Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
June 2009

SCIENCE A **CHY1BP**
Unit Chemistry C1b (Oils, Earth and Atmosphere)

CHEMISTRY
Unit Chemistry C1b (Oils, Earth and Atmosphere)

Monday 22 June 2009 Morning Session

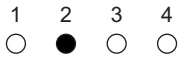
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

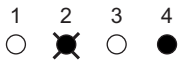
Time allowed: 30 minutes

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.

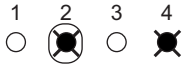
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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**.

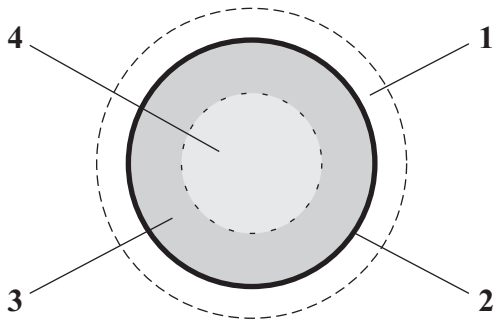
Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows the layered structure of the Earth.

The outer dotted line marks a layer that is above the Earth's surface.



Match words, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagram.

A Atmosphere

B Core

C Crust

D Mantle

QUESTION TWO

The table shows the properties of four polymers **A**, **B**, **C** and **D**.

	Polymer	Properties
A	PTFE	can withstand high temperatures and is non-stick
B	Nylon	strong, does not rot and can be pulled into fibres
C	Polystyrene	makes a very light, solid foam which is a good heat insulator
D	PET	strong, light, waterproof and can be recycled

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

	How the polymer could be used
1	to make disposable cups for hot drinks
2	to make the coating on frying pans
3	to make string and ropes
4	to make bottles for soft drinks

Turn over for the next question

QUESTION THREE

The most abundant gases in the Earth's atmosphere are nitrogen and oxygen.

The table shows the next four most abundant gases, three of which are noble gases.

	Gas	Percentage (%) in atmosphere by volume	Boiling point in °C
1	Argon	0.930	–185
2	Carbon dioxide	0.030	–78
3	Neon	0.018	–246
4	Helium	0.005	–269

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

A It is the gas that is a compound.

B It is the most abundant of the noble gases.

C It is the noble gas with the lowest boiling point.

D There are 18 cm^3 of this gas in 100 litres of air.

QUESTION FOUR

Castor oil is obtained by crushing and pressing the seeds from the castor oil plant. It has been used for thousands of years for a wide variety of purposes. Around 98.5 % of castor oil consists of unsaturated fats which are easily decomposed by natural organisms.

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

A can release a large quantity of energy

B is biodegradable

C is obtained from a vegetable source

D is unsaturated

Castor oil can be used effectively in oil lamps because it . . . **1** . . . .

Castor oil does **not** create long-term pollution problems because it . . . **2** . . . .

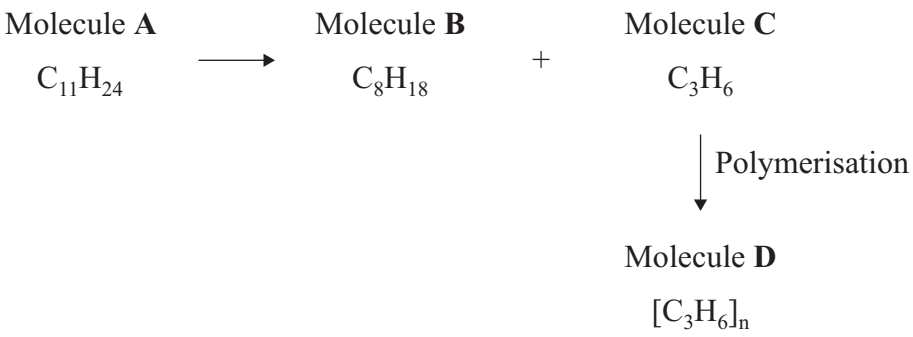
Castor oil supplies will **not** run out because it . . . **3** . . . .

Castor oil will remove some of the colour from an iodine solution because it . . . **4** . . . .

QUESTION FIVE

This question is about reactions of some hydrocarbon molecules.

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



The molecule that has been cracked is . . . **1** . . . .

The molecule that is an alkene is . . . **2** . . . .

The molecule that is a plastic is . . . **3** . . . .

The molecule that is the smallest alkane in these reactions is . . . **4** . . . .

SECTION TWO

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

Each of these questions has four parts.

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

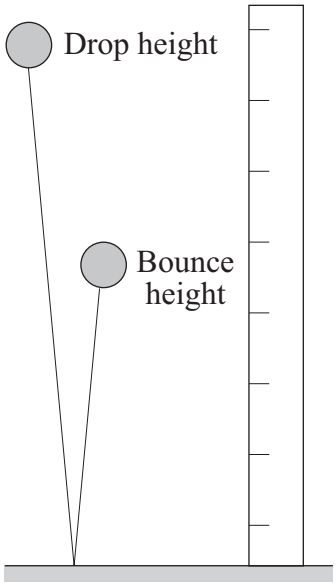
Mark your choices on the answer sheet.

QUESTION SIX

A student tested two balls; one ball was made from natural rubber and the other from a new polymer.

The student dropped the rubber ball from a measured height and recorded the height to which it bounced. The student did the experiment using different drop heights.

The student repeated the whole experiment using the polymer ball.



The results are shown in the table.

Drop height in cm	Rubber ball bounce height in cm	Polymer ball bounce height in cm
20	14	18
40	28	36
60	42	54
80	67	71
100	70	90

6A To improve the reliability of the results, the student could have . . .

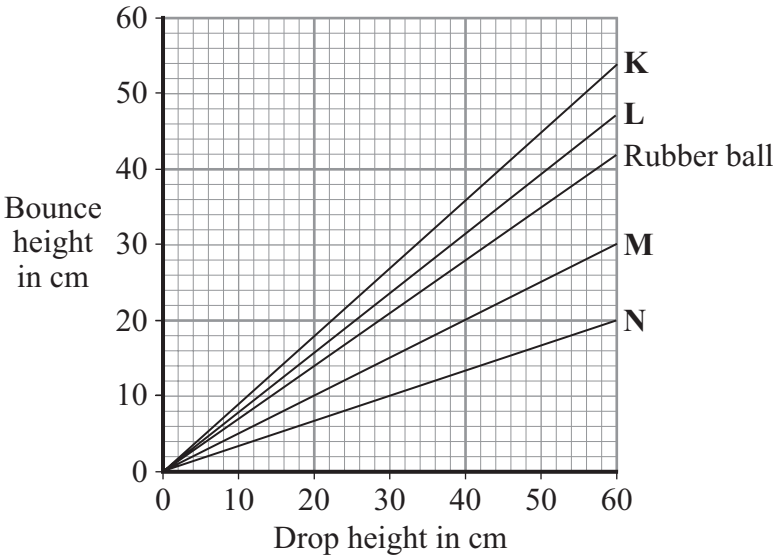
1 repeated the test with balls made of different polymers.

2 repeated the experiment for each drop height several times.

3 used a longer measuring instrument.

4 dropped the ball onto a harder surface.

6B Which of the lines, **K**, **L**, **M** or **N**, on the graph, represents the polymer ball?



1 **K**

2 **L**

3 **M**

4 **N**

6C Which one of the following values **in the table** for the bounce height is clearly anomalous?

1 28 cm for the rubber ball

2 67 cm for the rubber ball

3 36 cm for the polymer ball

4 71 cm for the polymer ball

6D The results show that for each drop height . . .

1 the rubber ball will bounce higher than the polymer ball.

2 the polymer ball will bounce higher than the rubber ball.

3 the rubber ball will bounce higher as it warms up.

4 the rubber ball becomes less bouncy the more it is used.

QUESTION SEVEN

A manufacturer of sugar-coated sweets stopped using the colour blue. This was because of concerns about the effect of artificial colours on children's health.

They replaced the blue colour with another dye extracted from plants.

7A The sweets are now labelled as 'free of all artificial colours and flavours'.

What information does this give the consumer?

1 Scientists have shown that the sweets are free of health risks.

2 It has been found that the sweets can be stored for a long time.

3 Naturally occurring chemicals have been used to make the sweets.

4 There has been no cruelty to animals in experiments to make the sweets.

7B Some of the ingredients in the sweets have an *E-number*.

What does this mean?

1 They are permitted additives.

2 They are natural ingredients.

3 They have been made from an emulsion.

4 They are eco-friendly.

7C Chromatography can be used to identify coloured ingredients.

Which statement about chromatography is true?

1 Chromatography works on any soluble colouring.

2 Chromatography works only on natural colouring.

3 Chromatography works only on artificial colouring.

4 Chromatography works on any insoluble colouring.

7D What should scientists do to help to reduce the risks from food additives?

1 remove food containing additives from supermarkets

2 investigate the links between additives and health problems

3 advise food manufacturers about clear labelling

4 explain to people the risks of eating sugar-coated sweets

Turn over for the next question

QUESTION EIGHT

This question is about vegetable oils.

8A When food is cooked, it is heated up and chemical changes take place in the food. Food that is cooked in vegetable oil (fried) is completely different from food cooked in water (boiled). Food cooked in oil reaches a much higher temperature than food cooked in water.

This is because . . .

1 water has a higher melting point than vegetable oil.

2 vegetable oil has a higher melting point than water.

3 water has a higher boiling point than vegetable oil.

4 vegetable oil has a higher boiling point than water.

8B Many vegetable oils contain unsaturated compounds.

This means that . . .

1 they do **not** dissolve in water.

2 they contain double carbon carbon bonds.

3 they react with an emulsifier.

4 they are hydrocarbons.

8C The amount of unsaturation in a vegetable oil is found by measuring . . .

1 how much steam it reacts with.

2 how much hydrogen it reacts with.

3 how much iodine it reacts with.

4 how much nickel it reacts with.

8D Biodiesel is a fuel made from vegetable oils.

Biodiesel is almost ‘carbon neutral’.

This is because . . .

1 it is a renewable energy source.

2 it will never run out.

3 carbon dioxide is absorbed by the plants from which vegetable oils are obtained.

4 the carbon dioxide produced when it burns is not acidic.

Turn over for the next question

QUESTION NINE

Scientists used to believe that the Earth's core is cooling. They thought that this made the Earth shrink.
In 1915, Alfred Wegener suggested that the continents had once been joined together. Later, the continents split up and moved apart.
At first, scientists did not believe Wegener's theory. They only began to accept his theory with the discovery of new evidence.

9A How did the scientists who believed that the Earth's core is cooling explain the formation of mountains?

1 Mountains were formed by volcanic eruptions.

2 Large wrinkles in the Earth's crust formed the mountains.

3 Mountains were formed by huge tidal waves.

4 The least dense parts of the Earth's crust rose up above parts that were more dense.

9B Scientists now believe that . . .

1 the core is heated by global warming.

2 the core is heated by volcanic eruptions.

3 radioactive processes keep the core heated.

4 burning fossil fuels keeps the core heated.

9C What was the new evidence that persuaded many scientists to accept Wegener's theory?

1 The Earth's crust is cracked into a number of plates.

2 The Earth is almost spherical not square.

3 The Earth is made up of three layers.

4 The Earth's crust is much less dense than the mantle.

9D Scientists now believe that mountain ranges are formed . . .

1 by earthquakes.

2 by rising liquid material from the core.

3 by magma pushing up the Earth's crust where it is very thin.

4 by large-scale movements of the Earth's crust.

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**.

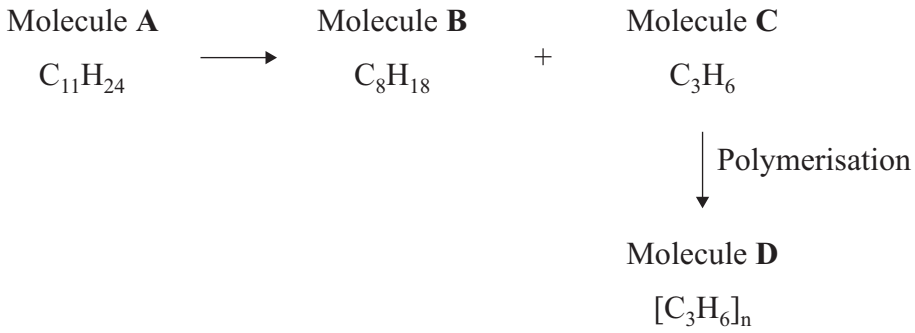
Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

This question is about reactions of some hydrocarbon molecules.

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



The molecule that has been cracked is . . . **1** . . . .

The molecule that is an alkene is . . . **2** . . . .

The molecule that is a plastic is . . . **3** . . . .

The molecule that is the smallest alkane in these reactions is . . . **4** . . . .

QUESTION TWO

This question is about obtaining useful substances from crude oil fractions.

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

A polymerisation

B thermal decomposition

C unsaturation

D hydration (addition of water)

Alkenes can be made from oil fractions by . . . **1** . . . .

Bromine can be used to test for . . . **2** . . . in any alkenes formed.

Ethene formed from oil fractions can be made into ethanol by . . . **3** . . . .

Alkene molecules can be joined together into long-chain molecules in the process called . . . **4** . . . .

Turn over for the next question

SECTION TWO

Questions **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

This question is about vegetable oils.

3A When food is cooked, it is heated up and chemical changes take place in the food. Food that is cooked in vegetable oil (fried) is completely different from food cooked in water (boiled). Food cooked in oil reaches a much higher temperature than food cooked in water.

This is because . . .

1 water has a higher melting point than vegetable oil.

2 vegetable oil has a higher melting point than water.

3 water has a higher boiling point than vegetable oil.

4 vegetable oil has a higher boiling point than water.

3B Many vegetable oils contain unsaturated compounds.

This means that . . .

1 they do **not** dissolve in water.

2 they contain double carbon carbon bonds.

3 they react with an emulsifier.

4 they are hydrocarbons.

3C The amount of unsaturation in a vegetable oil is found by measuring . . .

1 how much steam it reacts with.

2 how much hydrogen it reacts with.

3 how much iodine it reacts with.

4 how much nickel it reacts with.

3D Biodiesel is a fuel made from vegetable oils.

Biodiesel is almost ‘carbon neutral’.

This is because . . .

1 it is a renewable energy source.

2 it will never run out.

3 carbon dioxide is absorbed by the plants from which vegetable oils are obtained.

4 the carbon dioxide produced when it burns is not acidic.

Turn over for the next question

QUESTION FOUR

Scientists used to believe that the Earth's core is cooling. They thought that this made the Earth shrink.
In 1915, Alfred Wegener suggested that the continents had once been joined together. Later, the continents split up and moved apart.
At first, scientists did not believe Wegener's theory. They only began to accept his theory with the discovery of new evidence.

4A How did the scientists who believed that the Earth's core is cooling explain the formation of mountains?

1 Mountains were formed by volcanic eruptions.

2 Large wrinkles in the Earth's crust formed the mountains.

3 Mountains were formed by huge tidal waves.

4 The least dense parts of the Earth's crust rose up above parts that were more dense.

4B Scientists now believe that . . .

1 the core is heated by global warming.

2 the core is heated by volcanic eruptions.

3 radioactive processes keep the core heated.

4 burning fossil fuels keeps the core heated.

4C What was the new evidence that persuaded many scientists to accept Wegener's theory?

1 The Earth's crust is cracked into a number of plates.

2 The Earth is almost spherical not square.

3 The Earth is made up of three layers.

4 The Earth's crust is much less dense than the mantle.

4D Scientists now believe that mountain ranges are formed . . .

1 by earthquakes.

2 by rising liquid material from the core.

3 by magma pushing up the Earth's crust where it is very thin.

4 by large-scale movements of the Earth's crust.

Turn over for the next question

QUESTION FIVE

Alkenes that have one or more hydrogen atoms replaced by fluorine can be polymerised to make thermosoftening polymers. Replacing hydrogen atoms with fluorine is a very expensive process.

Increasing the number of fluorine atoms in the polymers makes them very unreactive. Polymers with more fluorine atoms in their molecules are more resistant to heat damage. However, if they are subjected to intense heat, they can burn and release some very toxic fumes.

5A Which one of the following monomers would result in the least reactive polymer?

1 $CHF=CH_2$

2 CHF=CHF

3 $CH_2=CF_2$

4 $CF_2=CF_2$

5B The monomer CHF=CHF . . .

1 is saturated.

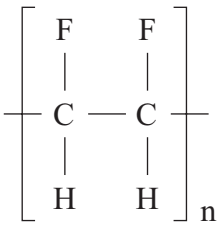
2 does **not** react with bromine.

3 reacts with hydrogen in the presence of a catalyst.

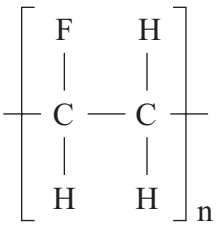
4 can be produced by cracking alkanes.

5C Which polymer would result from polymerisation of CHF=CHF?

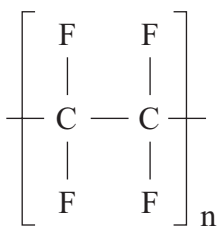
1



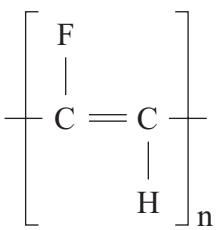
2



3



4



5D Which statement would **not** apply to objects made from polymers containing a lot of fluorine?

1 They can be disposed of safely in an incinerator.

2 They are resistant to breakdown by microorganisms.

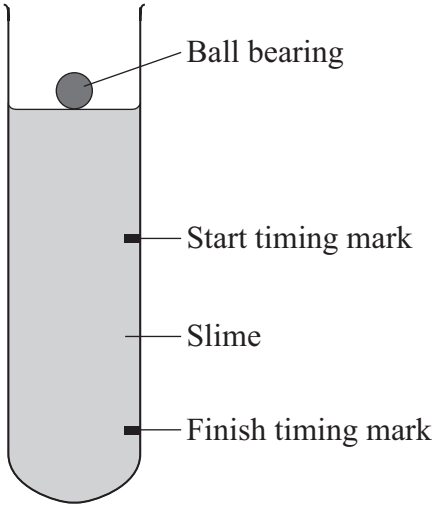
3 They are expensive to manufacture.

4 They can be used to make kitchen utensils.

Turn over for the next question

QUESTION SIX

Some students made a slime by mixing a solution of PVA with a solution of borax.



They decided to investigate how the viscosity (thickness) of the slime depended on the amount of borax solution added to the PVA solution. They used various mixtures and timed how long a ball bearing took to fall between two timing marks, as shown in the diagram.
The same person took the time readings throughout the experiment. The temperature of the room did not change.

The students' results are shown in the table.

Volume of PVA solution in cm^3	Volume of borax solution in cm^3	Volume of water in cm^3	Time 1 in seconds	Time 2 in seconds	Time 3 in seconds	Average time in seconds
40	1	9	1.6	1.6	1.6	1.6
40	2	8	3.6	4.0	–	3.8
40	3	7	4.8	5.2	5.6	5.2
40	4	6	7.2	7.4	7.4	7.3
40	5	5	10.0	10.2	9.8	10.0
40	6	4	10.2	10.4	10.0	10.2
40	7	3	11.0	9.0	10.6	10.2
40	8	2	10.0	9.8	9.6	9.8
40	9	1	9.0	9.2	8.8	9.0
40	10	0	8.8	8.8	–	8.8

6A Which row in the table shows the correct independent and dependent variables in this experiment?

	Independent variable	Dependent variable
1	Volume of PVA solution	Time for ball to drop between the marks
2	Time for ball to drop between the marks	Volume of borax solution
3	Volume of borax solution	Volume of PVA solution
4	Volume of borax solution	Time for ball to drop between the marks

6B In the experiment, one variable that is **not** controlled is . . .

1 the total volume of PVA, borax and water.

2 the person taking the time readings.

3 the temperature of the room.

4 the total volume of water.

6C Which of the following actions will **not** improve the reliability of the results?

1 Measuring the time taken three times instead of two for the tests with $2\,cm^3$ and $10\,cm^3$ of borax solution.

2 Using a timer able to read to 0.1 seconds instead of 0.2 seconds.

3 Repeating the set of readings for $7\,cm^3$ of borax solution.

4 Repeating the whole experiment on another day.

6D What is the **best** conclusion that can be made from the results?

1 There is a consistent error in the method of timing.

2 The viscosity of slime depends directly on the volume of borax solution.

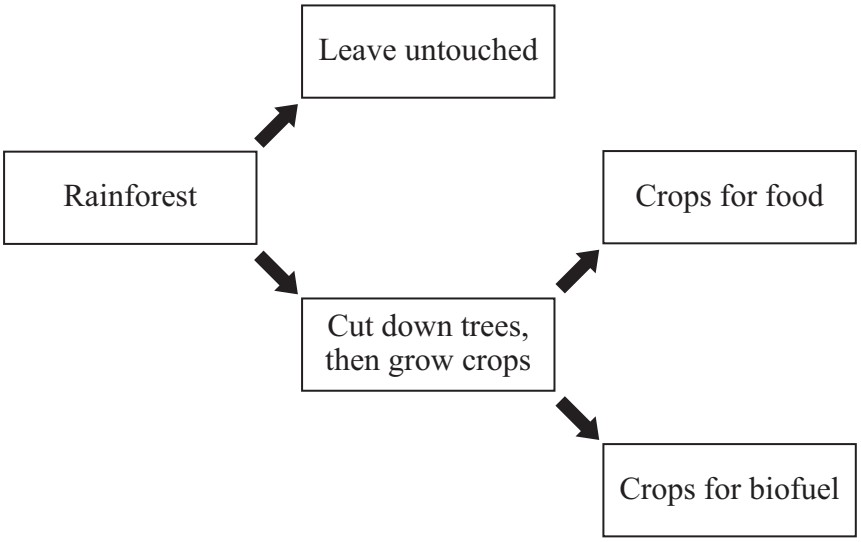
3 There is **not** enough evidence to relate the volume of borax solution to the viscosity of slime.

4 There is a clear relationship between the volume of borax solution and the viscosity of slime.

QUESTION SEVEN

Rainforests have an important global role in absorbing carbon dioxide. They are also a habitat for many endangered species.

Many countries have to make difficult decisions about the use of land. This is summarised in the flow chart. Biofuels that are produced include biodiesel and bioethanol. The trees that are cut down are not always replaced.



7A Why is there a large worldwide demand for biofuels?

1 The carbon dioxide produced by the use of the fuel is completely matched by the carbon dioxide taken in when the fuel is grown.

2 They are a renewable source of energy.

3 Their use is always sustained.

4 No greenhouse gases are produced.

7B Which row in the table correctly shows two likely consequences of a long-term increase in the demand for biofuel?

1	fewer crops will be grown for food	more species will be endangered
2	fewer trees in rainforests will be cut down	more land will be used for crops
3	less carbon dioxide will be absorbed by the rainforests	more crops will be grown for food
4	land will not be used and will be returned to rainforest	fossil fuel reserves will run out sooner

7C Scientists have been asked to carry out research to produce evidence about the consequences of developing the use of biofuels.

Which row in the table gives the correct description of an issue and its impact?

	Issue	**Impact**
1	ethical	effect on endangered species
2	social	effect on price of fossil fuels
3	environmental	effect on price of wood
4	economic	effect on levels of oxygen in the atmosphere

7D Some of the vegetable oils grown as a food crop are reacted with hydrogen at 60 °C using a nickel catalyst.

The purpose of this process is to . . .

1 remove single carbon carbon bonds in the oil.

2 add double carbon carbon bonds to the oil.

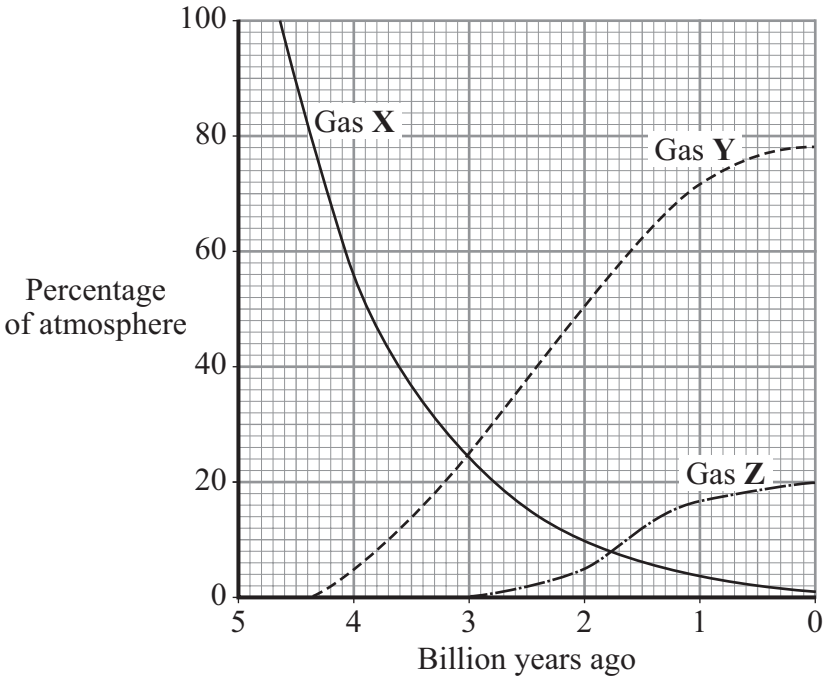
3 change the oil so that its melting point is higher than room temperature.

4 make the chemicals in the oil detectable with bromine.

QUESTION EIGHT

Gases **X**, **Y** and **Z** are found in the Earth's atmosphere today.

The graph shows how the percentages of these gases in the atmosphere have changed over the last five billion years.



8A Which row in the table correctly describes the gases **X**, **Y** and **Z**?

	Gas X	**Gas Y**	**Gas Z**
1	Carbon dioxide	Nitrogen	Oxygen
2	Oxygen	Nitrogen	Carbon dioxide
3	Nitrogen	Carbon dioxide	Oxygen
4	Carbon dioxide	Oxygen	Nitrogen

8B The Earth's atmosphere today contains the noble gas argon, which is by far the most abundant noble gas.

Argon is used in filament light bulbs because . . .

1 it has a low density.

2 it glows red when hot.

3 it can be obtained from the air by filtration.

4 it is chemically unreactive.

The table below shows the amounts of carbon dioxide in the Earth's atmosphere since 1750.

Year	**1750**	**1800**	**1850**	**1900**	**1950**	**2000**
Percentage (%) of carbon dioxide by volume	0.0270	0.0282	0.0288	0.0297	0.0310	0.0368

8C A graph of percentage (%) of carbon dioxide on the *y*-axis against time on the *x*-axis from 1750 to 2000 would show . . .

1 direct proportionality after 1800.

2 many anomalous values.

3 random scatter.

4 stronger positive correlation after 1850 than before.

8D The values given in the table show . . .

1 sensitivity because the values are close together.

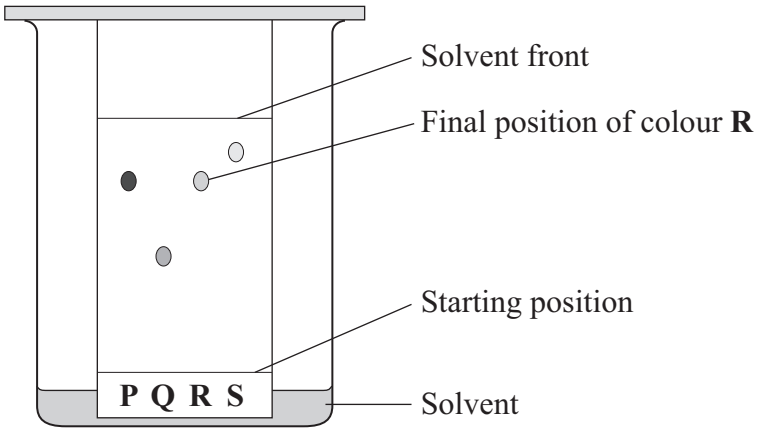
2 reliability because the values are calculated by modern techniques.

3 precision because the values are given to 4 decimal places.

4 accuracy because famous scientists have calculated the values.

QUESTION NINE

The diagram shows an investigation of four colours, **P**, **Q**, **R** and **S**, using paper chromatography.



As the solvent rises up the paper it moves the colours depending on their attraction for the solvent and the paper.
The greater the attraction of a colour for the solvent and the less the attraction for the paper, the further the colour moves.

The R_f value is defined as:

$$R_f = \frac{\text{distance travelled by the colour}}{\text{distance travelled by the solvent}}$$

9A In the investigation shown in the diagram, what was the R_f value of colour **Q**?

1 0.0

2 0.5

3 0.7

4 0.9

The R_f values for the colours, **P**, **Q**, **R** and **S**, in four different solvents are shown in the table.

	Solvent			
	Water	**Ethanol**	**Propanone**	**Tetrachloromethane**
Colour P	0.5	0.9	0.7	0.5
Colour Q	0.0	0.8	0.6	0.2
Colour R	0.5	0.7	0.6	0.1
Colour S	0.2	0.6	0.4	0.2

9B Which colour is **not** soluble in water?

1 **P**

2 **Q**

3 **R**

4 **S**

9C Using the data in the table above, which solvent could be used to separate a mixture of all four colours, **P**, **Q**, **R** and **S**?

1 water

2 ethanol

3 propanone

4 tetrachloromethane

Question 9 continues on the next page

9D R_f values are not very reliable because other factors can affect how the colours move. These factors include the temperature and the amount of solvent vapour in the atmosphere around the chromatography paper. For this reason, R_f values are not normally quoted in textbooks.

Which of the following statements is true?

1 Chromatography is useless for identifying unknown substances.

2 Chromatography can only be used if the temperature is carefully controlled to a constant value.

3 Chromatography can only be used if there is always the same amount of solvent in the beaker.

4 Chromatography can be used if known colours are used, with the unknown colour as a comparison.

END OF TEST

There are no questions printed on this page

There are no questions printed on this page