

CHEMISTRY

Time Allowed : 3 hours

Full Marks : 100

*The figures in the margin indicate
full marks for the questions.*

Attempt all questions.

SECTION - A

1. (a) Write the Schrodinger's wave equation vibrating along the x-axis. What does ψ represent? (2)
- (b) With appropriate illustrations, explain briefly the differences encountered in Stoichiometric and Non-Stoichiometric defects. (2×2=4)
- (c) Write the molecular orbital configuration of CO molecule and draw the Molecular orbital in support of your configuration. Highlight the bond order and its magnetic property. (4)

2. (a) Calculate the amount of work done by 2 moles of an ideal gas at 298K in a reversible isothermal expansion from 10 litres to 20 litres.
($n=2 \text{ mol}$, $V_1 = 10L$, $V_2 = 20L$, $T=298K$,
 $R=8.314 \text{ JK}^{-1} \text{ mol}^{-1}$) (3)

(Contd. 2)

- (b) Explain the Maxwell's distribution of speeds from the following *figure A*. (3)

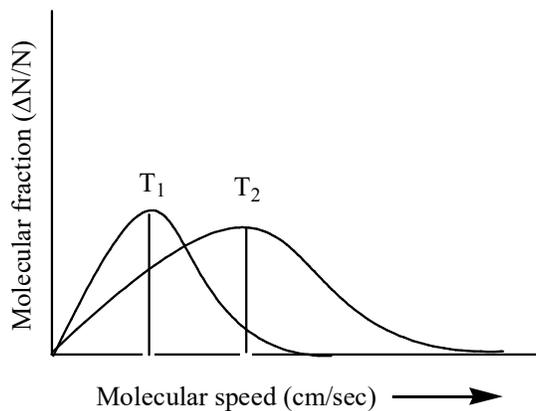


Figure A

- (c) Explain with examples the 6:6 co-ordination cubicle structures of an ionic crystal. (4)
3. (a) $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ has co-ordination number (CN) of 6 for the central metal ion. Draw the geometry. (2)
- (b) Write the Clausius-Clapeyron equation and explain briefly why P-T for solid-liquid equilibrium is a much steeper slope than solid-vapour or liquid-vapour lines. (4)
- (c) What are the various processes of entropy changes? (4)

(Contd. 3)

4. (a) Write briefly the factors that determine the effectiveness of colliding molecules. How are these collisions related to the activated complex? (5)
- (b) Illustrate the role of cytochromes and ferridoxins in the biological electron transfer processes. (5)
5. (a) Discuss the Mechanism of photochemical reactions and illustrate the phenomenon involved in the decay of excited molecules. (5)
- (b) Define adsorption isotherm. Explain Type-I and Type-II adsorption isotherm. In which type of adsorption isotherm do Langmuir and B.E.T isotherms fit in? (5)
6. (a) Explain briefly Lanthanide contraction. (2)
- (b) Show the crystal field splitting of d-orbitals in tetrahedral Complexes. (4)
- (c) What are Ionophores? Discuss the process of ionophore as a carrier. (4)

(Contd. 4)

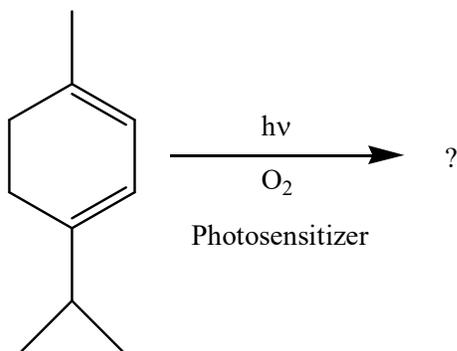
SECTION - B

7. (a) Attempt the following: **(4×1½=6)**

- (i) Why is nucleophilic addition not favourable in symmetrical C=C bonds?
- (ii) Explain aromaticity and anti-aromaticity in terms of their stability/energy.
- (iii) Why is benzyne more reactive than benzene?
- (iv) What stereochemistry will you encounter in S_N² reaction?

(b) Complete the following reactions:

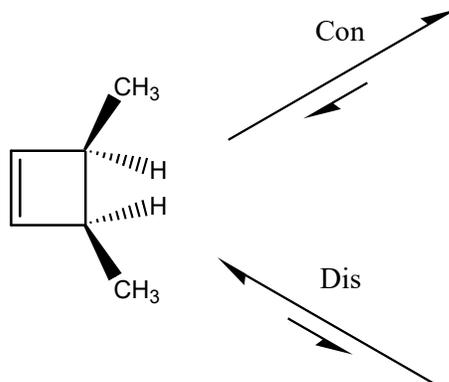
(i) **(1½)**



(Contd. 5)

(ii)

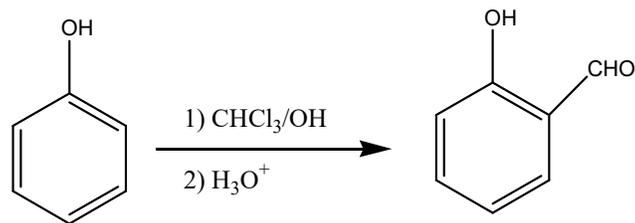
(2½)



8. (a) Show appropriate mechanisms for the following:

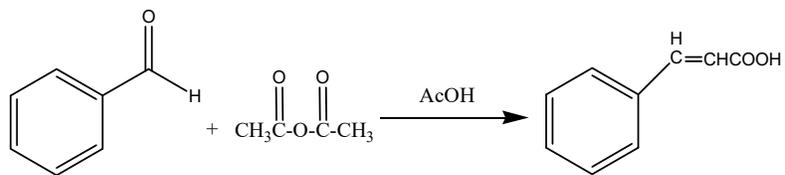
(i)

(3)



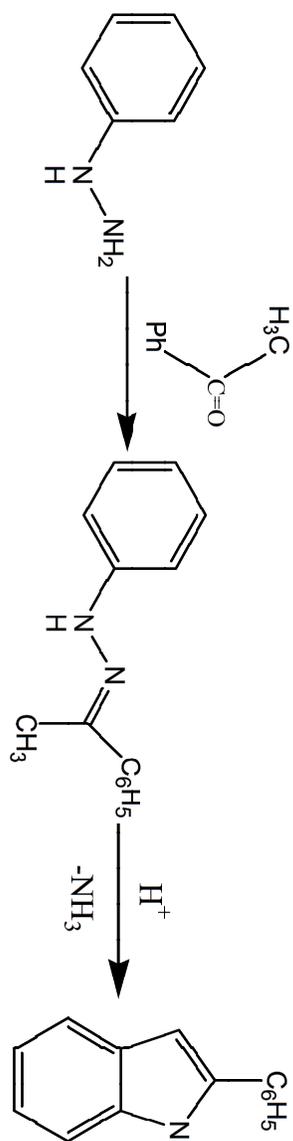
(ii)

(3)



(Contd. 6)

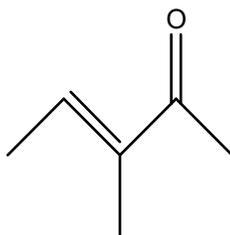
(iii)



(4)

(Contd. 7)

9. (a) What do you understand by singlet and triplet states? (3)
- (b) What are the heterocyclic bases from the RNA nucleotide? Draw the structures. (3)
- (c) Give the ideal preparation for polystyrene and mention at least two of its uses. (4)
10. (a) Show the peak positions for 1,4-dimethylbenzene in $^1\text{H NMR}$ spectrum. (2)
- (b) The base peak of Ammonia is $m/z = 17$. Write down the major peaks corresponding to the fragmentation of ammonia in the mass Spectrum. (2)
- (c) Predict the λ_{max} for π - π^* absorption band in the UV spectrum of *Compound A*. (3)



Compound A

- (d) What are the Vibrational Frequencies for methane and ethane? (3)

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