TDC Even Semester Exam., 2019

CHEMISTRY

(Honours)

(2nd Semester)

Course No. : CHMH–203

(Physical Chemistry)

Full Marks : 35

Pass Marks : 12

Time : 2 hours

The figures in the margin indicate full marks for the questions

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

UNIT—I

1. *(a)* Define the 'most probable velocity' and obtain its expression from the Maxwell distribution function. 1+2=3

(b) State the principle of 'equipartition of energy' and mention its limitations. 1+1=2

(c) In a gas mixture, 20% molecules have a velocity of 5 $ms^{\ 1}$, 30% have 9 $ms^{\ 1}$ and the rest 20 $ms^{\ 1}$. Find the root mean square velocity. 2

2. *(a)* Draw a curve showing the pressure dependence of the compressibility factor (z) in case of H_2 and He. How can you account for the observed result with the help of van der Waals' equation? 1+1+1=3

(b) Graphically show the variation of the Maxwell distribution function at different temperatures and explain. 1+1=2

(c) Calculate the mean free path of the molecules of a gas (4 0 Å) at 1 atm and 300 K. 2

UNIT—II

3. *(a)* Write down an expression for 'Langmuir adsorption isotherm' and graphically show the variation. 2+1=3

(b) State the differences between physisorption and chemisorption. 2

(c) "Adsorption is an exothermic process." Comment. 2

4. *(a)* Derive an expression for the determination of surface area of finely divided solid using BET adsorption isotherm. 2

(b) Discuss the factors affecting the adsorption of CO on charcoal. 3

(c) From the following data for adsorption of N_2 gas on a solid surface, calculate the constant involved in the Langmuir adsorption isotherm :

$$p \quad , v \quad 180 \text{ cc/gm}$$

$$p \quad 3 \ 5 \text{ atm}, v \quad 100 \text{ cc/gm}$$

(v volume of gas adsorbed) 2

Unit—III

5. *(a)* Discuss the principle of determination of bond dissociation energy with one suitable example. 4

(b) The heat of neutralization of HCN (aq) is 3000 cal at 25 °C by a strong alkali. What is the heat of dissociation of HCN? Given : HCN (aq) H (aq) CN (aq). 3

6. *(a)* State and explain integral and differential heat of solution. 2+2=4

(b) The heat of combustion of liquid ethanol into CO_2 and liquid water is –327 kcal at constant pressure. Calculate the heat of reaction at constant volume (q_v). The temperature is maintained at 27 °C. 3

Unit—IV

7. *(a)* Discuss the salient features of phase diagram of nicotine-water system. 4

(b) Assuming Henry's law regarding the solubility of a gas in a liquid, show that the volume of a gas dissolved in unit volume of a given solvent is independent of pressure. 3

8. *(a)* Show that the concentrations of a solute distributed between two phases at equilibrium at a constant temperature bear a fixed ratio. 5

(b) Calculate the volume of N_2 dissolved per litre of water in equilibrium with water at 20 °C, the partial pressure being 0·80. Given, Henry's law constant, $K \quad P_{N_2} / X_{N_2} \quad 8 \quad 10^4$, where X_{N_2} is expressed in mole fractions. 2

Unit—V

9. *(a)* Describe, in brief, different types of 'computer languages'. 4

(b) What are binary numbers? Perform the following binary addition : 2+1=3

1000100
11010

10. *(a)* Discuss, in brief, different components of a computer. 4

(b) What is meant by an 'operating system'? Convert the following decimals into binary : 1+2=3

135, 276

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