29. An introduction to A Level organic chemistry

29.4 Isomerism- optical

Paper 4

Question Paper

1 Neotame is an artificial sweetener added to some foods.

neotame

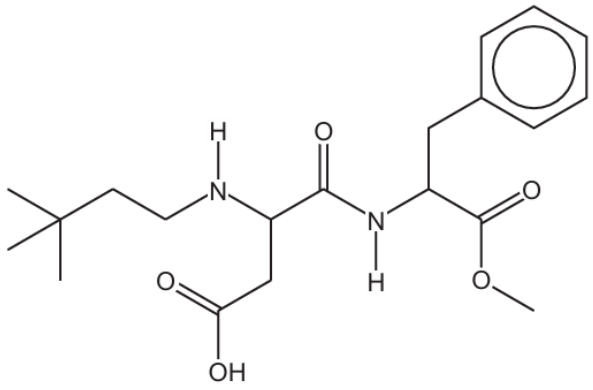


Fig. 8.1

(a) (i) State the number of chiral carbon atoms in a molecule of neotame.

..... [1]

2 **(a)** The structure of compound **P** is shown in Fig. 7.1.

P

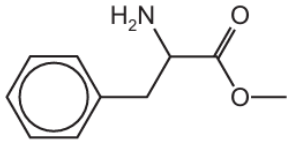


Fig. 7.1

(i) **P** is optically active.

Use an asterisk (*) to identify all chiral carbon atoms on the structure of **P** in Fig. 7.1. [1]

(ii) Plane polarised light is passed through a pure sample of one enantiomer of **P**. This is then repeated with a pure sample of the other enantiomer of **P**.

Describe the results of these two experiments, stating the similarities and differences of the results.

.....

.....

..... [2]

3 The amino acid serine, $HOCH_2CH(NH_2)COOH$, exists in two optically active forms. These optical isomers, isomer **P** and isomer **Q**, are shown in Fig. 8.1.

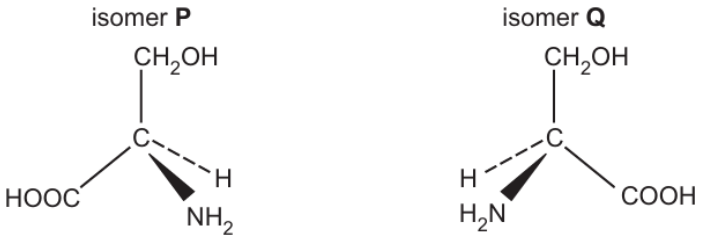


Fig. 8.1

(a) Isomer **P** and isomer **Q** have identical physical and chemical properties, with the exception of two specific properties. One of these two properties is their differing effect on plane polarised light.

State the other property by which they differ.

.....

..... [1]

(b) A solution of pure isomer **P** of a particular concentration rotates plane polarised light by 5.0° in a clockwise direction.

Describe how a solution of pure isomer **Q** of the same concentration affects plane polarised light.

.....

..... [1]

(c) State another term, in addition to stereoisomers, optical isomers and non-superimposable mirror images, which can be used to describe this pair of chiral compounds, isomer **P** and isomer **Q**.

..... [1]

(d) Give the term used to describe a mixture containing equal amounts of isomer **P** and isomer **Q**.

..... [1]

(e) Describe **one** way in which a single pure optical isomer of serine can be produced, instead of making a mixture of isomer **P** and isomer **Q**.

..... [1]

4 **(a)** Perindopril is a drug used to treat heart disease.

perindopril

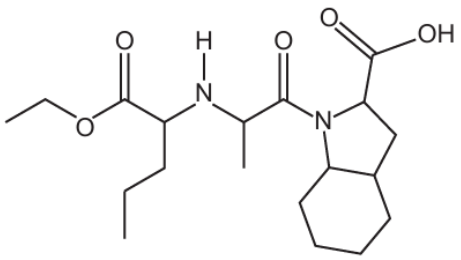


Fig. 6.1

(i) State the number of chiral carbon atoms present in one molecule of perindopril.

..... [1]

(ii) Suggest **one** benefit and **one** disadvantage of producing a drug such as perindopril as a single pure optical isomer.

benefit .....

.....

disadvantage .....

.....

[2]

5 **(a)** Describe what is meant by a racemic mixture.

.....

..... [1]

6 **(c)** Cortisone, $C_{21}H_{28}O_5$, is a naturally occurring chemical that contains chiral carbon atoms.

cortisone

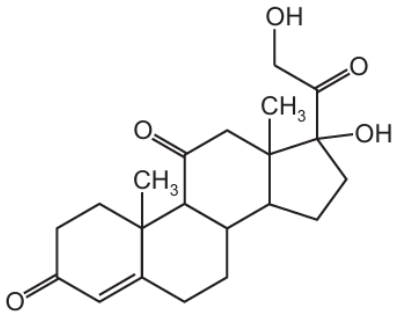


Fig. 7.1

(i) Deduce the number of chiral carbon atoms in one molecule of cortisone.

..... [1]

(ii) Cortisone is reacted with an excess of $NaBH_4$.

State the molecular formula of the organic compound formed.

..... [1]

(iii) Cortisone is an optically active molecule.

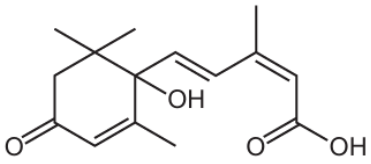
Explain what is meant by optically active.

.....

.....

..... [1]

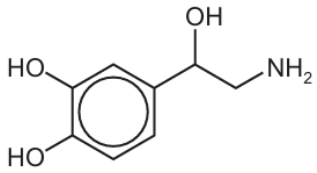
7 Abscisic acid, $C_{15}H_{20}O_4$, is a plant hormone.



abscisic acid, $C_{15}H_{20}O_4$

(a) On the diagram of abscisic acid, use an asterisk (*) to label each chiral carbon atom. [1]

8 Noradrenaline is a hormone found in humans.



noradrenaline

(b) State whether or not noradrenaline shows stereoisomerism. Explain your answer.

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..... [1]