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)

$$\frac{Full\ Marks\ :\ 50}{Pass\ Marks\ :\ 20}$$

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_6H_6

(*Turn Over*)

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

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 $CuSO_4$ 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 $1500 \ m \, s^{-1}$.   3

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 SO_2 gas occupies a volume of 350 mL at 27 °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 $T_B = \dfrac{a}{Rb}$.   3

(b) Mention the difference between real and ideal gases.   1½

(c) Write the expression for reduced equation of state and explain the terms.   1½

(Continued)

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 $0.80 \, g \, cm^{-3}$ and $0.96 \, g \, cm^{-3}$. Find the surface tension of organic liquid, if that of water is $7.2 \times 10^{-2} \, Nm^{-1}$.　　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

(c) What do you mean by stoichiometric defect? 2

23. (a) Draw the different types of unit cell which are defined as $\alpha = \beta = \gamma = 90°$ 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

(Continued)

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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