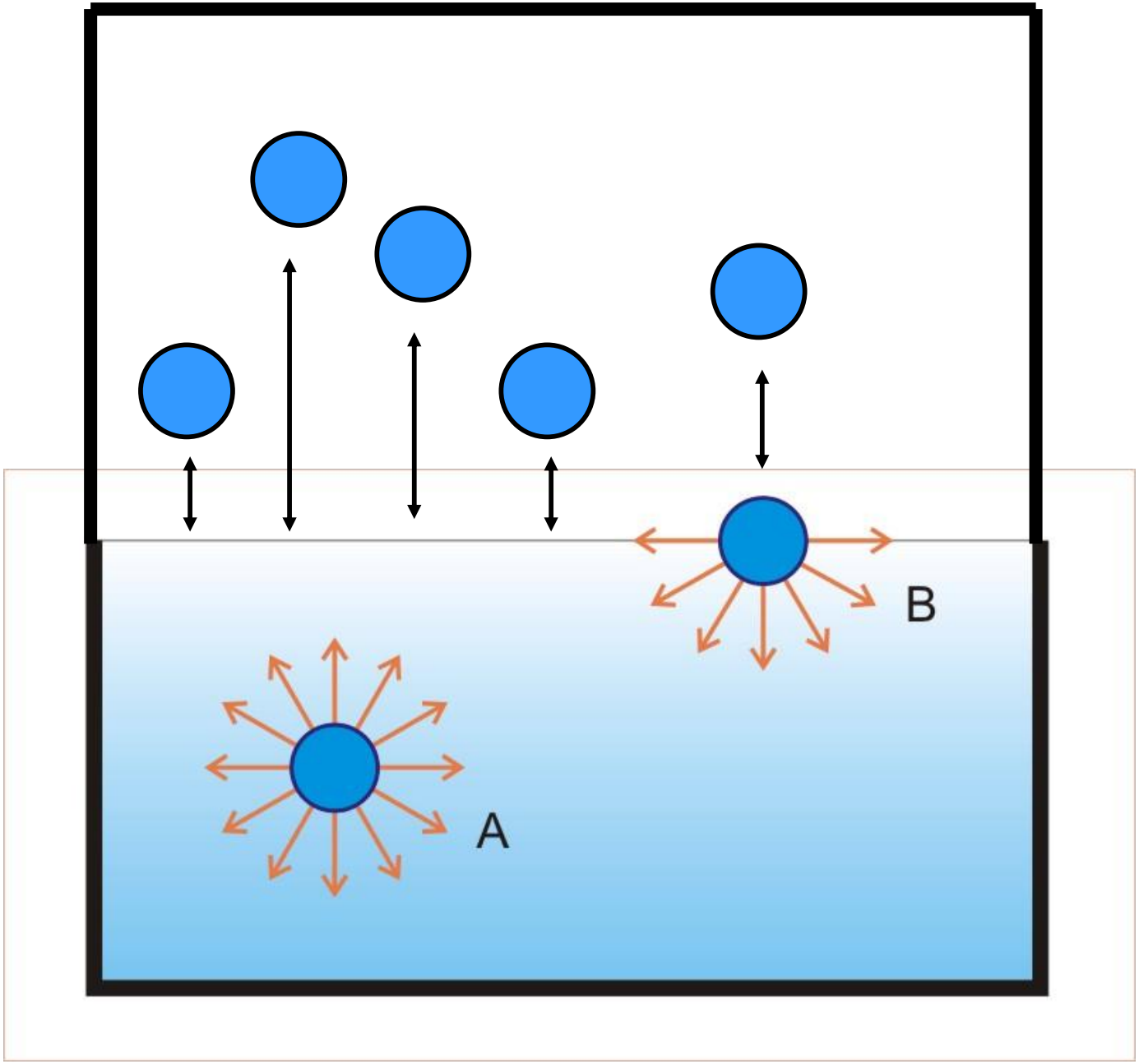
ZnPyP

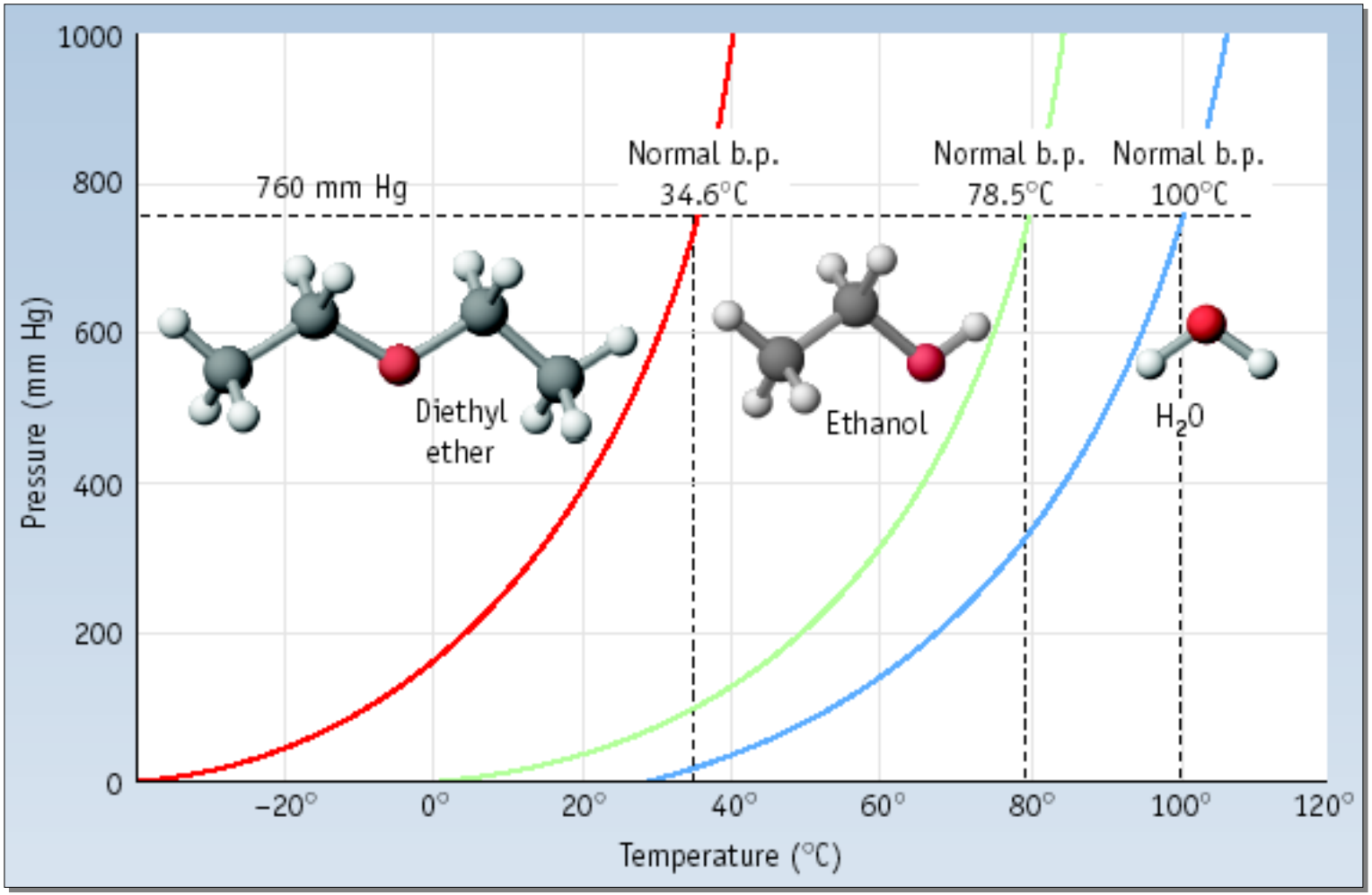


Pressão de Vapor dos Líquidos

Pressão de Vapor de um Líquido



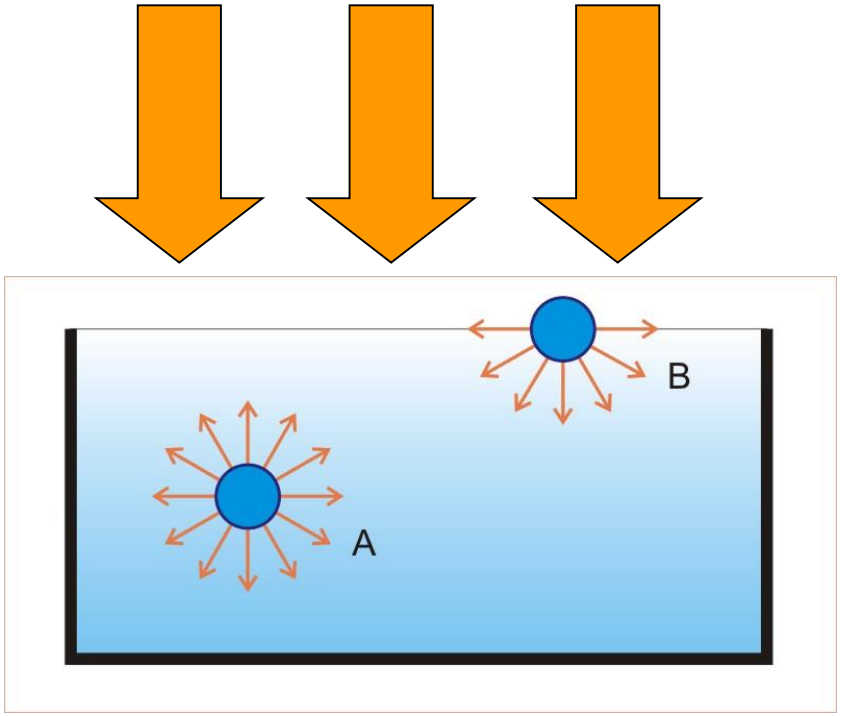

B
A

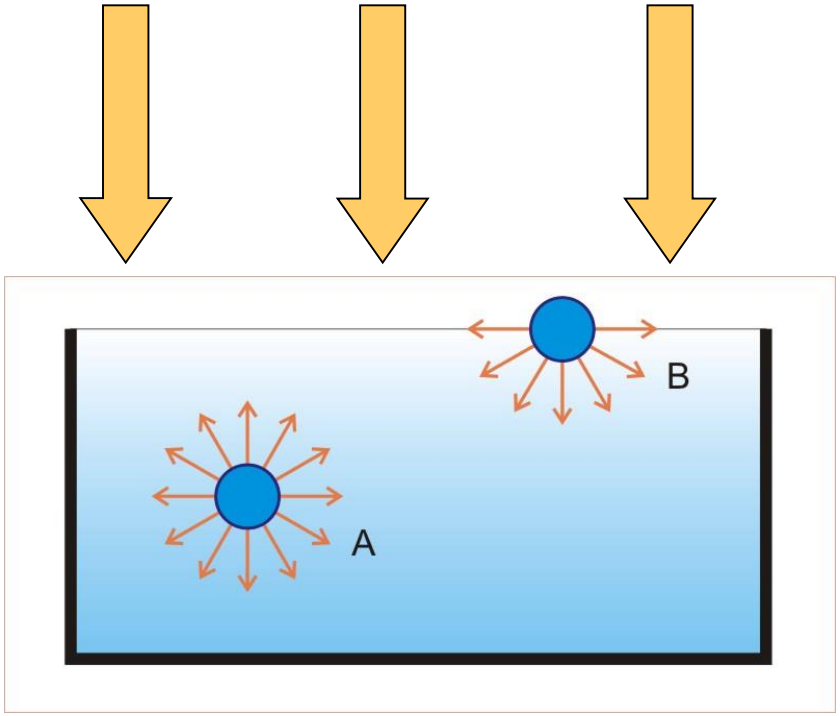

1000
800
600
400
200
0
Pressure (mm Hg)
760 mm Hg
Normal b.p.
34.6°C
Normal b.p.
78.5°C
Normal b.p.
100°C
Diethyl
ether
Ethanol
H_2O
−20°
0°
20°
40°
60°
80°
100°
120°
Temperature (°C)

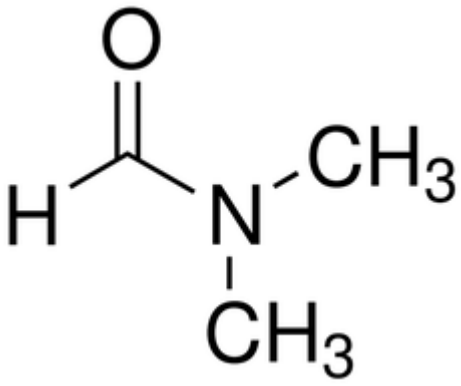
Ebulição

Pressão vapor = Pressão atmosférica

Pontos de Ebulição e Pressão Externa

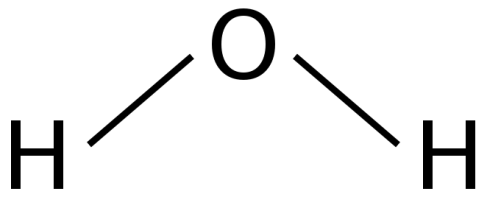






PE (760 mmHg)= 150 ºC

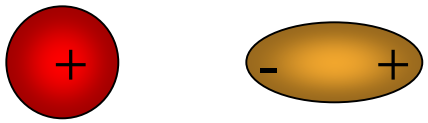
PE (8-10 mmHg)= 50 ºC



PE (760 mmHg)= 100 ºC

PE (30-35 mmHg)= 45 ºC

TIPOS DE INTERAÇÕES INTERMOLECULARES

Tipo de interação	Fatores	E aprox. (kJ/mol)
Íon Dipolo 	Carga Iônica, momento de dipolo	40-600
Dipolo Dipolo 	Momento de dipolo	5-25
Dipolo Dipolo induzido 	Momento de dipolo polarizabilidade	2-10
Dipolo induzido Dipolo induzido 	Polarizabilidade	0,05-40

As energias de ligações covalentes são de 100-400 kJ/mol e as iônicas de várias centenas de kJ/mol.

Íon – Íon:

$$F \propto \frac{1}{d^2}$$

Dipolo – Dipolo:

$$F \propto \frac{1}{d^4}$$

Forças de Dispersão:

Dipolo Induzido – Dipolo Induzido

$$F \propto \frac{1}{d^7}$$