# S-445

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# MCH-503

**Physical Chemistry-I**

M.Sc. Chemistry (MSCCH)

1st Semester Examination, 2022 (Dec.)

**Time : 2 Hours]** **[Max. Marks : 35**

**Note :** This paper is of Thirty Five (35) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

## SECTION–A
## (Long Answer Type Questions)

**Note :** Section 'A' contains Five (05) long answer type questions of Nine and Half (9½) marks each. Learners are required to answer any Two (02) questions only. (2×9½=19)

**1.** What are approximation methods? Describe any one method of approximation in detail.

**2.** Explain Carnot cycle and derive an expression for thermodynamic efficiency of Carnot engine.

**3.** Write notes on the following :

(a) Clapeyron equation.

(b) Le Chatelier's principle.

**4.** (a) Define free energy. Show how free energy vary with temperature and pressure.

(b) Describe operators used in quantum chemistry.

**5.** Write explanatory notes on the following :

(a) Rigid rotator.

(b) Gibbs-Duhem equation.

## SECTION–B

## (Short Answer Type Questions)

**Note :** Section 'B' contains Eight (08) short answer type questions of Four (04) marks each. Learners are required to answer any Four (04) questions only. (4×4=16)

**1.** What do you mean by quantum mechanics. Discuss the postulates of quantum mechanics.

**2.** Describe valence bond method for hydrogen molecule.

**3.** Derive an expression of entropy change for an ideal gas with temperature and volume as variables. Calculate the entropy change that takes place during an expansion of 2 moles of an ideal gas from a volume of 10 litres to a volume of 100 litres at 300 K.

**4.** Write short notes on the following :

(a) Nernst heat theorem.

(b) First law of thermodynamics.

**5.** Derive Schrödinger's wave equation. Give significance of $\psi$ and $\psi^2$.

**6.** Explain the following :

(a) Different statements of second law of thermodynamics.

(b) Joule-Thomson effect.

**7.** Explain third law of thermodynamics and define residual entropy.

**8.** Discuss the concept of activity and activity coefficient.

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