OCR
Oxford Cambridge and RSA

GCSE

Chemistry A

Unit **A173/02**: Module C7 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2014

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Available in scoris to annotate scripts:

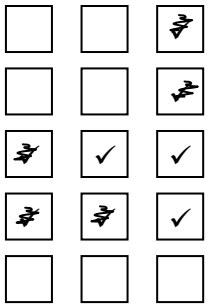
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	correct response
	incorrect response
BOD	benefit of doubt
NBOD	no benefit of doubt
ECF	error carried forward
0 , L1 , L2 , L3	indicate level awarded for a question marked by level of response
^	information omitted
CON	contradiction
R	reject
	indicate uncertainty or ambiguity
	draw attention to particular part of candidate's response

ADDITIONAL OBJECTS: You **must** assess and annotate the additional objects for each script you mark. Where credit is awarded, appropriate annotation must be used. If no credit is to be awarded for the additional object, please use annotation as agreed at the SSU.

Subject-specific Marking Instructions

a. Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).
b. 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 the third <u>and</u> fourth boxes are required for the mark:



This would be worth 1 mark. *This would be worth 0 marks.* *This would be worth 1 mark.*

c. Marking method for tick-box questions:

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 and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. 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 cities in England:

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**

d. For answers marked by levels of response:

i. **Read through the whole answer from start to finish**

ii. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor

iii. **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

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

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Question			Answer/Indicative content	Mark	Guidance
1	a	i	15.38 [2] Use 8 [mass of hydrogen] or uses 52 [mass of atoms of all reactants] [1 mark]	2	**accept** correctly rounded answers e.g. 15, 15.4, 15.38, 15.385, 15.3846 ....
	a	ii	**comments on the size of the atom economy** [it/atom economy] is a small number/ is only X ; **explain what it implies** little useful product made /lot of other product [CO_2]/ lot of waste/ other product harms the environment / waste of raw materials;	2	**Allow** ecf from ai if X is less than 50% only a small <u>number of atoms</u> from reactants become useful products [2] **Assume** "product" is hydrogen unless specified. **ignore** 'sustainability' statements **ignore** <u>hydrogen</u> atoms wasted/not used [incorrect]
	b		**<u>Any two from</u>** **comment about trees** trees renewable/ can plant more; **detail about new process** total CO_2 output zero/ trees use CO_2 / carbon neutral / trees photosynthesise; **comment about methane** methane a fossil fuel / finite/ non-renewable;	2	Unspecified 'it/they' = trees **Ignore** sustainable **Ignore** atom economy **Ignore** reference to energy **Ignore** less CO_2 produced / released
			TOTAL	6	

Question			Answer/Indicative content	Mark	Guidance
2	a		**[Level 3]** Recognises that there is an equilibrium and identifies some conditions and includes a level 3 link. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Recognises that there is an equilibrium and identifies some conditions OR Recognises that there is an equilibrium and gives a level 3 link. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Recognises that there is an equilibrium or identifies some conditions 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	**This question is targeted at grades up to A*** **Level 3 links** • recycling [of unreacted material] • high pressure favours forward reaction/ increases yield / fewer molecules on RHS • low temperature favours forward reaction/ increases yield/ exothermic **Conditions:** • compromise temperature / quotes a suitable value 300-600^{o}C • high[er] temp increases rate • high pressure / quotes a suitable value [25-200atm] • catalyst [iron] • removal of ammonia **Equilibrium statements** • reaction reversible • there is a backward reaction • involves equilibrium If answer includes incorrect points (e.g. high temperature) then consider quality of communication to be impeded at levels 2 and 3 only. Do not penalise candidates who think that the Haber Process reaches equilibrium. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer/Indicative content	Mark	Guidance
2	b		**any three from** used [to make] fertiliser; detail - effect on crops/food supply; explosives are used for more than warfare; idea that benefit outweighs the harm;	3	Accept fertilisers make crops grow **Allow** "weapons used for peacekeeping/ deterrence /defence"
			Total	9	

Question			Answer/Indicative content	Mark	Guidance
3	a		C_2H_5OH	1	**allow** C_2H_6O /structural etc formulae
	b		**[Level 3]** Gives operational points AND theoretical points which describe the distillation including a reference to BPt difference [from water]. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Gives operational points AND theoretical points which describe the distillation. OR Makes reference to BPt and operational OR theoretical points. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Gives indicative points which describe the distillation. 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	**This question is targeted at grades up to C** **CHECK FOR INFORMATION ON THE DIAGRAM** **Indicative operational points may include:** • boil/heat [the dilute ethanol] • antibumping granules control the boiling • condenser used • [condenser] is cold / cooled / water flows through • use of thermometer • keep the liquid that collects around the boiling temperature of the alcohol • stop when temp too high **Indicative theoretical points may include:** • boiling points different / boiling point of alcohol lower than water • gas/ vapour / evaporation [of ethanol] • vapour contains both alcohol and water • [vapour] richer in alcohol • [Vapour] condenses / turns to liquid [in the condenser] • vapour contains increasing amounts of water as distillation proceeds If answer includes incorrect points (e.g. BPt of ethanol higher than water) then consider quality of communication to be impeded at levels **2 and 3** **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer/Indicative content	Mark	Guidance
3	c		any three from ethanol is the alcohol which boils at 79^{o}; general comparison – ethanol is the least toxic/poisonous /the largest amount needed to poison a person [of all the alcohols]; specific – compares toxicity of ethanol to another named alcohol ; quotes at least one correct value for toxicity; compares amount that can be **drunk** of different alcohols;	3	candidate may either agree or disagree, the marks are for the explanation only **Ignore** "ethanol <u>does</u> distil over at only one temperature" **Ignore** "safe[est] to drink" - stem methanol is more poisonous than ethanol [1]
	d		$C_4H_9OH + 6O_2$ □ $4CO_2 + 5H_2O$	3	correct formulae for reactants & products correct numbers on RHS [on correct formulae] correct numbers on LHS [on correct formulae] correct multiple on complete equation[3] $2C_4H_9OH$ + incorrectO_2 □ $8CO_2 + 10H_2O$ [2]
	ei		hydrogen	1	**Allow** H_2
	eii		water reacts faster / reactive etc	1	'It forms an alkali with water and a salt with butanol' = 1 **Accept** sodium sinks in butanol / does not melt in butanol **accept** 'forms sodium butoxide' "fast reaction with water, NO reaction with butanol" = 0 **Ignore** take a different amount of time **Ignore** 'different salts formed'
			Total	15	

Question			Answer/Indicative content	Mark	Guidance
4	a		**left hand side** / **right hand side** $HCOOH + C_4H_9OH$ → $CH_3COOC_2H_5 + H_2$ $CH_3COOH + C_2H_5OH$ → $CH_3COOC_2H_5 + O_2$ $C_2H_5COOH + C_3H_7OH$ → $CH_3COOC_2H_5 + CO_2$ $C_3H_7COOH + CH_3OH$ → $CH_3COOC_2H_5 + H_2O$	2	LHS box correct RHS box correct
	b		Any three from all acid and alcohol are not used up / amounts [of reactants] stay the same; there is a reverse/backward reaction / reaction reversible; dynamic [equilibrium] / reactions don't stop / both at same time; equal / same rate [in each direction];	3	**ignore** reference to equilibrium - stem **ignore** "this reaction will NOT run out of …" stem "Forward and backward reactions have same rate" = 3 [last three points] **ignore** 'reactants equal the products' "balance" is not enough for credit
	c		any two from catalyst; speed up reaction; lower activation energy/alternative pathway;	2	**ignore** "to produce more" **ignore** "removes water"
			Total	7	

Question			Answer/Indicative content	Mark	Guidance
5	(a)		**[Level 3]** Gives most of the essential stages in the method AND makes a statement about accuracy AND makes a statement about repeating. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Gives most of the essential stages in the method AND makes a statement about accuracy OR makes a statement about repeating. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes points about the titration. 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	**This question is targeted at grades up to B** **Indicative scientific points may include:** **Method - Essential stages [cued in stem]** • alkali [solution] in flask / beaker • indicator into alkali • add acid /acid in burette • [sudden] indicator/colour change **Method - Other points** • read the burette • swirl • stop adding acid [at endpoint] **Accuracy** • [measure alkali using] pipette • Run acid through tap [to flush out air] • drop by drop / slowly • meniscus • look for similar results / concordant **Repeating** • repeat; • rough; A level 1 method may include any statements from the method lists. Incorrect statements limit the mark to the lower mark of the level at levels 2 & 3 e.g. “indicator goes clear” [rather than colourless] If they make up the alkali solution from solid, ignore the **whole** of that section, until the titration begins. Consider this to impede QWC at level 3. N.B. The alkali must then be transferred to a flask/beaker to gain credit for the first point in the essential stages. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer/Indicative content	Mark	Guidance
5	b		1g [2] Either 40x25.0 or divides by 1000 [1]	2	
	c		Any two from He calculated a mean; ignored 26.4; it is an outlier / rough result;	2	**Ignore** It is the middle of the other two values **Ignore** take the median 25.2 + 25.6 + 25.4 [=76.2] divided by 3 (2)
	d	i	98	1	
	d	ii	49g [2] 98/2 [1]	2	ECF on di ie half the answer to di [2] Recognises that the reacting ratio is 1:2 eg 196g or di) x 2 [1]
				13	

Question			Answer/Indicative content	Mark	Guidance
6	a		**energy levels** reactants have more energy than products / energy decreases/ energy change negative; **what happens to the energy** given out / is lost / exothermic; **the hump** reference to activation energy / energy in to start reaction / energy increases [before decreasing]/ energy in to break bonds;	3	Allow 'gets hot'/'heat released' Energy in to make bonds is CON for third marking point
	b		[activation] energy/heat taken in/needed; Bonds break;	2	**ignore** reference to 'starting the reaction' – stem
	ci		2 872	2	
	cii		486	1	Ignore signs
	d		similarity both make H_2O / steam / water; difference hydrocarbons make CO_2 ; ORA	2	
			Total	10	

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