Solution Calculations Quiz Name: _____

This is a sample quiz for CH 222 providing examples of solution calculations. Answers are provided on the next pages. *Good luck!*

Problem #1: Fill in the blanks in the table. All solutions are aqueous.

Solute	*solution density, g/cm³*	*molality (m)*	*weight percent solute*	*mole fraction solute (X)*	*Molarity (M)*
$NiCl_2$	0.99777			**0.00331**	
acetone	0.9163				**4.00 M**
NH_4NO_3	1.112	**3.54 m**			
HCl	1.47		**90.0%**		

Problem #2: Fill in the blanks in the table. All solutions are aqueous.

Solute	*solution density, g/cm³*	*molality (m)*	*weight percent solute*	*mole fraction solute (X)*	*Molarity (M)*
KBr	0.9977			**0.120**	
ethanol	0.9163				**0.801 M**
MgI_2	1.112	**1.17 m**			
H_2SO_4	1.84		**95.0%**		

Answers appear on the next pages

*Problem #1 Answers: (answers in **bold**)*

Solute	*solution density, g/cm³*	*molality (m)*	*weight percent solute*	*mole fraction solute (X)*	*Molarity (M)*
$NiCl_2$	0.99777	**0.184 m**	**2.33%**	*0.00331*	**0.180 M**
acetone	0.9163	**5.85 m**	**25.3%**	**0.0943**	*4.00 M*
NH_4NO_3	1.112	*3.54 m*	**22.1%**	**0.0599**	**3.07 M**
HCl	1.47	**247 m**	*90.0%*	**0.817**	**36.3 M**

For $NiCl_2$: molar mass = 129.59 g/mol. Assume **1.00000 mol total**

Solute: **0.00331 mol $NiCl_2$** * 129.59 g/mol = **0.429 g $NiCl_2$**
Solvent: 1 – 0.00331 = **0.99669 mol H_2O** * 18.016 g/mol = **17.956 g H_2O**

molality = 0.00331 mol $NiCl_2$ / 0.017956 kg H_2O = **0.184 m**
wt% = (0.429 g $NiCl_2$) / (0.429 g $NiCl_2$ + 17.956 g H_2O) * 100% = **2.33%**

mass solution = (0.429 g $NiCl_2$ + 17.956 g H_2O) = **18.385 g solution**
volume solution = 18.385 g solution * (mL / 0.99777 g) = **18.426 mL solution**
molarity = 0.00331 mol $NiCl_2$ / 0.018426 L = **0.180 M**

For acetone (CH_3COCH_3): molar mass = 58.078 g/mol. Assume **1.00 L of solution**.

Solute: **4.00 mol acetone** * 58.078 g/mol = **232 g acetone**

mass solution = 1.00 L * (10^3 mL/L) * (0.9163 g/mL) = **916 g solution**
mass solvent = 916 g solution – 232 g solute = **684 g solvent (H_2O)**
moles solvent = 684 g H_2O * (mol / 18.016 g) = **38.0 mol H_2O**

molality = 4.00 mol acetone / 0.684 kg H_2O = **5.85 m**
wt% = (232 g acetone) / (232 g acetone + 684 g H_2O) * 100% = **25.3%**
X = (4.00 mol acetone) / (4.00 mol acetone + 38.0 mol H_2O) = **0.0943**

Answers continue on next page

For NH_4NO_3: molar mass = 80.052 g/mol. Assume **1.000 kg total solvent**

Solute: **3.54 mol NH_4NO_3** * 80.052 g/mol = **283 g NH_4NO_3**
Solvent: 1.000 kg * (10^3 g/kg) = **1000. g** * (1 mol / 18.016 g) = **55.51 mol H_2O**

X = (3.54 mol NH_4NO_3) / (3.54 mol NH_4NO_3 + 55.51 mol H_2O) = **0.0599**
wt% = (283 g NH_4NO_3) / (283 g NH_4NO_3+ 1000. g H_2O) * 100% = **22.1%**

mass solution = (283 g NH_4NO_3 + 1000. g H_2O) = **1283 g solution**
volume solution = 1283 g solution * (mL / 1.112 g) = **1154 mL solution**
molarity = 3.54 mol NH_4NO_3 / 1.154 L = **3.07 M**

For HCl: molar mass = 36.458 g/mol. Assume **100.0 g total solution**

Solute: **90.0 g HCl** * (mol / 36.458 g/mol) = **2.47 mol HCl**
Solvent: (100.0 – 90.0) = **10.0 g H_2O** * (1 mol / 18.016 g) = **.555 mol H_2O**

X = (2.47 mol **HCl**) / (2.47 mol **HCl** + 0.555 mol H_2O) = **0.817**
molality = 2.47 mol HCl / 0.0100 kg H_2O = **247 m**

mass solution = **100.0 g solution**
volume solution = 100.0 g solution * (mL / 1.47 g) = **68.0 mL solution**
molarity = 2.47 mol HCl / 0.0680 L = **36.3 M**

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*Problem #2 Answers: (answers in **bold**, try working the problems out on your own!)*

Solute	*solution density, g/cm³*	*molality (m)*	*weight percent solute*	*mole fraction solute (X)*	*Molarity (M)*
KBr	0.9977	**7.55 m**	**47.4%**	*0.120*	**3.96 M**
ethanol	0.9163	**0.911 m**	**4.03%**	**0.0161**	*0.801 M*
MgI_2	1.112	*1.17 m*	**24.5%**	**0.0206**	**0.982 M**
H_2SO_4	1.84	**190 m**	*95.0%*	**0.777**	**17.8 M**