

CSM—19/22

CHEMISTRY

ରସାୟନ ବିଜ୍ଞାନ

PAPER—II

Time : 3 Hours

ସମୟ : ୩ ଘଣ୍ଟା

Full Marks : 250

ପୂର୍ଣ୍ଣ ସଂଖ୍ୟା : ୨୫୦

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The figures in the right-hand margin indicate marks.

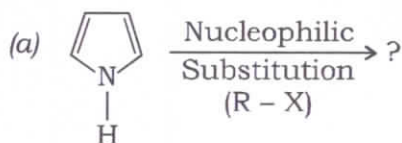
ପ୍ରଶ୍ନପତ୍ରର ଡାହାଣ ପଟେ ପ୍ରତ୍ୟେକ ପ୍ରଶ୍ନର ମାର୍କ ଦର୍ଶାଯାଇଛି ।

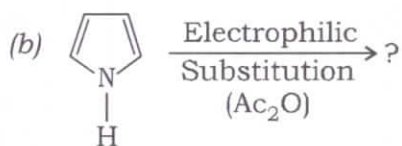
Candidates should attempt **any 10 (ten)** questions of **GROUP—A** with word limit of 250 words and should attempt **any 5 (five)** questions from **GROUP—B** with word limit of 300 words.

ପରୀକ୍ଷାର୍ଥୀମାନେ **GROUP—A** ରୁ ଯେକୌଣସି ୧୦ଟି ପ୍ରଶ୍ନର ଉତ୍ତର ୨୫୦ ଶବ୍ଦ ମଧ୍ୟରେ ଏବଂ **GROUP—B** ରୁ ଯେକୌଣସି ୫ଟି ପ୍ରଶ୍ନର ଉତ୍ତର ୩୦୦ ଶବ୍ଦ ମଧ୍ୟରେ ସୀମିତ ରଖିବେ ।

### GROUP—A

1. Why is  $4n+2$  cycloaddition reaction thermally allowed? Explain with Woodward correlation diagram. 15  
କାହିଁକି  $4n+2$  cycloaddition reaction thermally ଅନୁମତି ଦିଆଯାଏ? Woodward correlation diagram ସହିତ ବ୍ୟାଖ୍ୟା କର ।
2. Why is the hierarchy of protein structure essential? 15  
କାହିଁକି hierarchy of protein structure ଅତ୍ୟାବଶ୍ୟକ ଅଟେ ?
3. How can porphyrine ring be synthesized from pyrrole? Give all the possible products of the following substitution reactions : 15  
Pyrrole ରୁ porphyrine ring କିପରି synthesize କରାଯାଇ ପାରିବ? ନିମ୍ନୋକ୍ତ ପ୍ରତିସ୍ଥାପନ ପ୍ରତିକ୍ରିୟାଗୁଡ଼ିକର ସମସ୍ତ ସମ୍ଭାବ୍ୟ ଉତ୍ପାଦ ଉଲ୍ଲେଖ କର ।





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4. Find the organic compound with molecular formula C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>N gives IR at 1695 cm<sup>-1</sup>, 1573 cm<sup>-1</sup>, 1358 cm<sup>-1</sup> and 1281 cm<sup>-1</sup>. Its NMR (<sup>1</sup>H) gives δ = 8.0 (d, 10.49 sq.), δ = 7.4 (d, 10.5 sq.), δ = 3.0 (q, 10.5 sq.), δ = 1.2 (t, 15.7 sq.). 15

Molecular formula ସହିତ Organic compound ବାହାର କର । C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>N gives IR at 1695 cm<sup>-1</sup>, 1573 cm<sup>-1</sup>, 1358 cm<sup>-1</sup> and 1281 cm<sup>-1</sup>. Its NMR (<sup>1</sup>H) gives δ = 8.0 (d, 10.49 sq.), δ = 7.4 (d, 10.5 sq.), δ = 3.0 (q, 10.5 sq.), δ = 1.2 (t, 15.7 sq.).

5. How can the molecular weight of a polymer be determined using viscometry method? Derive Poiseuille equation. 15

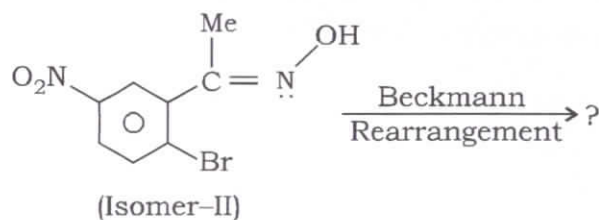
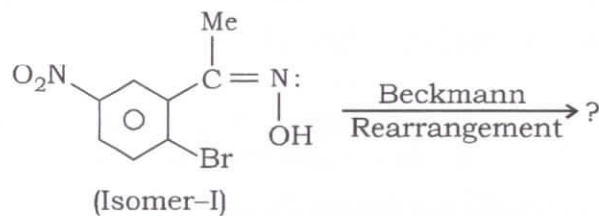
Viscometry method ବ୍ୟବହାର କରି ଏକ polymer molecular ଓଜନ କିପରି ନିର୍ଣ୍ଣୟ କରାଯାଇ ପାରିବ? Poiseuille ସମୀକରଣର ସମାଧାନ କର ।

6. What is the concept behind NMR active and NMR inactive nuclei? Describe the reason why neutron shows magnetic moments although it is neutral in charge. 15

NMR active ଏବଂ NMR inactive nuclei ପଛରେ କ'ଣ ଧାରଣା ରହିଛି? ଯଦିଓ Neutron charge ରେ ନିରପେକ୍ଷ ରହେ ଏହା କାହିଁକି ରୁମ୍ବକୀୟ ମୁହୂର୍ତ୍ତଗୁଡ଼ିକ ଦେଖାଇଥାଏ, କାରଣ ବର୍ଣ୍ଣନା କର ।

7. How do the isomeric rearrangements affect the Beckmann Rearrangement reaction? Explain the following reactions using complete mechanism : 15

Isomeric rearrangements Beckmann Rearrangement reaction କୁ କିପରି ପ୍ରଭାବିତ କରେ? ସଂପୂର୍ଣ୍ଣ କୌଶଳ ବ୍ୟବହାର କରି ନିମ୍ନୋକ୍ତଗୁଡ଼ିକୁ ବ୍ୟାଖ୍ୟା କର ।



8. Why is the nucleophilicity order of halides  $I^- > Br^- > Cl^-$  in protic solvent but it is reverse in aprotic solvent? 15

Halides ର Nucleophilicity order protic ଦ୍ରବଣରେ  $I^- > Br^- > Cl^-$  କିନ୍ତୁ ଏହା aprotic ଦ୍ରବଣରେ ଓଲଟା କାହିଁକି?

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9. Describe the principle of vibrational spectroscopy indicating harmonic vibrational levels, construct the character table for  $C_{3v}$  space group with active vibration in IR and Raman. 15

Harmonic vibrational levels କୁ ସୂଚିତ କରି vibrational spectroscopyର ନୀତିକୁ ବର୍ଣ୍ଣନା କର, IR ଏବଂ Raman ରେ active vibration ସହ  $C_{3v}$  space group ପାଇଁ character table ତିଆରି କର ।

10. Why are synthetic metals attracted attention in research? Find  $\bar{M}_N$  and  $\bar{M}_M$  of two polymers of equal masses having  $M_1 = 10000$  and  $M_2 = 100000$ . 15

ଗବେଷଣାରେ Synthetic metals କାହିଁକି ଧ୍ୟାନ ଆକର୍ଷଣ କରେ?  $M_1 = 10000$  ଏବଂ  $M_2 = 100000$  ଥିବା ସମାନ mass ଗୁଡ଼ିକର ଦୁଇଟି polymer ର  $\bar{M}_N$  ଏବଂ  $\bar{M}_M$  ବାହାର କର ।

11. Write the mechanism and difference between Norrish-I and Norrish-II reactions. Describe the  $\alpha$ -cleavage in cyclic ketone. 15

Norrish-I ଏବଂ Norrish-II ପ୍ରତିକ୍ରମା ମଧ୍ୟରେ କୌଣସି ଏବଂ ପାର୍ଥକ୍ୟ ସବୁ କ'ଣ? cyclic ketone ରେ  $\alpha$ -cleavage କୁ ବର୍ଣ୍ଣନା କର ।

12. What is the process of DNA denaturation? How does it impact the structure and function of DNA molecule? Explain mid-point temperature ( $T_m$ ). 15

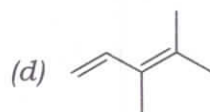
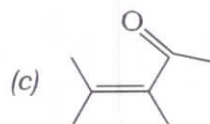
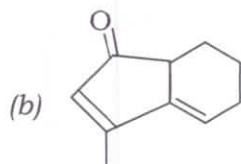
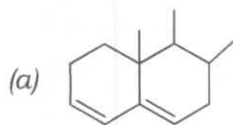
DNA denaturation ର ପ୍ରକ୍ରିୟା କ'ଣ? ଏହା DNA molecule ର ଗଠନ ଏବଂ କାର୍ଯ୍ୟକୁ କିପରି ପ୍ରଭାବିତ କରେ? Mid-point ତାପମାତ୍ରାକୁ ବ୍ୟାଖ୍ୟା କର ।

GROUP—B

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13. What is Franck-Condon principle in electronic spectroscopy? Calculate the  $\lambda_{\max}$  of the following structures using Woodward-Fieser rule : 20

Electronic spectroscopy ରେ Franck-Condon ନୀତି କ'ଣ? Woodward-Fieser କ ନିୟମ ବ୍ୟବହାର କରି ନିମ୍ନ ଗଠନର  $\lambda_{\max}$  ଗଣନା କର ।



14. What is metastable ion or peak? Explain the formation of metastable ion by showing 1st and 2nd field free region. Rearrange *n*-heptanone using McLafferty rearrangement. 20

Metastable ion କିମ୍ବା Peak କ'ଣ? ପ୍ରଥମ ଓ ଦ୍ୱିତୀୟ କ୍ଷେତ୍ରମୁକ୍ତ ଅଞ୍ଚଳ ଦେଖାଇ metastable ion ର ବ୍ୟାଖ୍ୟା କର । McLafferty rearrangement ବ୍ୟବହାର କରି *n*-heptanone କୁ rearrange କର ।

15. Compare the chain-growth polymerization mechanism and step growth polymerization mechanism of addition polymerization process. Write the preparatory mechanism of polysilane. 20

Compare the chain-growth polymerization mechanism ଏବଂ step growth polymerization mechanism of addition polymerization process କୁ ତୁଳନା କର । Polysilane ର Preparatory mechanism କୁ ଉଲ୍ଲେଖ କର ।



16. Describe the complete mechanisms of the following rearrangement reactions (any three) : 20

ନିମ୍ନଲିଖିତ Rearrangement ର Complete mechanism କୁ ବର୍ଣ୍ଣନା କର । (ଯେକୌଣସି ତିନିଟିର)

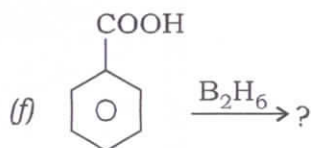
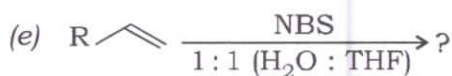
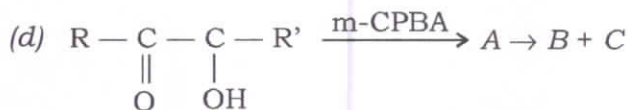
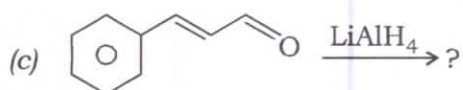
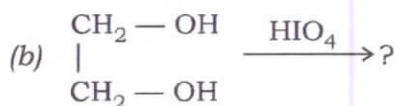
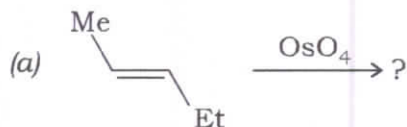
- (a) Hoffmann
- (b) Claisen
- (c) Wagner-Meerwein
- (d) Pinacol-Pinacolone

17. Give the energy diagram of  $S_N1$  and  $S_N2$  reactions for hydrolysis of  $1^\circ$  and  $3^\circ$  halides. Compare electrophilic substitution in benzene with activating and deactivating groups. 20

$1^\circ$  ଏବଂ  $3^\circ$  halides ର hydrolysis ପାଇଁ  $S_N1$  ଏବଂ  $S_N2$  reaction ର energy diagram ପ୍ରଦାନ କର । Activating ଏବଂ Deactivating group ସହ Benzene electrophilic substitution ର ତୁଳନା କର ।

18. Predict the product with suitable mechanism of reagent. 20

Reagentର ଉପଯୁକ୍ତ mechanism ସହ ଉତ୍ପାଦକୁ ପୂର୍ବାନୁମାନ କର ।



★★★