OCR
Oxford Cambridge and RSA

GCSE

Chemistry A

Unit **A171/02**: Modules C1, C2, C3 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2016

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

1. **Annotations**

Used in the detailed Mark Scheme:

Annotation	**Meaning**
/	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
words	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	credit alternative wording / or words to that effect
ORA	or reverse argument

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

2. **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.

3. 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	Mark	Guidance
1	a		(ethyne burns) quicker / faster / hotter	1	
	b		hydrocarbon / alkyne	1	**accept** monomer, linear, unsaturated, covalent
	c		4 mols CO_2 ;(1) 2 mols H_2O;(1)	2	**Allow** indication of '4' CO_2 and 2 H_2O Diagrams **MUST** make it clear which atom is which, look for additional 3 molecules of CO_2 and an additional 1 extra molecule of H_2O to have been drawn in the respective boxes. Molecules should not touch each other. Atoms within the molecule should touch.
			Total	**4**	

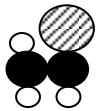
2	a		Some carbon atoms in the fuel react with oxygen in the air. √ (1) There is not enough oxygen for complete combustion. √ (1)	2	
	b		carbon monoxide……. carbon dioxide;(1) nitrogen (mon)oxide…….. nitrogen; (1)	2	For **EACH** pair answers **MUST** be in the correct order **Allow** formulae **Reject** if additional reactants or products given

Question			Answer	Mark	Guidance
2	c		**[Level 3]** Gives 1 advantage **and** 2 disadvantages or 2 advantages **and** 1 disadvantages of diesel **and** states harmful effects of 2 pollutants **and** relates these to why diesel cars may be banned in cities. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Gives 1 advantage **and** 2 disadvantages or 2 advantages **and** 1 disadvantages of diesel **and** states harmful effect of 1 pollutant. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Gives 1 advantage **and** 1 disadvantage of diesel cars. 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*** **Indicative scientific points may include:** **Advantages** • diesel cars emit less carbon monoxide than petrol cars. • diesel cars burn less fuel than petrol cars **(**so less carbon **monoxide** produced**)**. / Diesel cars travel further for the same amount of fuel **Disadvantages** • diesel cars emit more carbon particulates than petrol cars. • diesel cars emit more nitrogen monoxide than petrol cars. **Effects** • carbon monoxide emissions are toxic to humans. • carbon monoxide emissions lower the amount of oxygen the blood can carry. • carbon particulates cause breathing problems and make buildings dirty. • carbon particulates contribute to global dimming • nitrogen monoxide causes breathing problems and causes acid rain • nitrogen monoxide contributes to photochemical smog and global dimming **Reason why banned** Diesel banned because of effects of **carbon particulates and/or NO only.** eg breathing problems, smog, dirt **Ignore** catalytic convertors **Reject** ‘using’ pollutants **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**10**	

Question			Answer	Mark	Guidance
3	a	i	Value between 10000 and 11000	1	
		ii	Any 2 from: More renewable / alternative forms of energy; Fossil fuels running out / are non-renewable; Use of nuclear energy not known; More efficient power stations; increased industry/population new sources of fossil fuels;	2	**Accept** named renewables such as solar/wind turbines/biofuels **Allow:** other examples of better efficiency reducing fossil fuel usage. ORA
	b		As the amount of fossil fuels burned increases the average global temperatures increase; (2)	2	Factors must be named and linked directly for 2 marks Factors linked with time = 1 mark only One goes up / increases. The other goes up (1) If given only as a causal link 1 mark
			Total	**5**	

Question			Answer	Mark	Guidance
4	a		**LOR** **[Level 3]** **Matt's** plan chosen with at least 3 features that make it the best and reasons for 2 of them making it the best plan. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Matt's plan chosen with 2 features **and** a reason for one of those features making it the chosen plan OR **3** features. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Matt's plan chosen and 1 reason or 1 feature for this choice. 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** **Features:** Same length of ruler Same mass / force Measure distance bends Repeats Calc mean Ruler fixed at one end **Explanations / reasons** Control variables (**allow** fair test) Increase reliability Identify outliers Can calculate best estimate of true value Safety Accuracy –fixed rather than loose ruler - linked to calculating mean **Accept reverse argument in terms of why Jane / Katya are not chosen.** **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	b	i	test 3 / 13; (1)	1	
	b	ii	repeat test / check again / see how far away it is from the other values / see if the range is too large	1	**Ignore:** 'real difference' for 'how far away it is'
	b	iii	(23+26+13+19+24)/5;(1) =21;(1)	2	Process of calculating a mean correctly = 1 mark Correct answer without working= 2 marks
	b	iv	There is a difference because: the means / best estimates are different ;(1) the ranges do not overlap/ are lower / higher;(1)	2	'The mean of each is outside the range of the other' is 2 marks **Do not accept**: smaller range / larger range **Ignore:** different range
			Total	**12**	

Question			Answer	Mark	Guidance
5			molecules in petrol are smaller than those in fuel oil;(1) intermolecular forces are smaller**/**weaker in petrol molecules than fuel oil molecules;(1) less **energy** required to overcome imf / separate molecules in petrol than fuel oil;(1) petrol boils at a lower temperature / has a lower boiling range than fuel oil;(1)	4	**Allow**: chains **Allow:** bonds between molecules **Ignore:** bonds **Ignore:** bonds breaking ORA for all statements
			Total	**4**	

6	a	i	<u>chlorine</u>	1	
		ii		1	**Allow** any clearly recognisable representation of the monomer. Accept chemical symbols as the diagram.
	b	i	Plasticizer moves molecules / chains apart; (1) this weakens / breaks the intermolecular forces;(1) allows the molecules / chains to slide over each other; (1)	3	Must be idea of increased separation **Allow:** bonds between molecules
		ii	<u>Plasticizers</u> can get into food / <u>Plasticizers</u> leach out ;(1) (plasticizer) could have harmful effect when eaten with the food;(1)	2	
			Total	**7**	

Question			Answer	Mark	Guidance
7			**[Level 3]** Gives a reason **and** uses data **and** details of extra information on the LCA Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Gives a reason **and** uses data **or** Gives a reason **and** details of extra information on the LCA **or** Uses data **and** details of extra information on the LCA. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Gives a reason **or** uses data **or** details of extra information on the LCA 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/A*** **Indicative scientific points may include:** **Reasons why expected to do less harm:** • Plants are a renewable resource. • Plants are carbon neutral. • Recycled materials don't use resources. • Uses less fossil fuels. • Plastics are manufactured / made from crude oil. Accept reverse arguments for all points. **Using Data:** • Calculates or reference to **total** energy. • Calculates or references to **total** greenhouse gases. **Extra information on LCA** • use of other resources such as water/fertilisers to grow plants • environmental impact of growing crops for making plastic rather than for food crops • how long the trainers last • transportation of the trainers • use of resources, energy or environmental impact of using the trainers **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

Question			Answer	Mark	Guidance
8	a	i	B A G C	3	**ALL** 4 correct scores 3 marks, if not all correct look for; B first for 1 mark AG together, in that order anywhere 1 mark. C at end for 1 mark
		ii	As a preservative	1	**Ignore:** kills microorganisms
	b	i	hydrogen;(1) sodium hydroxide;(1)	2	Answers in either order.
	b	ii	10 000;(1) 1.6×10^{6};(1)	2	
		iii	Increase in amount of chlorine made; Decrease in electricity used per tonne; increase in **overall amount** of electricity used; less toxic substances produced/ toxic substances reduced to zero ;	4	'It' means chlorine Must link decrease to electricity per tonne / for the same amount of chlorine Must link increase to overall / total electricity used **Ignore:** incorrect causality
			Total	**12**	

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