CHEMISTRY MULTIPLE CHOICE QUESTIONS

Organic Chemistry

Introductory Topics

2002 -2014

1.

What is the total number of different chloroethanes (formula $C_2H_{6-n}Cl_n$, where n can be any integer from 1 to 6)?

A 6 **B** 8 **C** 9 **D** 10

[2002 M/J (21)]

2.

Which compound on reaction with hydrogen cyanide produces a compound with a chiral centre?

A CH_3CHO

B $CH_3CH_2COCH_2CH_3$

C $CH_3CO_2CH_3$

D HCHO

[2002 M/J (25)]

3.

Which pairs of compounds have the same empirical formula?

1 ethane and ethene

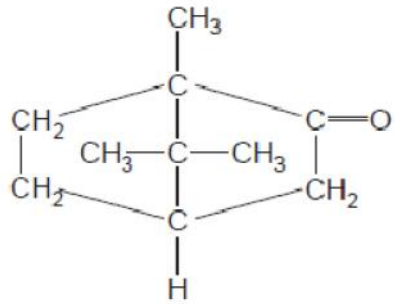
2 ethene and cyclohexane

3 cyclohexane and oct-1-ene

[2002 M/J (31)]

4.

Camphor is used for medical purposes, the diagram shows its structure.



How many chiral centres are present in one molecule of camphor?

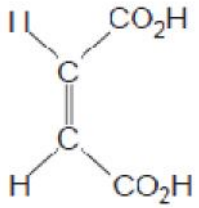
A 0 **B** 1 **C** 2 **D** 3

[2002 O/N (21)]

5.

Which compound is both chiral and acidic?

A



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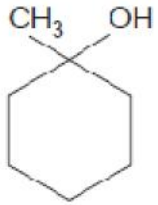
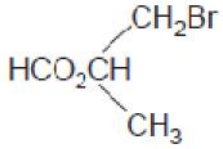
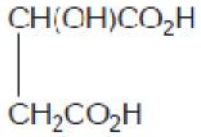


C



D



[2002 O/N (29)]

6.

Which compounds have the empirical formula CH_2O?

1 methanal

2 ethanoic acid

3 methyl methanoate

[2002 O/N (31)]

7.

Which compounds show *cis trans* isomerism?

1 but-2-ene

2 but-1-ene

3 2-methylpropene

[2002 O/N (37)]

8.

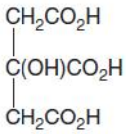
How many structural and *cis-trans* isomers are there for dichloropropene, $C_3H_4Cl_2$?

A 3 **B** 5 **C** 6 **D** 7

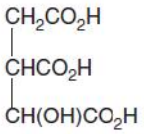
[2003 M/J (20)]

9.

The isomers, citric acid and isocitric acid, are intermediates in the Krebs cycle of the oxidation of glucose in living cells.



citric acid



isocitric acid

How many chiral centres does each acid possess?

	citric acid	isocitric acid
A	0	1
B	0	2
C	1	1
D	1	2

[2003 M/J (21)]

10.

Which reaction is **not** an electrophilic addition?

A $CH_2{=}CH_2 + HI \longrightarrow CH_3CH_2I$

B $CH_3CH{-}CH_2 + Br_2 \longrightarrow CH_3CHBrCH_2Br$

C $CH_3CH{=}CH_2 + H_2O \xrightarrow{\text{conc } H_2SO_4} CH_3CH(OH)CH_3$

D $CH_3CHO + HCN \longrightarrow CH_3CH(OH)CN$

[2003 M/J (25)]

11.

How many alcohols (including both structural isomers and stereoisomers) can have the molecular formula $C_4H_{10}O$?

A 3 **B** 4 **C** 5 **D** 6

[2003 O/N (20)]

12.

On strong heating a hydrocarbon produces ethene, propane and but-1-ene in the mole ratio 5 : 1 : 1.

What is the molecular formula of the hydrocarbon?

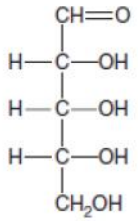
A $C_{17}H_{34}$ **B** $C_{17}H_{36}$ **C** $C_{19}H_{38}$ **D** $C_{19}H_{40}$

[2003 O/N (22)]

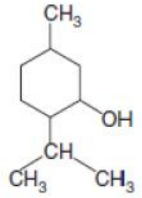
13.

38 The taste buds on the tongue are chiral and can distinguish one optical isomer from another.

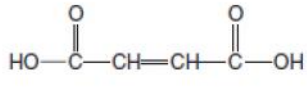
Which naturally-occurring compounds will have optical isomers that may be distinguished by taste?

1 

ribose

2 

menthol

3 

maleic acid

[2003 O/N (38)]

14.

Which of these always applies to a nucleophile?

A It attacks a double bond.

B It has a lone pair of electrons.

C It is a single atom.

D It is negatively charged.

[2004 M/J (21)]

15.

What can behave as an electrophilic reagent?

A Br_2

B Na

C NH_3

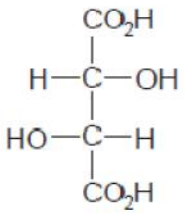
D CN^-

[2004 O/N (20)]

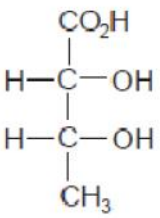
16.

Which molecule does not have a chiral centre?

A



B



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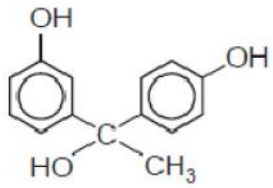
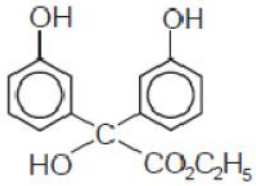


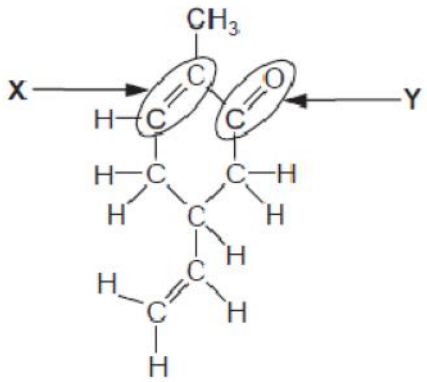
D



[2004 O/N (21)]

17.

This molecule is responsible for the flavour of spearmint chewing gum.



What is a true statement about the functional groups **X** or **Y**?

A **X** will undergo nucleophilic addition.

B **Y** will undergo nucleophilic addition.

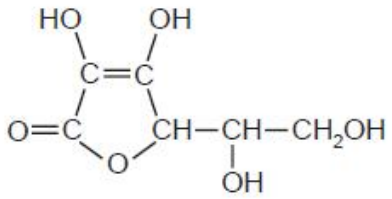
C **X** will undergo electrophilic substitution.

D **Y** will undergo electrophilic substitution.

[2004 O/N (24)]

18.

The diagram shows the structure of vitamin C.



How many chiral centres are there in one molecule?

A 1 **B** 2 **C** 3 **D** 4

[2005 O/N (19)]

19.

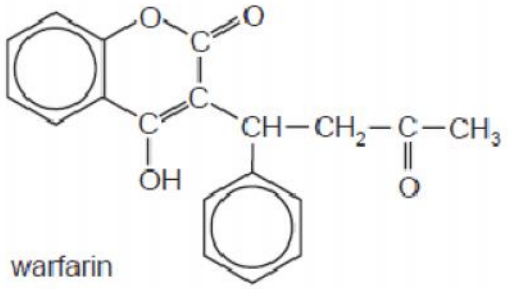
What is the number of isomers of $C_2H_2Cl_2$ including *cis-trans* isomers?

A 2 **B** 3 **C** 4 **D** 5

[2005 O/N (20)]

20.

Warfarin is used as a rat poison.



warfarin

How many chiral centres are present in the warfarin molecule?

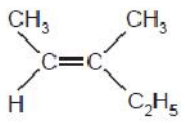
A 0 **B** 1 **C** 2 **D** 3

[2006 M/J (21)]

21.

The structures below show isomers of C_6H_{12}.

1



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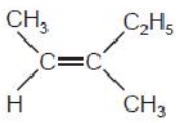

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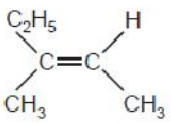

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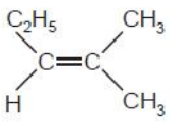


In which pair are the members *cis-trans* isomers of each other?

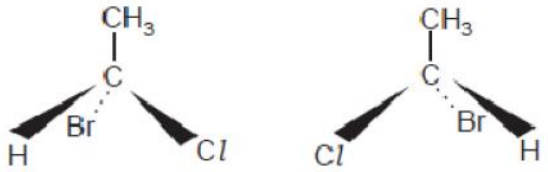
A 1 and 2 **B** 1 and 3 **C** 1 and 4 **D** 2 and 4

[2006 M/J (22)]

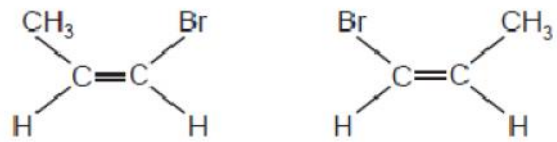
22.

In which pairs are the members stereoisomers of each other?

1



2



3

[2006 M/J (37)]

23.

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

A alcohols

B aldehydes

C carboxylic acids

D halogenoalkanes

[2006 O/N (20)]

24.

What is the total number of different chloroethanes, formula $C_2H_{6\,n}Cl_n$, where n can be any integer from 1 to 4?

A 4 **B** 6 **C** 7 **D** 8

[2006 O/N (21)]

25.

Which reaction is an example of nucleophilic substitution?

A $CH_3CH_2Br \rightarrow CH_2{=}CH_2 + HBr$

B $CH_2{=}CH_2 + HBr \rightarrow CH_3CH_2Br$

C $C_3H_7Br + H_2O \rightarrow C_3H_7OH + HBr$

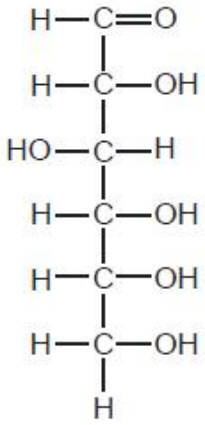
D $C_2H_6 + Br_2 \rightarrow C_2H_5Br + HBr$

[2006 O/N (22)]

26.

Glucose, $C_6H_{12}O_6$, is a product of photosynthesis.

It has the following structure.



How many *chiral* centres does the molecule have?

A 1 **B** 2 **C** 4 **D** 6

[2007 M/J (19)]

27.

Which molecules, each with a linear carbon chain, can have an optically active isomer?

I	II	III	IV
C_3H_6BrI	C_3H_4BrI	$C_3H_6I_2$	$C_3H_4Br_2$

A I and II only

B I, II and III only

C II and III only

D I, II and IV only

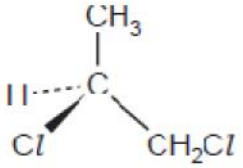
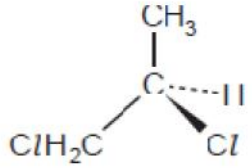
[2007 O/N (19)]

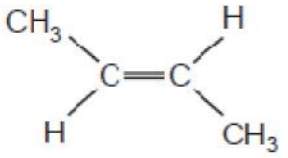
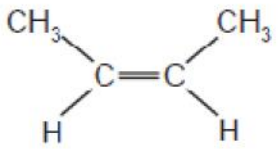
28.

In which pair do the isomers have identical boiling points?

A $CH_3CH_2CH_2CH_2OH$ and $(CH_3)_2CHCH_2OH$

B $CH_3(CH_2)_4CH_3$ and $(CH_3)_2CHCH(CH_3)_2$

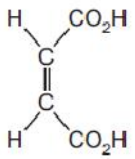
C  and 

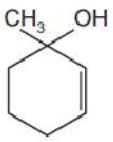
D  and 

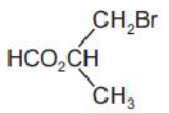
[2007 O/N (20)]

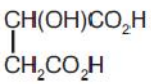
29.

Which compound is both chiral and acidic?

A 

B 

C 

D 

[2008 M/J (29)]

30.

For complete combustion, 1 mol of an organic compound **X** was found to require 2.5 mol of molecular oxygen.

Which compounds could be **X**?

1 C_2H_5OH

2 C_2H_2

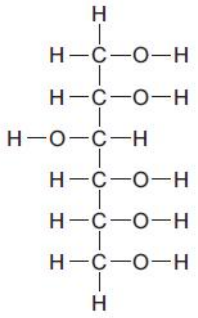
3 CH_3CHO

[2008 M/J (31)]

31.

Sorbitol is a naturally-occurring compound with a sweet taste. It is often used as a substitute for sucrose by the food industry.

The diagram shows its structure.



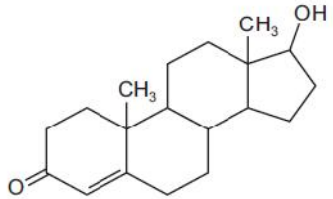
How many chiral centres are present in sorbitol?

A 1 **B** 2 **C** 3 **D** 4

[2008 O/N (20)]

32.

In recent years a number of athletes have been banned from sports because of their illegal use of synthetic testosterone, a naturally occurring hormone in the body.



testosterone

How many chiral centres are present in a testosterone molecule?

A 1 **B** 2 **C** 3 **D** 6

[2009 M/J (19)]

33.

The compound known as 'gamma-linolenic acid' is found in significant amounts in the seeds of the Evening Primrose plant. There is evidence that the compound may help patients with diabetes.

$CH_3(CH_2)_4CH=CHCH_2CH=CHCH_2CH=CH(CH_2)_4CO_2H$

gamma-linolenic acid

How many *cis-trans* isomers does gamma-linolenic acid have?

A 3 **B** 6 **C** 8 **D** 12

[2009 M/J (20)]

34.

What always applies to a nucleophile?

A It attacks a double bond.

B It has a lone pair of electrons.

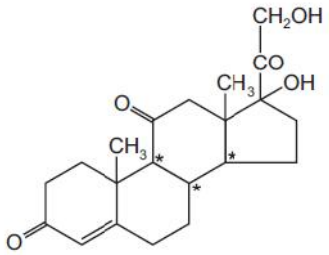
C It is a single atom.

D It is negatively charged.

[2009 M/J (21)]

35.

The drug cortisone has the formula shown.



In addition to those chiral centres marked by an asterisk (*), how many other chiral centres are present in the cortisone molecule?

A 0 **B** 1 **C** 2 **D** 3

[2009 O/N-11 (20)]

36.

Which compound exhibits both *cis-trans* and optical isomerism?

A $CH_3CH{=}CHCH_2CH_3$

B $CH_3CHBrCH{=}CH_2$

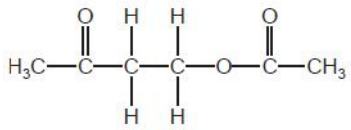
C $CH_3CBr{=}CBrCH_3$

D $CH_3CH_2CHBrCH{=}CHBr$

[2010 M/J-11 (30)]

37.

Compound X reacts with ethanoic acid in the presence of an H^+ catalyst to produce the compound below.



What is the molecular formula of compound X?

A $C_2H_6O_2$ **B** $C_2H_6O_3$ **C** C_4H_8O **D** $C_4H_8O_2$

[2010 O/N-11 (21)]

38.

How many structural isomers are there of trichloropropane, $C_3H_5Cl_3$?

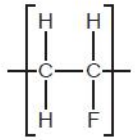
A 3 **B** 4 **C** 5 **D** 6

[2010 O/N-12 (20)]

39.

Fluoroalkenes are used to make polymers such as poly(vinyl)fluoride (PVF).

PVF is used to make non-flammable interiors for aircraft. The diagram shows the repeat unit of the polymer PVF.



What is the skeletal formula of the monomer of PVF?

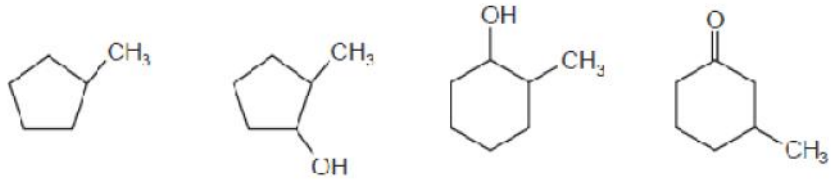
A  **B**  **C**  **D** 

[2010 O/N-12 (28)]

40.

Which of the compounds shown have chiral carbon atoms?

1 2 3 4



A 1, 2, 3 and 4

B 1 and 4 only

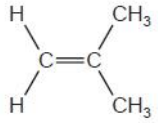
C 2 and 3 only

D 2, 3 and 4 only

[2010 O/N-12 (30)]

41.

The compound 2-methylpropene, C_4H_8, is a monomer used in the production of synthetic rubber.



In addition to 2-methylpropene there are x other isomers of C_4H_8, structural or otherwise, which contain a double bond.

What is the value of x?

A 1 **B** 2 **C** 3 **D** 4

[2010 O/N-13 (29)]

42.

The formula CH_3 can represent an anion, a cation or a free radical. Species with the molecular formula 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 CH_3 to act in these different ways?

	CH_3 as an electrophile	CH_3 as a free radical	CH_3 as a nucleophile
A	6	7	8
B	6	8	7
C	7	6	8
D	8	7	6

[2011 M/J-11 (22)]

43.

Pentanol, $C_5H_{11}OH$, has four structural isomers that are primary alcohols.

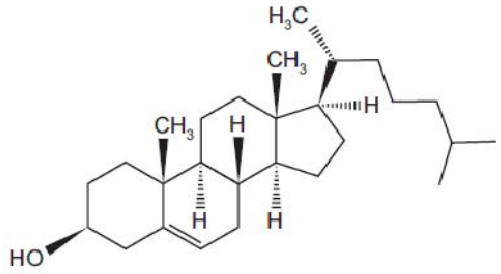
How many of these primary alcohols contain a chiral carbon atom?

A 0 **B** 1 **C** 2 **D** 3

[2011 M/J-11 (23)]

44.

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 C=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

[2011 M/J-11 (24)]

45.

The products obtained by cracking an alkane, **X**, are methane, ethene and propene.

The mole fraction of ethene in the products is 0.5.

What is the identity of **X**?

A C_6H_{14} **B** C_8H_{18} **C** C_9H_{20} **D** $C_{11}H_{24}$

[2011 M/J-12 (23)]

46.

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

[2011 M/J-12 (24)]

47.

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**

[2011 M/J-12 (25)]

48.

How many isomers with the formula C_5H_{10} have structures that involve π bonding?

A 3 **B** 4 **C** 5 **D** 6

[2011 M/J-12 (26)]

49.

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

[2011 O/N-11 (22)]

50.

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.

$$\text{sucrose} + H_2O \rightarrow \underset{\text{glucose}}{CH_2OH(CHOH)_4CHO} + \underset{\text{fructose}}{CH_2OH(CHOH)_3COCH_2OH}$$

$$\text{lactose} + H_2O \rightarrow \underset{\text{glucose}}{CH_2OH(CHOH)_4CHO} + \underset{\text{galactose}}{CH_2OH(CHOH)_4CHO}$$

Which statements about these hydrolysis products are correct?

1 Glucose and fructose have structural isomers.

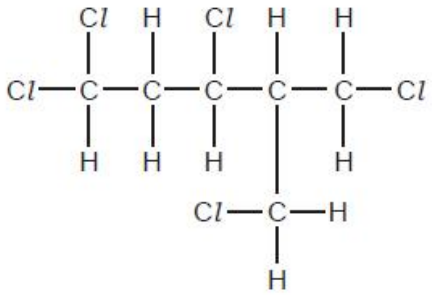
2 Glucose and galactose are optical isomers.

3 Glucose and galactose are ketones.

[2011 O/N-11 (37)]

51.

The molecule shown is optically active.



How many chiral carbon atoms are present in this molecule?

A 1 **B** 2 **C** 3 **D** 4

[2011 O/N-12 (27)]

52.

Which pairs of homologous series have the same C:H ratio in their general formulae?

1 aldehydes and ketones

2 carboxylic acids and esters

3 alkenes and ketones

[2011 O/N-12 (40)]

53.

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

[2011 O/N-13 (23)]

54.

An organic compound **J** reacts with sodium to produce an organic ion with a charge of –3. **J** reacts with NaOH(aq) to produce an organic ion with a charge of –1.

What could be the structural formula of **J**?

A $HO_2CCH(OH)CH_2CO_2H$

B $HO_2CCH(OH)CH_2CHO$

C $HOCH_2CH(OH)CH_2CO_2H$

D $HOCH_2COCH_2CHO$

[2012 M/J-11 (21)]

55.

How many isomeric esters have the molecular formula $C_4H_8O_2$?

A 2 **B** 3 **C** 4 **D** 5

[2012 M/J-11 (24)]

56.

What is **always** involved in a carbon-carbon π bond?

1 a shared pair of electrons

2 a sideways overlap of p orbitals

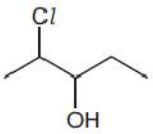
3 delocalised electrons

[2012 M/J-11 (37)]

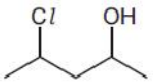
57.

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

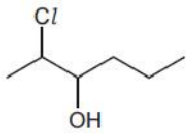
A



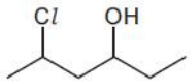
B



C



D



[2012 M/J-12 (21)]

58.

What are the same for a pair of optical isomers?

1 their empirical formula

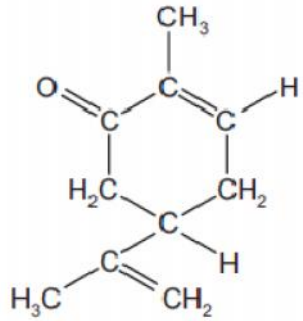
2 their functional groups

3 their structural formula

[2012 M/J-12 (38)]

59.

Carvone is found in spearmint.



carvone

How many σ and π bonds are present in this molecule?

	σ	π
A	13	3
B	22	3
C	22	6
D	25	3

[2012 O/N-11 (20)]

60.

An alkene has the formula $CH_3CH{=}CRCH_2CH_3$ and does **not** possess *cis-trans* isomers.

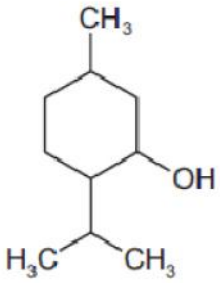
What is *R*?

A H **B** Cl **C** CH_3 **D** C_2H_5

[2012 O/N-11 (21)]

61.

Menthol is an important compound extracted from the peppermint plant.



menthol

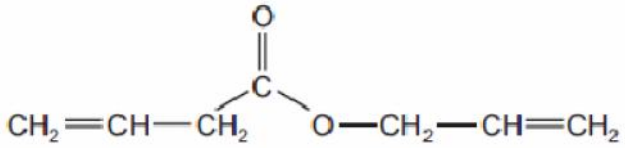
How many chiral centres are there in one molecule of menthol?

A 1 **B** 2 **C** 3 **D** 4

[2012 O/N-11 (22)]

62.

The diagram shows a molecule that has σ bonds and π bonds.



How many σ bonds are present in this molecule?

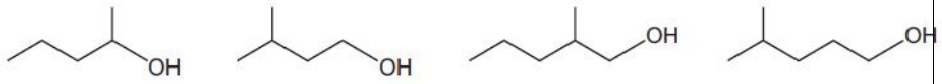
A 15 **B** 17 **C** 18 **D** 21

[2012 O/N-13 (21)]

63.

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

A **B** **C** **D**



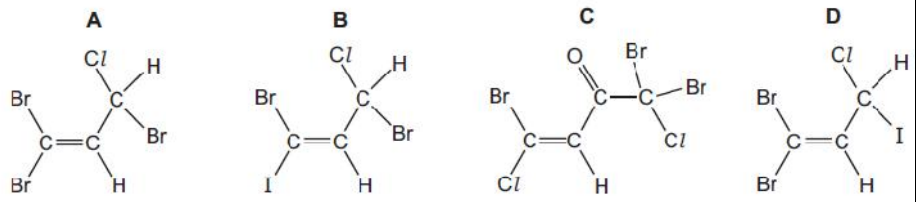
[2012 O/N-13 (29)]

64.

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

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

A **B** **C** **D**



[2013 M/J-11 (20)]

65.

What is true of every nucleophile?

A It attacks a double bond.

B It has a lone pair of electrons.

C It is a single atom.

D It is negatively charged.

[2013 M/J-13 (21)]

66.

How many isomers, including structural and stereoisomers, with the formula C_4H_8 have structures that involve π bonding?

A 1 **B** 2 **C** 3 **D** 4

[2013 M/J-13 (22)]

67.

Which compound exhibits stereoisomerism?

A $CH_3CHClCH_3$

B $CH_3CHClCH_2Cl$

C $CH_3CCl_2CH_3$

D $CH_2ClCH_2CH_2Cl$

[2013 O/N-11 (23)]

68.

Including structural and stereoisomers, how many isomers are there of $C_2H_2Br_2$?

A 2 **B** 3 **C** 4 **D** 5

[2013 O/N-11 (23)]

69.

How many geometrical (cis-trans) isomers are there of hex-2,4-diene, $CH_3CH=CHCH=CHCH_3$?

A none; hex-2,4-diene does not show geometric isomerism

B 2

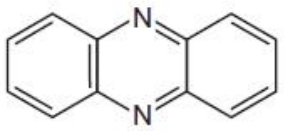
C 3

D 4

[2014 M/J-11 (29)]

70.

The diagram shows the skeletal formula of phenazine.



phenazine

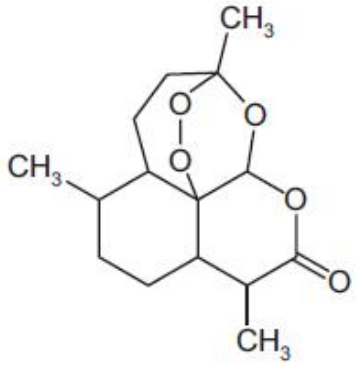
What is the empirical formula of phenazine?

A C_6H_4N **B** C_6H_6N **C** $C_{12}H_8N_2$ **D** $C_{12}H_{12}N_2$

[2014 M/J-12 (20)]

71.

Artemisinin is a powerful anti-malarial drug.



artemisinin

How many chiral centres are there in each molecule of artemisinin?

A 4 **B** 6 **C** 7 **D** 8

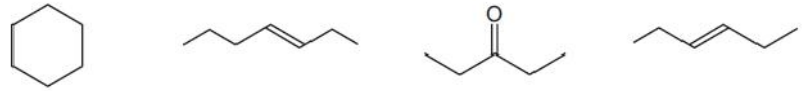
[2014 M/J-12 (30)]

72.

Use of the Data Booklet is relevant to this question.

Which compound has an M_r of 84 and will react with HBr to give a product with an M_r of 164.9?

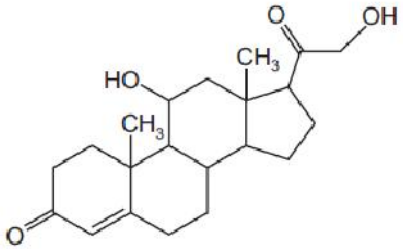
A **B** **C** **D**



[2014 O/N-11 (21)]

73.

Corticosterone is a hormone involved in the metabolism of carbohydrates and proteins.



corticosterone

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

A 5 **B** 6 **C** 7 **D** 8

[2014 O/N-11 (26)]

74.

The compound known as 'gamma-linolenic acid' is found in the seeds of the evening primrose plant.

$CH_3(CH_2)_4CH=CHCH_2CH=CHCH_2CH=CH(CH_2)_4CO_2H$

gamma-linolenic acid

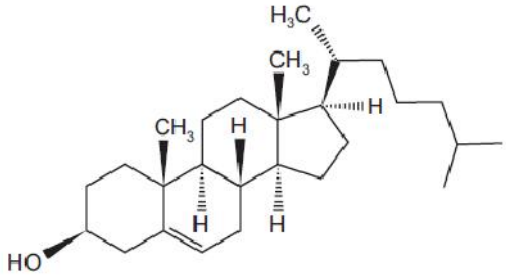
How many *cis-trans* isomers are there with this structural formula?

A 3 **B** 6 **C** 8 **D** 12

[2014 O/N-13 (25)]

75.

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



cholesterol

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

Student Y stated that this molecule displays *cis-trans* isomerism at the C=C double bond.

Which of the students are correct?

A both X and Y

B neither X nor Y

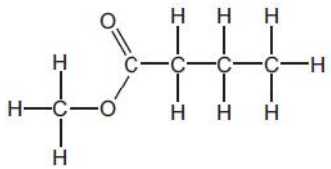
C X only

D Y only

[2014 O/N-13 (29)]

76.

Methyl butanoate, $C_5H_{10}O_2$, is an ester used in the food industry to give products the flavour of apples.



methyl butanoate

Including methyl butanoate, how many **structural** isomers are there of $C_5H_{10}O_2$ that are esters?

A 6 **B** 8 **C** 9 **D** 10

[2014 O/N-13 (30)]