Pearson Edexcel

Additional Assessment Materials
Summer 2021

Pearson Edexcel GCSE in Chemistry (1CH0)
Foundation

Resource Set Topic L: Fuels

Questions

(Public release version)

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Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

5 Crude oil is found in the Earth's crust.

(a) Which of the statements about crude oil is correct?

(1)

- ☐ **A** crude oil is a finite resource
- ☐ **B** crude oil is a mixture of the elements hydrogen and carbon
- ☐ **C** all of the molecules in crude oil contain rings of carbon atoms
- ☒ **D** crude oil is used in cars as a fuel

(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

(c) (i) Use a word from the box to complete each of the sentences about the fractional distillation of crude oil.

condensed	heated	melted	solidified	stirred

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

(2)

The separation of crude oil into fractions occurs in a fractional distillation column.

Before crude oil is passed into the column it is heated .

During the distillation, vapour rises up the column until it is cold enough for the vapour to form a liquid. The vapour has been condensed .

(ii) Complete this sentence by underlining the correct answer in the box.

(1)

Compared with the fraction from the top of the column,

the fraction from the bottom of the column

has more carbon atoms per molecule.
has a lower viscosity.
is easier to ignite.

(d) When crude oil is separated into fractions, the amount of each fraction obtained rarely matches the demand for that fraction.

Figure 7 shows the relative amounts of four of the fractions obtained from a crude oil and the relative demand for each of these fractions.

fraction	relative amount obtained from the crude oil	relative demand
gases	5	5
petrol	10	25
kerosene	20	25
fuel oil	45	5

Figure 7

State the fraction for which the relative amount obtained exceeds the relative demand.

(1)

fuel oil

(e) In January 2015 the United Kingdom produced 850000 barrels of crude oil per day. 45% of this crude oil was fuel oil.

Calculate the number of barrels of fuel oil present in the 850000 barrels of crude oil.

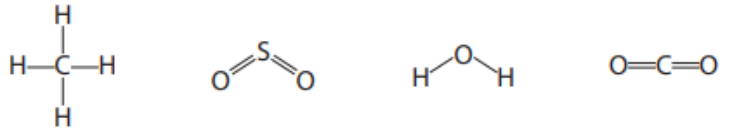
Give your answer to two significant figures.

(3)

$\frac{45}{100} \times 850000 = 382500$

382500 barrels

6 Figure 8 shows one molecule of each of four different substances, **A**, **B**, **C** and **D**.



substance A substance B substance C substance D

Figure 8

(a) State the formula of a molecule of substance **B**.

(1)

SO_2

(b) (i) Substance **C** can be formed by burning an element in oxygen.

Write the word equation for this reaction.

(1)

hydrocarbon + oxygen → water + carbon dioxide

(ii) Consider substances **A**, **B**, and **D**.

Give the letters of the two substances that can be formed by burning an element in oxygen.

(1)

substances B and D

8 Most of the fuels used today are obtained from crude oil.

(a) Which statement about crude oil is correct?

(1)

☒ **A** crude oil is a compound of different hydrocarbons

☒ **B** crude oil is a mixture of hydrocarbons

☒ **C** crude oil contains different hydrocarbons, all with the same molecular formula

☒ **D** crude oil is an unlimited supply of hydrocarbons

(b) Crude oil is separated into several fractions by fractional distillation.
Two of these fractions are kerosene and diesel oil.

(i) State a use for each of these fractions.

(2)

kerosene fuel for aircraft

diesel oil fuel for train

(ii) Figure 13 shows where the fractions kerosene and diesel oil are produced in the fractionating column.

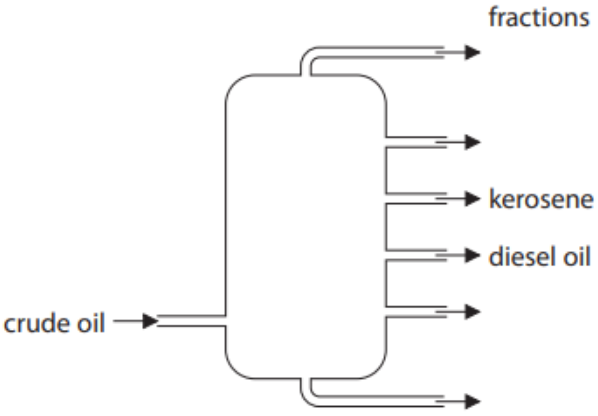


Figure 13

Kerosene is obtained higher up the column than diesel oil.
Kerosene and diesel oil fractions have slightly different properties.

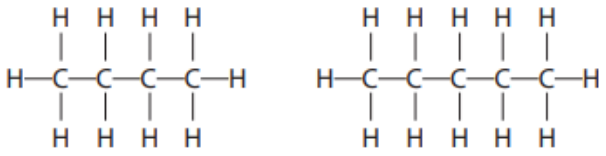
Choose a property.
State how this property for kerosene compares with the property for diesel oil.

(1)

property boiling point

comparison kerosene has a lower boiling point

(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.



butane pentane

Figure 14

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

(2)

The molecular formula for butane is C_4H_{10} and for pentane is C_5H_{12}. They differ by CH_2 so they are neighbouring members of the same homologous series.

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

Write the word equation for this reaction.

(2)

butane + oxygen → carbon dioxide + water

6 (a) Methane is a hydrocarbon fuel.

(i) Complete the word equation for the **complete** combustion of methane in oxygen.

(2)

methane + oxygen → water + carbon dioxide

(ii) The **incomplete** combustion of methane can produce carbon and carbon monoxide.

Give the reason why carbon and carbon monoxide are produced in the **incomplete** combustion of methane.

(1)

In incomplete combustion, there is insufficient oxygen to form CO_2.

(b) Crude oil is a complex mixture of hydrocarbons.
Crude oil can be separated into useful fractions by fractional distillation.

Figure 10 shows a fractional distillation column and the fractions produced when crude oil is distilled.

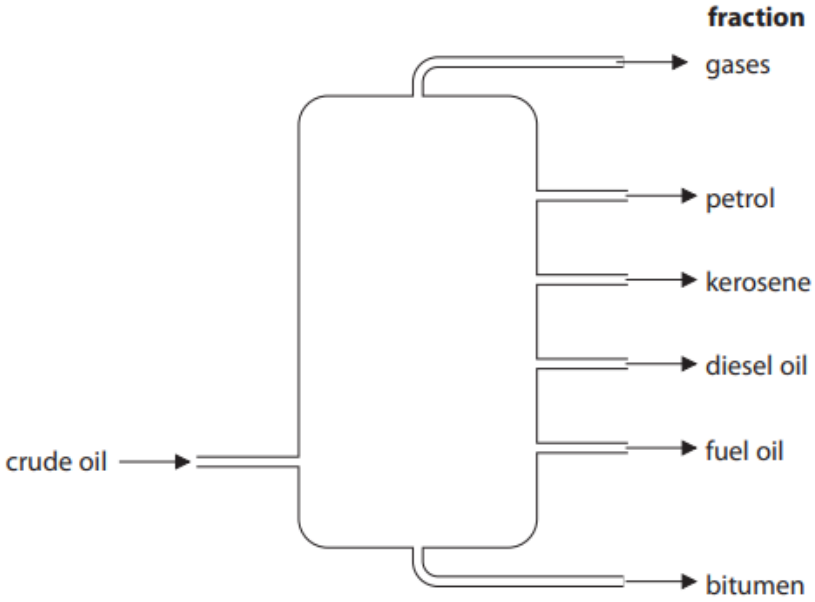


Figure 10

(i) Name the fraction in Figure 10 that is used to surface roads.

(1)

bitumen

(ii) Name the fraction in Figure 10 that contains hydrocarbons with the lowest boiling point.

(1)

gases

(c) When crude oil is fractionally distilled, the demand for some fractions is more than the amount produced.

Figure 11 shows the relative amounts of each fraction in a crude oil and the relative demand for each of these fractions.

fraction	relative amount	relative demand
gases	2	6
petrol	12	29
kerosene	16	11
diesel oil	24	29
fuel oil	37	21
bitumen	9	4

Figure 11

Which of the following shows the fractions where the relative demand is greater than the relative amount in the crude oil?

(1)

☒ **A** kerosene, diesel oil, bitumen

☒ **B** gases, petrol, diesel oil

☒ **C** gases, petrol, kerosene

☒ **D** petrol, diesel oil, fuel oil

(d) Cracking involves the breaking down of large hydrocarbon molecules into smaller hydrocarbon molecules.

(i) Octane, C_8H_{18}, can be cracked to produce one molecule of ethene, C_2H_4, and one molecule of C_xH_{14}.

$$C_8H_{18} \rightarrow C_2H_4 + C_xH_{14}$$

Determine the value of x in the molecule of C_xH_{14}.

(1)

x = 6

(ii) Dodecane is a large hydrocarbon molecule.
When one molecule of dodecane is cracked the products are one molecule of octane and one molecule of butene.

dodecane → octane + butene

Calculate the maximum mass of octane that could be produced when 340 g of dodecane is cracked in this reaction.

(relative formula masses: dodecane = 170, octane = 114)

(2)

$\frac{170 - 114}{170} \times 340 = 112$

mass of octane = 112 g

TOTAL FOR PAPER IS 29 MARKS