



**2019/TDC/ODD/SEM/CHMHCC-102T/131**

**TDC (CBCS) Odd Semester Exam., 2019**

**CHEMISTRY**

**( 1st Semester )**

Course No. : CHMHCC-102T

**( States of Matter and Ionic Equilibrium )**

Full Marks : 50

Pass Marks : 20

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

**SECTION—A**

**( Marks : 20 )**

Answer **ten** questions, taking **two** from each Unit

**UNIT—I**

1. Show that the mean free path of a gas at constant volume is directly proportional to temperature. 2
2. Calculate various degrees of freedom for the following : 2
  - (a) HCl
  - (b) C<sub>6</sub>H<sub>6</sub>



3. Prove that the molecular velocity of any gas is proportional to the square root of absolute temperature. 2

UNIT—II

4. Write the dimension and significance of van der Waals' constant  $a$ . 2
5. Calculate the value of critical compressibility factor  $Z_c$ . 2
6. Write the Dieterici equation and explain the terms. 2

UNIT—III

7. What are cohesion and adhesion forces? 2
8. Explain the term 'cybotactic group'. 2
9. What is viscosity of a liquid? How does viscosity vary with temperature? 2

UNIT—IV

10. Write the cell parameters for the most unsymmetric unit cell. 2

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11. Explain the term 'F-centre'. 2

12. What do you mean by the term 'plane of symmetry'? 2

UNIT—V

13. Write the solubility product expression for aluminium sulphide. 2
14. Calculate the pH of  $10^{-9}$  M HCl solution. 2
15. "Aqueous  $\text{CuSO}_4$  solution is acidic or alkaline." Explain the statement. 2

SECTION—B

( Marks : 30 )

Answer **five** questions, taking **one** from each Unit

UNIT—I

16. (a) Deduce the kinetic gas equation. 3
- (b) Calculate the temperature at which the root mean square velocity, the average velocity and the most probable velocity of oxygen gas are all equal to  $1500 \text{ ms}^{-1}$ . 3

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( Turn Over )



17. (a) Find out the number of molecules of an ideal gas per litre at (i) 300 K and 1 atm pressure and (ii) 400 K and 2 atm pressure. 2
- (b) What is the effect of temperature and pressure on the coefficient of viscosity? 2
- (c) Deduce an expression for mean free path relating to temperature. 2
- UNIT—II
18. (a) Derive the van der Waals' equation for real gas. 3
- (b) One mole of  $\text{SO}_2$  gas occupies a volume of 350 mL at  $27^\circ\text{C}$  and 50 atm pressure. Calculate the compressibility factor of the gas. Comment on the type of deviation shown by the gas from ideal behaviour. 2+1=3
19. (a) Show that for a van der Waals' gas, the Boyle temperature is  $T_B = \frac{a}{Rb}$ . 3
- (b) Mention the difference between real and ideal gases.  $1\frac{1}{2}$
- (c) Write the expression for reduced equation of state and explain the terms.  $1\frac{1}{2}$

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## UNIT—III

20. (a) Describe the process of determination of a liquid using Ostwald's viscometer. 3
- (b) Equal volume of an organic liquid and water gave 55 drops and 25 drops respectively. The densities of liquid and water are  $0.80\text{ g cm}^{-3}$  and  $0.96\text{ g cm}^{-3}$ . Find the surface tension of organic liquid, if that of water is  $7.2 \times 10^{-2}\text{ Nm}^{-1}$ . 3
21. (a) What is radial distribution function? How is it used for elucidation of structure of liquid? 2+2=4
- (b) What do you mean by 'free volume' in a liquid? 2

## UNIT—IV

22. (a) Write the difference between symmetry element and symmetry operation. 2
- (b) Explain the following terms : 2
- (i) Primitive unit cell
- (ii) Non-primitive unit cell

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- (c) What do you mean by stoichiometric defect? 2
23. (a) Draw the different types of unit cell which are defined as  $\alpha = \beta = \gamma = 90^\circ$  and  $a = b = c$ . 3
- (b) Write the symmetry operations for any two of the following molecules : 3
- (i)  $H_2O$
- (ii)  $CO_2$
- (iii)  $NH_3$
- (iv)  $O_2$

## UNIT—V

24. (a) Mention two limitations of pH scale. 2
- (b) Explain the common ion effect with reference to wet test for basic radical in Gr-III(A). 2
- (c) 10 mL of  $10^{-3} M Na_2SO_4$  is mixed with 20 mL of  $10^{-4} M BaCl_2$ . Predict whether barium sulphate will precipitate or not if its solubility product is  $10^{-7}$ . 2

25. (a) Calculate the pH of a mixture obtained by mixing 30 mL of 0.25 M  $CH_3COOH$  and 60 mL of 0.65 M  $CH_3COONa$ . ( $K_a = 1.2 \times 10^{-3}$ ) 3
- (b) Derive the expression for the hydrolysis constant, degree of hydrolysis and pH for hydrolysis of a salt of strong acid and weak base. 3

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