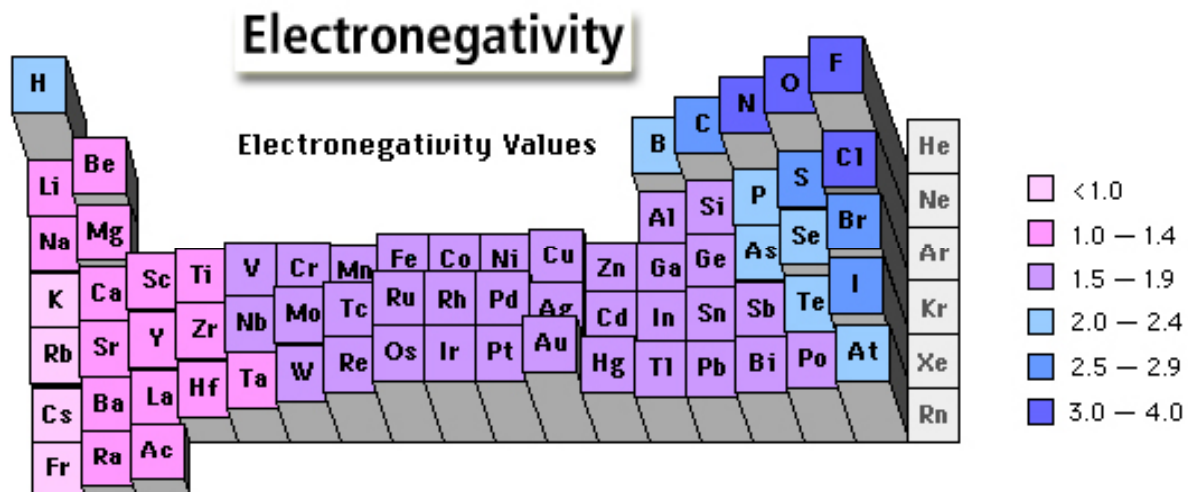


### 3.11 How Do We Determine if a Molecule is Polar



? Polar bond ... different electronegativities



Non polar bond



Polar bond

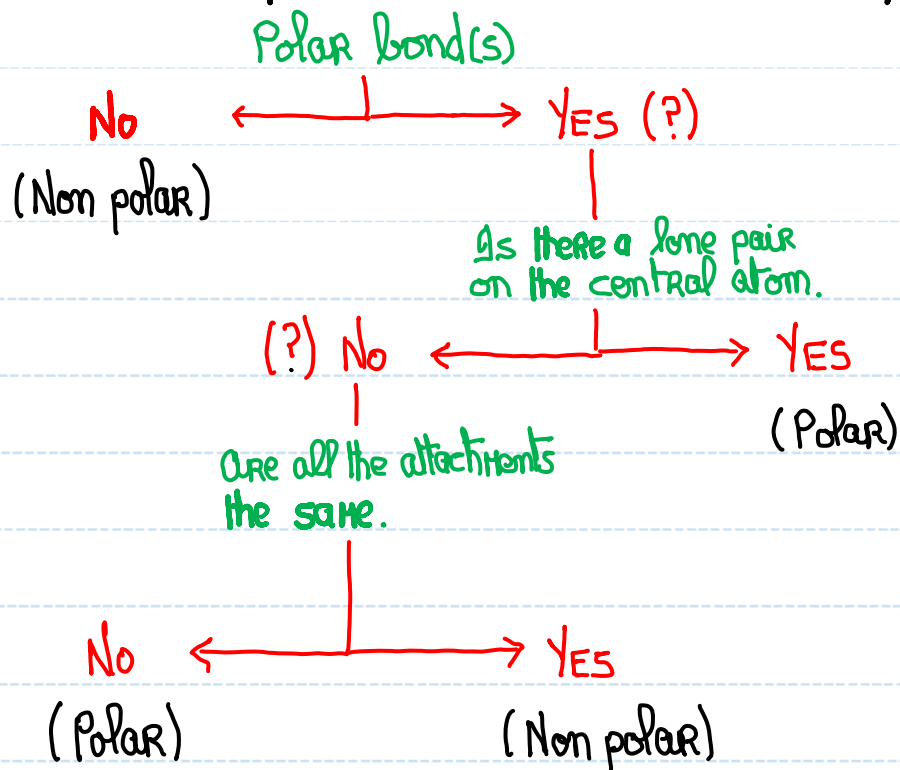


Oxygen more electronegative  
Polar molecule

### 3.11 How Do We Determine if a Molecule is Polar

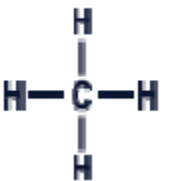
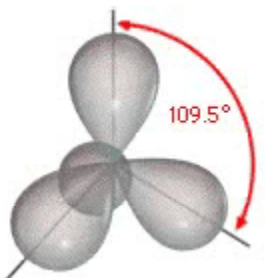
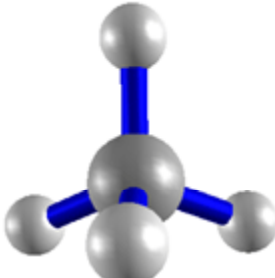
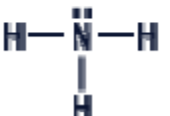
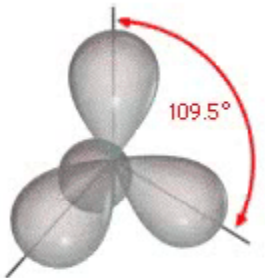
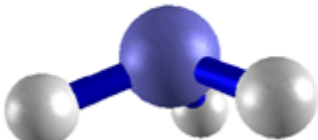

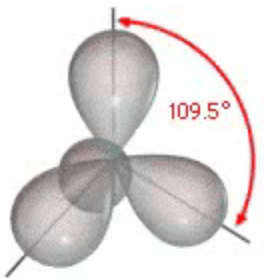
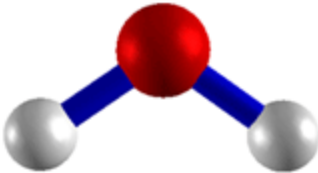
If the vector sum of the polar bonds is  $\neq 0$ , the molecule is polar.

The following works for simple molecules whose  $X+E = 2, 3$  or  $4$ .



### 3.11 How Do We Determine if a Molecule is Polar

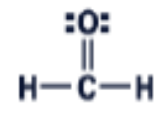
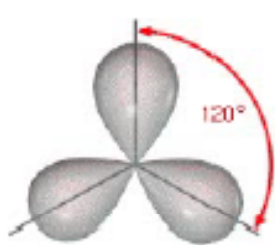
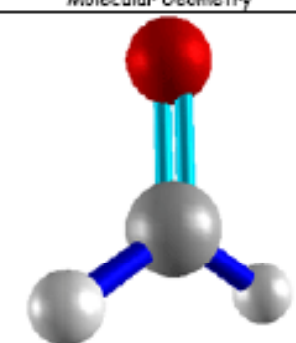
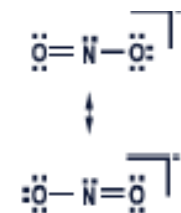
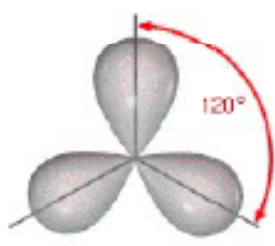
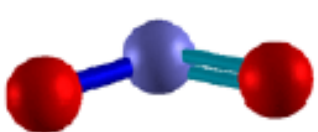

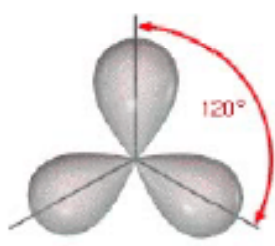
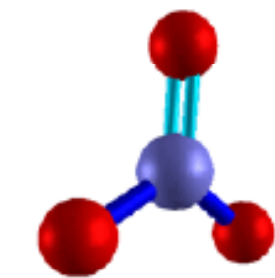
Molecular Geometry Worksheet ... Fall 2008 ... Whelan ... Page 1

Lewis Structure	Classification	X+E	Parent Geometry	Molecular Geometry	Bond Angle	Polarity
$\text{CH}_4$ 	$\text{AX}_4\text{E}_0$	4	 Tetrahedron	 Tetrahedron	$\sim 109^\circ$	<u>NP</u>
$\text{NH}_3$ 	$\text{AX}_3\text{E}_1$	4	 Tetrahedron	 Trigonal pyramid	$\sim 109^\circ$	<u>P</u>
$\text{H}_2\text{O}$ 	$\text{AX}_2\text{E}_2$	4	 Tetrahedron	 Bent/Angular ( $109^\circ$ )	$\sim 109^\circ$	<u>P</u>



### 3.11 How Do We Determine if a Molecule is Polar

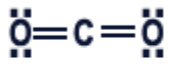
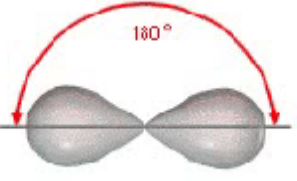

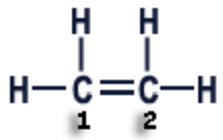
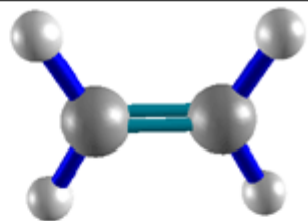
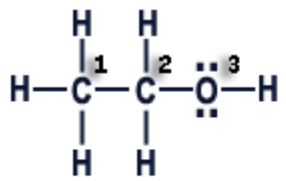
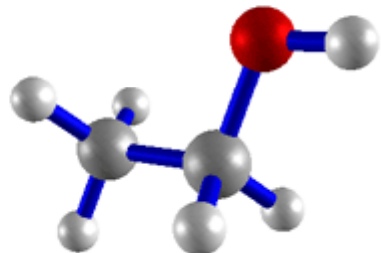
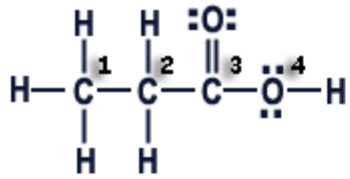
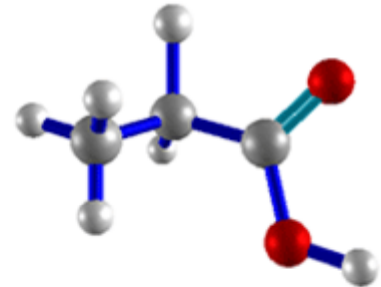
Molecular Geometry Worksheet ... Fall 2008 ... Whelan ... Page 2

Lewis Structure	Classification	X+E	Parent Geometry	Molecular Geometry	Bond Angle	Polarity
$\text{H}_2\text{CO}$ 	$\text{AX}_3\text{E}_0$	3	 Trigonal planar	 Trigonal planar	$120^\circ$	<u>P</u>
$\text{NO}_2^-$ 	$\text{AX}_2\text{E}_1$	3	 Trigonal planar	 Bent/Angular ( $120^\circ$ )	$120^\circ$	<u>P</u>
$\text{NO}_3^-$ 	$\text{AX}_3\text{E}_0$	3	 Trigonal planar	 Trigonal planar	$120^\circ$	<u>NP</u>



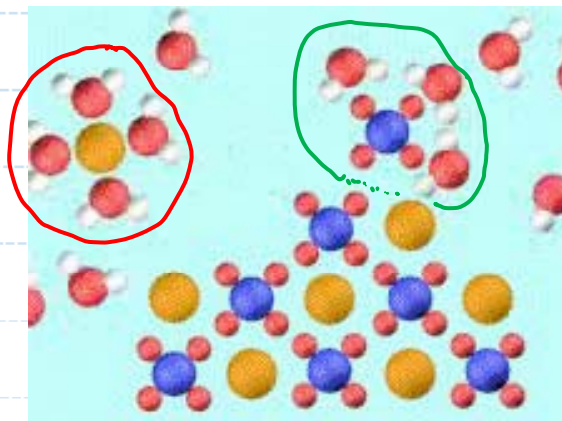
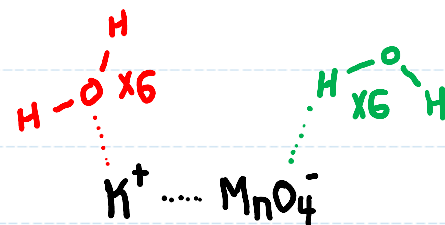
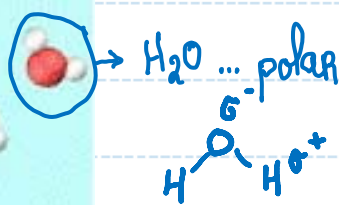
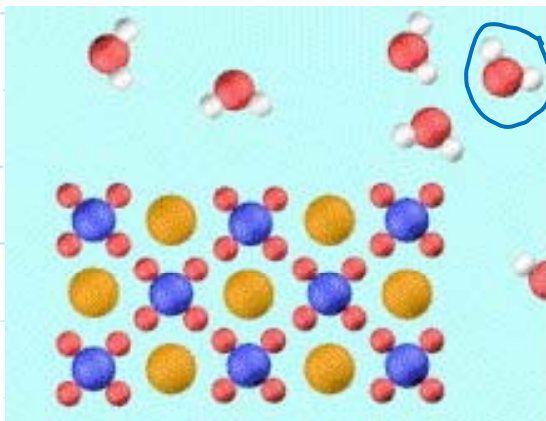
### 3.11 How Do We Determine if a Molecule is Polar

Molecular Geometry Worksheet ... Fall 2008 ... Whelan ... Page 3

Lewis Structure	Classification	X+E	Parent Geometry	Molecular Geometry	Bond Angle	Polarity
$CO_2$ 	$AX_2$	2	 Linear	 Linear	$180^\circ$	<b>NP</b>
$C_2H_4$ 	1: $AX_3E_0$ 2: $AX_3E_0$	3 3	1: Trigonal planar 2: Trigonal planar		1: $120^\circ$ 2: $120^\circ$	
$C_2H_5OH$ 	1: $AX_4E_0$ 2: $AX_4E_0$ 3: $AX_2E_2$	4 4 4	1: Tetrahedron 2: Tetrahedron 3: Tetrahedron		1: $\sim 109^\circ$ 2: $\sim 109^\circ$ 3: $\sim 109^\circ$	
$C_2H_5COOH$ 	1: $AX_4E_0$ 2: $AX_4E_0$ 3: $AX_3E_0$ 4: $AX_2E_2$	4 4 3 4	1: Tetrahedron 2: Tetrahedron 3: Trigonal planar 4: Tetrahedron		1: $\sim 109^\circ$ 2: $\sim 109^\circ$ 3: $120^\circ$ 4: $\sim 109^\circ$	

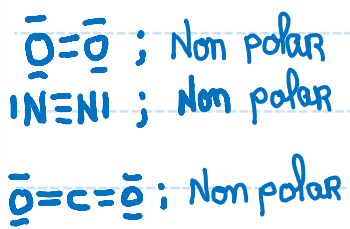


### 3.11 Consequence of Molecular Polarity



Solubility of Some Common Substances		
Compound	Solubility in $H_2O$ g/100mL	
NaCl	35.7	0°C
O <sub>2</sub>	4.5x10 <sup>-3</sup>	18°C
N <sub>2</sub>	2.0x10 <sup>-3</sup>	18°C
NH <sub>3</sub>	89.5	0°C
CO <sub>2</sub>	0.179	18°C
HCl	72.1	20°C

$H_2O$  → polar



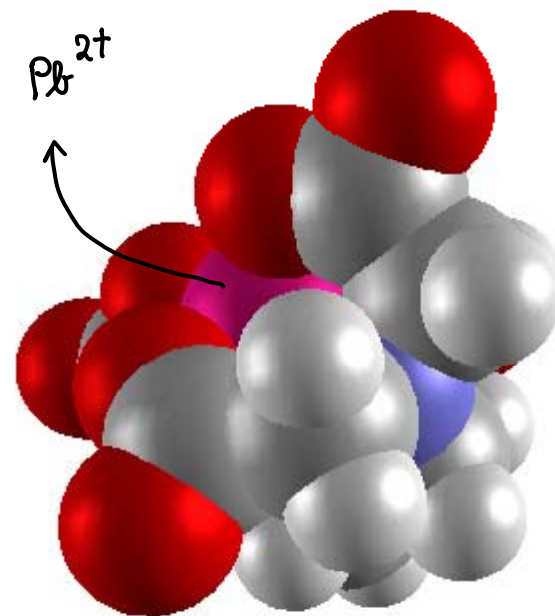
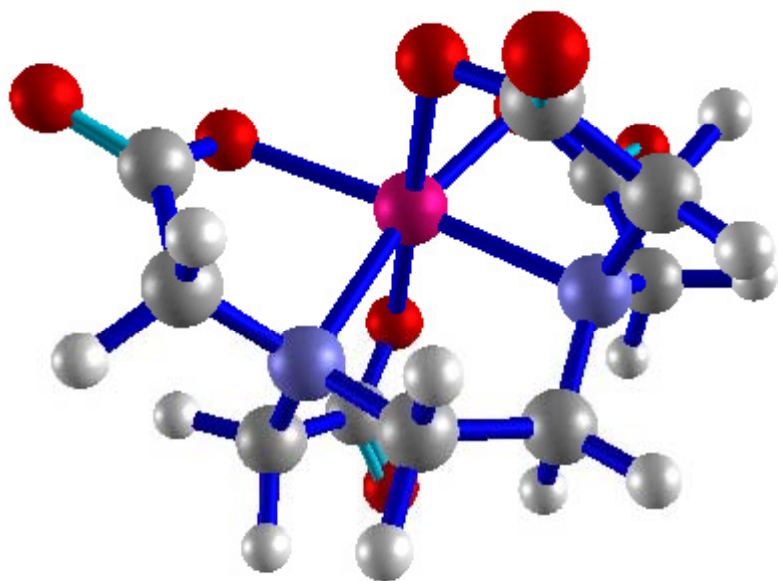
"like dissolves like"

### 3.11 Consequence of Molecular Polarity

Salad dressings ... Lead poisoning ... Chelating therapy

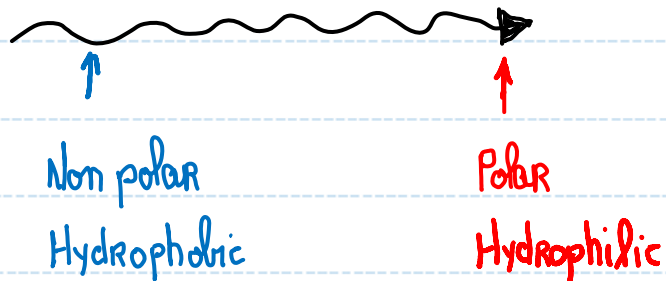
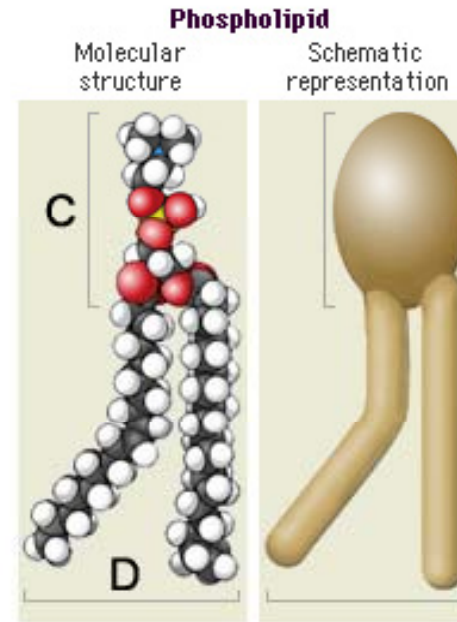
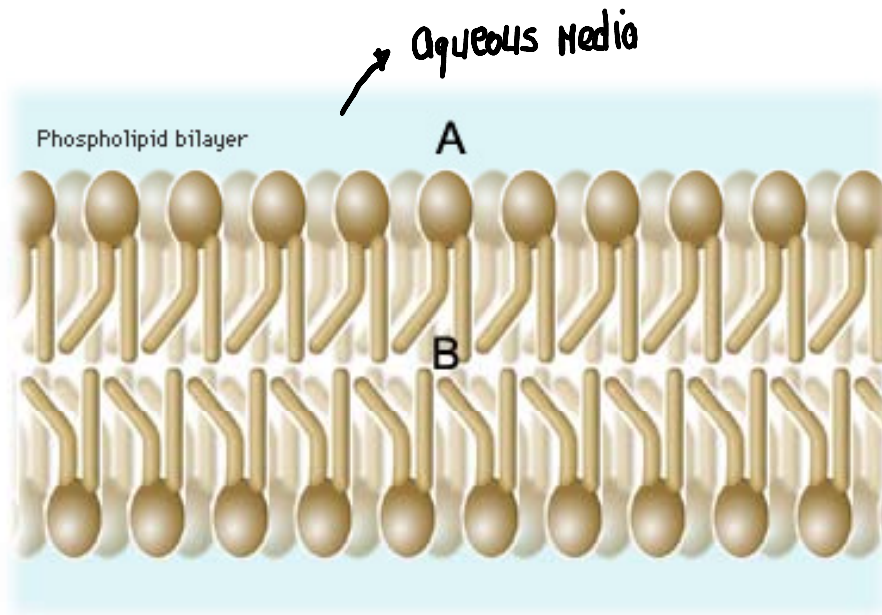
EDTA: Ethylenediaminetetraacetic acid

see class web site ... Lead Poisoning





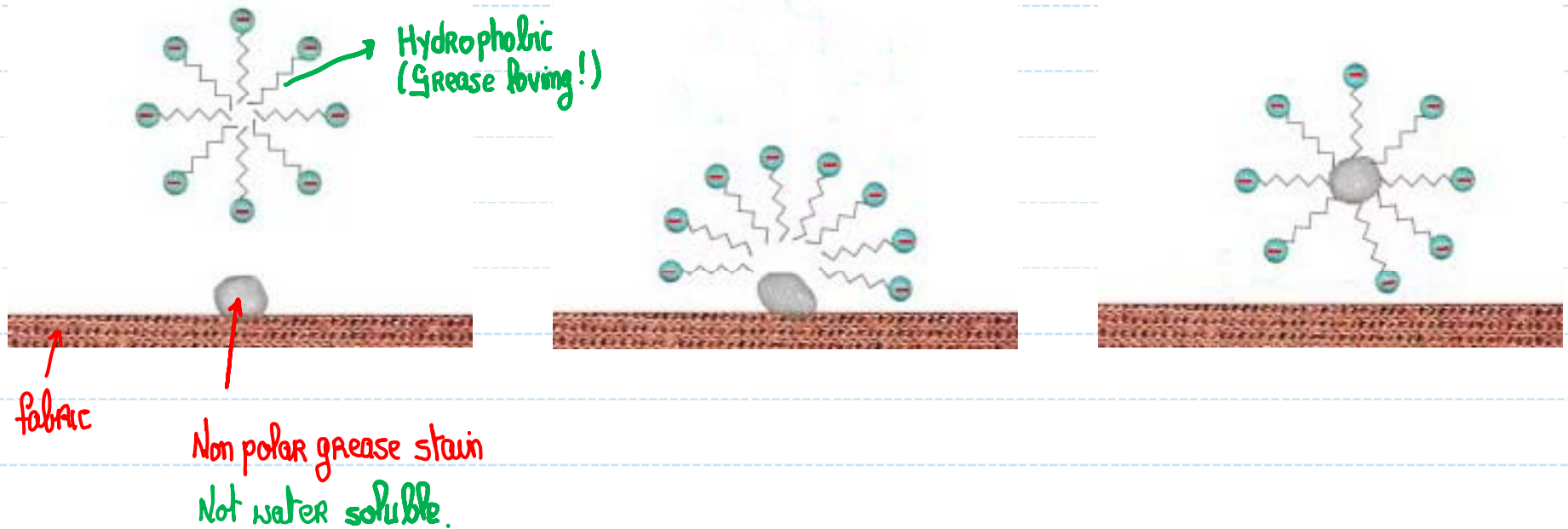
### 3.11 Consequence of Molecular Polarity





## 4.11 Consequence of Molecular Polarity

Detergents

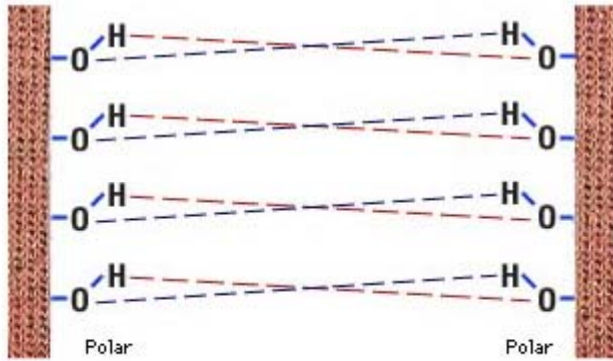


? How might the REVERSE of this process be of use in medicine ??

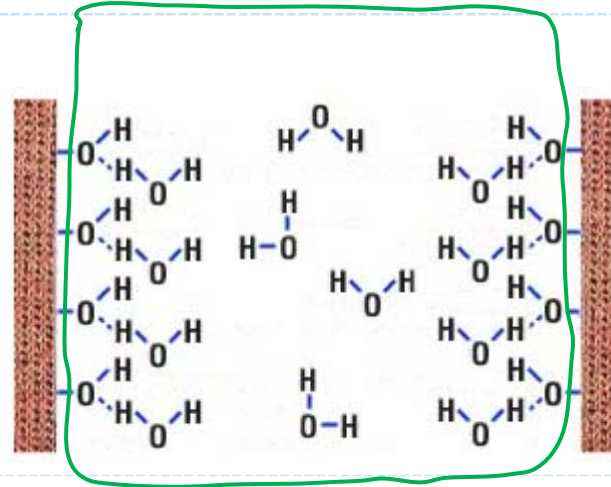


### 3.11 Consequence of Molecular Polarity

Static cling!



Hydrophilic



Oh so soft!



fabric softener

Hydrophobic

