

Today Jan 12 - Sections 12.4-12.6

pick lab partner and station / buy lab manual

Monday Jan 15 - Sections 12.7-12.8

A sugar solution is 40.2 mass % $C_{12}H_{22}O_{11}$ (MM = 342g/mol)

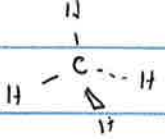
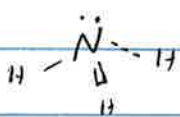
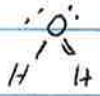
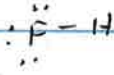
What is its molality and mole fraction?

	MM	m	n
$C_{12}H_{22}O_{11}$	342g/mol	40.2g	0.118mol
H_2O	18.0g/mol	59.8g	3.32mol

assume 100g total

$$\text{molality} = \frac{n_{\text{solute}}}{m_{\text{solvent (kg)}}} = \frac{0.118 \text{ mol}}{0.0598 \text{ kg}} =$$

$$X_{C_{12}H_{22}O_{11}} = \frac{n_{C_{12}H_{22}O_{11}}}{n_{C_{12}H_{22}O_{11}} + n_{H_2O}} = \frac{0.118 \text{ mol}}{0.118 \text{ mol} + 3.32 \text{ mol}} =$$

	CH_4	NH_3	OH_2	FH
				
	MM = 16g/mol	MM = 17g/mol	MM = 18.0g/mol	MM = 20g/mol
bp:	-164°C	-33°C	+100°C	+20°C
	non-polar LDF only	H-bonding	best H-bonding (equal ratio of electron pairs and hydrogens)	H-bonding

Solvent

	H ₂ O	CH ₃ OH	CH ₂ Cl ₂	C ₆ H ₆
	super H-bonding	H-bonding	polar	non-polar
	Use chapter 4 solubility rules	not as much	very little	no
solute	ionic	yes	maybe a little	no
	H-bonding	yes	yes	maybe a little
	polar	yes	yes	yes
	nonpolar	no	no	yes

learns dot \rightarrow structure shape (E groups)

Miscible - solute and solvent are soluble in all proportions

\rightarrow examples:

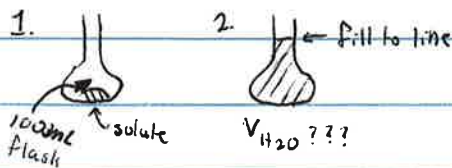
gas-gas (N₂ + O₂)
 liq-liq (H₂O + C₂H₆O) \leftarrow alcohol
 solid-solid (Ag + Au) (Cu + Ag)

Alcohol solubility in water

CH ₃ OH	methanol	miscible
CH ₃ CH ₂ OH	ethanol	miscible
CH ₃ CH ₂ CH ₂ OH	propanol	miscible
CH ₃ CH ₂ CH ₂ CH ₂ OH	butanol	73g butanol in 1L H ₂ O
	$\underbrace{\hspace{2cm}}_{\text{non-polar}} \quad \underbrace{\hspace{1cm}}_{\text{H-bonding}}$	
C ₅ H ₁₁ OH	pentanol	$\frac{22g \text{ pentanol}}{1L \text{ H}_2\text{O}}$

Demo! (Hint: Pay attention to demos)

$$\text{molarity} = \frac{n_{\text{solute}}}{V_{\text{solution}} (\text{L})}$$



Molarity
X
mass %

← must use density of solution → Molarity

HCl(aq) is 37% HCl and has a density of 1.19 g/mL.

What is its molarity?

	MM	m	n	Vol
HCl	36.46 g/mol	37g	1.02 mol	
H ₂ O	18.0 g/mol	63g		
Solution	—	100g		84.0 mL = 0.0840 L

$d = \frac{m}{V}$

$$\text{molarity} = \frac{n_{\text{HCl}}}{V_{\text{soln}}} = \frac{1.02 \text{ mol}}{0.0840 \text{ L}} = 12.1 \text{ mol/L soln} = \boxed{12.1 \text{ M HCl}}$$

$v = \frac{m}{d} = \frac{100 \text{ g}}{1.19 \text{ g/mL}}$

Practice problem:

HNO₃(aq) is 15.8 M with d = 1.42 g/mL. Calculate the

X_{HNO₃}

	MM	m	n	vol
HNO ₃	63 g/mol	995.4g	15.8 mol	
H ₂ O	18.0 g/mol	424.6g	23.9 mol	
Solution	—	1420g		1000 mL

$$X_{\text{HNO}_3} = \frac{15.8 \text{ mol}}{15.8 + 23.9 \text{ mol}} =$$