

Carbon Compounds as Fuels + Feedstock

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.7 Organic Chemistry
Sub-Topic	Carbon Compounds as Fuels + Feedstock
Difficulty Level	Bronze Level
Booklet	Question Paper 1

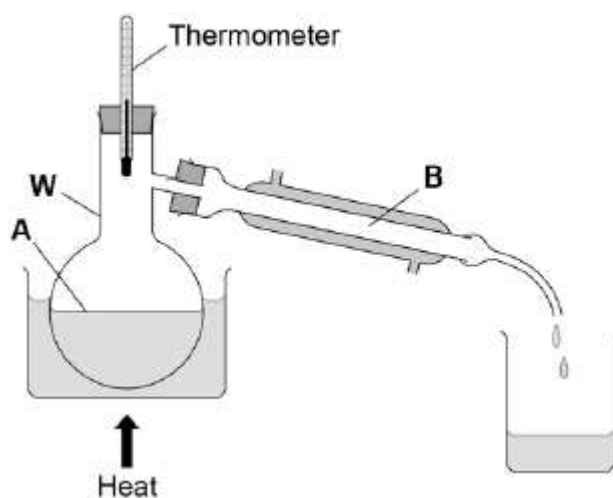
Time Allowed: 58 minutes

Score: /57

Percentage: /100

Grade Boundaries:

Q1. The apparatus in the figure below is used to separate a mixture of liquids in a fuel.



(a) What is apparatus **W** on above the figure above?

Tick **one** box.

Beaker

☐

Boiling Tube

☐

Flask

☐

Jug

☐

(1)

(b) What is the name of this method of separation?

Tick **one** box.

Crystallisation

☐

Electrolysis

☐

Filtration

☐

Distillation



(1)

- (c) Name the changes of state taking place at **A** and **B** in the figure above.

Use words from the box.

boiling	condensing	freezing	melting
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Change of state at **A**:

Change of state at **B**:

(2)

- (d) **Table 1** shows the boiling points of the hydrocarbons in the fuel.

Table 1

Hydrocarbon	Boiling point in °C
Pentane	36
Hexane	69
Heptane	98
Octane	125

Which hydrocarbon will be the last to collect in the beaker?

Tick **one** box.

Pentane

☐

Hexane

☐

Heptane

☐

Octane

☐

(1)

- (e) The fuel is a mixture of liquids that has been designed as a useful product.

What name is given to this type of mixture?

Tick **one** box.

Catalyst

☐

Formulation

☐

Polymer

☐

Solvent

☐

(1)

- (f) Describe how this fuel is different from crude oil.

.....

.....

.....

.....

(2)

- (g) A student measured the melting point of a solid hydrocarbon four times.

The student's results are in **Table 2**.

Table 2

	Trial 1	Trial 2	Trial 3	Trial 4
Melting	35	48	37	37

point in °C				
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Calculate the mean melting point of the hydrocarbon, leaving out any anomalous result.

Give your answer to two significant figures.

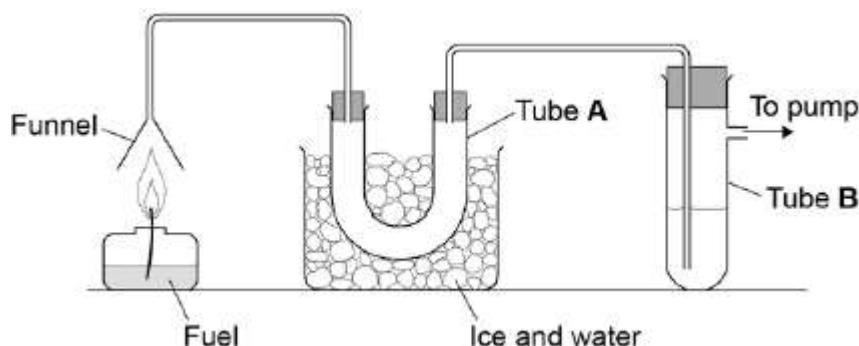
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Mean melting point = °C

(2)
 (Total 10 marks)

Q2.A student investigated the substances produced when fuels burn.

The figure below shows the apparatus the student used.



- (a) The complete combustion of a hydrocarbon produces carbon dioxide and one other substance.

Look at the figure above. What would the student see in tube **A**?

.....

(1)

- (b) When the student burned the fuel she saw soot in the funnel.

Explain why soot forms.

.....

.....
.....

(2)

- (c) The student burned another fuel which contained impurities.

The substance in tube **B** is water containing universal indicator.

The indicator turned red.

Which gas made the indicator turn red?

Tick **one** box.

Ammonia

☐

Carbon monoxide

☐

Nitrogen

☐

Sulfur dioxide

☐

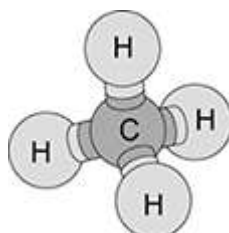
(1)

(Total 4 marks)

Q3. There are several different forms of carbon and many different carbon compounds.

- (a) **Figure 1** shows a 3D model of a molecule of methane (CH_4).

Figure 1



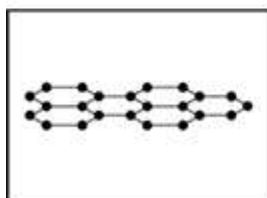
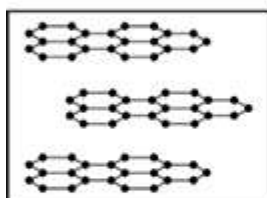
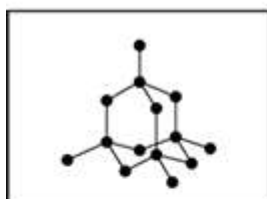
Draw the 2D structure of a methane molecule.

(1)

- (b) Different forms of carbon have different bonding and structure.

Draw **one** line from the form of carbon to the bonding and structure.

Form of carbon



Bonding and structure

Each carbon atom is bonded to three other carbon atoms in a single layer

Each carbon atom is bonded to four other carbon atoms

Layers of carbon atoms with no covalent bonds between the layers

Carbon ions held together by strong electrostatic forces

Pairs of carbon atoms with no covalent bonds between the molecules

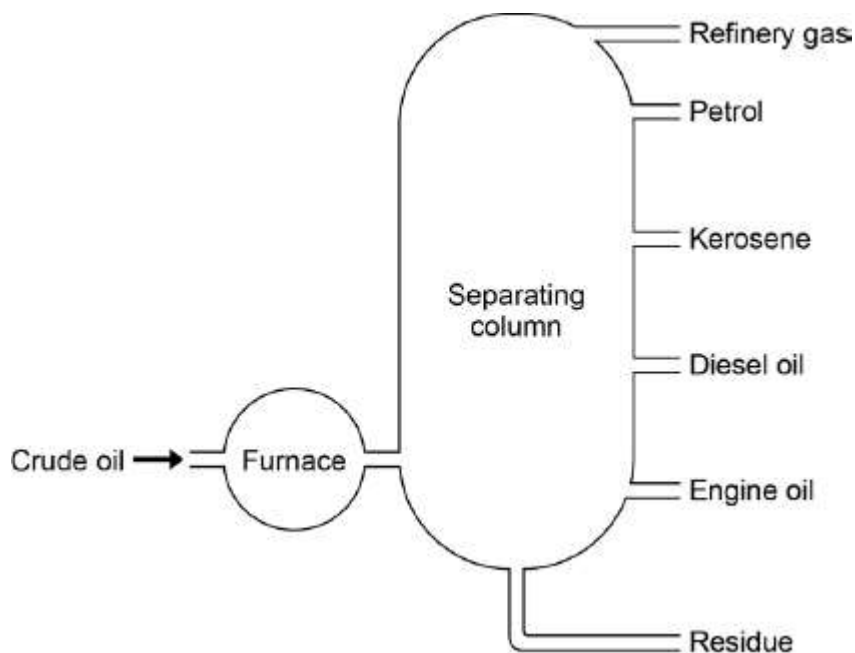
(3)

- (c) Crude oil is a mixture of many different carbon compounds.

Crude oil can be separated into useful fractions by fractional distillation.

Figure 2 shows a column used to separate crude oil.

Figure 2



Complete the sentences.

Use words from the box.

condense

evaporate

freeze

Crude oil is heated so that most of the compounds

At different temperatures the compounds cool and

(2)

(d) Which fraction is the most **viscous**?

Tick **one** box.

Engine oil

☐

Diesel oil

☐

Kerosene

☐

Petrol

☐

(1)

(e) Which fraction is the most **flammable**?

Tick **one** box.

Diesel oil

☐

Kerosene

☐

Petrol

☐

Refinery gas

☐

(1)

(f) Why does kerosene separate out of the mixture before diesel oil?

.....
.....

(1)

(Total 9 marks)

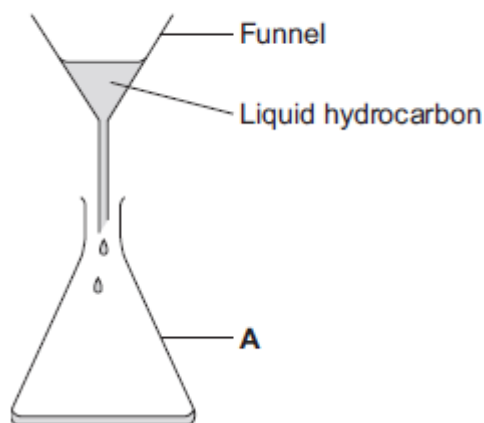
Q4.A student investigated the viscosity of liquid hydrocarbons.

A viscous liquid is a liquid that flows slowly.

The student used this method.

- Measure 50 cm³ of the liquid hydrocarbon.
- Pour the liquid hydrocarbon into the funnel, as shown in **Figure 1**.

Figure 1



- Time how long it takes for all of the liquid hydrocarbon to run out of the funnel.
- Repeat the experiment for other liquid hydrocarbons.

(a) (i) Give the name of apparatus **A** in **Figure 1**.

.....

(1)

(ii) Name the apparatus that could be used to measure 50 cm³ of liquid hydrocarbon.

.....

(1)

(b) The student's results for six liquid hydrocarbons are shown in **Table 1**.

Table 1

Formula of liquid hydrocarbon	Time for liquid hydrocarbon to run out of the funnel in seconds			Mean time in seconds
	Experiment 1	Experiment 2	Experiment 3	
C ₅ H ₁₂	12	11	13	12
C ₆ H ₁₄	14	15	15	15
C ₇ H ₁₆	19	20	18	
C ₈ H ₁₈	27	26	28	27
C ₁₀ H ₂₂	46	48	24	47
C ₁₂ H ₂₆	65	67	69	67

- (i) The student did the experiment three times with each liquid hydrocarbon.

Give **two** reasons why.

.....

.....

.....

.....

(2)

- (ii) Use the data in **Table 1** to calculate the mean time, in seconds, for C_7H_{16}

.....

.....

Mean time = seconds

(1)

- (iii) Complete the sentence.

As the number of carbon atoms in a molecule of liquid hydrocarbon increases,
the time taken for the liquid hydrocarbon to run out of the funnel

.....

(1)

- (iv) A ring has been drawn around one result in **Table 1**.

This result has **not** been used to calculate the mean time for $C_{10}H_{22}$

Suggest why this result was not used.

.....

.....

(1)

- (v) Suggest **one** error the student may have made to get the ringed result.

.....

.....

.....

(1)

- (c) The student investigated the effect of temperature on the viscosity of one of the liquid hydrocarbons.

The liquid hydrocarbon he was using had the hazard symbols shown in **Figure 2**.

Figure 2



- (i) Suggest why the student warmed the liquid hydrocarbon using warm water and **not** a Bunsen flame.

.....
.....

(1)

- (ii) The student wore safety glasses.

Give **one** other safety precaution the student should take, and give a reason for this safety precaution.

Safety precaution

Reason

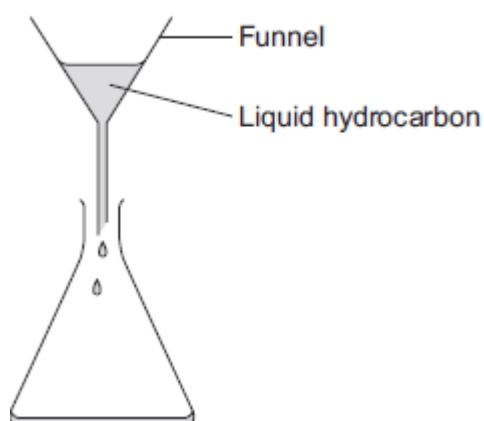
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(2)

- (d) This is the method the student used to investigate the effect of temperature on the viscosity of one of the liquid hydrocarbons.

- Measure 50 cm³ of the liquid hydrocarbon and pour it into a beaker.
- Stand the beaker of liquid hydrocarbon in a heated water bath.
- Leave for a few minutes.
- Measure the temperature of the liquid hydrocarbon.
- Pour the liquid hydrocarbon into the funnel, as shown in **Figure 3**.

Figure 3



- Time how long it takes for all of the liquid hydrocarbon to run out of the funnel.
 - Repeat the experiment at different temperatures.
- (i) The student's results are shown in **Table 2**.

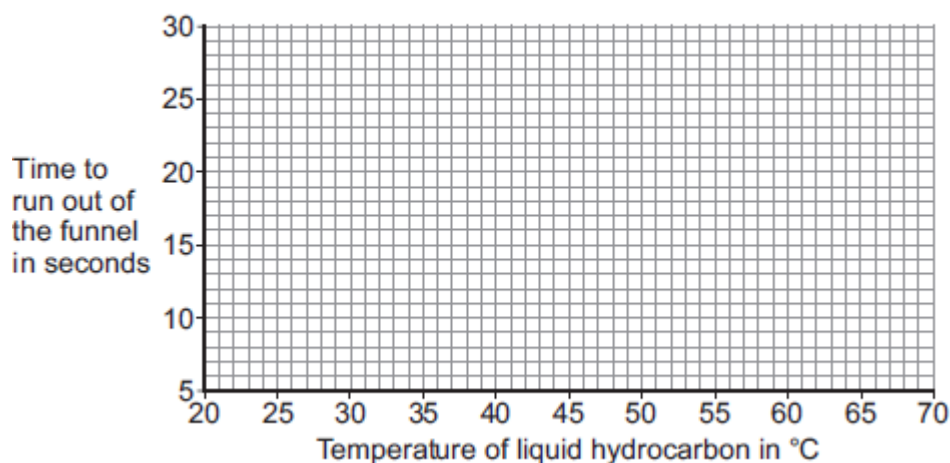
Table 2

Temperature of liquid hydrocarbon in °C	Time to run out of the funnel in seconds
23	27
30	21
37	17
46	16
55	11
65	9

Plot the results shown in **Table 2** on the graph in **Figure 4**.

Draw a curve of best fit.

Figure 4



(3)

- (ii) One of the points is anomalous.

Draw a ring around the anomalous point on your graph.

(1)

- (iii) Predict how long it will take the liquid hydrocarbon to run through the funnel at 70 °C.

Show your working on your graph.

Time = seconds

(2)

- (iv) Describe the relationship between the temperature of the liquid hydrocarbon and the viscosity of the liquid hydrocarbon.

.....
.....
.....
.....
.....
.....

(3)

- (v) The apparatus the student used in **Figure 2** could lead to a systematic error in the results.

Identify **one** source of systematic error, and describe how the student could avoid or reduce the error.

.....
.....
.....
.....

(2)

(Total 22 marks)

Q5.Crude oil is a fossil fuel.

- (a) To make crude oil more useful it is separated into fractions.

Use the correct word from the box to complete each sentence.

boiling	compound	decomposition	distillation
filtration		mixture	molecule

- (i) Crude oil is a of different substances.

(1)

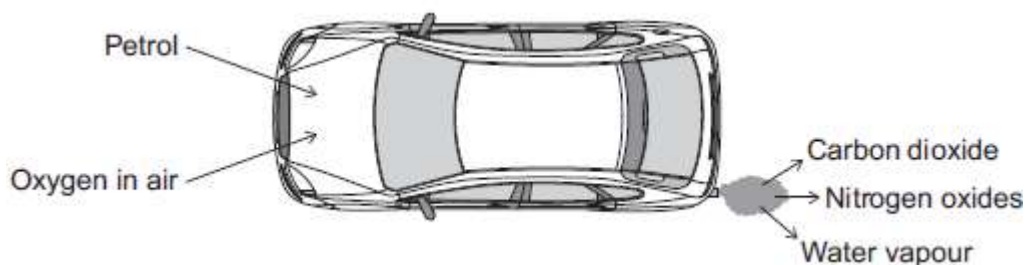
(ii) The substances in crude oil have different points. (1)

(iii) Crude oil is separated by fractional (1)

(b) Petrol is one of the fractions produced from crude oil.

Car engines use a mixture of petrol and air.

The diagram shows some of the gases produced.



(i) What type of reaction happens to petrol in a car engine?

Tick (✓) **one** box.

combustion

☐

decomposition

☐

neutralisation

☐

(1)

(ii) Petrol contains octane (C_8H_{18}).

Complete the word equation for the reaction of octane with oxygen.

octane + \longrightarrow +

(2)

(iii) Cars use sulfur-free petrol as a fuel.

Describe why sulfur should be removed from petrol.

.....

.....

.....

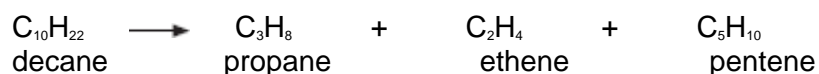
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(2)

- (c) Some fractions from crude oil contain large hydrocarbon molecules.

These molecules can be cracked to produce smaller, more useful molecules.

An equation for cracking decane is:



- (i) Why is propane useful?

Tick (✓) **one** box.

Propane is a polymer.

☐

Propane is an alloy.

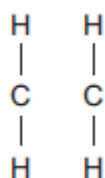
☐

Propane is a fuel.

☐

(1)

- (ii) Draw bonds to complete the displayed structure of ethene.



(1)

- (iii) What is the colour change when bromine water reacts with ethene?

Tick (✓) **one** box.

Orange to colourless

☐

Orange to green

☐

Orange to red

☐

(1)

(iv) Complete the sentence.

Pentene is useful because many pentene molecules can join together

to form

(1)

(Total 12 marks)