Updated July 11/06 **CHAPTER 12 ANSWERS**

NUMERICAL ANSWERS TO ASSIGNED TUTORIAL PROBLEM SETS FOR CHEM205
FROM KOTZ & TREICHEL'S CHEMISTRY & CHEMICAL REACTIVITY, **6th Ed.**

NOTE: none of the answers from Ch.12 have been verified. Please report any errors.
(except #96, which was incorrect in the Instructor's Solutions Manual, but is correct here.)

Ch.	Q#	Answer	Units	SF	Comments
12	4				Convert them all to atm to compare them: Then: 0.256 atm < 363 mm Hg < 0.523 bar < 363 kPa
12	8	4.6	mL	2	Use $P_1/T_1 = P_2/T_2$
12	14	$1.2x10^7$	L	2	Use $P_1*V_1/T_1 = P_2*V_2/T_2$
12	16	18	L O_2	2	(i) Use stoichiometric ratio 7/2
		17	L H_2O	2	(i) Use stoichiometric ratio 6/2
12	20	0.0326	mol C_2H_5OH	3	in container of volume 0.251 L
		5.6	atm		exerted by that quantity of ethanol vapour in the container
12	22	0.22	mol He	2	Use P*V = n*R*T
12	24	0.307	atm	3	then use d = (P*M)/(R*T)
		0.929	g/L		
12	26	0.257	atm	3	converted from mmHg
		119	g/mol	3	integrate density & mole definition into PV=nRT…solve for MM.
12	30	0.856	g/L	3	(i) Use d = m/V
		0.436	atm	3	(ii) Use 1 stm = 760 mm Hg
		44.1	g/mol	3	(iii) Use M = d*R*T/P
12	34	$8.3x10^{-4}$	mol C_8H_{18}	2	(i) Use 114 g of C_8H_{18} = 1 mol
		0.0075	mol H_2O	2	(ii) Use stoiciometric ratio 18/2
		0.039	atm	2	(iii) Use n*R*T/V
		0.010	mol O_2	2	(iv) Use stoichiometric ration 25/2
		0.053	atm	2	(v) Use P = n*R*T/V
12	36	1.01	atm	3	(i) Use 1 atm = 760 mm Hg
		0.371	mol CO_2	3	(ii) Use n = (P*V)/(R*T)
		52.7	g KO_2	3	(iii) Use stoiciometric ratio 4/2 and 1 mo KO_2 = 71.10 g
12	38	92.5	% N_2	3	(i) Use $\%N_2 = 100\% - \%H_2S - \%CO_2$
		43	atm	2	(ii) use Partial pressure = total pressure * %gas/100
		2.1	atm	2	
		1.4	atm	2	

Ch.	Q#	Answer	Units	SF	Comments
12	40a	0.517	mol He	3	(i) Use n = (P*V)/(R*T)
		2.07	g He	3	(ii) Use 1 mol = 4.003 g
	40b	0.48	atm	2	Use P = n*R*T/V
	40c	0.52	atm	2	Use $P_{total} = P_{O2} + P_{He}$
	40di	0.48	none	2	Use $X_{He} = P_{He}/P_{total}$
	40dii	0.52	none	2	
12	42				The molar mass of Ar (40 g/mol) is greater than the molar mass of N_2 (28 g/mol). Therefore, for samples with equal mass there are more moles of N_2 present than moles of Ar.
	42a				True. More moles, so more molecules.
	42b				False. Pressure is directly related to the number of moles present. The pressure is therefore greater in the nitrogen flask.
	42c				False. The molecules of the gas with the smaller molar mass will have greater velocity.
	42d				True. The nitrogen molecules have greater velocity than the argon molecules, and there are more molecules of nitrogen present, so they will collide more frequently with the walls of the flask.
12	46				Molecular speed: $OSCl_2 < Cl_2O < Cl_2 < SO_2$ Molar mass: 119 > 87 > 71 > 64 g/mol
12	48	3.16	none	3	Use Graham's law of effusion
12	54	628.	L	3	(i) Use V = π*r^2*l
		1.14	atm	3	(ii) Use 760 mm Hg = 1 atm
		29.2	mol CO_2	3	(iii) Use n = (P*V)/(R*T)
		1.29×10^3	g	3	(iv) Use 1 mol CO_2 = 44.01 g
12	60	58.	°C	2	Use T = (P*V)/(n*R), and °C = K - 273.2
12	62	0.0801	mol Si	3	(i) Use 1 mol Si = 28.09 g
		0.206	mol CH_3Cl	3	(ii) n = (P*V)/(R*T) (Watch the units!)
					(iii) Check for limiting reagent. It is Si.
		10.3	g $(CH_3)_2SiCl_2$	3	(iv) Use stoichiometric ratio 1/1, and 1 mole $(CH_3)SiCl_3$ = 129.1 g
		0.369	atm	3	(v) Use P = n*R*T/V
12	64a				Heavier molecules have lower average speed: $O_2 < B_2H_6 < H_2O$
	64b	768	atm	3	= partial pressure of O_2
12	72	0.0115	mol N_2	2	in 1:1 ratio with $NaNO_2$
		0.791	g $NaNO_2$	3	which makes up 64.2% of sample by mass.
12	74	87	mmHg He	2	
		140	mmHg Hg	2	Total pressure: $P_{He} + P_{Hg}$ = 230 mmHg to 2SF…
12	78	777	mmHg He	3	Helium P = gauge P + barometric P
		0.0128	mol He	3	using ideal gas law (with P converted to atm…)

Ch.	Q#	Answer	Units	SF	Comments
12	82	163	mmHg N	3	because $P_{N2} = P_{total} – P_{H2O} – P_{O2} – P_{CO2}$
12	88	0.00107	mol MCO_3	3	since # mol MCO_3 = # mol CO_2
		148	g/mol MCO_3	3	since mass is known…
		88	g/mol M	2	since $MM_{MCO3} = MM_M + MM_{CO3}$…. So, M is likely Sr (87.6 g/mol).
12	96	12	mmHg H_2O	2	since P_{H2O} = (relative humidity)*(H_2O vapour pressure)
		9.9	mol H_2O	2	using ideal gas law with V = room volume = 15750 L
		180	g H_2O	2	using MM of H_2O…
12	98a				True.
	98b				False. Nitrogen has a smaller molecular mass than O_2, so an equal mass of N_2 contains more moles and more molecules than O_2.
12	100				At constant pressure, the number of moles of a gas is inversely proportional to the temperature. Therefore flask B(at a lower temperature) contains more moles (and more molecules) of oxygen.
12	104a				19 valence e-.
	104b				The electron pair geometry of Cl is determined by 2 Cl-O bonds and 2 lone pairs as tetrahedral.
	104c				Hybridization: sp^3; molecular geometry: bent.
	104d				The angle is larger in ozone where the central O is sp^2-hyb'd.
	104e	0.172	mol $NaClO_2$	3	(i) Use 1 mol NaClO2 = 90.44 g
		0.0828	mol Cl_2	3	(ii) Use n = (P*V)/(R*T)
					(iii) Determine limiting reagent. It is Cl_2.
		11.2	g ClO_2	3	(iv) Use stoichiometric ratio = 2/1, and 1 mol ClO_2 = 67.45 g