Fuels

1. What is meant by the term fuel?

2. Name the gas required for a fuel to burn.

3. Give another name for burning.

3. What is meant by the term exothermic?

4. Oil is a fossil fuel. Name another two fossil fuels.

5. (a) Circle the correct words to complete the sentence.

Oil was formed over { thousands / millions } of years from the remains of dead animals and plants which decayed under the { sea bed / land }.

(b) When burned, some fossil fuels produce a poisonous gas.
This gas reacts with water in the atmosphere to produce acid rain.
Name the poisonous gas.

6. What is meant by the term finite?

7. When sulfur dioxide reacts with water in the atmosphere, acid rain is produced.

Give **one** example of a damaging effect of acid rain.

8. The table shows how the level of carbon dioxide in the atmosphere has changed since 1975.

Year	Level of carbon dioxide/units
1975	330
1985	345
1995	358
2005	374
2015	

Predict the level of carbon dioxide in the atmosphere in 2015 if the trend continues.

9. Crude oil is a mixture of hydrocarbons.

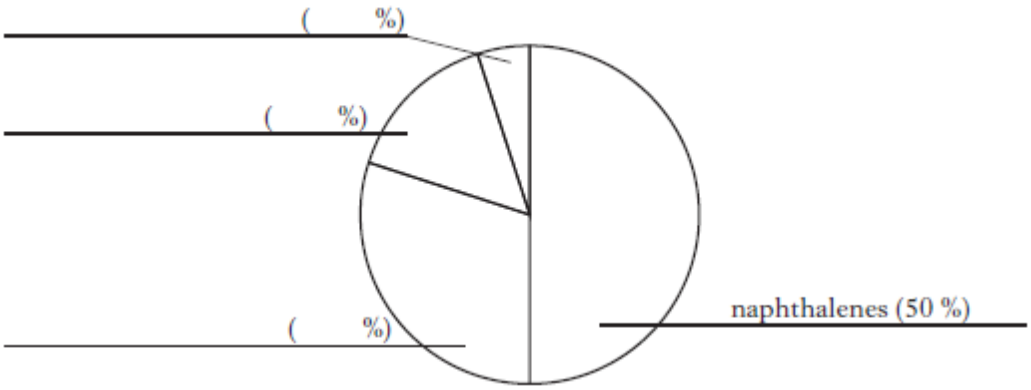
   (a) Name the **two** elements found in a hydrocarbon.

   (b) Name the process used to separate the mixture of hydrocarbons found in crude oil.

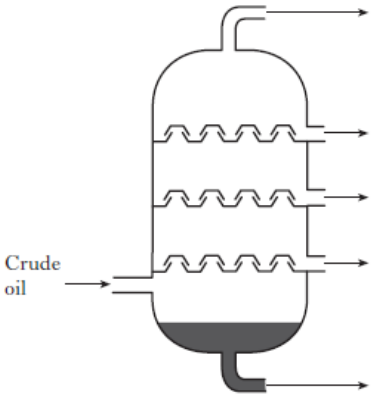
10. One way of classifying the types of hydrocarbon found in crude oil is shown in the table.

Type of hydrocarbon	% in crude oil
naphthalenes	50
paraffins	30
aromatics	15
asphalts	

Copy and complete the pie chart to show the name and percentage for each type of hydrocarbon. One label has already been completed for you.



11. The table shows some fractions from crude oil.

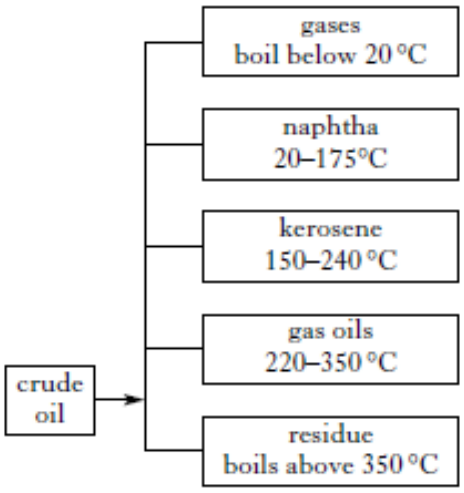


Boiling range/°C	Name of fraction
–160 to 20 °C	Refinery Gas
20 to 120 °C	Naphtha
120 to 240 °C	Kerosene
240 to 350 °C	Gas Oils
Over 350 °C	Residue

(a) Name the fraction with the shortest chain length.

(b) Name the fraction which can be used to tar roads.

12. Crude oil can be separated into fractions.



(a) Identify the fraction in which butane is present.
(You may wish to use the data booklet to help you.)

(b) The table shows information about the colour of each fraction.

Alkanes and Alkenes

1. The grid shows the names of some hydrocarbons.

A propane	B hexene	C pentane
D pentene	E ethene	F propene

(a) Name the **two** hydrocarbons which are alkanes.
(b) Name the two hydrocarbons with three carbon atoms in each molecule.
(c) Name the hydrocarbon with the highest boiling point.
(You may wish to use your data booklet to help you.)

2. The table below gives information about some hydrocarbons obtained from the paraffins.

Name	Formula
octane	C_8H_{18}
nonane	C_9H_{20}
decane	$C_{10}H_{22}$
undecane	$C_{11}H_{24}$

(a) Name the family of hydrocarbons in the table.
(b) Eicosane is another member of this family.
A molecule of eicosane contains 20 carbon atoms.
Write the molecular formula of eicosane.

3. Name and draw the full structural formula for the alkanes with molecular formula

(a) CH_4 (b) C_2H_6 (c) C_4H_{10} (d) C_5H_{12}

4. State the general formula for the alkanes.

5. The alkanes are described as being saturated.

What does saturated mean?

6. The alkanes are known as a homologous series.

What is meant by a homologous series?

7. The table gives information about some members of the alkane family.

Name	Molecular formula	Boiling point/°C
nonane	C_9H_{20}	151
decane	$C_{10}H_{22}$	174
undecane	$C_{11}H_{24}$	196
dodecane	$C_{12}H_{26}$	

(a) Predict the boiling point of dodecane.

(*b*) What term is used to describe any family of compounds, like the alkanes, which have the same general formula and similar chemical properties?

8. Ethers are useful chemicals.
Some are listed in the table.

Structural formula	Name of ether
$CH_3CH_2-O-CH_2CH_3$	ethoxyethane
$CH_3-O-CH_2CH_2CH_3$	methoxypropane
$CH_3-O-CH_2CH_3$	methoxyethane
$CH_3CH_2-O-CH_2CH_2CH_3$	**X**

(a) Suggest a name for ether **X**.

(b) The boiling points of ethers and alkanes are approximately the same when they have a **similar** relative formula mass.

Suggest the **boiling point** of ethoxyethane (relative formula mass 74).
You may wish to use the data booklet to help you.

9. The grid shows the names of some hydrocarbons.

A propane	B hexane	C pentene
D pentane	E ethene	F butane

(a) Name the **two** hydrocarbons which are alkenes
(b) Name the two hydrocarbons with five carbon atoms in each molecule.
(c) Name the hydrocarbon which is the first member of a homologous series.

10. Name and draw the full structural formula for the alkenes with molecular formula

(a) C_2H_4 (b) C_3H_6 (c) C_4H_8 (d) C_5H_{10}

11. State the general formula for the alkenes.

12. The alkenes are described as being unsaturated.

What does unsaturated mean?

13. Describe the chemical test, including the result for an unsaturated alkene.

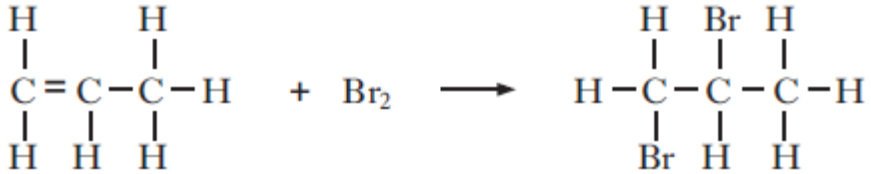
14. The alkenes are known as a homologous series.

What is meant by a homologous series?

15. Alkenes decolourise bromine solution.
What does this tell you about the structure of alkenes?

16. Name the type of chemical reaction taking place when an alkene reacts with hydrogen.

17. Name the type of chemical reaction represented by the equation:



Cycloalkanes and Isomers

1. Cyclobutane belongs to a family of hydrocarbons.

(a) (i) Name this family of hydrocarbons.

(ii) Write the molecular formula for cyclobutane.

(b) Draw the full structural formula and name the first member of this family.

2. What term is used to describe any family of hydrocarbons which have the same general formula and similar chemical properties?

3. State the general formula for the family of hydrocarbons which contains cyclobutane.

4. Cyclobutane is described as a saturated hydrocarbon
What is meant by the term saturated?

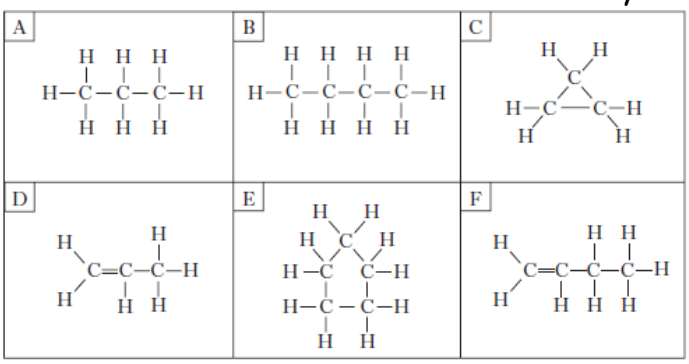
5. Draw a structural formula for an isomer of cyclobutane which does **not** belong to the same family.

6. What is meant by the term isomer?

7. Name the two families of hydrocarbons with the same general formula each other.

8. A hydrocarbon molecule has molecular formula C_5H_{10}.
(i) To which two families could this molecule belong?
(ii) Describe a chemical test, including the result, which would confirm which family C_5H_{10} belongs to.

9. The grid shows the structural formulae of some hydrocarbons.

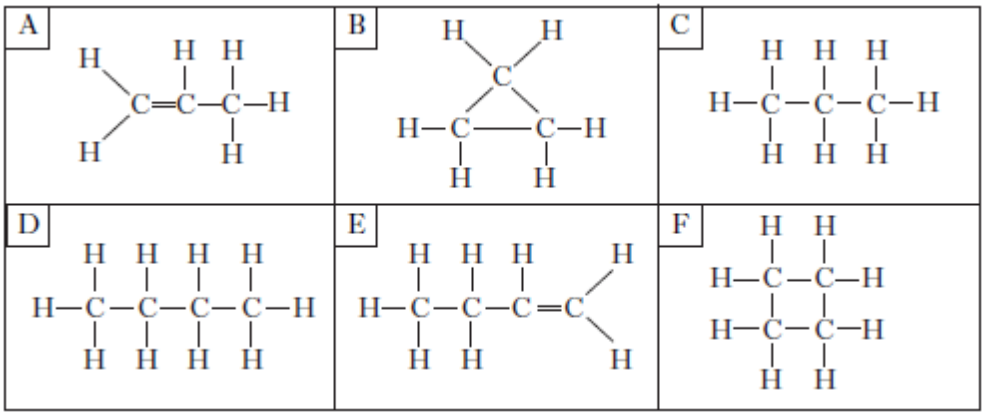


Identify the **two** isomers.

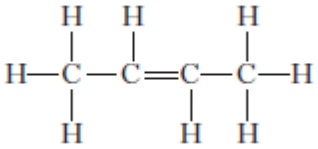
10. C_4H_8 decolourises bromine solution quickly.

Draw a structural formula for an isomer of C_3H_6, which would **not** decolourise bromine solution quickly.

11. The structures of some hydrocarbons are shown in the grid.



Identify the **two** isomers of



12. The names of some hydrocarbons are shown in the grid.

A ethane	B pentene	C cyclohexane
D pentane	E cyclopentane	F propene

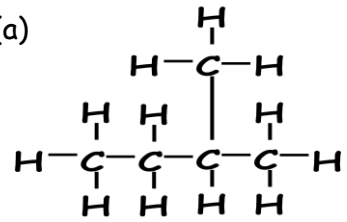
(a) Identify the **two** isomers.

(b) Identify the **two** hydrocarbons which can take part in an addition reaction with hydrogen.

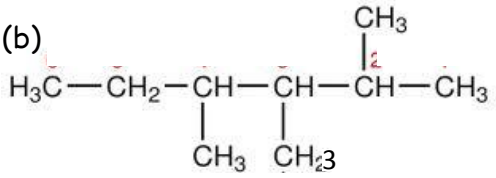
Systematic Naming

1. State the systematic name for each of the following.

(a)

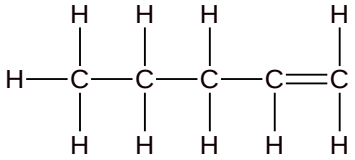


(b)



(c) $CH_3\text{-}\underset{\displaystyle CH_3}{\underset{|}{CH}}\text{-}CH_2\text{-}CH_2\text{-}CH_3$

(d)



(e) $CH_3\text{-}CH_2\text{-}CH{=}CH_2$ (f) $CH_3\text{-}CH{=}CH\text{-}CH_3$ (g) $CH_2{=}CH\text{-}\underset{\displaystyle CH_3}{\underset{|}{CH}}\text{-}CH_3$

2. Draw the full structural formula for each of the following.

(a) 3-methyl hexane

(b) 2,2,4 -trimethyl pentane

(c) 2, 4, dimethyl butane

(d) pent-2-ene

(e) 4,4-dimethyl octene

(f) 2-methylprop-1-ene

Carbohydrates

1. Name the **three** elements present in a carbohydrate.

2. Scientists have developed a method of producing hydrocarbons from carbohydrates.
   Name the element removed from a carbohydrate to produce a hydrocarbon.

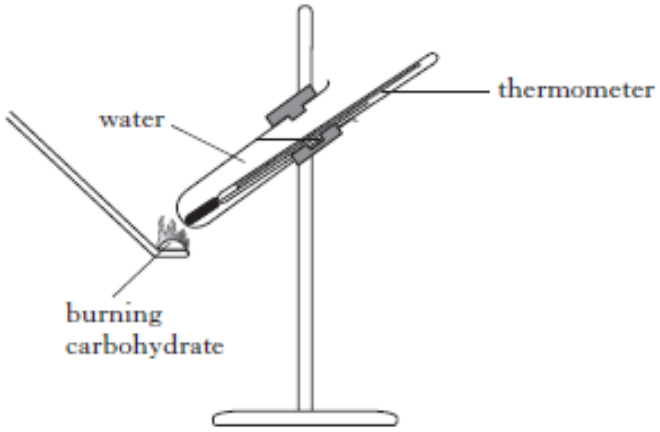
3. Circle the correct words to complete the sentence.

   Starch is sweet / not sweet and dissolves / does not dissolve well in water.

4. Describe the chemical test, including the result, for glucose.

5. Describe the chemical test, including the result, for starch.

6. A student set up an experiment to investigate the burning of carbohydrates.



Her results are shown below.

Carbohydrate	Starting temperature of water/° C	Final temperature of water/° C
glucose	20	44
starch	20	56

Suggest **one** factor that the student would have kept the same to make a fair comparison.

Alcohols

1. Name the functional group present in an alcohol.

2. Give the systematic name for each of the following alcohols

(a) CH_3-$\underset{\displaystyle OH}{\underset{|}{CH}}$-$CH_2$-$CH_3$ (b) $CH_3 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_2 - CH_2 - CH_3$

(c) CH_3-CH_2-CH_2-$\underset{\displaystyle OH}{\underset{|}{CH_2}}$-$CH$-$CH_2$-$CH_3$ (d) CH_3-CH_2-CH_2-CH_2-OH

3. Draw the full structural formula for each of the following alcohols and give the systematic name.

(a) $CH_3CH_2CH_2OH$ (b) $CH_3CH_2CH(OH)CH_2CH_3$

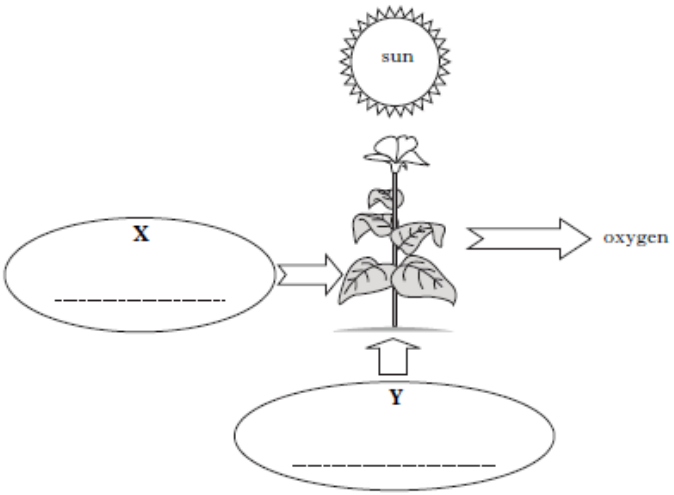
4. Draw the full structural formula for each of the following alcohols.

(a) pentan-1-ol (b) butan-2-ol

(c) octan-4-ol (d) heptan-2-ol

5. State the general formula for the alcohols.

6. Plants make glucose and oxygen gas during photosynthesis.



(a) State the test for oxygen gas.
(b) Write the names for substances **X** and **Y**.

7. The equation for photosynthesis is:

water + compound **Y** ⟶ glucose + oxygen

Name compound **Y**.

8. Flowers produce a sweet-tasting liquid called nectar.
Nectar contains a mixture of sugars such as glucose and sucrose.

(a) To which family of compounds do glucose and sucrose belong?
(b) Glucose can be broken down to produce alcohol.
(i) Name this **type** of chemical reaction.
(ii) What is the chemical name for the alcohol produced?

9. Ethanol, for alcoholic drinks, can be made from glucose.
Name this process.

10. The table below shows the relationship between the percentage of ethanol and the density of alcoholic drinks.

Percentage of ethanol (%)	40	50	60	70	80
Density of alcoholic drink (g/cm^3)	0·928	0·907	0·886	0·865	0·844

(a) Write a general statement describing how the percentage of ethanol affects the density of the alcoholic drink.

(b) The density of a particular brand of alcoholic drink is 0·970 g/cm^3.
Predict the percentage of ethanol in this alcoholic drink.

Carboxylic Acids and Esters

1. State the name of the functional group in carboxylic acids

2. Suggest a pH for a carboxylic acid.

3. Give the systematic name for each of the following carboxylic acids.

   a) $CH_3CH_2CH_2CH_2CH_2CH_2CH_2COOH$ b) $CH_3CH_2CH_2CH_2COOH$

4. Draw the **full structural formula** for the following carboxylic acids.

   a) propanoic acid b) butanoic acid

5. State the general formula for the carboxylic acids.

6. State **one** use of esters.

7. Name the **two** families of compounds which react together to produce esters.

8. The table gives information on esters.

Alkanol	Alkanoic acid	Ester
methanol	ethanoic acid	methyl ethanoate
ethanol	propanoic acid	ethyl propanoate
propanol	methanoic acid	propyl methanoate
butanol	ethanoic acid	butyl ethanoate
pentanol	butanoic acid	**X**

Suggest a name for **X**.