



**DOON UNIVERSITY, DEHRADUN**

**End Semester Examination, December, 2017**

**School of Physical Sciences**

**Integrated M.Sc. Chemistry**

**Course: CYC-102: States of Matter & Ionic Equilibrium (1<sup>st</sup> Semester)**

*Time Allowed: 3 Hours.*

*Maximum Marks: 30*

Note: Attempt All Questions

**SECTION: A**

**Attempt All Questions.**

*(Marks: 4Q × 1/2= 2)*

1. What are units of van der Waals constants 'a' and 'b'.
2. Does solution of NaCl act as buffer. Explain your answer.
3. What are color centers in solids?
4. The intercept ratio of a plane on the crystallographic axes is 2a:3b:2c. Calculate Miller Indices of the plane.

*(Marks: 2Q × 1= 2)*

5. Calculate the volume occupied by 1 mol of slightly imperfect gas at 4.75 atm at 17°C. The second virial coefficients being 0.028 lt/mol.
6. Calculate molecular diameter of He given that  $b=2.4 \times 10^{-5} \text{ m}^3/\text{mol}$ .

**SECTION: B**

**Attempt All Questions.**

*(Marks: 7 Q × 2=14)*

7. Explain, what is meant by critical constants of a gas.
8. Using the principle of equipartition of energy and taking various degrees of freedom of motion into consideration, estimate the value of  $C_v$  for  $\text{SO}_2$  molecule.
9. How does surface tension, viscosity and vapor pressure changes with change in temperature.
10. What are lattice planes of a crystal? What is meant by (100), (110) and (111) planes of cubic lattices?
11. What is the collision frequency and collision density? Write the equation relating these two and explain their physical significance.

12. Write a note on types of solids mention their physical properties and forces in action.
13. Compare the capillary rise of water and mercury in a glass tube of 2 mm diameter at 20°C. Given that the surface tension of water and mercury at 20°C are 0.0736 N/m and 0.051N/m, respectively. Contact angles of water and mercury are 0° and 130° respectively.

### SECTION: C

Attempt All Questions.

(Marks:4 Q × 3=12)

14. State postulates of kinetic Gas equation and give suitable justification for the postulates. Also point out those assumptions which later not found valid for real gases.
15. Drive an expression for kinetic gas equation and deduce Boyle's law from the derived equation in terms of kinetic energy. Calculate the RMS velocity of oxygen molecules at 140°C and 98 cm pressure.
16. What is the equation for the fraction of gas molecule with speed in a certain range according to Maxwell distribution law of speeds? Also illustrate the effect of temperature on: (i) the distribution and (ii) the most probable speed, with the help of a diagram.
17. What are metal excess and metal deficiency defects? How are these created in the ionic solids? What are their consequences on the properties of solids?