SPECIMEN H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

CHEMISTRY A / FURTHER ADDITIONAL SCIENCE A **A173/02**

Unit A173/02: Module C7 (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 / 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	

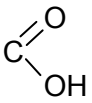
   the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

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

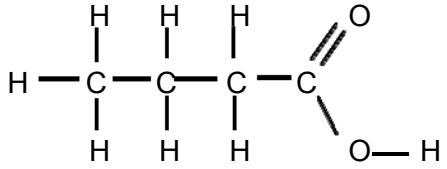
10. For answers marked by levels of response:
    a. **Read through the whole answer from start to finish**
    b. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor
    c. **To determine the mark within the level**, consider the following:

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)		COOH	[1]	**allow** CO_2H **allow** 
	(b)	(i)	$CaCO_3 + 2HCOOH \rightarrow Ca(HCOO)_2 + CO_2 + H_2O$	[2]	1 mark for formulae 1 mark for balanced equation
		(ii)	it is soluble / it dissolves	[1]	

Question			Expected answers	Marks	Additional guidance
1	(b)	(iii) ✎	**[Level 3]** Answer identifies an appropriate reaction, clearly identifies correct reagents and products of the chosen reaction, and gives a balanced equation for the chosen reaction. Comparison is made with similar hydrochloric acid reaction to show why this is a strong acid but methanoic a weak acid. Quality of written communication does not impede communication of the science at this level. (5-6 marks) **[Level 2]** Answer identifies an appropriate reaction with correct reagents and products, and gives an equation for the chosen reaction. Reaction with hydrochloric acid is included but not compared. Distinction between strong and weak acid is not fully made. Quality of written communication partly impedes communication of the science at this level. (3-4 marks) **[Level 1]** Answer identifies an appropriate reaction, with correct reagents and/or products. Hydrochoric acid is not mentioned. 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:** • appropriate reaction (e.g. with an alkali, an oxide or a hydroxide) • correct reagents for the reaction • correct products of the reaction • balanced equation for the reaction • details of similar reaction with hydrochloric acid • comparison of two reactions to show difference between a weak acid and a strong acid

Question			Expected answers	Marks	Additional guidance
1	(c)			[1]	**allow** $CH_3CH_2CH_2COOH$
			Total	[11]	

Question			Expected answers	Marks	Additional guidance
2	(a)		glycerol + fatty acid	[1]	any order
	(b)		*purification:* the product is shaken with reagent in a tap funnel (1) and then the layer containing impurities is run off (1) *drying:* solid drying agent is added to the product (1) and then the mixture is filtered to remove the drying agent (1)	[4]	 **credit** a named reagent e.g. distilled water **credit** a named drying agent e.g. calcium chloride
			Total	[5]	

Question			Expected answers	Marks	Additional guidance
3	(a)	(i)	the peak at 4.1 is higher than the other peaks	[1]	
		(ii)	as the size of the molecule increases, the retention time increases / owtte	[1]	
	(b) ✎		**[Level 3]** Answer shows a full and detailed understanding of how the idea of a dynamic equilibrium explains the separation. Quality of written communication does not impede communication of the science at this level. (5-6 marks) **[Level 2]** Answer explains how components are separated but does not relate this to dynamic equilibrium. For the most part the information is relevant and presented in a structured and coherent format. Quality of written communication partly impedes communication of the science at this level. (3-4 marks) **[Level 1]** Answer refers to the phases but does not adequately explain how the components are separated. 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:** • mobile phase moves through stationary phase • mobile phase carries some components further than others • components are separated by moving at different speeds • each component of the mixture is in a dynamic equilibrium between the two phases • for each component the equilibrium will lie more towards the one phase than the other • each component will be more soluble / more attracted / spend more time in one phase than the other • the speed of movement of a component depends on its equilibrium position in / solubility in / attraction to each phase **accept** ideas of position of dynamic equilibrium or solubility in each phase or time spent in each phase with equal merit **ignore** irrelevant detail
			Total	[8]	

Question			Expected answers	Marks	Additional guidance
4	(a)	(i)	58	[1]	
		(ii)	0.94 (g)	[1]	
		(iii)	$\frac{0.94 \times 58}{36.5 \times 2}$ (1) 0.75 (g) (1)	[2]	**accept** 0.747 **credit** an answer correctly calculated from the candidate's answers to **(a)(i)** and **(a)(ii)**
		(iv)	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
	(b)		small degree of uncertainty (1) because all of the titration values are very close / because all of the titration values are within 0.1 of the average (1)	[2]	
			Total	[8]	

Question			Expected answers	Marks	Additional guidance
5	(a)	(i)	ethene is obtained from crude oil (1) idea that our supply of crude oil is finite / cannot be replaced / will take millions of years to be replaced (1)	[2]	

Question			Expected answers	Marks	Additional guidance
5	(a)	(ii)	☐ ☐ There is little use for calcium chloride. ✓ ☐ ☐ The new process had no by-products. ✓	[2]	1 mark for each correct tick 3 ticks = max. 1 mark 4 or more ticks = 0 marks
	(b)		route (1) activation energy (1)	[2]	
	(c)		$2C_2H_4 + O_2 \rightarrow 2(CH_2)_2O$	[2]	1 mark for correct product 1 mark for correct balancing
			Total	[8]	

Question			Expected answers	Marks	Additional guidance
6	(a) ✎		**[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. For the most part the information is relevant and presented in a structured and coherent format. 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

Question			Expected answers	Marks	Additional guidance
6	(b)	(i)	2 x 805 = 1610 (1) 4 x 464 = 1856 (1) 3466 (kJ/mol)	[3]	 **do not credit** 3466 if the candidate goes on to calculate –730 here
		(ii)	–730	[1]	only credit with minus sign
			Total	[10]	

Question			Expected answers	Marks	Additional guidance
7	(a)	(i)	**C E A F**	[3]	one mark per correct order: **C** before **E** (1) **E** before **A** (1) **A** before **F** (1)
		(ii)	4.0	[1]	**credit** 4
	(b)	(i)	 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
		(ii)	the mean of one set of data lies in range of the other set of data / the ranges overlap	[1]	

Question			Expected answers	Marks	Additional guidance
7	(b)	(iii)	*RAM CH_3COOH = 60* *RAM NaOH = 40* conc. = 4.0 x (12.5/1000) x (60/40) x (1000/25) (1) = 3.0 (1)	[2]	**credit** an answer correctly calculated from the candidate's answer to **(a)(ii)** and/or from incorrect RAMs
		(iv)	vinegar concentration is within quality control limits and reference to being in range of 2.52 – 3.08 g/dm^3	[1]	**credit** an answer that agrees with candidate's answer to **(b)(iii)**
			Total	[10]	