

2022

1st Semester Examination

CHEMISTRY (Honours)

Paper : C 2-T

(Physical Chemistry-I)

[CBCS]

Full Marks : 40

Time : Two Hours

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

Group - A

Answer any *five* questions from the following :

2×5=10

1. Show that Joule-Thomson experiment is an irreversible process.
2. Calculate the volume occupied by a 8.2 millimoles of gas at 27°C and 20 atm pressure. Given that the compressibility factor of the gas is 0.86.
3. Discuss the Euler's reciprocity relation. What is its utility?
4. Heat supplied to a Carnot engine is 1897.86 kJ. How much useful work can be done by the engine which works between 0°C and 100°C?
5. $\oint dH$ for any system is zero — criticize or justify.

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(2)

6. The activation energy of a reaction is 22.5 k cal/mol and the value of rate constant at 40°C is $1.8 \times 10^{-5} \text{ sec}^{-1}$. Calculate the frequency factor, 'A'.
7. Increase of volume for a given decrease in pressure will be less in adiabatic than in isothermal expansion — Justify.
8. Volume parameter of an ideal gas equation is either extensive or intensive — Justify or criticize the statement.

Group - B

Answer any **four** questions from the following :

5×4=20

9. State the law of corresponding states and deduce the expression $(\Pi + 3/\phi^2)(3\phi - 1) = 8\theta$. What is the importance of this law?
10. Derive the expression for 2nd order reaction involving one reactant only. Also show that the half life period ($t_{1/2}$) of such a reaction is inversely proportional to the initial concentration of the reactant.
11. The distribution of molecular speeds is supposed to be given by the expression $dn_c = A c^2 e^{-c^2/kT} dc$ where 'A' is a constant and other symbols have their usual meanings (i) evaluate 'A' (ii) calculate the average speed and (iii) Demonstrate a plot of $\frac{1}{c^3} \frac{dn_c}{dc}$ vs c.
12. 1×10^{-6} gm radioactive iodine was injected into the blood of a patient. It takes 26.75 days to fall its radio

activity to 10% of its initial value. Calculate the half life of iodine.

13. Express van der Waals' equation of state in the form of virial equation of state and hence derive the expression for second virial coefficient.
14. What is enzyme catalysis? Why is it so specific in its action? Explain the fact that the enzyme catalysed reaction has the optimum pH for its maximum activity.

Group - C

Answer any *one* question from the following :

$$10 \times 1 = 10$$

15. (a) Describe Lindemann theory of first order reaction. 4
- (b) The stoichiometry of a reaction indicates the order of a reaction. Justify or criticize. 2
- (c) If the reaction $A \rightarrow \text{Products}$ is zero order w.r.t A , draw the graph of $[A]$ vs time. 2
- (d) Define auto catalytic reaction with a suitable example. 2
16. (a) State the principle of equipartition of energy. 2
- (b) Argon has $T_c = 151 \text{ K}$ and $P_c = 48 \text{ atm}$. What is the radius of Argon atom? 5
- (c) Show that Joule-Thomson expansion is an isenthalpic process. 3