

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted during the academic year 2011-12 & thereafter)

SUBJECT CODE: 11CH/MC/PC44

B.Sc. DEGREE EXAMINATION, APRIL 2015
BRANCH IV - CHEMISTRY
FOURTH SEMESTER

Reg. No

COURSE : MAJOR – CORE
PAPER : PHYSICAL CHEMISTRY- I
TIME : 30 MINUTES

MAX. MARKS : 30

SECTION – A

TO BE ANSWERED ON THE QUESTION PAPER ITSELF.

ANSWER ALL THE QUESTIONS.

(30x1=30)

I. Choose the correct answer:

- Partial molar free energy is
(i) $(\partial H/\partial n_i)_{T,P,n_j}$ (ii) $(\partial G/\partial n_i)_{T,P,n_j}$ (iii) $(\partial G/\partial n_i)_{S,P,n_j}$ (iv) $(\partial H/\partial n_i)_{S,V,n_j}$
- Spontaneity of a reaction is accompanied by
(i) decrease in entropy (ii) increase in internal energy
(iii) decrease in free energy (iv) decrease in enthalpy
- In an isothermal process
(i) T remains constant (ii) P remains constant
(iii) V remains constant (iv) none of the above
- $C_p - C_v$ is equal to
(i) gas constant (ii) Plank's constant
(iii) vander Waal's constant (iv) Boltzmann constant
- Joule – Thomson coefficient is
(i) $(\partial T/\partial P)_H$ (ii) $(\partial H/\partial T)_P$ (iii) $(\partial H/\partial T)_V$ (iv) $(\partial T/\partial P)_V$
- Dissolution of ammonia in water is accompanied by
(i) increase in enthalpy (ii) decrease in enthalpy (iii) no change in enthalpy (iv) none
- Resonance energy of benzene is
(i) 100 kJ (ii) 125 kJ (iii) 151 kJ (iv) 176 kJ
- Efficiency of a heat engine working between 25°C and 110°C is
(i) 100 % (ii) 20% (iii) 50% (iv) 40%

9. When ice melts entropy
 (i) remains same (ii) increases (iii) decreases (iv) becomes zero
10. Boltzmann entropy equation is
 (i) $S = k \ln W$ (ii) $S = W \ln K$ (iii) $S = \ln W / K$ (iv) $S = \ln k/W$

II. Fill in the Blanks:

11. Gibbs – Duhem equation is -----.
12. Standard state for a liquid is -----.
13. Activity of a solid in the pure state is -----.
14. Nernst heat theorem is -----.
15. Heat capacity of a solid at 25°C is -----.
16. Chemical potential is a -----.
17. Vapourisation of water is a -----.
18. Unit of vander Waal's constant 'a' is -----.
19. Inversion temperature is -----.
20. Formation of ammonia from N_2 and H_2 is a ----- process.

III. State true or false:

21. In real gases fugacity replaces pressure.
22. Heat capacity of solids decrease with increase in temperature.
23. Le Chatelier principle is applicable for equilibrium reactions.
24. Temperature is an intensive variable.
25. Entropy of crystalline solids is zero at 0K.

IV. Match the following:

26. $(\partial H / \partial n_i)_{S, V, n_j}$ (i) $RT \ln (1/K_p)$
27. ΔG° (ii) V
28. $(\partial G / \partial P)_T$ (iii) $-S_i$
29. $(\partial \mu / \partial T)_P$ (iv) f_i / f_i°
30. a_i (v) $(\partial G / \partial n_i)$



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PAPER : PHYSICAL CHEMISTRY-I
TIME : 2 ½ HOURS **MAX. MARKS : 70**

SECTION – B

ANSWER ANY FIVE QUESTIONS: (5x6=30)

1. State and explain zeroth law of thermodynamics.
2. Derive Kirchoff's equation.
3. What is partial molar free energy? How does it vary with pressure and temperature?
4. Explain – Criteria for reversible and irreversible processes.
5. Derive an expression for work done in a reversible isothermal expansion of an ideal gas.
6. Distinguish the terms-(i) extensive and intensive variables (ii) open and closed systems.
7. Write a note on thermodynamic scale of temperature.

SECTION – C

ANSWER ANY TWO QUESTIONS: (2x20=40)

8. (a) State the third law of thermodynamics. Explain how the absolute entropy of a substance be determined with the help of it? (10)
(b) Derive Gibbs- Helmholtz equation for a process at constant pressure and at constant volume. (6)
(c) Calculate ΔS if one mole of an ideal gas is heated from 27°C to 227°C at constant volume. (4)
9. (a) Explain the terms fugacity and activity . (4)
(b) Derive Clasius- Clapeyron equation and explain its applications. (12)
(c) Calcualte the entropy of mixing of one mole of oxygen gas and two moles of hydrogen gas assuming that the mixture behaves ideally. (4)

10. (a) State and explain Hess's law of constant heat summation and discuss any two of its applications. (10)
- (b) Discuss the need for the second law of thermodynamics. (5)
- (c) The free energy change accompanying a given process is -85.77kJ at 25°C and -83.68 kJ at 35°C . Calculate the change in enthalpy for the process at 30°C . (5)
11. Give an account of the following 5x4=20
- | | |
|-----------------------------|------------------------------|
| (i) Maxwell's relations | (ii) Le Chatlier's Principle |
| (iii) Joule –Thomson effect | (iv) Significance of entropy |
