1 SEM TDC CHMH (CBCS) C 2

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(Nov/Dec)

CHEMISTRY

(Core)

Paper : C–2

(Physical Chemistry)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

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

1. Choose the correct answer from the following : 1×3=3

   (a) If the volume of a gas molecule is v, then the excluded volume is

   (i) $2v$

   (ii) $\frac{1}{2}v$

   (iii) $3v$

   (iv) $4v$

(b) With the increase in temperature, the viscosity of a liquid

   (i) increases

   (ii) decreases

   (iii) at first increases and then decreases

   (iv) remains same

(c) Solution *A* has pH = 3 and solution *B* has pH = 6. Find the correct statement from the following.

   (i) Solution *A* is twice as acidic as *B*.

   (ii) Solution *B* is twice as acidic as *A*.

   (iii) Solution *A* is 1000 times more acidic than *B*.

   (iv) Solution *B* is 1000 times more acidic than *A*.

2. Answer any *four* from the following questions :   2×4=8

(a) Explain why the viscosity of a gas increases with increase of temperature.

(b) Mention the physical significances of van der Waals' constants *a* and *b*.

(c) Frenkel defect is not shown by alkali metal halides but silver halides show. Explain.

(d) Explain ionic product of water. What is the effect of temperature on it?

(e) The surface tension of a liquid vanishes at its critical temperature. Explain.

UNIT—I

3. Answer any *two* from the following questions :   7×2=14

(a) *(i)* Deduce the reduced equation of states from van der Waals' equation of states and state the law of corresponding states from it.   3+1=4

   (ii) State the law of equipartition of energy. Calculate the various degrees of freedom for H_2O and CO_2 molecules.   1+1+1=3

(b) *(i)* Deduce van der Waals' equation of states for a real gas.   4

   (ii) Define Boyle's temperature.   1

(iii) Calculate the temperature at which the root-mean-square velocity of CO_2 gas is same as that of Cl_2 gas at 293 K. 2

(c) (i) Briefly describe the Maxwell's law of distribution of molecular velocities. Discuss the effect of temperature on it. 2+2=4

(ii) Write kinetic gas equation. Deduce Charles' law from it. 1+2=3

Unit—II

4. Answer any *one* from the following questions : 5

(a) Define coefficient of viscosity. Write its SI unit. Describe the laboratory method for determining the coefficient of viscosity of a liquid. 1+1+3=5

(b) (i) Briefly discuss the cleansing action of detergents. 2½

(ii) In the determination of surface tension of a liquid by drop number method using stalagmometer, the liquid gave 58 drops while water gave 24 drops, the volume of the liquid and water being the same. The density of water is 0·998 g/ml while that of the liquid is 0·795 g/ml. If the surface tension of water at the given temperature is 70·8 dyne/cm, then calculate the surface tension of the liquid. 2½

Unit—III

5. Answer any *two* from the following questions : 4½×2=9

(a) (i) Define unit cell. Name the seven crystal systems. Which of them is the most symmetrical and which one is the most unsymmetrical? 1+1+1=3

(ii) State and explain the law of constancy of interfacial angles. 1½

(b) (i) Derive Bragg's equation. 3

(ii) Calculate the Miller indices of a crystal plane which cuts through the crystal axes at $(2a, -3b, -3c)$. 1½

(c) (i) What are liquid crystals? Classify them giving one example of each. 3

(ii) Briefly discuss some of the applications of liquid crystals. 1½

UNIT—IV

6. Answer any *two* from the following questions : 7×2=14

(a) (i) Define salt hydrolysis. Derive an expression for the pH of an aqueous solution of a salt of strong base and weak acid. 1+3=4

(ii) Calculate the degree of hydrolysis, hydrolysis constant and pH of $0.02\ M$ of aqueous solution of sodium acetate. The dissociation constant of acetic acid is 1.8×10^{-5}, $k_w = 10^{-14}$. 1+1+1=3

(b) (i) What are buffer solutions? Write briefly about the applications of buffers in biological systems and in agriculture. 1+2=3

(ii) What is buffer capacity? 1

(iii) Derive Henderson equation for a basic buffer solution. 3

(Continued)

(c) (i) What is common ion effect? Write the difference between ionic product and solubility product. 1+2=3

(ii) Explain why ZnS is precipitated in alkaline medium whereas CuS is precipitated in acidic medium. 2

(iii) Deduce the relation between solubility and solubility product for As_2S_3. 2

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