Pearson Edexcel

Additional Assessment Materials Summer 2021

Pearson Edexcel GCSE in Chemistry (1CH0) Higher

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- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.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.

6 Crude oil is a complex mixture of substances.

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

Figure 7 shows a fractional distillation column and the fractions produced when a sample of crude oil is distilled.

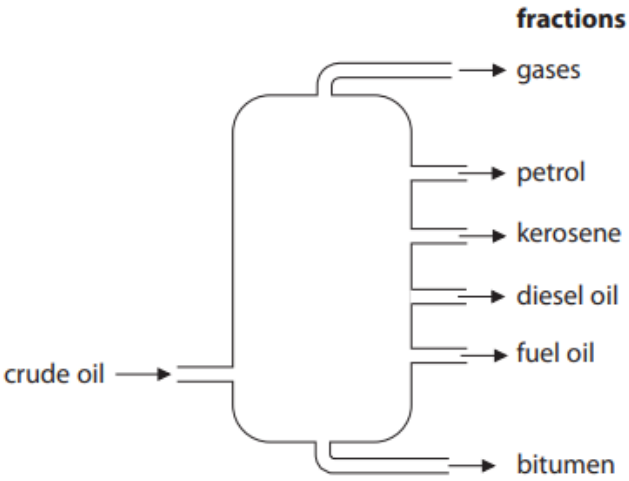


Figure 7

The properties of these fractions vary from the top of the column to the bottom of the column.

Which of the following is a trend in a property of the fractions obtained from the top of the column to those obtained from the bottom?

(1)

☒ **A** the average number of carbon atoms in molecules present decreases

☒ **B** the ease of ignition increases

☒ **C** the boiling points decrease

☒ **D** the viscosities increase

(b) Most of the substances in crude oil are alkanes.

(i) Which of the following is the general formula of an alkane?

(1)

☒ **A** C_nH_{2n}

☒ **B** C_nH_{2n+1}

☒ **C** C_nH_{2n-1}

☒ **D** C_nH_{2n+2}

(ii) Explain why alkanes are described as hydrocarbons.

(2)

(c) Figure 8 shows a graph of the boiling points of some alkanes against the number of carbon atoms in one molecule of each alkane.

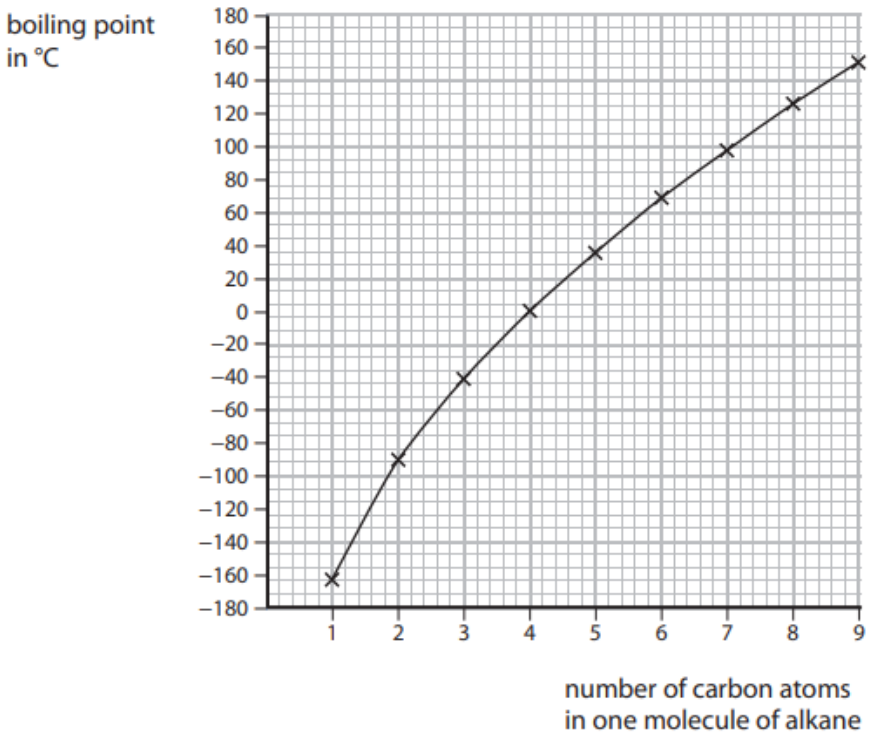


Figure 8

Explain the pattern shown by this graph.

(2)

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

Figure 9 shows the relative amounts of six of the fractions present in a crude oil and the relative demand for each of these fractions.

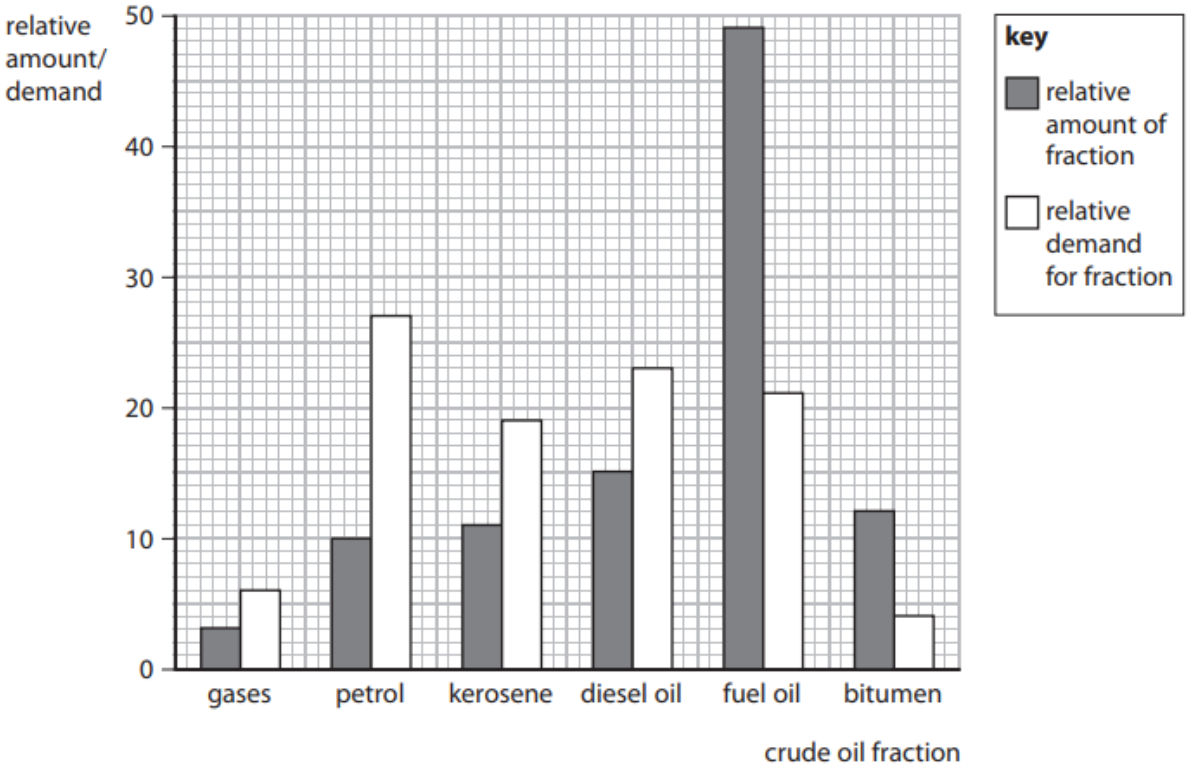


Figure 9

Cracking is used to match the relative amount of a fraction of crude oil to the demand for that fraction.

(i) Use the information in Figure 9 to give the name of the fraction that is most likely to need to be cracked.

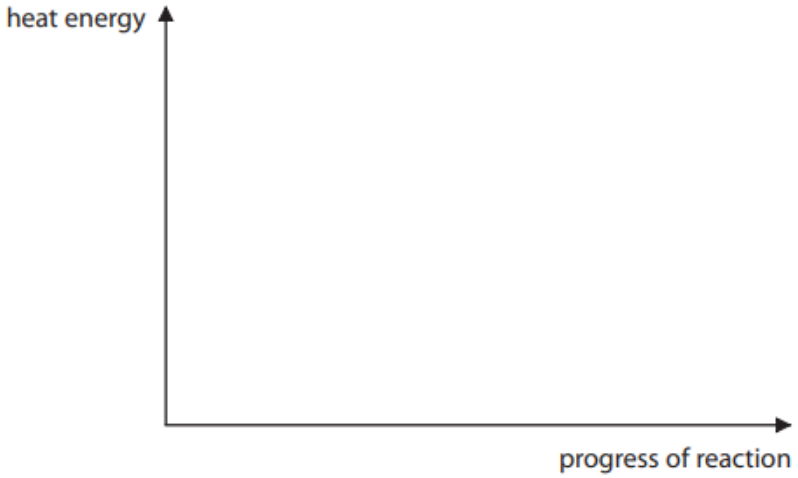
(1)

.....

(ii) In a cracking reaction, reactants are heated to form products.
This reaction is endothermic.

On the axes provided, draw the reaction profile of this reaction.
Label the energy of the reactants, the energy of the products and the activation energy of the reaction.

(3)



(iii) Dodecane, $C_{12}H_{26}$, can be cracked to form useful products.

Complete the equation for the cracking of dodecane by filling in the formula of the single molecule needed to balance the equation.

(1)

$$C_{12}H_{26} \rightarrow \text{.....} + 3C_2H_4$$

2 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 .....

diesel oil .....

(ii) Figure 1 shows where the fractions kerosene and diesel oil are produced in the fractionating column.

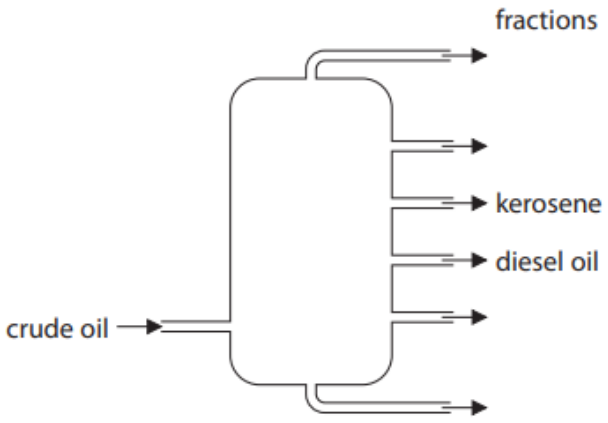


Figure 1

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

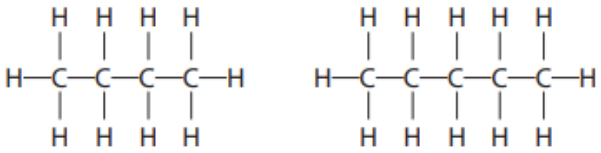
Choose a property.
State how this property for kerosene compares with the property for diesel oil.

(1)

property .....

comparison .....

(c) Figure 2 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 2

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

(2)

.....

.....

.....

.....

(ii) Butane has the formula C_4H_{10}.

Calculate the mass of carbon in 100 g of butane.

Give your answer to three significant figures.

(relative atomic masses: H = 1.00, C = 12.0;
relative formula mass: C_4H_{10} = 58.0)

You must show your working.

(3)

.....

.....

.....

mass of carbon = ... g

9 (a) An impure hydrocarbon fuel is burned in the apparatus in Figure 7.

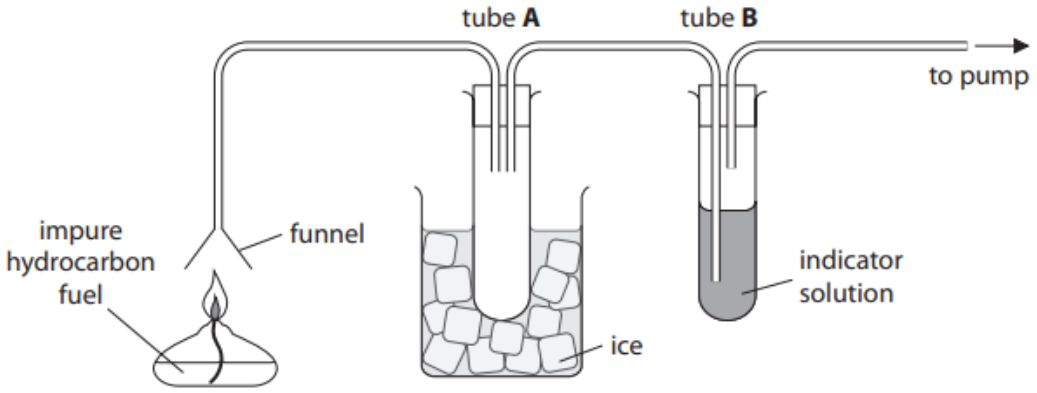


Figure 7

When the fuel is burned

- the funnel becomes hot
- a colourless liquid forms in tube **A**
- the indicator in tube **B** changes colour to show an acidic gas.

Explain these observations.

(3)

TOTAL FOR PAPER IS 23 MARKS