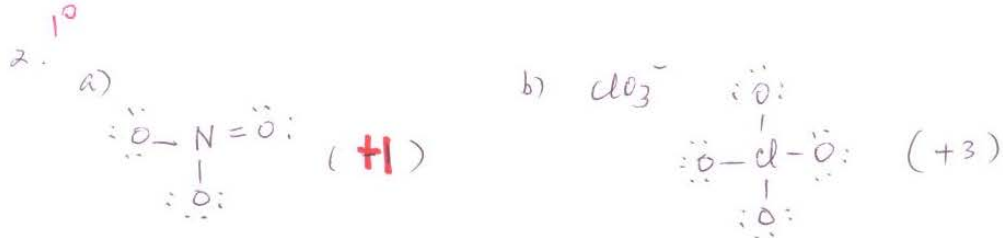


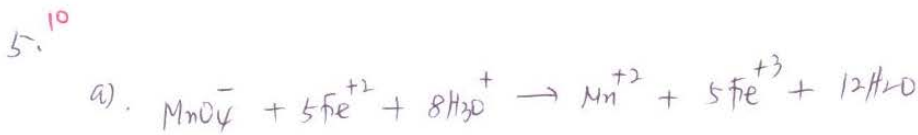
기초화학 (2004) 중간과제 평가

1. ¹⁰
- ① ^{비결합} C-C bond length > C-C or C=C 이 옳다
- ② ^{비결합} C-C bond energy > C-C or C=C 이 옳다



3. ¹⁰
- a) pyramidal (SN=4)
- b) trigonal planar (SN=3)

4. ¹²
- | | | | |
|-----------------|----------------|---|---|
| KCl | D | 1 | ionic bond |
| HCl-HCl | C B | | H-bond |
| Cl ₂ | A C | | covalent bond |
| Ar-Ar | A | | London dispersion (Van der Waals) force |



b) mole of $\text{FeCl}_2 = 0.1 \text{ mol KMnO}_4 \times 5 = 0.5 \text{ mole}$
 molar mass of $\text{FeCl}_2 = 55.85 + 35.45 \times 2 = 126.75$
 $\therefore \text{g of FeCl}_2 = 126.75 \text{ g} \times 0.5 \text{ mol} = \underline{63.375 \text{ g}}$

6. ¹⁰

Hexane in vapor = $0.198 \text{ atm} \times 0.5 = 0.099 \text{ atm}$

$P_1 = X_1 P_1^0$

Heptane = $P_2 = X_2 P_2^0 = 0.5 \times 0.060 \text{ atm} = 0.03 \text{ atm}$

$P_{\text{total}} = P_1 + P_2 = 0.129 \text{ atm}$

\therefore mole fraction of hexane in vapor, $X_1' = \frac{0.099 \text{ atm}}{0.129 \text{ atm}} = \underline{0.78}$

7. 10

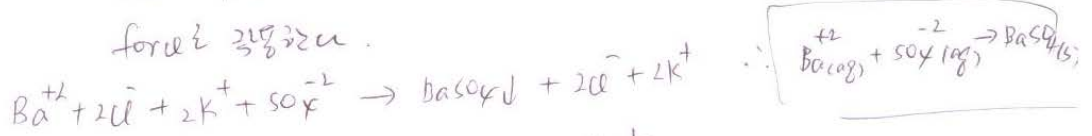
1. HCl-H₂O interaction of HCl-HCl, H₂O-H₂O 각각보다 크다.

2. HCl + H₂O → H₃O⁺ + Cl⁻ 이 이온화되기 때문에 attractive force 이 작용한다.

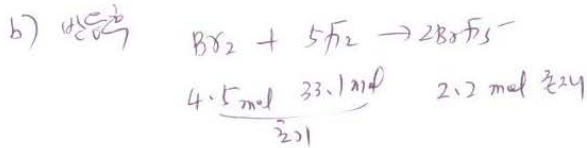
8. 10

9.

10



a) $BaCl_2$ mole fraction of $BaCl_2 = \frac{4.5}{4.5 + 33.1} = 0.12$



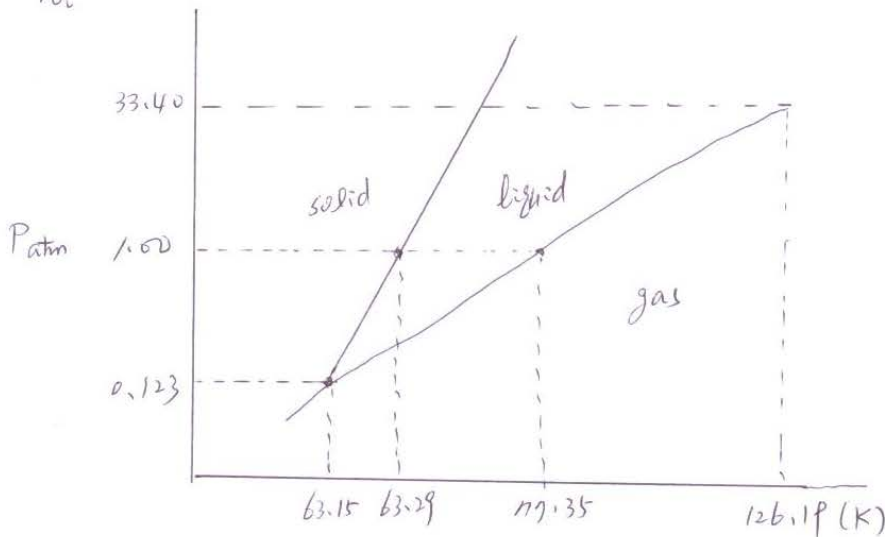
≈ 1 $BaCl_2 = 1.1 \text{ mol}$, $F_2 = 2.2 \text{ mol} \times \frac{5}{2} = 5.5 \text{ mol}$ 반응

$BaCl_2 = 4.5 - 1.1 = 3.4 \text{ mol}$
 $F_2 = 33.1 - 5.5 = 27.6 \text{ mol}$

$\therefore \text{total mole} = BaCl_2 \ 3.4 \text{ mol} + F_2 \ 27.6 \text{ mol} + BaF_2 \ 2.2 \text{ mol}$
 $= 33.2 \text{ mol}$

\therefore mole fraction of $BaCl_2 = \frac{3.4}{33.2} = 0.1$

10. 10



기초화학 기말고사 (2004)

담당교수 : 심홍구교수

2004. 6. 14(월)

- Bomb calorimeter에 들어있는 2 mole의 이상기체를 25°C에서 125°C로 가열하였을때 아래를 기체상수 R로 답하시오.(10점)
가) w (3점) 나) q (3점) 다) ΔE (4점)
- $C(s) + O_2(g) \rightarrow CO_2(g)$, $\Delta H_1 = -393.54 \text{ KJ}$
 $CO_2(g) \rightarrow CO(g) + \frac{1}{2}O_2(g)$, $\Delta H_2 = +283.0 \text{ KJ}$
위 반응식으로부터 아래 질문에 답하시오. (10점), 단 위 반응은 모두 1 atm, 25°C이다.
가) CO(g) 1 mole의 생성 enthalpy, ΔH 값은 몇 KJ인가?
나) 가) 반응식의 ΔE 값은 몇 KJ인가?
- Isothermal reversible에서 n mole 의 이상기체가 V_1 에서 V_2 로 부피 팽창되었다.
아래를 식으로 답하시오. (10점)
가) w (3점) 나) q (3점) 다) ΔS (4점)
- $-W_{\text{irrev}} < -W_{\text{rev}}$ 의 관계와 열역학 제1법칙을 이용하여 $\Delta S \geq \frac{q}{T}$ 를 증명하시오. (10점)
- 다음 물음에 답하시오. (10점)
가) $2Cl_2(g) + 2HgO(s) + H_2O(l) \rightleftharpoons HgO \cdot HgCl_2(g) + 2HOCl(aq)$
이 반응의 평형상수 K를 식으로 쓰시오.
나) $2NO_2(g) \rightleftharpoons N_2O_4(g)$, $\Delta H = -58 \text{ KJ}$ 에서 압력을 크게하면 평형상수 K 값은 어떻게 변하는가?
- 0.6 atm의 CO(g)와 1.10 atm 의 Cl₂(g)를 600°C에서 반응시켰다.
반응 후 평형에서 생성된 COCl₂(g)의 부분압력은 0.10 atm 이었다. (10점)
가) 평형상수 K값을 구하시오.
나) 위 평형이 완료된 후에 Cl₂ 기체를 0.20 atm 만큼 증가시켰을때 새로운 평형상수 K 값은?
- 아래 원자들의 전자 배치를 쓰시오. (10점)
가) $_{29}Cu$ 나) $_{21}Sc^+$
- 3d orbital에 대해 물음에 답하시오. (10점)
가) angular node 수는? (3점) 나) radial node 수는? (3점)
다) d orbital 5개를 쓰시오. (4점)

9. A gas expands against a constant external pressure of 2.00 atm until its volume has increased from 6.00 L to 10.00L. During this process it absorbs 500 J of heat from the surroundings. ($1 \text{ L} \cdot \text{atm} = 101.325 \text{ J}$). (10점)

가) Calculate the energy change of the gas ΔE

나) Calculate the work w done on the gas in an irreversible adiabatic($q=0$) process connecting the same initial and final states.

10. At 248°C and a total pressure of 1.000 atm, the fractional dissociation of SbCl_5 is 0.718 for the reaction



This means that 718 of every 1000 molecules for SbCl_5 originally present have dissociated. Calculate the equilibrium constant. (10점)

기초화학 기체역학 평형

단열과정 : $Q = 0$

1. 3가) $W = -P\Delta V$ 이거나 부피가 일정하므로 $W = 0$
 3나) $Q = nC_V\Delta T = 2 \text{ mol} \times \frac{5}{2}R (125^\circ - 25^\circ) = 300R$
 4가) $\Delta E = Q + W = 300R + 0 = 300R$

2. 5가) $C(s) + O_2(g) \rightarrow CO_2(g), \Delta H_1 = -393.54 \text{ kJ}$
 +) $CO_2(g) \rightarrow CO(g) + \frac{1}{2}O_2(g), \Delta H_2 = 283.0 \text{ kJ}$

 $C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g), \Delta H = \Delta H_1 + \Delta H_2 = -110.54 \text{ kJ}$

- 5나) $C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g)$
 $\Delta n = 1 \text{ mol} - \frac{1}{2} \text{ mol} = \frac{1}{2} \text{ mol}$
 $\Delta H = \Delta E + \Delta(PV)$
 $\therefore \Delta E = \Delta H - \Delta(PV) = \Delta H - \Delta(nRT) = \Delta H - RT\Delta n$
 $= -110.54 \text{ kJ} - (8.314 \text{ J})(298)(\frac{1}{2})$
 $= -111.7 \text{ kJ}$

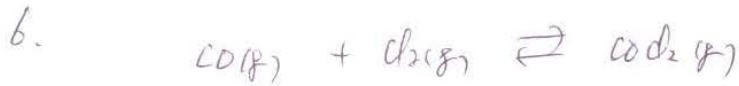
3. 3가) $W = -nRT \ln \frac{V_2}{V_1}$
 3나) $\Delta E = Q + W$ 이거나 $\Delta E = 0$ 이므로
 $Q = -W = nRT \ln \frac{V_2}{V_1}$
 3다) $\Delta S = \frac{Q}{T} \therefore \Delta S = nR \ln \frac{V_2}{V_1}$

$\Delta S = \frac{Q}{T}$ 여기서 기체 2몰

4. $-W_{\text{irrev}} < -W_{\text{rev}}$
 $\Delta E = -W_{\text{irrev}} + Q_{\text{irrev}} = W_{\text{rev}} + Q_{\text{rev}}$
 $-W_{\text{irrev}} < -W_{\text{rev}}$ 는 $W_{\text{irrev}} > W_{\text{rev}}$ 이므로
 $Q_{\text{irrev}} < Q_{\text{rev}}$ 이고 $\Delta S = \frac{Q_{\text{rev}}}{T}$ 이므로
 $\Delta S > \frac{Q_{\text{irrev}}}{T}$ 이다
 $\therefore \Delta S \geq \frac{Q}{T}$

5. 5 가) $K = \frac{(P_{\text{H}_2\text{O}} \cdot \text{H}_2\text{O}_2) [\text{HCl}]^2}{(P_{\text{Cl}_2})^2}$

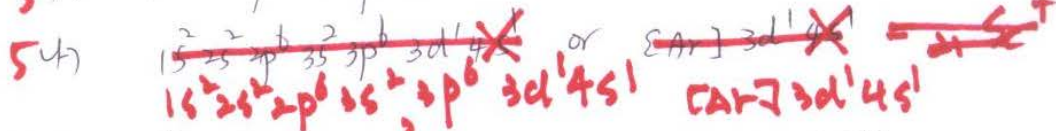
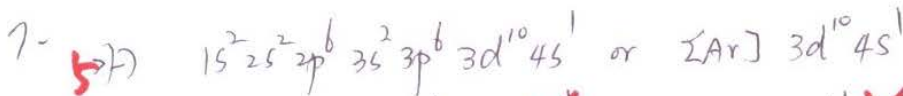
5 나) 변화량이 서로 동등 상리 다



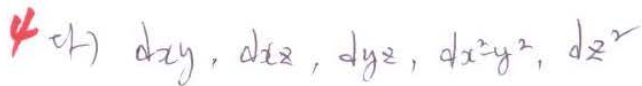
initial	0.60	1.10	0
change	-0.10	-0.10	+0.10
평형상태	0.50	1.00	0.10

5 가) $K = \frac{(0.10)}{(0.50)(1.00)} = 0.20$

5 나) K 값 변화 않 고 0.20



8. 3 가) $l = 2 > H$ 나) $n - l - 1 = 3 - 2 - 1 = 0 > H$



9. a) $w = -p\Delta V = -2.00 \text{ atm} (10.00 - 6.00 \text{ L}) = -8.00 \text{ L}\cdot\text{atm} = -811 \text{ J}$
 $\Delta E = q + w = 500 - 811 = -311 \text{ J}$

b) $\Delta E = -311 \text{ J}$
 $w = \Delta E - q = -311 \text{ J} - 0 = -311 \text{ J}$

10. 비 지

10.

924 To calculate the equilibrium constant requires the partial pressures of all three gases at equilibrium. Set up a three-line table:

	$\text{SbCl}_5(g)$	\rightleftharpoons	$\text{SbCl}_3(g)$	+	$\text{Cl}_2(g)$
Initial partial pressure (atm)	x		0.0		0.0
Change in partial pressure(atm)	$-0.718x$		$+0.718x$		$+0.718x$
Equilibrium partial pressure (atm)	$0.282x$		$0.718x$		$0.718x$

What is different here is that the original partial pressure of SbCl_5 is not known and is represented by an x . The total pressure at equilibrium is the sum of the partial pressures of the three gases and equals 1.000 atm:

$$1.000 \text{ atm} = P_{\text{SbCl}_5} + P_{\text{SbCl}_3} + P_{\text{Cl}_2} = 0.282x + 0.718x + 0.718x$$

Solving gives $x = 0.582$ atm. The equilibrium partial pressures of the three gases are now readily computed:

$$P_{\text{SbCl}_5} = 0.164 \text{ atm}; \quad P_{\text{SbCl}_3} = P_{\text{Cl}_2} = 0.418 \text{ atm}$$

Substitution in the equilibrium expression gives

$$\frac{P_{\text{SbCl}_3} P_{\text{Cl}_2}}{P_{\text{SbCl}_5}} = \frac{(0.418)(0.418)}{(0.164)} = 1.07 = K$$