SPECIMEN **F**

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

CHEMISTRY A / FURTHER ADDITIONAL SCIENCE A **A173/01**

Unit A173/01: Module C7 (Foundation Tier)

MARK SCHEME

Duration: 1 hour

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 / or words to that effect
   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. 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.

   E.g.
   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, 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.

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, 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	

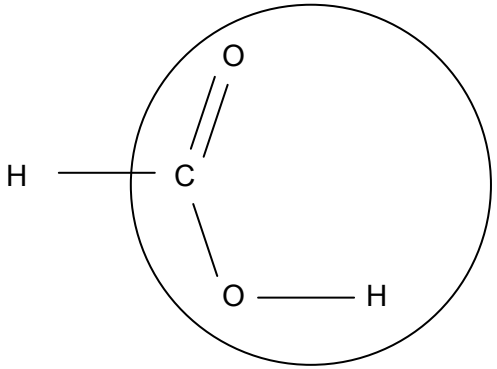
   the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

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

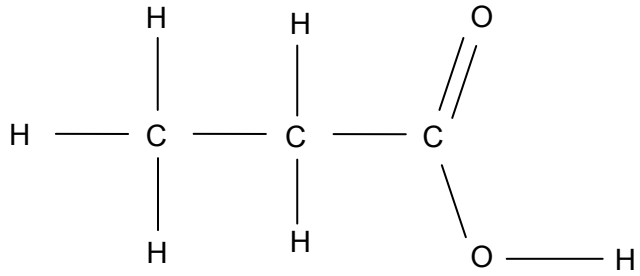
10. For answers marked by levels of response:
    a. **Read through the whole answer from start to finish**
    b. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor
    c. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

    d. Use the **L1**, **L2**, **L3** annotations in SCORIS to show your decision; do not use ticks.

Question			Expected answers	Marks	Additional guidance
1	(a)			[1]	circle around COOH group
	(b)	(i)	*reactants:* methanoic acid <u>and</u> calcium carbonate (1) *products:* carbon dioxide <u>and</u> water (1)	[2]	 any order any order

Question			Expected answers	Marks	Additional guidance
1	(b) ✎	(ii)	**[Level 3]** Answer correctly identifies the strong acid and the weak acid, compares their reactivity and shows a clear understanding of why the strong acid is not used. Quality of written communication does not impede communication of the science at this level. (5-6 marks) **[Level 2]** Answer correctly identifies the strong acid and the weak acid, but does not clearly explain why the strong acid is not used. Quality of written communication partly impedes communication of the science at this level. (3-4 marks) **[Level 1]** Answer correctly identifies either the strong acid or the weak acid without considering the other, and does not clearly explain why the strong acid is not used. Quality of written communication impedes communication of the science at this level. (1-2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**relevant points include:** • methanoic acid is a weak acid • hydrochloric acid is a strong acid • strong acids are more reactive than weak acids Hydrochloric acid is not used because • it will, react with the metal / damage the kettle • idea of safety considerations when using strong acids

Question			Expected answers	Marks	Additional guidance
1	(c)			[2]	no errors = 2 marks one error = 1 mark two or more errors = 0 marks
			Total	[11]	

Question			Expected answers	Marks	Additional guidance
2	(a)		energy	[1]	
	(b)		glycerol + fatty acid	[1]	any order
	(c)		It can improve the taste. ✓ ☐ ☐ ☐ It can improve the smell. ✓ ☐	[1]	both correct ticks for 1 mark three or more ticks = 0 marks
			Total	[3]	

Question			Expected answers	Marks	Additional guidance
3	(a)	(i)	the length of time from the injection of the sample (1) until the chemical leaves the column / to the appearance of the peak (1)	[2]	
		(ii)	as the size of the molecule increases, the retention time increases / owtte	[1]	
	(b)	(i)	ethane butane pentane	[1]	all three correct for 1 mark; any order
		(ii)	butane	[1]	
	(c)		**[Level 3]** Answer clearly shows a good understanding of exothermic reactions. Quality of written communication does not impede communication of the science at this level. (5-6 marks) **[Level 2]** Answer shows a partial understanding of exothermic reactions. Quality of written communication partly impedes communication of the science at this level. (3-4 marks) **[Level 1]** Answer shows a limited understanding of exothermic reactions. Quality of written communication impedes communication of the science at this level. (1-2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	[6]	**relevant points include:** • in an exothermic reaction energy is released / given out, as heat • during a reaction bonds are broken in the reactants and new bonds formed in the products • breaking bonds, requires / uses / takes in, energy • forming bonds, releases / gives out, energy • energy change for a reaction is the sum of these two energy changes • idea that if the energy, released / given out, (when forming bonds) is greater than the energy, used / taken in, (when breaking bonds) the reaction is exothermic **accept** the idea that the reaction heats up its surroundings for a low-level mark
			Total	[11]	

Question			Expected answers	Marks	Additional guidance
4	(a)		**A C F B E**	[3]	all five in correct order = 3 marks four in correct order = 2 marks three in correct order = 1 mark
	(b)		burette (1) because it allows accurate measurement of the volume (1)	[2]	
	(c)	(i)	58	[1]	
		(ii)	0.75 (2)	[2]	**credit** 1 mark max. for any number other than 0.75 that has been rounded correctly from 0.746849315 (e.g. 0.7, 0.747, 0.7468 etc.) **credit** an answer correctly calculated from the candidate's answer to **(c)(i)**
	(d)	(i)	*yes because:* **any one from:** there is too much variation in the amount of active ingredient/magnesium hydroxide ; it is important that there is the correct/same amount of active ingredient in each tablet	[1]	no marks for "yes" or "they should be concerned"; marks are awarded for the explanation

Question			Expected answers	Marks	Additional guidance
4	(d)	(ii)	test a larger sample/more tablets from each batch / idea of a larger proportion of the total number of tablets (1) test the same number of tablets from each batch / idea of consistent method (1)	[2]	credit any relevant suggestion that addresses the question
			Total	**[11]**	

Question			Expected answers	Marks	Additional guidance
5	(a)	(i)	a chemical made in large quantities	[1]	
		(ii)	☐ ☐ ☐ ☐ Ethene is obtained from crude oil. ✓ One day we will run out of crude oil. ✓	[2]	1 mark for each correct tick three ticks = max. 1 mark four or more ticks = 0 marks

Question			Expected answers	Marks	Additional guidance
5	(b)	(i)	The company has to dispose of … ✓	[1]	two or more ticks = 0 marks
		(ii)	activation energy (1) route (1)	[2]	
	(c)		to protect people (1) and the environment (1)	[2]	
			Total	[8]	

Question			Expected answers	Marks	Additional guidance
6	(a)		To increase the concentration … ✓	[1]	two or more ticks = 0 marks
	(b)	(i)	ethane is converted to ethene (1) ethene is reacted with steam to make ethanol (1)	[2]	

Question			Expected answers	Marks	Additional guidance
6	(b) ✎	(ii)	**[Level 3]** Answer shows a clear understanding of sustainability and applies it fully to both processes and indicates clearly why fermentation is the more sustainable method. Quality of written communication does not impede communication of the science at this level. (5-6 marks) **[Level 2]** Answer shows an understanding of sustainability but applies partially to both processes. For the most part the information is relevant and presented in a structured and coherent format, but the complete case for saying fermentation is more sustainable is not presented. Quality of written communication partly impedes communication of the science at this level. (3-4 marks) **[Level 1]** Answer has a valid comment on the sustainability of one or other of the two processes, but does not demonstrate why fermentation is more sustainable. Quality of written communication impedes communication of the science at this level. (1-2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**relevant points include:** • making ethanol by fermentation is more sustainable than making ethanol from ethane • making ethanol by fermentation uses wheat/beet • more wheat/beet can be grown / wheat/beet is a renewable resource • making ethanol from ethane uses ethene • ethane is obtained from natural gas • natural gas is a finite/non-renewable resource **accept** crude oil in place of natural gas **ignore** technical details of either process
			Total	**[9]**	

Question			Expected answers	Marks	Additional guidance
7	(a)	(i)	vinegar	[1]	
		(ii)	in the conical flask	[1]	
	(b)	(i)	*set 1:* 12.1 to 12.9 *set 2:* 12.4 to 12.6	[1]	all four numbers correct for 1 mark
		(ii)	$\frac{12.4 + 12.6 + 12.5 + 12.5 + 12.4 + 12.6}{6}$ (1) 12.5 (1)	[2]	
		(iii)	the data/results (in set 2) have a smaller range / are closer together (1) (which means) they are more consistent / will give a more accurate best estimate / closer to the true value (1)	[2]	**do not credit** "more accurate" without qualification
			Total	[7]	