RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

FIRST YEAR [2018-21]

B.A./B.Sc. FIRST SEMESTER (July – December) 2018

Mid-Semester Examination, September 2018

Date : 25/09/2018 **CHEMISTRY (General)**

Time : 12 noon – 1pm Paper: I Full Marks : 25

Answer **any five** questions**:** (5 × 5)

1. a) Indicate the two postulates of kinetic theory of gas, which are not applicable for real gases. 1

   b) Write down Maxwell's equation for the distribution of molecular speeds indicating the terms involved. Show graphically how the distribution curves vary at two different temperatures for the same gas. 1+1

   c) Using the principle of equipartition of energy and taking various degrees of freedom into consideration estimate the value of C_v for SO_2 (a bent molecule). 2

2. a) State the differences between average speed and root mean square speed of gas molecules? At what temperature the average speed of a gas molecule will be equal to root mean square speed at 63^oC of the same gas molecules? 2+2

   b) What is compressibility factor? 1

3. a) Explain the Arhenius equation defining the T dependency of the rate of any reaction. 3

   b) Show that for the 2^{nd} order reaction, half life depends on the initial amount of the reactant. 2

4. a) Inversion of cane sugar in presence of an acid catalyst is a 1^{st} order reaction. Justify or criticize it. 3

   b) For the reaction $N_2+3H_2 = 2NH_3$, show that rate of consumption of H_2 is 3 times the rate of reaction. 2

5. a) Draw an energy profile diagram to show the activation energy of hypothetical endothermic reaction. Also comment on the change in equilibrium constant value when a catalyst is introduced in the reaction mixture. 2+2

   b) A 1^{st} order reaction never comes to an end. Explain. 1

6. a) An ideal gas can expand (i) Reversibly, isothermally and (ii) Irreversibly, isothermally. Is there any difference in work as output? Explain with graph. 4

   b) State Hess' law of constant heat summation. 1

7. a) For the ideal gas, show that $\bar{C}_p - \bar{C}_v = R$, explaining all terms, involved. 3

   b) Calculate the enthalpy of formation of $PCl_5(s)$, given the heats of following reactions at 25^oC: 2

$$2P(s) + 3Cl_2(g) = 2PCl_3(l) \qquad \Delta H^o = -151{,}800\ Cal\ mol^{-1}$$

$$PCl_3(l) + Cl_2(g) = PCl_5(s) \qquad \Delta H^o = -32{,}810\ Cal\ mol^{-1}$$

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