

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A

UNIT 1 – Modules C1 C2 C3 (Higher Tier)

SAMPLE ASSESSMENT MATERIALS
(from 2010 onwards)

Time: 40 minutes

Candidates answer on the question paper

Additional materials (enclosed):

None

Calculators may be used.

Additional materials: Pencil
 Ruler (cm/mm)

Candidate
Forename

Candidate
Surname

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name 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 you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question 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.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	6	
2	4	
3	4	
4	4	
5	10	
6	4	
7	7	
8	3	
TOTAL	42	

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

Answer **all** the questions.

- 1 Cars on motorways use the right hand lane for overtaking. The left hand lanes are used for slower vehicles.

From 2007, car pool lanes will be introduced on some motorways.

Only cars with two or more people in them will be allowed to drive in the right hand lane.



- (a) The effect of car pool lanes is beneficial to those who use them and to the environment.

Here are **six** statements about the effects of car pool lanes.

A	Less fossil fuel will be extracted.
B	There will be traffic jams in the left hand lanes.
C	Journeys to work will be cheaper.
D	It will be dangerous to drive in the right hand lane.
E	There will be less air pollution.
F	Journeys to work will be faster.

- (i) Which **two** statements from **A, B, C, D, E** or **F** benefit **only** those who use car pool lanes?

answer and [1]

- (ii) Which **two** statements from **A, B, C, D, E** or **F** benefit the environment?

answer and [1]

(b) The exhaust fumes from cars cause pollution.

Nitrogen dioxide is a pollutant gas in the air that results from car exhaust fumes.

Explain how this pollutant gas is formed as a car is driven.

.....

.....

.....

.....

.....

.....

.....

.....

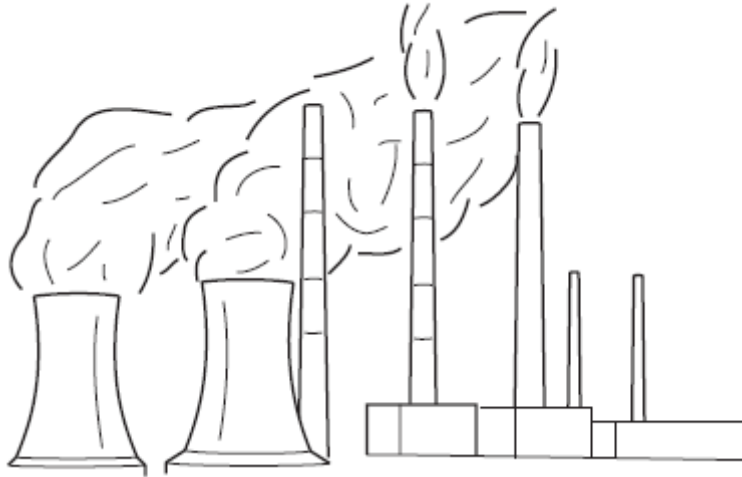
.....

.....

[4]

[Total: 6]

2 This question is about pollution from power stations.



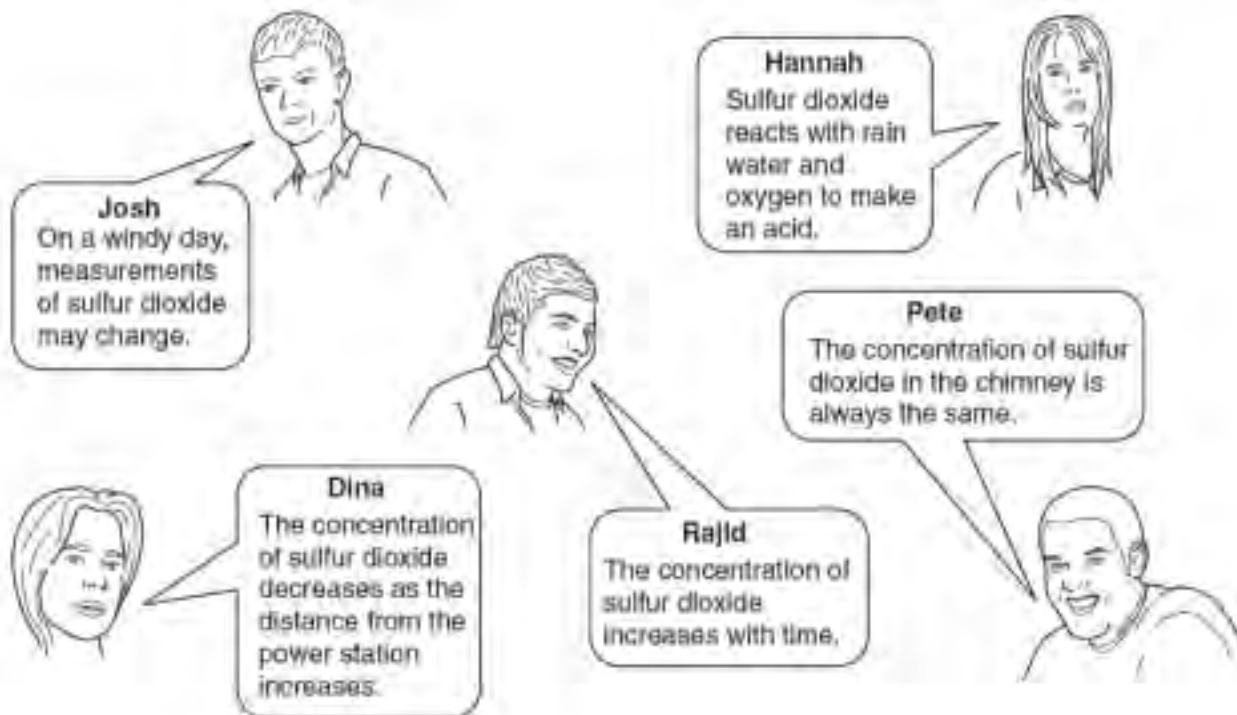
One of the pollutants from power stations is sulfur dioxide.

Sulfur dioxide levels are measured at different distances from a power station. The table shows the results on one day.

distance from power station m	concentration of sulfur dioxide $\mu\text{g} / \text{m}^3$
0	64
500	50
1000	14
1500	8
2000	3

Levels of sulfur dioxide higher than $50 \mu\text{g} / \text{m}^3$ are considered harmful to humans.

Here is what five students said about the data in the table.



(a) Which **one** person has described the correlation in the table?

..... [1]

(b) On another day, the concentrations of sulfur dioxide are lower.

Which **two** people have suggested explanations for this change?

.....[2]

(c) Who has explained how sulfur dioxide is removed from the air?

..... [1]

[Total: 4]

3 This question is about chemical reactions.

Petrol is a liquid fuel. In a car engine, it burns in oxygen from the air to transfer energy.

The products of this reaction are carbon dioxide and water vapour.

Carbon dioxide and water vapour are gases.

(a) Which of the following statements show that the properties of **reactants** are different from properties of **products** of this reaction?

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

Petrol is a liquid and oxygen is a gas.

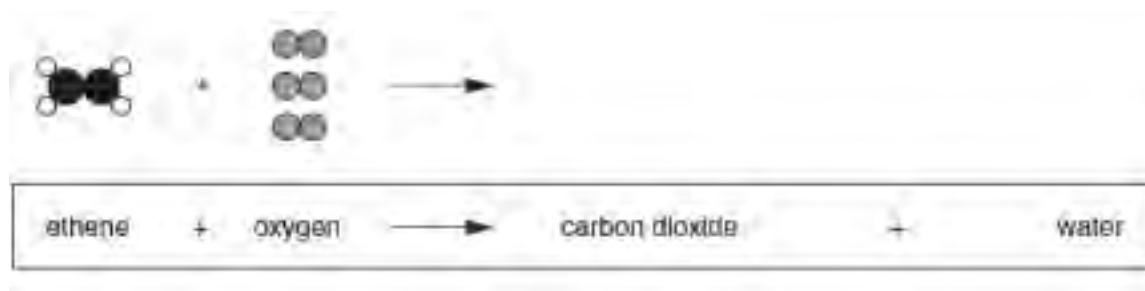
Petrol is a liquid and carbon dioxide and water vapour are gases.




Water vapour condenses in the air.

Petrol burns while carbon dioxide and water vapour do not.

[1]

(b) Complete the diagram below to show the products made when the hydrocarbon ethene is burned in oxygen.



key	
	carbon atom
	hydrogen atom
	oxygen atom

[3]

Total [4]

BLANK PAGE

Question 4 begins on page 8.

PLEASE DO NOT WRITE ON THIS PAGE

4 A supermarket is encouraging customers to re-use plastic carrier bags.

These carrier bags are made of polythene.

(a) Finish each sentence about polythene.

(i) The raw material used to make polythene is [1]

(ii) The process of forming long chains by joining small molecules is called
..... [1]

(b) Some scientists believe that incineration is a better way of disposing of plastic bags than landfill.

Which **two** of the following statements when **put together** explain why **incineration** has less environmental impact than **landfill**?

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

They are burned at high temperatures.

The energy made when they burn is wasted.

The need for burning fuel from crude oil is reduced.

Incinerators need energy to be built.

The waste has to be collected.

The energy made when they burn is used.

[1]

(c) It is possible to make **biodegradable** plastic bags.

What is the advantage of biodegradable plastic bags?

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

There is no need to take them to landfill.

Carbon dioxide is released as the bags biodegrade.

They take up space in landfill but then rot away.

They don't take up space in landfill.

[1]

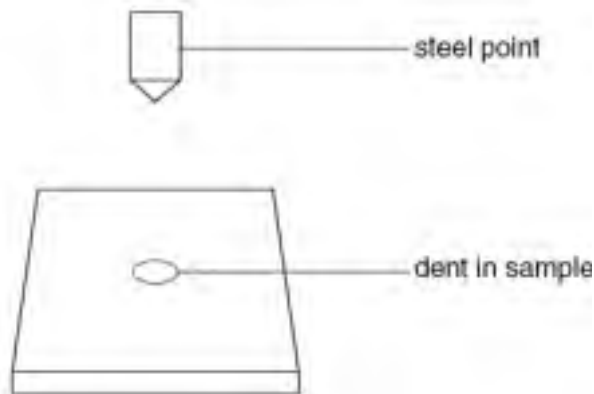
[Total: 4]

5 A scientist measures the hardness of two different materials, **X** and **Y**.

A machine presses a steel point into samples of each material.

The machine uses the same force each time.

A hardness number is calculated from the size of the dent in the sample: the higher the number the harder the material.



(a) Each type of material is tested several times. The results are shown in the table.

	hardness number						
material	sample 1	sample 2	sample 3	sample 4	sample 5	sample 6	mean
X	8	10	9	8	7	12	9
Y	18	20	16	7	21	20	19

The mean hardness has been calculated for each material.

One result has not been used to calculate the mean for **material Y** because it is an outlier.

(i) Which result is the outlier?

Put a ring around the correct sample number.

1
2
3
4
5
6
[1]

(ii) Suggest reasons why this test gave the wrong result.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[4]

- (b) All the test results for material X are reliable, but there are small differences between their values.

Why are these values different?

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

- Samples of X and Y had been mixed up.
- Samples of X may vary.
- It is not a fair test.
- The steel point had not been pressed into the samples.

[1]

- (c) Complete the table below to show the range of hardness number for material X.

	range
range for X to

[1]

- (d) Five students are discussing whether there is a **real difference** in the hardness of the two materials.

Here is what they say.

Sam
There is a real difference because the mean value for Y is bigger than that for X.

Anna
There is a real difference. The ranges of X and Y do not overlap.

Lisa
There is no real difference. The outlier is within the range of material X.

Mel
There is no real difference. The mean of X is within the range of Y.

Brett
There is a real difference because you ignore the outlier.

Who is giving the right answer **and** the right explanation for this answer?

..... [1]

(e) Material Y is a polymer with cross-links in it.

These cross-links make the polymer stronger.

(i) Which of the following statements explains this?

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

Larger atoms are used to make the cross-links.

The polymer molecules slide over each other more easily.

Cross-links make the polymer molecules longer.

The polymer molecules cannot slide past each other.

[1]

(ii) Cross-linking also gives the polymer a higher melting point.

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

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

Cross-links make strong forces inside molecules.

Cross-links make strong forces between molecules.

More energy is needed to break up each polymer molecule.

Cross-links put different atoms into polymer molecules.

More energy is needed to break the polymer molecules apart from each other.

[1]

[Total: 10]

BLANK PAGE

Question 6 starts on page 14.

PLEASE DO NOT WRITE ON THIS PAGE

6 Read this article from a national newspaper.

There will be no more blue Smarties

The manufacturer is removing all artificial colours from Smarties. There is no natural alternative to the blue chemical used now.

The blue will be replaced by a white Smartie.

A recent study showed a possible harmful effect on the nervous system due to artificial colours and chemicals.

The blue colouring may cause hyperactivity and skin rashes. It is also listed as a cancer risk by the US Environmental Protection Agency.

A scientist said 'It is great news for children's health. We would now like to see the Government announce a total ban on the blue colouring.'



© iStockphoto.com / RA Photograph

(a) Why are blue Smarties no longer being made?

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

Eating a blue Smartie will give all children a rash.

All children who eat blue Smarties will develop health problems.

The blue colouring may make some children hyperactive.

All artificial additives will harm children.

[1]

(b) Why would the scientist like to see the Government ban the blue colour?

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

To stop blue Smarties from being made.

The blue colour is used in other foods.

So the risk can be measured.

To make Smarties cheaper.

To reduce the risk to children's health.

[1]

(c) Many artificial food colours have an E number.

What does having an E number tell you about an artificial food colour?

.....

.....

.....

..... [2]

[Total: 4]

7 The Government is worried about the increase in childhood obesity.

The number of 2 to 11 year olds who are obese has risen steadily over the past 10 years, and there is a known link between obesity and type 2 diabetes.

(a) Politicians want to pass laws to help reduce childhood obesity.

The lists show some possible **actions** by the Government and the **results** they hope to achieve.

Draw a straight line from each **action** to the matching **result**.

action	result
banning chocolate machines from schools	children won't know it is available.
banning junk food advertising	children will get better food at home.
educating new parents on nutrition	no-one will be able to buy unhealthy food from shops.
setting nutritional standards for school dinners	at least one meal a day will be of good standard.
	these foods will be less easily available.

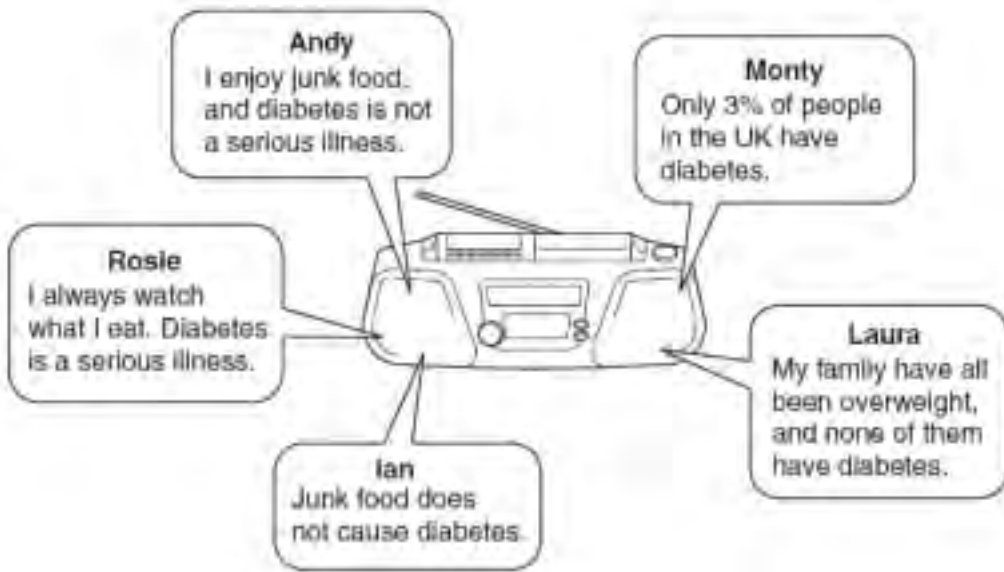
[3]

(b) Being overweight is a leading risk factor for type 2 diabetes.

(i) What information do you need to assess the risk to children of contracting type 2 diabetes as a result of being obese?

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

(ii) Five people are interviewed on a radio programme about their health and diet. Here is what they say.



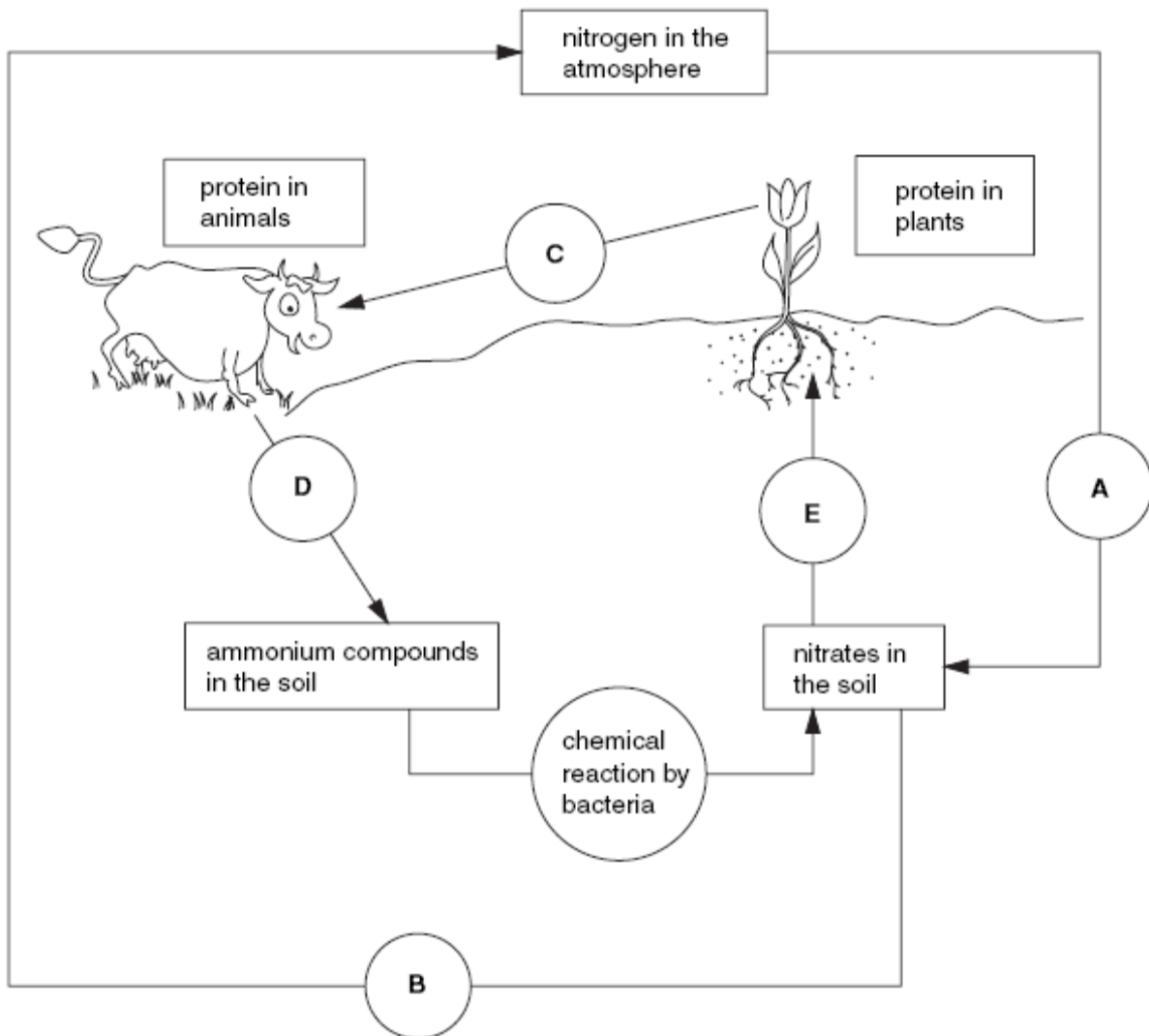
Which people are giving a reason to accept the risk of eating a poor diet?

answer and [2]

[Total: 7]

8 This question is about the nitrogen cycle.

A simplified diagram of the nitrogen cycle is shown below.



A, B, C, D and E are all processes in the cycle of nitrogen atoms on the earth.

(a) Write down the letters of **two** processes in the cycle which involve the formation of amino acids.

answer and [2]

(b) Process **A** shows nitrogen being taken from the air and put into the ground.

In which **two** ways can this happen?

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

Bacteria in the soil that turn nitrates into nitrogen.

Bacteria in the roots of some plants.

Lightning.

Decomposition.

[1]

[Total: 3]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1

2

3

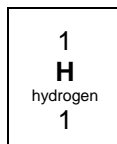
4

5

6

7

0



Key

relative atomic mass
atomic symbol
name
atomic (proton) number

7 Li lithium 3	9 Be beryllium 4
23 Na sodium 11	24 Mg magnesium 12
39 K potassium 19	40 Ca calcium 20
85 Rb rubidium 37	88 Sr strontium 38
133 Cs caesium 55	137 Ba barium 56
[223] Fr francium 87	[226] Ra radium 88

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	
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	
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	
[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	

11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
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
70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86

*** 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

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GCSE Unit

MARK SCHEME

SAMPLE ASSESSMENT MATERIAL
(from 2010 onwards)

Chemistry A (J634)
Modules C1, C2 and C3
Higher Tier

A321/02

Maximum Mark: 42

Guidance for Examiners

Additional Guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, e.g. mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

/	= alternative and acceptable answers for the same marking point
(1)	= separates marking points
not/reject	= answers which are not worthy of credit
ignore	= statements which are irrelevant - applies to neutral answers
allow/accept	= answers that can be accepted
(words)	= words which are not essential to gain credit
<u>words</u>	= underlined words must be present in answer to score a mark
ecf	= error carried forward
AW/owtte	= alternative wording
ORA	= or reverse argument

E.g. mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)

work done = 0 marks

work done lifting = 1 mark

change in potential energy = 0 marks

gravitational potential energy = 1 mark

5. If a candidate alters his/her response, examiners should accept the alteration.
6. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.
7. The list principle:
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

8. Marking method for tick boxes:

Always check the additional guidance.

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.

If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses.

Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

E.g. If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	


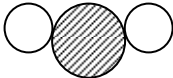


the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	x	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	x		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

Question			Expected Answers	Marks	Rationale
1	a	i	C and F (1)	1	both answers needed for one mark
		ii	A and E (1)	1	both answers needed for one mark

Question		Expected Answers	Marks	Rationale
1	b	<p>[4 marks] Candidate demonstrates a high level of understanding of the reactions of nitrogen and oxygen, both from air, to produce nitrogen monoxide in the car engine. Release of this nitrogen monoxide from car exhaust into the air where it is oxidised by atmospheric oxygen to produce nitrogen dioxide. The answer is expressed clearly and logically.</p> <p>[3 marks] Candidate demonstrates understanding of the reaction of nitrogen and oxygen to produce nitrogen monoxide in the car engine. Release of this nitrogen monoxide from car exhaust into the air where it is converted into nitrogen dioxide. No mention of how nitrogen monoxide is converted into nitrogen dioxide. The answer is expressed clearly and logically.</p> <p>[2 marks] Candidate demonstrates an understanding that there is a reaction of nitrogen and oxygen to produce nitrogen monoxide, which then forms nitrogen dioxide. No mention of how or where the reaction of nitrogen monoxide to nitrogen dioxide takes place. The answer is expressed clearly and logically.</p> <p>[1 mark] Candidate shows basic knowledge that Nitrogen and oxygen react to produce nitrogen dioxide, but no details of intermediate formation of nitrogen monoxide. The answer is expressed logically but may lack clarity in expression.</p>	4	<p>allow word equations, e.g.</p> <p>nitrogen + oxygen → nitrogen dioxide</p> <p>nitrogen + oxygen → nitrogen monoxide</p> <p>nitrogen monoxide + oxygen → nitrogen dioxide</p>
		Total	6	

Question		Expected Answers	Marks	Rationale
2	a	Dina (1)	1	More than one response = 0marks
	b	Josh (1) Hannah (1)	2	One mark for each correct answer in EITHER order. If three names given mark answers and deduct 1 mark. 4 names given = 0
	c	Hannah (1)	1	More than one response = 0marks
		Total	4	

Question		Expected Answers	Marks	Rationale
3	a	<p>CO₂ and water vapour are gasses</p> <p>petrol burns</p> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px; text-align: center;">✓</div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px; text-align: center;">✓</div> </div>	1	Ticks in second and fourth boxes required for 1 mark. One tick or any other response = 0 marks.
	b	<p>carbon dioxide drawn (1)</p>  <p>water drawn (1)</p>  <p>two correct water and two correct carbon dioxide molecules drawn (1)</p>	3	<p>For carbon dioxide there must be one black circle in the middle of two shaded circles. The two shaded circles must not touch each other.</p> <p>For water there must be one shaded circle in the middle of two blank circles. The two blank circles must not touch each other.</p> <p>Shapes may be linear or bent.</p> <p>For both diagrams:</p> <p>allow letters in circles like this: </p> <p>allow lines connecting circles like this: </p>
Total			4	

Question			Expected Answers	Marks	Rationale
4	a	i	(crude) oil / alkene / ethene / petroleum / naphtha (1)	1	One mark for any correct answer
		ii	polymerisation / polymerising (1)	1	Reject: polymer.
	b		<p>need for burning fuel is reduced</p> <p>energy made when they burn is used</p> <div style="display: inline-block; vertical-align: middle;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> </div>	1	Ticks in third and sixth boxes required for 1 mark. One tick or any other response = 0 marks.
	c		<p>space in landfill but then rot away</p> <div style="display: inline-block; vertical-align: middle;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> </div> <p>(1)</p>	1	A tick in any other box = 0 marks
Total				4	

Question			Expected Answers	Marks	Rationale								
5	a	i	4 (1)	1	Accept: a circle around 'Sample 4' or number '7' in Sample 4. More than one number circled = 0 marks								
		ii	a larger force was used on the steel point (1) this sample of material Y was different to the others (1) the machine developed a fault (1) the scientist made a mistake (1) samples of X and Y had been mixed up (1)	4	any four								
	b		samples of X may vary <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td></tr><tr><td>✓</td></tr><tr><td> </td></tr><tr><td> </td></tr></table> (1)		✓			1	A tick in any other box = 0 marks				
✓													
	c		7-12 (1)	1	Allow 12 -7. allow 5 or 6 or 12-7=5								
	d		Anna (1)	1	More than one name = 0 marks								
	e	i	cannot slide past each other <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td>✓</td></tr></table> (1)				✓	1	A tick in any other box = 0 marks				
✓													
		ii	strong forces between molecules <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td></tr><tr><td>✓</td></tr><tr><td> </td></tr><tr><td> </td></tr></table> break polymer molecules apart <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td>✓</td></tr></table>		✓						✓	1	Ticks in second and fifth boxes required for 1 mark. One tick or any other response = 0 marks.
✓													
✓													
Total				10									

Question		Expected Answers	Marks	Rationale					
6	a	may make children hyperactive <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td>✓</td></tr> <tr><td> </td></tr> </table> (1)			✓		1	A tick in any other box = 0 marks	
✓									
	b	reduce risk to children's health <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td>✓</td></tr> </table> (1)					✓	1	A tick in any other box = 0 marks
✓									
	c	it has passed a safety test (1) it has been approved for use in the EU (1)	2						
		Total	4						

Question		Expected Answers	Marks	Rationale	
7	a		3	<p>Look at the links as they leave the left-hand boxes. If any left-hand box has more than one link, count those links as incorrect.</p> <p>All four lines correct = 3 marks Three lines correct = 2 marks Two lines correct = 1 mark One or no lines correct = 0 marks</p>	
	b	i	<p>the chances of an obese person contracting diabetes (1) the consequences of having diabetes (1)</p>	2	
		ii	<p>Andy (1) Laura (1)</p>	2	<p>One mark for each correct answer in EITHER order. If three names given mark answers and deduct 1 mark. 4 names given = 0</p>
Total			7		

Question		Expected Answers	Marks	Rationale
8	a	E (1) C (1)	2	One mark for each correct answer in EITHER order. If three letters given mark answers and deduct 1 mark. 4 or more letters given = 0
	b	bacteria in the roots of some plants lightning <div style="display: inline-block; vertical-align: middle;"> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> </div>	1	Ticks in second and third boxes required for 1 mark. One tick or any other response = 0 marks.
		Total	3	
		Section total	42	