

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
 TWENTY FIRST CENTURY SCIENCE  
 CHEMISTRY A**

**A321/01**

Unit 1 Modules C1 C2 C3 (Foundation Tier)

**FRIDAY 18 JANUARY 2008**

Afternoon  
 Time: 40 minutes

Candidates answer on the question paper.

**Additional materials (enclosed):**

None

Calculators may be used.

**Additional materials:** Pencil  
 Ruler (cm/mm)



Candidate  
 Forename

Candidate  
 Surname

Centre  
 Number

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
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Candidate  
 Number

|  |  |  |  |
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**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

**INFORMATION FOR CANDIDATES**

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- The Periodic Table is printed on the back page.

**FOR EXAMINER'S USE**

| Qu.          | Max       | Mark |
|--------------|-----------|------|
| 1            | 9         |      |
| 2            | 6         |      |
| 3            | 7         |      |
| 4            | 5         |      |
| 5            | 4         |      |
| 6            | 7         |      |
| 7            | 4         |      |
| <b>TOTAL</b> | <b>42</b> |      |

This document consists of **17** printed pages and **3** blank pages.

Answer **all** the questions.

- 1 Cars on motorways use the right hand lane for overtaking. The left hand lanes are used for slower vehicles.

From 2007, car pool lanes will be introduced on some motorways. Only cars with two or more people in them will be allowed to drive in the right hand lane.



- (a) (i) Finish the sentence by choosing the **best** word from this list.

**less**  
**more**  
**the same**

Car pool lanes should mean that the number of cars on motorways will be

.....

[1]

- (ii) Why should people be encouraged to take passengers in their cars?

Put a tick (✓) in the box next to the **best** answer.

There will be fewer buses on the motorway.

Less fossil fuel will be burned.

It will stop lorries using the motorway.

More people will ride bicycles.

[1]

(iii) Why will people want to use the car pool lane?

Put ticks (✓) in the boxes next to the **two best** answers.

There is someone to talk to.

It is cheaper per person.

They like to be in the right hand lane.

They won't be stuck in traffic jams.

[2]

(b) Polluting gases from car engines include:

- carbon dioxide
- carbon monoxide
- nitrogen oxides

Which of these will be reduced if there are fewer cars on motorways?

Put a (ring) around the correct answer.

**all of them**

**carbon dioxide only**

**none of them**

[1]

(c) Pollution from cars is reduced by using catalytic converters.

Catalytic converters change carbon monoxide to carbon dioxide and change nitrogen oxides to nitrogen.

How do the amounts of gases produced by a car change when a catalytic converter is used?

Put ticks (✓) in the correct boxes in the table.

|                 | <b>decreases</b> | <b>increases</b> | <b>stays the same</b> |
|-----------------|------------------|------------------|-----------------------|
| carbon dioxide  |                  |                  |                       |
| carbon monoxide |                  |                  |                       |
| nitrogen oxides |                  |                  |                       |

[2]

(d) Petrol is made up of compounds of carbon and hydrogen **only**.

(i) What is the name given to these compounds?

Put a ring around the correct answer.

**carbohydrates**

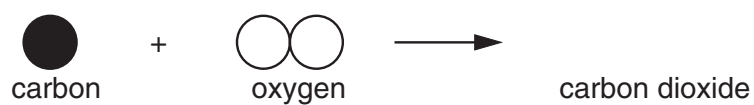
**hydrocarbons**

**polymers**

[1]

(ii) When petrol burns, the **carbon** atoms react with oxygen to make carbon dioxide.

Finish the diagram to show the reaction.



[1]

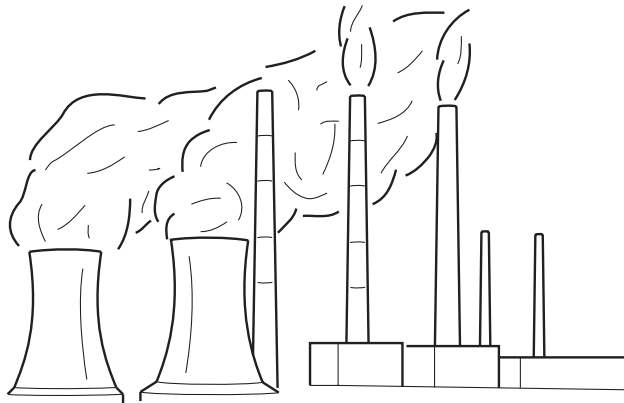
[Total: 9]

5  
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**Question 2 starts on page 6.**

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2 This question is about pollution from power stations.



One of the pollutants from power stations is sulfur dioxide.

Sulfur dioxide levels are measured at different distances from a power station. The table shows the results on one day.

| distance from power station in metres | concentration of sulfur dioxide in $\mu\text{g} / \text{m}^3$ |
|---------------------------------------|---|
| 0                                     | 64  |
| 500                                   | 50  |
| 1000                                  | 14  |
| 1500                                  | 8   |
| 2000                                  | 3   |

(a) Levels of sulfur dioxide higher than  $50 \mu\text{g} / \text{m}^3$  are considered harmful to humans.

Where was the air harmful?

Put ticks (✓) in the boxes next to the **two** correct answers.

At the power station.

Less than 500 metres from the power station.

More than 500 metres from the power station.

Between 500 metres and 1000 metres from the power station.

[2]

(b) Here is what five students said about the data in the table.

**Josh**  
On a windy day, measurements of sulfur dioxide may change.

**Hannah**  
Sulfur dioxide reacts with rain water and oxygen to make an acid.

**Pete**  
The concentration of sulfur dioxide in the chimney is always the same.

**Dina**  
The concentration of sulfur dioxide decreases as the distance from the power station increases.

**Rajid**  
The concentration of sulfur dioxide increases with time.

(i) Which **one** person has described the correlation in the table?

..... [1]

(ii) On another day, the concentrations of sulfur dioxide are lower.

Which **two** people have suggested explanations for this change?

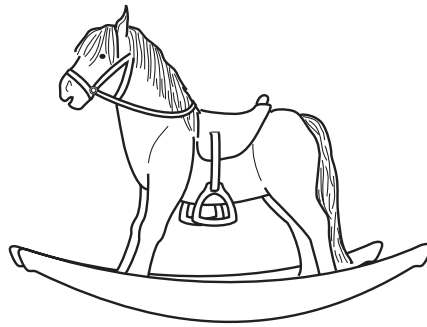
..... [2]

(iii) Who has explained how sulfur dioxide is removed from the air?

..... [1]

[Total: 6]

- 3 Julie and Sam are designing a new rocking horse for a toy company.



The rocking horse will be used by children between three and eight years old.  
 They should be able to move it around.  
 It must be strong enough to sit on.  
 It must not be dangerous.  
 It must be cheap to buy.

They test a number of materials.

The table gives the results of these tests.

| material      | strength    | density | flexibility | cost   |
|---------------|-------------|---------|-------------|--------|
| iron          | very strong | high    | low         | medium |
| polypropylene | strong      | low     | high        | low    |
| wood          | strong      | medium  | medium      | high   |

They choose to make the rocking horses with polypropylene.

- (a) Use the table to answer these questions.

- (i) Which **two** properties of polypropylene make it better than iron or wood for making the rocking horse?

Put ticks (✓) in the boxes next to the **two** correct answers.

|             |                          |
|-------------|--------------------------|
| strength    | <input type="checkbox"/> |
| density     | <input type="checkbox"/> |
| flexibility | <input type="checkbox"/> |
| cost        | <input type="checkbox"/> |

[2]



(ii) Which property of polypropylene is the **main** disadvantage for making the rocking horse?

Put a tick (✓) in the box next to the correct answer.

- strength
- density
- flexibility
- cost

[1]

(b) Julie says it would be better for the environment if the rocking horses were made of wood. Which of the following explains this?

Put a tick (✓) in the box next to the **best** answer.

- Wood is a natural material.
- Wood has to be carved into shape.
- Wood is strong.
- Wood is a renewable material.

[1]

(c) Sam says there are **three** different ways of getting rid of the polypropylene rocking horse at the end of its life. These will also affect the environment.

Finish the sentences. Choose words from this list.

- burned**
- disposed**
- energy**
- landfill**
- products**
- recycled**
- rot**
- rust**

The polypropylene rocking horse can be dumped in ..... where it will not .....

It can be put in an incinerator and .....

It can be ..... to make new products. [3]

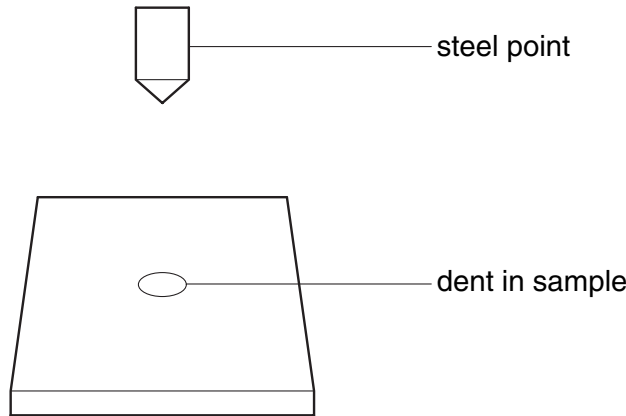
[Total: 7]

4 A scientist measures the hardness of two different materials, X and Y.

A machine presses a steel point into samples of each material.

The machine uses the same force each time.

A hardness number is calculated from the size of the dent in the sample: the higher the number the harder the material.



(a) Each type of material is tested several times. The results are shown in the table.

| material | hardness number |          |          |          |          |          | mean |
|----------|-----------------|----------|----------|----------|----------|----------|------|
|          | sample 1        | sample 2 | sample 3 | sample 4 | sample 5 | sample 6 |      |
| X        | 8               | 10       | 9        | 8        | 7        | 12       | 9    |
| Y        | 18              | 20       | 16       | 7        | 21       | 20       | 19   |

The mean hardness has been calculated for each material.

One result has not been used to calculate the mean for **material Y** because it is an outlier.

(i) Which result is the outlier?

Put a ring around the correct sample number.

1                      2                      3                      4                      5                      6                      [1]

(ii) Here are four suggestions why this test gave the wrong result.

|          |  |
|----------|--|
| <b>A</b> | Samples of X and Y had been mixed up.                  |
| <b>B</b> | The steel point had been pressed with a larger force.  |
| <b>C</b> | The steel point had been pressed with a smaller force. |
| <b>D</b> | The steel point had not been pressed into the sample.  |

Write down the letters of the **two** best suggestions.

answer ..... and ..... [2]

- (b) All the test results for material X are reliable, but there are small differences between their values.

Why are these values different?

Put a tick (✓) in the box next to the correct answer.

Samples of X and Y had been mixed up.

Samples of X may vary.

It is not a fair test.

The steel point had not been pressed into the samples.

[1]

- (c) Complete the table below to show the range of hardness number for material X.

|                    |              |
|--------------------|--------------|
|                    | <b>range</b> |
| <b>range for X</b> |              |

[1]

[Total: 5]

## 5 Read this article.

## There will be no more blue Smarties

The manufacturer is removing all artificial colours from Smarties. There is no natural alternative to the blue chemical used now.

The blue will be replaced by a white Smartie.

A recent study showed a possible harmful effect on the nervous system due to artificial colours and chemicals.

The blue colouring may cause hyperactivity and skin rashes. It is also listed as a cancer risk by the US Environmental Protection Agency.

A scientist said 'It is great news for children's health. We would now like to see the Government announce a total ban on the blue colouring.'



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**(a)** Why are blue Smarties no longer being made?

Put a tick (✓) in the box next to the **best** answer.

Eating a blue Smartie will give all children a rash.

All children who eat blue Smarties will develop health problems.

The blue colouring may make some children hyperactive.

All artificial additives will harm children.

[1]

**(b)** Why would the scientist like to see the Government ban the blue colour?

Put a tick (✓) in the box next to the **best** answer.

To stop blue Smarties from being made.

The blue colour is used in other foods.

So the risk can be measured.

To make Smarties cheaper.

To reduce the risk to children's health.

[1]

(c) Here are three statements about food additives.

Put ticks (✓) in the correct boxes to show whether each statement is **true** or **false**.

|   | <b>true</b>              | <b>false</b>             |
|---|--------------------------|--------------------------|
| Additives with an E number have passed a safety test. | <input type="checkbox"/> | <input type="checkbox"/> |
| Preservatives slow down the growth of microbes.       | <input type="checkbox"/> | <input type="checkbox"/> |
| All natural additives are harmless.                   | <input type="checkbox"/> | <input type="checkbox"/> |

[2]

[Total: 4]

6 This is a question about farming.



(a) Here are five sentences explaining why a wheat field becomes less fertile each year. They are in the wrong order.

|          |  |
|----------|--|
| <b>A</b> | Wheat uses these nitrogen compounds to make proteins in the plant. |
| <b>B</b> | There are nitrogen compounds in water in the soil.                 |
| <b>C</b> | Wheat is harvested and taken from the field.                       |
| <b>D</b> | Wheat plants take in nitrogen compounds through their roots.       |
| <b>E</b> | The concentration of nitrogen compounds in the soil falls.         |

Fill in the boxes to show the right order. The last one has been done for you.

|  |  |  |  |          |
|--|--|--|--|----------|
|  |  |  |  | <b>E</b> |
|--|--|--|--|----------|

[3]

(b) Here are three statements about the advantages and disadvantages of intensive farming.

For each one write **A** if it is an advantage or **D** if it is a disadvantage.

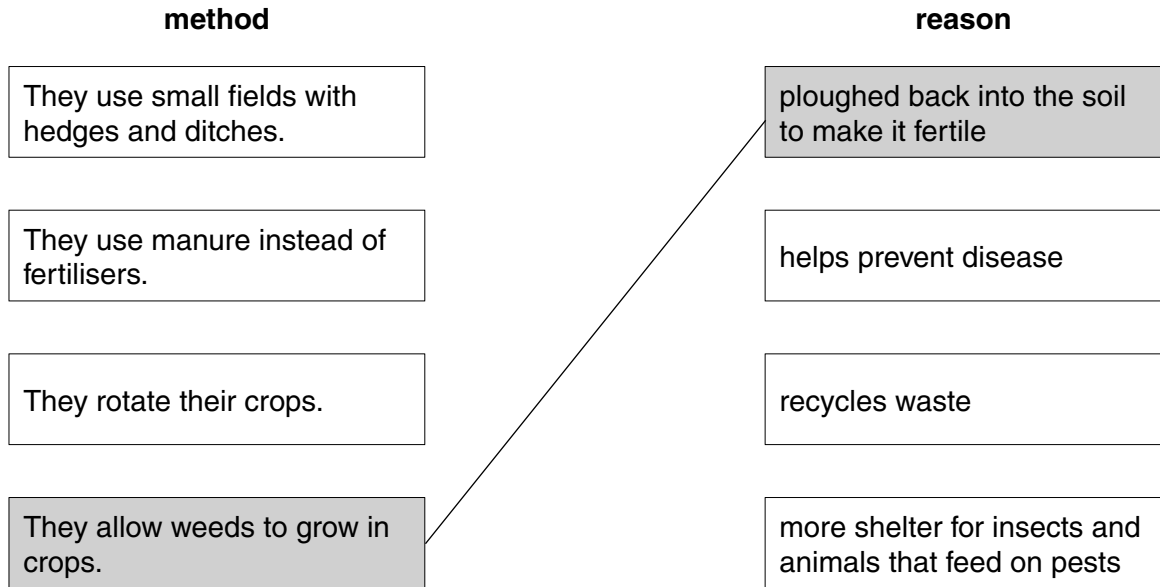
| statement                      | A (advantage) or<br>D (disadvantage) |
|--------------------------------|--------------------------------------|
| Food is cheaper.               |                                      |
| Less land is needed.           |                                      |
| Soil structure may be damaged. |                                      |

[2]

(c) The lists below show different organic farming methods and the reasons for their use.

Draw a straight line from each **method** to the correct **reason**.

One has been done for you.



[2]

[Total: 7]

7 The Government is worried about the increase in childhood obesity.  
The number of 2 to 11 year olds who are obese has risen steadily over the past 10 years.

(a) Here are some sentences about obesity.

Finish the sentences using words from this list.

- diabetes
- exercise
- insulin
- measles
- protein

Obesity is caused by eating too much food and not getting enough .....

Obesity increases the risk of heart disease and ..... [2]

(b) Politicians want to pass laws to help reduce childhood obesity.

Here are some actions they could take.

Which **two** actions may help reduce obesity?

Put ticks (✓) in the boxes next to the **two** correct answers.

- Banning salads from school lunches.
- Banning fizzy drinks machines from schools.
- Banning junk food advertising.
- Banning the sale of bottled water in schools.

[2]

[Total: 4]

**END OF QUESTION PAPER**



17  
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**18**  
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*Copyright Acknowledgements:*

Q5 “Smarties” is a Registered Trademark of Société des Produits Nestlé S.A. Photograph © iStockphoto.com / RA Photography

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# The Periodic Table of the Elements

|   |                                    |   |   |   |   |   |  |                                   |
|---|------------------------------------|---|---|---|---|---|--|-----------------------------------|
| 1   | 2                                  | 3 | 4 | 5 | 6 | 7 | 0  |                                   |
| 7<br><b>Li</b><br>lithium<br>3  | 9<br><b>Be</b><br>beryllium<br>4   |   |   |   |   |   | 19<br><b>F</b><br>fluorine<br>9            | 4<br><b>He</b><br>helium<br>2     |
| 23<br><b>Na</b><br>sodium<br>11   | 24<br><b>Mg</b><br>magnesium<br>12 |   |   |   |   |   | 16<br><b>O</b><br>oxygen<br>8              | 20<br><b>Ne</b><br>neon<br>10     |
| 39<br><b>K</b><br>potassium<br>19   | 40<br><b>Ca</b><br>calcium<br>20   |   |   |   |   |   | 32<br><b>S</b><br>sulfur<br>16             | 40<br><b>Ar</b><br>argon<br>18    |
| 85<br><b>Rb</b><br>rubidium<br>37   | 88<br><b>Sr</b><br>strontium<br>38 |   |   |   |   |   | 79<br><b>Se</b><br>selenium<br>34          | 84<br><b>Kr</b><br>krypton<br>36  |
| 133<br><b>Cs</b><br>caesium<br>55   | 137<br><b>Ba</b><br>barium<br>56   |   |   |   |   |   | 128<br><b>Te</b><br>tellurium<br>52        | 131<br><b>Xe</b><br>xenon<br>54   |
| [223]<br><b>Fr</b><br>francium<br>87  | [226]<br><b>Ra</b><br>radium<br>88 |   |   |   |   |   | [209]<br><b>Po</b><br>polonium<br>84       | [222]<br><b>Rn</b><br>radon<br>86 |
|   |                                    |   |   |   |   |   | 207<br><b>Pb</b><br>lead<br>82             |                                   |
|   |                                    |   |   |   |   |   | 204<br><b>Tl</b><br>thallium<br>81         |                                   |
|   |                                    |   |   |   |   |   | 201<br><b>Hg</b><br>mercury<br>80          |                                   |
|   |                                    |   |   |   |   |   | 112<br><b>Cd</b><br>cadmium<br>48          |                                   |
|   |                                    |   |   |   |   |   | 108<br><b>Ag</b><br>silver<br>47           |                                   |
|   |                                    |   |   |   |   |   | 106<br><b>Pd</b><br>palladium<br>46        |                                   |
|   |                                    |   |   |   |   |   | 195<br><b>Pt</b><br>platinum<br>78         |                                   |
|   |                                    |   |   |   |   |   | 192<br><b>Ir</b><br>iridium<br>77          |                                   |
|   |                                    |   |   |   |   |   | 190<br><b>Os</b><br>osmium<br>76           |                                   |
|   |                                    |   |   |   |   |   | 186<br><b>Re</b><br>rhenium<br>75          |                                   |
|   |                                    |   |   |   |   |   | 184<br><b>W</b><br>tungsten<br>74          |                                   |
|   |                                    |   |   |   |   |   | 181<br><b>Ta</b><br>tantalum<br>73         |                                   |
|   |                                    |   |   |   |   |   | 178<br><b>Hf</b><br>hafnium<br>72          |                                   |
|   |                                    |   |   |   |   |   | 177<br><b>Hs</b><br>hasium<br>108          |                                   |
|   |                                    |   |   |   |   |   | [271]<br><b>Ds</b><br>darmstadtium<br>110  |                                   |
|   |                                    |   |   |   |   |   | [268]<br><b>Mt</b><br>meitnerium<br>109    |                                   |
|   |                                    |   |   |   |   |   | [272]<br><b>Rg</b><br>roentgenium<br>111   |                                   |
|   |                                    |   |   |   |   |   | [266]<br><b>Sg</b><br>seaborgium<br>106    |                                   |
|   |                                    |   |   |   |   |   | [264]<br><b>Bh</b><br>bohrium<br>107       |                                   |
|   |                                    |   |   |   |   |   | [261]<br><b>Rf</b><br>rutherfordium<br>104 |                                   |
|   |                                    |   |   |   |   |   | [262]<br><b>Db</b><br>dubnium<br>105       |                                   |
|   |                                    |   |   |   |   |   | [261]<br><b>Rf</b><br>rutherfordium<br>104 |                                   |
|   |                                    |   |   |   |   |   | [262]<br><b>Db</b><br>dubnium<br>105       |                                   |
|   |                                    |   |   |   |   |   | [266]<br><b>Sg</b><br>seaborgium<br>106    |                                   |
|   |                                    |   |   |   |   |   | [268]<br><b>Mt</b><br>meitnerium<br>109    |                                   |
|   |                                    |   |   |   |   |   | [271]<br><b>Ds</b><br>darmstadtium<br>110  |                                   |
|   |                                    |   |   |   |   |   | [272]<br><b>Rg</b><br>roentgenium<br>111   |                                   |
| Elements with atomic numbers 112-116 have been reported but not fully authenticated |                                    |   |   |   |   |   |  |                                   |

|                                |
|--------------------------------|
| 1<br><b>H</b><br>hydrogen<br>1 |
|--------------------------------|

|   |
|---|
| relative atomic mass<br>atomic symbol<br>name<br>atomic (proton) number |
|---|

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.