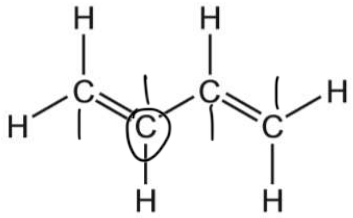
HW_AL_Hydrocarbons_30min

NO. 1

The diagram shows the structure of 1,3-butadiene.



1,3-butadiene

The addition reaction between 1,3-butadiene and two molecules of hydrogen bromide can produce three structurally isomeric products.

How many of these products have at least one chiral centre?

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

NO. 2

Which bromopropenes would react with cold bromine in the dark to form a product containing a chiral carbon atom?

1. $CHBr=CHCH_3$
2. $CH_2=CHCH_2Br$
3. $CH_2=CBrCH_3$

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

NO. 3

Which stage in the free radical substitution of ethane by chlorine has the lowest activation energy?

A. $Cl_2 \rightarrow 2Cl\bullet$
B. $Cl\bullet + C_2H_6 \rightarrow C_2H_5\bullet + HCl$
C. $C_2H_5\bullet + Cl_2 \rightarrow C_2H_5Cl + Cl\bullet$
D. $Cl\bullet + C_2H_5\bullet \rightarrow C_2H_5Cl$

NO. 4

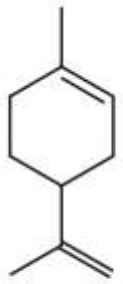
Ethane burns in oxygen to produce carbon dioxide and water vapour.

Which bond angles are present in the molecules of ethane and its combustion products?

	ethane	combustion products
A	90°	104.5° and 180°
B	90°	109.5° and 120°
C	109.5°	104.5° and 180°
D	109.5°	109.5° and 180°

NO. 5

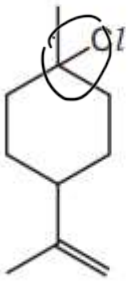
Limonene is found in lemon and orange oils.



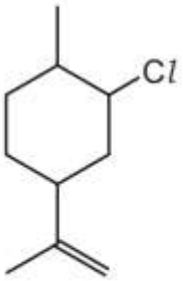
limonene

What will be the major product when limonene is reacted with an excess of dry hydrogen chloride?

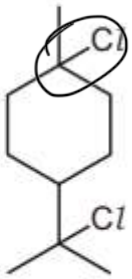
A



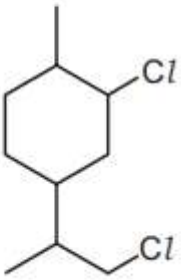
B



C

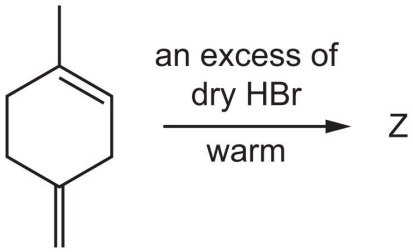


D

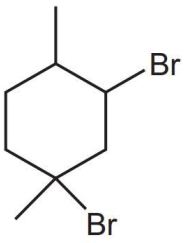


NO. 6

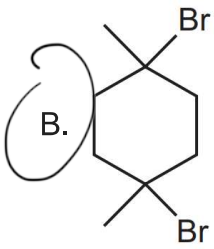
What is the major product Z of the following reaction?



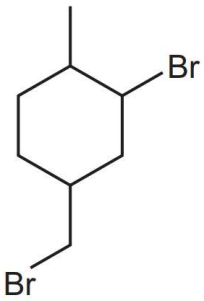
A.



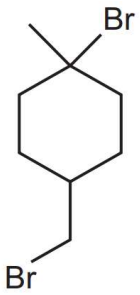
B.



C.



D.



NO. 7

A sample of propane, C_3H_8, with a mass of 9.61 g is completely combusted in an excess of oxygen under room conditions.

Which volume of carbon dioxide gas is produced?

A. 4.89 dm^3
B. 5.24 dm^3
C. 14.7 dm^3
D. 15.7 dm^3

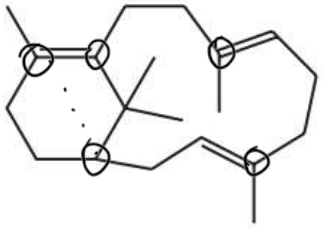
$12 \times 3 + 8 = 44$

$\frac{9.61}{44} \times 3 \times 24$

NO. 8

Compound P is treated with an excess of hydrogen gas in the presence of a nickel catalyst. The product Q is fully saturated.

compound P

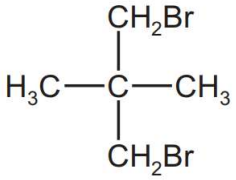


What is the number of chiral carbon atoms in the product Q?

A. 4
B. 5
C. 6
D. 7

NO. 9

The diagram shows the structure of a bromo compound that may be formed by the reaction of bromine with a hydrocarbon.



Which row is correct?

	type of reaction	mechanism
A	addition	electrophilic
B	addition	nucleophilic
C	substitution	nucleophilic
D	substitution	free-radical

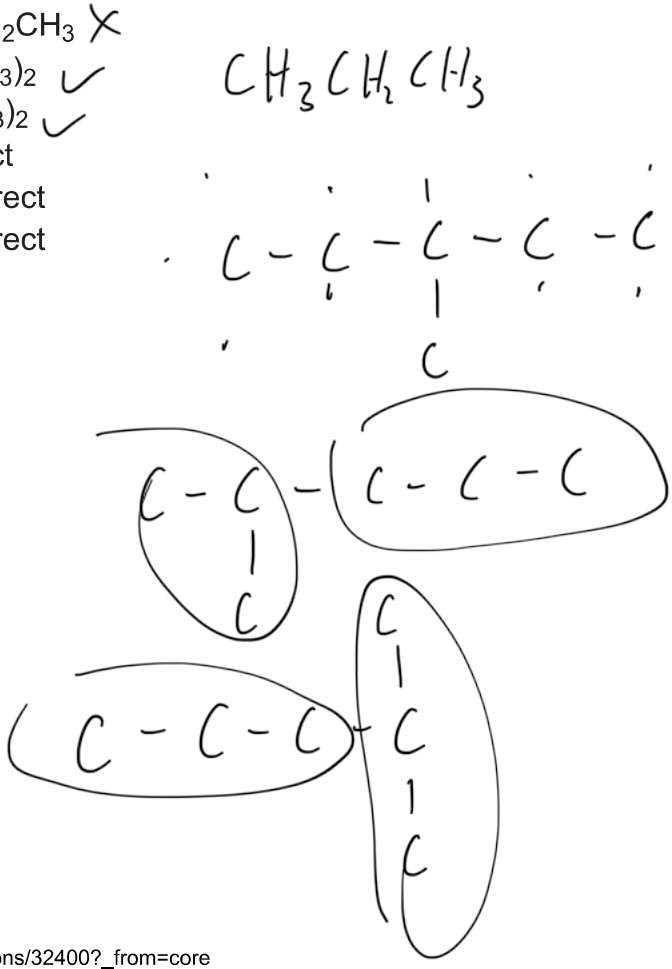
NO. 10

During the bromination of methane, the free radical CH_3• is generated. A possible termination step of this reaction is the formation of C_2H_6 by the combination of two free radicals.

What could be produced in a termination step during the bromination of **propane**?

1. $CH_3CH_2CH(CH_3)CH_2CH_3$
2. $CH_3CH(CH_3)CH(CH_3)_2$
3. $CH_3CH_2CH_2CH(CH_3)_2$

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



NO. 11

When aqueous bromine is shaken with cyclohexane and allowed to stand, two layers form. The top cyclohexane layer is coloured and the bottom aqueous layer is almost colourless.

What is the most likely explanation for this observation?

A. Bromine is reduced to bromide ions in the bottom layer.
B. Bromine molecules are non-polar.
C. Bromine reacts with water but cannot react with cyclohexane.
D. The product of the reaction between bromine and cyclohexane is coloured.

NO. 12

10 cm^3 of ethane is burned in 45 cm^3 of oxygen at a pressure of 101 kPa and a temperature of 200 °C. Complete combustion takes place.

What is the total volume of gas present when the reaction is complete, measured under the same conditions?

A. 30 cm^3
B. 50 cm^3
C. 55 cm^3
D. 60 cm^3

$$C_2H_6 + \frac{7}{2}O_2 \rightarrow 2CO_2 + 3H_2O$$

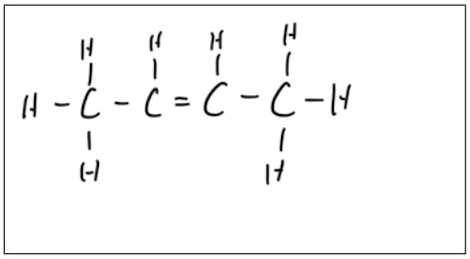
$$\frac{10}{24} \quad \frac{45}{24}$$

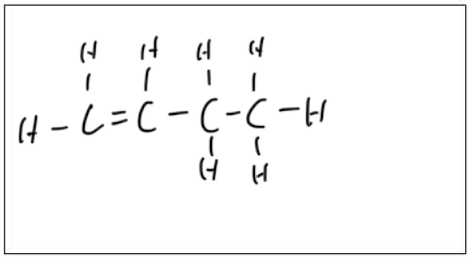
$$0 \quad \frac{10}{24} \quad \frac{20}{24} \quad \frac{30}{24}$$

NO. 13

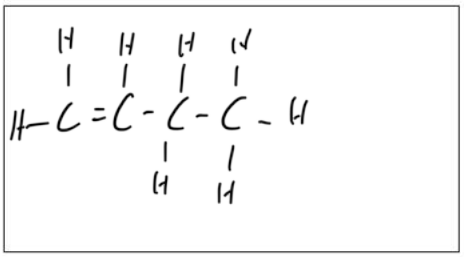
This question is about molecules with molecular formula C_4H_8.

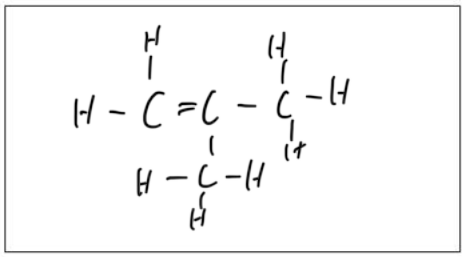
a. Give the structures of a pair of **positional** isomers with the formula C_4H_8. [1]



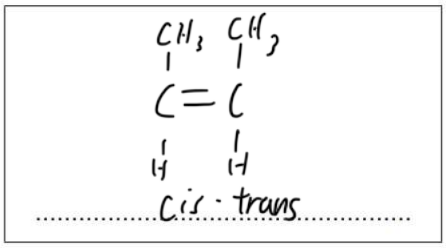


b. Give the structures of a pair of **chain** isomers with the formula C_4H_8, that do **not** exhibit stereoisomerism. [1]

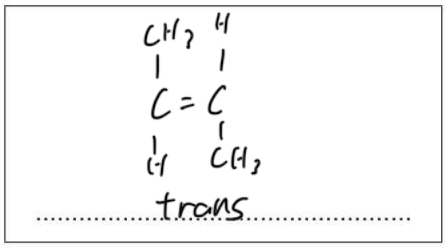




c. Give the structures and full names of a pair of **stereoisomers** with the formula C_4H_8. [2]

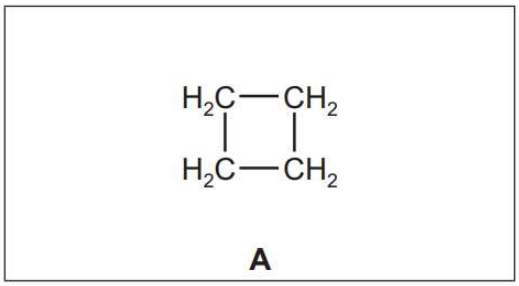


cis - trans

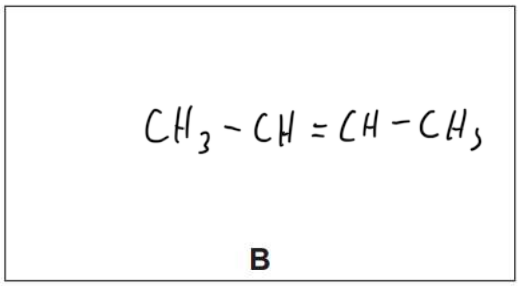


trans

d. The structure of a molecule, **A**, of formula C_4H_8 is shown.
Draw a functional group isomer of molecule **A** in box **B**. Explain how molecules **A** and **B** could be distinguished by a chemical test.



A



B

Use bromine water, B will decolorise ..... [3]

bromine water by electrophilic addition will
A is saturated) therefore cannot add bromine
all C-C bond are single bond
into it.

[Total: 7]