

Alkanes vs Alkenes (Tests & Simple Reactions)

Q1. (2018) – 4b

(b) The molecules of three organic substances **A**, **B** and **C** are shown in Figure 6.

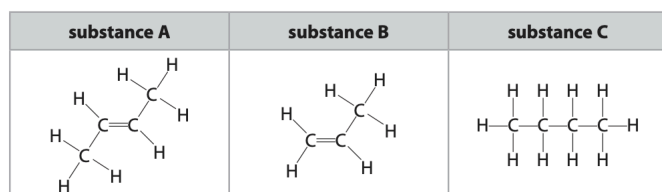


Figure 6

A)

- (i) A small volume of bromine water is added to each of the substances **A**, **B** and **C** and the mixtures shaken.
Explain why **A** and **B** decolourise bromine water but **C** does not.

(3)

B)

- (ii) Ethane, C_2H_6 , is a hydrocarbon.

Draw a molecule of ethane showing all covalent bonds.

(2)

C)

- (iii) State why ethane is described as a **hydrocarbon**.

(2)

Q2. (2018) – 5b

(b) The substances ethane, C_2H_6 , octane, C_8H_{18} , and pentadecane, $C_{15}H_{32}$, are all found in crude oil.

These substances

(1)

- ☐ **A** have the same formula
- ☐ **B** have the same boiling point
- ☐ **C** are in the same homologous series
- ☐ **D** form different products when completely combusted in air

Q3. (2018) – 7c

- (c) (i) The structure of a molecule of a polymer is shown in Figure 12.

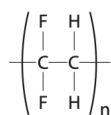
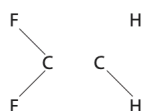


Figure 12

Complete the structure of a molecule of the monomer used to make this polymer by adding the missing covalent bonds.

(2)



10 Ethanol can be used as a liquid fuel.

A student investigates how much heat energy is released when a known mass of ethanol is burned.

The apparatus is set up as shown in Figure 15.

A known volume of water is placed in a metal can.

The temperature of the water is measured.

The ethanol is ignited and placed under the beaker so that the flame is touching the beaker.

The water is heated by the flame.

The flame is extinguished.

The final temperature of the water is measured.

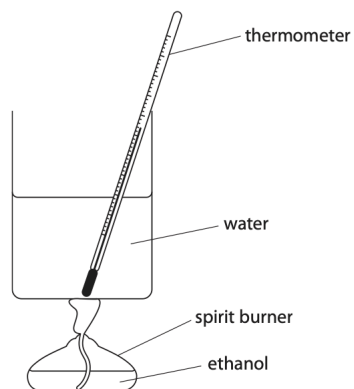
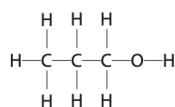


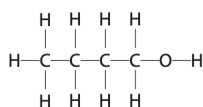
Figure 15

A)

(b) Propanol and butanol are both members of the same homologous series as ethanol.



propanol



butanol

Propanol and butanol can also be burned in the apparatus shown in Figure 15.

Give **three** reasons why ethanol, propanol and butanol are members of the same homologous series.

(3)

reason 1

reason 2

reason 3

B)

(c) Ethanol can oxidise when exposed to air to produce ethanoic acid and water.

Propanol can also oxidise in a similar reaction when it is exposed to air.

(i) Write the word equation for the reaction when **propanol** oxidises when it is exposed to air.

(2)

- 3 Polymer molecules can be made by joining together large numbers of small molecules called monomers.

(a) Figure 5 shows the names and structures of some polymers and the monomers used to make them.

Complete the table using the information given.

(3)

name of polymer	structure of polymer molecule	name of monomer	structure of monomer molecule
poly(ethene)		ethene	$\begin{array}{c} \text{H} & & \text{H} \\ & \diagdown & / \\ & \text{C}=\text{C} \\ & / & \diagdown \\ \text{H} & & \text{H} \end{array}$
poly(chloroethene)	$\left[\begin{array}{cc} \text{H} & \text{Cl} \\ & \\ -\text{C} & -\text{C}- \\ & \\ \text{H} & \text{H} \end{array} \right]_n$	chloroethene	
	$\left[\begin{array}{cc} \text{F} & \text{F} \\ & \\ -\text{C} & -\text{C}- \\ & \\ \text{F} & \text{F} \end{array} \right]_n$	tetrafluoroethene	$\begin{array}{c} \text{F} & & \text{F} \\ & \diagdown & / \\ & \text{C}=\text{C} \\ & / & \diagdown \\ \text{F} & & \text{F} \end{array}$

Figure 5

Q6. (2019) – 3c

(c) A molecule of propene has the structure shown in Figure 6.

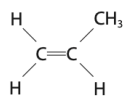


Figure 6

Which of the following shows the structure of part of a poly(propene) molecule?

(1)

- ☒ A
$$\begin{array}{ccccccc} \text{CH}_3 & \text{H} & \text{H} & \text{CH}_3 & \text{H} & \text{H} \\ | & | & | & | & | & | \\ -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C}- \\ | & | & | & | & | & | \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array}$$
- ☒ B
$$\begin{array}{ccccccc} \text{H} & \text{CH}_3 & \text{H} & \text{CH}_3 & \text{H} & \text{CH}_3 \\ | & | & | & | & | & | \\ -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C}- \\ | & | & | & | & | & | \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array}$$
- ☒ C
$$\begin{array}{ccccccc} \text{H} & \text{CH}_3 & \text{H} & \text{H} & \text{CH}_3 & \text{H} \\ | & | & | & | & | & | \\ -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C}- \\ | & | & | & | & | & | \\ \text{H} & \text{CH}_3 & \text{H} & \text{H} & \text{CH}_3 & \text{H} \end{array}$$
- ☒ D
$$\begin{array}{ccccccc} \text{CH}_3 & \text{CH}_3 & \text{CH}_3 & \text{CH}_3 & \text{CH}_3 & \text{CH}_3 \\ | & | & | & | & | & | \\ -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C}- \\ | & | & | & | & | & | \\ \text{CH}_3 & \text{CH}_3 & \text{CH}_3 & \text{CH}_3 & \text{CH}_3 & \text{CH}_3 \end{array}$$

Q7. (2019) – 5c

- (c) Substance X is an unsaturated hydrocarbon.
The structure of a molecule of substance X is shown in Figure 10.

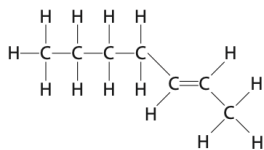


Figure 10

Explain how the structure of substance X shows that it is an **unsaturated hydrocarbon**.

(2)

Q8. (2019) – 5d

- (d) Two liquid hydrocarbons, **A** and **B**, were tested with bromine water.
One hydrocarbon was known to be an alkane.
The other hydrocarbon was known to be an alkene.

Each hydrocarbon was shaken with a few drops of bromine water.

The results of the tests were
hydrocarbon A + bromine water: the mixture turned from orange to colourless.
hydrocarbon B + bromine water: the orange colour remained.

Explain these results.

(2)

Q9. (2019) – 8c (i, iii)

- (c) Figure 14 shows the formulae of a molecule of butane and of a molecule of pentane.
Butane and pentane are neighbouring members of the same homologous series.

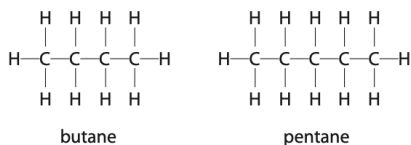


Figure 14

A)

- (i) Explain, using these formulae, why butane and pentane are neighbouring members of the same homologous series.

(2)

B)

- (iii) Butane burns completely in air to form carbon dioxide and water.

Write the word equation for this reaction.

(2)

Q10. (2019)

- 10 (a) Ethanol is made by fermentation of a carbohydrate dissolved in water, in the presence of yeast.

The reaction is carried out at 30 °C.

Explain why the reaction is carried out at a temperature of 30 °C rather than at a temperature of 80 °C.

(2)

Q11. (2020)

- 7 (a) Ethanol can be produced by the fermentation of glucose solution.

Which of these shows the word equation for the fermentation of glucose solution?

(1)

- ☐ A glucose → ethanol + water
- ☐ B glucose → ethanol + carbon dioxide
- ☐ C glucose → ethanol + hydrogen
- ☐ D glucose → ethanol + water + carbon dioxide

Q12. (2020) – 7b

- (b) The names and formulae of the first four alcohols in the homologous series of alcohols are given in Figure 12.

name of alcohol	formula
methanol	CH ₃ OH
ethanol	C ₂ H ₅ OH
propanol	C ₃ H ₇ OH
butanol	C ₄ H ₉ OH

Figure 12

- (i) Pentanol is the next member of this series.
A molecule of pentanol contains five carbon atoms.

Suggest the formula of a molecule of pentanol.

(1)

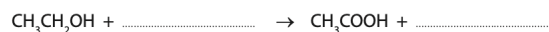
Q13. (2020) – 7c

- (c) Ethanol is present in alcoholic drinks, such as wine.

When a bottle of wine is left open some of the ethanol reacts with the oxygen in the air to form ethanoic acid, CH₃COOH, and water.

- (i) Complete the equation for this reaction.

(2)



Q14. (2020)

- 10 Figure 16 shows the structure of a molecule of dichloroethene.

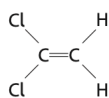


Figure 16

A)

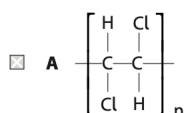
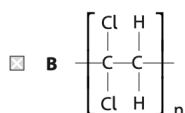
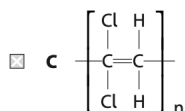
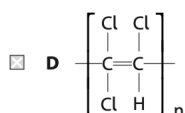
- (a) (i) Describe how dichloroethene monomers form a polymer.

(2)

B)

- (ii) Which of these represents the structure of the polymer formed from the monomer in Figure 16?

(1)



C)

- (iii) Separate samples of dichloroethene and poly(dichloroethene) are shaken with a few drops of bromine water.

What would be **seen**?

(1)

- ☐ **A** both mixtures remain orange
☐ **B** only the dichloroethene and bromine water goes colourless
☐ **C** only the poly(dichloroethene) and bromine water goes colourless
☐ **D** both mixtures go colourless

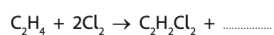
D)

- (b) Dichloroethene is produced from ethene and chlorine.

In the overall reaction, ethene reacts with chlorine and forms dichloroethene and hydrogen chloride.

Complete the balanced equation for the overall reaction.

(2)



E)

- (c) Poly(dichloroethene) was used to wrap food to keep it fresh.

Explain **one** property that a plastic food wrapping must have.

(2)

Q15. (2021) – 7a (ii)

- (ii) Propanol can be converted into propanoic acid.

What happens to propanol in this reaction?

(1)

- ☐ **A** it is dehydrated
☐ **B** it is neutralised
☐ **C** it is oxidised
☐ **D** it is polymerised

Q16. (2021) – 9b

- (b) Diesel oil contains alkanes.
These alkanes are part of an homologous series.

Which statement about compounds in this homologous series is true?

(1)

- ☐ A they have the same chemical formula
☐ B they have the same empirical formula
☐ C they have the same general formula
☐ D they have the same molecular formula

Q17. (2021) – 10b

- (b) Poly(chloroethene) is a polymer made from chloroethene.
A molecule of chloroethene is shown in Figure 20.

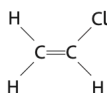


Figure 20

A)

- (i) On Figure 20, draw a circle around the functional group in this molecule.

(1)

B)

- (ii) Draw a section of a poly(chloroethene) molecule containing three repeating units, showing all bonds.

(3)

C)

- (iii) What type of polymer is poly(chloroethene)?

(1)

Q18. (2022)

- 1** Figure 1 shows toothbrushes in a container.

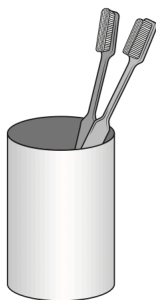


Figure 1

- (a) The toothbrush handles are made of plastic (polymer).

- (i) Give a reason why plastic is a suitable material to make a toothbrush handle.

(1)

Q19. (2022)

- 5 (a) Figure 8 shows one molecule of a compound obtained from crude oil.

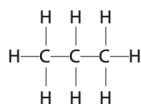


Figure 8

A)

- (i) Give the names of the **two** elements in this molecule.

(2)

B)

- (ii) What is the molecule in Figure 8?

(1)

- ☐ A an oxide
- ☐ B a chain molecule
- ☐ C a fullerene
- ☐ D a ring molecule

Q20. (2022) – 7b, 7c (i)

- 7 The structure of one molecule of a compound is shown in Figure 10.

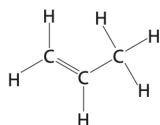


Figure 10

A)

- (b) The compound in Figure 10 is an unsaturated hydrocarbon.

State why the compound is described as an **unsaturated hydrocarbon**.

(3)

unsaturated

.....

hydrocarbon

.....

.....

B)

- (c) Many molecules of the compound in Figure 10 combine to form substance Y.
Figure 11 shows part of a molecule of substance Y.

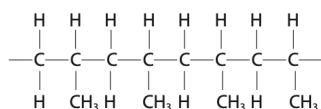


Figure 11

- (i) What type of substance is Y?

(1)

- ☐ A a composite
- ☐ B a nanoparticle
- ☐ C a polymer
- ☐ D a protein

Q21. (2023) – 5a, 5c, 5d, 5f

- 5 Ethanol can be made by fermentation of a solution of glucose, a carbohydrate.

A student used the apparatus shown in Figure 9 for the fermentation reaction.

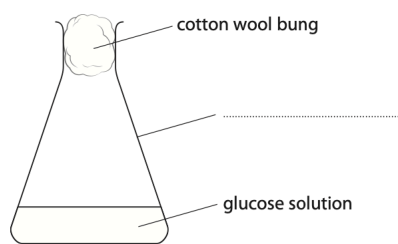


Figure 9

A)

- (a) Complete the missing label on Figure 9.

(1)

B)

- (c) State what should be added to the glucose solution to cause the fermentation reaction.

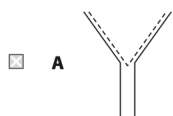
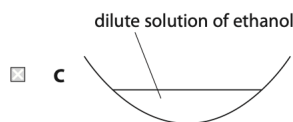
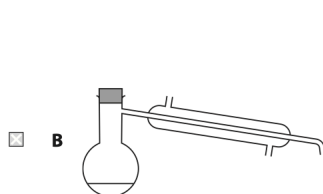
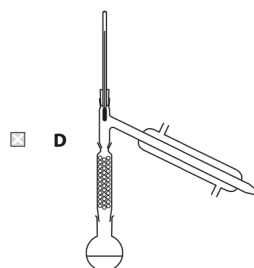
(1)

C)

- (d) After a few days, a dilute solution of ethanol is formed.

Which piece of apparatus should be used to produce a concentrated solution of ethanol from the dilute solution of ethanol by fractional distillation?

(1)



D)

- (f) The structure of a molecule of ethanol is shown in Figure 10.

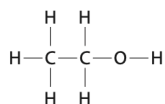
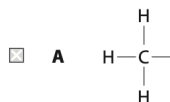
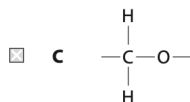
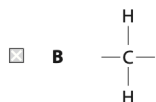


Figure 10

Ethanol is an example of an alcohol.

What is the functional group of an alcohol?

(1)



Q22. (2023) – 7b

- 7 In the complete combustion of alkanes, the alkane reacts with oxygen to produce carbon dioxide and water only.

(b) Figure 13 shows some information about four alkanes.

- (i) Complete Figure 13 to show the structure of one molecule of propane and the formula of butane.

(2)

alkane	formula	structure of one molecule
propane	C_3H_8	
butane		$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array} $
pentane	C_5H_{12}	$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array} $
hexane	C_6H_{14}	$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array} $

Figure 13

Q23. (2023) – 10c

(c) Figure 20 shows the structure of a molecule of tetrafluoroethene.

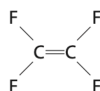


Figure 20

A)

(i) Tetrafluoroethene can form the polymer poly(tetrafluoroethene).

Draw a diagram to show the structure of the repeating unit of this polymer.

(2)

B)

(ii) Poly(tetrafluoroethene) is also known as Teflon™.

State one use of poly(tetrafluoroethene) and explain how one of its properties makes it suitable for that use.

(3)

use

explanation

Q24. (2024)

5 (a) Figure 9 shows the structure of one molecule of three different compounds, X, Y and Z.

X	Y	Z

Figure 9

The molecules of the compounds shown in Figure 9 all contain the same number of carbon atoms.

A)

(i) Give the number of carbon atoms in a molecule of compound X.

(1)

B)

(ii) Compound X contains carbon and one other element.

Give the **name** of the other element in compound X.

(1)

C)

(iii) Which of the compounds in Figure 9 is a hydrocarbon?

(1)

- ☐ A X only
- ☐ B Y only
- ☐ C X and Y only
- ☐ D X, Y and Z

Q25. (2024) – 7a (ii)

- 7 (a) The structure of one molecule of compound **L** is shown in Figure 12.

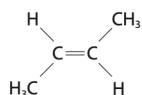


Figure 12

- (ii) Explain why compound **L** is an alkene.

(2)

Q26. (2024) – 7b

- (b) Some naturally occurring molecules are polymers.

Draw **one** straight line from each natural polymer to its monomer.

(2)

natural polymer	monomer
<div style="border: 1px solid black; padding: 5px; display: inline-block;">DNA</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">amino acids</div>
<div style="border: 1px solid black; padding: 5px; display: inline-block;">proteins</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">nucleotides</div>
<div style="border: 1px solid black; padding: 5px; display: inline-block;">starch</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">PVC</div>
	<div style="border: 1px solid black; padding: 5px; display: inline-block;">sugars</div>

Q27. (2024) – 7c

- *(c) Figure 13 shows information about four compounds, **E**, **F**, **G** and **H**.

The compounds are in no particular order

- butane
- carbon dioxide
- ethane
- ethene.

compound	boiling point in °C	reaction with limewater	reaction with bromine water	products when burned in oxygen
E	–78	mixture turns milky	no reaction	does not burn
F	–104	no reaction	mixture goes colourless	carbon dioxide and water
G	–89	no reaction	no reaction	carbon dioxide and water
H	–1	no reaction	no reaction	carbon dioxide and water

Figure 13

Use all of the information in Figure 13 to identify which of the four compounds, **E**, **F**, **G** and **H**, is

- butane
- carbon dioxide
- ethane
- ethene.

You must give reasons for your choices.

(6)

Q28. (2024) – 10a (iii)

- 10 (a) Figure 17 shows a poly(ethene) bottle containing substance **K** with one of its hazard symbols showing.

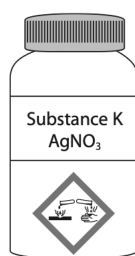


Figure 17

- (iii) State **one** property of poly(ethene) that makes it a suitable material to make a container for storing substances.

(1)