

TEST 4, FORM A
CHEM 1110, SPRING 2011

You may use a calculator on this test.

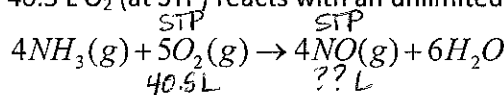
Part I: Multiple Choice (60 pts) – clearly circle the best answer.

1. Which one of the following has the highest boiling point?

- a. I₂ London
b. Xe London
D c. CH₃CH₂OH H-bonding
d. KF ion-ion

2. What volume of NO is produced at STP when 40.5 L O₂ (at STP) reacts with an unlimited amount of ammonia?

- a. 40.5 L NO
B b. 32.4 L NO
c. 50.6 L NO
d. None of these



$$40.5 \text{ L O}_2 \times \frac{4 \text{ L NO}}{5 \text{ L O}_2} = 32.4 \text{ L NO}$$

3. What is the partial pressure of N₂ in a mixture if the mole percent of N₂ is 65.9% and the total pressure is 742 mmHg?

- a. 742 mmHg
b. 1130 mmHg
C c. 489 mmHg
d. 8.88 x 10⁻⁴ mmHg

$$P_{\text{N}_2} = X_{\text{N}_2} P_{\text{total}} = (0.659)(742 \text{ mmHg}) = 489 \text{ mmHg}$$

4. Whose gas law states that volume is inversely proportional to pressure?

- a. Avogadro
b. Gay-Lussac
D c. Charles
d. Boyle

5. _____ is the resistance to flow.

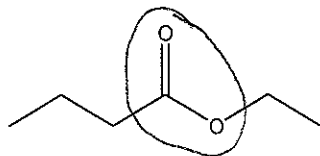
- a. Wetting
b. Surface tension
D c. Boiling point
d. Viscosity

6. Which of the following ranks intermolecular/interparticle forces from strongest to weakest?

- a. Hydrogen bonding, Dipole-Dipole, Ion-Ion, London Dispersion
B b. Ion-Ion, Hydrogen bonding, Dipole-Dipole, London Dispersion
c. London Dispersion, Dipole-Dipole, Hydrogen bonding, Ion-Ion
d. London Dispersion, Ion-Ion, Dipole-Dipole, Hydrogen bonding

7. What is the main functional group in the following molecule?

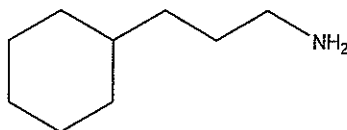
- A a. Ester
b. Amine
c. Aldehyde
d. Ketone



8. What is the main functional group in the following molecule?

- a. Alcohol
- b. Alkene
- c. Amine
- d. Aldehyde

C



9. Which of the following is not contained within RNA molecules?

- a. deoxyribose
- b. phosphate linkages
- c. hydrogen bonding
- d. nitrogen containing organic bases

A

10. What would be the complimentary base pairing for this nucleotide sequence, TAGCGCCAAT?

- a. TAGCGCCAAT
- b. ATGCGCCTTA
- c. TACGCGGAAT
- d. ATCGCGGTTA

ATCGCGGTTA

D

11. _____ is the phase change that occurs when a gas ^{goes} directly to a solid.

- a. Sublimation
- b. Deposition
- c. Condensation
- d. Freezing

B

12. Which of the following statements is true about an ideal gas?

- a. A gas is ideal over all ranges of temperatures and pressure.
- b. Ideal gas molecules react with one another.
- c. Gases are compressible.
- d. The volume of the gas molecule is very important when determining volume of an ideal gas.

C

13. The rate of diffusion (or effusion) of a molecule is inversely related to:

- a. The number of atoms in the molecule.
- b. The molar mass of the molecule.
- c. The number of electrons in the molecule.
- d. The polarity of the molecule.

B

14. Which of the following is NOT contained in a protein molecule?

- a. Amino acids
- b. Peptide linkages
- c. Nucleotides
- d. All of these

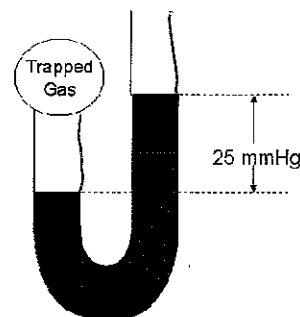
C

15. What is the pressure of the trapped gas (in atm) in the barometer if the atmospheric pressure is 717 mmHg?

- a. 0.911 atm
- b. 692 atm
- c. 742 atm
- d. 0.976 atm

D

$$\begin{aligned} P_{\text{gas}} &> P_{\text{atm}} \\ P_{\text{gas}} &= 717 \text{ mmHg} + 25 \text{ mmHg} \\ &= 742 \text{ mmHg} \times \frac{1 \text{ atm}}{760 \text{ mmHg}} \\ &= 0.976 \text{ atm} \end{aligned}$$



Part II: Short Answer/Calculations (40 pts) – clearly show all work for full credit.

1. (10 pts) Consider the curve below:

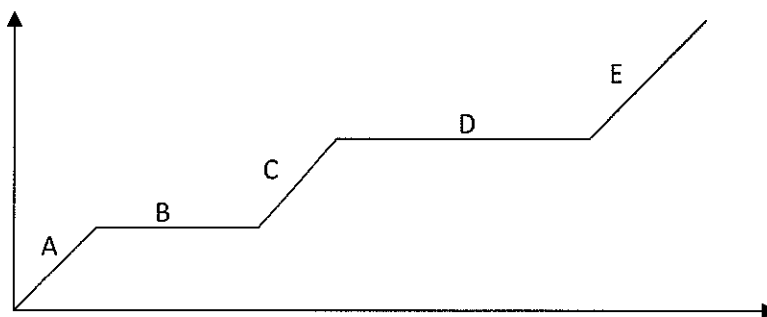
a. Give the phase(s) present at locations: A: solid, B: solid/liquid,
C: liquid, D: liquid/gas, and E: gas

b. What phase changes occur at the locations indicated below?

B: melting and D: boiling

c. Give the labels for the x-axis: heat added and the y-axis: temperature

d. What type of curve is this? heating curve



2. (10 pts) A 75.0g sample of N_2O is confined in a 3.1 L container. What is the pressure (in atm) at $155^\circ C$? (MM of $N_2O = 44.02 \text{ g/mol}$)
 $m = 75.0g$ $V = 3.1L$ $T = 155^\circ C + 273 = 428K$

$$PV = \frac{m}{MM} \cdot RT$$

$$P = \frac{mRT}{MM \cdot V} = \frac{(75.0g)(0.0821 \frac{L \cdot atm}{mol \cdot K})(428K)}{(44.02 \text{ g/mol})(3.1L)} = \boxed{19. \text{ atm}}$$

3. (10 pts) A 93.0 L sample of dry air cools from $145^\circ C$ to $-22^\circ C$ while the pressure is maintained at 2.85 atm. What is the final volume?

$$P_1 = P_2$$

$$V_1 = 93.0L$$

$$V_2 = ??L$$

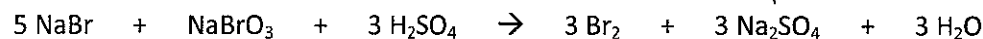
$$T_1 = 145^\circ C + 273 = 418K$$

$$T_2 = -22^\circ C + 273 = 251K$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$V_2 = \frac{V_1 \cdot T_2}{T_1} = \frac{(93.0L)(251K)}{418K} = \boxed{55.8L}$$

4. (10 pts) How many liters of gaseous elemental bromine (Br_2) at 300°C and 0.855 atm are formed by the reaction of 275 g of sodium bromide with excess sodium bromate and sulfuric acid? (MM of $\text{NaBr} = 102.89 \text{ g/mol}$)



275 g NaBr

$$T = 300^\circ\text{C} + 273 = 573 \text{ K}$$

$$P = 0.855 \text{ atm}$$

$$V = ?$$

$$275 \text{ g NaBr} \times \frac{1 \text{ mol NaBr}}{102.89 \text{ g NaBr}} \times \frac{3 \text{ mol Br}_2}{5 \text{ mol NaBr}} = 1.60 \text{ mol Br}_2$$

$$PV = nRT$$

$$V = \frac{nRT}{P} = \frac{(1.60 \text{ mol})(0.0821 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}})(573 \text{ K})}{0.855 \text{ atm}}$$

$$= 88.0 \text{ L}$$

IA																										VIIIA			
1	H 1.008																										2	He 4.00	
3		4											5	6	7	8	9	10											
2		Li 6.94	Be 9.01											B 10.81	C 12.01	N 14.01	O 16.00	F 19.00	Ne 20.18										
3		11	12											13	14	15	16	17	18										
		Na 22.99	Mg 24.31	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	Al 26.98	Si 28.09	P 30.97	S 32.06	Cl 35.45	Ar 39.95										
4		19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36										
		K 39.10	Ca 40.08	Sc 44.96	Ti 47.90	V 50.94	Cr 52.00	Mn 54.94	Fe 55.85	Co 58.93	Ni 58.71	Cu 63.55	Zn 65.37	Ga 69.72	Ge 72.59	As 74.92	Se 78.96	Br 79.90	Kr 83.80										
5		37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54										
		Rb 85.47	Sr 87.62	Y 88.91	Zr 91.22	Nb 92.91	Mo 95.94	Tc [98]	Ru 101.1	Rh 102.9	Pd 106.4	Ag 107.9	Cd 112.40	In 114.8	Sn 118.7	Sb 121.8	Te 127.60	I 126.90	Xe 131.30										
6		55	56	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86										
		Cs 132.9	Ba 137.3	La 175	Hf 178.5	Ta 181	W 183.9	Re 186.2	Os 190.2	Ir 192.2	Pt 195.1	Au 197	Hg 200.59	Tl 204.4	Pb 207.2	Bi 209	Po [209]	At [210]	Rn [222]										
7		87	88	103	104	105	106	107	108	109	110	111	112	113	114	115	116		118										
		Fr [223]	Ra [226]	Ac [227]	Rf [267]	Db [268]	Sg [271]	Bh [272]	Hs [270]	Mt [276]	Ds [281]	Rg [280]	Uub [285]	Uut [284]	Uuq [289]	Uup [288]	Uuh [293]		Uuo [294]										
		57	58	59	60	61	62	63	64	65	66	67	68	69	70														
		La 138.9	Ce 140.1	Pr 140.9	Nd 144.2	Pm [145]	Sm 150.4	Eu 152	Gd 157.3	Tb 158.9	Dy 162.5	Ho 164.93	Er 167.3	Tm 168.9	Yb 173														
		89	90	91	92	93	94	95	96	97	98	99	100	101	102														
		Ac [227]	Th 232	Pa [231]	U 238	Np [237]	Pu [244]	Am [243]	Cm [247]	Bk [247]	Cf [251]	Es [252]	Fm [257]	Md [258]	No [259]														