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Thursday 26 January 2012 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE CHEMISTRY A

A321/02 Unit 1: C1 C2 C3 (Higher Tier)

A313580112

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)

Duration: 40 minutes

A321102

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. 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).
- Do **not** write in the bar codes.

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 printed on the back page.
- This document consists of **12** pages. Any blank pages are indicated.

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.

	concentration of carbon particulates in µg/m^3						
	sample 1	sample 2	sample 3	sample 4	sample 5	sample 6	best estimate
Town **A**	13	11	14	10	12	24	
Town **B**	64	66	66	65	67	68	66

(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 = ... µg/m^3 **[2]**

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

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

.....

.....

.....

..... **[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_2, and water, H_2O.

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.

	elements		
	carbon	hydrogen	oxygen
total number of atoms in reactants	3		
total number of atoms in products	3		

[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.

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

(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.

	true	**false**
They help to mix ingredients together.	☐	☐
They prevent the growth of harmful microbes.	☐	☐
They reduce the amount of sugar in the food.	☐	☐
They prevent ingredients such as oil and water from separating.	☐	☐
They help to separate unwanted ingredients from the food.	☐	☐

[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.

.....

.....

.....

..... **[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.

.....

.....

.....

..... **[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

PLEASE DO NOT WRITE ON THIS PAGE

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
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.