

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI-86
(For candidates admitted during the academic year 2004-05 & thereafter)

SUBJECT CODE: CH/MC/PC54

B.Sc. DEGREE EXAMINATION, NOVEMBER 2007
BRANCH IV- CHEMISTRY
FIFTH SEMESTER

REG.NO

COURSE : MAJOR CORE
PAPER : PHYSICAL CHEMISTRY-II
TIME : 30 MINUTES

MAX.MARKS : 30

SECTION – A (30x1=30)

ANSWER ON THE QUESTION PAPER ITSELF.

Answer all the questions.

I. Fill in the blanks :

1. A crystal system which does not possess element of symmetry is _____.
2. NaCl has FCC structure. The number of Na^+ and Cl^- ions in the unit cell is _____ and _____ respectively.
3. Diffraction occurs when the wave length of the electromagnetic radiation is comparable with _____.
4. In neutron diffraction the fast moving neutrons are first converted into _____ neutrons.
5. The cryoscopic constant of a solvent can be evaluated by measuring depression in freezing point of solution having concentration _____.
6. Substance existing in more than one crystalline forms possessing different physical properties is referred to as _____.
7. A mixture distills over completely at a constant temperature like a pure chemical compound is called _____.
8. The temperature at which the partially miscible liquid pair becomes miscible at all proportions is known as _____.
9. Solubility of a gas at constant pressure _____ with rise in temperature.
10. The condensed phase rule is given as _____.

II Match the following :

- | | |
|-----------------------------|----------------------------------|
| 11. Vant' Hoff factor | a) Easy melting |
| 12. Enantiotropy | b) Lever rule |
| 13. Eutectic | c) Degree of association |
| 14. Fractional distillation | d) Polymorphism |
| 15. Distribution law | e) Critical solution temperature |
| | f) Partition coefficient |

III Choose the correct answer :

16. The freezing point of 0.01 molal aqueous solution of NaCl will be
a) 273 K b) below 273 K c) 274K d) 276 K
17. The number of components and number of degrees of freedom of an aqueous solution of NaCl is
a) C=3; F=3 b) C=2; F=1 c) C=2; F=3 d) C=2; F=2
18. The crystal plane for which the interplanar spacing $d_{hkl} = \frac{a}{\sqrt{2}}$ is
a) 110 b) 111 c) 221 d) 222
19. The triple point is the point where
a) three components are in equilibrium
b) the number of degrees of freedom is 3.
c) two components are in equilibrium.
d) the number of degrees of freedom is zero.
20. Isotonic solutions have
a) the same freezing point
b) the same boiling point
c) the same surface tension
d) the same osmotic pressure

IV Substantiate the following:**4x2½ =10**

21. Diffraction of visible light onto the crystals does not occur.
22. Osmotic pressure of 0.1 Molal. NaCl solution and that of Urea are not the same.
23. Diamond is hard whereas graphite is used as a lubricant.
24. It is possible to recover only 95.6% of ethanol from ethanol-water system through distillation.

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TIME : 2 ½ HOURS

MAX.MARKS : 70

SECTION – B

(5x6=30)

Answer any five questions:

1. What are liquid crystals? How are they classified? Mention their applications.
2. a) Draw the planes in a cube corresponding to the following Miller indices. (3)
(i) 222 (ii) 110
b) Calculate the angle at which diffraction will occur in an X-ray spectrometer, when X-rays of wavelength 1.55\AA is used. Given that the interplanar distance is 4.05\AA .
3. Determine the number of components, phases and degrees of freedom for the following system. (3)
a) $H_2O(s) \rightleftharpoons H_2O(l) \rightleftharpoons H_2O(g)$.
b) $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$
c) $Na_2SO_4 \cdot 10H_2O \rightleftharpoons Na_2SO_4(s) + 10H_2O(g)$
d) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$
e) $N_2O_4(g) \rightleftharpoons 2NO_2(g)$
f) $NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$ when $p_{NH_3} = p_{HCl}$.
4. Draw schematically the phase diagram for water and apply Gibb's phase rule to it.
5. State the distribution law. Under what conditions is the law valid? How is the law derived from thermodynamic consideration?
6. Write short notes on (i) Efflorescence (ii) deliquescence with suitable examples.
7. Acetic acid associates in benzene to form double molecules, 1.70 g of acetic acid when dissolved in 100g of benzene raised the boiling point by 0.41°C . calculate the Vant'Hoff factor ($k_b = 2.57 \text{ k kg mol}^{-1}$).

SECTION – C

(2x20=40)

Answer any two questions:

8.
 - a) Describe the theory of neutron diffraction? How is it different from X-ray diffraction? Mention few applications of it.
 - b) Draw a neat sketch illustrating various axes of symmetry and planes of symmetry in a cube and work out the symmetry operations for each.

9. Draw and discuss the phase diagrams for the following systems bringing out their significance.
 - (i) Lead-silver system.
 - (ii) Ferric chloride-water system.

10.
 - a) Obtain the expression for depression in freezing point based on thermodynamic considerations.
 - b) Explain the terms osmosis and osmotic pressure. Derive Van't Hoff equation for the osmotic pressure of a dilute solution. How is the equation utilized for determining molar mass of a solute?

4.
 - a) Discuss the solubility of binary systems of partially miscible liquids with a special reference to phenol-water system.
 - b) Write short notes on
 - (i) Fractional distillation
 - (ii) Steam distillation

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