

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2905~

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Unique Paper Code : 2172524801

Name of the Paper : DSC:ORGANOMETALLIC CHEMISTRY AND
BIOCATALYSIS, APPLICATION OF REAGENTS
IN ORGANIC SYSTHESIS AND CRYSTALLINE
SOLIDS & THEIR MAGENETIC PROPERTIES

Name of the Course : B.Sc.(Prog) Life Science

Semester : VIII

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll no. on the top immediately on receipt of this question paper.
2. All questions carries equal marks.
3. Attempt six questions in total and any two questions from each section: (A, B, C)

Section: A

Attempt any two questions out of three.

Q1 (i) How do you rationalize the increase in the C-C bond length from 133.7 pm in ethene to 137.5 pm in Zeise's salt, accompanied by a decrease in C-C stretching frequency from 1623 cm^{-1} to 1526 cm^{-1} ?

(ii) Discuss the challenges in developing organometallic radiopharmaceuticals, including toxicity and biological compatibility.

(iii) Explain how ferrocene conjugation can improve the efficacy of an existing drug with suitable example. (5,5,5)

Q2. (i) Describe the effect of temperature in enzyme-catalyzed reactions.

(ii) The CO stretching frequency in IR spectra (ν_{CO} values) in $[\text{Fe}(\text{CO})_4]^{2-}$, $[\text{Co}(\text{CO})_4]^-$ and $[\text{Ni}(\text{CO})_4]$ are 1788, 1918 and 2121 cm^{-1} respectively while the ν_{CO} value for CO(g) is 2143 cm^{-1} . Explain the trend.

(iii) Write a short note on nano biocatalysis with examples and discuss their advantages over traditional catalysis? (5,5,5)

P.T.O.

Q3. (A) Using the 18 electron rule, find/ identify:

(i) The number of CO ligands in

(a) $[\text{Fe}(\text{NO})_2(\text{CO})_n]$ (b) $[\text{V}(\text{NO})(\text{CO})_n]$ (c) $[\text{W}(\eta^6\text{-C}_6\text{H}_6)(\text{CO})_n]$ (d) $[\text{Co}(\eta^5\text{-C}_5\text{H}_5)(\text{CO})_n]$

(ii) The number of metal-metal bonds in

(a) $\text{Fe}_3(\text{CO})_{12}$ (b) $\text{Co}_4(\text{CO})_{12}$

(iii) The charge on the species

(a) $[\text{Co}(\text{CO})_4]^x$ (b) $[\text{Fe}(\text{CO})_4]^x$ (c) $[\text{V}(\text{CO})_6]^x$

(iv) The number of ligands (m and n) in $[(\eta^6\text{-C}_6\text{H}_6)_n\text{Cr}(\text{CO})_m]$

(B) Explain the structure of ferrocene and explain its staggered and eclipsed conformations.

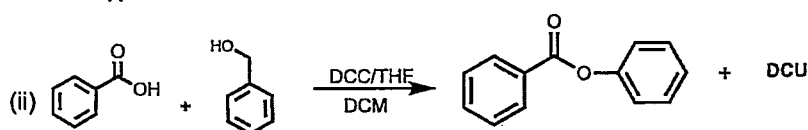
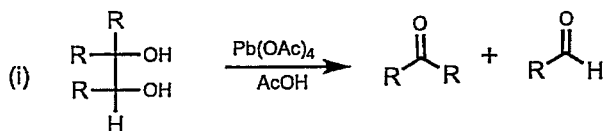
(10, 5)

Section: B

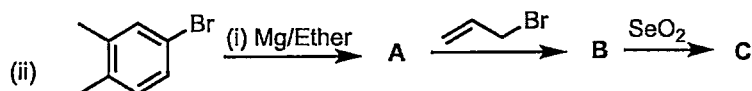
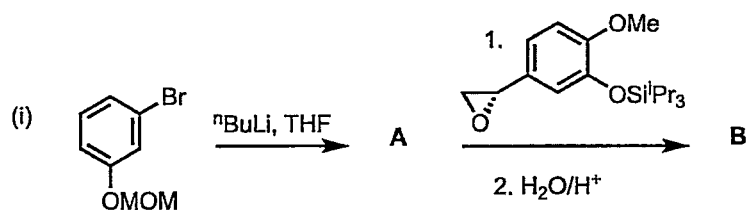
Attempt any two questions out of three.

Q4. (i) Why Hydroboration of an alkene is highly regioselective process? Explain an example with plausible reaction mechanism.

(ii) Outline the mechanism of the following transformations:



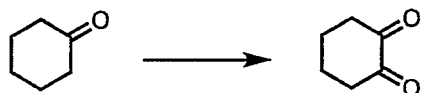
(iii) Write the product of given reactions and explain each step.



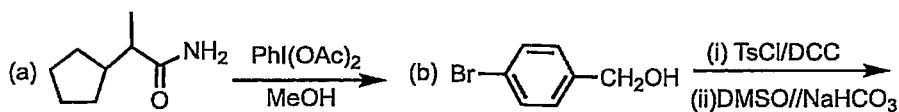
(5,5,5)

Q5. (i) Write the method of synthesis for methyl lithium and ethyl magnesium bromide, and why alkyl lithium reagent is more reactive in comparison of alkyl magnesium bromide.

(ii) Write the most suitable reagent for the given reaction and explain the reaction mechanism.



(iii) Write the product in the following reactions.



(5,5,5)

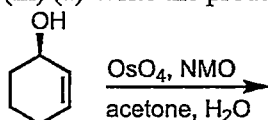
Q6. (i) Write one application of following reagents:

- (a) Organoaluminium
(b) Jones Reagent

(ii) Give the preparation and applications of the following reagents:

- (a) PCC
(b) Thallium Nitrate

(iii) (a) Write the product of given reaction with stereochemical outcome.



(5,5,5)

Section: C

Attempt any two questions out of three.

Q7. (i) What are the symmetry elements found in any crystalline solid? Which rotational axes of rotation is present of a cubic unit cell.

(ii) What is magnetic anisotropy? Explain its type.

(iii) Define Miller indices. Determine the Miller indices for a plane,

$$3x+2y+z=6$$

(5,5,5)

Q8. (i) What is space lattice. Differentiate between monoclinic and triclinic crystal systems.

(ii) A crystal preferentially diffracts monochromatic X-rays having a wavelength of $10.4 \text{ \AA}$

at an angle of 25.5° . (a) Assuming that this is the first-order diffraction, what is the d spacing between the crystalline planes? (b) At what angle would the second-order diffraction be found

(iii) State and explain Curie's law for paramagnetic materials. Find the temperature at which susceptibility becomes infinite for a material with $\theta = 320$ K. What is the physical significance of it? (5,5,5)

Q9. (i) What is a magnetic theory of domain? Explain the formation of ferromagnetic and antiferromagnetic solids on the basis of it.

(ii) State Bragg's Law of X ray diffraction. Derive Bragg's equation and write its limitations.

(iii) An unknown crystal has a cubic unit cell. The refractions angles of X-rays by a powdered sample are given below-

θ (degrees)	13.7°	15.9°	22.8°	27.0°	28.3°	33.2°	36.6°	37.8°
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If the X rays have a wavelength of $1.5418 \text{ \AA}$, determine the type of cubic unit cell.

(5,5,5)