R–3036

Sub. Code
538201

M.Sc. DEGREE EXAMINATION, APRIL 2019

Second Semester

Chemistry (Specialization in Nano Science and Technology)

INORGANIC CHEMISTRY – II

(CBCS – 2016 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Applying EAN rule find out which metal carbonyl complex is more stable among the following:
$Fe_2(CO)_9$, $Mn(CO)_5$, $[Mn(CO)_5]$.

2. $Fe(CO)_5$ dimerises while $V(CO)_6$ does not – Explain?

3. What is an OXO process? Write the reaction.

4. Give an example for fluxional molecule and explain why it is so?

5. Write down the structure of $[(C_5H_5)_3Ni_2]^+$. What is the structural feature?

6. Write any one reaction for the synthesis of $[(C_6H_6)_2Cr]$.

7. B_2H_6 is said to be an electron deficient compound – explain with its structure.

8. Give an example for trinuclear cluster and its structure.

9. Co (III) complexes are inert relative to $Cr(III)$ complexes in photochemistry – Explain.

10. Photogalvanic cell has lower efficiency that semi-conductor based PEC cell in solar energy conversion – why?

Part B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) Give one example each for polynuclear metal carbonyls without bridging and with bridging CO groups. How is IR spectroscopy useful in identifying these carbonyls?

Or

(b) Explain the phenomenon of isolobal fragments.

12. (a) Illustrate hydrosilation reaction and its mechanism.

Or

(b) Explain the mechanistic steps in hydrogenation of alkenes with Wilkinson's catalyst.

13. (a) Discuss Fischer Tropsch synthesis method.

Or

(b) Discuss the structure and bonding of Zesse's salt.

14. (a) Borazene is called inorganic benzene. Is it correct? Explain your answer by comparing the properties of borazene and benzene.

Or

(b) $(SN)_x$ compound functions as superconductor below Ta. Explain this property with its structure and bonding.

15. (a) Applying two Adamson's rules, predict the products in photoaquation of cis and trans $[Cr(NH_3)_5 Cl]^{2+}$ complex. Explain your answer.

Or

(b) With a neat sketch, explain the function of Honda cell.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Giving suitable examples, describe the structure and bonding of metal nitrosyls with linear and bent NO groups. How do metal nitrosyls differ from metal carbonyls.

17. Discuss Ziegler-Natta polymerization reaction. How is stereoregular polypropylene obtained by this reaction?

18. Discuss the preparation, structure and bonding of beryllocene. Does it have ionic or covalent bonding? Comment and explain your answer.

19. Illustrate the special features in structure and bonding of $Re_2 Cl_8^{-2}$ ion.

20. Explain how the photophysical and photochemical characteristics of $[Ru(bpy)_3]^{2+}$ lead to its wide use as a photosensitizer in solar energy conversion.

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R–3037

Sub. Code
538202

M.Sc. DEGREE EXAMINATION, APRIL 2019

Second Semester

Chemistry
(Specialisation with Nanoscience and Technology)

ORGANIC CHEMISTRY — II

(CBCS – 2016 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is the advantage of using t-butylhydroperoxide along with osmium tetroxide during oxidation of double bonds?

2. Write the products in the following reactions :

   (a) Acetophenone $\xrightarrow{\text{PhCOOOH}}$ in $CHCl_3$

   (b) 2-Methylcyclopentanone $\xrightarrow{\text{PhCOOOH}}$ in $CHCl_3$.

3. What is cannizaro reaction? Write the Cannizaro reaction product of glyoxal.

4. How many possible stereoisomeric products can be obtained when RCHO and $R'COCH_2R''$ are subjected to aldol condensation?

5. What happens when $PhCH_2\ CH_2NHCOCH_3$ is treated with $POCl_3$? Write the mechanism of the reaction.

6. Write down the structure of Vilsmier reagent obtained by the addition of $Ph-N(Me)-CHO$ with $POCl_3$. What happens when this reagent attacks anisole?

7. Indicate (a) the number of benzimidazole rings present in vitamin B_{12} and (b) the nature of the sugar unit present in vitamin B_{12}.

8. What happens when vitamin K_1 is subjected to (a) reductive acetylation and (b) Oxidation by chromic acid?

9. Explain why the equatorial position is preferred by a substituent in a mono substituted cyclohexane.

10. Explain the term 'stereoelectronic factor'.

Part B $(5 \times 5 = 25)$

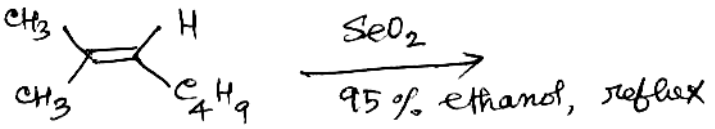
Answer **all** questions choosing either (a) or (b).

All questions carry equal marks.

11. (a) Discuss the utility of enantioselective epoxidation of allylic alcohols. Explain the role of chiral tartarate and the titanium complex in the asymmetric epoxidation.

Or

(b) Explain the mechanism of selenium dioxide oxidation of allylic position. Show that the mechanism involves hydrated selenium dioxide and an ene mechanism. Write the product in the following reaction :



12. (a) Discuss the mechanisms of Fries rearrangement and Mannich reaction.

Or

(b) Explain how alkylidene phosphoranes can be prepared. Discuss the mechanism of Wittig reaction. What happens when $Ph_3P = CH - COOEt$ is refluxed in benzene with (i) Cyclohexanone and (ii) Crotanaldehyde.

13. (a) Compare the scope and mechanism of Kolbe-Schmidt reaction and Reimer Tiemann reaction.

Or

(b) Discuss the mechanism of chichibabin reaction and Bischler-Napieralski reaction.

14. (a) Discuss the structure and functioning of RNA and DNA.

Or

(b) What happens when oestrone is (i) distilled with zinc and (ii) subjected to catalytic hydrogenation. Write the equations corresponding to the above transformations.

15. (a) Explain why (i) the axial alcohols are easily oxidised by chromic acid while equatorial alcohols react slowly and (ii) Trans-4-t-butylcyclohexyl acetate is easily hydrolysed compared to the cis isomer.

Or

(b) Describe the significance of Eliel-Ro equation.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Write notes on :

(a) Homogenous catalytic hydrogenation

(b) Chiral boranes

(c) Birch reduction. (3 + 3 + 4)

17. Write notes on :

(a) Di-π -methane rearrangement

(b) Favorski rearrangement

(c) Reformatsky reaction. (4 + 3 + 3)

18. (a) Provide the mechanism of Friedel crafts acylation.

(b) Explain the course of aromatic nucleophilic substitution that involves benzyne intermediate.

(c) Write a note on ortho/para ratio. (3 + 3 + 4)

19. Establish the structure of cholesterol.

20. (a) Explain how the conformational features decide the course of elimination reactions in cyclohexyl systems.

(b) Draw the energy profile diagram of the $C_2 - C_3$ rotation in n-butane.

(c) What are *ansa* compounds? Explain the origin of chirality in this class of compounds. (4 + 3 + 3)

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R–3038

Sub. Code
538203

M.Sc. DEGREE EXAMINATION, APRIL 2019.

Second Semester

Chemistry (Specialization in Nano Science & Tech.)

PHYSICAL CHEMISTRY – II

(CBCS – 2016 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Write the shape of p orbital. Why it is so?

2. Write the condition for an orthonormal wave function.

3. Distinguish between symmetry element and symmetry operation.

4. Write the reduction formula and explain the terms.

5. What is direct product representation? Give an example.

6. Write the selection rules for n $-\pi^*$ and $\pi-\pi^*$ transitions.

7. Distinguish between chain and explosion reaction.

8. What is the principle of relaxation methods?

9. Distinguish between contact angle and wetting.

10. What do you mean by semi conductor catalysis?

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) State and explain John – Teller effect? In what way it is related to quantum numbers?

Or

(b) Write the significance of tunneling in quantum mechanics.

12. (a) In what way mathematical group postulates matched with group theory.

Or

(b) Write the rules and properties of irreducible representations.

13. (a) State and explain mutual exclusion rule. How it is used to explain vibrational modes of molecule?

Or

(b) Determine the energy of ethylene by using SALC procedure.

14. (a) Distinguish between stepwise and chain polymerizations with mechanisms.

Or

(b) How will you measure rate of a rate of a reaction by stopped flow method?

15. (a) Derive Gibb's absorption isotherm.

Or

(b) Explain Langmuir – Hinshelwood mechanism.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Determine energy and wave function of a particle in 3 – D box.

17. How will you determine print group for a molecule?

18. Discuss the electronic spectra of formaldehyde.

19. Discuss the theory of enzyme catalysis with mechanism.

20. How will you determine surface area?

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R–3039

Sub. Code
538503

M.Sc. DEGREE EXAMINATION, APRIL 2019

Second Semester

Chemistry (Special in Nanoscience and Technology)

SYNTHESIS AND ANALYSIS OF NANOMATERIALS

(CBCS – 2016 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** the questions.

1. Define nanomaterial.

2. What is the different between bottom – up and top-down approach to fabricate Nanomaterial?

3. Write a short note on sonochemical method of synthesis.

4. List out the advantages of nanomaterial synthesis.

5. What is meant by sol gel process?

6. List three general applications of Nanomaterials.

7. Write the advantages of CVD method.

8. Explain bacteria and its type.

9. Name one major challenge in fabrication and processing of Nanomaterials.

10. Define beer Lambert law.

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Write in detail the top down and bottom up approaches.

Or

(b) Write short notes on ball milling techniques.

12. (a) Explain the mechanical allowing techniques.

Or

(b) Write short notes on hydrothermal method.

13. (a) Explain in detail the Co-precipitation method and its advantages.

Or

(b) Write the principle of CVD and its application.

14. (a) List the advantages and disadvantages of using ALD method to grow thin films.

Or

(b) Write the uses of bacteria and fungi.

15. (a) Explain short notes on NMR.

Or

(b) Write the principle of electron spin resonance spectroscopy.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Discuss on arc plasma and laser ablation.

17. Explain in detail the MOCVD.

18. Write the principle and theory of MBE.

19. How to magnetotatie bacteria involve in magnetic nanoparticle.

20. Write the working principle of fluorescence spectroscopy.

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R–3040

Sub. Code
538401

M.Sc. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Chemistry (Spelization in Nanoscience and Technology)

APPLICATION OF NANOTECHNOLOGY

(CBCS – 2016 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What do you mean by lithography?
2. What is the principle of fusion bonding?
3. What are bioactive nanomaterials? Give an example.
4. What are nanobiosensors? Give an example.
5. What do you mean by drug tergetting?
6. Distinguish between cell therapy and gene therapy.
7. Write the principle of photocatalytic decontamination.
8. Distinguish between thermoelectrics and piezoelectrics.
9. What do you mean by Photonics?
10. What is quantization of action?

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) How will you prepare nanoparticles by ion beam lithography technique?

Or

(b) Write notes on surface confined chemical sensors.

12. (a) Discuss the principles of nanomedicine.

Or

(b) Write the use of nanoparticles in diagnostics.

13. (a) How targetted delivery is taking place?

Or

(b) Explain the interaction between the protein and nanopaticles.

14. (a) How will you remove microbes by using nanoparticles?

Or

(b) Write the application of nanoparticles in fuel cells.

15. (a) Write the role of CNTs in electronics.

Or

(b) Discuss the applications of CNTs in dye sensitized solar cells.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. How will you evaluate the performance of MEMS?

17. Discuss the applications of nanoparticles in cancer therapy.

18. Discuss the role of nanoparticles drug delivery in cardiology and vascular disease.

19. How will you study antimalarial and antiviral activities using nanomaterials?

20. Write notes on Nanoelectronics.

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R–3041

Sub. Code
538506

M.Sc. DEGREE EXAMINATION, APRIL 2019.

Fourth Semester

Chemistry (Spl. in Nanoscience B.Tech.)

NANOCOMPOSITES

(CBCS – 2016 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Define stability.
2. Write nanocomposite.
3. What is metal oxide?
4. Define XRD.
5. Define self-assembly.
6. Write the uses of synthetic polymer nanocomposite.
7. What are nanomaterials used for teeth replacement?
8. What are the factors involved in nanocomposite?
9. What is Clay?
10. Write the types of carbon nanocomposite.

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Write the types of nanocomposite and its application.

Or

(b) Make short notes on mechanical properties of nanocomposite.

12. (a) Write short notes on metal oxide with example of nanocomposite material.

Or

(b) Write short notes on metal nanocomposite.

13. (a) Write the types of nancomposite.

Or

(b) Explain neatly polymer – based nanocomposite.

14. (a) Write the industrial application of nanocomposite.

Or

(b) Write short notes on sample preparation of nanocomposite from Spider Silk.

15. (a) Write the synthesis process of Chitosan – based nanocomposite.

Or

(b) Explain about self-assembly.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Write in detail about synthesis method of nanocomposite with one example.

17. Write in detail about properties of nanocomposite and its advantages.

18. Describe the clay – based nanocomposite.

19. Explain in detail about organic and inorganic nanocomposite through self-assembly.

20. Discuss the pharmaceutical application of nanocomposite.

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R–3227

Sub. Code
538102

M.Sc. DEGREE EXAMINATION, APRIL 2019

First Semester

Chemistry (Spl. in Nano Science and Technology)

ORGANIC CHEMISTRY – I

(CBCS – 2016 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is a carbanion? Give an example.

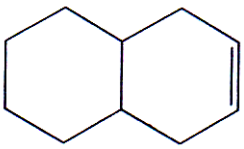
2. Define Microscopic reversibility.

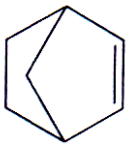
3. What is S_N1 mechanism? Explain with examples.

4. Define 'Bredts rule'.

5. Define homoaromaticity with example.

6. Write the name of the following compounds:

(a) 

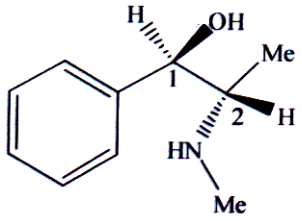
(b) 

7. Define Fischer Projection formula.

8. What is meant by *threo* and *erythro* isomers?

9. Give an example of stereospecific reaction.

10. Assign RS notation of the following compound:



Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) State and explain Steric inhibition of resonance.

Or

(b) Write note on Hammond postulate.

12. (a) Give the S_E2 and S_E1 mechanisms with suitable example.

Or

(b) Discuss the mechanism of E1 reaction.

13. (a) Explain the Huckels 4n+2 rule with suitable examples.

Or

(b) Why Cyclopenta dienyl anion is aromatic and its Cyclopenta dienyl cation is antiaromatic? Explain.

14. (a) Describe the conformers and their stability ethylene glycol.

Or

(b) Discuss the difference between chirality and prochirality.

15. (a) Explain conformational analysis of mono and disubstituted pyclohexanes.

Or

(b) Explain the stereochemical features of allenes and spirans.

Part C (3 × 10 = 30)

Answer any **three** questions.

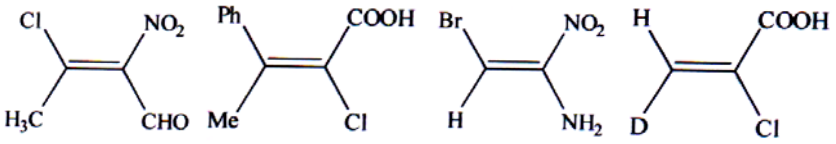
16. Discuss any two non-kinetic methods of determination of reaction mechanism.

17. Discuss briefly the E2 and E1CB mechanisms with the corresponding stereochemical implications.

18. Discuss briefly on homoaromaticity and antiaromaticity.

19. Assign E-Z notation for the following compounds:

[4 × $2\frac{1}{2}$ = 10]



(a) (b) (c) (d)

20. Define the term asymmetric synthesis. State and illustrate Cram's rule of asymmetric induction.

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R–3228

Sub. Code
538301

M.Sc. DEGREE EXAMINATION, APRIL 2019

Third Semester

Chemistry (Special in Nanoscience and Technology)

INORGANIC CHEMISTRY – III

(CBCS – 2016 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Give the limitation of VBT.

2. Define Jahn-Teller distortion. Give suitable example.

3. Define anation reaction. Give example.

4. State trans effect.

5. Explain Nephelauxetic effect.

6. Describe spin cross over in detail.

7. What is sodium ion pump?

8. How is detoxification done by chelation?

9. Describe the function of Myoglobine.

10. Explain chlorophyll with uses.

Part B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) Explain in detail about VBT.

Or

(b) Comparison between CFT and MOT.

12. (a) Give an account on acid hydrolysis.

Or

(b) What are the factors that govern the rate of substitution reaction?

13. (a) What are characteristic of d-d transition?

Or

(b) Give an account temperatureindependent paramagnetism.

14. (a) Give the names of essential and trace metal ion in the Human body along with its function.

Or

(b) Explain the toxic effect of metal cadmium with suitable example.

15. (a) Give a detail account on hemoglobin.

Or

(b) Explain in detail about cytochrome.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. (a) Based on CFT explain the colour and magnetic properties of the complex.

(i) $[CoF_6]^{3-}$

(ii) $[F_6(CN)_6]^{4-}$

(b) Write notes on the experimental evidences for the presence of pi-bonding in co-ordination compounds.

17. (a) Explain S_N1 and S_N2. S_N1CB substitution reaction with mechanism.

(b) Write the detail about innersphere and outersphere reaction with suitable example.

18. (a) Draw and explain the Orgel diagram for the tetrahedral and octahedral d^2 and d^3 system.

(b) Define para and antiferro magnetism.

19. (a) Explain the process occur in photosystem I and II.

(b) Explain the therapeutic application of cis-platin.

20. (a) Discuss in elaborate about Nitrogen fixation.

(b) Discuss about structure and function of the following.

(i) Hemocynin

(ii) Hemerythrin

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R–3229

Sub. Code
538302

M.Sc. DEGREE EXAMINATION, APRIL 2019

Third Semester

Chemistry (Specialisation with Nanoscience and Technology)

ORGANIC CHEMISTRY — III

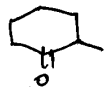
(CBCS – 2016 onwards)

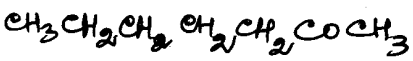
Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Write the photolysis products in the following compounds.

   (a) 

   (b) 

2. Draw a simple Jablonski diagram.

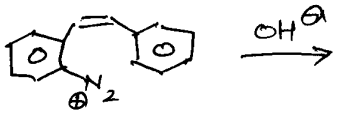
3. Explain the characteristics of metastable ions.

4. Indicate the requirement of a carbonyl compound to undergo McLafferty rearrangement. Illustrate with examples.

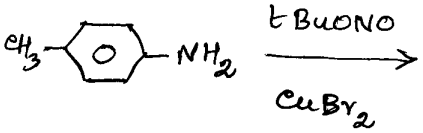
5. Explain what is meant by CIDNP.

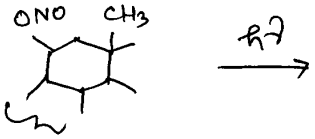
6. Predict the number of signals for p-nitroanisole in the ^{13}C NMR spectrum. Indicate the off-resonance decoupled pattern for the predicted signals.

7. What happens when the acidic solution of an aryl diazonium salt is made alkaline? Write the product in the following reaction.



8. Write the products in the following reactions:

(a) 

(b) 

9. Define 'synthetic equivalent' and 'disconnection'.

10. Provide examples of functional group disposition while proposing any retrosynthetic route.

Part B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) Explain the processes photosensitization and photoreduction.

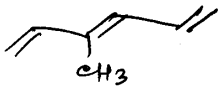
Or

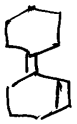
(b) Write the mechanism and scope of Paterno Buchi reaction. What type of ketones cannot undergo Paterno Buchi reaction?

12. (a) Describe the importance of isotope peaks of mass spectra in recognising the number of carbon atoms in a molecule and to predict the number and nature of halogen atoms present in a molecule.

Or

(b) Predict the λ_{max} for the following compounds:

(i) 

(ii) 

(iii) 

(iv) 

(v) 

13. (a) Explain the terms 'free induction decay', 'frequency domain spectrum' and 'relaxation time'.

Or

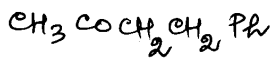
(b) What is nuclear overhauser effect? What are the consequences of nuclear overhauses effect? Explain how this phenomenon is helpful in understanding the structure of an organic compound.

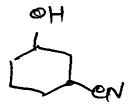
14. (a) Describe the applications of LDA and Gilman's reagent.

Or

(b) Explain the factors that decide the stability of a free radical that is generated as an intermediate during chemical transformation.

15. (a) Propose retrosynthetic analysis for the following compounds identifying the starting materials:

(i) 

(ii) 

Or

(b) Explain how the nitro group attached to an aryl ring can be converted to other useful functional groups for further manipulation.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. What is cotton effect? Explain the different types of ORD curves. Discuss the concept of octant rule and explain its applications in arriving at configurations of cyclic chiral ketones.

17. Explain how IR spectroscopy can be used to distinguish the following pairs of compounds: (5 × 2)

    (a) terminal alkyne and nonterminal alkyne

    (b) 2-hydroxybenzoic acid and 4-hydroxybenzoic acid

    (c) $CH_3COCH = CH_2$ and $CH_3COCH_2CH = CH_2$

    (d) Cyclohexanone and 2-methylcyclopentanone

    (e) PhCOOMe and MeCOOPh.

18. Write notes on : (7 + 3)

    (a) Methods of simplifying complex NMR spectra

    (b) Ring current effect.

19. (a) Provide the outcome of woodward and prevost methods of hydroxylation by providing the mechanism of the reactions. (5 + 5)

    (b) Explain the uses of DCC and Merrifield resins.

20. Highlight the necessity for protection and deprotection while proposing synthetic routes. Discuss the methods of protecting and deprotecting hydroxyl, amino, keto and carboxyl groups.

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