**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI-86**
**(For candidates admitted during the academic year 2015–16 & thereafter)**

**SUBJECT CODE: 15CH/MC/PC54**

**B.Sc. DEGREE EXAMINATION, NOVEMBER 2017**
**BRANCH IV- CHEMISTRY**
**FIFTH SEMESTER**

**COURSE : MAJOR CORE**
**PAPER : PHYSICAL CHEMISTRY-II**
**TIME : 3 HOURS** **MAX.MARKS :100**

**SECTION – A (30x1=30)**

**Answer all the questions.**

**I. Choose the Correct Answer:**

1. The variation of enthalpy of reaction with temperature is given by
   (a) Arrhenius equation (b) Kirchoff equation
   (c) Hesss's law (d) Clausius – Clapeyron equation.
2. The maximum efficiency of a steam engine operating between $100^oC$ and $25^oC$ is
   (a) 22.2% (b) 20% (c) 25% (d) 30%
3. The temperature at which a compound melts into a liquid of the same composition of solid is called the
   (a) congruent melting point (b) incongruent melting point
   (c) peritectic temperature (d) metastable point.
4. The law which relates the solubility of a gas to its pressure is
   (a) Raoult's law (b) Henry's law (c) Nernst law (d) Ostwald's law
5. At equilibrium of a chemical reaction, $\Delta G$ is
   (a) zero (b) positive (c) negative (d) none of the above
6. When a solid melts, entropy
   (a) decreases (b) increases (c) becomes zero (d) none
7. Chemical potential is partial molar
   (a) free energy (b) heat content (c) volume (d) entropy
8. Liquid phase exists for all composition in aphase diagram above the
   (a) tie line (b) solvus (c) solidus (d) liquidus.
9. For an endothermic reaction at constant pressure
   (a) $\Delta H=0$ (b) $\Delta H>0$ (c) $\Delta H<0$ (d) $\Delta G<0$
10. For an ideal gas $C_p$is equal to
    (a) $C_v$ - R (b) $C_v$+ R (c) $C_v/R$ (d) $R/C_v$.

**II. Fill in the blanks:**

11. In ---------- process, volume of the system remains constant.
12. In a reversible process , the entropy is ----------.
13. Reduced phase rule is ----------.
14. $\Delta H_{mix}$ is ---------- for an ideal solution.
15. $K_P$ = ----------.
16. When a non volatile solid is added to a solvent the vapour pressure of the solvent ---------

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17. An example of a partially miscible liquid pair is ----------.
18. For reversible reactions $K_p$ and $K_c$ will be ----------.
19. Process of mixing is always accompanied by ---------- in entropy.
20. In an isothermal change PV is ----------.

**III. State whether true or false:**

21. Work is a path function.
22. Entropy of all solids is zero at absolute zero temperature.
23. A mixture of benzene and toluene is an ideal solution.
24. Catalyst shifts the equilibrium to the right.
25. Solutions having same osmotic pressure are called ----------.

**IV. Answerin a line or two:**

26. State Raoult's law.
27. What is a heat engine?
28. Give examples of freezing mixtures.
29. Define activity and activity coefficient.
30. State Lever rule.

**SECTION – B** **(5x6=30)**

**Answer any FIVE questions:**

31. State and explain Henry's law. Give its limitations.
32. Discuss the phase diagram of $CO_2$ system.
33. Give the different statements of second law of thermodynamics.
34. What is chemical potential? How does it vary with pressure and temperature?
35. Derive an expression for the entropy of mixing of an ideal gas.
36. Derive vant Hoff isotherm.
37. State Le Chatlier's principle. Discuss the effect of temperature and pressure on the following equilibrium

$$N_2O_{4(g)} \rightleftharpoons 2\,NO_{2(g)} \quad ; \quad \Delta H = +59.0 \text{ kJ mol}^{-1}$$

**SECTION-C**

**Answer any TWO questions:** **(2x20=40)**

38. (a) Discuss the phase diagram of water.
    (b) (i) State and explain Nernst distribution law
    (ii) Explain the applications and limitations of this law. (10+10)

39. (a) Derive Gibbs- Helmholtz equation.
    (b) Calculate q, w, E and H for the reversible isothermal expansion of an ideal gas at $27^oC$ from a volume of 1 $dm^3$ to a volume of 8 $dm^3$.
    (c) Discuss the applications of Clausius – Clapeyron equation. (5+7+8)

40. (a) Derive $K_p$ and $K_c$ for the formation of $PCl_5$.
    (b) Discuss the principle of fractional distillation with a suitable example. (10+10)