OCR
RECOGNISING ACHIEVEMENT

SPECIMEN **H**

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

CHEMISTRY A **A171/02**

Unit A171: Modules C1, C2, C3 (Higher Tier)

MARK SCHEME

MAXIMUM MARK 60

This document consists of 16 pages

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

   Eg 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. Annotations:
   The following annotations are available on SCORIS.

   ✓ = correct response
   ✖ = incorrect response
   bod = benefit of the doubt
   nbod = benefit of the doubt **<u>not</u>** given
   ECF = error carried forward
   ^ = information omitted
   I = ignore
   R = reject

6. If a candidate alters his/her response, examiners should accept the alteration.

7. 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.

   Eg
   For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.
☐	☐	✓
☐	☐	✓
✓	✓	☐
✓	✓	☐
☐	☐	☐
This would be worth 0 marks.	This would be worth one mark.	This would be worth one mark.

8. 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, eg 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.

9. 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, eg 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.

   Eg 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 <u>should be blank</u> (or have indication of choice crossed out).

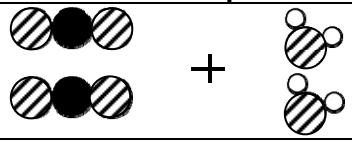
Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

10. Three questions in this paper are marked using a Level of Response (LoR) mark scheme with embedded assessment of the Quality of Written Communication (QWC). When marking with a Level of Response mark scheme:

- Read the question in the question paper, and then the list of relevant points in the 'Additional guidance' column of the mark scheme, to familiarise yourself with the expected science. The relevant points are not to be taken as marking points, but as a summary of the relevant science from the specification.
- Read the level descriptors in the 'Expected answers' column of the mark scheme, starting with Level 3 and working down, to familiarise yourself with the expected levels of response.
- *For a general correlation between quality of science and QWC*: determine the level based upon which level descriptor best describes the answer; you may award either the higher or lower mark within the level depending on the quality of the science and/or the QWC.
- *For high-level science but very poor QWC*: the candidate will be limited to Level 2 by the bad QWC no matter how good the science is; if the QWC is so bad that it prevents communication of the science the candidate cannot score above Level 1.
- *For very poor or totally irrelevant science but perfect QWC*: credit cannot be awarded for QWC alone, no matter how perfect it is; if the science is very poor the candidate will be limited to Level 1; if there is insufficient or no relevant science the answer will be Level 0.

Question			Expected answers	Mark	Additional guidance
1	(a)	(i)	70	[1]	**allow** any answer between 68 and 72
		(ii)	(decrease) of 13 µg/m^3	[1]	**allow** any answer between 11 and 15
		(iii)	**[Level 3]** Answer explains the difference between correlation and cause, and correctly identifies the correlation shown by the graphs. Explains clearly that nitrogen dioxide could be a cause of asthma or asthma could be caused by other factors and that more information is needed to be sure. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5-6 marks) **[Level 2]** Answer does not clearly explain the difference between correlation and cause, but correctly identifies the correlation shown by the graphs. Explains that nitrogen dioxide could or could not be a cause of asthma. Understands that more information is needed to be sure. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3-4 marks) **[Level 1]** Answer identifies a link shown by the graphs. Explains that nitrogen dioxide may not be a cause of asthma. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1-2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	[6]	**relevant points include:** • a correlation is present when an outcome changes, as an input (factor) changes / OWTTE • graphs show a (positive) correlation between levels of nitrogen dioxide in the air and hospital admissions for asthma. • as nitrogen dioxide decreases hospital admissions for asthma decrease • a correlation does not necessarily indicate a causal link • a causal link needs a known mechanism linking the input factor and the outcome OWTTE • nitrogen dioxide in the air is a plausible cause of asthma, but need to know how it causes asthma to be sure • asthma could be caused by other factors that need to be investigated.

Question			Expected answers	Mark	Additional guidance
1	(b)		1 3	[2]	either order
			Total	[10]	

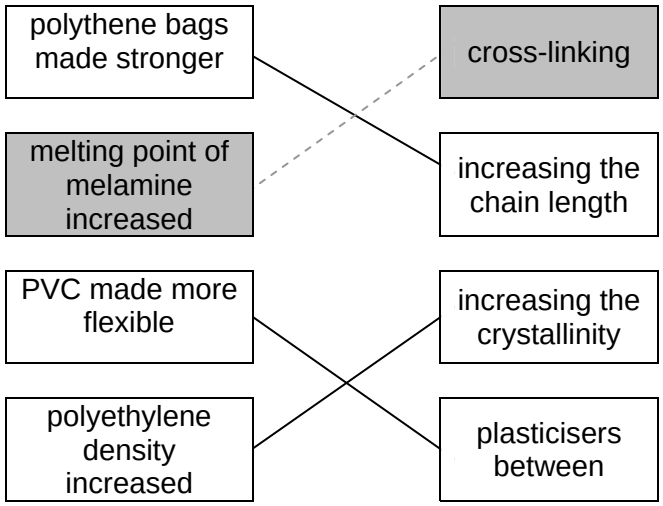
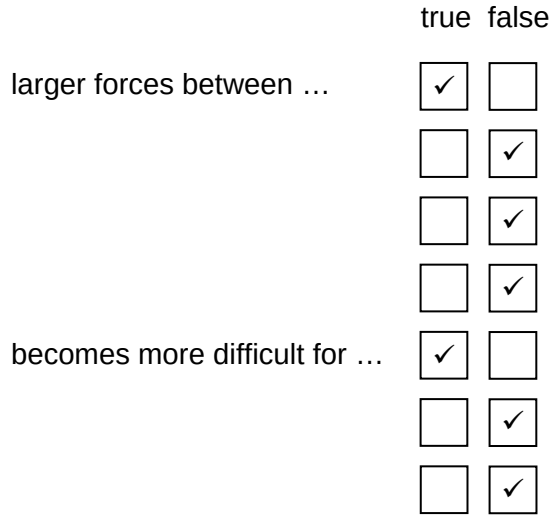
Question			Expected answers	Mark	Additional guidance
2	(a)			[3]	1 mark for correct drawing of CO_2 molecule 1 mark for correct drawing of water molecule 1 mark for 2 CO_2 and 2 water molecules
	(b)	(i)	25.2	[1]	
		(ii)	there was a lack of oxygen since carbon monoxide and carbon were produced due to incomplete combustion	[2]	for full marks the explanation must be linked to the conclusion
			Total	[6]	

Question			Expected answers	Mark	Additional guidance
3			water decreased because Earth cooled and water condensed into oceans CO_2 decreased by photosynthesis and CO_2 also decreased by dissolving in oceans/formation of fossil fuels oxygen increased through photosynthesis	[4]	
			Total	[4]	

Question			Expected answers			Marks	Additional guidance
4	(a)			**true**	**false**	[2]	all four correct = 2 marks 3 or 2 correct = 1 mark
			… 0.5 m every 20 years.	☐	☑		
			... poles changed	☑	☐		
			…more between 1996 and 2008 …	☐	☑		
			... 0.1 m every 4 years.	☑	☐		
	(b)	(i)	**any two from:** find the best estimate of the true value identify outliers discard outliers ensure results are reliable			[2]	
		(ii)	**any two from:** human error in measuring weight not placed in middle / weight hung from a different place supports move apart or together / pole in a different position on supports pole does not straighten after weight hung on it			[2]	
	(c)	(i)	11.2 12.3			[1]	both correct for 1 mark

Question			Expected answers	Marks	Additional guidance
4	(c)	(ii)	the ranges of the two data sets do not overlap / the mean of each data set is outside the range of the other data set indicating that the true values/best estimates/means/flexibilities are likely to be different / Anna's conclusion is likely to be correct **OR** the sample size is too small <u>and</u> the ranges too close together to be sure that the true values/best estimates/means/flexibilities are different / to be sure that Anna's conclusion is correct	[2]	maximum of 1 mark if answer implies that Anna's conclusion is definitely correct or incorrect
			Total	[9]	

Question			Expected answers	Marks	Additional guidance
5		✎	**[Level 3]** Detailed and clear explanation of why experts have concerns about nanoparticles and suggestions of how consumers may be protected. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5-6 marks) **[Level 2]** An explanation of why experts have concerns about nanoparticles and at least one suggestion of how consumers may be protected. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3-4 marks) **[Level 1]** Answer only refers to either why experts are worried or how consumers can be protected. Little detail is provided. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1-2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**relevant points include:** • nanoparticles show different properties to larger particles of the same material • one of the reasons is that their surface area to volume ratio is very large • may be harmful • may have long-term effects • difficulty of establishing long-term effects since new technology • harmful effects have not been fully investigated • more research needed • to establish safe levels • specific to each application / type of nanoparticle • labelling to show when nanoparticles used
			Total	**[6]**	

Question			Expected answers	Marks	Additional guidance
6	(a)			[2]	3 lines correct = 2 marks 2 or 1 line correct = 1 mark
	(b)			[2]	evaluate every row all 7 rows correct = 2 marks 6 rows correct = 1 mark
			Total	[4]	

Question			Expected answers	Marks	Additional guidance
7	(a)	(i)	as age increases the daily maximum amount of salt increases up to the age of 11, then the daily maximum is fixed / does not increase (any further) with age	[1]	
		(ii)	(for a particular amount of salt) a person with a low mass will get much more salt per kg of body mass than a person with a high body mass therefore the daily maximum should be linked to mass because people of different ages may have the same body mass / people who are the same age may have (very) different body masses	[2]	**credit** the idea that the same amount of salt gives a higher concentration in a person with low body mass than in a person with high body mass

Question			Expected answers	Marks	Additional guidance
7	(b)		**[Level 3]** Answer clearly considers (perceived) risks versus (perceived) benefits in the argument *against* lowering salt, and in the argument *for* lowering salt. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5-6 marks) **[Level 2]** Answer for the most part considers (perceived) risks and (perceived) benefits on both sides of the argument. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There may be occasional errors in grammar, punctuation and spelling. (3-4 marks) **[Level 1]** Answer shows a limited consideration of (perceived) risks and (perceived) benefits, but may not address both sides of the argument. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling may be intrusive. (1-2 mark) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**relevant points include:** food companies may not want to lower the amount of salt in their food because: • (the companies think) the , cost of reformulating recipes / cost of removing salt / risk of decreased sales (due to , poorer taste / shorter shelf life) , outweighs benefits to health • (the companies think) the benefits of taste and preservative outweigh (perceived) risk(s) to health food companies should be made to lower the amount of salt in their foods because: • too much salt in a diet increases the risk of high blood pressure, heart disease and strokes • risk / cost , of ill health outweighs benefits of adding salt • benefit to population outweighs , risk / cost , to food companies
			Total	**[9]**	

Question			Expected answers	Marks	Additional guidance
8	(a)		**C A G E**	**[2]**	**C A** in correct place = 1 mark **G E** in correct place = 1 mark
	(b)		land above the mine is unsupported/less stable so it could collapse into the mine / subside subsidence affects buildings/structures/roads/habitats / risk of falling through cracks to humans/wildlife/livestock	**[2]**	
			Total	**[4]**	

Question			Expected answers	Marks	Additional guidance
9	(a)		first use: glass = 7.2 + 2.5 = 9.7 (MJ) plastic = 4.7 + 2.2 = 6.9 (MJ) second use: glass = 2.5 (MJ) plastic = 4.7 + 2.2 = 6.9 (MJ) number of times = 2	[2]	first mark is for correctly calculating the energy used each time for both types of bottle; second mark is for correctly concluding that a glass bottle must be used twice to save energy compared to two plastic bottles correct answer with no working shown = 1 mark
	(b)		Carly Frankie	[2]	
	(c)		**any two pairs from:** environmental impact of obtaining raw materials suggestion of how this will be different for glass and plastic bottles making and using the product suggestion of how this will be different for glass and plastic bottles using resources (including water) suggestion of how this will be different for glass and plastic bottles	[4]	 **credit** any reasonable suggestion **credit** any reasonable suggestion **credit** any reasonable suggestion
			Total	[8]	