

B.SC DEGREE END SEMESTER EXAMINATION OCTOBER 2016
SEMESTER - 5: CHEMISTRY (CORE COURSE)
COURSE: U5CRCHE7 - STATES OF MATTER

Time: Three Hours

Max.Marks: 60

SECTION A

*Answer **all** questions. Each question carries **1 mark***

1. Give the co-ordination number of cation in the ionic crystal, AX when the limiting radius ratio, $\left(\frac{r_{A^+}}{r_{X^-}}\right)$ is 0.225
2. Name the rotation axis symmetry element possessed by silicate tetrahedral (SiO_4)
3. Find the Miller indices of the planes intersect the crystallographic axes at the distances (3a, 2b, c) and (2a, α b, α c) where a, b and c are unit distances in three axes.
4. How many formula mass of NaCl present in a unit cell of NaCl.
5. Name experimental method for the measurement of surface tension.
6. 1 atm pressure = Nm^{-2}
7. Find the most probable velocity of gas molecules when their root mean square velocity is 5×10^4 cm/s.
8. Define collision frequency. (1 x 8 = 8)

SECTION B

*Answer any **Six** questions. Each question carries **2 marks***

9. How many Bravais lattices are possible for all the seven crystal systems. Name the Bravais lattices of cubic crystal system.
10. Calculate the separation of (111) planes in cubic crystal with unit cell dimension, $a = 1\text{nm}$.
11. Define law of constancy of interfacial angle. Name the instrument used to measure the interfacial angle.
12. Define co-efficient of viscosity (η) and give the equation to determine ' η '.
13. State BET theory of adsorption. Which parameter is obtained from BET equation to find the surface area of the adsorbent.

14. How the angle of diffraction of the first and second order diffraction for the (100) and (200) planes respectively in cubic crystal relates.
15. Define Boyle temperature. Give an expression for Boyle temperature in terms of van der Waals constant.
16. What is the mean free path of hydrogen gas at 25°C and a pressure of atm. Given $d = 2.86 \text{ \AA}$, collision cross section of the molecules, $\sigma = \pi d^2$, $1 \text{ atm} = 1.01325 \times 10^5 \text{ N/m}^2$, k , Boltzmann constant $= 1.3806 \times 10^{-23} \text{ J/K}$. (2 x 6 = 12)

SECTION C

Answer any **Four** questions. Each question carries **5 marks**

17. What are Non-Stoichiometric defects. How does it influence the crystal nature.
18. Differentiate zinc blende and wurtzite structure of zinc sulphide.
19. Define Boyle's law and Charles's law. Deduce it from kinetic model of gas.
20. Differentiate between metal and semiconductor using band theory. How does temperature influence the conductivity of the metal and semiconductor.
21. Copper crystallize in cubic close packing with unit cell edge, $a = 3.6 \text{ \AA}$. Calculate the density of copper metal. (Atomic Weight of Cu = 63.5 amu)
22. Differentiate between surface tension and surface energy. Discuss on their units. (5 x 4 = 20)

SECTION D

Answer any **Two** questions. Each question carries **10 marks**

23. What is meant compressibility factor, Z of a gas. How it relates to molecular interactions. Formulate and explain the van der Waals equation of state.
24. a) What are liquid crystals. Explain the different types of liquid crystals (5 marks)
 b) Define superconductivity and give an example for superconducting material. Describe the challenges and later developments in superconducting material research. (5 marks)
25. Derive Bragg's equation. Explain experimental methods of crystal structure analysis using Bragg method and powder method.

26. How isotherm of real gas differ at a temperature above and below its critical temperature, T_c . What do you understand by “continuity of state” and “critical constants”?

(10 x 2 = 20)