

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education
Foundation Tier and Higher Tier
November 2009

Science A
Unit Chemistry C1b (Oils, Earth and Atmosphere)

Chemistry
Unit Chemistry C1b (Oils, Earth and Atmosphere)

CHY1BP
F&H

Thursday 19 November 2009 Morning Session

For this paper you must have:

- a black ball-point pen
 - an objective test answer sheet.
- You may use a calculator.

Time allowed

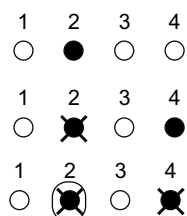
- 30 minutes

Instructions

- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Chemistry Unit 1b' printed on it.
- Attempt **one Tier only**, either the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only.
- Do all rough work in this book, **not** on your answer sheet.

Instructions for recording answers

- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown.
- Do **not** extend beyond the circles.
- If you want to change your answer, **you must** cross out your original answer, as shown.
- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown.



Information

- The maximum mark for this paper is 36.

Advice

- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you cross out **completely** the work that is not to be marked.

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 14 of this booklet.

FOUNDATION TIER

SECTION ONE

Questions **ONE** to **FIVE**.

In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

This table shows some information about four types of vegetable oil, **A**, **B**, **C** and **D**.

Vegetable oil	Fat content as a percentage (%) of the vegetable oil			Melting point in °C
	Saturated fat	Monounsaturated fat	Polyunsaturated fat	
A	14	9	77	–12
B	52	36	12	35
C	12	24	64	5
D	13	67	20	–18

Match vegetable oils, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table below.

1	It contains the lowest percentage (%) of monounsaturated fat.
2	It has the lowest melting point.
3	It has the highest melting point.
4	It contains the highest percentage (%) of unsaturated fat.

QUESTION TWO

This question is about some of the gases in the Earth's atmosphere.

Match gases, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A oxygen

B nitrogen

C carbon dioxide

D helium

The most abundant gas in the Earth's atmosphere is . . . **1**

The gas used to fill party balloons because it is less dense than air is . . . **2**

The burning of fossil fuels uses . . . **3** . . . gas from the air, and releases . . . **4** . . . gas into the air.

Turn over for the next question

Turn over ►

QUESTION THREE

The table gives some information about layers of the Earth.

	Name of layer	Thickness in km	Volume as a percentage (%) of the Earth's volume	Density in g per cm³
A	Crust	5–65	1.5	2.7–3.0
B	Mantle	2835	82.3	3.3–5.8
C	Outer core	2250	15.4	9.4–12.3
D	Inner core	1220	0.8	13.0–13.5

Match layers, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table below.

1	It is the thickest layer.
2	It is the layer with the smallest volume.
3	It is the layer that has the largest range of density.
4	It is the solid layer made up of tectonic plates.

QUESTION FOUR

The main ingredients in salad cream are water, vegetable oil, egg and vinegar.

Salad cream also contains food additives.

Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A a preservative

B a colouring

C an emulsifier

D a vegetable oil

The ingredient that provides the most energy is . . . **1**

The ingredient that keeps the water and vegetable oils mixed together is . . . **2**

Potassium sorbate is an additive to increase the shelf-life. It is . . . **3**

E160 is an additive to improve the appearance. It is . . . **4**

QUESTION FIVE

This question is about extracting lavender oil from lavender plants.

Match processes, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A condenses

B boils

C evaporates

D floats

The crushed lavender plants are mixed with water in a distillation flask and heated until the mixture . . . **1**

The lavender oil and some water . . . **2**

The vapour is allowed to cool and it . . . **3**

The lavender oil rises to the surface of the water where it . . . **4**

The lavender oil is separated from the water and collected.

Turn over ►

SECTION TWO

Questions **SIX** to **NINE**.

Each of these questions has four parts.

In each part choose only **one** answer.

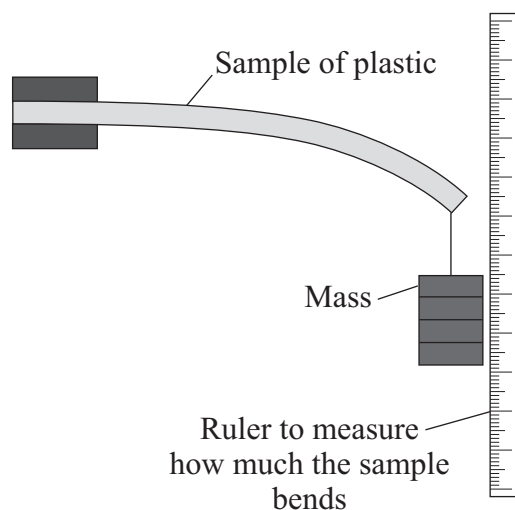
Mark your choices on the answer sheet.

QUESTION SIX

A student used the apparatus shown in the diagram to measure the flexibility of a strip of plastic with a thickness of 5 mm.

The student did the test again using the same piece of plastic and recorded the results of both tests.

He carried out identical tests using three more strips of the same plastic but each with a different thickness. All four strips were the same length.



The results are shown in the table.

Plastic thickness in mm	How much the plastic strip bends downwards in mm	
	Test 1	Test 2
5	27	25
10	18	20
15	12	8
20	8	7

6A The plastic that provides the most unreliable pair of results is that with the thickness of . . .

- 1 5 mm.
- 2 10 mm.
- 3 15 mm.
- 4 20 mm.

6B Which one of the following is controlled to ensure that it is a fair test?

- 1 the mass added
- 2 the thickness of the plastic strip
- 3 the width of the ruler
- 4 the distance the plastic bends

6C To improve the reliability of the results, you can . . .

- 1 use different lengths of plastic.
- 2 use a larger range of plastic thicknesses.
- 3 ask another student to repeat the tests.
- 4 do the tests at a higher temperature.

6D Which one of the following correctly describes the relationship in the results?

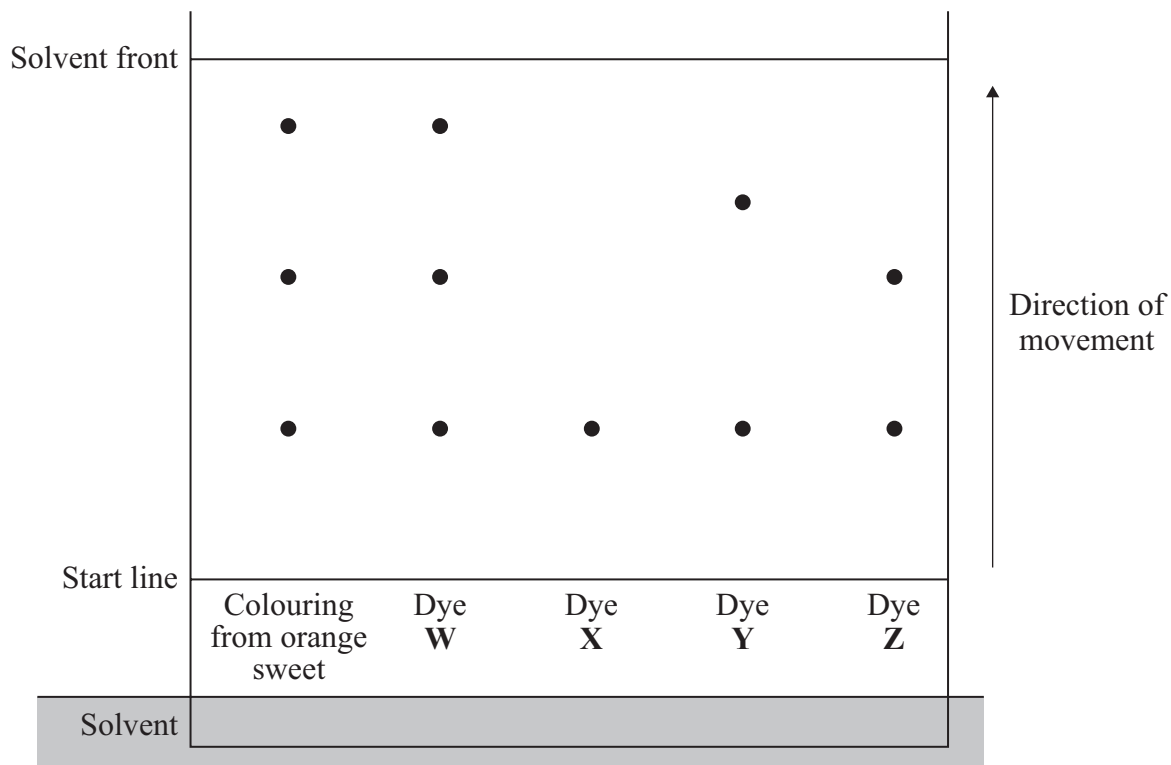
- 1 As the thickness increases, the flexibility decreases.
- 2 The thickness does **not** affect the flexibility.
- 3 The flexibility is proportional to the mass added.
- 4 The longer the plastic, the less it bends.

Turn over ►

QUESTION SEVEN

A chromatogram of an orange colouring from a sweet was made and this was compared with various orange dyes, **W**, **X**, **Y** and **Z**.

The results are shown below.



7A Which dye contains the most colours?

- 1 dye **W**
- 2 dye **X**
- 3 dye **Y**
- 4 dye **Z**

7B Which statement about the orange colouring in the sweet could be true?

- 1 It contains dyes **W** and **Z** only.
- 2 It contains dyes **X** and **Z** only.
- 3 It contains dyes **Y** and **Z** only.
- 4 It contains dye **Z** only.

7C Dye **Z** was found to cause an allergic reaction in some people.

What should the orange sweet manufacturer do?

- 1 replace dye **Z** with dye **Y**
- 2 reduce the amount of dye **Z** in the sweets
- 3 stop the sale of these orange sweets
- 4 use only dye **W**

7D Which of these statements are reasons for putting additives into food?

Statement **K** – Increase the shelf-life of the food

Statement **L** – Improve the taste of the food

Statement **M** – Raise the cost of the food

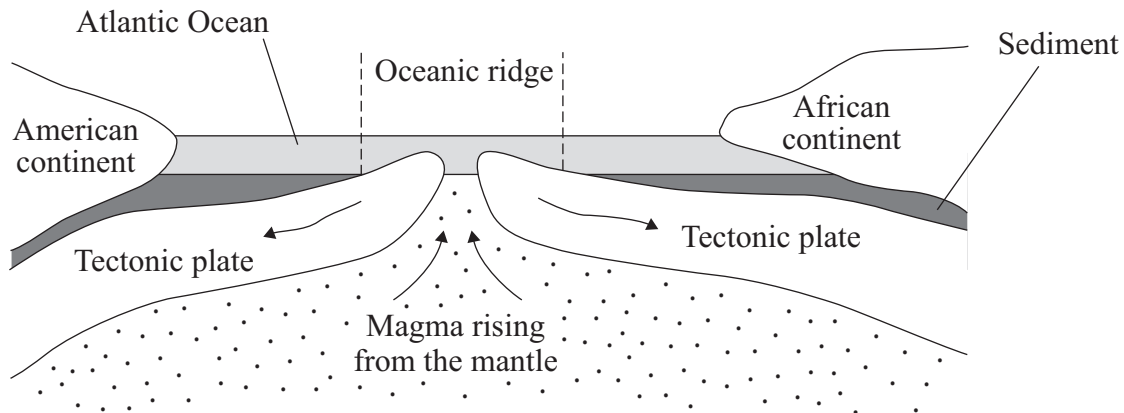
- 1 **L** only
- 2 **K** and **L**
- 3 **K** and **M**
- 4 **K, L** and **M**

Turn over for the next question

Turn over ►

QUESTION EIGHT

The diagram shows a section across the Atlantic Ocean.



The oceanic ridge has formed at the boundary between two tectonic plates which are moving apart.

8A What causes the tectonic plates to move apart?

- 1 strong ocean currents
- 2 convection currents
- 3 tidal waves
- 4 the weight of the sediments

8B There are volcanic islands in several places in the mid-Atlantic Ocean.

They have probably formed there because . . .

- 1 magma has erupted until it is above sea level.
- 2 sediments have piled up along the oceanic ridge.
- 3 the tides have washed up a shell bank.
- 4 there is debris from oil drilling.

8C Sudden movements of tectonic plates can cause . . .

- 1 earthquakes.
- 2 continents to collide.
- 3 the Earth to shrink.
- 4 the Earth to cool down.

8D The discovery of tectonic plates brought greater acceptance of the theory that . . .

- 1 the Earth is cooling down.
- 2 the temperature of the atmosphere is rising.
- 3 continents can move.
- 4 the Earth is shrinking.

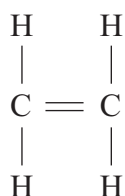
Turn over for the next question

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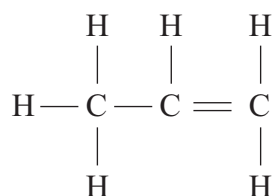
QUESTION NINE

The diagram shows three compounds.

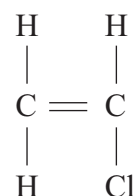
Compound W



Compound X



Compound Y



9A Which of the compounds are hydrocarbons?

- 1 W and X
- 2 W and Y
- 3 X and Y
- 4 W, X and Y

9B Which row in the table correctly describes the bonding in Compound X?

	Number of bonds to each carbon atom	Number of bonds to each hydrogen atom
1	1	1
2	1	4
3	4	1
4	4	4

9C All three compounds can form polymers because . . .

- 1 they have saturated molecules.
- 2 their molecules contain two or more carbon atoms.
- 3 their molecules have a double carbon carbon bond.
- 4 they have small molecules.

9D Disposal of polymer waste can be a problem.

The main reason that it causes problems in a landfill site is that . . .

- 1 it is very light.
- 2 it is not easily broken down by microorganisms.
- 3 it is difficult to bury.
- 4 it burns easily, releasing toxic gases.

END OF TEST

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Foundation Tier is earlier in this booklet.

HIGHER TIER

SECTION ONE

Questions **ONE** and **TWO**.

In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

This question is about extracting lavender oil from lavender plants.

Match processes, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

- A** condenses
- B** boils
- C** evaporates
- D** floats

The crushed lavender plants are mixed with water in a distillation flask and heated until the mixture . . . **1**

The lavender oil and some water . . . **2**

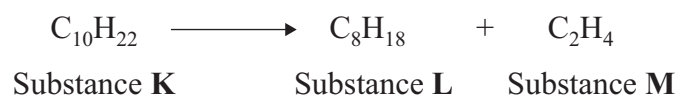
The vapour is allowed to cool and it . . . **3**

The lavender oil rises to the surface of the water where it . . . **4**

The lavender oil is separated from the water and collected.

QUESTION TWO

The equation shows a chemical reaction.



Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

- A** polymerisation
- B** thermal decomposition
- C** unsaturation
- D** hydration

Substances **L** and **M** are obtained from substance **K** by . . . **1**

Iodine or bromine can be used to test the products for . . . **2**

Ethanol can be made from substance **M** by . . . **3**

Molecules of substance **M** can be joined together into long chains by . . . **4**

Turn over for the next question

Turn over ►

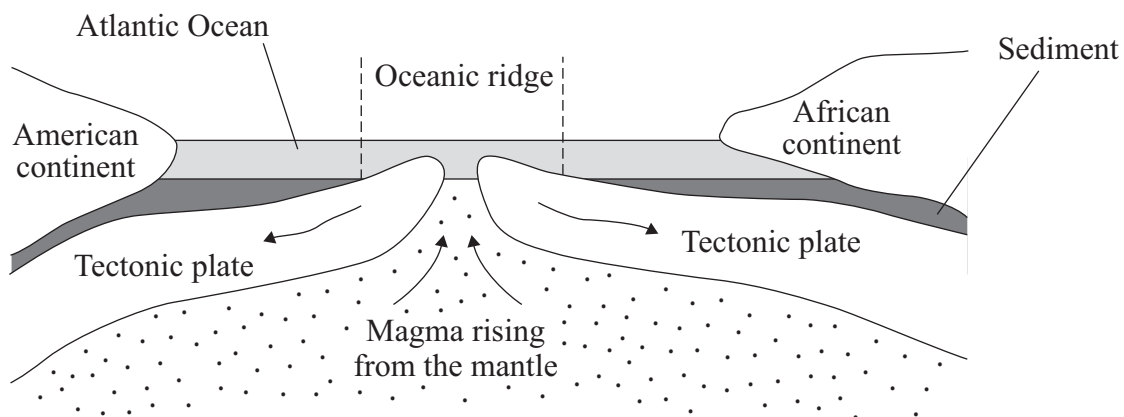
SECTION TWOQuestions **THREE** to **NINE**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

QUESTION THREE

The diagram shows a section across the Atlantic Ocean.



The oceanic ridge has formed at the boundary between two tectonic plates which are moving apart.

3A What causes the tectonic plates to move apart?

- 1 strong ocean currents
- 2 convection currents
- 3 tidal waves
- 4 the weight of the sediments

3B There are volcanic islands in several places in the mid-Atlantic Ocean.

They have probably formed there because . . .

- 1 magma has erupted until it is above sea level.
- 2 sediments have piled up along the oceanic ridge.
- 3 the tides have washed up a shell bank.
- 4 there is debris from oil drilling.

3C Sudden movements of tectonic plates can cause . . .

- 1 earthquakes.
- 2 continents to collide.
- 3 the Earth to shrink.
- 4 the Earth to cool down.

3D The discovery of tectonic plates brought greater acceptance of the theory that . . .

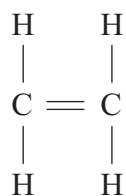
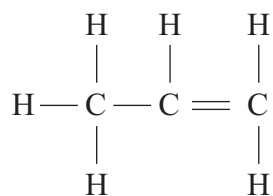
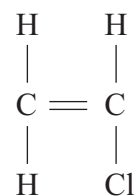
- 1 the Earth is cooling down.
- 2 the temperature of the atmosphere is rising.
- 3 continents can move.
- 4 the Earth is shrinking.

Turn over for the next question

Turn over ►

QUESTION FOUR

The diagram shows three compounds.

Compound W**Compound X****Compound Y**

4A Which of the compounds are hydrocarbons?

- 1 W and X
- 2 W and Y
- 3 X and Y
- 4 W, X and Y

4B Which row in the table correctly describes the bonding in Compound X?

	Number of bonds to each carbon atom	Number of bonds to each hydrogen atom
1	1	1
2	1	4
3	4	1
4	4	4

4C All three compounds can form polymers because . . .

- 1 they have saturated molecules.
- 2 their molecules contain two or more carbon atoms.
- 3 their molecules have a double carbon carbon bond.
- 4 they have small molecules.

4D Disposal of polymer waste can be a problem.

The main reason that it causes problems in a landfill site is that . . .

- 1 it is very light.
- 2 it is not easily broken down by microorganisms.
- 3 it is difficult to bury.
- 4 it burns easily, releasing toxic gases.

Turn over for the next question

Turn over ►

QUESTION FIVE

AQA-Dri is a material with a polymer coating. The polymer called poly(tetrafluoroethene) is produced from the monomer tetrafluoroethene, C_2F_4 . AQA-Dri is useful for making outdoor clothing because it prevents rain droplets from passing through the pores of the material, but allows water vapour formed during sweating to escape.

5A Which of the following statements explains the useful properties of AQA-Dri?

- 1 The pores in AQA-Dri are smaller than the molecules in sweat.
- 2 Water molecules are small enough to pass through AQA-Dri.
- 3 The pores in AQA-Dri are smaller than water molecules.
- 4 Water droplets are smaller than the pores in AQA-Dri.

5B Old documents become dry and brittle. AQA-Dri is used to help to flatten old documents, rather than wetting them with a fine water sprayer.

This is because . . .

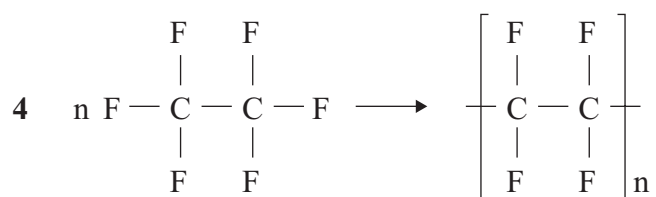
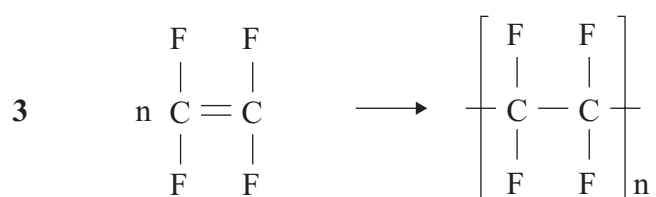
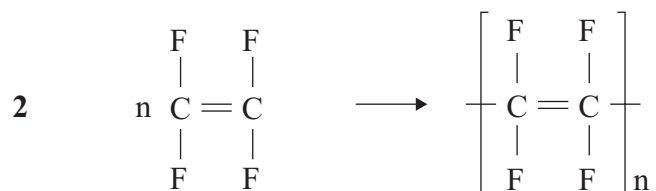
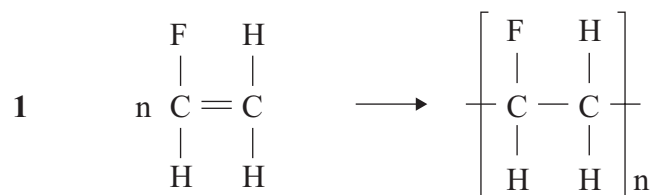
- 1 AQA-Dri will let the documents absorb water more quickly.
- 2 water droplets will not moisten the documents enough to let them flatten.
- 3 water sprayers make the documents too wet, so they become even more fragile.
- 4 water sprayers are a low technology, out-of-date solution to the problem.

5C In the 1950s, the inventors of AQA-Dri intended to use poly(tetrafluoroethene) as an electrical insulator. Today, it has many uses.

This is because . . .

- 1 scientists are constantly discovering new electrical insulators.
- 2 chemical companies are always trying to find new applications for their products.
- 3 chemical companies are trying to find alternative ways of waterproofing fabrics.
- 4 scientists stop testing the properties of materials once they are discovered.

5D Which of the following is the correct equation for the formation of poly(tetrafluoroethene) from tetrafluoroethene?



Turn over for the next question

Turn over ►

QUESTION SIX

This question is about heating oil fractions.

$C_{20}H_{42}$ is found in one of the oil fractions. On heating, it can break down as shown in the equation:



6A Which row in the table correctly identifies **X** and **Y** in the equation?

	X	Y
1	C_2H_4	C_8H_{14}
2	C_3H_6	C_6H_{14}
3	C_4H_8	C_3H_8
4	C_5H_{10}	CH_4

6B From the information in the table, substance **X** is . . .

- 1 a saturated hydrocarbon.
- 2 an alkane.
- 3 an alkene.
- 4 a polymer.

6C In the reaction shown in the equation, which of the following is occurring?

- 1 Polymer chains are being cracked.
- 2 Only alkenes are produced.
- 3 Long-chain hydrocarbons are being emulsified.
- 4 Long-chain hydrocarbons are being changed into alkane fuels and alkenes.

- 6D** The process of heating certain oil fractions is carried out continuously night and day because . . .
- 1 this will provide more work for local people.
 - 2 there is more demand for products at night.
 - 3 extra fuel would be used if the process was restarted every day.
 - 4 this will help to dispose of unwanted oil fractions.

Turn over for the next question

Turn over ►

QUESTION SEVEN

Usually, the lower the melting point of a fat, the more unsaturated it is.

A student measured the melting points of four fats so that he could later compare the amount of unsaturation.

He used four boiling tubes, each half-filled with a different fat. A thermometer was used to measure the melting point of each fat.

The student repeated the measurement of the melting point for each fat either once or twice.

Fat	Melting point in °C		
	Attempt 1	Attempt 2	Attempt 3
Coconut	25	26	
Lard	33	33	
Frying fat	41	49	42
Pastry fat	46	44	

7A Which statement is correct about the way he carried out the test?

- 1 It was **not** a fair test because he did not repeat each measurement the same number of times.
- 2 It was a fair test because everything used except the fat, was the same.
- 3 It was **not** a fair test because he used different fats.
- 4 It was a fair test because they were all fats.

7B What is the mean value that the student should use for the melting point of frying fat?

- 1 41.5 °C
- 2 43.0 °C
- 3 44.5 °C
- 4 45.0 °C

7C If it is true that the lower the melting point of a fat, the more unsaturated it is, then . . .

- 1 coconut fat should react with the most bromine in a fair test.
- 2 pastry fat should react with the most bromine in a fair test.
- 3 coconut fat should contain the highest number of carbon carbon single bonds.
- 4 pastry fat should contain the highest number of carbon carbon double bonds.

7D Which row in the table shows the conditions that would be required to harden the coconut oil?

	React with	Temperature in °C	Catalyst
1	oxygen	60	nickel
2	hydrogen	60	nickel
3	hydrogen	100	iron
4	oxygen	100	iron

Turn over for the next question

Turn over ►

QUESTION EIGHT

This question is about ethanol. Some ethanol is used as a fuel to replace petrol.

The table compares two different industrial processes for making ethanol.

Process	Raw material	Type of process	Purity of product	Rate of ethanol production
Fermentation using yeast	Sugar	Batch – one tank of sugar solution is fermented at a time	Dilute solution of ethanol	Slow
Hydration using steam	Ethene	Continuous – ethene and steam flow steadily into the reaction vessel and ethanol flows steadily out	Almost pure ethanol	Fast

8A Ethene is obtained from the hydrocarbons in crude oil by . . .

- 1 thermal decomposition.
- 2 hydration.
- 3 fractional distillation.
- 4 polymerisation.

8B In some countries, very little ethanol for fuel is produced by fermentation because . . .

- 1 ethene is obtained from a non-renewable resource.
- 2 they have a hot climate suitable for growing sugar cane.
- 3 they are wealthy enough to import oil from abroad.
- 4 the ethanol from fermentation produces more carbon dioxide when burnt.

8C Which of the following is **not** a reason why an ethanol factory using sugar takes longer to produce ethanol than a factory using ethene?

- 1 A fermentation tank has to be emptied and cleaned after each batch.
- 2 After fermentation, the ethanol needs to be separated from water.
- 3 Sugar cane plants take a long time to grow.
- 4 Yeast takes several days to convert sugar into ethanol.

8D Who would benefit economically if ethanol was made by hydration of ethene rather than by fermentation?

- 1 investors in the fermentation industry
- 2 oil companies
- 3 environmental pressure groups
- 4 sugar cane farmers

Turn over for the next question

Turn over ►

QUESTION NINE

Some scientists think that the Earth's early atmosphere was mainly carbon dioxide, water vapour and nitrogen, with no oxygen.

Some scientists think that the early atmosphere also contained carbon monoxide, hydrogen, methane and ammonia.

Other scientists think that the atmosphere has always contained some oxygen.

Evidence comes from geological records starting over 4 billion years ago, the composition of gases from volcanoes, observations of conditions on other planets, and the composition of the atmosphere today.

The table shows some information about the atmospheres of the planets, Venus, Earth and Mars today.

	Venus	Earth	Mars
Carbon dioxide, % by mass	98.0	0.036	95.0
Oxygen, % by mass	0.0	21.0	0.25
Nitrogen, % by mass	2.0	78.0	2.4
Water vapour, % by mass	0.05	0.20	0.10
Mass of atmosphere in tonnes	5.2×10^{17}	5.2×10^{15}	2.4×10^{10}

9A Scientists do **not** agree about the Earth's early atmosphere because . . .

- 1 there is too much evidence available.
- 2 the information can be interpreted in different ways.
- 3 the data is inaccurate.
- 4 geological records do not go back far enough.

9B Which of the following supports the idea that there was oxygen in the Earth's early atmosphere?

- 1 Calcium sulfate (CaSO_4) is found in rocks formed 3.5 billion years ago.
- 2 Many of the oldest rocks contain iron sulfide, FeS.
- 3 The atmosphere now contains more than 20% oxygen.
- 4 Some of the gases in the early atmosphere came from volcanoes.

9C Which one of these is an **incorrect** reason for the small percentage of carbon dioxide in the Earth's atmosphere today?

- 1 Some carbon dioxide has dissolved in the oceans.
- 2 Carbon dioxide has been used in chemical reactions to form sedimentary rocks.
- 3 Some carbon dioxide has been locked up in fossil fuels.
- 4 There has always been only a small amount of carbon dioxide in the atmosphere.

9D Which one of the following statements is true?

- 1 Venus has the smallest mass of water vapour in its atmosphere.
- 2 Earth has a greater mass of water vapour in its atmosphere than Venus or Mars.
- 3 Venus has a greater mass of nitrogen in its atmosphere than Earth or Mars.
- 4 Mars has a greater mass of carbon dioxide in its atmosphere than the Earth.

END OF TEST

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