C1b (1) QUESTIONS

1 (a) The hydrocarbon $C_{16}H_{34}$ was heated strongly in the absence of air.

This is one of the reactions which took place:

$$C_{16}H_{34} \longrightarrow C_6H_{14} + C_6H_{12} + 2C_2H_4$$

This type of reaction is carried out because there is a greater demand for the products than for the original hydrocarbon.

Suggest **two** reasons for this.

1 .....

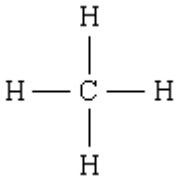
.....

2 .....

.....

(2)

(b) A molecule of the compound methane, CH_4, can be shown like this:

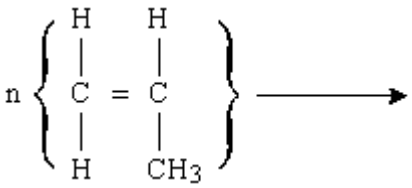


Draw a molecule of the compound ethene, C_2H_4.

(2)

(c) Small molecules of substances called monomers can be joined together in polymerisation, eg. ethene poly $\longrightarrow$ (ethene).

(i) Complete the equation below to show formation of the polymer from the monomer propene.



(1)

(ii) Suggest the name of the polymer formed.

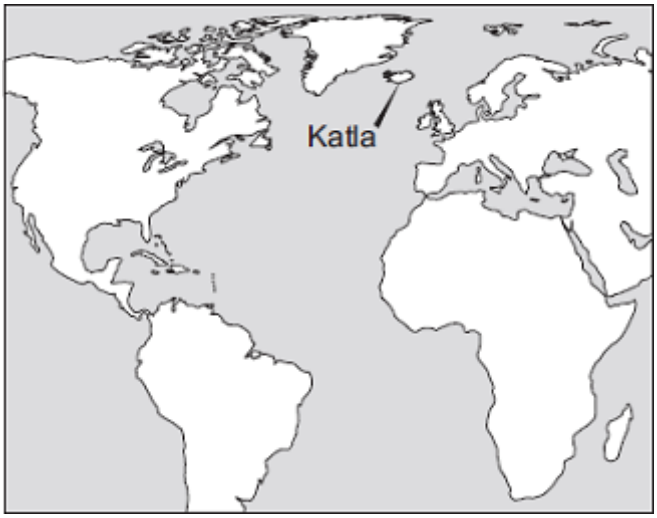
.....

(1)

(Total 6 marks)

2. Iceland has many volcanoes.

(a) Scientists are monitoring a volcano in Iceland, called Katla.
There has been an increase in the number of tremors (small earthquakes) in this area.



(i) Why does Iceland have volcanoes?

.....

.....

.....

(1)

(ii) Scientists predict that Katla may erupt soon.
However, scientists do **not** know exactly when Katla will erupt.

Suggest **one** reason why.

.....

.....

.....

(1)

(b) During the first billion years of the Earth's existence its surface was covered with volcanoes.

Describe how this volcanic activity led to the formation of oceans.

.....

.....

.....

.....

.....

.....

(2)

(c) The Earth has about 500 000 earthquakes each year.

Describe how activity within the Earth results in earthquakes.

.....

.....

.....

.....

.....

.....

.....

.....

(3)
(Total 7 marks)

3. Ethanol and vegetable oil are used as fuels.

(a) There are two different ways to produce ethanol:

- using ethene from crude oil
- using sugar from plants.

(i) Ethanol is produced from ethene by **hydration** in the presence of a catalyst.

What is **hydration**?

.....

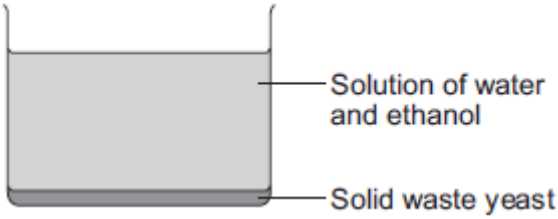
.....

(1)

(ii) Fermentation is used to produce ethanol from sugar by:

- dissolving the sugar in water
- adding yeast to the sugar solution
- leaving the mixture for three days.

The figure below shows the substances after three days.



Suggest:

- how the solid waste yeast is removed
- how ethanol is obtained from the solution.

.....

.....

.....

.....

(2)

(b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Crude oil is separated to produce the fraction petroleum diesel.

Worries about low supplies of crude oil have led to the growing of large areas of crops to produce vegetable oil.

Vegetable oils are used to produce biodiesel.

There are economic, ethical and environmental issues about the use of biodiesel.

Biodiesel and petroleum diesel are used as a fuel for cars. In a car engine the fuel burns and releases waste products through the car exhaust system.

The table below shows the amount of waste products formed by biodiesel compared with the amount of waste products formed by petroleum diesel.

(Note that ppm is parts per million.)

	Carbon dioxide in ppm	**Nitrogen oxides in ppm**	**Sulfur dioxide in ppm**	**Particulates in g per m^3**
Biodiesel	20 000	760	0	0.3
Petroleum diesel	80 000	700	300	0.6

Use this information and your knowledge and understanding to give advantages and disadvantages of using biodiesel instead of petroleum diesel.

.....

.....

.....

.....

.....

.....

Extra space .....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6)
(Total 9 marks)

4. Olive oil has a melting point of −6°C and a boiling point of 300°C.
Olive oil has a high content of healthy, unsaturated fats.

(a) Olive oil can be hardened by reacting it with hydrogen.

(i) State the conditions needed for this reaction.

.....

.....

.....

.....

(2)

(ii) A student said that hardening would make olive oil healthier.

Is this student's hypothesis correct?

Explain your answer in terms of what happens in the hardening process.

.....

.....

.....

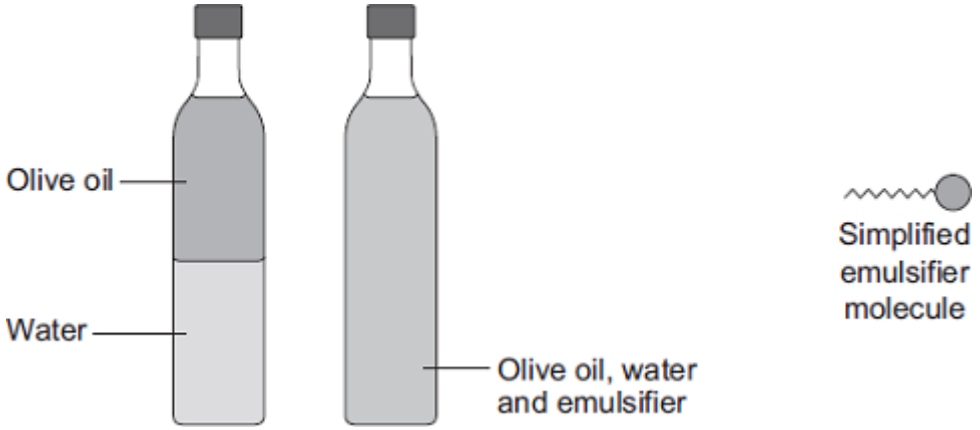
.....

.....

.....

(2)

(b) Olive oil and water do not mix.
A salad dressing is made by shaking olive oil and water with an emulsifier.



Explain how these emulsifier molecules are able to produce a stable mixture after shaking olive oil and water.

Use the diagram of the simplified emulsifier molecule to help you to answer this question.

.....

.....

.....

.....

.....

.....

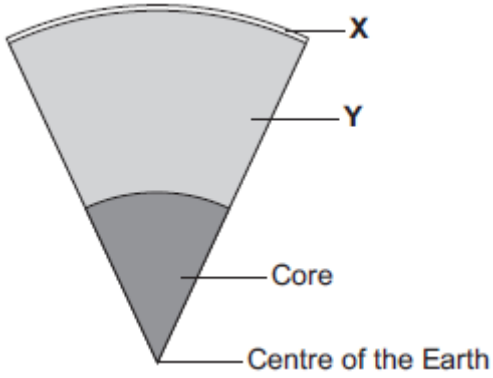
.....

.....

(3)
(Total 7 marks)

5. The Earth is almost spherical and is surrounded by an atmosphere.

The figure below shows a section of the layered structure of the Earth.



(a) In 1915 Alfred Wegener put forward his idea of continental drift.

(i) Why did most scientists in 1915 **not** accept Wegener's idea of continental drift?

.....

.....

(1)

(ii) Describe how **and** explain why continental drift takes place.

Include the names of **X** and **Y** in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(5)

(b) The table below shows some properties of gases in the Earth's atmosphere.

Gas	Melting point in °C	Boiling point in °C
Argon	–189	–186
Carbon dioxide	–78	–78
Helium	–272	–269
Neon	–249	–246
Nitrogen	–210	–196
Oxygen	–219	–183

These gases are separated by:

- removing carbon dioxide
- cooling the remaining gases to –200 °C
- removing the gases that do not condense
- allowing the liquefied gases to warm up.

(i) Suggest **one** reason why carbon dioxide is removed before the gases are cooled to –200 °C.

.....

.....

(1)

(ii) Draw a ring around **one** gas that does **not** condense when the remaining gases are cooled to –200 °C.

argon	**neon**	**nitrogen**	**oxygen**

(1)

(iii) The oxygen separated by this process contains another gas.

Name the gas and give a reason for your answer.

.....

.....

.....

.....

(2)

(Total 10 marks)

6. Cooking oils contain unsaturated fats. Unsaturated fats are more healthy than saturated fats.

Unsaturated fats change bromine water from orange to colourless.

A scientist from a food company called Vegio wanted to find the amount of unsaturated fat in cooking oils.

The scientist tested Vegio's own brand of oil and oils from four other companies, **A**, **B**, **C** and **D**.

The scientist used the same volume of oil for each test.

The scientist's results are shown in the table below.

Company	**Number of drops of bromine water that reacted**		
	Test 1	**Test 2**	**Test 3**
Vegio	14	13	16
A	25	17	27
B	17	18	16
C	5	6	4
D	10	9	7

(a) (i) Describe how the bromine water is used to obtain these results.

.....

.....

.....

.....

.....

.....

.....

.....

(3)

(ii) Choose **one** result from the table that should be tested again.

Result: Company ..... Test .....

Why did you choose this result?

.....

.....

(2)

(iii) The same volume of each oil was used for each test.

Suggest **one** other variable that should be controlled in these tests.

.....

.....

(1)

(b) The Vegio food company claims that its cooking oil has more unsaturated fat than other cooking oils.

Compare the results for Vegio's cooking oil with the results of the other companies, **A**, **B**, **C** and **D**.

Give **three** conclusions that can be made from the results.

.....

.....

.....

.....

.....

.....

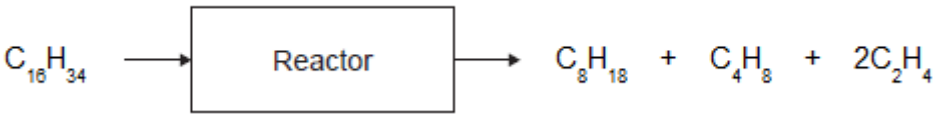
.....

.....

(3)
(Total 9 marks)

7. Poly(butene) is a polymer made from crude oil in two stages.

(a) The first stage in making poly(butene) is to break down large hydrocarbon molecules from crude oil into smaller hydrocarbon molecules, as shown in the figure below.



(i) The products contain two types of hydrocarbon with different general formulae.

Name the two types of hydrocarbon.

.....

(1)

(ii) Describe the conditions in the reactor.

.....

.....

.....

.....

(2)

(iii) Suggest why air must **not** enter the reactor.

.....

.....

(1)

(iv) Suggest a method that can be used to separate butene (C_4H_8) from the other hydrocarbons.

.....

(1)

(b) The second stage is to use butene (C_4H_8) to produce poly(butene).

(i) Draw the displayed structure of a butene (C_4H_8) molecule.

(1)

(ii) Describe how molecules of butene (C_4H_8) form poly(butene).

.....

.....

.....

.....

(2)

(Total 8 marks)