

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GCSE**

**A321/02**

**TWENTY FIRST CENTURY SCIENCE  
CHEMISTRY A**

**Unit 1: C1 C2 C3 (Higher Tier)**

**THURSDAY 26 JANUARY 2012: Morning**

**DURATION: 40 minutes**

**SUITABLE FOR VISUALLY IMPAIRED CANDIDATES**

**Candidates answer on the Question Paper.  
A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:**

**None**

**OTHER MATERIALS REQUIRED:**

**Pencil**

**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. HB pencil may be used for graphs and diagrams only.**
- **Answer ALL the questions.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**

## **INFORMATION FOR CANDIDATES**

- **The number of marks 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 provided.**

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**Answer ALL the questions.**

- 1 The centre of Town A is traffic-free. Shoppers can walk in these streets but cars are not allowed to drive along them.**

**Cars are allowed to drive along the streets in the centre of Town B.**

**Scientists compare the concentration of carbon particulates in samples of air from the centres of these two towns.**

**Samples were collected at one place in each town. They were collected at the same time on the same day.**

**Their results are shown in the table.**

<b>CONCENTRATION OF CARBON PARTICULATES IN <math>\mu\text{g}/\text{m}^3</math></b>							
	<b>sample 1</b>	<b>sample 2</b>	<b>sample 3</b>	<b>sample 4</b>	<b>sample 5</b>	<b>sample 6</b>	<b>best estimate</b>
<b>Town A</b>	<b>13</b>	<b>11</b>	<b>14</b>	<b>10</b>	<b>12</b>	<b>24</b>	
<b>Town B</b>	<b>64</b>	<b>66</b>	<b>66</b>	<b>65</b>	<b>67</b>	<b>68</b>	<b>66</b>

**(a) The scientists use their results to work out the best estimate of the concentration of carbon particulates in the centre of Town B.**

**(i) Work out the best estimate for the concentration of carbon particulates in the centre of Town A.**

**Show your working.**

**best estimate = \_\_\_\_\_  $\mu\text{g}/\text{m}^3$  [2]**

**(ii) Look at the measurements for Town B.**

**Comment on the repeatability of these measurements and explain your answer.**

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**[2]**

- (iii) The scientists decide that there is a real difference between the measurements for Town A and those for Town B.

Which statements support this decision?

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

The mean for Town B is higher than the mean for Town A.

The ranges for Town A and Town B do not overlap.

The measurements for Town B do not include an outlier.

The range for Town A is higher than the range for Town B.

None of the measurements for Town A are identical but two of the measurements for Town B are identical.

The mean for Town B is outside the range of the measurements for Town A.

[2]

**(b) The scientists think that carbon particulates come from cars.**

**How do their results support this idea?**

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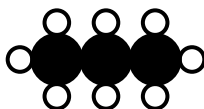
**[3]**

**[Total: 9]**

**2 Propane is a fuel used for central heating.**

**When propane burns completely it produces carbon dioxide, CO<sub>2</sub>, and water, H<sub>2</sub>O.**

**This diagram shows the atoms in a molecule of propane.**



**(a) Finish this table to show the number of MOLECULES, of reactants and of products, when ONE molecule of propane burns completely.**

	REACTANTS		PRODUCTS	
	propane	oxygen	carbon dioxide	water
number of molecules	1		3	

**[2]**



**(b) Finish this table to show the total number of ATOMS of each element, in the reactants and in the products, when ONE molecule of propane burns completely.**

	<b>ELEMENTS</b>		
	<b>carbon</b>	<b>hydrogen</b>	<b>oxygen</b>
<b>total number of atoms in reactants</b>	<b>3</b>		
<b>total number of atoms in products</b>	<b>3</b>		

**[2]**

**(c) When there is not enough air, propane does not burn completely.**

**Two other products are formed, as well as carbon dioxide and water.**

**These other products cause air pollution.**

**Name these two other products.**

\_\_\_\_\_ and \_\_\_\_\_ **[2]**

**[Total: 6]**

**3 This question is about the chemicals in crude oil.**

**(a) Crude oil is a mixture of chemicals.**

**Which of these statements describe evidence that crude oil is a mixture of chemicals?**

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

**Crude oil is a viscous, dark-coloured liquid.**

**Crude oil can be separated into a number of useful fractions with different boiling points.**

**Crude oil was made from the remains of living organisms.**

**Only a small percentage of crude oil is used for chemical synthesis.**

**The molecules in crude oil have different chain lengths.**

**The molecules in crude oil are all made of the same elements.**

**[2]**

**(b) The chemicals in crude oil are hydrocarbons.**

**Name the elements in hydrocarbons.**

\_\_\_\_\_ **[1]**

**(c) In the petrochemical industry crude oil is refined to produce three TYPES of useful product.**

**Fuels are one type of useful product.**

**What are the other two TYPES of useful product?**

**1. \_\_\_\_\_**

**2. \_\_\_\_\_ [2]**

**[Total: 5]**

**4 Window frames can be made from wood or uPVC (unplasticized polyvinylchloride).**

**Data from a Life Cycle Assessment (LCA) for window frames of the same size, made from each of these two materials, are shown in the table.**

<b>PART OF LCA</b>		<b>WOOD</b>	<b>uPVC</b>
<b>A</b>	<b>total energy used</b>	<b>9150 MJ</b>	<b>9700 MJ</b>
<b>B</b>	<b>fossil fuel used</b>	<b>5.6 kg</b>	<b>18.2 kg</b>
<b>C</b>	<b>carbon dioxide produced</b>	<b>450 kg</b>	<b>500 kg</b>
<b>D</b>	<b>air pollutants formed (arbitrary units)</b>	<b>890</b>	<b>380</b>
<b>E</b>	<b>acid rain formed (arbitrary units)</b>	<b>29</b>	<b>38</b>
<b>F</b>	<b>water pollution (arbitrary units)</b>	<b>67</b>	<b>2</b>

- (a) Use data from the table to compare the sustainability of making window frames from wood and from uPVC.**

**In your answer you should make clear how data in the table help to show why one material may be more sustainable than the other.**

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**[4]**

**(b) Which of the following statements support the idea that making window frames from wood is more sustainable than making them from uPVC?**

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

**Wood can be painted or stained to the required colour.**

**Wood can be cut and joined to make window frames.**

**Trees can be grown to get more wood.**

**uPVC can be coloured as it is made.**

**uPVC is made from chemicals in crude oil, which is not renewable.**

**uPVC can be moulded to make any shape.**

**[2]**

**(c) PVC is much more flexible than uPVC because it contains a plasticizer.**

**PVC is used to make covering material for sofas and chairs.**

**Which statement explains why the plasticizer makes this PVC more flexible than uPVC?**

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

**The polymer chains are shorter.**

**There are fewer cross-links between polymer chains.**

**The forces of attraction between polymer chains are reduced.**

**Different molecules are joined together to make the polymer.**

**[1]**

**(d) Adding plasticizer to a polymer lowers its melting point.**

**Briefly describe TWO other modifications of polymers that result in a lower melting point.**

**1. \_\_\_\_\_**

**2. \_\_\_\_\_ [2]**

**[Total: 9]**

**5 This question is about some of the chemicals added to food.**

**(a) (i) Some processed foods contain emulsifiers and stabilisers.**

**Which of these statements about emulsifiers and stabilisers are TRUE and which are FALSE?**

**Put ticks (✓) in the correct boxes to show your answers.**

	<b>TRUE</b>	<b>FALSE</b>
<b>They help to mix ingredients together.</b>	<input type="checkbox"/>	<input type="checkbox"/>
<b>They prevent the growth of harmful microbes.</b>	<input type="checkbox"/>	<input type="checkbox"/>
<b>They reduce the amount of sugar in the food.</b>	<input type="checkbox"/>	<input type="checkbox"/>
<b>They prevent ingredients such as oil and water from separating.</b>	<input type="checkbox"/>	<input type="checkbox"/>
<b>They help to separate unwanted ingredients from the food.</b>	<input type="checkbox"/>	<input type="checkbox"/>

**[2]**



**(ii) Antioxidants are added to some foods.**

**Explain why.**

**Your answer should include**

- the type of food that antioxidants are added to**
- why it is necessary to add antioxidants to this type of food**
- what reaction they prevent.**

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**[3]**

**(b) Some food additives are given E numbers.**

**Which of these statements about food additives with E numbers are correct?**

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

**They have passed a safety test.**

**It is impossible for them to do you any harm.**

**They cannot be used in food for children.**

**Only food colourings have E numbers.**

**They are approved for use in the European Union.**

**[2]**

**(c) Even organic food may contain harmful chemicals when it is eaten.**

**Suggest TWO ways that this food may contain harmful chemicals.**

**1. \_\_\_\_\_**

**2. \_\_\_\_\_ [2]**

**[Total: 9]**

**6 Modern intensive farming methods use synthetic pesticides and herbicides to increase crop yield.**

**Some of these chemicals may remain on food or get into water supplies.**

**(a) Most people are willing to eat food from crops that have been sprayed with synthetic pesticides and herbicides.**

**Use ideas about risk to explain why they do this.**

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**[2]**

**(b) Some people who only eat food from organic crops apply the PRECAUTIONARY PRINCIPLE.**

**Which two statements, WHEN TAKEN TOGETHER, describe their use of the precautionary principle?**

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

**The residues of pesticides and herbicides left in food are very large.**

**We are not sure whether synthetic pesticide and herbicide residues in food may be harmful.**

**The chemicals used in pesticides and herbicides are very poisonous.**

**Pesticides and herbicides can be harmful to the environment.**

**Organic farming methods do not use synthetic pesticides and herbicides.**

**Pesticides and herbicides are made using chemicals from crude oil.**

**[2]**

**[Total: 4]**

**END OF QUESTION PAPER**

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