

(58) Seat No.: _____

No. Of printed pages: 02

SARDAR PATEL UNIVERSITY

B.Sc. (II SEM) EXAMINATION

FRIDAY, 21st October, 2016

02:30pm – 04:30pm

US02CCHE02- PHYSICAL CHEMISTRY

TOTAL MARKS: 70

Note: Figures to the right indicate full marks.

Q.1 Choose an appropriate answer for each of the following.

10

- Which one of the following is not correct postulate of kinetic theory of gases?
(a) The volume of the gas is due to the large number of molecules present in it
(b) The average K.E. of the gas molecules is directly proportional to the absolute temperature of the gas
(c) The molecules of the gas are continuously moving in different directions with different velocities
(d) The pressure of the gas is due to hitting of the molecules on the walls of the container
- The Normal boiling point of any liquid is related to the critical temperature T_C by the expression
(a) $\frac{2}{3}T_b$ (b) $\frac{3}{3}T_C$ (c) $\frac{1}{3}T_C$ (d) $\frac{3}{4}T_C$
- The surface tension of a liquid vanishes roughly at above critical temperature
(a) 4^0 (b) 6^0 (c) 9^0 (d) 3^0
- The units of surface tension and viscosity of a liquid are, respectively
(a) $\text{kg m}^2 \text{s}^{-1}$, N m^{-1} (b) $\text{kg m}^{-1} \text{s}^{-1}$, N m^{-1}
(c) N m^{-1} , $\text{kg m}^{-1} \text{s}^{-1}$ (d) N m^{-1} , $\text{kg m}^2 \text{s}^{-1}$
- The Reynolds number for the laminar flow of a liquid through a pipe is approximately
(a) 3500 (b) 4000 (c) 4200 (d) 2000
- With increase in temperature vapour pressure of a liquid..... while surface tension.....
(a) decreases, increases (b) increases, increases
(c) decreases, decreases (d) increases, decreases
- Which out of the following is not an extensive property?
(a) mass (b) volume (c) energy (d) density
- For a cyclic process the change in internal energy of the system is
(a) always positive (b) always negative
(c) equal to zero (d) equal to infinity
- The differential rate law of reaction: $\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$.
(a) Rate = $k [\text{H}_2]^{1/2} [\text{Br}_2]^{1/2}$ (b) Rate = $k [\text{H}_2] [\text{Br}_2]^{1/2}$
(c) Rate = $k [\text{H}_2] [\text{Br}_2]$ (d) Rate = $k [\text{H}_2]^{1/2} [\text{Br}_2]$
- 75% of a first order reaction was completed in 56 minutes. When was 50% of the reaction completed?
(a) 29 minutes (b) 39 minutes (c) 8 minutes (d) 4 minutes

Q.2 Answer the following. (Any Ten)

20

- Give the characteristics of second order reaction.
- Prove that the excluded volume per molecule is four times of the actual volume of the gas molecule.
- Why $\Delta H = \Delta E$ for reactions in which only liquids and solids are involved? Derive the relation between ΔH and ΔE in which gases are involved in the reaction.
- Write units of Vander Waal's constants a and b.
- Explain the "Hole theory".
- Show that $\Delta E = q_v$
- What is meant by differential rate law and integrated rate law?

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(P.T.O)

8. Define refractive index and give its mathematical expression.
 9. If concentration is measured in moles per litre and time in second then what will be the units of rate constant for first and second order reaction.
 10. Explain effect of temperature on surface tension of a liquid.
 11. Give the two important properties of a state function.
 12. State and give mathematical expression of law of conservation of energy.

Q.3

- [A] Discuss the experimental method for determination of T_c , P_c and V_c . 06
 [B] Give the main postulate of kinetic molecular theory of gases. 04

OR

- [A] Discuss the Vander Waal's corrections for pressure and volume in ideal gas equation and hence derive equation of state. 06
 [B] Calculate the critical temperature of ethane if its boiling point is -84.7°C . 04

- Q.4 Explain the surface tension of liquid. Describe in detail the Capillary rise method and double capillary rise method to measure surface tension of a liquid. 10

OR

- Q.4 Describe the Ostwald's viscometer method for the measurement of viscosity of liquid and also prove that $1 \text{ poise} = 10^{-1} \text{ kg m}^{-1} \text{ sec}^{-1}$. 10

Q.5

- [A] Derive the equation proving that enthalpy values depend on temperature. 05
 [B] When 78 gm of benzene is burnt completely in oxygen to form liquid water and CO_2 gas, ΔH is -781 Kcal at 25°C . Calculate the value of ΔE of this reaction at constant volume. 05

OR

- [A] State Hess's law of constant heat summation and also give its applications. 05
 [B] Define Heat Capacity. Establish the relation between C_p and C_v . 05

Q.6

- [A] State and explain the principle of detailed balancing for single step and multi step reaction. 06
 [B] A first order reaction is 50% completed in 20 minutes. How long will it take to be 60% completed? 04

OR

- [A] Derive the integrated rate law for second order reaction and give its characteristics. 06
 [B] For the reaction $2\text{NO} + \text{Cl}_2 \longrightarrow 2\text{NOCl}$. 04
 It is found that doubling the concentration of both reactants, increases the rate by a factor of eight, but doubling the chlorine concentration alone only doubles the rate. What is the order of reaction with respect to NO and Cl?

— X —
 (2)