TDC (CBCS) Odd Semester Exam., 2018

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—1

1. Write two important postulates of kinetic theory of gases. 2

2. Calculate the most probable velocity of oxygen molecule at 27 °C. 2

3. Define collision frequency and collision diameter. 1+1=2

UNIT—2

4. What are the causes of deviation of real gas from ideal behaviour? 2

5. What is Boyle's temperature? State the law of corresponding states. 1+1=2

6. Draw isotherms of carbon dioxide at the following temperatures : ½×4=2

   (a) 13·1 °C

   (b) 21·5 °C

   (c) 31·1 °C

   (d) 35·5 °C

UNIT—3

7. Define angle of contact for a liquid that *(a)* wets glass and *(b)* does not wet glass. 1+1=2

8. What are surface active agents? Give examples. 2

9. Distinguish between Newtonian and non-Newtonian liquids. 2

UNIT—4

10. State the law of rational indices. 2

11. What are Bravais lattices? 2

12. Define glass and liquid crystal. 1+1=2

UNIT—5

13. Define pH. Calculate the pH of 100 ml *M*/50 HCl solution. 1+1=2

14. Give the theory of acid-base indicators, taking methyl orange as an example. 2

15. Give two applications of solubility product principle. 2

SECTION—B

(*Marks* : 30)

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

UNIT—1

16. Give an account of Maxwell's distribution of velocities. Explain graphically how the velocity changes with temperature. 4+2=6

17. Discuss the principle of equipartition of energy. Calculate the average internal energy of a diatomic molecule at 27 °C using law of equipartition of energy. 3+3=6

UNIT—2

18. *(a)* Starting from van der Waals' equation, obtain an expression for critical constants in terms of van der Waals' constants *a* and *b*. 3

(b) The critical temperature and critical pressure of chlorine are 146 °C and 93·5 atm respectively. Calculate the values of van der Waals' constants *a* and *b*. Also find its critical volume. 2+1=3

19. *(a)* Describe virial equation of state for real gases. 3

(b) What is the molar volume of $N_2(g)$ at 500 K and 600 atm according to *(i)* the perfect gas law and *(ii)* the virial equation? Given the virial coefficient *B* of $N_2(g)$ at 500 K is $0 \cdot 0169\ L\,mol^{-1}$. 1+2=3

UNIT—3

20. *(a)* Describe drop number method for the determination of surface tension of a liquid using stalagmometer. 4

(b) Explain the cleansing action of soaps and detergents. 2

21. *(a)* Write Poiseuille's equation. Use this equation to determine the relative viscosity of a liquid experimentally. Mention the name of the apparatus used for the purpose. 1+3+1=5

(b) Show that 1 Pa.s = 10 poise. 1

UNIT—4

22. Derive Bragg's equation. How can this equation be used to determine the structure of NaCl? 4+2=6

23. Differentiate between Weiss and Miller indices. Calculate the Miller indices of crystal planes which cut through the crystal axes at—

(a) (2*a*, 3*b*, *c*);

(b) (6*a*, 3*b*, 3*c*);

(c) (2*a*, −3*b*, −3*c*). 3+3=6

UNIT—5

24. *(a)* Derive expressions for the hydrolysis constant, degree of hydrolysis and pH for hydrolysis of ammonium nitrate salt. 3

(b) Calculate the solubility of $BaSO_4$ at 298 K in *(i)* pure water and *(ii)* 0·05 (*M*) $BaCl_2$ solution. Given solubility product of $BaSO_4$ at 298 K is $1·5 \times 10^{-9}$. 1+2=3

25. *(a)* Derive Henderson equation for basic buffer solution. What is buffer capacity? 3+1=4

(b) Draw acid-base titration curves for—

(i) NaOH *vs.* HCl titration (conductometric);

(ii) CH_3COOH *vs.* KOH titration (conductometric). 1×2=2

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