New Document 1

Name: _____

Class: _____

Date: _____

Time: **40 minutes**

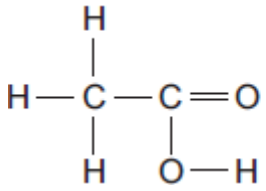
Marks: **40 marks**

Comments:

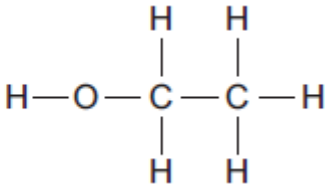
Q1.

The diagrams represent two compounds, **A** and **B**.

Compound A



Compound B



(a) (i) Compound **B** is an alcohol.

Name compound **B**.

_____

(1)

(ii) Use the correct answer from the box to complete the sentence.

burned	**decomposed**	**oxidised**

To form compound **A**,

compound **B** is _____

(1)

(iii) Compounds **A** and **B** are both colourless liquids.

A test tube contains a colourless liquid, which could be either compound **A** or compound **B**.

Describe a simple **chemical** test to show which compound, **A** or **B**, is in the test tube.

_____

_____

_____

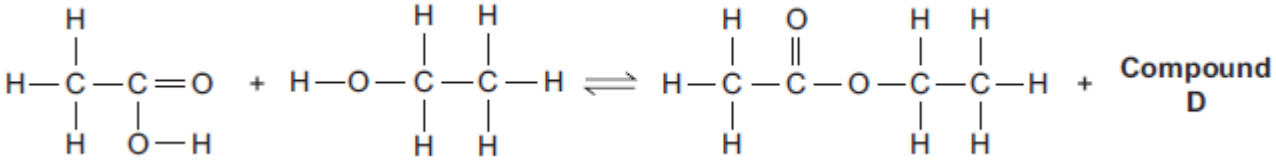
_____

_____

(2)

(b) Compounds **A** and **B** react to produce compound **C** and compound **D**.

Compound A **Compound B** **Compound C**



(i) What is the formula of compound **D**?

_____

(1)

(ii) Compound **C** is an ester.

Name compound **C**.

_____

(1)

(iii) State **one** use of esters.

_____

(1)

(Total 7 marks)

Q2.

A mixture of petrol and air is burned in a car engine.
Petrol is a mixture of alkanes. Air is a mixture of gases.

The tables give information about the composition of petrol and the composition of air.

Petrol	
Alkane	**Formula**
hexane	C_6H_{14}
heptane	
octane	C_8H_{18}
nonane	C_9H_{20}
decane	$C_{10}H_{22}$

Air	
Gas	**Percentage (%)**
nitrogen	78
oxygen	21
carbon dioxide	0.035
Small amounts of other gases and water vapour	

(a) Use the information above to answer these questions.

(i) Give the formula for heptane

_____

(1)

(ii) Complete the general formula of alkanes.
n = number of carbon atoms

C_nH

(1)

(b) Alkanes in petrol burn in air.
The equations represent two reactions of hexane burning in air.

Reaction 1 $2C_6H_{14} + 19O_2 \rightarrow 12CO_2 + 14H_2O$

Reaction 2 $2C_6H_{14} + 13O_2 \rightarrow 12CO + 14H_2O$

Reaction 2 produces a different carbon compound to **Reaction 1.**

(i) Name the carbon compound produced in **Reaction 2.**

_____

(1)

(ii) Give a reason why the carbon compounds produced are different.

_____

_____

(1)

(c) The table shows the percentages of some gases in the exhaust from a petrol engine.

Name of gas	Percentage (%)
nitrogen	68
carbon dioxide	15
carbon monoxide	1.0
oxygen	0.75
nitrogen oxides	0.24
hydrocarbons	0.005
sulfur dioxide	0.005
other gases	

(i) What is the percentage of the other gases in the table?

_____

(1)

(ii) What is the name of the compound that makes up most of the other gases?

_____

(1)

(iii) Give a reason why sulfur dioxide is produced in a petrol engine.

_____

_____

(1)

(iv) State how nitrogen oxides are produced in a petrol engine.

_____

_____

_____

_____

(2)

(d) Many scientists are concerned about the carbon dioxide released from burning fossil fuels such as petrol.

Explain why.

_____

_____

_____

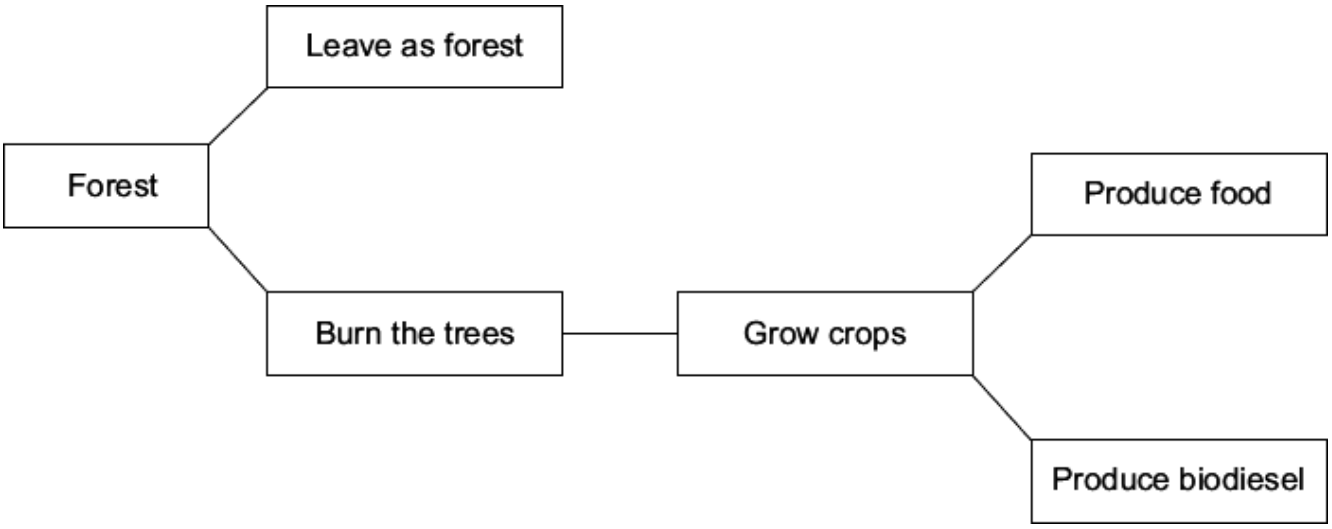
_____

(2)

(Total 11 marks)

Q3.

Petroleum diesel is a fuel made from crude oil.
Biodiesel is a fuel made from vegetable oils.
To make biodiesel, large areas of land are needed to grow crops from which the vegetable oils are extracted.
Large areas of forest are cleared by burning the trees to provide more land for growing these crops.



(a) Use this information and your knowledge and understanding to answer these questions.

(i) Carbon neutral means that there is no increase in the amount of carbon dioxide in the atmosphere.

Suggest why adverts claim that using biodiesel is carbon neutral.

_____

_____

_____

_____

_____

_____

(2)

(ii) Explain why clearing large areas of forest has an environmental impact on the atmosphere.

_____

_____

_____

_____

_____

_____

(2)

(b) Why is there an increasing demand for biodiesel?

_____

_____

(1)

(c) Suggest why producing biodiesel from crops:

(i) causes ethical concerns

_____

_____

(1)

(ii) causes economic concerns.

_____

_____

(1)

(Total 7 marks)

Q4.

Crude oil is a mixture of mostly alkanes.

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

(i) Describe and explain how the mixture of alkanes is separated by fractional distillation.

_____

_____

_____

_____

_____

_____

_____

(3)

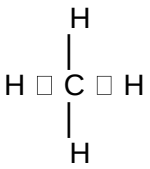
(ii) The table gives the name and formula for each of the first three alkanes.

Complete the table to show the formula of butane.

Name of alkane	**Formula**
Methane	CH_4
Ethane	C_2H_6
Propane	C_3H_8
Butane	

(1)

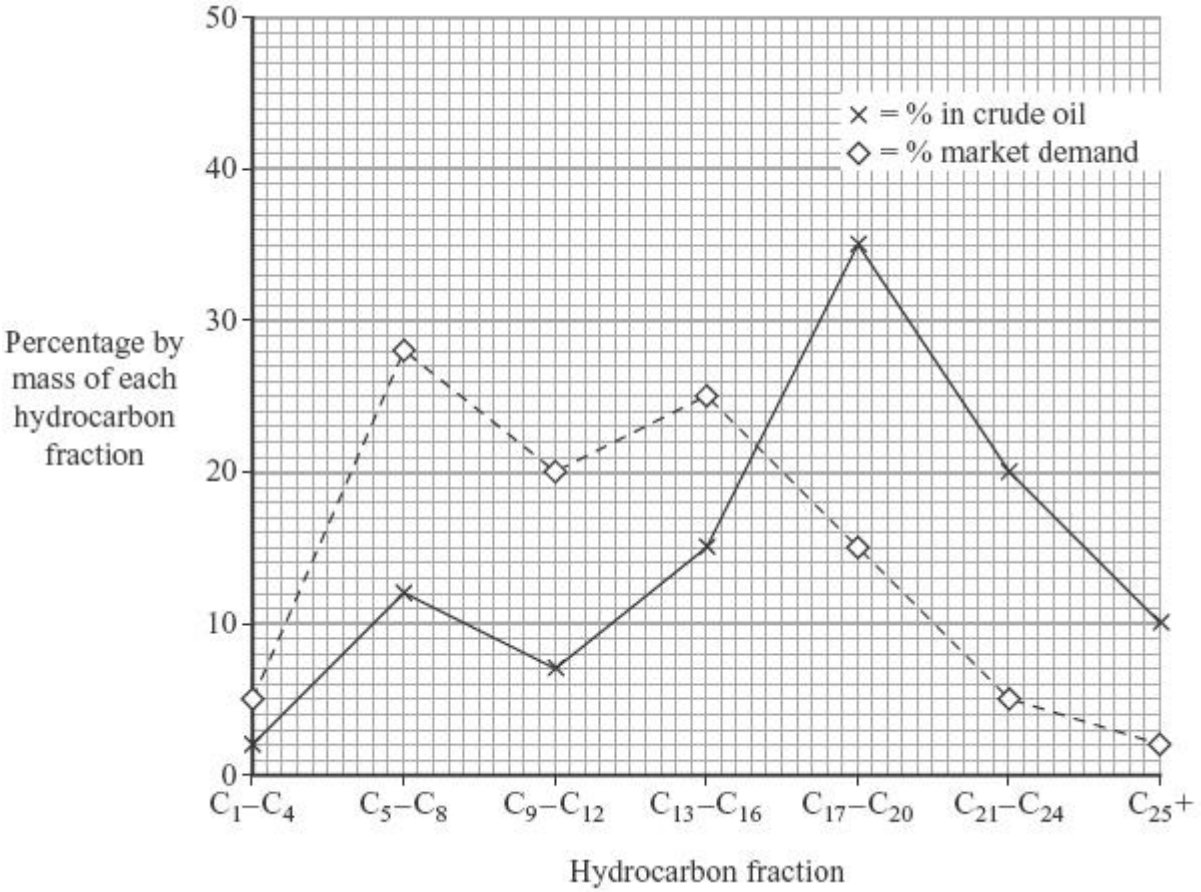
(b) The structural formula of methane, CH_4, is:



Draw the structural formula of propane, C_3H_8

(1)

(c) The relative amounts of and the market demand for some hydrocarbons from the fractional distillation of crude oil are shown in the graph.



(i) Why is the market demand for the $C_5 – C_8$ fraction higher than the market demand for the $C_{21} – C_{24}$ fraction?

_____

_____

(1)

(ii) Cracking is used to break down large hydrocarbon molecules into smaller hydrocarbon molecules.

Complete the symbol equation by writing in the formula of the other hydrocarbon.

$C_{20}H_{42}$ $C_{16}H_{34}$ + 2 _____

(1)

(iii) The $C_5 – C_8$ fraction has low supply and high market demand.

Suggest **three** ways in which the oil industry could overcome this problem.

1. _____

_____

2. _____

_____

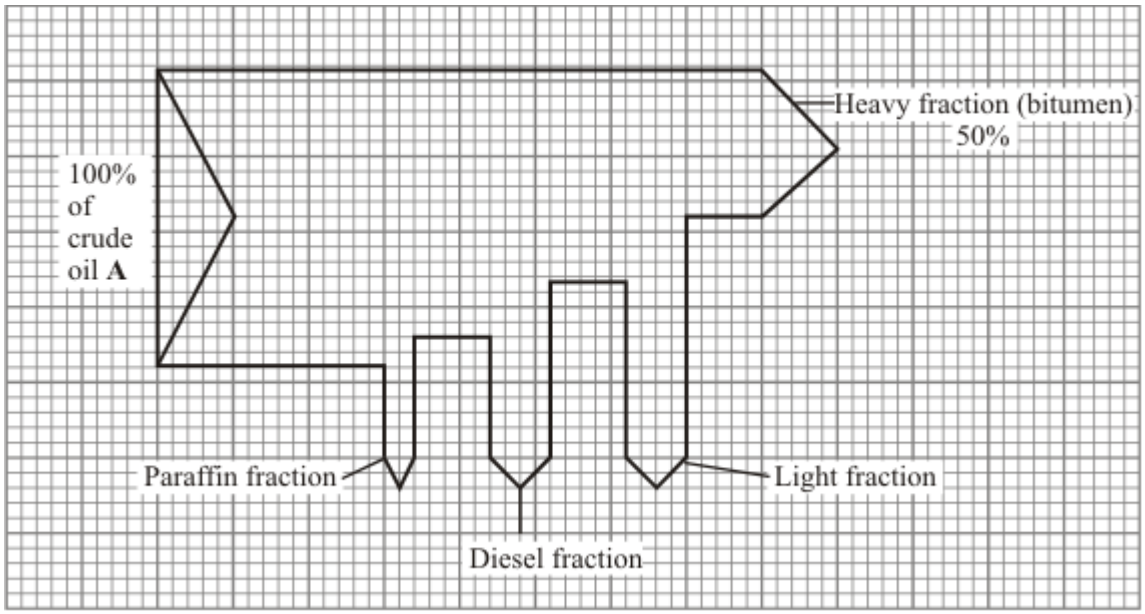
3. _____

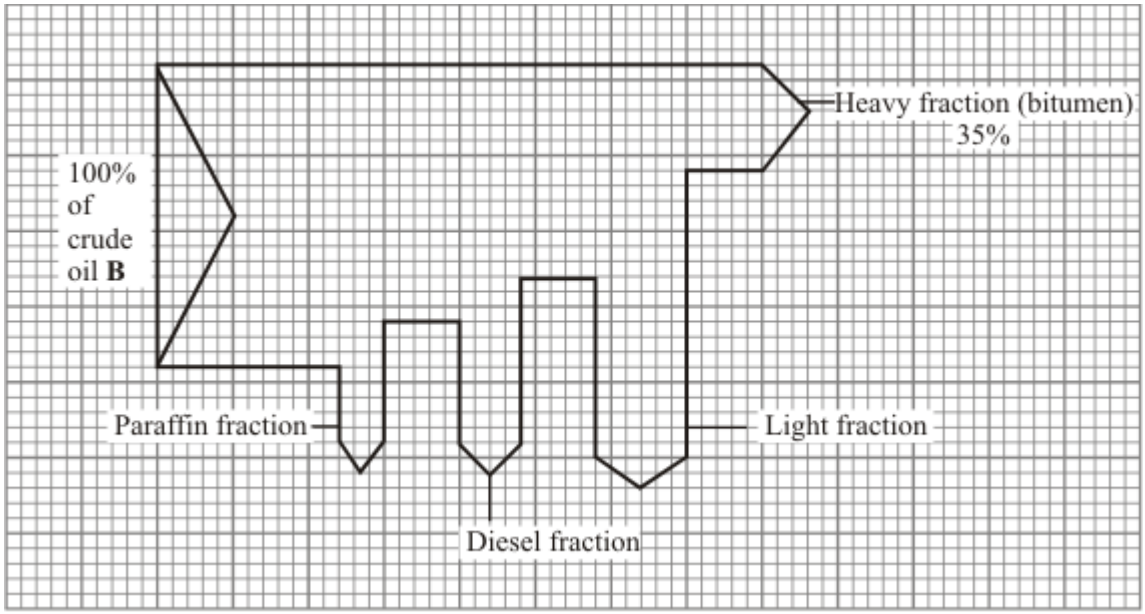
(3)

(Total 10 marks)

Q5.

The diagrams show the percentages of the four main fractions produced from two samples of crude oil, **A** and **B**.





(a) The light fraction contains hydrocarbons used for the manufacture of useful chemicals such as polymers. Which one of the samples, **A** or **B**, would be more useful for the manufacture of polymers? Explain your answer.

_____

_____

_____

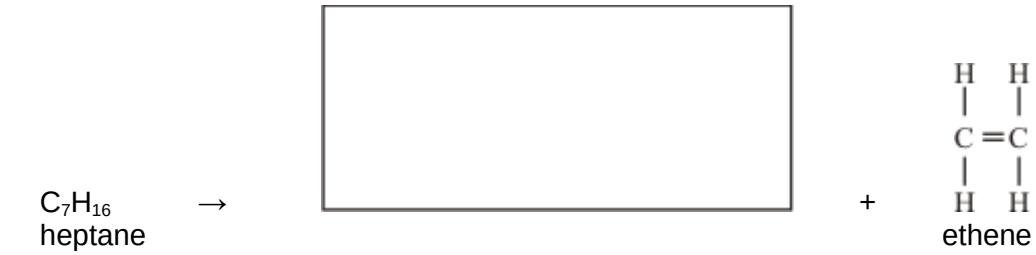
_____

_____

_____

(2)

(b) Heptane (C_7H_{16}), is one of the hydrocarbons used for the manufacture of poly(ethene). The first stage of the process is the production of ethene and another hydrocarbon from heptane.



(i) In the box, draw the structural formula of the other hydrocarbon produced.

(1)

(ii) Describe how the reaction is carried out.

_____

_____

_____

_____

_____

_____

(2)

(Total 5 marks)

Mark schemes

Q1.

(a) (i) ethanol

1

(ii) oxidised

1

(iii) **Test**

add any named carbonate or hydrogen carbonate

the first mark is for the test; the second is for the result
if the test is incorrect award 0 marks.

1

Result

A will effervesce (carbon dioxide) **or B** will not effervesce.

if the result is incorrect, award the first mark only

1

or

candidates do not have to name a gas but penalise an incorrect gas.

Test

add a named (magnesium, aluminium, zinc, iron or tin) metal

give credit to any test that will work.

Result

A will effervesce (hydrogen), **B** will not

*allow a test that would identify **B**.*

or

Test

add an acid-base indicator

Result

credit any acid colour for that indicator eg for universal indicator allow red, yellow or orange

give credit for the neutral colour for **B**

or

Test

add an alcohol (+ acid catalyst)

Result

sweet or fruity smell of esters.

(b) (i) H_2O

1

(ii) ethyl ethanoate

1

(iii) any **one** from:

- flavourings
- perfumes
- solvents
- plasticisers

allow any correct use of esters

1

[7]

Q2.

(a) (i) C_7H_{16}

mark answer line first

answer may be given in the table

1

(ii) C_nH_{2n+2}

1

(b) (i) carbon monoxide

*do **not** accept carbon oxide*

*do **not** accept water*

ignore CO

1

(ii) because of partial / incomplete combustion (in reaction 2) **or** complete combustion (in reaction 1)

*allow because there is less / insufficient oxygen (in reaction 2) **or** sufficient oxygen (in reaction 1) allow different amounts of oxygen used (in the reactions) **or** $19O_2$ (in reaction 1) **and** $13O_2$ (in reaction 2)*

ignore air

1

(c) (i) 15 (%)

ignore units

1

(ii) water (vapour)/steam

allow H_2O / OH_2 / hydrogen oxide

1

(iii) sulfur in petrol / crude oil (reacts with oxygen)

it = sulfur dioxide

1

(ii) because nitrogen **and** oxygen (are in the air and) react

*allow nitrogen **and** oxygen burn*

*accept nitrogen + oxygen → nitrogen oxide **or** symbol equation*

ignore air

1

at high temperature (inside a petrol engine)

allow heat / hot (engine)

1

(d) because carbon dioxide / it causes global warming **or**

allow because carbon dioxide / it causes greenhouse effect / climate change

1

because carbon dioxide / it has an impact on oceans

because this carbon dioxide / carbon / it was '<u>locked up</u>' (in fossil fuels) **or**

because the percentage/amount of carbon dioxide / it in the atmosphere is <u>increasing</u>

1

[11]

Q3.

(a) (i) *use of carbon throughout = **max 1***

<u>burning biodiesel</u> releases CO_2

ignore burning trees

1

CO_2 is <u>absorbed</u> / <u>used</u> by the crops/plants (used to produce the biodiesel)

allow CO_2 <u>absorbed</u> / <u>used</u> by trees

1

(ii) *allow use of carbon for carbon dioxide throughout*

<u>increases</u> CO_2 / greenhouse effect

accept causes global warming

OR

allow causes climate change

<u>less</u> $CO_2$is absorbed (from atmosphere)

ignore other correct effects

1

because <u>burning</u> trees releases CO_2

accept <u>fewer</u> trees to absorb CO_2

***or** crops / plants do not absorb as much CO_2 as trees*

OR

because there is <u>less</u> photosynthesis

ignore habitats / biodiversity

*if no other mark awarded global dimming because of smoke / particles gains **1** mark*

1

(b) any **one** from:

ignore carbon neutral / cost / less harmful / environmentally

friendly

- crude oil / fossil fuel is running out / non-renewable
  allow biodiesel is renewable / sustainable
- demand for fuels / energy is increasing
  ignore demand for biodiesel is increasing
- new legislation / protocols

1

(c) (i) uses crops / land that could be used for food
*allow destroys habitats **or** reduces biodiversity*
ignore cost

1

(ii) increases the cost of food / land
ignore cost of machinery / process
ignore cheaper to produce biodiesel

1

[7]

Q4.

(a) (i) heat / evaporate the crude oil / change to gas or vapour
*do **not** accept heat with catalyst*

1

cool / condense (hydrocarbons)
allow small molecules at top and / or large molecules at bottom

1

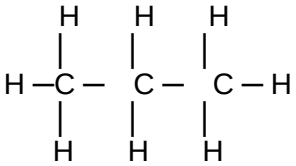
at different temperatures / boiling points
if the answer describes cracking ' no marks

1

(ii) C_4H_{10}

1

(b)



1

(c) (i) C_5 to C_8 fraction are fuels **or** easier to burn or petrol (fraction)
accept C_{21} to C_{24} fraction not useful as fuels
***do not** accept produce more energy*

1

(ii) C_2H_4
*do **not** accept C_4H_8*

1

(iii) any **three** from:

- use different / lighter crude oils

- develop markets for low demand fractions
- develop new techniques / equipment to use low demand fractions as fuels
- cracking
- convert low demand fractions to high demand fractions or bigger molecules to smaller molecules
- develop alternative / bio fuels

*do **not** accept price*

3

[10]

Q5.

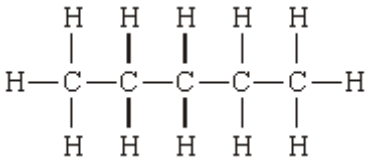
(a) **B** because it contains more of the light fraction)

1

Quantitative answer e.g. **B** has 30%,
A has 20% / 10% more / 1.5 times more

1

(b) (i)



1

(ii) heat

1

catalyst

if neither mark gained allow cracking for 1 mark

1

[5]