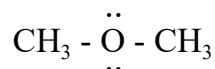
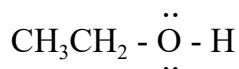


All Sections
December 4, 2022

3. (3 pts) Which gases, N_2O , C_2H_2 , NO , diffuse **faster** than O_2 under identical experimental conditions? (atomic weights: $\text{N} = 14.01$, $\text{O} = 16.00$, $\text{C} = 12.01$, $\text{H} = 1.008$)
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 is 140.0 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) $\text{CH}_3\text{CH}_2\text{F}$ London forces, dipole-dipole forces
 - e) $\text{CH}_3\overset{\text{O}}{\parallel}\text{CCH}_3$ 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. (**Give a short explanation for your choices**, 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)



- Which compound(s) has(have) **only London forces**?
- Which compound(s) has(have) **Dipole-Dipole** forces?
- Which compound(s) can form **H-bonds** between molecules (as a pure substance)?
- Which compound should have the **highest** heat of vaporization, ΔH_{vap} ?

8. (3 pts) Which of the following statements is **INCORRECT**?

- Br_2 has a **higher** boiling point than Cl_2 .
- H_2S has **stronger** London forces than H_2O .
- The vapor pressure of solid He is **higher** than the vapor pressure of solid Ne at a given temperature.
- $\text{CH}_3\text{-CH}_2\text{-OH}$ has a **greater** viscosity than $\text{CH}_3\text{-O-CH}_3$.
- 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 °C to its boiling point (357 °C) and then vaporize it? (specific heat of liquid Hg = 0.138 J/g•°C, $\Delta H_{\text{vap}} = 292 \text{ J/g}$)
10. (6 pts) A substance has a $\Delta H_v = 20.0 \text{ kJ/mol}$. It has a vapor pressure of 0.800 atm at -2.00 °C. What is its **normal boiling point**?

USEFUL INFORMATION

$$R = 0.08206 \text{ L-atm/mol-K} = 8.3145 \text{ J/mol-K}$$

$$\text{Avogadro's number} = 6.02 \times 10^{23} \text{ particles/mole}$$

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

$$\text{molar volume at STP} = 22.41 \text{ L}$$

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

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

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

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

	IA	IIA	IIIB	IVB	VB	VIB	VII B	VIII B				IB	II B	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 Uu 110	272 Uub 111	277 Uut 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 ¹²C)