ISLAMIC UNIVERSITYOF SCIENCE & TECHNOLOGY
DEPARMENT OF CHEMISTRY

M Sc. (3rdSemester) (Mid.term) **Max. Marks: 30**
Course Title: Chemical Thermodynamics and Solid State Chemistry (PCH-CC-303) **Time: 40mi**
Roll No:

1. For isothermal expansion of an ideal gas:
   a) $\Delta U = 0$
   b) $dq_{rev} = -dw$
   c) $dS = nR \ln V_2 / V_1$
   d) All of the above
2. If T and V are variables, then ΔS of a system is given by:
   a) $\Delta S = C_V \ln T_2 / T_1 + R \ln V_2 / V_1$
   b) $\Delta S = C_V \ln T_1 / T_2 + R \ln V_2 / V_1$
   c) $\Delta S = C_p \ln T_2 / T_1 + R \ln V_2 / V_1$
   d) $\Delta S = C_V \ln T_1 / T_2 + R \ln V_1 / V_2$
3. Match the following:

   (1) $\Delta H + T\left[\frac{\partial(\Delta G)}{\partial T}\right]_P$ (A) $\frac{-\Delta H}{T^2}$

   (2) $\Delta H^0 + \int_0^T \Delta C_P dT$ (B) ΔV

   (3) $[\frac{\partial(\Delta G/T)}{\partial P}]_P$ (C) ΔH_T

   (4) $\left[\frac{\partial(\Delta G)}{\partial P}\right]_T$ (D) ΔG

   a) 1-D, 2-A, 3-B, 4-C
   b) 1-D, 2-C, 3-A, 4-B
   c) 1-C, 2-B, 3-D, 4-A
   d) 1-C, 2-D, 3-B, 4-A
4. The expression for the mixture of idea gas is:
   a) $\Delta S = \Sigma_n (C_P \ln T - R \ln \chi - R \ln p + C'$
   b) $\Delta S = (C_P \ln T - R \ln \chi - R \ln p + C'$
   c) $\Delta S = \Sigma_n (C_V \ln T - R \ln \chi - R \ln p + C'$
   d) $\Delta S = \Sigma_n (C_P \ln T - R \ln \chi)$
5. One mole of O_2 is mixed with nine moles of nitrogen at 298 K, then:
   (I) Molar entropy of mixing
   (II) Entropy of mixing of one mole
   (III) Molar entropy of mixing of 9 moles of oxygen is mixed with one mole of nitrogen, is:
   a) Same in all cases
   b) Different in all cases
   c) Different in (I) and same in (II) and (III)
   d) None of the above
6. Work function and Gibbs free energy relations are:
   I. $-\Delta A = w$
   II. $\Delta A = w$
   III. $-\Delta G = w - p\Delta V$
   IV. $\Delta G = w + p\Delta V$
   a) II and III
   b) I and III
   c) II and IV
   d) None
7. The following relations are correct for a closed system with special conditions:
   a) $dG = -SdT$
   b) $\left(\frac{\partial G}{\partial T}\right)_P = -S$
   c) $\Delta G = RT \ln P_2 / P_1$
   d) All of the above
8. Which of the following is partial molar property?
   a) $\left(\frac{\partial V}{\partial n_i}\right)_{T,P,n_1,n_2.....}$
   b) $\left(\frac{\partial H}{\partial n_1}\right)_{T,P,n_1,n_2.....}$
   c) $\left(\frac{\partial E}{\partial n_1}\right)_{T,P,n_1,n_2.....}$
   d) All of the above
9. Partial molar property of work function is related as:
   a) $A_{i,m} = U_{i,m} - TS_{i,m}$
   b) $A_{i,m} = H_{i,m} - TS_{i,m}$
   c) $A_{i,m} = G_{i,m} - TS_{i,m}$
   d) None
10. Which of the following are intensive properties?
    a) $S_{i,m}$
    b) $V_{i,m}$
    c) $H_{i,m}$
    d) All of the above
11. If ΔG^0 is zero for a reaction, then:

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a) $\Delta H = 0$
b) $\Delta S = 0$
c) $K = 0$ (equilibrium constant)
d) $K = 1$

12. Chemical potential is defined as:
a) $\left(\frac{\partial G}{\partial n_i}\right)_{T,P,n_1,n_2.....}$
b) $\left(\frac{\partial G}{\partial n_1}\right)_{T,P,n_1,n_2.....}$
c) $\left(\frac{\partial H}{\partial n_i}\right)_{S,P,n_j.....}$
d) Both a) and c)

13. Which of the following is Gibbs-Duhem Equation:
a) $\Sigma \mu_i dn_i = 0$
b) $\Sigma n_i d\mu_i = 0$
c) $n_1 d\mu_1 + n_2 d\mu_2 = 0$
d) All of the above

14. Chemical potential of an ideal gas in a mixture is always:
a) $\mu_i < \mu_i^*$
b) $\mu_i > \mu_i^*$
c) $\mu_i = \mu_i^*$
d) $\mu_i \leq \mu_i^*$

15. If $\mu_{real} = \mu_{ideal}$
a) $\gamma = 1$
b) $\gamma = 0$
c) $\gamma > 1$
d) None of the above

16. If the observed molar volumes of ideal and real gases are equal,and also if $f = 1$ atm. $P_{ideal} = 4atm$,then pressure in real gas is:
a) 2atm.
b) 4 atm.
c) 1 atm.
d) None

17. Gibbs-Duhem-Margules equation can be written as:
a) $\frac{\chi_1}{p_1} dp_1 \Big/ d\chi_1 = \frac{\chi_2}{p_2} dp_2 \Big/ d\chi_2$
b) $\frac{p_1}{\chi_1} dp_1 \Big/ d\chi_1 = \frac{p_2}{\chi_2} dp_2 \Big/ d\chi_2$
c) $\frac{\chi_1}{p_1} d\chi_1 \Big/ dp_1 = \frac{\chi_2}{p_2} d\chi_2 \Big/ dp_2$
d) None

18. Konovalov`s 1st and 2nd law are:
a) $\chi_1 < y_1; \chi_1 = y_1$
b) $\chi_1 > y_1; \chi_1 = y_1$
c) $\chi_1 = y_1; \chi_1 > y_1$
d) None

19. The departure or deviation (α) from ideal behavior is defined by:
a) $\frac{RT}{P} - V$
b) $\frac{RT}{P} + V$
c) $\frac{-RT}{P} - V$
d) None

20. Which of the following is/are correct?
a) $f / P = \gamma$
b) $f = P \exp\left[\frac{1}{RT}\int_0^P V_m(real) - V_m(ideal)\, dP\right]$
c) $f = P \exp\left[\int_0^P \frac{Z-1}{P} dP\right]$
d) All of the above

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