Updated Oct.20/09 **CHAPTER 14 ANSWERS**

NUMERICAL ANSWERS TO ASSIGNED TUTORIAL PROBLEM SETS FOR CHEM206
FROM KOTZ & TREICHEL'S CHEMISTRY & CHEMICAL REACTIVITY, **6th Ed.**

NOTE: the answers from Ch.14 have <u>not</u> been verified. Please report any errors.

Ch.	Q#	Answer	Units	SFs	Comments
14	2	0.696	M	3	molarity
14	2	0.886	mol/kg	3	molality
14	2	0.0392		3	mole fraction camphor
14	2	11.9	%	3	weight percentage
14	6	2.18	g	3	mass to add
14	6	9.22×10^{-4}		3	mole fraction sodium nitrate
14	12a	2.6×10^{-7}	mol/kg	2	Ag^+ ion molality
14	12b	3.6×10^{6}	L	2	volume of water to treat to get 100 g Ag
14	14				acetone is polar…strong dipole-dipole interactions with water…
14	18				Li_2SO_4: as T increases, more solid will ppt out
14	18				LiCl: as T increases, more solid will dissolve
14	20				Be^{2+} most strongly hydrated (i.e., largest hydration enthalpy) (WHY? smallest ion ∴ most charge at any point on surface)
14	20				Ca^{2+} least strongly hydrated (largest ∴ lowest surface charge)
14	22	8.80×10^{-7}	M/mmHg	3	gas solubility decreases as T increases, so choose value < constant's value at 25°C

Since the solubility of a gas generally decreases with increasing temperature (because it is entropically unfavourable…), answer (a) 8.80×10^{-7} M/mmHg is the only reasonable choice because it is less than the value of the constant at 25°C.

14	24	1.59×10^{-6}	g/mL	3	dissolved $H_2(g)$; hint: must factor out the vapour P of water
14	26	17.6	mm Hg	3	vapour pressure
14	32	80.20	°C	4	bp of 0.0407 molal solution of caffeine in benzene
14	34	0.13		2	mole fraction glycerol
14	36	2500	g	2	mass ethylene glycol added
14	40	180	g/mol	2	for 0.14 molal solution of BHA
14	42				$C_{14}H_{10}$
14	48	510	g	2	NaCl required to freeze at -10°C

Ch.	Q#	Answer	Units	SFs	Comments
					these answers ignore the 90% dissociation factor!
14	50a	0.20	mol/kg	2	particles in eth.glycol soln
14	50b	0.36	mol/kg	2	particles in K_2SO_4 soln
14	50c	0.30	mol/kg	2	particles in $MgCl_2$ soln
14	50d	0.24	mol/kg	2	particles in KBr soln
14	50				soln m.p.: eth.glycol > KBr > $MgCl_2$ > K_2SO_4 (lowest)
14	52	7.7	atm	2	for 0.30 M solution
14	60a	13.5	wt %	3	mass percentage NaCl
14	60b	0.0459		3	mole fraction NaCl
14	60c	2.67	mol/kg	3	molality NaCl
14	64	0.016	mol/kg	2	molality $Ca(NO_3)_2$
14	64	0.049	mol/kg	2	molality ions
14	66a				Na_2SO_4 soln highest b.p.
14	66b				Na_2SO_4 soln lowest m.p.
14	66c				ethylene glycol solution has highest vapour pressure
14	72	888	g	3	precipitates out
14	76	50000	ppm	1	need total volume of solution (requires density)
14	78	104.13	°C	5	for 8.06 molal solution
14	80	55.3	M	3	molarity
14	80	55.5	mol/kg	3	molality
14	82	0.852	mol C_2H_5OH	3	
	82	2.77	mol H_2O	3	
	82	0.235	mole fraction	3	= χ_{C2H5OH}… and $\chi_{H2O} = 1 - \chi_{C2H5OH}$
	82	23.6	mmHg	3	= $P_{tot} = (\chi_{C2H5OH} P^o_{C2H5OH}) + (\chi_{H2O} P^o_{H2O})$
14	86a	0.123	molal	3	molality of maltose
	86a	0.0118	moles	3	moles maltose in 0.09600 kg water
	86a	338	g/mol	3	molar mass maltose since mass of 0.0118mol = 4.00 g
	86b	98.62	mL	4	volume of 100.00 g solution
	86b	0.120	mol/L	3	concentration of maltose in molarity
	86b	2.93	atm	3	osmotic pressure exerted by solution
14	88a	0.0402	M	3	3SF because of conversion of T to Kelvin (subtraction rules)
14	88b	1.4	wt %	2	SFs limited by density data
14	90	77	g/mol	2	halide ion is likely Br^-
14	92	292.4	g/mol	4	empirical FW…so formula = $C_{18}H_{24}Cr$
14	94	skin = semipermeable membrane; higher [solvent] inside cucumber; water flows out			

Ch.	Q#	Answer	Units	SFs	Comments
14	98	All alcohols contain a polar –OH group that can interact with water molecules. The smaller alcohols are miscible with water because of this polar group. However, with an increase in the size of the hydrocarbon group, the organic group (the nonpolar part of the molecule) has become a larger fraction of the molecule, and properties associated with nonpolarity begin to dominate.			
14	102	cell membrane = semipermeable membrane; higher [solvent ie water] outside cell, so water will flow into cell…unless cell can quickly pump it back out again (likely not), the cell will burst & the protozoan will die.			