Organic Chemistry – 2022 IGCSE

1. June/2022/Paper_11/No.35

In which lists are the compounds in the same homologous series?

1 CH_4, C_2H_4, C_3H_8

2 CH_3OH, C_2H_5OH, C_3H_7OH

3 CH_3CO_2H, CH_3CH_2OH, $CH_3CH_2CH_2OH$

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

2. June/2022/Paper_11/No.36

Which row about aqueous ethanoic acid and dilute hydrochloric acid is correct?

	both contain carbon	both contain hydrogen	both react with carbonates
A	✓	✗	✓
B	✓	✓	✗
C	✗	✓	✓
D	✗	✗	✗

key

✓ = yes

✗ = no

3. June/2022/Paper_11/No.37

Some properties of colourless liquid L are listed.

- It boils at 65 °C.
- When added to water, two layers form which do not mix.
- It does not react with sodium carbonate.
- It has no effect on bromine water.

What is L?

A ethanol

B hexane

C hexene

D ethanoic acid

4. June/2022/Paper_11/No.38

A molecule of compound P contains two carbon atoms and four hydrogen atoms.

Which row represents P?

	name of compound	M_r	reacts with aqueous bromine
A	ethane	30	✗
B	ethene	16	✓
C	ethene	28	✓
D	ethene	28	✗

5. June/2022/Paper_11/No.39

The equation representing the reaction of a hydrocarbon with water is shown.

$$C_xH_y + H_2O \xrightarrow{\text{catalyst}} C_xH_5OH$$

What are the values of x and y?

	x	y
A	1	4
B	1	6
C	2	4
D	2	6

6. June/2022/Paper_11/No.40

Many molecules of J join together in reaction R to form a long chain molecule K.

K is the only product.

Which row describes molecule J, reaction R and molecule K?

	molecule J	reaction R	molecule K
A	polymer	addition	monomer
B	monomer	addition	polymer
C	polymer	cracking	monomer
D	monomer	cracking	polymer

7. June/2022/Paper_12/No.32

Compound J is an unsaturated carboxylic acid.

Which bonds are present in a molecule of J?

	C=C	C=O	O–H
A	✓	✓	✓
B	✗	✓	✓
C	✓	✗	✗
D	✗	✓	✗

key

✓ = yes

✗ = no

8. June/2022/Paper_12/No.33

Petroleum is separated into useful fractions by fractional distillation.

Which fraction is used as a fuel for jet aeroplanes?

A fuel oil

B gasoline

C naphtha

D kerosene / paraffin

9. June/2022/Paper_12/No.35

Ethene reacts with substance X to form ethanol.

What is X?

A ethanoic acid

B glucose

C hydrogen

D steam

10. June/2022/Paper_12/No.36

What is the equation for the complete combustion of methane?

A $CH_4 + 4O_2 \rightarrow CO_2 + 2H_2O$

B $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$

C $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

D $C_2H_6 + 3O_2 \rightarrow 2CO_2 + 3H_2O$

11. June/2022/Paper_12/No.37

Alkenes can be produced by cracking large hydrocarbon molecules to form smaller hydrocarbon molecules.

Which equations represent possible reactions when tetradecane, $C_{14}H_{30}$, is cracked?

1 $C_{14}H_{30} \rightarrow C_2H_6 + C_3H_6 + C_4H_8 + C_5H_{10}$

2 $C_{14}H_{30} \rightarrow H_2 + C_2H_4 + C_3H_6 + C_4H_8 + C_5H_{10}$

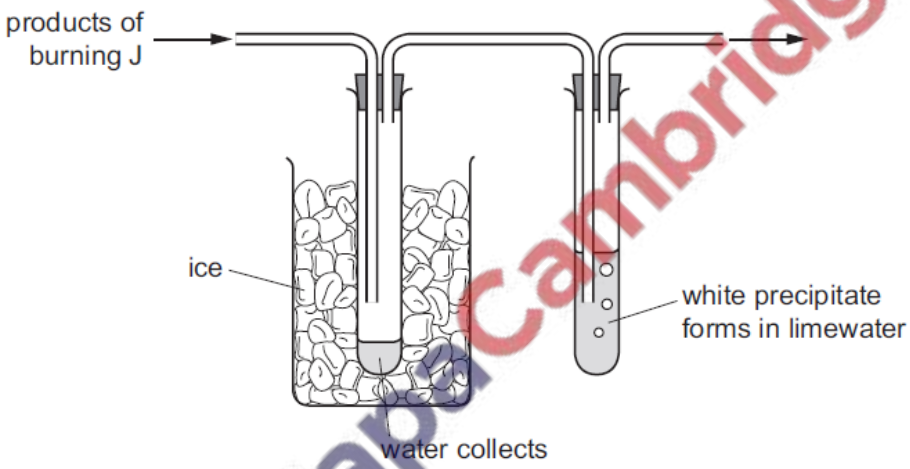
3 $C_{14}H_{30} \rightarrow C_2H_6 + 4C_3H_6$

4 $C_{14}H_{30} \rightarrow C_2H_6 + C_3H_8 + C_9H_{18}$

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

12. June/2022/Paper_12/No.38

The products formed by burning substance J are passed through the apparatus shown.



What is substance J?

A carbon monoxide

B ethanol

C hydrogen

D sulfur

13. June/2022/Paper_12/No.39

Which statements about ethanoic acid are correct?

1 Aqueous ethanoic acid reacts with magnesium to form magnesium ethanoate.

2 Carbon dioxide is formed when aqueous ethanoic acid reacts with sodium carbonate.

3 Hydrogen is formed when aqueous ethanoic acid reacts with sodium hydroxide.

4 Ethanoic acid turns red litmus paper blue.

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

14. June/2022/Paper_12/No.40

Which statement about polymerisation is correct?

A Large monomer molecules join to form small polymer molecules.

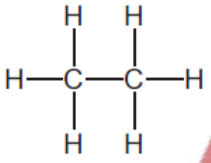
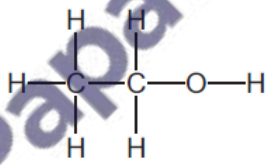
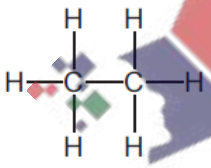
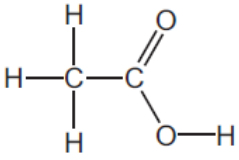
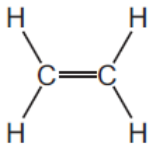
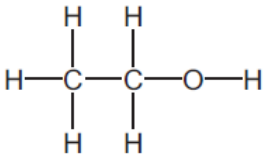
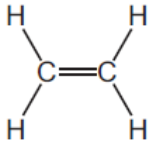
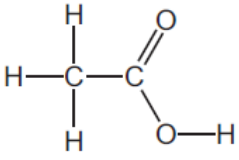
B Large polymer molecules join to form small monomer molecules.

C Small monomer molecules join to form large polymer molecules.

D Small polymer molecules join to form large monomer molecules.

15. June/2022/Paper_13/No.35

Which structures represent ethene and ethanol?

	ethene	ethanol
A		
B		
C		
D		

16. June/2022/Paper_13/No.36

One of the fractions obtained from the fractional distillation of petroleum is naphtha.

What is a major use of the naphtha fraction?

A as a fuel for jet aircraft

B as a lubricant for moving machine parts

C as a smooth surface covering for roads

D as a starting material to make other chemicals

17. June/2022/Paper_13/No.37

Which statement describes the process of cracking?

A It is the breakdown of a compound using electricity.

B It is the breakdown of long chain hydrocarbons.

C It is the combination of many small monomers.

D It is the separation of a mixture of hydrocarbons.

18. June/2022/Paper_13/No.38

Which temperature range is used in the production of ethanol by fermentation?

A 0–20 °C **B** 25–40 °C **C** 50–70 °C **D** 80–100 °C

19. June/2022/Paper_13/No.39

A hydrocarbon is tested with aqueous bromine.

The aqueous bromine turns from orange to colourless.

Which row describes the hydrocarbon?

	homologous series	type of hydrocarbon
A	alkane	saturated
B	alkane	unsaturated
C	alkene	saturated
D	alkene	unsaturated

20. June/2022/Paper_13/No.40

Which polymers are constituents of food?

1 carbohydrate

2 nylon

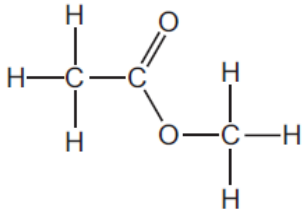
3 *Terylene*

4 protein

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

21. June/2022/Paper_21/No.35

The structure of ester W is shown.



Which row gives the names of ester W and the carboxylic acid and alcohol from which it is made?

	name of ester W	carboxylic acid	alcohol
A	ethyl methanoate	ethanoic acid	methanol
B	ethyl methanoate	methanoic acid	ethanol
C	methyl ethanoate	ethanoic acid	methanol
D	methyl ethanoate	methanoic acid	ethanol

22. June/2022/Paper_21/No.36

Ethanol is made industrially by the fermentation of glucose or by the catalytic addition of steam to ethene.

Which statement describes an advantage of fermentation compared to catalytic addition?

A Ethanol is the only product of fermentation.

B Fermentation uses a batch process but catalytic addition is continuous.

C Fermentation uses a higher temperature than catalytic addition.

D Fermentation uses a renewable resource.

23. June/2022/Paper_21/No.37

Some properties of colourless liquid L are listed.

- It boils at 65 °C.
- When added to water, two layers form which do not mix.
- It does not react with sodium carbonate.
- It has no effect on bromine water.

What is L?

A ethanol

B hexane

C hexene

D ethanoic acid

24. June/2022/Paper_21/No.38

A molecule of compound P contains two carbon atoms and four hydrogen atoms.

Which row represents P?

	name of compound	M_r	reacts with aqueous bromine
A	ethane	30	✗
B	ethene	16	✓
C	ethene	28	✓
D	ethene	28	✗

25. June/2022/Paper_21/No.39

The reaction of ethanol with acidified potassium manganate(VII) is shown.

$$CH_3CH_2OH \xrightarrow[H^+]{KMnO_4} CH_3COOH$$

Which type of reaction is taking place?

A addition

B condensation

C hydrolysis

D oxidation

26. June/2022/Paper_21/No.40

Which polymer is a synthetic polyamide?

A nylon

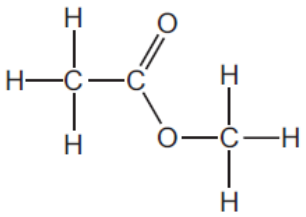
B poly(ethene)

C protein

D *Terylene*

27. June/2022/Paper_22/No.35

The structure of ester W is shown.



Which row gives the names of ester W and the carboxylic acid and alcohol from which it is made?

	name of ester W	carboxylic acid	alcohol
A	ethyl methanoate	ethanoic acid	methanol
B	ethyl methanoate	methanoic acid	ethanol
C	methyl ethanoate	ethanoic acid	methanol
D	methyl ethanoate	methanoic acid	ethanol

28. June/2022/Paper_22/No.36

Ethene reacts with substance X to form ethanol.

What is X?

A ethanoic acid

B glucose

C hydrogen

D steam

29. June/2022/Paper_22/No.37

Alkenes can be produced by cracking large hydrocarbon molecules to form smaller hydrocarbon molecules.

Which equations represent possible reactions when tetradecane, $C_{14}H_{30}$, is cracked?

1 $C_{14}H_{30} \rightarrow C_2H_6 + C_3H_6 + C_4H_8 + C_5H_{10}$

2 $C_{14}H_{30} \rightarrow H_2 + C_2H_4 + C_3H_6 + C_4H_8 + C_5H_{10}$

3 $C_{14}H_{30} \rightarrow C_2H_6 + 4C_3H_6$

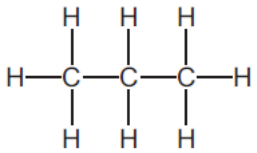
4 $C_{14}H_{30} \rightarrow C_2H_6 + C_3H_8 + C_9H_{18}$

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

30. June/2022/Paper_22/No.38

The structures of some hydrocarbons are shown.

1



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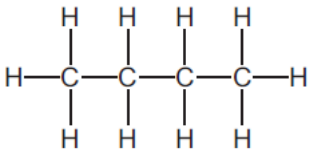

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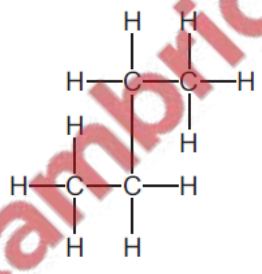

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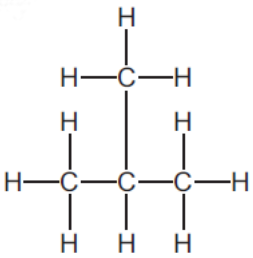


Which statement about the hydrocarbons is correct?

A 1 and 2 have a different general formula.

B 1 and 4 are in different homologous series.

C 2 and 3 are structural isomers.

D 3 and 4 have the same empirical formula.

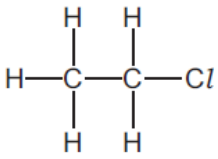
31. June/2022/Paper_22/No.39

Ethane reacts with chlorine in the presence of ultraviolet light.

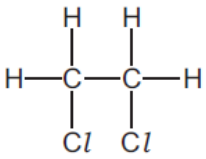
Which substances are produced in the reaction?

1

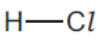
2



3



4

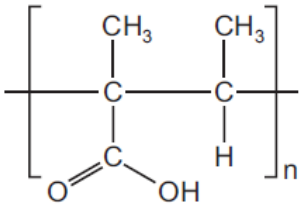


A 1, 2 and 3 **B** 1 and 3 only **C** 2, 3 and 4 **D** 2 and 4 only

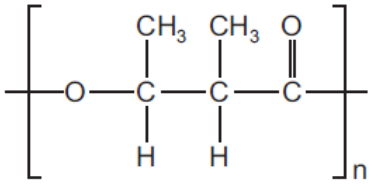
32. June/2022/Paper_22/No.40

Which polymer structure has the same linkages as *Terylene*?

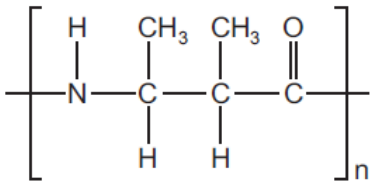
A



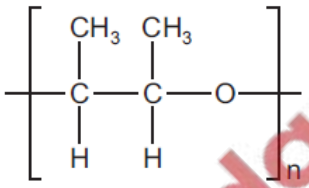
B



C

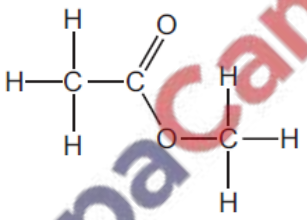


D



33. June/2022/Paper_23/No.35

The structure of ester W is shown.



Which row gives the names of ester W and the carboxylic acid and alcohol from which it is made?

	name of ester W	carboxylic acid	alcohol
A	ethyl methanoate	ethanoic acid	methanol
B	ethyl methanoate	methanoic acid	ethanol
C	methyl ethanoate	ethanoic acid	methanol
D	methyl ethanoate	methanoic acid	ethanol

34. June/2022/Paper_23/No.36

The equation for the reaction between butane, C_4H_{10}, and chlorine is shown.

$$C_4H_{10} + Cl_2 \rightarrow C_4H_9Cl + HCl$$

Which type of reaction does butane undergo when it reacts with chlorine?

A addition

B reduction

C acid–base

D substitution

35. June/2022/Paper_23/No.37

Butene has three structural isomers which are alkenes.

Which statements about these isomers are correct?

1 They have the same molecular formula.

2 They have different numbers of bonds in the molecule.

3 They have a C=C bond in the structure.

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

36. June/2022/Paper_23/No.38

The hydrocarbon $C_{12}H_{26}$ is cracked to give X and Y, as shown.

$$C_{12}H_{26} \rightarrow X + Y$$

Which statement is correct?

A If X is C_6H_{12} then Y will react with aqueous bromine.

B If X is $C_{10}H_{22}$ then Y can be used to make a polymer.

C If X is a hydrogen molecule then Y is an alkane.

D X and Y could be structural isomers.

37. June/2022/Paper_23/No.39

An ester, $C_4H_8O_2$, is made by reacting 0.06 mol of ethanol, C_2H_6O, and 0.05 mol of ethanoic acid, $C_2H_4O_2$.

$$C_2H_6O + C_2H_4O_2 \rightarrow C_4H_8O_2 + H_2O$$

0.0375 mol of the ester was made.

What is the percentage yield and the M_r of the ester?

	percentage yield / %	M_r
A	62.5	48
B	75.0	48
C	62.5	88
D	75.0	88

38. June/2022/Paper_23/No.40

Which type of compound is made when a protein is hydrolysed?

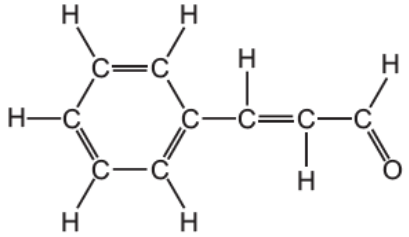
A alkene

B amino acid

C carboxylic acid

D sugar

(c) Toothpaste also contains cinnamal.
The structure of cinnamal is shown.



Deduce the formula of cinnamal to show the number of atoms of carbon, hydrogen and oxygen.

..... [1]

(d) Cinnamal can be oxidised to a carboxylic acid.

(i) Draw the structure of a carboxylic acid functional group to show all of the atoms and all of the bonds.

[1]

(ii) Ethanoic acid is a carboxylic acid.
Ethanoic acid reacts like a typical acid.

Complete the word equation for the reaction of ethanoic acid with sodium carbonate.

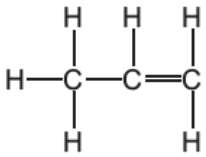
ethanoic acid	+	sodium carbonate	→	sodium ethanoate	+	....	+	.....

[2]

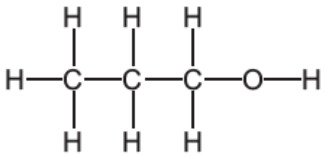
40. June/2022/Paper_31/No.6

(a) The structures of four organic compounds, **C**, **D**, **E** and **F**, are shown.

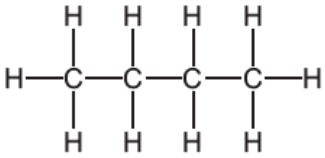
C



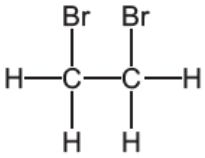
D



E



F



Answer the following questions about these compounds.
Each compound may be used once, more than once or not at all.

State which compound, **C**, **D**, **E** or **F**:

(i) decolourises aqueous bromine ..... [1]

(ii) is an alcohol ..... [1]

(iii) is unsaturated ..... [1]

(iv) is in the same homologous series as ethane. ..... [1]

(b) Petroleum is a mixture of hydrocarbons which can be separated into fractions with different boiling points.

Name the method used to separate these fractions.

..... [1]

(c) Complete the table to show the name and uses of some petroleum fractions.

name of fraction	use of fraction
refinery gas	
gasoline	
	waxes and polishes

[3]

(d) Some hydrocarbons are formed by the process of cracking.

(i) State the meaning of the term *cracking*.

.....

.....

..... [2]

(ii) Describe the conditions needed for cracking.

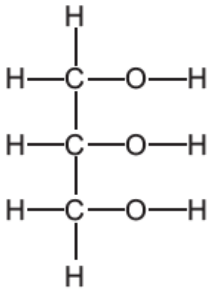
.....

..... [2]

[Total: 12]

41. June/2022/Paper_32/No.2(c, d)

(c) Toothpaste also contains glycerol.
The structure of glycerol is shown.



Deduce the formula of glycerol to show the number of atoms of carbon, hydrogen and oxygen.

..... [1]

(d) Glycerol is an alcohol.
Ethanol is also an alcohol.

(i) Draw the structure of ethanol to show all of the atoms and all of the bonds.

[1]

(ii) Name the **two** products formed when ethanol undergoes complete combustion.

..... and ..... [2]

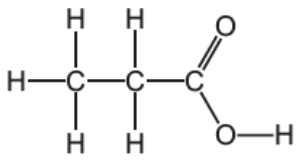
(iii) Give **one** use of ethanol.

..... [1]

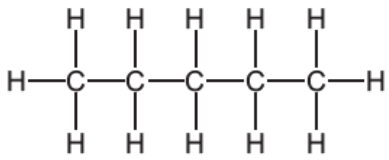
42. June/2022/Paper_32/No.6

(a) The structures of four organic compounds, **C**, **D**, **E** and **F**, are shown.

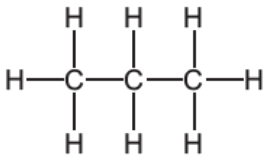
C



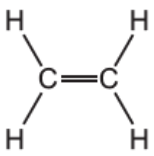
D



E



F



(i) State which **two** of the compounds, **C**, **D**, **E** and **F**, are in the same homologous series.

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

(ii) State which compound, **C**, **D**, **E** or **F**, is the monomer used to make poly(ethene).

..... [1]

(iii) State which compound, **C**, **D**, **E** or **F**, is a carboxylic acid.

..... [1]

(b) Petroleum is a mixture of hydrocarbons, which can be separated into fractions.

Describe how petroleum is separated into fractions to include:

- the name of the process used to separate the fractions

.....

- how this process separates the different fractions.

.....

.....

.....

.....

.....

[4]

(c) Complete the table to show the name and uses of some petroleum fractions.

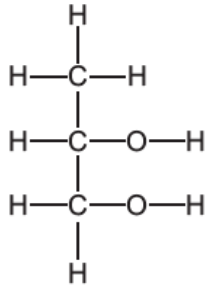
name of fraction	use of fraction
naphtha	
diesel oil (gas oil)	
	making roads

[3]

[Total: 10]

43. June/2022/Paper_33/No.2(c, d)

(c) Toothpaste also contains compound **A**.
The structure of compound **A** is shown.



Deduce the formula of compound **A** to show the number of atoms of carbon, hydrogen and oxygen.

..... [1]

(d) Compound **A** is an alcohol.
Ethanol, C_2H_5OH, is also an alcohol.

(i) Complete these sentences about ethanol using words from the list.

different **formula** **group** **identical** **molecule** **similar**

Ethanol is part of the alcohol homologous series.

Each member of the alcohol homologous series has the same functional ..... .

Members of the same homologous series have chemical properties that are ..... .
[2]

(ii) When ethanol undergoes incomplete combustion, a small amount of carbon dioxide is produced.

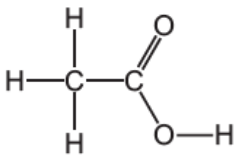
Name two **other** substances that are produced when ethanol undergoes incomplete combustion.

..... and ..... [2]

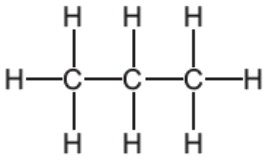
44. June/2022/Paper_33/No.6

(a) The structures of four organic compounds, **B**, **C**, **D** and **E**, are shown.

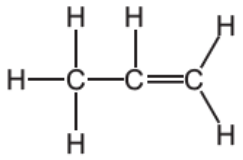
B



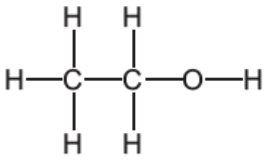
C



D



E



(i) State which compound, **B**, **C**, **D** or **E**, dissolves in water to form an acidic solution.

..... [1]

(ii) State which compound, **B**, **C**, **D** or **E**, is a saturated hydrocarbon.

..... [1]

(iii) State which compound, **B**, **C**, **D** or **E**, is an unreactive compound except in terms of burning.

..... [1]

(iv) State which compound, **B**, **C**, **D** or **E**, decolourises aqueous bromine.

..... [1]

(b) Ethanol can be manufactured from ethene and one other reactant.

Describe the manufacture of ethanol from ethene to include:

- the formula of ethene

.....

- the name of the other reactant

.....

- the conditions needed.

.....

.....

[4]

(c) Complete the table to show the name and uses of some petroleum fractions.

name of fraction	use of fraction
	making chemicals
kerosene	
fuel oil	

[3]

[Total: 11]

45. June/2022/Paper_41/No.5(e, f, g)

(e) Ethanoic acid is a member of the homologous series of carboxylic acids.

State the general formula of this homologous series.

..... [1]

(f) Draw the structure of the carboxylic acid containing three carbon atoms. Show all of the atoms and all of the bonds.

[2]

(g) When carboxylic acids react with alcohols, esters are produced.

The formula of ester **X** is $CH_3CH_2CH_2COOCH_3$.

(i) Name ester **X**.

..... [1]

(ii) Give the name of the carboxylic acid and the alcohol that react together to produce ester **X**.

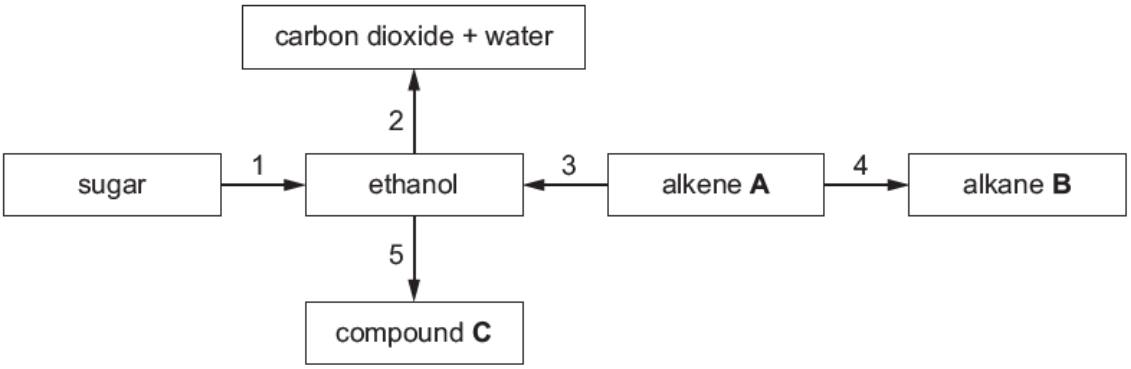
carboxylic acid .....

alcohol .....

[2]

46. June/2022/Paper_42/No.5

The reaction scheme shows five organic reactions, numbered 1 to 5.



(a) Name reaction 1.

..... [1]

(b) Name reaction 2 and write the chemical equation for this reaction.

name .....

equation .....

[3]

(c) Reaction 3 forms ethanol from alkene **A**.

(i) Identify alkene **A**.

..... [1]

(ii) State the type of reaction that occurs during reaction 3.

..... [1]

(iii) State the reagents and conditions needed for reaction 3.

.....

..... [2]

(d) Alkene **A** is converted into alkane **B** in reaction 4.

(i) State the reagent and conditions for reaction 4.

.....

..... [3]

(ii) State the general formula of alkanes.

..... [1]

(e) Ethanol is oxidised in reaction 5 by heating it with dilute sulfuric acid and one other reagent.

(i) Identify the other reagent in reaction 5.

..... [1]

(ii) Name the homologous series compound **C** belongs to.

..... [1]

(iii) Draw the structure of compound **C**.

Show all of the atoms and all of the bonds.

[1]

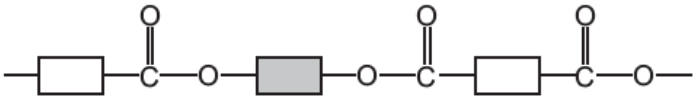
[Total: 15]

47. June/2022/Paper_42/No.6

This question is about polymers.

(a) Polymer **X** is a condensation polymer.

Part of the structure of polymer **X** is shown.



(i) How many molecules of water are produced when this part of polymer **X** is formed from its monomers?

..... [1]

(ii) Complete the structures of the **two** monomers used to make polymer **X**.

Show all of the atoms and all of the bonds in the functional groups.

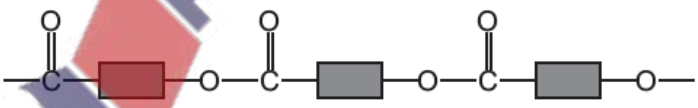
and

[2]

(iii) What type of condensation polymer is **X**?

..... [1]

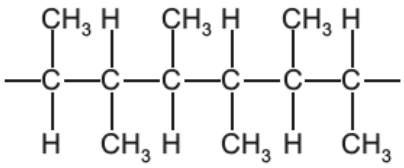
(b) Part of polymer **Y** has the structure shown.



State the number of different types of monomer needed to make polymer **Y**.

..... [1]

(c) Part of polymer **Z** has the structure shown.



(i) Draw and name the structure of the monomer which forms polymer **Z**.

Show all of the atoms and all of the bonds.

name .....

[3]

(ii) Name the chemical process used to make the monomer that forms polymer **Z**.

..... [1]

[Total: 9]

48. June/2022/Paper_43/No.4(c _d)

(c) Ethanol is a member of the alcohol homologous series.

Members of the same homologous series have the same general formula.

(i) State the general formula of alcohols.

..... [1]

(ii) State two **general** characteristics, other than the same general formula, of all homologous series.

1 .....

2 .....

[2]

(iii) One alcohol containing three carbon atoms is propan-1-ol.

Draw the structure of one **other** alcohol containing three carbon atoms. Show all of the atoms and all of the bonds.

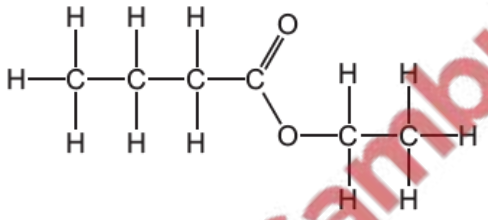
Name the alcohol you have drawn.

name .....

[2]

(d) When alcohols react with carboxylic acids, esters are produced.

(i) The structure of ester **X** is shown.



Name ester **X**.

..... [1]

(ii) Give the name of the alcohol and the carboxylic acid that react together to produce ester **X**.

alcohol .....

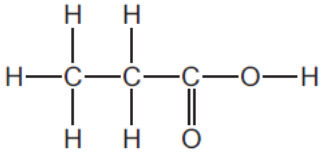
carboxylic acid .....

[2]

49. March/2022/Paper_12/No.35

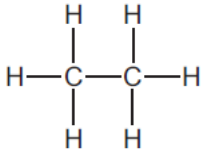
Which structure is correctly named?

A



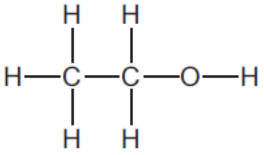
ethanoic acid

B



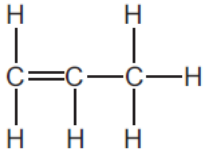
ethene

C



ethanol

D



propane

50. March/2022/Paper_12/No.36

The fractional distillation of petroleum produces a series of fractions with different uses.

Which row identifies a use for a fraction?

	fraction	use
A	bitumen	jet fuel
B	gas oil	cooking
C	kerosene	making roads
D	naphtha	making chemicals

51. March/2022/Paper_12/No.37

Ethene and propene are both members of the same homologous series.

Which statements explain why ethene and propene have similar chemical properties?

1 They are both hydrocarbons.

2 They are both made by cracking.

3 They have the same functional group.

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

52. March/2022/Paper_12/No.38

Which statement about ethane is correct?

A It decolourises bromine water.

B It burns in excess oxygen to form water and carbon dioxide.

C Its molecular formula is C_2H_4.

D Its atoms are joined together by ionic bonding.

53. March/2022/Paper_12/No.39

Which statements about ethanol are correct?

1 Ethanol is used as a solvent.

2 Ethanol can be made directly from ethane.

3 Ethanol is a covalent compound.

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

54. March/2022/Paper_12/No.40

Polymers are long-chain molecules made from small molecules linked together.

Four polymers or types of polymer are listed.

1 carbohydrates

2 nylon

3 proteins

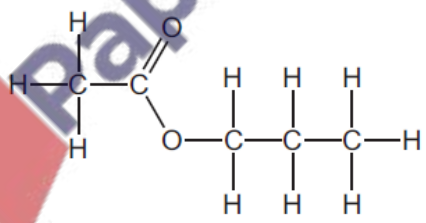
4 *Terylene*

Which polymers or types of polymer are synthetic?

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

55. March/2022/Paper_22/No.33

The structure of an ester is shown.



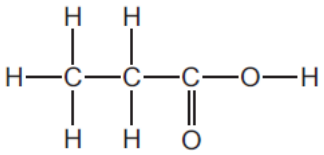
What are the names of the carboxylic acid and the alcohol that react together to form this ester?

	carboxylic acid	alcohol
A	ethanoic acid	ethanol
B	ethanoic acid	propan-1-ol
C	propanoic acid	ethanol
D	propanoic acid	propan-1-ol

56. March/2022/Paper_22/No.35

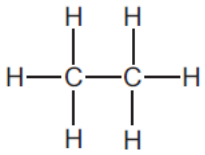
Which structure is correctly named?

A



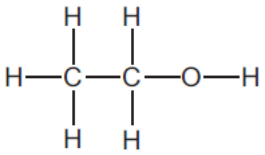
ethanoic acid

B



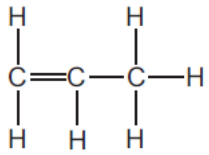
ethene

C



ethanol

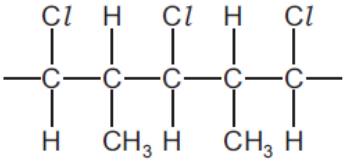
D



propane

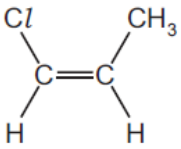
57. March/2022/Paper_22/No.36

The structure of part of a polymer is shown.

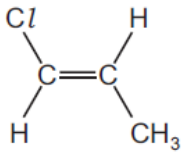


Which monomers can be used to make this polymer?

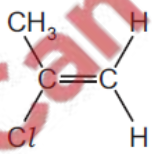
1



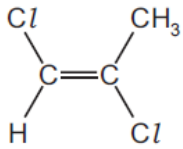
2



3



4



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

58. March/2022/Paper_22/No.37

Carboxylic acids are made by the oxidation of alcohols.

Which carboxylic acid is produced from CH_3CH_2OH?

A butanoic acid

B ethanoic acid

C methanoic acid

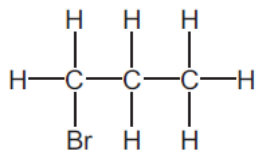
D propanoic acid

59. March/2022/Paper_22/No.38

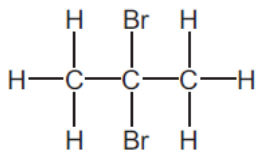
Propene, C_3H_6, reacts with bromine, Br_2, in an addition reaction.

Which structure represents the product of this reaction?

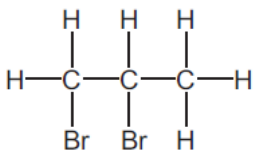
A



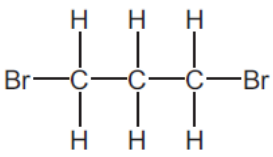
B



C



D



60. March/2022/Paper_22/No.39

Which statements about ethanol are correct?

1 Ethanol is used as a solvent.

2 Ethanol can be made directly from ethane.

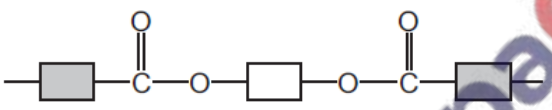
3 Ethanol is a covalent compound.

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

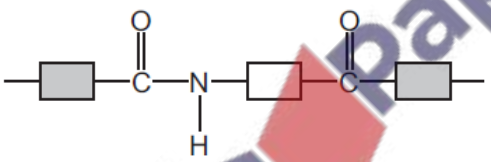
61. March/2022/Paper_22/No.40

Which diagram represents the structure of nylon?

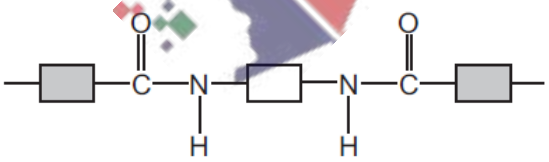
A



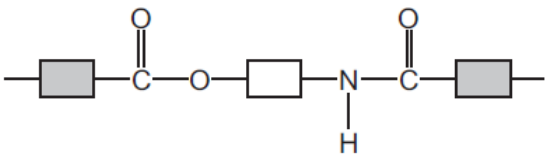
B



C



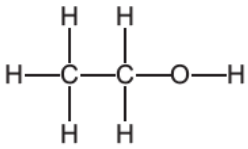
D



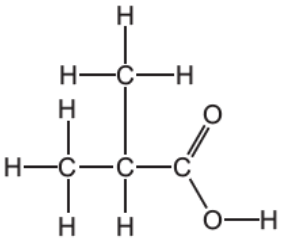
62. March/2022/Paper_32/No.7

(a) The structures of four organic compounds, **P**, **Q**, **R** and **S**, are shown.

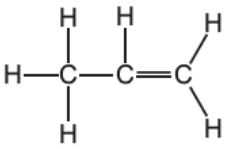
P



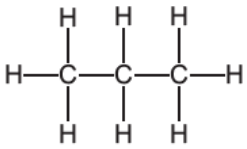
Q



R



S



Answer the following questions about these structures.

Each structure may be used once, more than once or not at all.

(i) State which structure, **P**, **Q**, **R** or **S**, has a carboxylic acid functional group.

..... [1]

(ii) State which structure, **P**, **Q**, **R** or **S**, is in the same homologous series as ethane.

..... [1]

(iii) State which structure, **P**, **Q**, **R** or **S**, decolourises aqueous bromine.

..... [1]

(iv) Deduce the molecular formula of structure **Q** to show the number of carbon, hydrogen and oxygen atoms.

..... [1]

(b) Structure **S** is produced by cracking petroleum fractions.

(i) Complete the sentence using a word from the list.

acids **alkenes** **alcohols** **nitrogen**

During cracking, long-chain alkanes are converted to shorter chain alkanes and ..... . [1]

(ii) Cracking is an example of thermal decomposition.

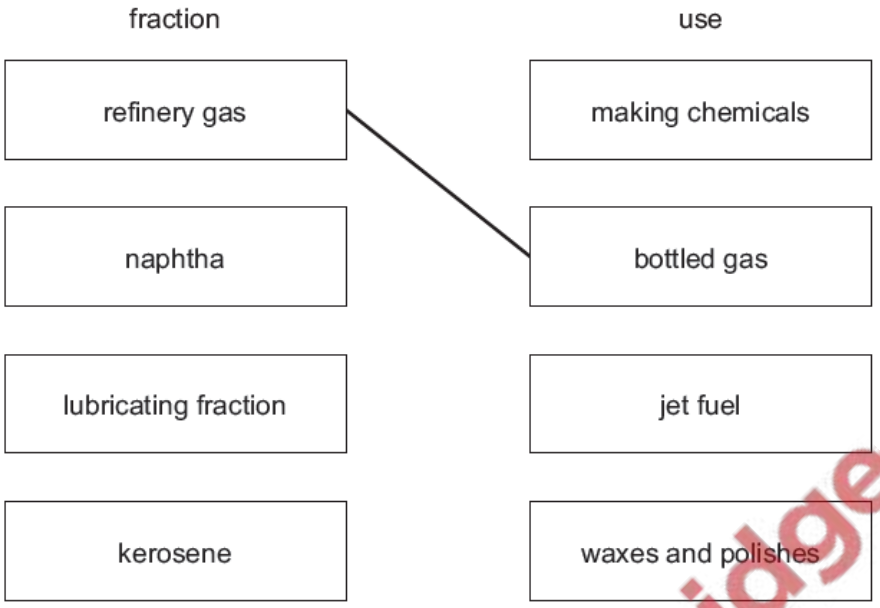
State the meaning of the term *thermal decomposition*.

.....

..... [2]

(c) Link each petroleum fraction on the left to its use on the right.

The first one has been done for you.



[2]

[Total: 9]

63. March/2022/Paper_42/No.5

This question is about alkanes and alkenes.

(a) Short-chain alkanes and alkenes can be formed from long-chain alkanes in a chemical reaction.

(i) Name the type of chemical reaction which forms short-chain alkanes and alkenes from long-chain alkanes.

..... [1]

(ii) Decane has 10 carbon atoms. It forms ethane and ethene as the only products in this type of chemical reaction.

Write the chemical equation for this reaction.

..... [3]

(b) Ethane reacts with chlorine at room temperature to form chloroethane, C_2H_5Cl, and one other product.

(i) Name the other product formed.

..... [1]

(ii) State the condition needed for this reaction to take place.

..... [1]

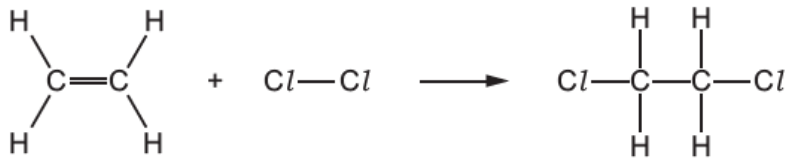
(c) Ethene reacts with chlorine at room temperature to form dichloroethane, $C_2H_4Cl_2$.

$$C_2H_4 + Cl_2 \rightarrow C_2H_4Cl_2$$

(i) State why this is an addition reaction.

..... [1]

(ii) The chemical equation for this reaction can be represented as shown.



The energy change for the reaction is –180 kJ/mol.

Use the bond energies in the table to calculate the bond energy of a C–C*l* bond, in kJ/mol.

bond	C–H	C=C	C*l*–C*l*	C–C
bond energy in kJ/mol	410	610	240	350

Use the following steps.

step 1 Calculate the energy needed to break bonds.

energy needed to break bonds = ... kJ

step 2 Use your answer in **step 1** and the energy change for the reaction to determine the energy released when bonds are formed.

energy released when bonds form = ... kJ

step 3 Use your answer in **step 2** and bond energy values to determine the energy of a C–C*l* bond.

bond energy of a C–C*l* bond = ... kJ/mol
[4]

[Total: 11]

64. March/2022/Paper_42/No.6

The names of four esters are listed.

methyl propanoate

ethyl propanoate

propyl propanoate

butyl propanoate

(a) Esters are a family of organic compounds with similar chemical properties. They can be represented by the formula $C_nH_{2n}O_2$.

(i) State the name given to a family of organic compounds with similar chemical properties.

..... [1]

(ii) Explain why members of a family of organic compounds have similar chemical properties.

..... [1]

(iii) State the name given to a formula such as $C_nH_{2n}O_2$.

..... [1]

(iv) Determine the value of '*n*' in butyl propanoate.

..... [1]

(b) All four of the esters in the list are liquids at room temperature.

Name the technique used to separate ethyl propanoate from a mixture of the four esters.

..... [2]

(c) All four esters can be made by reacting different alcohols with the same substance.

(i) Name this substance and draw its structure. Show all of the atoms and all of the bonds.

name .....

structure

[2]

(ii) Name the alcohol used to make methyl propanoate.

..... [1]

(d) Other esters, not in the list, have the same molecular formula as propyl propanoate, but different structures.

(i) State the term used to describe substances with the same molecular formula but different structures.

..... [1]

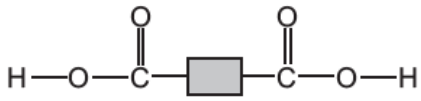
(ii) Name **two** esters with the same molecular formula as propyl propanoate.

1 .....

2 .....

[2]

(e) Polyesters can be made from the two different molecules shown.



and

(i) Complete the diagram to show a section of the polyester made from these two molecules. Include all of the atoms and all of the bonds in the linkages.

[3]

(ii) Name the type of polymerisation that takes place when this polymer forms.

..... [1]

(iii) Name a polyester.

..... [1]

[Total: 17]