Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A321/01

TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A

Unit 1: Modules C1 C2 C3 (Foundation Tier)

MONDAY 18 JANUARY 2010: 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

DC (AC/SW) MEP10232 24390/1

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **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.**
- **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.**

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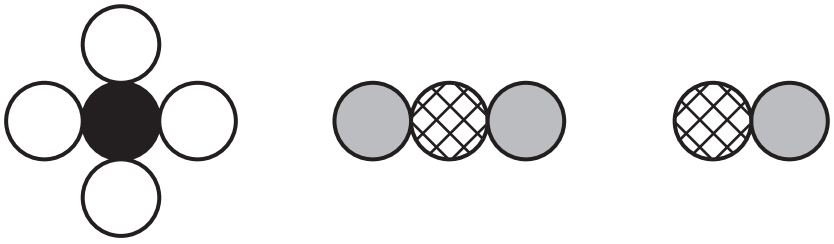
Answer ALL the questions.

1 (a) These diagrams show the atoms in six different molecules.



A **B** **C**

D **E** **F**

key

carbon **hydrogen** **nitrogen**

oxygen **sulfur**

Which of the diagrams, A, B, C, D, E or F, shows a molecule of

(i) carbon monoxide _____ [1]

(ii) nitrogen dioxide _____ [1]

(iii) a hydrocarbon _____ [1]

(iv) an element _____ [1]

(b) Nitrogen dioxide is a pollutant gas.

(i) Which of these statements describe how nitrogen oxides most commonly enter the atmosphere?

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

from air breathed out by animals ☐

from the exhaust of car engines ☐

from oil-burning power stations ☐

from the eruption of volcanoes ☐

[2]

(ii) Nitrogen dioxide does not stay in the atmosphere.

Explain how nitrogen dioxide is removed from the air and why the result may be harmful.

_____

_____

_____

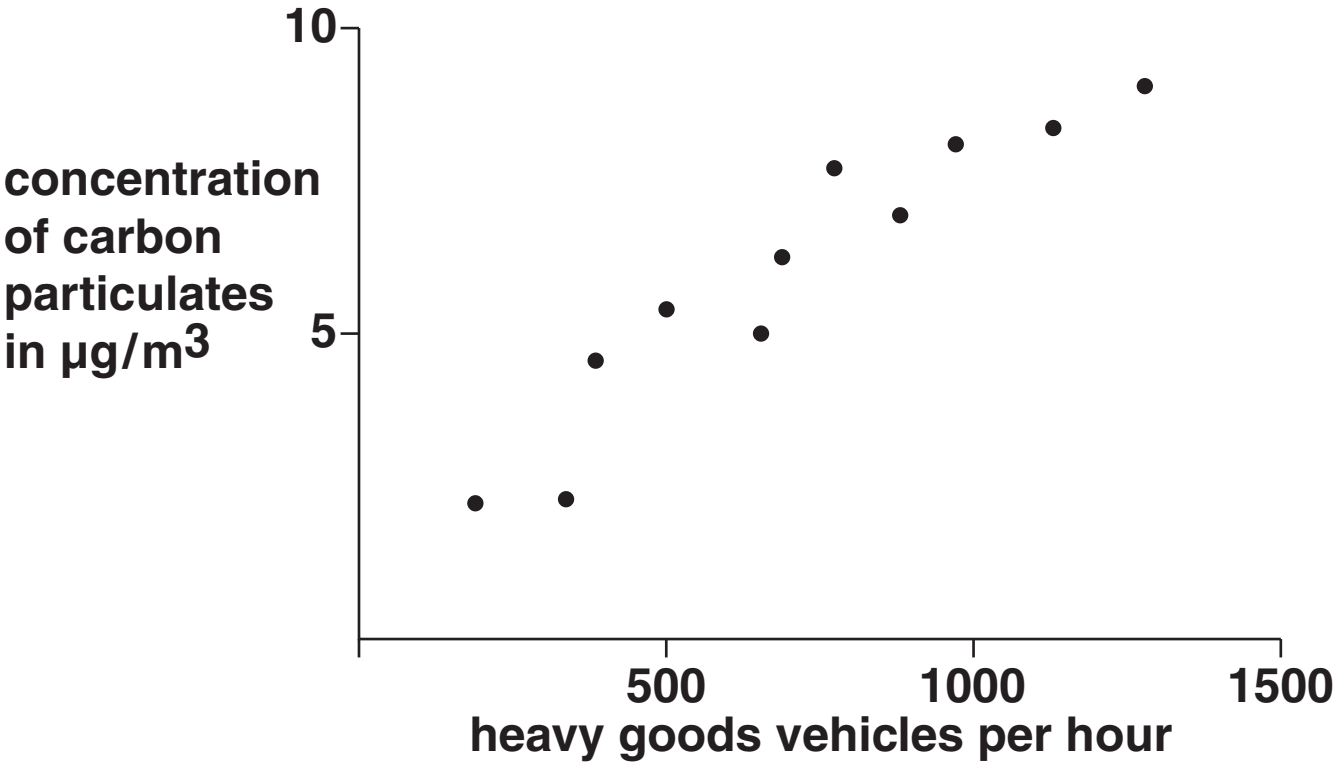
_____ **[3]**

[Total: 9]

2 Black carbon pollution is caused by very small carbon particulates in the air.

Some scientists measure the concentration of carbon particulates in the air beside a motorway. They also count the number of heavy goods vehicles passing along the motorway.

Their results are shown on this scatter graph.



(a) What trend is shown by the scatter graph?

_____

_____ **[1]**

(b) (i) Why is it NOT possible to use these results to prove that the carbon particulates came from the heavy goods vehicles?

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

A pattern in the results does not prove a cause. ☐

The equipment used by the scientists may be faulty. ☐

The scientists may have miscounted the heavy goods vehicles. ☐

The scientists only measured particulates made of carbon. ☐

There may be other explanations for the observed results. ☐

[2]

(ii) The concentration of carbon particulates in the air measured in this investigation may be affected by other factors.

Put ticks (✓) in the correct boxes to show whether each factor is <u>LIKELY TO</u> or is <u>NOT LIKELY TO</u> affect this outcome.

	LIKELY TO AFFECT CONCENTRATION OF CARBON PARTICULATES MEASURED	NOT LIKELY TO AFFECT CONCENTRATION OF CARBON PARTICULATES MEASURED
The direction of the wind.		
How close to the motorway the measurements are made.		
Whether the sun is shining.		
The number of cars passing by.		

[2]

[Total: 5]

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3 Vulcanisation is a process that has been used for many years to make natural rubber harder.

Scientists develop a new process for hardening rubber.

They test the hardness of this rubber by measuring the force needed to push a metal pin through several samples.

They use the same test on samples of natural rubber, vulcanised rubber and new process rubber.

All of the rubber samples are the same shape and size.

Their results are shown in the table opposite.

TYPE OF RUBBER	FORCE NEEDED TO PUSH PIN THROUGH SAMPLE IN kN					
	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5	SAMPLE 6
natural rubber	4	6	8	7	2	9
vulcanised rubber	24	21	24	23	22	24
new process rubber	28	11	24	27	26	25

(a) The scientists decide to repeat their tests on NATURAL RUBBER.

Which statement gives the BEST reason for this?

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

The results are not high enough. ☐

The range of the results is too large. ☐

The results contain an outlier. ☐

The mean for the results is too low. ☐

[1]

(b) (i) The scientists work out the mean for NEW PROCESS RUBBER to be 26.

They use this as their best estimate for the hardness of this rubber.

They use only five of the six results to work out the mean.

Suggest which result they do NOT use.

the result for sample _____ [1]

(ii) Why do they not use this result?

Put a tick (✓) in the box next to the <u>BEST</u> answer.

They only need five results to calculate the mean. ☐

It is easier to divide by five than by six. ☐

This result is very different from the other results. ☐

This result falls within the range for natural rubber. ☐

[1]

(c) Give a best estimate for the hardness of <u>VULCANISED RUBBER</u> by working out the mean for this set of results.

mean = _____ kN [1]

(d) (i) Natural rubber is a polymer.

During vulcanisation, sulfur reacts with the polymer chains in the rubber.

Suggest how this reaction with sulfur increases the hardness of rubber.

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

It makes the polymer chains shorter. ☐

It lowers the melting point. ☐

It pushes the polymer chains further apart. ☐

It forms strong bonds between the polymer chains. ☐

[1]

(ii) The new process for making natural rubber harder works in a different way to vulcanisation.

Which of these statements could explain how the new process makes natural rubber harder?

Put a tick (✓) in the box next to the <u>BEST</u> answer.

It decreases the cross-linking between polymer chains. ☐

It adds plasticizer to the polymer chains. ☐

It increases the length of the polymer chains. ☐

It changes the small molecules used to make the polymer chains. ☐

[1]

[Total: 6]

4 Different materials are used to make bags to carry food.

(a) (i) What features of the Life Cycle Assessment for a paper bag are different from those for a plastic bag?

Put ticks (✓) in the boxes next to the <u>THREE</u> best answers.

The energy used to make the material.	☐
The energy used to make bags from the material.	☐
The energy used to transport the same mass of bags.	☐
The environmental impact of using the bags.	☐
The environmental impact of disposing of the bags.	☐

[2]

(ii) Plastic bags cause more harm to the environment than paper bags.

Which TWO statements explain why?

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

Plastic decomposes very slowly. ☐

Plastic bags cause more harm to the environment than paper bags. ☐

Plastic bags stretch, so they cannot be used to carry heavy objects. ☐

Paper is attacked by bacteria and rots away. ☐

Paper bags are large, and so hold a lot of groceries. ☐

[2]

(iii) In the UK, most supermarkets use plastic bags instead of paper bags.

Suggest why.

_____

_____ **[1]**

(b) A supermarket chain recently announced that it will no longer be giving its customers plastic bags.

Suggest three benefits of a ban on the use of plastic bags.

_____

_____

_____

_____

_____ **[3]**

[Total: 8]

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5 Organic farming uses different methods to those used in intensive farming.

(a) Draw a line from each FARMING METHOD to the correct TYPE OF FARMING.

FARMING METHOD	TYPE OF FARMING
pull out weeds by hand	
use pesticides to kill pests	organic farming
use predators to kill pests	intensive farming
use herbicides to kill weeds	

[3]

(b) Organic farming methods use manure from animals as a fertiliser.

Intensive farming methods use synthetic fertiliser made using energy from fossil fuels.

Some farmers have changed from intensive farming to organic farming. These farmers think that the change is a SUSTAINABLE DEVELOPMENT.

(i) What is meant by the term sustainable development?

_____

_____

_____ **[2]**

(ii) Suggest TWO reasons why organic farming may be more sustainable than intensive farming.

_____

_____

_____

_____ **[2]**

[Total: 7]

6 Sodium benzoate is added to many soft drinks, such as cola, as a preservative.

(a) Why is sodium benzoate added to soft drinks?

Put a tick (✓) in the box next to the <u>BEST</u> answer.

It makes the drink look more attractive. ☐

It gives the drink a longer shelf life. ☐

It makes the drink taste better. ☐

[1]

(b) The Food Standards Agency (FSA) approves the use of sodium benzoate, E211, in the UK.

(i) The following statements are about the Food Standards Agency.

Put ticks (✓) in the correct boxes to show which statements are TRUE and which are FALSE.

	TRUE	FALSE
The FSA is an independent food safety watchdog.	☐	☐
The FSA is funded by major food manufacturers.	☐	☐
The FSA protects the public's health in relation to food.	☐	☐
The FSA was set up by an Act of Parliament.	☐	☐

[2]

(ii) Sodium benzoate has the number E211. What does this mean?

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

Sodium benzoate should not be used in food products.	☐
Sodium benzoate has passed a safety test.	☐
Sodium benzoate has been approved for use in the EU.	☐
Sodium benzoate is safe to use at any concentration.	☐
Sodium benzoate can only be used in drinks.	☐

[2]

(c) Some people are worried about soft drinks that contain sodium benzoate.

Which TWO of these statements suggest that sodium benzoate in soft drinks does not pose a significant health risk?

Put ticks (✓) in the boxes next to the TWO BEST statements.

Little research has been carried out on the effects of sodium benzoate on health.	☐
Sodium benzoate is found naturally in some fruits.	☐
Soft drinks contain much lower concentrations of sodium benzoate than some food.	☐
Sodium benzoate has been added to soft drinks for many years.	☐
You would have to drink about ten litres of soft drinks to exceed the maximum recommended dose of sodium benzoate in one litre of drinking water.	☐

[2]

[Total: 7]

END OF QUESTION PAPER

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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.