RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, SEPTEMBER 2020

FIRST YEAR (BATCH 2019-22)

Date : 28/09/2020 **CHEMISTRY (General)**

Time : 11.00 am – 1.00 pm **Paper : II** Full Marks : 25

[Attempt <u>any five</u> questions from the followings] [5×5]

1. a) Write down the mathematical form of first law of thermodynamics. From this show that work done in an adiabatic process is independent of path.

   b) Consider an ideal gas initially at (P_i, V_i) expands to (P_f, V_f) at a constant temperature

   (i) reversibly
   (ii) in a single step

   Show in separate P-V plots the amount of work done in the two separate cases. [2+1.5+1.5]

2. a) Show that for a given reaction A → B,

   $$\Delta H(T_f) = \Delta H(T_i) + \int_f^i \Delta C_p dT$$

   where $\Delta C_p = C_p\,(B) - C_p(A)$

   b) Classify the following quantities as state or path function -

   Heat, work, internal energy, enthalpy [3+2]

3. a) The first order rate constant for the decomposition of N_2O_5 at 0°C is $5.2\times10^{-6}\ min^{-1}$. If the energy of activation is 6200 J mol^{-1} . Calculate the rate constant and $t_{1/2}$ at 25°C.

   b) For the given reaction A + B → Products, following data are given

$[A]_0$ (mmol L^{-1})	$[B]_0$ (mmol L^{-1})	Rate (mol L^{-1} S^{-1})
5.0	2.5	0.03
15.0	2.5	0.09
15.0	10.0	0.36

   Calculate the order with respect to A and B. [3+2]

4. a) From the kinetic theory equation and ideal gas equation, show that the translational kinetic energy of an ideal gas is a function of temperature only.

   b) At what temperature will r.m.s. velocity of hydrogen molecule be 1.84 km/sec?

   c) Draw a qualitative plot of Maxwell's distribution of molecular speed (3D) at two different temperatures, $(T_1>T_2)$. [2+1+2]

5. a) Write down the van der Waals' equation for n moles of gas and explain the terms involved.

   b) Explain that for any diatomic molecule the average kinetic energy is same according to the law of equipartition of energy. [2+3]

6. a) Define the following terms with examples of each:

   (i) Mutarotation
   (ii) Reducing and non-reducing sugars

   b) Write the following reaction which shows that pentahydroxy groups present in the glucose. [(2+2)+1]

7. a) Write down short notes on:

   (i) Osazone formation reaction

   (ii) Kiliani – Fisher synthesis

   b) Write the following reaction which shows that D-glucose can exist in cyclic structure also. [(2+2)+1]

8. Predict the product when methyl magnesium bromide is treated with the following compounds:

   (i) Ethyl formate
   (ii) But-1-yne
   (iii) Acetaldehyde [2+2+1]

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