

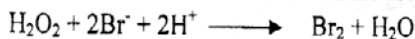
[12]

SARDAR PATEL UNIVERSITY**B.Sc. Examination, IInd - Semester****Monday, 4th April 2016****TIME: 10:30 A.M. To 12:30 P.M.****US02CCHE02 - PHYSICAL CHEMISTRY****Total Marks: 70****Q.1 Choose the correct option and write the answer :****[10]**

- The value of compressibility factor Z for Vander Waals equation at high pressure is
(a) $Z = 1 + Pb/RT$ (b) $Z = 1 + a/RT$ (c) $Z = 1 - Pb/RT$ (d) $Z = a/RTV$
- The excluded volume is _____ times the actual volume of gas molecule.
(a) Five (b) Four (c) Seven (d) Eight
- In capillary rise method, the surface tension of liquid is given by the expression _____.
(a) $\gamma = h\rho g/2$ (b) $\gamma = h\rho g/3$ (c) $\gamma = h\rho g$ (d) $\gamma = 2 h\rho g$
- Which of the following has maximum viscosity?
(a) Nitrobenzene (b) Glycerol (c) Ethyl ether (d) Water
- An adiabatic expansion of an ideal gas always has _____.
(a) Increase in temperature (b) $W = 0$ (c) $q = 0$ (d) $H = 0$
- For exothermic reactions, ΔH is _____ while for endothermic reaction it is _____.
(a) positive, negative (b) positive, positive
(c) negative, negative (d) negative, positive
- Which is true for isobaric process?
(a) $dP = 0$ (b) $dP < 0$ (c) $dP > 0$ (d) none of these
- The rate constant for zeroth order reaction has unit _____.
(a) sec^{-1} (b) $\text{mole lit}^{-1} \text{sec}^{-1}$ (c) $\text{lit. mole}^{-1} \text{sec}^{-1}$ (d) none of these
- The sum of power to which the concentration of a substance appears in the rate expression is known as _____.
(a) rate of reaction (b) order of reaction w.r. to that substance
(c) overall order of reaction (d) molecularity of reaction
- The rate of chemical reaction indicates the change in the concentration of a reactant or a product per _____.
(a) unit pressure (b) unit time (c) unit temperature (d) none of these

Q.2 Answer the following : (Attempt any ten)**[20]**

- Show graphically the effect of temperature on deviations from ideal behavior.
- Obtain the units of Vander Waals constants 'a' and 'b'.
- Write the definition of Critical temperature and Critical volume.
- Define Refractive Index. Explain the term involve in the formula for refractive index.
- Prove that 1 Poise is equal to $10^{-1} \text{kgm}^{-1} \text{sec}^{-1}$.
- Define: (1) Vaporisation (2) Vapour pressure
- Define state function and give its two important properties.
- Define: (1) Isolated system (2) Thermodynamic equilibrium
- Show that $\Delta H = q_p$
- Give the characteristics of second order reaction.
- What is meant by Differential rate law and Elementary process .
- Write mechanism and rate law of the following reaction.



Q.3 (a) State the basic postulates of kinetic theory of gases which are affected at high pressure and low temperature. [06]

(b) Calculate the critical temperature of Vander Waals gas for which P_c is 100 atm. and b is $50 \text{ cm}^3 \text{ mole}^{-1}$. ($R=0.8206 \text{ dm}^3 \text{ atm}^{-1} \text{ mole}^{-1}$) [04]

OR

Q.3 (a) Establish the relation between critical constants and Vander Waal's constants. [06]

(b) For oxygen gas the Vander Waal's constant ' b ' is $0.0318 \text{ dm}^3 \text{ mole}^{-1}$. Calculate diameter of oxygen molecule. [04]

Q.4 Define the term viscosity. Describe the Ostwald's viscometer method for the measurement of viscosity of liquid. Discuss the effect of temperature on viscosity. [10]

OR

Q.4 Define surface tension. How will you measure surface tension of a liquid by capillary rise method. Discuss the effect of temperature on surface tension. [10]

Q.5 (a) Define work and derive the expression for work associated with pressure volume change. [06]

(b) Calculate ΔH and ΔE when 1 mole of ice melt at 0°C and constant pressure of 1 atm., 1440 cal. of heat are absorbed by the system. The volumes of ice and water are 0.0196 and 0.0180 litre respectively. [04]

OR

Q.5 (a) Derive the equation which shows the temperature dependence of enthalpy change. [06]

(b) Calculate the heat of formation of H_2SO_4 using the data given below. [04]

(i) Enthalpies of formation of $\text{SO}_2(\text{g})$ and $\text{H}_2\text{O}(\text{l})$ are -70.9 and -68.4 K cal/mole.

(ii) Heat of combustion $\text{SO}_2(\text{g})$ to $\text{SO}_3(\text{g})$ is -23.49 Kcal/mole.

(iii) $\text{SO}_3(\text{g}) + \text{H}_2\text{O}(\text{l}) \longrightarrow \text{H}_2\text{SO}_4(\text{l}); \quad \Delta H = -31.14 \text{ Kcal/mole}$

$\text{S}(\text{s}) + 2\text{O}_2(\text{g}) + \text{H}_2(\text{g}) \longrightarrow \text{H}_2\text{SO}_4(\text{l}), \quad \Delta H_f^\circ = ?$

Q.6 (a) What is Integrated rate law? Derive Integrated rate law for first order reaction and give its characteristics. [06]

(b) The time for 50% completion of a certain second order reaction is 150 minutes. When the initial concentration is 0.08 M, calculate the rate constant of the reaction. How much time will it take to consume 75% reactant? [04]

OR

Q.6 (a) State and explain the principle of detailed balancing for single-step and multi-step reaction. [06]

(b) The rate constant of one reaction is $1 \times 10^{-4} \text{ min}^{-1}$ at 27°C and $2 \times 10^{-4} \text{ min}^{-1}$ at 37°C . Calculate the activation energy of this reaction. [04]

($R=1.987 \text{ cal. mole}^{-1} \cdot \text{deg}^{-1}$).

