Dr. Zellmer | Chemistry 1210 | All Sections
Time: 7 PM Sun. | Autumn Semester 2022 | December 4, 2022
40 min | Quiz XII

Name _____ Rec. TA/time _____

Show **ALL** your work or **EXPLAIN** to receive full credit.

1. (5 pts) A mixture of gases contains 0.25 mol He and 0.65 mol N_2. If the total pressure of the mixture is 5.50 atm at 25ºC, what are the **partial pressures** of He and N_2 at 25°C? (At. Wts: He = 4.00, H = 14.01)

2. (6 pts) A 1.50 L container of Ar at 740.0 torr and 25.0 °C is connected to a 2.50 L container of O_2 at 765.0 torr and 25.0 °C. What is the **total pressure** (torr) after the gases have mixed if the temperature remains at 25.0 °C? (Atomic weights: O = 16.00, Ar = 39.95)

3. (3 pts) Which gases, N_2O, C_2H_2, NO, diffuse **faster** than O_2 under identical experimental conditions? (atomic weights: N = 14.01, O = 16.00, C = 12.01, H = 1.008)

4. (3 pts) Which one of the statements below is **FALSE**?

a) A real gas behaves more nearly as an ideal gas at high temperatures and low pressures.

b) In the van der Waals equation, one would expect a larger value of "a" for HF than for He.

c) Gases approach their liquefaction points as temperature decreases and as pressure increases.

d) The "b" factor in the van der Waals equation should be larger for He than for Cl_2.

e) It is not possible for the “a” factor in the van der Waals equation to be negative.

5. (5 pts) The pressure of a 2.855 moles sample of O_2 contained in a 1.00 L flask is140.0 atm at 300°C. One can conclude (to 3 significant figures) that

a) The gas is behaving ideally.

b) The gas exhibits a positive deviation from ideality.

c) The gas exhibits a negative deviation from ideality.

d) The collision of the molecules with the walls of the container are no longer elastic

e) no statement can be made without the Van der Waals constants.

6. (3 pts) Which of the following compounds is **INCORRECTLY** paired with the intermolecular forces that exist between neighboring molecules?

a) PF_5 London forces only

b) $AsCl_3$ London forces, dipole-dipole forces

c) $SiCl_4$ London forces only

d) CH_3CH_2F London forces, dipole-dipole forces

e) $CH_3\overset{\overset{O}{\|}}{C}CH_3$ London forces, dipole-dipole forces, hydrogen bonding

7. (8 pts) Examine the following compounds and then answer the questions below which refer to these compounds, as pure substances. (**<u>Give a short explanation for your choices</u>**, i.e, types of **attractive forces**, whether **polar** or **nonpolar**, etc.)
(At. no.: H = 1, B = 5, C = 6, N = 7, F = 9, Al = 13, Si=14, P = 15, S = 16, Cl = 17)
(Group no.: H = 1A, B,Al = 3A, C,Si = 4A, N,P = 5A, O,S = 6A, F,Cl,Br,I = 7A)
(At. Wts.: H = 1.01, B = 10.81, C = 12.01, N = 14.01, O = 16.00, F = 19.00, Al = 26.98, Si = 28.09, P = 30.97, S = 32.07, Cl = 35.45)

C_3H_8 $\quad$ $CH_3CH_2 - \ddot{O} - H$ $\quad$ $CH_3 - \ddot{O} - CH_3$ $\quad$ CH_2F_2

a) Which compound(s) has(have) **<u>only</u> London forces**?

b) Which compound(s) has(have) **<u>Dipole-Dipole</u>** forces?

c) Which compound(s) can form **H-bonds** between molecules (as a pure substance)?

d) Which compound should have the **<u>highest</u>** heat of vaporization, ΔH_{vap}?

8. (3 pts) Which of the following statements is **<u>INCORRECT</u>**?

a) Br_2 has a **higher** boiling point than Cl_2.

b) H_2S has **stronger** London forces than H_2O.

c) The vapor pressure of solid He is **higher** than the vapor pressure of solid Ne at a given temperature.

d) CH_3-CH_2-OH has a **greater** viscosity than CH_3-O-CH_3.

e) CO_2 has a **higher** critical temperature than SO_2.

9. (5 pts) Calculate the amount of heat (kJ) required to heat 125 g of mercury (Hg) from 25.0 ºC to its boiling point (357 ºC) and then vaporize it? (specific heat of liquid Hg = 0.138 J/g•ºC, ΔH_{vap} = 292 J/g)

10. (6 pts) A substance has a ΔH_v = 20.0 kJ/mol. It has a vapor pressure of 0.800 atm at -2.00 ºC. What is it's **<u>normal</u> boiling point**?

USEFUL INFORMATION

R = 0.08206 L-atm/mol-K = 8.3145 J/mol-K

Avogadro's number = 6.02×10^{23} particles/mole

$1\ \text{Å} = 1 \times 10^{-10}\ \text{m} = 1 \times 10^{-8}\ \text{cm}$

molar volume at STP = 22.41L

$KE = \frac{1}{2}\, mv^2$, $KE_{avg} = \frac{1}{2}\, mu^2$, total average KE per mole = 3/2 RT

$$\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$$

$$u = \sqrt{\frac{3RT}{M}}$$

$$\ln\left(\frac{P_2}{P_1}\right) = \frac{\Delta Hv}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right) \qquad \log\left(\frac{P_2}{P_1}\right) = \frac{\Delta Hv}{2.303R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right) \qquad \ln(P) = \frac{-\Delta Hv}{R}\left(\frac{1}{T}\right) + C$$

	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1.008 **H** 1																	4.003 **He** 2
2	6.941 **Li** 3	9.012 **Be** 4											10.811 **B** 5	12.011 **C** 6	14.007 **N** 7	15.999 **O** 8	18.998 **F** 9	20.179 **Ne** 10
3	22.990 **Na** 11	24.305 **Mg** 12											26.98 **Al** 13	28.09 **Si** 14	30.974 **P** 15	32.06 **S** 16	35.453 **Cl** 17	39.948 **Ar** 18
4	39.098 **K** 19	40.08 **Ca** 20	44.96 **Sc** 21	47.88 **Ti** 22	50.94 **V** 23	52.00 **Cr** 24	54.94 **Mn** 25	55.85 **Fe** 26	58.93 **Co** 27	58.69 **Ni** 28	63.546 **Cu** 29	65.38 **Zn** 30	69.72 **Ga** 31	72.59 **Ge** 32	74.92 **As** 33	78.96 **Se** 34	79.904 **Br** 35	83.80 **Kr** 36
5	85.47 **Rb** 37	87.62 **Sr** 38	88.91 **Y** 39	91.22 **Zr** 40	92.91 **Nb** 41	95.94 **Mo** 42	98 **Tc** 43	101.07 **Ru** 44	102.91 **Rh** 45	106.42 **Pd** 46	107.87 **Ag** 47	112.41 **Cd** 48	114.82 **In** 49	118.69 **Sn** 50	121.75 **Sb** 51	127.60 **Te** 52	126.90 **I** 53	131.39 **Xe** 54
6	132.91 **Cs** 55	137.33 **Ba** 56	138.91 **La** 57	178.39 **Hf** 72	180.95 **Ta** 73	183.85 **W** 74	186.21 **Re** 75	190.23 **Os** 76	192.22 **Ir** 77	195.08 **Pt** 78	196.97 **Au** 79	200.59 **Hg** 80	204.38 **Tl** 81	207.2 **Pb** 82	208.98 **Bi** 83	209 **Po** 84	210 **At** 85	222 **Rn** 86
7	223 **Fr** 87	226.03 **Ra** 88	227.03 **Ac** 89	261 **Rf** 104	262 **Ha** 105	263 **Sg** 106	262 **Ns** 107	265 **Hs** 108	266 **Mt** 109	269 110	272 111	277 112						

Lanthanide Series	140.12 **Ce** 58	140.91 **Pr** 59	144.24 **Nd** 60	145 **Pm** 61	150.36 **Sm** 62	151.96 **Eu** 63	157.25 **Gd** 64	158.93 **Tb** 65	162.50 **Dy** 66	164.93 **Ho** 67	167.26 **Er** 68	168.93 **Tm** 69	173.04 **Yb** 70	173.04 **Lu** 71
Actinide Series	232.04 **Th** 90	231.04 **Pa** 91	238.03 **U** 92	237.05 **Np** 93	**Pu** 94	**Am** 95	**Cm** 96	**Bk** 97	**Cf** 98	**Es** 99	**Fm** 100	**Md** 101	**No** 102	**Lr** 103

A PERIODIC CHART OF THE ELEMENTS
(Based on ^{12}C)