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SARDAR PATEL UNIVERSITY

B.Sc. Examination, II[nd] - Semester

Monday, 4[th] 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]**

1. The value of compressibility factor Z for VanderWaals equation at high pressure is
   (a) Z = 1+Pb/RT (b) Z = 1+a/RT (c) Z = 1 - Pb/RT (d) Z = a/RTV
2. The excluded volume is _____ times the actual volume of gas molecule.
   (a) Five (b) Four (c) Seven (d) Eight
3. In capillary rise method, the surface tension of liquid is given by the expression___.
   (a) $\Upsilon = hr\rho g/2$ (b) $\Upsilon = hr\rho g/3$ (c) $\Upsilon = hr\rho g$ (d) $\Upsilon = 2\, hr\rho g$
4. Which of the following has maximum viscocity?
   (a) Nitrobenzene (b) Glycerol (c) Ethyl ether (d)Water
5. An adiabatic expansion of an ideal gas always has _____.
   (a) Increase in temperature (b) W = 0 (c) q = 0 (d) H = 0
6. For exothermic reactions, ΔH is _____ while for endothermic reaction it is _____
   (a) positive,negative (b) positive,positive
   (c) negative, negative (d) negative, positive
7. Which is true for isobaric process?
   (a) dP = 0 (b) dP < 0 (c) dP > 0 (d) none of these
8. The rate constant for zeroth order reaction has unit _____.
   (a) sec^{-1} (b) mole lit^{-1} sec^{-1} (c) lit. $mole^{-1}$ sec^{-1} (d) none of these
9. The sum of power to which the concentration of a substance appears in the rate expression is known as _____.
   (a) rate of reaction (c) overall order of reaction
   (b) order of reaction w.r. to that substance (d) molecularity of reaction
10. 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]**

1. Show graphically the effect of temperature on deviations from ideal behavior.
2. Obtain the units of Vander Waals constants 'a' and 'b'.
3. Write the definition of Critical temperature and Critical volume.
4. Define Refractive Index. Explain the term involve in the formula for refractive index.
5. Prove that 1 Poise is equal to $10^{-1} kgm^{-1} sec^{-1}$.
6. Define: (1) Vaporisation (2) Vapour pressure
7. Define state function and give its two important properties.
8. Define: (1) Isolated system (2) Thermodynamic equilibrium
9. Show that $\Delta H = q_p$
10. Give the characteristics of second order reaction.
11. What is meant by Differential rate law and Elementary process .
12. Write mechanism and rate law of the following reaction.
    $H_2O_2 + 2Br^- + 2H^+ \longrightarrow Br_2 + H_2O$

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 Pc is 100 atm. and b is 50 cm^3 $mole^{-1}$. (R=0.8206 dm^3 atm^{-1} $mole^{-1}$) **[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 dm^3 $mole^{-1}$. 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 0^0C 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 $SO_{2(g)}$ and $H_2O_{(l)}$ are -70.9 and -68.4 K cal/mole.

(ii) Heat of combustion $SO_{2(g)}$ to $SO_{3(g)}$ is -23.49 Kcal/mole.

(iii) $SO_{3(g)} + H_2O_{(l)} \longrightarrow H_2SO_{4(l)}$; ΔH = -31.14 Kcal/mole

$S_{(s)} + 2O_{2(g)} + H_{2(g)} \longrightarrow H_2SO_{4(l)}$, ΔH^0_f = ?

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 $1x10^{-4}min^{-1}$ at 27^0C and $2x10^{-4}$ min^{-1} at 37^0C. Calculate the activation energy of this reaction. **[04]**

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

BEST WISHES

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