OCR
RECOGNISING ACHIEVEMENT

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A
Unit 1 Modules C1 C2 C3
HIGHER TIER
THURSDAY 21 JUNE 2007

H **A321/02**

Afternoon
Time: 40 minutes

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T43357

Candidate Name

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	6	
2	7	
3	9	
4	6	
5	9	
6	5	
TOTAL	42	

This document consists of **18** printed pages and **2** blank pages.

[Turn over

Answer **all** the questions.

1 Read this article about diabetes.

Number of diabetes cases rises

More than 2 million people in the UK now have diabetes. Experts blame the growing obesity problem for the increase in the number of people who have this condition. About 75% of all cases are type 2 diabetes and 25% are type 1.

More than 65% of men and 55% of women in the UK are overweight or obese, which is a major cause of type 2 diabetes. Experts blame an increase in obesity on the high levels of sugar and fat in the diets of many people.

There has been a large increase in the number of children with type 2 diabetes. Very few children had type 2 diabetes a decade ago.

Diabetes is a serious illness. People with diabetes must get the care and education they need because diabetes can lead to heart disease, strokes, kidney disease, amputations and blindness.

(a) The table gives information about the two types of diabetes.

Put ticks (✓) in the correct boxes to show whether each of the statements best applies to type 1 **or** type 2 diabetes.

statement	type 1 diabetes	type 2 diabetes
controlled by insulin injections		
controlled by diet and exercise		
usually occurs in people over 50		
the body no longer responds to its own insulin		

[3]

(b) (i) When thinking about their diet and health, people need to decide what they will and will not eat on the basis of the risk involved.

What information do they need to make this assessment of risk with respect to diabetes and the amount of fat and sugar in their diet?

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

the consequences of contracting diabetes	☐
the different treatments for type 1 and type 2 diabetes	☐
the percentage of people with type 2 diabetes compared with type 1	☐
the chance of diabetes occurring in people with a high fat and sugar diet	☐

[1]

(ii) Many people continue to eat a poor diet, despite the increased chance of getting diabetes.

Which of these statements offer reasons for why people are willing to take this risk?

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

Most people are not overweight.	☐
Diabetes is not a serious illness.	☐
Most people will not get diabetes.	☐
Poor diet does not cause diabetes.	☐
Most people are not aware of how serious diabetes is.	☐

[2]

[Total: 6]

2 Sam and Zoe are shopping in a supermarket.

Sam looks at the ingredients on the label of a packet of 'instant' onion soup.

(a) When soup powder is mixed with hot water, the ingredients may separate. The emulsifier stops this happening.

Which substances in the soup are likely to separate if no emulsifier is present?

Put a (ring) around the **two** best answers.

flavour **enhancer** **preservative** **starch** **vegetable oil** **water**

[2]

(b) Zoe says that they should buy fresh onions and use them to make soup.

She says that this soup will contain fewer harmful additives.

(i) Sam says that additives with an E number are safe to eat.

Which of these statements suggests he may be correct?

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

Additives with an E number have passed a safety test.	☐
Additives with an E number have been used for many years.	☐
Additives with an E number are approved for use in the UK and Europe.	☐
Additives with an E number cause problems for people with food allergies.	☐

[1]

(ii) Zoe says that they should buy organically grown vegetables because these contain no harmful chemicals.

She says that other farmers may use pesticides that remain in the onions.

Organic farmers do not use pesticides. What other chemicals are **not** used by organic farmers?

Put a (ring) around the **two** best answers.

lime **manure** **synthetic fertilizer** **weedkiller**

[1]

(c) Zoe and Sam read an article about plans to help farmers in developing countries.

Richer countries send synthetic fertilizer to help these farmers grow more food.

Zoe says that synthetic fertilizer will harm the soil structure, and that it is better to use manure. She says that farmers in developing countries should grow crops organically.

(i) Why is it not practical (technically feasible) to send manure to developing countries?

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

Large quantities of manure will discourage the growth of crops.	☐
For the same quantity of nutrients, manure is heavier and bulkier to transport.	☐
Manure does not contain the essential nutrients that are provided by synthetic fertilizer.	☐
It is not possible to produce enough manure to give the quantity of nutrients provided by synthetic fertilizer.	☐

[1]

(ii) In the UK, the number of farmers growing crops organically using manure instead of synthetic fertilizer is increasing.

In developing countries, the number of farmers using synthetic fertilizer instead of manure is increasing.

Which **two** of the following statements can be **put together** to explain this difference?

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

People in the UK have more information about food that is grown organically.	☐
Farmers in the UK are more interested in making a profit than in growing food that is good for health.	☐
Farmers in the developing countries are more interested in making a profit than growing food that is good for health.	☐
People in the UK have plenty of food available and many more are becoming interested in eating food that is good for health.	☐
People in developing countries may have food shortages and are more interested in getting enough food than whether it is organically grown.	☐

[2]

[Total: 7]

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QUESTION 3 STARTS ON PAGE 8

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3 In February 2003 a traffic Congestion Charging Scheme (CCS) was introduced in London.

Drivers have to pay if their vehicles enter central London.

These tables show how the traffic and the air quality in central London changed from 2002 to 2003.

type of vehicle	change in distance travelled
cars	29% decrease
buses	20% increase
motorcycles	3% increase
lorries	11% decrease
taxis	13% increase

type of pollution	change in air quality
carbon dioxide	20% decrease
nitrogen dioxide	16% decrease
particulates	16% decrease

(a) (i) After the Congestion Charging Scheme (CCS) was introduced, the types of vehicles traveling to central London changed.

Which statements describe the changes?

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

The number of lorries decreased more than the number of cars.	☐
The number of taxis increased more than the number of buses.	☐
The number of cars decreased more than the number of lorries.	☐
The number of cars and motorcycles decreased, and the number of taxis increased.	☐
The number of cars and lorries decreased, and the number of buses increased.	☐
The number of motorcycles and lorries decreased, and the number of buses increased.	☐

[2]

(ii) Which of these statements describes how the air quality changed after the CCS was introduced?

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

Carbon dioxide, nitrogen dioxide and particulates all increased.	☐
Carbon dioxide decreased more than nitrogen dioxide and particulates.	☐
Carbon dioxide increased, but nitrogen dioxide and particulates decreased.	☐
Carbon dioxide, nitrogen dioxide and particulates all decreased by the same amount.	☐

[1]

(iii) What does the data in the tables show about air pollution in central London?

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

Cars are the main cause of air pollution.	☐
Cars cause more air pollution than buses.	☐
There is no correlation between the decrease in distance travelled by cars and reduction in air pollution.	☐
There is a correlation between the decrease in distance travelled by cars and reduction in air pollution.	☐

[1]

(iv) The distance travelled by buses and taxis increased after CCS was introduced.

How may this have helped to reduce air pollution?

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

Buses and taxis use less fuel per kilometre than cars.	☐
Buses and taxis now travel a greater number of kilometres.	☐
Buses and taxis carry more people in each vehicle than cars.	☐
Buses and taxis do not give out carbon dioxide, nitrogen dioxide and particulates.	☐

[1]

(b) Draw lines to join one box from each of the lists **A**, **B** and **C** below to show how nitrogen dioxide is formed when a motor vehicle is driven.

A	B	C
nitrogen and oxygen from air react with each other	nitrogen dioxide is formed in the engine	this is reduced by nitrogen in air to make nitrogen dioxide
nitrogen from petrol reacts with oxygen from air	nitrogen monoxide is formed in the engine	this is released into the air
nitrogen and oxygen from petrol react with each other	dinitrogen monoxide is formed in the engine	this is oxidised by oxygen in the air to make nitrogen dioxide

[3]

(c) Carbon dioxide and nitrogen oxides produced by vehicles do not stay in the air.

Which of these statements describes one way that **both** of these gases are removed from the air?

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

They are both lost into space. ☐

They both dissolve in rain water. ☐

They are both deposited on surfaces, making them dirty. ☐

They are both used by plants in the process of photosynthesis. ☐

[1]

[Total: 9]

4 Many power stations burn natural gas to generate electricity.

Natural gas contains methane, which is made of hydrogen and carbon atoms only.

(a) What scientific term can be used to describe a compound that is made of hydrogen and carbon atoms only?

..... [1]

(b) When methane burns **completely** in air, the hydrogen and carbon atoms combine with oxygen to form products.

What are the names of these products?

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

(c) When methane burns with an insufficient supply of air, carbon monoxide is formed.

When carbon monoxide mixes with more air, it is oxidised to carbon dioxide.

Complete the diagram to show this oxidation reaction.

[3]

[Total: 6]

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QUESTION 5 STARTS ON PAGE 14

PLEASE DO NOT WRITE ON THIS PAGE

5 Scientists working for a plastics company test samples of poly(ethene) to see how much they stretch before breaking.

They measure what percentage of the original length each sample will stretch to.

Their results are shown in the table.

sample	1	2	3	4	5	6	7
percentage (%)	237	293	243	242	238	239	241

(a) The scientists got a best estimate for the stretching of this poly(ethene) by working out the mean (average) of these results.

They did not include the result for sample 2 when they made this calculation.

(i) What term can be used to describe the result for sample 2?

..... [1]

(ii) Work out the mean (average) of the other six results.

mean = ... [1]

(b) The scientists carried out a similar test on another type of poly(ethene).

sample	1	2	3	4	5	6	7
percentage (%)	299	295	294	300	298	296	297

They get a best estimate of 297 for the stretching of this second type of poly(ethene) by working out the mean (average) of all seven results.

(i) This time the scientists used all seven results to work out the mean.

Why did they **not** discard any of the results?

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

All of the results fit into a narrow range. ☐

The scientists used fair testing this time. ☐

This second type of poly(ethene) stretched more than the first type. ☐

This set of results was more accurate than those for the first type of poly(ethene). ☐

[1]

(ii) For the second type of poly(ethene), the scientists used the same set of apparatus and made sure that the measurements were carried out at the same temperature as for the first type of poly(ethene).

Why did they do this?

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

To make the tests easier to carry out.	☐
To make sure that the measurements were as accurate as possible.	☐
To make sure that all of the variables likely to affect the outcome were controlled.	☐
To make sure that the type of poly(ethene) was the only variable likely to affect the outcome.	☐

[1]

(iii) The scientists decide that there is a **real difference** between the stretching properties of the two types of poly(ethene).

What shows that this is true?

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

The ranges for the two types of poly(ethene) do not overlap.	☐
The sets of results for the two types of poly(ethene) are different.	☐
The first type of poly(ethene) has a different range to the second type of poly(ethene).	☐
The first type of poly(ethene) has a different mean to the second type of poly(ethene).	☐
The mean for the second type of poly(ethene) does not lie within the range for the first type of poly(ethene).	☐

[2]

(c) This poly(ethene) is used to make cling film.

Cling film can be used to wrap up food such as sandwiches.

Before cling film was invented, sandwiches were usually put into paper bags.

(i) The use of paper bags is sustainable.

Which **two** of the following statements can be **put together** to explain this?

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

Paper is made from trees.	☐
Paper can be made in different colours.	☐
Most waste paper is dumped in landfill sites.	☐
Waste paper can be burned to generate electricity.	☐
Paper is used to make books, newspapers and magazines.	☐
When a tree is cut down, another can be planted to replace it.	☐

[1]

(ii) The Life Cycle Assessments (LCAs) for sandwich wrapping made from poly(ethene) and from paper are different.

Choose the **two** rows of information in this table that show why these LCAs are different.

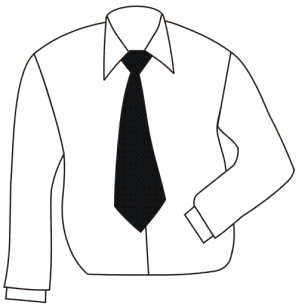
Put ticks (✓) next to the **two** correct rows.

poly(ethene)	paper	tick (✓) two rows
used for the past 50 years	used for hundreds of years	
non-biodegradable	biodegradable	
stretches when pulled hard	breaks when pulled hard	
transparent	opaque	
made from crude oil	made from trees	

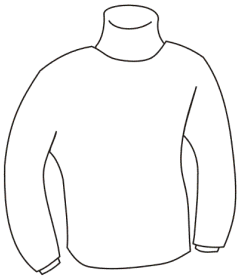
[2]

[Total: 9]

6 A wide variety of fibres can be used to make clothes.



cotton



wool

nylon

The table shows properties of some fibres, and the clothes made from them.

Each property has been scored from 0 (low) to 9 (high).

fibre	**property**				
	stretchiness	**heat insulation**	**water absorbance**	**strength**	**comfort when worn next to skin**
cotton	4	8	9	4	7
PVC	9	2	0	8	1
nylon	9	2	0	9	2
silk	2	4	4	3	9
wool	6	9	4	4	2

(a) Different fibres are used to make different types of clothes. The choice depends on how the clothing will be used and the properties of the fibre.

Draw one straight line from each type of **fibre** to its best **type of clothing**, and another line to the **property** that makes this the best choice.

Type of clothing	**Fibre**	**Property**
tights	cotton	high heat insulation
underwear	nylon	high stretchiness
jumper	wool	high water absorbance

[2]

(b) PVC is very soft and stretchy because it has a plasticizer added to it.

(i) How does the plasticizer make the polymer softer and more stretchy?

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

Plasticizer molecules break bonds in the polymer chains.	☐
Plasticizer molecules make extra links in the polymer chains.	☐
Plasticizer molecules make links between the polymer chains.	☐
Plasticizer molecules reduce the forces of attraction between polymer chains.	☐

[1]

(ii) State **two** other ways to modify the structure of a polymer that will change its properties.

1 .....

2 ..... [2]

[Total: 5]

END OF QUESTION PAPER

Acknowledgements:
Q.1 image © iStockphoto.com / Andrew Hill
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Q.5 image © David N Lees

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.