3 (Sem–1) CHM M2

2021

(Held in 2022)

CHEMISTRY

(Major)

Paper : 1·2

(Organic Chemistry)

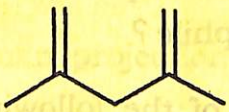
Full Marks : 60

Time : Three hours

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

1. Answer the following questions : 1×7=7

   (a) Write the IUPAC name of the following compound :



   (b) What is hybridization of an allylic carbon atom ?

   (c) Between dimethyl ether and diphenyl ether, which compound has the higher *C–O–C* bond angle ?

(d) Why is the melting point of *p*-nitrophenol higher than *o*-nitrophenol ?

(e) Define racemic mixture.

(f) What do you mean by an asymmetric carbon ?

(g) Draw the structure of benzyne.

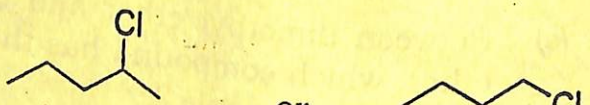
2. Answer the following questions : 2×4=8

(a) Between ethanol and ethanethiol, which one is a stronger acid and why ?

(b) What is a meso-compound ? Give *one* example.

(c) Why is benzene more reactive towards an electrophile compared to a nucleophile ?

(d) Which of the following molecules will undergo faster nucleophilic substitution reaction, and why ?



or

3. Answer the following questions : ***(any three)*** 5×3=15

(a) Explain why —

(i) pent-1-yne has lower pK_a than pent-1-ene ;

(ii) methylamine has lower pK_b than aniline. 2½+2½=5

(b) What is tautomerism ? Draw the tautomeric forms of nitromethane and indicate their stability. 2+3=5

(c) Draw and name the possible conformations of *n*-butane in—

(i) Sawhorse projection formula ;

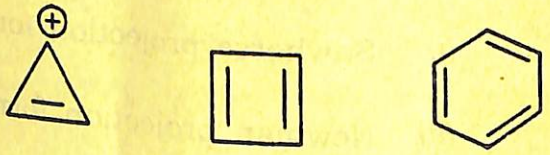
(ii) Newman projection formula. 2+3=5

(d) What is carbene ? What are different types of carbene ? Which is the most stable type and why ? 1+2+2=5

(e) What do you mean by kinetically-controlled and thermodynamically-controlled reactions? Draw the energy profile diagram for these two reactions. 2+3=5

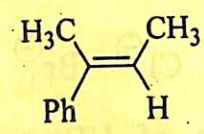
4. Answer the following questions : ***(any three)*** 10×3=30

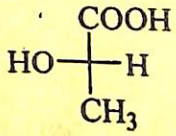
(a) (i) Explain resonance with an example. Classify the following molecules as either aromatic, non-aromatic or anti-aromatic : 2+3=5



(ii) Write the general mechanism for SN2 reaction. Explain the stereochemistry of the SN2 reaction. 3+2=5

(b) (i) Define enantiomer and diastereomer with *one* example each. Assign absolute configuration — *R/S* or *E/Z* to the following molecules : 3+2=5

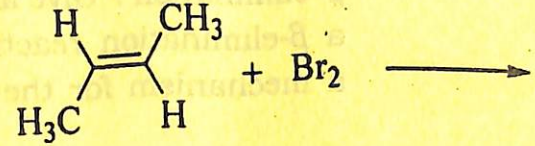




(ii) What is σ-complex in electrophilic aromatic substitution reactions? Write the steps involved in the nitration reaction of benzene. 2+3=5

(c) (i) Draw the possible conformations of cyclohexane. Which conformation is the most stable and why? 3+2=5

(ii) Identify the product and write the mechanism of the following reaction : 1+4=5

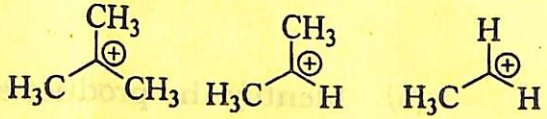


(d) (i) Distinguish between electrophile and nucleophile. Arrange the following nucleophiles in the increasing order of reactivity in a polar protic solvent with proper justification : 2+3=5

$F^{\ominus}$ $Cl^{\ominus}$ $Br^{\ominus}$ $I^{\ominus}$

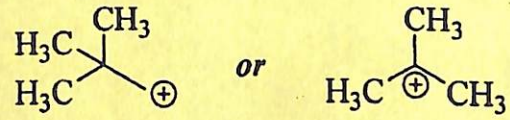
(ii) Addition of *HBr* to propene is regioselective. Explain. 5

(e) (i) What is hyperconjugation ? Draw the possible hyperconjugating structures of the following cations and arrange them according to their increasing stability : 1+4=5



(ii) What do you mean by β-elimination ? Give an example of a β-elimination reaction. Propose a mechanism for the reaction. 1+1+3=5

(f) (i) What are carbocations ? Suggest *one* general method for its generation. What kind of structure do carbocations generally adopt ? Which of the following two carbocations is more stable and why ? 1+1+1+2=5



(ii) What is a free radical ? By what process are free radicals formed ? Predict the product and write the mechanism of the following reaction : 1+1+3=5