Name : _____() Class: _____ Date: _____

1 Which compound undergoes an addition reaction with bromine?

A C_2H_4 B C_2H_6 C C_2H_5OH D CH_3CO_2H ☐

2 What feature would show that a compound **must** be an alkene?

A if it only contains carbon and hydrogen
B if it reacts with bromine
C if it is a hydrocarbon with a C=C bond
D if it burns in air with a smoky flame ☐

3 A 10 cm^3 sample of a gaseous hydrocarbon was completely burnt in oxygen. The total volume of the products was 80 cm^3. Which equation represents the combustion of the hydrocarbon?

A $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$
B $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O$
C $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O$
D $C_4H_8(g) + 6O_2(g) \rightarrow 4CO_2(g) + 4H_2O(g)$ ☐

4 Which compound reacts with steam to produce an alcohol?

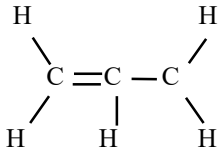
A butene B ethanoic acid C methane D propane ☐

5 Nonane, the ninth member of alkanes, is present in petrol. What products are formed when nonane is completely burnt in air?

A carbon dioxide and hydrogen
B carbon monoxide and water
C carbon dioxide and water
D carbon dioxide, carbon monoxide and water ☐

6 Which structural formula represents an unsaturated hydrocarbon?

A



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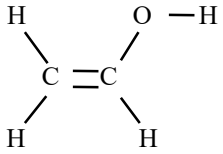

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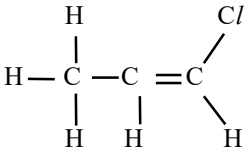

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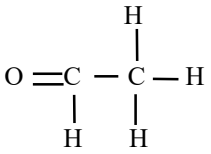


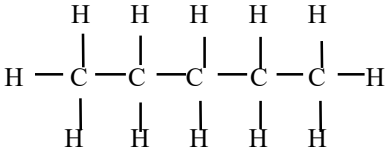
7 Which one of these equations does **not** shown an addition reaction?

A $CH_3Cl + Cl_2 \rightarrow CH_2Cl_2 + HCl$
B $C_3H_6 + Br_2 \rightarrow C_3H_6Br_2$
C $C_4H_8 + H_2O \rightarrow C_4H_9OH$
D $nC_2H_4 \rightarrow$ -[-CH_2-CH_2-]-$_n$

8 What feature would show that a compound **must** be an alkane?

A if it burns in air
B if it only contains carbon and hydrogen
C if it reacts with chlorine
D if it has the general formula $C_nH_{(2n+2)}$

9 The structures of two compounds are shown below.



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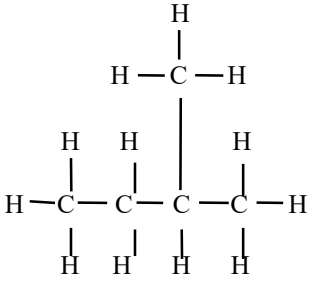


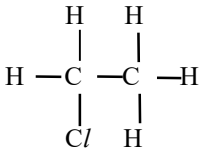
What must be the same for the two compounds?

A the melting point
B the structural formula
C the boiling point
D the percentage composition by mass

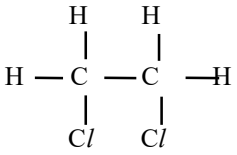
10 Decane is an alkane containing ten carbon atoms per molecule. What is its molecular formula?

A $C_{10}H_{18}$ B $C_{10}H_{20}$ C $C_{10}H_{22}$ D $C_{10}H_{24}$ ☐

11 The diagrams show the structures of three compounds.



1



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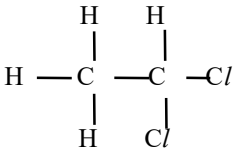


3

Which compounds could be the products of the substitution reaction between ethane with chlorine?

A 1 only
B 2 only
C 1 and 3 only
D 1, 2 and 3 ☐

12 Compounds **X** and **Y** are two different alkenes. Which statement about **X** and **Y** is **not** correct?

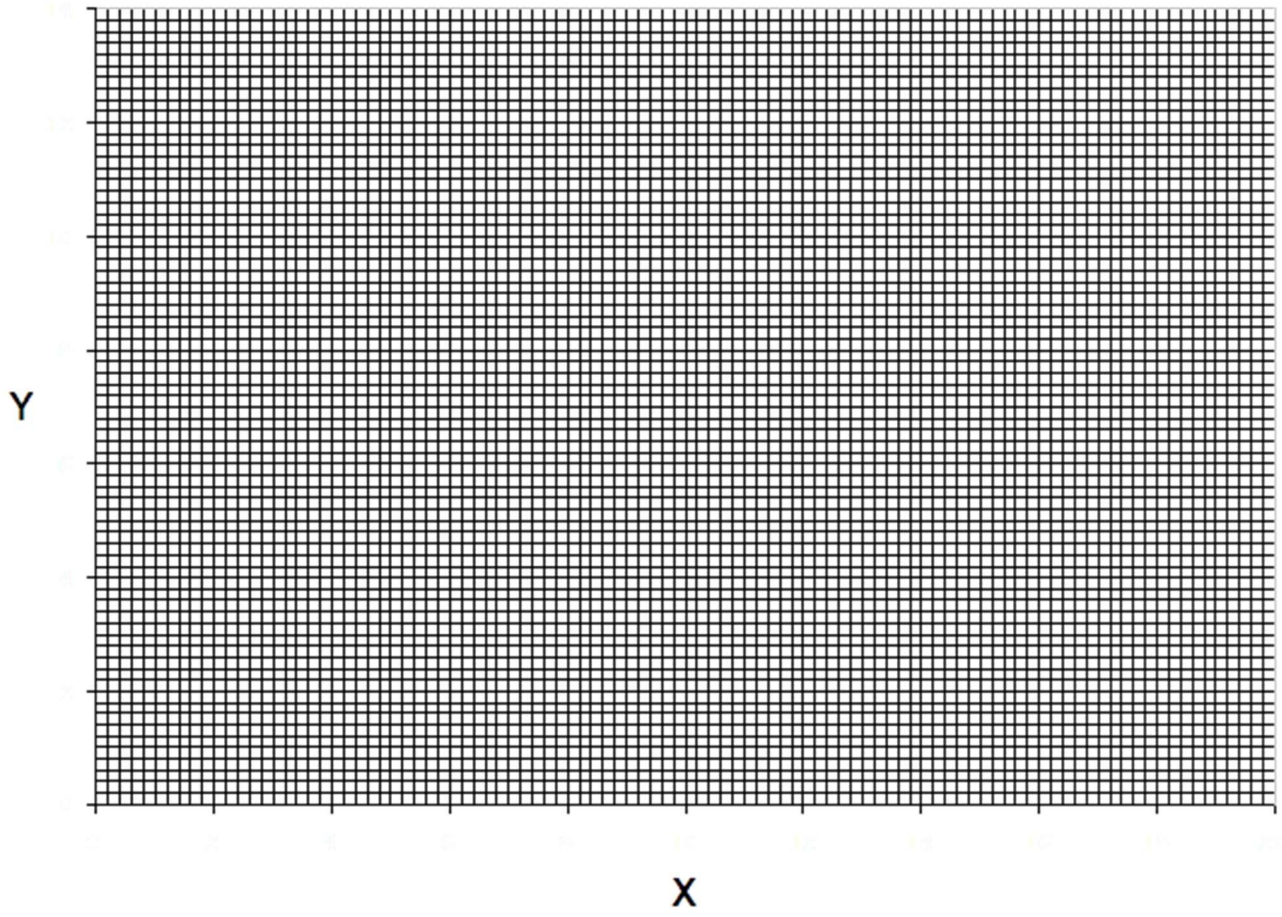
A They both undergo addition reactions.
B They have the same empirical formula.
C They both contain carbon and hydrogen only.
D They have the same boiling point. ☐

Section B: Structured Questions

1 The table shows some data about the first six members of the alkane homologous series.

alkane	**number of carbon atoms in one molecule X**	**melting point / °C**	**boiling point / °C**	**heat energy released by complete combustion of 1 mole of alkane / kJ Y**
methane	1	-182	-162	880
ethane	2	-183	-89	1540
propane	3	-188	-42	2200
butane	4	-138	0	2880
pentane	5	-130	36	
hexane	6	-95	69	4140

(a) Plot a graph of **Y** against **X** on the graph grid below. [3]



(b) Use the graph to estimate the value of **Y** for pentane. Write your answer in the table. [2]

(c) Calculate the energy released by **one gram** of methane.

.....

.....

[1]

(d) Give the molecular formula of an alkane which is a liquid at room temperature and and pressure (25ºC and 1 atmosphere).

.....

[1]

(e) Butane has two isomers. Draw the structural formula of both isomers.

[2]

(f) State the difference in the molecular formula of **two successive members** of a homologous series.

..... [1]

2 Cracking is used to break big hydrocarbon molecules into smaller ones.

(a) (i) State the conditions required for cracking.

..... [1]

(ii) State and explain one advantage to motor vehicles of cracking.

.....

.....

.....[2]

(b) A hydrocarbon, $C_{14}H_{30}$, is cracked to give two products. One of the products is propane.

(i) What is the molecular formula of the other product?

.....

(ii) Describe a chemical test to show that the other product is unsaturated.

test:

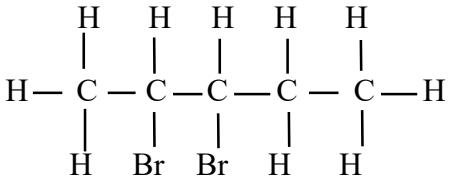
.....

observation in test:

.....

.....[2]

3 (a) An alkene has the molecular formula C_5H_{10}. This alkene reacts with bromine to form a compound with the structural formula shown below.



(i) Draw the structural formula of C_5H_{10}.

[2]

(ii) Write the equation for the reaction between C_5H_{10} and bromine.

.....[1]

(iii) Give the colours of

the alkene: .....

bromine:.....

the product of the reaction: ..... [3]

(iv) Explain why this reaction is called an *addition reaction*.

.....

.....

.....[1]

(b) The molecular formulas of the first three members of an homologous series of hydrocarbons are:

C_4H_6 C_5H_8 C_6H_{10}

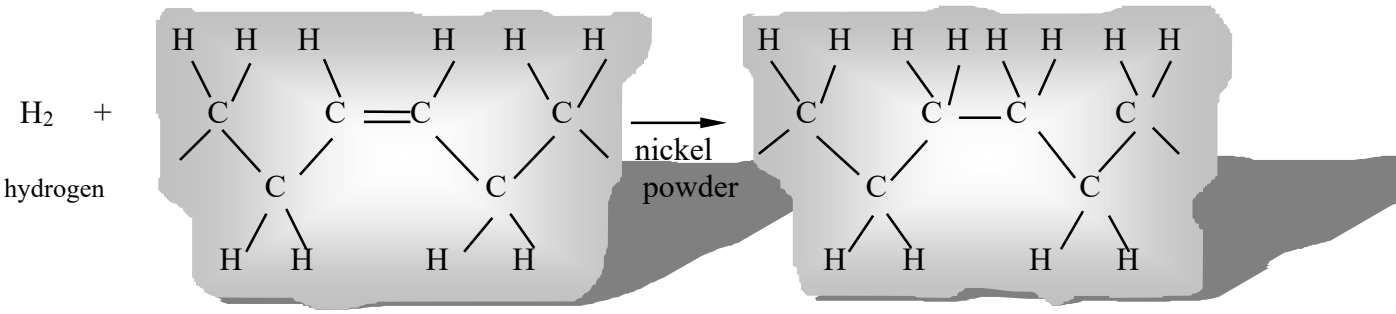
(i) What is the molecular formula of the next member of this series?

.....

(ii) Suggest a physical property of these hydrocarbons which is likely to change as the number of carbon atoms increases. How does it change?

.....[2]

4 The diagram shows how margarine is produced from vegetable oil.



(a) What type of reaction takes place between hydrogen and vegetable oil?

..... [1]

(b) (i) What is the purpose of the nickel in this reaction?

..... [1]

(ii) Why is the nickel in *powder* form?

..... [1]

(c) Some vegetable oil molecules contain more than one C=C bond. The number of C=C bonds in a vegetable oil molecule can be found by reacting the oil with iodine. Iodine reacts with C=C bonds in the same way as bromine. 0.05 mol of a vegetable oil was found to increase its mass by 25.4 g when shaken with an excess solution of iodine. How many C=C bonds are contained in one molecule of the oil?

.....

.....[2]

Section C: Essay Questions

1 (a) Give the structure of methane. [1]

(b) Methane undergoes a reaction with chlorine.

(i) State the type of reaction that takes place and one important condition for the reaction.

[2]

(ii) Draw the structures of any two organic products of this reaction and write an equation for the reaction producing **one** of them.

[3]

(c) Methane is the first member of a homologous series. Another homologous series has the general formula $C_nH_{(2n - 6)}$, where n is a number greater than 5. Give the formulas of the first **two** members of this series.

[2]

2 One of the compounds in crude oil is dodecane, $C_{12}H_{26}$.

(a) One of the reactions of dodecane is shown in the equation below.

$$C_{12}H_{26} \rightarrow C_8H_{18} + C_4H_8$$

(i) What is the name of this type of reaction?

[1]

(ii) State **two** conditions required for this reaction.

[2]

(iii) In the reaction, 1.00 mol of dodecane, $C_{12}H_{26}$, gives only 22.8 g of octane, C_8H_{18}. Calculate the percentage yield.

[2]

(b) (i) Draw the structural formulas of two isomers of C_4H_8.

[2]

(ii) Suggest one use of these isomers, other than as fuels.

[3]

(c) Octane is a saturated hydrocarbon and butene, C_4H_8, is an unsaturated hydrocarbon. Explain how aqueous bromine can be used to distinguish between these two compounds.

[2]