

**Section A**

Q1 The formula  $\text{CH}_3$  can represent an anion, a cation or a free radical. Species with the molecular formula  $\text{CH}_3$  can act as an electrophile, a free radical or a nucleophile depending on the number of outer shell electrons on the central carbon atom.

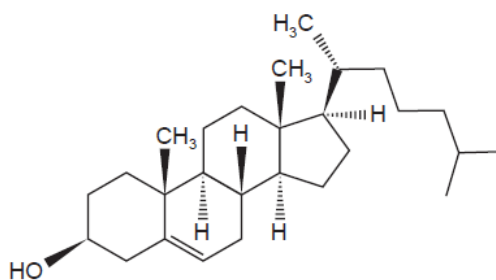
How many outer shell electrons must be present for  $\text{CH}_3$  to act in these different ways?

	$\text{CH}_3$ as an electrophile	$\text{CH}_3$ as a free radical	$\text{CH}_3$ as a nucleophile
<b>A</b>	6	7	8
<b>B</b>	6	8	7
<b>C</b>	7	6	8
<b>D</b>	8	7	6

Q2 Pentanol,  $\text{C}_5\text{H}_{11}\text{OH}$ , has four structural isomers that are primary alcohols. How many of these primary alcohols contain a chiral carbon atom?

A 0                      B 1                      C 2                      D 3

Q3 The diagram shows the structure of the naturally-occurring molecule cholesterol.



cholesterol

Student X claimed that the seventeen carbon atoms in the four rings all lie in the same plane.

Student Y claimed that this molecule displays cis-trans isomerism at the  $\text{C}=\text{C}$  double bond. Which of the students are correct?

A both X and Y                      B neither X nor Y  
C X only                                D Y only

Q4 Which compound does not show cis-trans isomerism?

A 2-methylpent-2-ene                      B 3-methylpent-2-ene  
C 3,4-dimethylhex-3-ene                      D pent-2-ene

Q5 Which formulae show propanone and propanal as different compounds?

A empirical, molecular, structural and displayed formulae  
B molecular, structural and displayed formulae only  
C structural and displayed formulae only  
D displayed formulae only

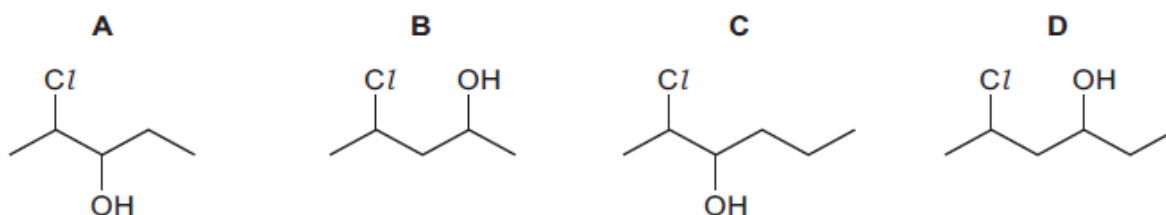
Q6 How many isomers with the formula  $\text{C}_5\text{H}_{10}$  have structures that involve  $\pi$  bonding?

A 3                      B 4                      C 5                      D 6

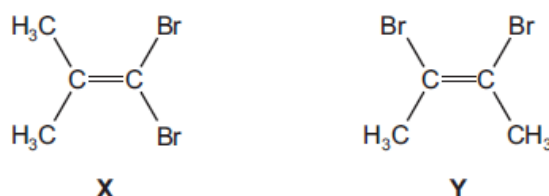
Q7 How many isomeric esters have the molecular formula  $\text{C}_4\text{H}_8\text{O}_2$ ?

A 2                      B 3                      C 4                      D 5

Q8 Which diagram gives the skeletal formula of 2-chloropentan-3-ol?



Q9 Isomers X and Y both react with HBr.



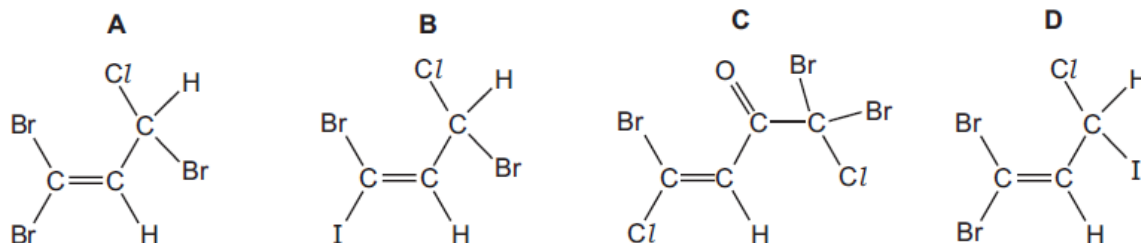
A mixture of X and Y is reacted with HBr.

Which three structures represent three different possible products of this reaction?

- A**  $(\text{CH}_3)_2\text{CHCBr}_3$      $(\text{CH}_3)_2\text{CBrCHBr}_2$      $\text{CH}_3\text{CHBrCHBrCH}_3$
- B**  $(\text{CH}_3)_2\text{CHCBr}_3$      $(\text{CH}_3)_2\text{CBrCHBr}_2$      $\text{CH}_3\text{CBr}_2\text{CHBrCH}_3$
- C**  $(\text{CH}_3)_2\text{CBrCBr}_3$      $(\text{CH}_3)_2\text{CHCBr}_3$      $\text{CH}_3\text{CBr}_2\text{CHBrCH}_3$
- D**  $(\text{CH}_3)_2\text{CBrCHBr}_2$      $\text{CHBr}_2\text{CBr}(\text{CH}_3)\text{CH}_3$      $\text{CH}_3\text{CHBrCBr}_2\text{CH}_3$

Q10 The following compounds are found in the seaweed *Asparagopsis taxiformis*.

Which compound could show both cis-trans isomerism and optical isomerism?



Q11 Pentane,  $\text{C}_5\text{H}_{12}$ , is reacted with chlorine in the presence of ultraviolet light. A compound R is found in the products. R has molecular formula  $\text{C}_5\text{H}_{10}\text{Cl}_2$ . Each molecule of R contains one chiral carbon atom.

Which two atoms of the pentane chain could be bonded to chlorine atoms in this isomer?

- A 1 and 3    B 1 and 5    C 2 and 3    D 2 and 4

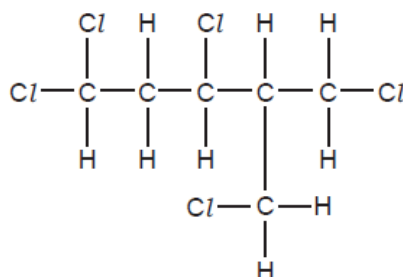
Q12 How many isomers, including structural and stereoisomers, with the formula  $\text{C}_4\text{H}_8$  have structures that involve  $\pi$  bonding?

- A 1    B 2    C 3    D 4

Q13 In the general formula of which class of compound, is the ratio of hydrogen atoms to carbon atoms the highest?

- A alcohols  
B aldehydes  
C carboxylic acids  
D halogenoalkanes

Q14 The molecule shown is optically active.



How many chiral carbon atoms are present in this molecule?

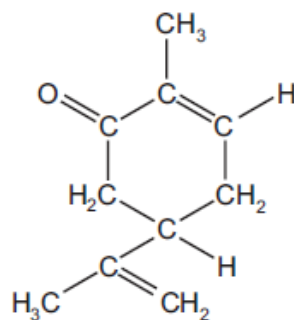
A 1

B 2

C 3

D 4

Q15 Carvone is found in spearmint.



carvone

How many  $\sigma$  and  $\pi$  bonds are present in this molecule?

	$\sigma$	$\pi$
A	13	3
B	22	3
C	22	6
D	25	3

Q16 An alkene has the formula  $\text{CH}_3\text{CH}=\text{CRCH}_2\text{CH}_3$  and does not possess cis-trans isomers.

What is R ?

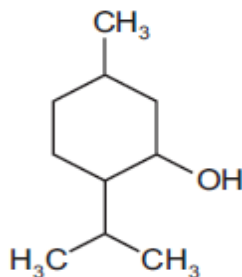
A H

B Cl

C  $\text{CH}_3$

D  $\text{C}_2\text{H}_5$

Q17 Menthol is an important compound extracted from the peppermint plant.

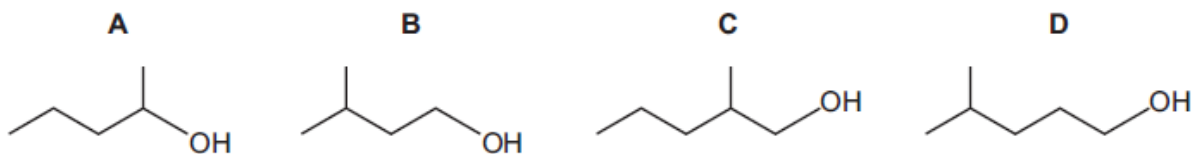


menthol

How many chiral centres are there in one molecule of menthol?

- A 1                      B 2                      C 3                      D 4

Q18 What is the skeletal formula of 2-methylpentan-1-ol?



### Section B

A	B	C	D
1, 2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

Q19 What is always involved in a carbon-carbon  $\pi$  bond?

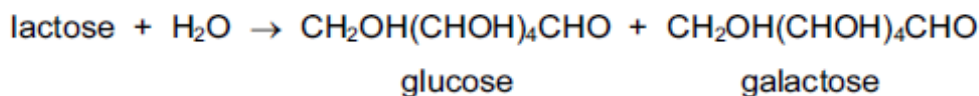
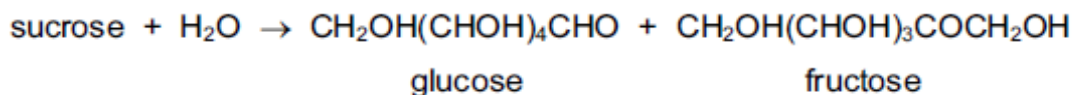
- 1 a shared pair of electrons
- 2 a sideways overlap of p orbitals
- 3 delocalised electrons

Q20 What are the same for a pair of optical isomers?

- 1 their empirical formula
- 2 their functional groups
- 3 their structural formula

Q21 Disaccharides,  $C_{12}H_{22}O_{11}$ , are important in the human diet. For example, sucrose is found in pastries and lactose occurs in milk products.

Both of these compounds can be hydrolysed.



Which statements about these hydrolysis products are correct?

- 1 Glucose and fructose have structural isomers.
- 2 Glucose and galactose are optical isomers.
- 3 Glucose and galactose are ketones.

1. A
2. B
3. B
4. A
5. C
6. D
7. C
8. A
9. B
10. B
11. A
12. D
13. A
14. A
15. D
16. D
17. C
18. C
19. B
20. A
21. B