**2 0 2 2**

( CBCS )

( 6th Semester )

# CHEMISTRY

TWELFTH (B) PAPER

**( Natural Products )**

*Full Marks* : 75

*Time* : 3 hours

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

## ( SECTION : A—OBJECTIVE )

( *Marks* : 10 )

Tick (✓) the correct answer in the brackets provided : 1×10=10

**1.** Sesquiterpenes consist of _____ isoprene units.

*(a)* two ( )

*(b)* three ( )

*(c)* four ( )

*(d)* five ( )

**2.** An alkaloid which can be isolated by steam distillation is

*(a)* reserpine ( )

*(b)* atropine ( )

*(c)* vinblastine ( )

*(d)* nicotine ( )

**3.** In mass spectrometry, the loss of methyl radical from the molecular ion is common if the molecule has

*(a)* $CH_3$ group ( )

*(b)* $OCH_3$ group ( )

*(c)* $NH_2CH_3$ group ( )

*(d)* None of the above ( )

**4.** In the analysis of terpene, UV-vis spectra gives useful information regarding

*(a)* the number of double bonds ( )

*(b)* degree of substitution of double bonds ( )

*(c)* Both *(a)* and *(b)* ( )

*(d)* Neither *(a)* nor *(b)* ( )

**5.** The total number of chiral centers in rotenone is

*(a)* three ( )

*(b)* four ( )

*(c)* five ( )

*(d)* six ( )

**6.** In morphine, the C-5 oxygen bridge and the C-6 hydroxyl bridge are

*(a)* *syn-* to each other ( )

*(b)* *anti-* to each other ( )

*(c)* *trans-* to each other ( )

*(d)* *cis-* to each other ( )

**7.** In Wesley-Moser rearrangement, demethylation is brought about by

*(a)* hydriodic acid ( )

*(b)* hydrochloric acid ( )

*(c)* perchloric acid ( )

*(d)* peracids ( )

**8.** Pheromones are chemical compounds which can be detected

*(a)* at moderate concentrations only ( )

*(b)* only at high concentrations ( )

*(c)* even at low concentrations ( )

*(d)* None of the above ( )

**9.** Which one of the following is an example of chiral marine natural product?

*(a)* Didemnenone *A* ( )

*(b)* Paraconic acid ( )

*(c)* Corey lactone benzoate ( )

*(d)* (–)-khusimone ( )

**10.** The key intermediate in the production of isoflavonoid phytoalexins is

*(a)* naringenin ( )

*(b)* hydrogenistein ( )

*(c)* liquiritigenin ( )

*(d)* daidzein ( )

## ( SECTION : B—SHORT ANSWER )

( *Marks* : 15 )

Answer the following questions : 3×5=15

### UNIT—I

**1.** What are benzylisoquinoline alkaloids? Give one example.

**OR**

**2.** Write the name and structure of a tetraterpenoid which is responsible for the deep red colour of ripe tomato.

UNIT—II

**3.** What do you understand by multiplicity of signals in $^{1}H$ NMR spectra?

**OR**

**4.** Mention one advantage and one disadvantage of mass spectrometry over other spectrometry.

UNIT—III

**5.** How will you distinguish between *S* and *R* isomers of benzylisoquinoline alkaloids?

**OR**

**6.** Explain why neomenthyl chloride reacts 200 times faster than menthyl chloride in $E_2$ elimination reaction.

UNIT—IV

**7.** Explain how a cabbage gives exclusive but restricted feeding rights to the cabbage butterfly while repelling other insects.

**OR**

**8.** Explain how even small change in structure of a pheromone could result in large in its physiological profile.

UNIT—V

**9.** Name an antihypertensive alkaloid isolated from *Rauwolfia serpentina*. Write its structure.

**OR**

**10.** Name one paraconic acid. Write its structure and mention its medicinal values.

## ( SECTION : C—DESCRIPTIVE )

( *Marks* : 50 )

UNIT—I

**1.** *(a)* Write the name and structure of a tertiary alcohol (sesquiterpene) which is a component of Peru balsam. 2

*(b)* Mention three general properties of terpenes. 3

*(c)* Starting from *R*-(–)-Mevalonic acid, describe the biosynthesis of geranyl-geranyl pyrophosphate (GGPP) (the precursor of all diterpenes). 5

**OR**

**2.** *(a)* How is UV-spectroscopy useful in alkaloid detection? 2

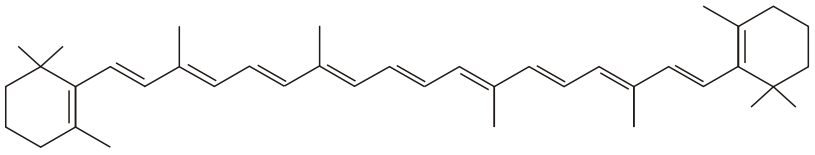
*(b)* Why is it not possible to devise an isolation procedure suitable for the extraction of all types of alkaloids? 3

*(c)* Explain Hoffmann degradation of alkaloids. What are its limitations? 5

UNIT—II

**3.** *(a)* What do you understand by multiplicity of signals? 3

*(b)* Calculate the absorption maximum in the UV spectra of -carotene, (*A*) recorded in hexane. 3



(*A*)

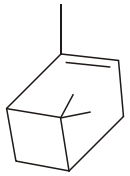
*(c)* Discuss the advantage of spectroscopic method over classical method for the structure elucidation of organic compounds. 4

**OR**

**4.** *(a)* How will you distinguish between cyclic and acyclic compounds using IR spectra? 2

*(b)* What are the advantages of using $^{13}C$ NMR spectroscopy in structure elucidation of organic compounds? 3

*(c)* The mass spectrum of -pinene (*B*) gives *m/z* values at 136, 106, 93 and 77. How will you account for this? 5



(*B*)

UNIT—III

**5.** *(a)* Explain why the skeletal structure of naturally occurring germacranolides could assume different stereochemical shapes. 2

*(b)* Write the structure of morphine and identify the chiral centers. 3

*(c)* Elucidate the absolute stereochemistry of (–)-abietic acid. 5

**OR**

**6** *(a)* Write the structure of rotenone. How many chiral centers does it have? Identify them. 3

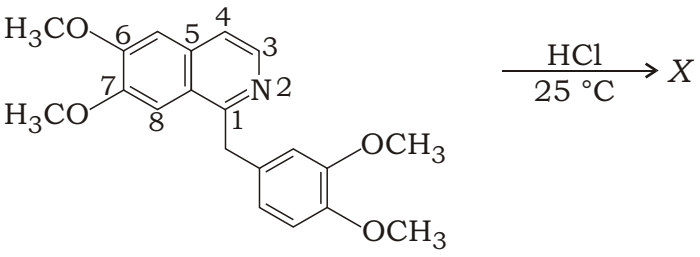
*(b)* Write the structure of vinblastine. Mention its medicinal uses. 3

*(c)* Write the names and structures of all the stereoisomers of menthol. 4

## UNIT—IV

**7.** *(a)* Explain why molecular rearrangement of *N*-methyl papaverine chloride to *N*-methyl pavine called a molecular yoga. 3

*(b)* Identify the missing compound, *X* : 3



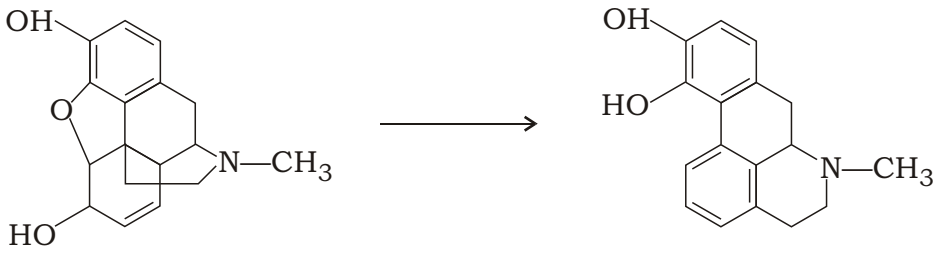

*(c)* What are defensive secretions of insects? Explain how *Anisomorpha buprestoides* defend itself against predators. 4

**OR**

**8.** *(a)* What are insect pheromones? How are they classified? 2

*(b)* Explain why defensive secretions are important for the very survival of the species. 3

*(c)* Discuss with mechanism rearrangement of morphine in the acid catalyzed reaction resulting in the formation of apomorphine : 5



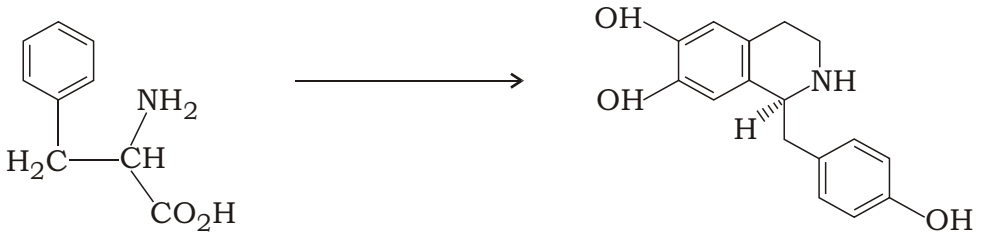

*Morphine* *Apomorphine*

## UNIT—V

**9.** *(a)* What are semiochemicals? 2

*(b)* Explain how morphinandienone alkaloids are produced by species of the genus *Papaver*. Write the structure of one such alkaloid. 3

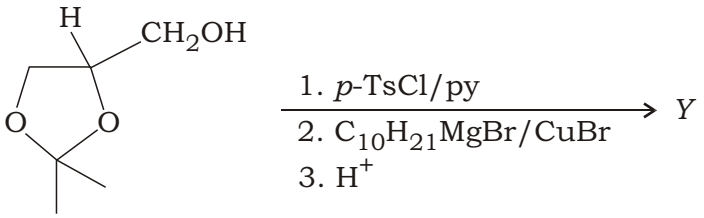
*(c)* What are the steps involved in the biosynthesis of (*S*)-norcoclaurine from *L*-phenylalanine? 5




*L-phenylalanine* *S-norcoclaurine*

**OR**

**10.** *(a)* Identify the missing compound *Y*, an intermediate in the synthesis of hexadecanolide, a semiochemical from oriental hornet (*Vespa orientalis*). 2




*(b)* Write the name and structure of first member of benzylisoquinoline alkaloids family. 2

*(c)* Explain the steps involved in the biosynthetic transformation of 1,2-dehydroreticulinium ion to thebaine. 6

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