

1. Nov/2023/Paper\_9701/11/No.28

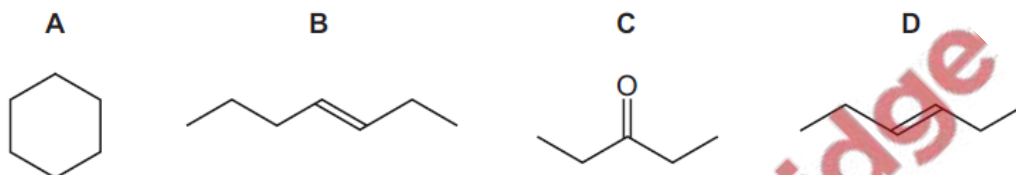
The hydrocarbon  $C_{17}H_{36}$  can be cracked.

Which compound is the **least** likely to be produced in this reaction?

- A  $C_3H_8$       B  $C_4H_8$       C  $C_8H_{16}$       D  $C_{16}H_{34}$

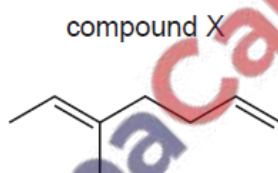
2. Nov/2023/Paper\_9701/11/No.29

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



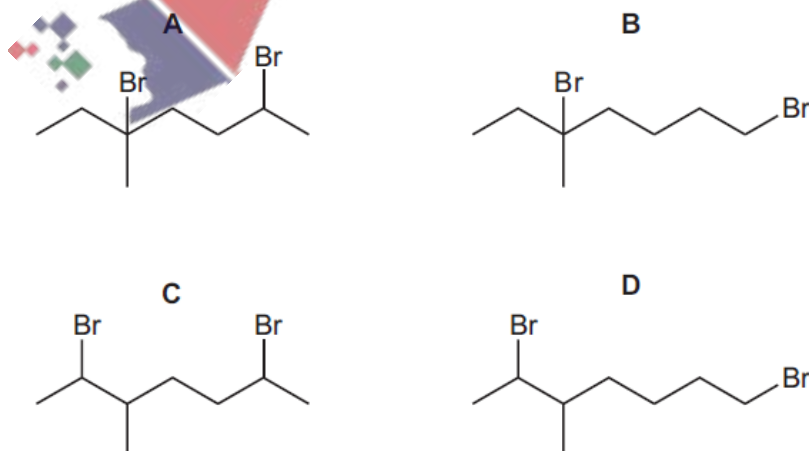
3. Nov/2023/Paper\_9701/12/No.30

The structure of compound X is shown.



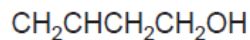
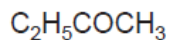
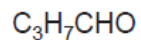
One mole of compound X reacts completely with two moles of hydrogen bromide.

What is the structure of the **major** product of this reaction?



4. Nov/2023/Paper\_9701/12/No.31

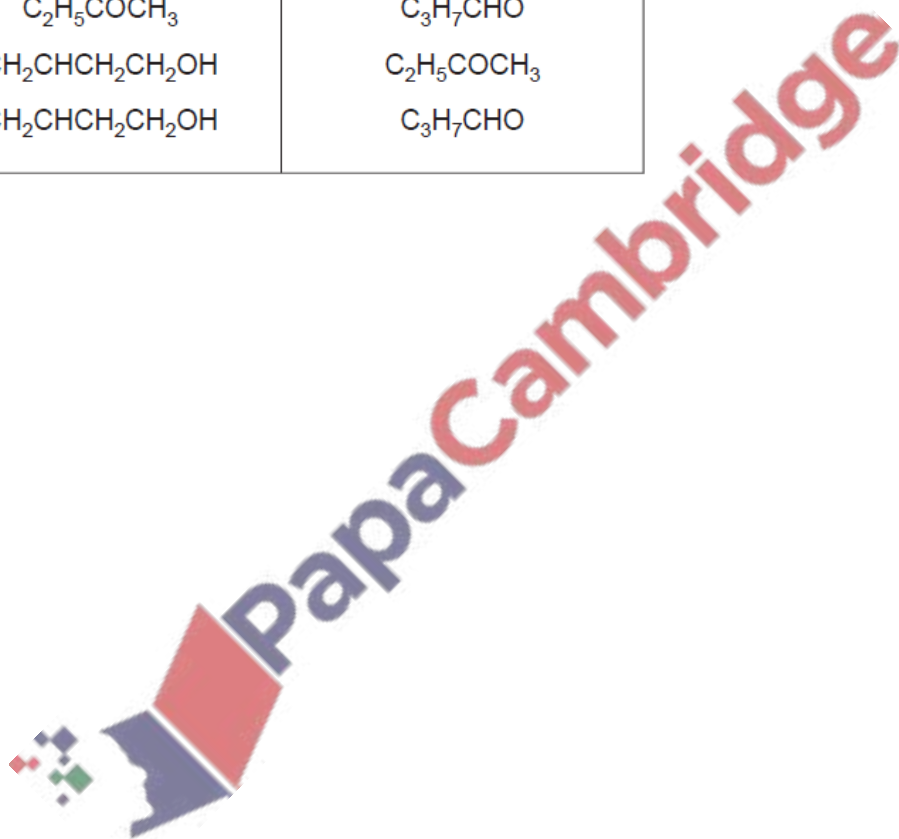
The formulae of three compounds are shown.



Only one of these compounds will decolourise bromine water. Only one of these compounds will produce a silver mirror with Tollens' reagent.

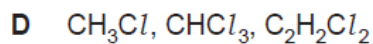
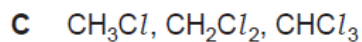
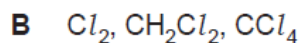
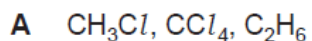
Which row shows the correct results?

	decolourises bromine water	forms a silver mirror with Tollens' reagent
<b>A</b>	$\text{C}_3\text{H}_7\text{CHO}$	$\text{C}_2\text{H}_5\text{COCH}_3$
<b>B</b>	$\text{C}_2\text{H}_5\text{COCH}_3$	$\text{C}_3\text{H}_7\text{CHO}$
<b>C</b>	$\text{CH}_2\text{CHCH}_2\text{CH}_2\text{OH}$	$\text{C}_2\text{H}_5\text{COCH}_3$
<b>D</b>	$\text{CH}_2\text{CHCH}_2\text{CH}_2\text{OH}$	$\text{C}_3\text{H}_7\text{CHO}$



5. Nov/2023/Paper\_9701/12/No.32

Which list contains a compound that is **not** made during the free radical substitution of methane with chlorine?



6. Nov/2023/Paper\_9701/21/No.4(a)

Compounds **C** and **D** are alkenes with the same molecular formula,  $C_5H_{10}$ .



Fig. 4.1

(a) (i) Give the systematic name of **D**.

..... [1]

(ii) Explain why **C** and **D** do not show geometrical (*cis/trans*) isomerism.

.....  
..... [1]

(iii) Draw the structure of a molecule that is a positional isomer of **C** and **D**.

[1]

(iv) Give the structural formula of the compound formed when **D** reacts with  $H_2(g)$  in the presence of a Pt catalyst.

..... [1]

(v) **C** can form an addition polymer.

Draw the structure of one repeat unit of this addition polymer.

[1]

(c) Fig. 3.1 shows a reaction scheme that involves  $\text{H}_3\text{PO}_4$  in several reactions.

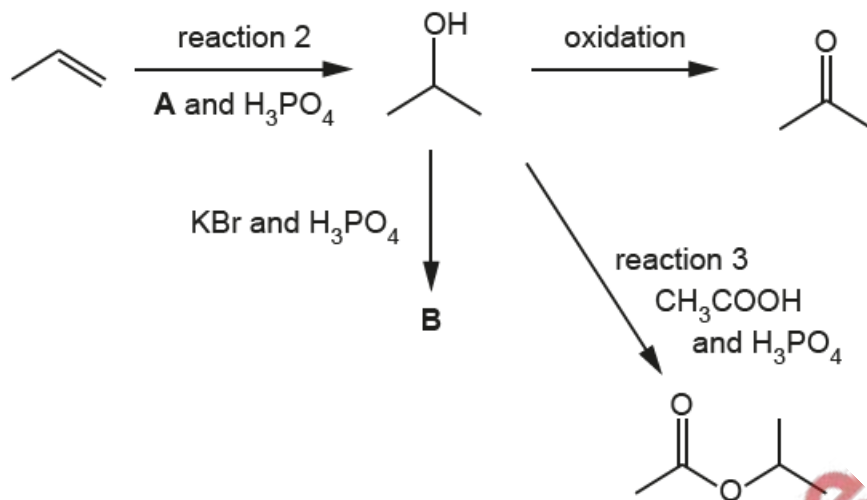


Fig. 3.1

(i) Identify **A**, which reacts with propene in the presence of  $\text{H}_3\text{PO}_4$  in reaction 2.

..... [1]

(ii) Draw the structure of **B**.



[1]

(iii) Name the type of reaction that occurs in reaction 3.

..... [1]

8. June/2023/Paper\_9701/11/No.24

Structural isomerism and stereoisomerism should be considered when answering this question.

If a molecule contains two non-identical chiral carbon atoms, four optical isomers exist.

How many isomers are there with:

- molecular formula  $C_7H_{14}O$  **and**
- a five-membered ring **and**
- a tertiary alcohol group?

A 4

B 5

C 9

D 13

9. June/2023/Paper\_9701/11/No.26

An organic molecule W contains 3 carbon atoms. It requires 4.5 molecules of oxygen for complete combustion.

What could W be?

- A propane
- B propanoic acid
- C propanone
- D propan-1-ol

10. June/2023/Paper\_9701/11/No.27

Which equation represents a reaction that proceeds through initiation, propagation and termination steps?

- A  $C_4H_{10} + Cl_2 \rightarrow C_4H_9Cl + HCl$
- B  $C_5H_{11}Br + NaOH \rightarrow C_5H_{11}OH + NaBr$
- C  $C_6H_{12} + H_2O \rightarrow C_6H_{13}OH$
- D  $C_6H_{13}CHO + HCN \rightarrow C_6H_{13}CH(OH)CN$

11. June/2023/Paper\_9701/11/No.28

Structural isomerism and stereoisomerism should be considered when answering this question.

A set of isomeric hydrocarbons:

- all contain 14.3% by mass of hydrogen
- all react with bromine by addition, 0.280 g of each hydrocarbon reacting with 0.799 g of bromine.

What is the maximum number of isomeric compounds in the set?

- A 1                      B 3                      C 4                      D 5

12. June/2023/Paper\_9701/12/No.28

Ethane reacts with an excess of chlorine in the presence of ultraviolet light to form a mixture of products.

How many of these products contain two carbon atoms and one or more chlorine atoms?

- A 6                      B 7                      C 8                      D 9

13. June/2023/Paper\_9701/13/No.31

A mixture of ethane and an excess of chlorine is exposed to UV light.

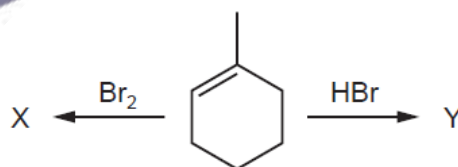
How many different products, each containing only two carbon atoms and at least one chlorine atom per molecule, can be formed?

- A 8                      B 9                      C 10                      D 12

14. June/2023/Paper\_9701/13/No.32

When 1-methylcyclohexene reacts with  $\text{Br}_2$  the product is X.

When 1-methylcyclohexene reacts with HBr the major product is Y.



Which statement is correct?

- A X is a mixture of two stereoisomers; Y does **not** have stereoisomers.  
B X is a mixture of two stereoisomers; Y is a mixture of four stereoisomers.  
C X is a mixture of four stereoisomers; Y does **not** have stereoisomers.  
D X is a mixture of four stereoisomers; Y is a mixture of four stereoisomers.

- (c) Biodiesel **T** is a fuel made from vegetable oil **R**. Fig. 5.1 shows the production of **T** from **R** in a two-step process.

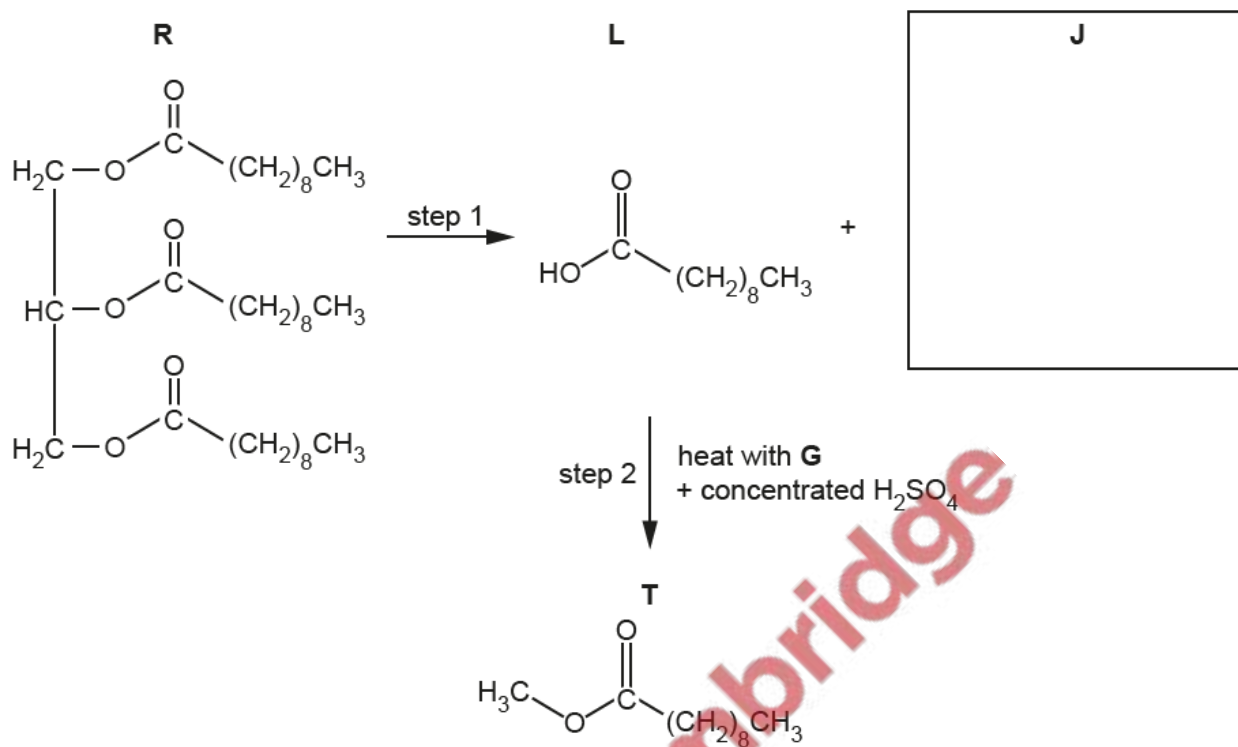


Fig. 5.1

- (i) In step 1 all three ester groups in **R** react. Suggest a suitable reagent and conditions for step 1. [1]
- ..... [1]
- (ii) Draw the structural formula of **J** in the box in Fig. 5.1. [1]
- (iii) Name the **type** of reaction that occurs in step 2. [1]
- ..... [1]
- (iv) Name organic reagent **G** used in step 2. [1]
- ..... [1]
- (v) **L** is called decanoic acid. Use systematic nomenclature to deduce the name of **T**. [1]
- ..... [1]

16. June/2023/Paper\_9701/22/No.5(a)

(a) Describe structural isomerism.

.....  
..... [1]

17. June/2023/Paper\_9701/23/No.5(c, d)

Y is formed from X in a single-step reaction, as shown in Fig. 5.1.

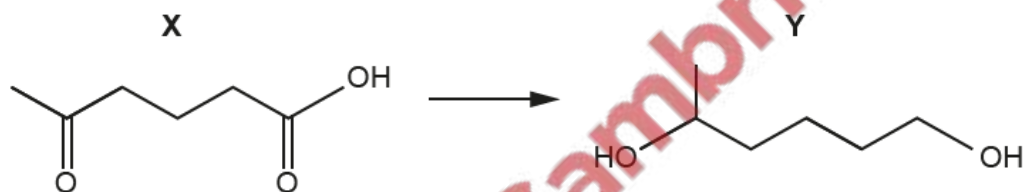


Fig. 5.1

(c) Complete Table 5.1 to show the number of  $sp^2$  and  $sp^3$  hybridised carbon atoms in a molecule of X.

Table 5.1

type of hybridisation	$sp^2$	$sp^3$
number of carbon atoms in X		

[2]



- (d) Complete Table 5.2 with the expected observations that occur when the reagents shown are added to separate solutions of **X** and **Y**. Do **not** refer to temperature changes in your answer.

Table 5.2

reagent	observation on addition to <b>X</b>	observation on addition to <b>Y</b>
aqueous sodium carbonate		
2,4-dinitrophenylhydrazine (2,4-DNPH reagent)		
alkaline aqueous iodine		

[3]

18. March/2023/Paper\_9701/12/No.29

Cyclohexene,  $C_6H_{10}$ , is a hydrocarbon with a six-membered ring of carbon atoms.

It has several structural isomers that are straight-chain alkenes. The number of double bonds in each of these molecules is P.

What is the shape of the cyclohexene molecule and what is the value of P?

	shape	P
<b>A</b>	planar	1
<b>B</b>	planar	2
<b>C</b>	non-planar	1
<b>D</b>	non-planar	2

19. March/2023/Paper\_9701/12/No.30

Exhaust gases from an internal combustion engine are made less harmful by passing them through a catalytic converter. A number of reactions take place in the catalytic converter. Two such reactions are described in the table.

Which row is correct?

	the type of reaction that removes carbon monoxide	the type of reaction that removes unburned hydrocarbons
<b>A</b>	oxidation	oxidation
<b>B</b>	oxidation	reduction
<b>C</b>	reduction	reduction
<b>D</b>	reduction	oxidation

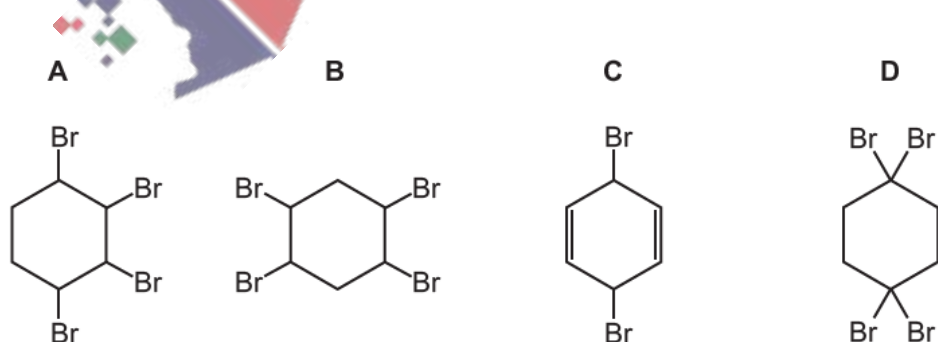
20. March/2023/Paper\_9701/12/No.39

Cyclohexa-1,4-diene is treated with a solution of bromine in tetrachloromethane in the dark.



cyclohexa-1,4-diene

Which product is formed?



21. March/2023/Paper\_9701/12/No.40

2-methylbut-2-ene is reacted with hot, concentrated, acidified potassium manganate(VII) solution.

What are the products of this reaction?

- A ethanal and propanone
- B ethanoic acid and propanone
- C ethanoic acid and propan-2-ol
- D ethanol and propan-2-ol

