



বিদ্যাসাগর বিশ্ববিদ্যালয়
VIDYASAGAR UNIVERSITY
Question Paper

B.Sc. Honours Examinations 2020

(Under CBCS Pattern)

Semester - I

Subject: CHEMISTRY

Paper : C 2-T & C 2-P

Physical Chemistry - I

Full Marks : 60 (Theory-40 + Practical-20)

Time : 3 Hours

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

[THEORY]

Answer any *two* questions from the following :

2 × 20 = 40

1. (i) What is Root Mean Square (RMS) speed ?
- (ii) What are the units of van der Waal's constant a and b ?
- (iii) Write the Berthelot's equation for real gas.
- (iv) Prove for ideal gas $(\partial H / \partial V)_T = 0$
- (v) What is Joule-Thomson coefficient ?
- (vi) Write the Gibbs-Helmholtz equation.

- (vii) What is the unit of rate constant for $3/2^{\text{th}}$ order reaction ?
- (viii) What do you mean by molecularity of a reaction ? $2\frac{1}{2} \times 8 = 20$
2. (i) (a) Considering Maxwell distribution of speed, derive the expression of most probable speed. 3
- (b) What is collision number ? 2
- (ii) (a) Evaluate the total energy of acetylene molecule using the principle of equipartition of energy. 3
- (b) What are the discrepancies between van der Waal's theoretical plot and Andrew's isotherms. 2
- (iii) (a) Show mathematically W_{rev} is greater than W_{irrev} for expansion work. 3
- (b) What are the criteria of a spontaneous reaction ? 2
- (iv) (a) Calculate the entropy change for heating of 7 gm of N_2 from 300K to 500K at constant volume. ($C_p = 7 \text{ cal/mol}$) 3
- (b) What is Clausius inequality ? 2
3. (i) (a) The half life of decomposition of Ra is 1590 years. Calculate the rate constant of the decomposition. 1
- (b) Derive the rate constant of opposing reaction. 4
- (ii) (a) Prove that an enzyme catalysis reaction is zero order for a given amount of enzyme. 3
- (b) For a gaseous reaction, the entropy of activation is generally negative — explain. 2
- (iii) Write explanatory notes on :
- (a) Irreversible and free expansion of van der Waals gas under adiabatic condition
- (b) Enzyme catalysis. 5+5
4. (i) (a) What do you mean by mean free path ? 2
- (b) Write the virial equation of state. 2
- (c) Derive the reduced equation of state from critical constants. 3

- (d) What is Boyle temperature ? 2
- (e) Why real gases show nearly ideal behaviour at high temperature. 1
- (ii) (a) Prove that $C_p - C_v = R$ for ideal gas. 3
- (b) Prove the relation : $(\partial T / \partial P)_S = (\partial V / \partial S)_P$ 3
- (c) Explain — the slowest elementary process is the rate-determining step of any multi-step reaction. 4

Paper - C-2-P

(Practical)

Full Marks : 20

Answer any **one** of the following questions :

1 × 20 = 20

Discuss any **one** of the following experiments with respect to working principle, experimental procedure and nature of plot.

1. Determination of pH of unknown solution (buffer), by color matching method.
 2. Determination of heat of neutralization of HCl by NaOH.
 3. Study of kinetics of acid-catalyzed hydrolysis of methyl acetate.
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