



**CHE 517 / CHE 518 / CHE 519**

**M.Sc. (III<sup>rd</sup> SEMESTER) EXAMINATION, 2024-25**

**(CBCS MODE)**

**CHEMISTRY**

1547

Time : Three Hours]

[Maximum Marks : 75

**CHE 517**

**Electronics and Electrochemical Phenomena**

**Note:** There are **three** sections (A, B and C) and Candidate has to attempt questions from all sections. Marks are indicated against each section.

**Section-A**

1. Answer all questions :  $5 \times 3 = 15$
- (a) Explain the influence of Solvent on ion conductance and Diffusion potential.
  - (b) What is electrical double layer and define Zeta Potential ?
  - (c) Discuss the factors affecting exchange current density.
  - (d) Define galvanisation and Tinning.
  - (e) What is polarisation resistance ?

## Section-B

**Note:** Answer all questions of the following :  $4 \times 5 = 20$

2. (a) Ilkovic equation from Fick's law of diffusion.

**Or**

- (b) Define conductance, specific conductance equivalent conductance and Molar conductance. Explain why specific conductance decreases with dilution where as molar conductance increases with dilution ?

3. (a) Discuss Gouy-Chapman Theory of electrical double layer.

**Or**

- (b) Describe stern Model of electrical double layer.

4. (a) Discuss Tafel Plots and Tafel Equation.

**Or**

- (b) Derivation of Butler-Volmer equation and significance of over potential and Exchange current density.

5. (a) What is linear polarization ? Give a method for the determination of polarization.

**Or**

- (b) Write short note on classification of polarisation phenomena.

### **Section-C**

**Note:** Answer any two questions of the following :  $2 \times 20 = 40$

6. What is meant by diffusion of electrolytes ? Explain Fick's first law and second law of diffusion and also give experimental method for the determination of diffusion coefficient.
7. Discuss the structure of electrified interfaces with reference to the Helmholtz-Perrin Theory.
8. What is corrosion ? Give the mechanism of electrochemical theory of corrosion. Discuss various factors which influence corrosion.
9. (a) Discuss various factors affecting over voltage.
- (b) Give the mechanism of corrosion of metals, its thermodynamics and kinetics.

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## CHE 518

### Coordination Chemistry

**Note:** There are **three** sections (A, B and C) and Candidate has to attempt questions from all sections. Marks are indicated against each section.

#### **Section-A**

1. Answer all questions : 5×3=15
- (a) Explain the “hole formalism”.
  - (b) Discuss the limitations of crystal field theory.
  - (c) What do you understand by Non-crossing rule ?
  - (d) How induced magnetic moment is related to magnetic susceptibility ?
  - (e) What is Land's interval rule ?

#### **Section-B**

**Note:** Answer all the questions : 4×5=20

2. (a) Explain spin-orbit coupling parameters.

**Or**

- (b) With the help of reduction formula. Calculate the value of following in

octahedral complex. The relevant character table is given in last.

(i)  $T_{2g} \times T_{2g}$

(ii)  $T_{2g} \times E_g$

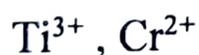
(iii)  $E_g \times E_g$

3. (a) Discuss Laporte selection rule and spin selection rule of electronic absorption spectroscopy. Under what conditions are these rules relaxed ?

**Or**

- (b) Draw Orgel diagrams for  $d^2$  and  $d^3$  systems in octahedral field.

4. (a) Discuss the electronic spectra of following transition metal ions in their aqueous solutions :



**Or**

- (b) Write short note on Tanabe-Sugano diagrams.
5. (a) Explain the effect of quenching of orbital angular momentum in A, E and T term in octahedral complex.

Or

- (b) What do you understand by critical temperature ? Discuss the effect of temperature on the magnetic behaviour of materials.

### Section-C

**Note:** Attempt any two questions from following :  $2 \times 20 = 40$

6. What are inter electron repulsion parameters ? How F-parameters are related to Racah parameters? Explain the variations of Racah's parameters in the periodic table.
7. Discuss the splitting of D and F terms in octahedral weak crystal field using the character table for octahedral point group as given in the end of the paper.
8. What is John-Teller distortion ? Discuss its effect on the electronic spectra of octahedral complexes both in weak and strong field. With suitable example, explain its effect on electronic spectra and stability of transition metal complexes.

9. Discuss the origin of paramagnetism in transition metal complexes with the help of Curie-Weiss law. Differentiate between magnetically dilute and concentrated systems.

$O_h$	E	$8C_3$	$6C_2$	$6C_4$	$3C_2$ ( $=C_4^2$ )	i	$6S_4$	$8S_6$	$3\sigma_h$	$6\sigma$		
$A_{1g}$	1	1	1	1	1	1	1	1	1	1	(R <sub>x</sub> , R <sub>y</sub> , R <sub>z</sub> )	$x^2+y^2+z^2$
$A_{2g}$	1	1	-1	-1	1	1	-1	1	1	-1		$(2z^2-x^2-y^2, x^2-y^2)$
$E_g$	2	-1	0	0	2	2	0	-1	2	0		$(xz, yz, xy)$
$T_{1g}$	3	0	-1	1	-1	3	1	0	-1	-1		
$T_{2g}$	3	0	1	-1	-1	3	-1	0	-1	1		
$A_{1u}$	1	1	1	1	1	-1	-1	-1	-1	-1		
$A_{2u}$	1	1	-1	-1	1	-1	1	-1	-1	1		
$E_u$	2	-1	0	0	2	-2	0	1	-2	0		
$T_{1u}$	3	0	-1	1	-1	-3	-1	0	1	1		(x, y, z)
$T_{2u}$	3	0	1	-1	-1	-3	1	0	1	-1		

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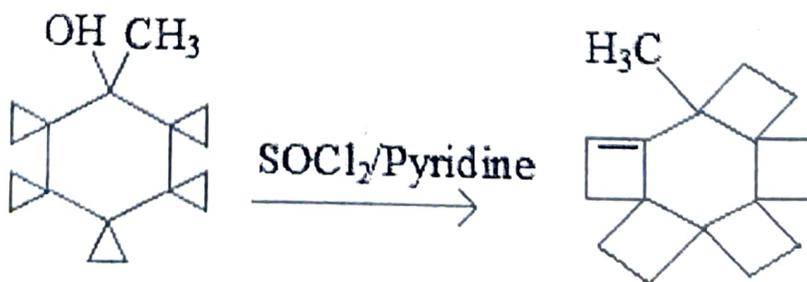
## CHE 519

### Pericyclic and Rearrangement Reactions

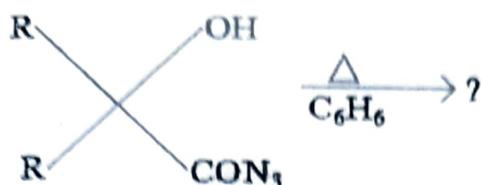
**Note:** There are **three** sections (A, B and C) and Candidate has to attempt questions from all sections. Marks are indicated against each section.

#### Section-A

1. Answer all questions : 5×3=15
- (a) Define each class of Pericyclic reaction and provide one example for each.
- (b) What is the endo-rule as it applies to the Diels—Alder reaction ?
- (c) Briefly explain, why [1, 3] sigmatropic shift of hydrogen is thermally forbidden but photochemically allowed ?
- (d) Provide plausible mechanism for the following transformations –



- (e) Draw the structure of the product and provide the reaction mechanism.



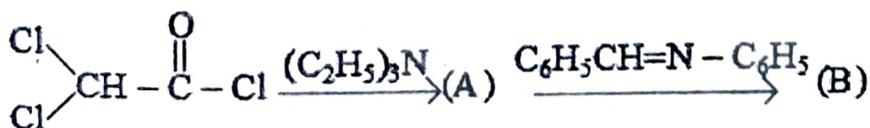
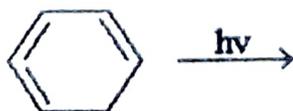
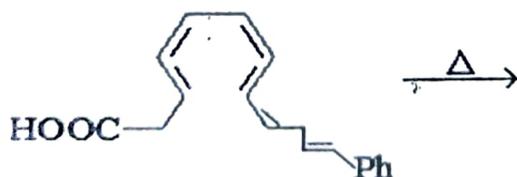
### Section-B

Note: Answer all the questions : 4×5=20

2. (a) With the help of correlation diagram write explanatory notes on the fact that  $[\pi 2S + \pi 2S]$  cycloaddition is a photochemically allowed process.

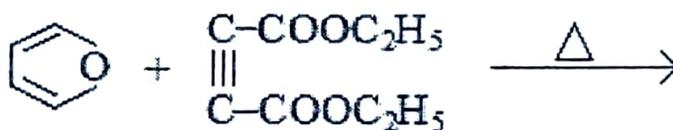
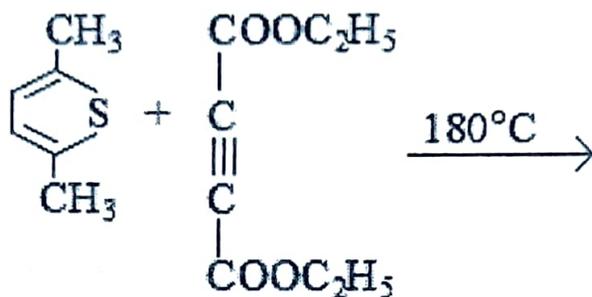
Or

- (b) With the help of FMO method shows that the  $[2+2]$  cycloaddition reaction between alkene and ketone is thermally allowed reaction.
3. (a) Predict the following reactions :

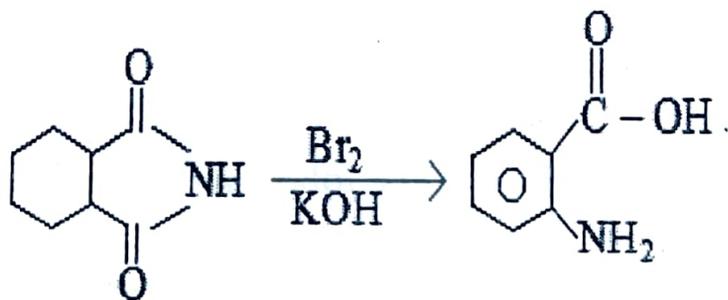


Or

- (b) Considering retro-Diels-Alder reaction, predict the product of the following reactions :



4. (a) Provide plausible mechanism for the following transformations :



Or

- (b) Discuss the mechanism of the Hoffmann rearrangement in cyclic systems.

5. (a) Prove the intra molecularity of Curtius rearrangement.

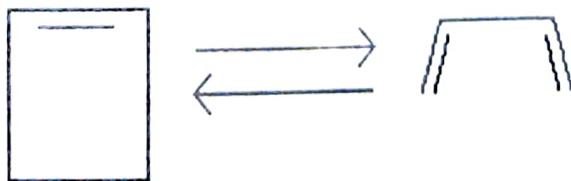
Or

- (b) Discuss the mechanism of the Daeyer-Villiger rearrangement.

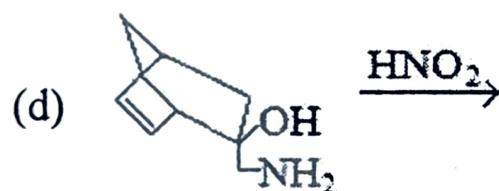
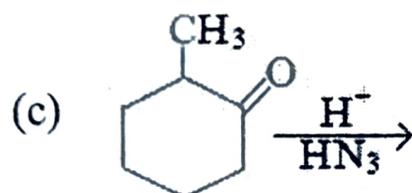
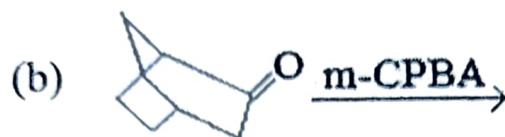
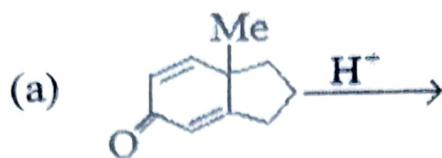
### Section-C

Note: Attempt any two questions of the following :  $2 \times 20 = 40$

6. Write short notes on any three of the following :
- (a) Huckel-Mobius method of electrocyclic reactions.
  - (b) Claisen rearrangement
  - (c) 1, 3 bipolar reaction
  - (d) Ene Reaction
  - (e) Fluxional tautomerism
7. Construct a correlation diagram depicting the orbital undergoing change along with their symmetries for the following transformations.



8. Rationalise the following :



9. (a) Explain the mechanism of the sommelet-Hauser rearrangement with supporting evidences.
- (b) Explain the mechanism of the following
- 1, 2 - Wittig rearrangement.
  - 2, 3 - Wittig rearrangement.

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