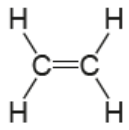
Organic chemistry – 2021/20 GCSE Gateway Chemistry A

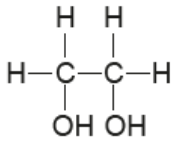
1. Nov/2021/Paper_J248/02/No.5

What is the correctly displayed formula of **ethanoic acid**?

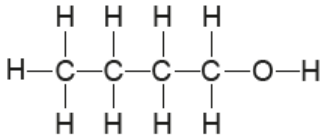
A



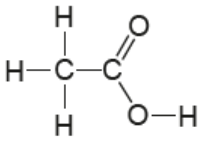
B



C



D



Your answer ☐ **[1]**

2. Nov/2021/Paper_J248/02/No.7

A chemical cell has a voltage of 1.50 V.

What will the voltage be once the reactants are used up?

A 0.00 V

B 0.75 V

C 1.50 V

D 3.00 V

Your answer ☐ **[1]**

3. Nov/2021/Paper_J248/02/No.9

The melting point of iodine is 114 °C. The boiling point of iodine is 184 °C.

What is the state of iodine at room temperature?

A Aqueous

B Gas

C Liquid

D Solid

Your answer ☐ **[1]**

4. Nov/2021/Paper_J248/02/No.11

Propene gas is bubbled into bromine water.

What happens to the colour of the bromine water?

A Changes from colourless to orange

B Changes from orange to colourless

C Stays colourless

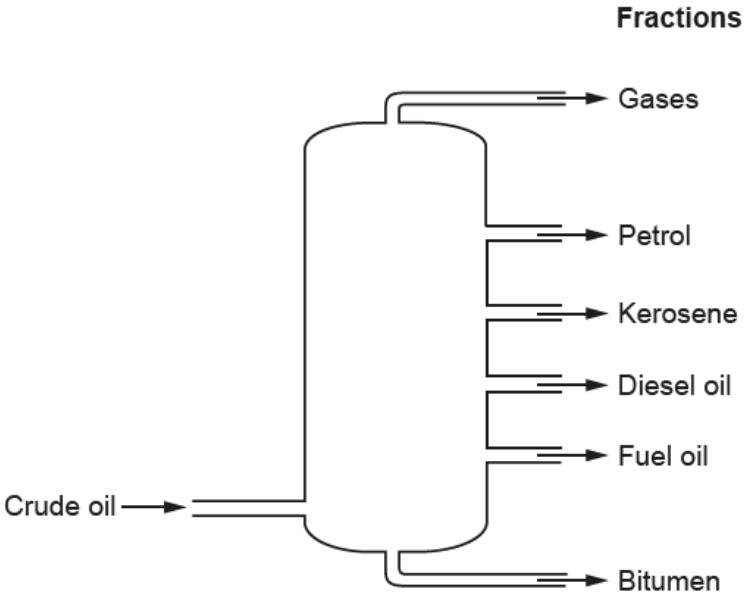
D Stays orange

Your answer ☐ **[1]**

5. Nov/2021/Paper_J248/02/No.7

Crude oil is separated into fractions by fractional distillation.

Look at the diagram of the fractions made in fractional distillation.



Which of these fractions has the **smallest** molecules?

A Bitumen

B Diesel oil

C Gases

D Petrol

Your answer ☐ **[1]**

6. Nov/2021/Paper_J248/02/No.14

Butene, pentene and hexene are alkenes. They are all members of the same homologous series.

Why are they members of the same homologous series?

A Their molecules differ by $-CH_3$.

B They have the same general formula.

C They have the same molecular formula.

D They have the same physical properties.

Your answer ☐ **[1]**

7. Nov/2021/Paper_J248/02/No.15

Butane is a hydrocarbon molecule with a low boiling point.

Which statement about butane is correct?

A Butane is a large molecule and has strong intermolecular forces.

B Butane is a large molecule and has weak intermolecular forces.

C Butane is a small molecule and has strong intermolecular forces.

D Butane is a small molecule and has weak intermolecular forces.

Your answer ☐ **[1]**

8. Nov/2021/Paper_J248/02/No.17

This question is about some of the hydrocarbons found in crude oil.

Table 17.1 shows information about four hydrocarbons found in crude oil.

Hydrocarbon	Molecular formula	Boiling point (°C)
Ethane	C_2H_6	–89
Hexane	C_6H_{14}	68
Nonane	C_9H_{20}	
Pentadecane	$C_{15}H_{32}$	271

Table 17.1

(a) Ethane is a **hydrocarbon**.

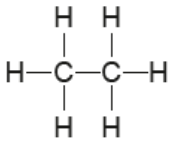
What is meant by a hydrocarbon?

.....

.....

..... **[2]**

(b) Look at the displayed formula for ethane.



Ethane is a **saturated** compound.

What is meant by a saturated compound?

.....

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

(c) Use the information in **Table 17.1** to predict the boiling point of nonane.

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

(d) Explain why a mixture of hexane, nonane and pentadecane can be separated by fractional distillation.

In your answer use information from **Table 17.1** and ideas about intermolecular forces.

.....

.....

.....

.....

.....

..... **[3]**

(e) Nonane is one of the hydrocarbons found in aircraft fuel.

Nonane burns completely in a plentiful supply of oxygen.

Complete the **balanced symbol** equation by putting numbers on the dotted lines.

$$C_9H_{20} + \ldots\ldots\ O_2 \rightarrow \ldots\ldots\ CO_2 + \ldots\ldots\ H_2O$$

[2]

(f) Incomplete combustion of nonane makes **carbon monoxide** instead of carbon dioxide.

Describe and explain **one problem** caused by carbon monoxide.

.....

..... **[2]**

9. Nov/2020/Paper_J248/02/No.6

What happens to the potential difference of a chemical cell once the reactants are used up?

A It decreases

B It increases

C It starts and finishes at 0 V

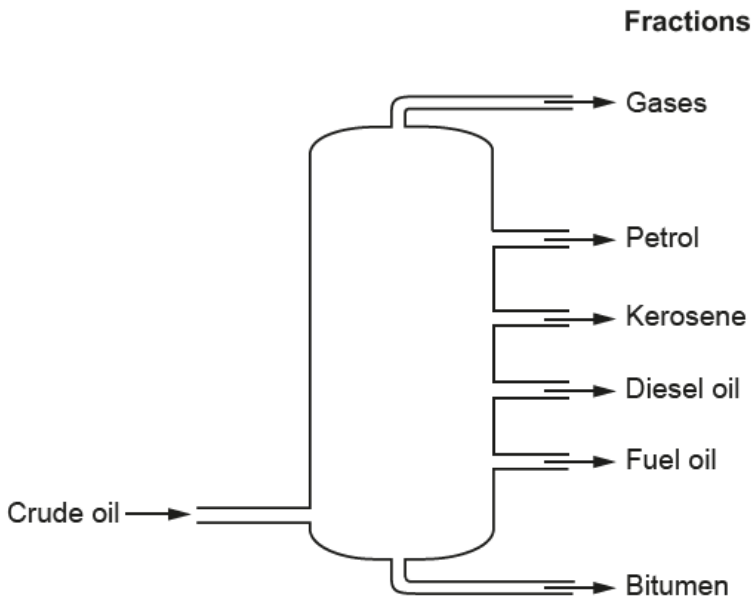
D It stays the same

Your answer ☐ **[1]**

10. Nov/2020/Paper_J248/02/No.7

Crude oil is separated into fractions by fractional distillation.

Look at the diagram of the fractions made in fractional distillation.



Which of these fractions has the **lowest** boiling point?

A Bitumen

B Diesel oil

C Gases

D Petrol

Your answer ☐ **[1]**

11. Nov/2020/Paper_J248/02/No.8

DNA molecules are polymers.

What is the name of the **monomers** that make up DNA molecules?

A Amino acids

B Carbohydrates

C Nucleotides

D Proteins

Your answer ☐ **[1]**

12. Nov/2020/Paper_J248/02/No.10

Which of the following are the first four members of the homologous series of **alcohols**?

A CH_4, C_2H_6, C_3H_8, C_4H_{10}

B CH_3OH, C_2H_5OH, C_3H_7OH, C_4H_9OH

C $HCOOH$, CH_3COOH, C_2H_5COOH, C_3H_7COOH

D C_2H_4, C_3H_6, C_4H_8, C_5H_{10}

Your answer ☐ **[1]**

13. Nov/2020/Paper_J248/02/No.12

Ethene, C_2H_4, reacts with bromine, Br_2, in an addition reaction.

Which is the balanced symbol equation for this reaction?

A $C_2H_4 + Br_2 \rightarrow C_2H_3Br + HBr$

B $C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$

C $C_2H_4 + 2Br_2 \rightarrow C_2Br_4 + 2H_2$

D $C_2H_4 + 2Br_2 \rightarrow C_2H_4Br_4$

Your answer ☐ **[1]**

14. Nov/2020/Paper_J248/02/No.19

Fractional distillation separates crude oil into useful fractions.

Look at the table.

It shows the percentage of each fraction made from crude oil. It also shows the percentage of each fraction needed for everyday uses.

Fraction	Percentage made by fractional distillation	Percentage needed for everyday uses
Gases	4	11
Petrol	11	22
Naphtha	10	18
Paraffin	12	20
Fuel oil	22	10
Waxes and tar	23	4

(a) (i) Which fraction is **made** in the **greatest** percentage?

Tick (✓) **one** box.

- Gases ☐
- Petrol ☐
- Naphtha ☐
- Paraffin ☐
- Fuel oil ☐
- Waxes and tar ☐

[1]

(ii) Which fraction is **needed** in the **smallest** percentage?

Tick (✓) **one** box.

- Gases ☐
- Petrol ☐
- Naphtha ☐
- Paraffin ☐
- Fuel oil ☐
- Waxes and tar ☐

[1]

(b) Cracking changes large hydrocarbon molecules into smaller hydrocarbon molecules.

(i) One of the conditions needed for cracking is a high pressure.

Write down **one** other condition needed.

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

(ii) Cracking is a very useful reaction.

Explain why.

Use information from the table in your answer.

.....

.....

..... **[2]**

(c) In 2008 the USA produced 4 900 000 barrels of crude oil per day. In 2019 this had increased to 11 000 000 barrels of crude oil per day.

Calculate the percentage increase in the number of barrels of crude oil produced per day from 2008 to 2019.

Use the formula: percentage increase = $\frac{\text{increase}}{\text{original}} \times 100$

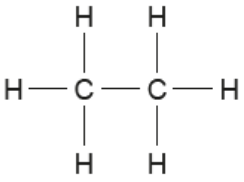
Give your answer to **2** decimal places.

Percentage increase = ... % **[3]**

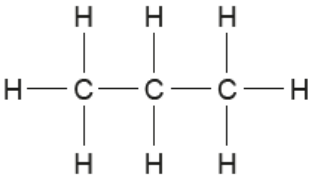
15. Nov/2020/Paper_J248/02/No.22

This question is about compounds of carbon.

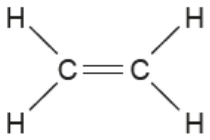
Look at the displayed formulae of ethane, propane and ethene.



Ethane



Propane



Ethene

(a) Ethane and propane are both members of the **homologous series** called the alkanes.

Write down **two** reasons why ethane and propane are members of the same homologous series.

1 .....

2 .....

[2]

(b) Many ethene molecules react together to form the polymer poly(ethene).

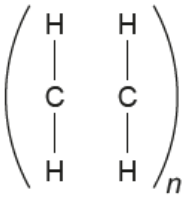
This reaction is called **polymerisation**.

(i) Why do ethene molecules undergo polymerisation but ethane molecules do not?

.....

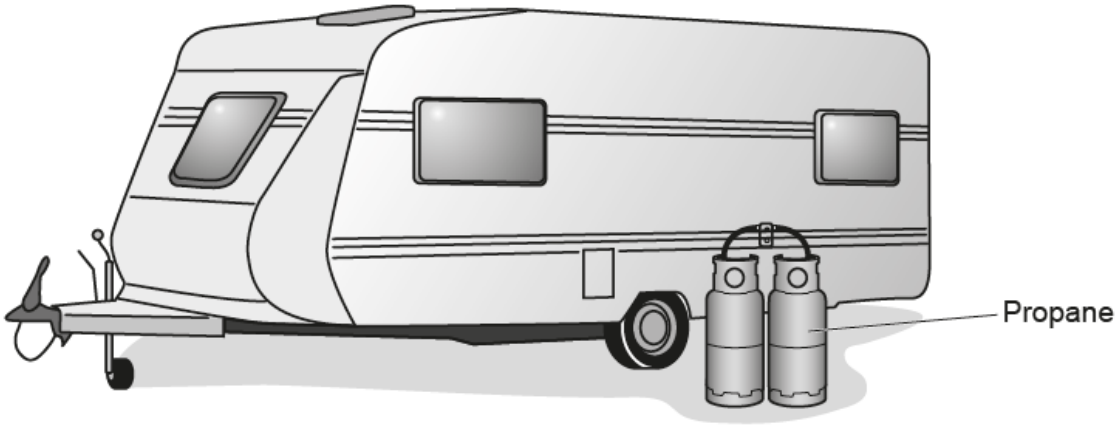
..... **[1]**

(ii) Complete the diagram to show the displayed formula of poly(ethene).



[2]

(c)* Propane gas is used as a fuel for cooking and heating in caravans.



Incomplete combustion of propane can occur if the campers do not take sensible precautions.

Describe how incomplete combustion of hydrocarbons such as propane happens and the problems it can cause for campers.

Include a **balanced symbol** equation in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

16. Nov/2021/Paper_J248/04/No.8

What is the formula of the functional group in **carboxylic acids**?

A –C=C–

B –COOH

C $-CO_2$

D –OH

Your answer ☐ **[1]**

17. Nov/2021/Paper_J248/04/No.12

Which of these functional groups can react together to form a **condensation** polymer?

A –C=C– and –COOH

B –C=C– and $-NH_2$

C –COOH and $-NH_2$

D –OH and $-NH_2$

Your answer ☐ **[1]**

18. Nov/2021/Paper_J248/04/No.13

An alcohol and a carboxylic acid react to form an ester and water in an equilibrium reaction.

alcohol + carboxylic acid $\rightleftharpoons$ ester + water

Why is an acid catalyst used in this reaction?

A The catalyst is changed chemically during the reaction.

B The equilibrium concentration of the ester is increased.

C The purity of the ester is increased.

D The time taken to reach equilibrium is decreased.

Your answer ☐ **[1]**

19. Nov/2021/Paper_J248/04/No.20

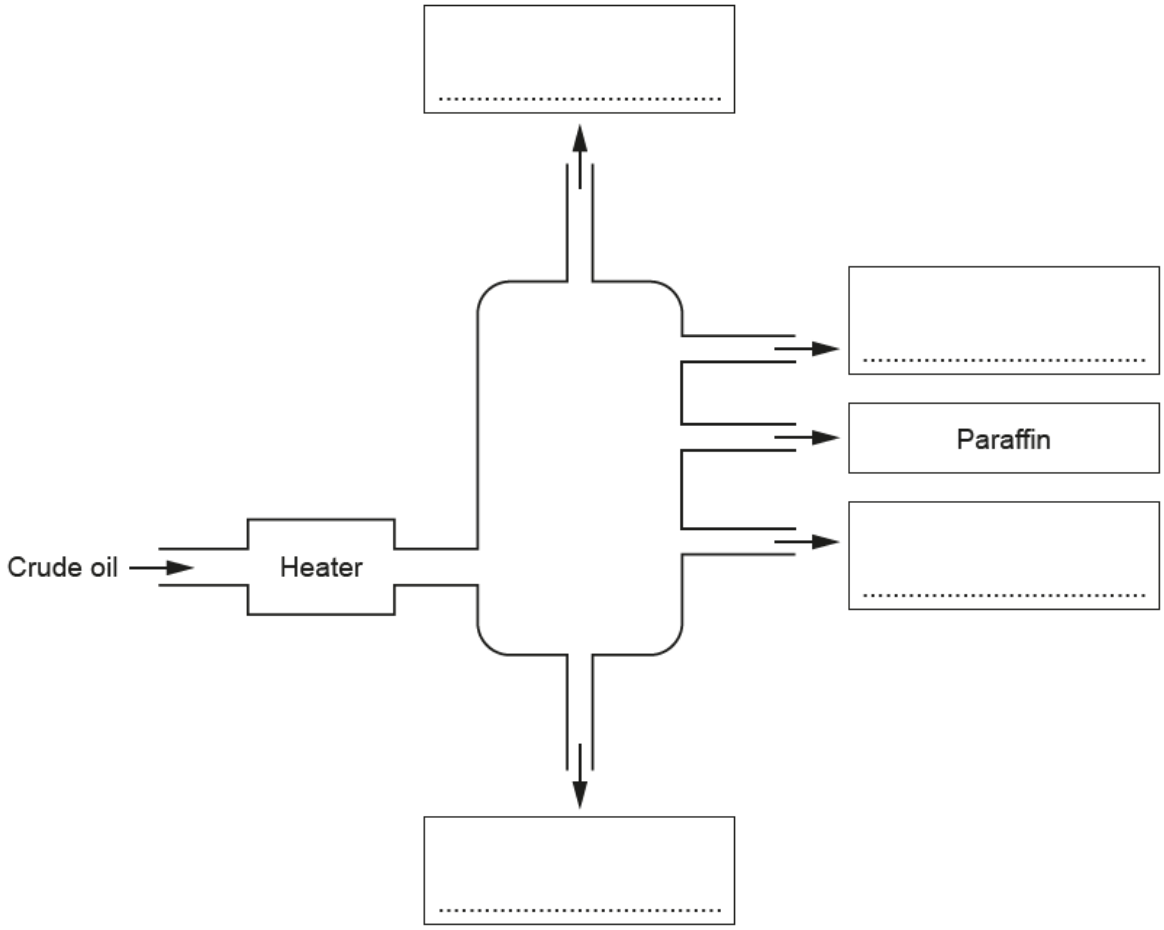
The fractional distillation of crude oil makes many useful fractions.

Table 20.1 shows the boiling temperatures of some fractions.

Fraction	Boiling temperature (°C)
Bitumen	above 400
Diesel	300–350
LPG	below 40
Paraffin	175–250
Petrol	4–175

Table 20.1

(a) Look at the diagram of a fractionating column.



Complete the diagram by writing the names of the missing fractions in the boxes.

Choose from the fractions in **Table 20.1**.

Use the boiling temperatures in the table to help you. **[2]**

(b) After crude oil is separated into fractions, some fractions are then **cracked**.

(i) Explain why some fractions are cracked.

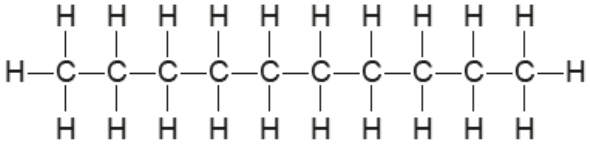
.....

.....

.....

..... **[3]**

(ii) Look at the displayed formula of decane.



The cracking of decane involves the breaking of covalent bonds.

Explain why the cracking of decane makes a mixture of products.

.....

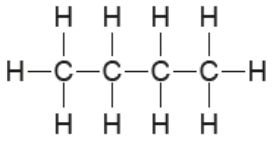
..... **[1]**

(iii) Complete the **balanced symbol** equation for the cracking of a molecule of $C_{30}H_{62}$.

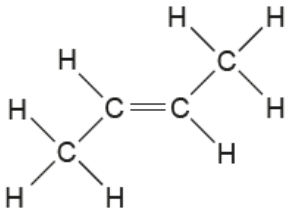
$$C_{30}H_{62} \rightarrow C_{20}H_{42} + 2 \text{ .....}$$

[1]

(c) Look at the displayed formulae of compounds **A** and **B**.



Compound **A**



Compound **B**

A few drops of bromine water are added to 1 cm^3 of each of compounds **A** and **B**.

(i) Explain why compound **B** decolourises bromine water but compound **A** does not.

.....

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

(ii) Write the **balanced symbol** equation for the reaction of compound **B** with bromine, Br_2.

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

20. Nov/2021/Paper_J248/04/No.21

This question is about polymers.

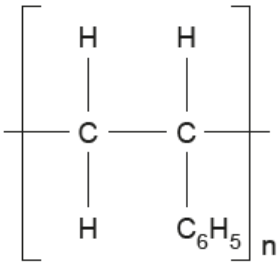
(a) Many biological substances are polymers.

Complete the table to state the type of monomer which forms each of the biological polymers.

Polymer	Type of monomer
DNA	.....
Protein	.....
Starch	.....

[3]

(b) Look at the structure of the polymer called poly(styrene).



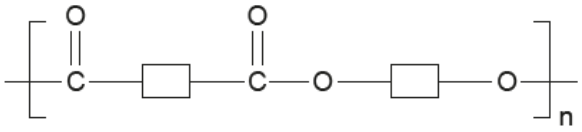
This polymer is made from a **monomer**.

Draw the structure of the monomer.

[2]

(c) Polyesters are also polymers.

Look at the structure of a polyester.

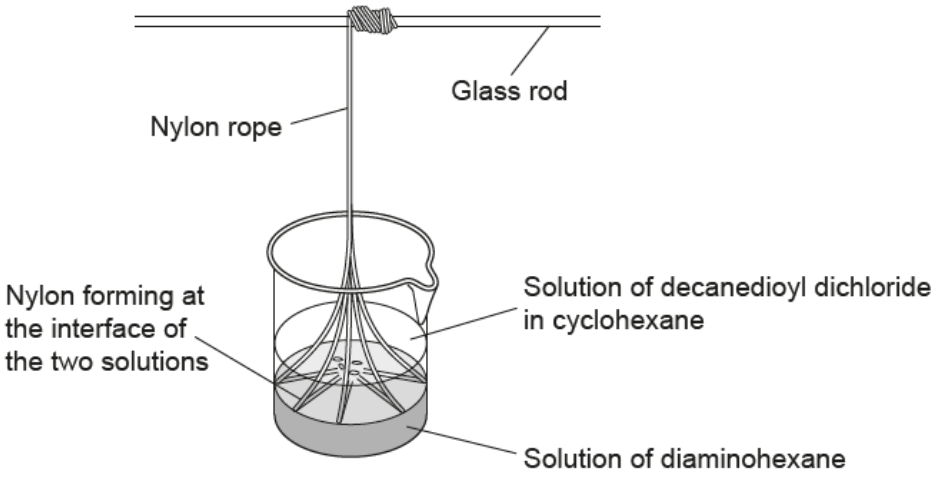


This polymer is made from **two different monomers**.

Draw a molecule of each different monomer.

[2]

(d) Nylon is another polymer.



The chemicals used to make nylon are **corrosive**. Cyclohexane is **highly flammable**.

Describe and explain **two** precautions a teacher should take to carry out this experiment safely.

1 .....

.....

2 .....

.....

[2]

21. Nov/2020/Paper_J248/04/No.4

What is the **general formula** of the fractions produced by the fractional distillation of crude oil?

A C_nH_{2n}

B C_nH_{2n+2}

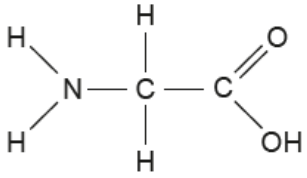
C $C_2H_{2n+1}OH$

D $C_{2n+2}H_2$

Your answer ☐ **[1]**

22. Nov/2020/Paper_J248/04/No.7

Look at the structure of glycine.



Glycine is a monomer that reacts to form proteins.

Glycine contains **two** different functional groups that allow it to undergo polymerisation.

What are the two functional groups?

A $-NH_2$ and $-C=O$

B $-NH_2$ and $-CH_2-$

C $-NH_2$ and $-OH$

D $-NH_2$ and $-COOH$

Your answer ☐ **[1]**

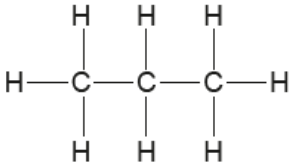
23. Nov/2020/Paper_J248/04/No.10

A student reacts a hydrocarbon with bromine water.

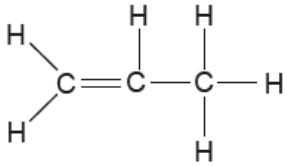
The formula of the product is $C_3H_6Br_2$.

Which is the displayed formula of the hydrocarbon?

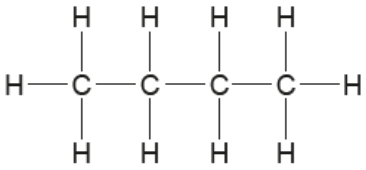
A



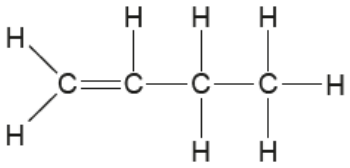
B



C



D



Your answer ☐ **[1]**

24. Nov/2020/Paper_J248/04/No.11

Which of these homologous series can react together to form addition polymers?

A Alcohols and carboxylic acids

B Alkenes only

C Alkenes and alkanes

D Carboxylic acids only

Your answer ☐ **[1]**

25. Nov/2020/Paper_J248/04/No.14

What is the formula of the functional group in **alcohols**?

A $-CH_3$

B $-COOH$

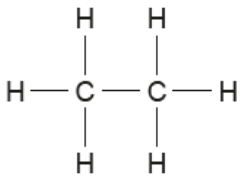
C $-CO_2$

D $-OH$

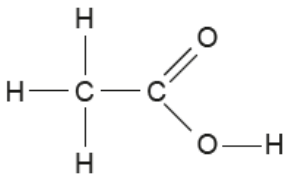
Your answer ☐ **[1]**

26. Nov/2020/Paper_J248/04/No.20

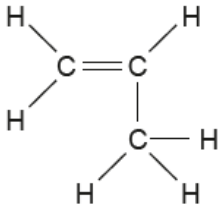
Look at the displayed formulae of some compounds.



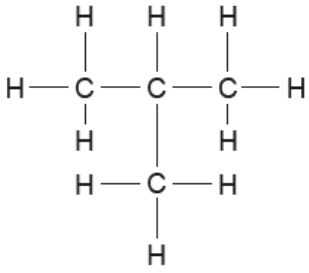
Compound **A**



Compound **B**



Compound **C**



Compound **D**

(a) (i) Which **two** compounds are members of the same **homologous series**?

..... and .....

(ii) Write down **two** reasons for your answer in **(a)(i)**.

1 .....

2 .....

[3]

(b) Many molecules of compound **C** react together to form a polymer.

This reaction is called **addition polymerisation**.

(i) Draw the **displayed formula** of the polymer formed by compound **C**.

[2]

(ii) Another type of polymerisation is **condensation polymerisation**.

Describe one **difference** between addition polymerisation and condensation polymerisation.

.....

.....

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

(c)* A student has unlabelled samples of three liquids.

The student knows that the three liquids are:

- pentane, C_5H_{12}
- pentene, C_5H_{10}
- ethanoic acid, CH_3COOH.

Describe tests that the student should do to identify each of the three liquids.

Include **balanced symbol** equations for the reactions described.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**