



**General Certificate of Education (A-level) Applied  
January 2011**

**Applied Science**

**SC11**

**(Specification  
8771/8773/8776/8777/8779)**

**Unit 11: Sports Science**

**Post-Standardisation**

***Mark Scheme***

---

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from: [aqa.org.uk](http://aqa.org.uk)

Copyright © 2011 AQA and its licensors. All rights reserved.

**Copyright**

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

Question	Part	Sub-part	Marking guidance	AO	Mark	Comment
1	(a)		Products are removed at same time as reactants are added Process never stops / continuously	1(AO1) 1(AO1)	2	
1	(b)		Reactants are added and reaction occurs And then products are removed	1(AO1) 1(AO1)	2	
1	(c)		Any <b>two</b> of: Lower labour cost/faster/can give purer product/lower energy cost/savings on rent, no downtime i.e. start-up/shut-down costs	2(AO1)	2	
1	(d)	(i)	Closed container	1(AO1)	1	
1	(d)	(ii)	Correct substitution 7.8(4) answer = 2 marks	1(AO2) 1(AO2)	2	
1	(d)	(iii)	$\text{mol}^{-1}\text{dm}^3$	1(AO2)	1	
2	(a)	(i)	Neutralisation/exothermic	1(AO2)	1	
2	(a)	(ii)	$2\text{HNO}_3$	1(AO2)	1	
2	(a)	(iii)	Heterogeneous	1(AO2)	1	
2	(b)	(i)	Change in concentration (of product/reactant) Over time	1(AO1) 1(AO1)	2	
2	(b)	(ii)	If measure mass loss: Top-pan balance  Any <b>two</b> of: Weigh boat Conical flask Cotton wool Measuring cylinder/bulb pipette/burette	1(AO3)  2(AO3)	3	

			Thermometer Stopclock <b>OR</b> If measure volume of gas produced: Gas syringe = 1 mark Any two of: Conical flask/ round bottomed flask Rubber bung to ensure airtight seal Measuring cylinder/bulb pipette/burette Thermometer Stopclock (list principle applies)			
--	--	--	--	--	--	--

2	(b)	(iii)	The marking scheme for this part of the question includes an assessment of the Quality of Written Communication (QWC). There are no discrete marks for the assessment of written communication but QWC will be one of the criteria used to assign the answer to an appropriate level below.															
			<table border="1"> <thead> <tr> <th>Level</th> <th>Mark</th> <th>Descriptor</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>an answer will be expected to meet most of the criteria in the level descriptor</td> </tr> <tr> <td>3</td> <td>4-5</td> <td>                             -answer is full and detailed and is supported by an appropriate range of relevant points such as those given below                              -argument is well structured with minimal repetition or irrelevant points                              -accurate and clear expression of ideas with only minor errors in the use of technical terms, spelling, punctuation and grammar                         </td> </tr> <tr> <td>2</td> <td>2-3</td> <td>                             -answer has some omissions but is generally supported by some of the relevant points below                              -the argument shows some attempt at structure. The ideas are expressed with reasonable clarity but with a few errors in the use of technical terms, spelling, punctuation and grammar                         </td> </tr> </tbody> </table>	Level	Mark	Descriptor			an answer will be expected to meet most of the criteria in the level descriptor	3	4-5	-answer is full and detailed and is supported by an appropriate range of relevant points such as those given below -argument is well structured with minimal repetition or irrelevant points -accurate and clear expression of ideas with only minor errors in the use of technical terms, spelling, punctuation and grammar	2	2-3	-answer has some omissions but is generally supported by some of the relevant points below -the argument shows some attempt at structure. The ideas are expressed with reasonable clarity but with a few errors in the use of technical terms, spelling, punctuation and grammar	5(AO3)	5	
Level	Mark	Descriptor																
		an answer will be expected to meet most of the criteria in the level descriptor																
3	4-5	-answer is full and detailed and is supported by an appropriate range of relevant points such as those given below -argument is well structured with minimal repetition or irrelevant points -accurate and clear expression of ideas with only minor errors in the use of technical terms, spelling, punctuation and grammar																
2	2-3	-answer has some omissions but is generally supported by some of the relevant points below -the argument shows some attempt at structure. The ideas are expressed with reasonable clarity but with a few errors in the use of technical terms, spelling, punctuation and grammar																

			1	0-1	<p>-answer is largely incomplete, and may contain some valid points which are not clearly linked to an argument structure</p> <p>-unstructured answer</p> <p>-errors in the use of technical terms, spelling, punctuation and grammar or lack of fluency</p>			
					<p>A good answer might include:</p> <p>Approximately 3g of limestone pieces would be measured accurately in a weigh boat using a top-pan balance. 50cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> nitric acid would be measured using a bulb pipette and placed in the conical flask (reasonable quantities required). The temperature of the acid is then measured.</p> <p>The conical flask would then be placed on the top-pan balance and the balance zeroed.</p> <p>The limestone pieces would then be added to the conical flask and the stopclock started at the same time.</p> <p>The initial mass reading (the starting mass of the limestone pieces) should be noted and then mass readings recorded every 20 seconds.</p>			
2	(b)	(iv)	Any two of: Same <b>mass</b> of limestone pieces Same <b>size</b> of limestone pieces Same <b>volume</b> of nitric acid Same <b>concentration</b> of nitric acid Same <b>temperature</b> of nitric acid		1(AO3)	1(AO3)	2	
2	(c)		Smaller pieces have an increased surface area And so a greater number of particles available for collision Therefore more successful collisions per second will occur		1(AO2)	1(AO2)	1(AO2)	3

3	(a)	(i)	78.5 74	1(AO2) 1(AO2)	2	
3	(a)	(ii)	Moles ethanoyl chloride = $10/78.5 = 0.1274$ 1:1 therefore moles methyl ethanoate = 0.1274 Mass of methyl ethanoate = $0.1274 \times 74 = 9.4(3)\text{g}$	1(AO2) 1(AO2) 1(AO2)	3	
3	(a)	(iii)	Incomplete reaction/side reactions occur/impure reactant/transfer losses	1(AO1)	1	
3	(b)		$\Sigma\Delta H_f(\text{products}) - \Sigma\Delta H_f(\text{reactants})$ /appropriate Hess's cycle $\Sigma\Delta H_f(\text{products}) = -538.1$ $\Sigma\Delta H_f(\text{reactants}) = -512.0$ $(-538.1) - (-512.0) = -26.1$ (ignore units unless wrong)	1(AO2) 1(AO2) 1(AO2) 1(AO2)	4	
3	(c)		Average enthalpy required to break one mole of a particular covalent bond in different environments.	1(AO1) 1(AO1)	2	
3	(d)		$\Sigma$ bonds broken = 4858 $\Sigma$ bonds formed = 4816 Enthalpy change = $\Sigma$ bonds broken - $\Sigma$ Bonds formed $= 4858 - 4816 = (+)42 \text{ kJmol}^{-1}$ (ignore units unless wrong)	1(AO2) 1(AO2) 1(AO1) 1(AO2)	4	
3	(e)		Bond enthalpies are averages and not specific to methyl ethanoate	1(AO2)	1	
4	(a)	(i)	The rate of the forward reaction is Equal to the rate of the backward reaction	1(AO1) 1(AO1)	2	
4	(a)	(ii)	Sketch has a peak which is above level of reactants and products and general shape correct Products are lower than reactants	1(AO1) 1(AO2)	2	
4	(b)		A system at equilibrium Shifts to oppose any change imposed on it	1(AO2) 1(AO2)	2	

4	(c)		The marking scheme for this part of the question includes an assessment of the Quality of Written Communication (QWC). There are no discrete marks for the assessment of written communication but QWC will be one of the criteria used to assign the answer to an appropriate level below.		2(AO1) 3(AO2)	5	
			<b>Level</b>	<b>Mark</b>			<b>Descriptor</b>
							An answer will be expected to meet most of the criteria in the level descriptor
			3	4-5			-answer is full and detailed and is supported by an appropriate range of relevant points such as those given below -argument is well structured with minimal repetition or irrelevant points -accurate and clear expression of ideas with only minor errors in the use of technical terms, spelling, punctuation and grammar
			2	2-3			-answer has some omissions but is generally supported by some of the relevant points below -the argument shows some attempt at structure the ideas are expressed with reasonable clarity but with a few errors in the -use of technical terms spelling, punctuation and grammar
1	0-1	-answer is largely incomplete, it may contain some valid points which are not clearly linked to an argument structure -unstructured answer -errors in the use of technical terms, spelling, punctuation and grammar or lack of fluency					
		<i>A typical answer would include:</i> The increase in pressure will mean that there are more particles in any given volume. The number of successful collisions per second will therefore increase and so will the rate of the reaction.					

			There is a smaller number of gaseous molecules on the RHS (or converse). Therefore if the pressure is increased the equilibrium will shift to the RHS to reduce the pressure of the system and so the yield of ammonia will increase.			
4	(d)	(i)	Yield of ammonia decreases As the <u>forward reaction is exothermic</u> The reverse reaction is favoured to <u>reduce the temperature</u> , or converse	1(AO2) 1(AO2) 1(AO2)	3	
4	(d)	(ii)	Even though higher temperature reduces yield it <u>increases rate</u> at which equilibrium is established (owtte)	1(AO1)	1	
5	(a)		A substance which alters the rate of a reaction Without being <u>used up</u> itself	1(AO1)	1	
5	(b)	(i)	The <u>minimum</u> amount of energy Particles require to react when they collide	1(AO1) 1(AO1)	2	
5	(b)	(ii)	Starts at origin and skewed to left Does not touch x-axis but approaches close to it	1(AO1) 1(AO1)	2	
5	(b)	(iii)	$E_a$ on x-axis $E_a(\text{cat})$ to left of $E_a$	1(AO1) 1(AO2)	2	
5	(b)	(iv)	A catalyst reduces the activation energy for a reaction and So increases the proportion of particles that possess an energy greater than or equal to the $E_a$ There will therefore be more successful collisions per second	1(AO1) 1(AO2) 1(AO2)	3	
6	(a)	(i)	First As concentration of A is tripled rate also triples Second As concentration of B is multiplied by 4 rate is multiplied by 16	1(AO2) 1(AO2) 1(AO2) 1(AO2)	4	



6	(a)	(ii)	Temperature	1(AO1)	1	
6	(b)	(i)	When the <u>concentration</u> of Y increases the rate is unaltered	1(AO1)	1	
6	(b)	(ii)	3	1(AO2)	1	
6	(b)	(iii)	Rate = $k[X]^2[Z]$ Rate = $k$ $[X]^2$ $[Z]$	1(AO1) 1(AO2) 1(AO2)	3	