OCR
RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE CHEMISTRY A

A321/01

Unit 1 Modules C1 C2 C3
(Foundation Tier)

Candidates answer on the question paper
Electronic calculators may be used

OCR Supplied Materials:
None

Other Materials Required:
- Pencil
- Ruler (cm/mm)

Thursday 15 January 2009
Afternoon

Duration: 40 minutes

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use 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.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

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 **16** pages. Any blank pages are indicated.

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

Answer **all** the questions.

1 This question is about gases in the air.

(a) This list contains some of the gases in the air.

argon

carbon monoxide

nitrogen

nitrogen dioxide

oxygen

Complete the table to show which of these gases are present in unpolluted air, and which are present **only** in polluted air.

gases present in unpolluted air	gases present only in polluted air

[3]

(b) Petrol is a fuel that contains hydrocarbons. Hydrocarbons are compounds containing atoms of hydrogen and carbon only.

When petrol burns these carbon and hydrogen atoms combine with atoms from the air. This makes the products carbon dioxide and water.

Complete the table to show where the atoms in each of these two products come from.

product from burning petrol	name of atom from petrol	name of atom from air
carbon dioxide, CO_2		
water, H_2O		

[2]

(c) Carbon dioxide is released into the air when fuels burn.

Which two statements describe how carbon dioxide is **removed** from the air?

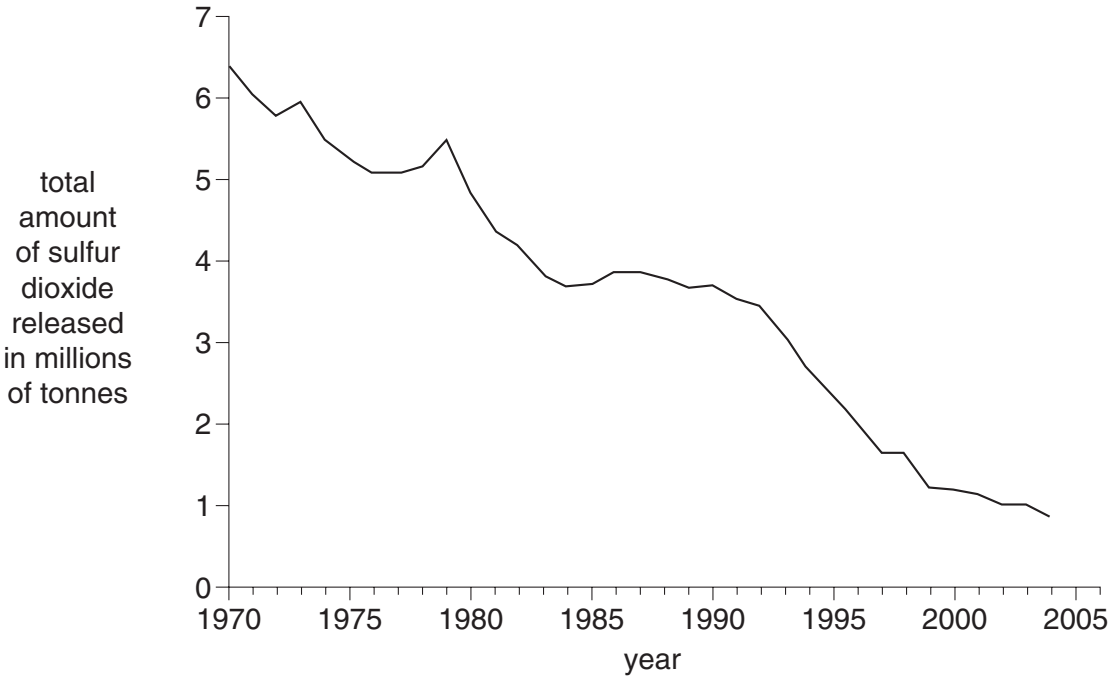
Put ticks (✓) in the boxes next to the **two** best answers.

It is used by plants in photosynthesis.	☐
It is released into outer space.	☐
It dissolves in sea water.	☐
It is deposited on surfaces, making them dirty.	☐

[2]

[Total: 7]

2 Sulfur dioxide is a pollutant gas. The graph shows how much sulfur dioxide was released into the air in the United Kingdom from 1970 to 2004.



Source: Department for Environment, Food and Rural Affairs, www.defra.gov.uk

Sulfur dioxide is released when fossil fuels are burned in power stations. Burning coal releases more sulfur dioxide than burning oil or natural gas.

Since 1970 many coal-burning power stations have been replaced by those burning oil or natural gas.

(a) (i) Which two statements, when put together, show a **correlation** between the number of coal-burning power stations and the amount of sulfur dioxide released into the air?

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

Total sulfur dioxide released decreased from 1970 to 2004. ☐

Total sulfur dioxide released increased from 1970 to 2004. ☐

Total sulfur dioxide released stayed the same from 1970 to 2004. ☐

The number of coal-burning power stations increased from 1970 to 2004. ☐

The number of coal-burning power stations decreased from 1970 to 2004. ☐

The number of coal-burning power stations stayed the same from 1970 to 2004. ☐

[2]

(ii) Power stations burning coal release more sulfur dioxide than power stations burning oil or natural gas.

Put a tick (✓) in the box next to the statement which explains why.

Coal is a solid fuel. ☐

Coal contains more sulfur-containing compounds than oil or natural gas. ☐

Coal burns at a higher temperature than oil or natural gas. ☐

[1]

(iii) What other changes may have caused a **decrease** in the sulfur dioxide released into the air?

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

People used more electricity. ☐

Low-sulfur petrol and diesel fuels were introduced for use in motor vehicles. ☐

The number of motor vehicles increased. ☐

Devices were fitted to remove sulfur dioxide from the flue gases released by coal-burning power stations. ☐

Some nuclear power stations were closed down. ☐

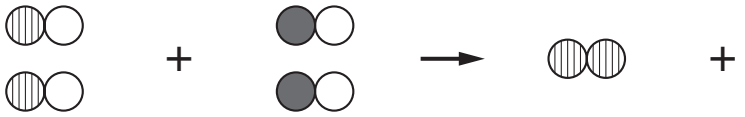
[2]

(b) Catalytic converters reduce the amount of nitrogen monoxide released from car engines.

The following reaction takes place.

nitrogen monoxide + carbon monoxide ⟶ nitrogen + carbon dioxide

Finish the diagram to show this reaction.



nitrogen monoxide		carbon monoxide		nitrogen		carbon dioxide

[2]

[Total: 7]

3 This question is about some of the materials in the world around us.

(a) Some of the materials we use are made from living things but others are synthetic.

Put a (ring) around the three materials which are made from living things.

cotton **glass** **nylon** **silk** **steel** **wool**

[2]

(b) Synthetic materials are now replacing materials made from living things.

Carrier bags are now made of the synthetic material poly(ethene) instead of paper.

Which of these statements describe advantages of using poly(ethene) instead of paper and which describe disadvantages?

Put ticks (✓) in the correct boxes.

statement	**advantage**	**disadvantage**
poly(ethene) is stronger than paper		
poly(ethene) gives off poisonous fumes when burned		
poly(ethene) is waterproof		
poly(ethene) is more flexible than paper		
poly(ethene) does not rot when thrown away		

[3]

(c) Some materials are single chemicals but others are mixtures of chemicals.

Put ticks (✓) in the correct boxes to show which of these materials are single chemicals and which are mixtures of chemicals.

material	**single chemical**	**mixture**
iron		
milk		
wood		
pure water		

[2]

[Total: 7]

4 Three technicians test the hardness of samples of the **same** type of rubber. They use identical apparatus and method.

A metal cylinder is pushed into a rubber sample. The depth it sinks into the rubber is measured.

Their results are shown in the table.

technician	depth in rubber for each sample in mm				
	sample 1	sample 2	sample 3	sample 4	sample 5
A	12	17	15	10	13
B	11	13	12	11	13
C	12	12	13	7	11

(a) The laboratory supervisor uses results from technician **B** to find the best estimate of the depth.

(i) Why did he **not** use results from technician **A** to calculate a best estimate?

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

The results are too high. ☐

The results are too low. ☐

The range of the results is too large. ☐

The results contain an outlier. ☐

[1]

(ii) The supervisor did not use the results from technician **C** because these results contain an outlier.

Which sample is the outlier?

Put a (ring) around the correct answer.

1 **2** **3** **4** **5**

[1]

(iii) Use the results from technician **B** to find the best estimate of the depth.

Best estimate of the depth = ... mm **[1]**

(iv) Each technician tested five samples of rubber.

Why did they each test more than one sample of rubber?

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

Taking more measurements reduces the effects of random errors.	☐
The technicians were learning how to take the measurements.	☐
A number of measurements are needed to give fair testing.	☐
If they take more measurements the technicians will make fewer errors.	☐
There may be small variations between different samples of the same type of rubber.	☐

[2]

(b) Natural rubber is made from liquid sap from rubber trees.

Synthetic rubber is made from chemicals from crude oil.

Which of these statements explain why the production, use and disposal of natural rubber are more **sustainable** than that of synthetic rubber?

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

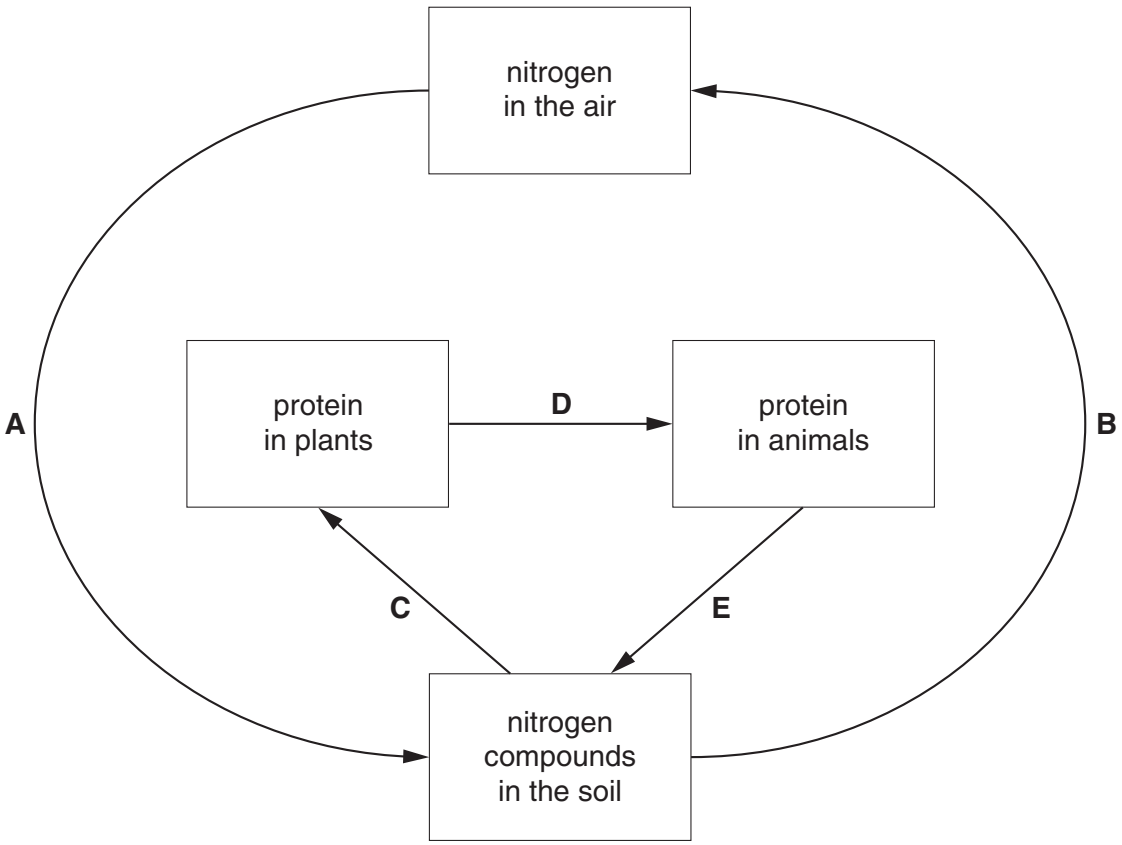
Liquid sap can be taken from the same rubber tree each year.	☐
Only one type of tree produces sap that can be made into rubber.	☐
It is easier to make rubber from liquid sap than from crude oil.	☐
Crude oil is used to make many products other than rubber.	☐
Crude oil is a finite resource.	☐

[2]

[Total: 7]

5 The diagram shows part of the nitrogen cycle.

Changes are labelled **A**, **B**, **C**, **D** and **E**.



(a) Choose the correct letter, **A**, **B**, **C**, **D** or **E**, to answer each of the following questions.

You may use each letter **once**, **more than once or not at all**.

(i) Which change involves decay?

answer ..... **[1]**

(ii) Which change involves bacteria in the roots of plants?

answer ..... **[1]**

(iii) Which change involves lightning in thunder storms?

answer ..... **[1]**

(b) Proteins contain nitrogen and carbon.

What are the other main elements in proteins?

Put a (ring) around each of the **two** correct answers.

argon **calcium** **hydrogen** **iron** **oxygen** **sodium**

[2]

(c) Farmers spread fertiliser on their fields to add nitrogen compounds to the soil.

Which statements describe why this is necessary?

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

Nitrogen compounds in the soil are used up by animals.	☐
When crops are harvested nitrogen is lost from the field.	☐
Liquid nitrogen evaporates from the soil into the air.	☐
With less nitrogen more weeds grow on the land.	☐
With less nitrogen the land becomes less fertile.	☐
With less nitrogen more pests attack the crops.	☐

[2]

[Total: 7]

6 The Food Standards Agency has introduced a 'traffic light' system for manufacturers to label food products.

Labels give the amounts of fat, saturates, sugar and salt per serving of the product.

Colours are used to highlight the amount of each food type present:

- red for high
- amber for medium
- green for low.

Labels may also state the GDA. This is the guideline daily amount for how much of each food type you should eat in a healthy diet.

FOOD STANDARDS AGENCY

	Per serving	GDA
FAT	7.7 g	70 g
SATURATES	2.0 g	20 g
SUGAR	42.4 g	90 g
SALT	2.0 g	6 g

■ HIGH ■ MEDIUM □ LOW

eatwell.gov.uk

(a) A food product contains low levels of fat and saturates, a high level of sugar and a medium level of salt.
What colours should the label have?
Write **red**, **amber** or **green** in each of the boxes.

FAT	
SATURATES	
SUGAR	
SALT	

[1]

(b) What does the GDA show?

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

The amount of each food type in each serving. ☐

The amount of each food type that is in the whole packet. ☐

How much sugar you must eat each day. ☐

The maximum amount of each food type that should be part of a healthy daily diet. ☐

[1]

(c) Diabetes prevents a person controlling the amount of sugar in their blood. Too much or too little sugar in the blood can cause severe health problems, including coma and death.

Many processed foods contain high levels of sugar.

(i) Why may processed foods cause problems for diabetics?

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

The sugar in these products gives diabetics too much energy. ☐

Diabetics do not like sweet-tasting food. ☐

The sugar in these products is quickly absorbed into the diabetics' blood stream. ☐

Eating these products may cause a rapid rise in diabetics' blood sugar level. ☐

All foods that are high in sugar are also high in fat. ☐

[2]

(ii) Diabetics can use the new 'traffic light' labelling system to avoid foods that contain high levels of sugar.

Finish this sentence by putting a (ring) around the correct word in each of the **two** boxes.

Diabetics should not buy foods with a label that is coloured **red / amber / green**

in the box that says **fat / sugar / salt** . **[1]**

(d) What is the role of the Food Standards Agency?

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

It is an independent food safety watchdog. ☐

It is funded by money donated from food manufacturers. ☐

It helps manufacturers to sell more of their food products to the public. ☐

It protects the public's health and consumer interests in relation to food. ☐

[2]

[Total: 7]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE

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Acknowledgements:

Q. 2 Source: Department for Environment, Food and Rural Affairs, www.defra.gov.uk. Crown copyright material is reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland.

Q. 6 Source: Food Standards Agency, www.eatwell.gov.uk. Crown copyright material is reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland.

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.