OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry A

General Certificate of Secondary Education

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

Mark Scheme for January 2013

Oxford Cambridge and RSA Examinations

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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.

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:

	indicate uncertainty or ambiguity
BOD	benefit of doubt
CON	contradiction
	incorrect response
ECF	error carried forward
	draw attention to particular part of candidate's response
NBOD	no benefit of doubt
R	reject
	correct response

L1 , L2 , L3	indicate level awarded for a question marked by level of response
^	information omitted

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 and 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. 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.

d. 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**

e. 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	Marks	Guidance
1	(a)	(i)	*any three from:* the charge resulted in a reduction in particulate concentration / air pollution in the town centre (1) the reduction in particulate concentration / air pollution in the town centre after the charge was gradual (1) there was less / low particulate concentration / air pollution in the town centre at weekends / ora / charge made little difference to / increased slightly the pollution at weekends / pollution higher on Saturday than on Sunday (1) particulate concentration / air pollution in the town centre varied from day to day (before and after the charge) (1)	3	**ignore** reference to changes in the number of cars / how many people paid the charge **ignore** idea of pollution changing (rather then decreasing) pollution gradually lowered after charge = 2 marks **ignore** figures quoted from bar chart
		(ii)	*any two from* fewer cars after charge / number of cars decreased each day after charge / more cars on day 15 than on day 21 (1) people did not want to pay the charge / people chose another way to travel / people shared cars (1) less fuel burned (1) took time for particulates to disperse (1)	2	**accept** any other valid explanation eg at first many people did not know about the charge (1) as they got to know they stopped using their cars / shared cars / used public transport (1) **allow** examples of other ways of travelling eg cycles / buses **ignore** reference descriptions of patterns eg less at weekends / gradual decrease with time
	(b)		When a hydrocarbon burns with a good supply of oxygen, carbon reacts to make carbon dioxide. ✓ The hydrogen in the hydrocarbon reacts more readily with oxygen than the carbon does. ✓ In a limited supply of oxygen some of the carbon in a hydrocarbon does not burn. ✓	2	all three correct scores 2 marks two correct scores 1 mark

Question			Answer	Marks	Guidance
	(c)		sulfur dioxide / nitrogen dioxide (1) causes acid rain / damages crops / kills fish (1)	2	**allow** correct formula **do not allow** pollutants that cause harm directly eg CO **allow** CO_2 (1) global warming / greenhouse effect (1) second mark cannot be scored if wrong pollutant given
	(d)		*any two from:* increase availability of public transport / make public transport free / introduce park and ride (1) have dedicated cycle lanes / routes (1) have no / reduced charge for cars with more than one person in / have no/reduced charge for electric vehicles (1) increase parking charges (1) only allow cars at certain times of day (1) make town centre traffic free (1) limit entry according to vehicle emissions (1)	2	**allow** other valid answers, but they must be practical steps that the **council** could take answer must clearly indicate what the council can do rather than what individuals can do eg no mark for people can share cars **ignore** vague ''encourage people to …' answers **ignore** reduce number of parking spaces / use catalytic converters / reference to MoT testing / car tax / fuel price / insurance cost / idea of rewards for walking etc
	(e)		5 3 4	2	all three correct scores 2 marks two correct scores 1 mark
			Total	**13**	

Question			Answer	Marks	Guidance
2	(a)		**Level 3 (5–6 marks)** Answer that makes clear the relationship between NO_2 and number of vehicles and explains this in terms of the reactions in a car engine, and in air. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Answer makes clear the relationship between NO_2 and vehicles, and tries to explain this in terms of reactions in a car engine. Quality of written communication partially impedes communication of science at this level. **Level 1 (1–2 marks)** Answer makes clear the relationship between NO_2 and vehicles. Quality of written communication does impede communication of science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to C** **Indicative scientific points may include:** • as number of vehicles increases nitrogen dioxide (concentration) increases • this relationship is proportional • there is a (positive) correlation between number of vehicles and nitrogen dioxide concentration • scatter on graph results from different vehicles / wind direction etc • vehicle engines are the cause of nitrogen dioxide pollution • nitrogen and oxygen react together in a car engine • nitrogen and oxygen are from air • the reaction takes place at high temperature • NO from exhaust reacts with O_2 in air to make NO_2 **ignore** references to catalytic converters. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Marks	Guidance
	(b)	(i)	*any two from:* sample 2 / 132 is not an outlier / there is not an outlier (1) there is no justification / evidence to discard sample 2 / 132 / any value (1) nitrogen dioxide concentration could vary from moment to moment / no reason to think a mistake has been made (1)	2	ignore reference to reliability / accuracy / average etc
		(ii)	calculates average as the best estimate (1) 123.7 (1)	2	**allow** 1 mark for any attempt at average calculation clearly shown but with wrong answer eg 122 (no mark for 122 without working) or if answer wrongly rounded eg 123.6 if both 123.7 and 122 given, award only 1 mark **allow** 2 marks for correct answer with no working **allow** 123.67 / 123.6r / 124 for 2 marks
		(iii)	the mean for the first motorway / 123.7 is outside the range for the second motorway	1	**do not allow** 'the ranges are different / do not overlap' **do not allow** 'they have different best estimates / means' **allow** mean of 132.2 for second not in range for first **ignore** reference to real difference
			Total	**11**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td>(i)</td><td>as fuels (1)
as lubricants (1)</td><td>2</td><td>ignore named examples of fractions eg diesel, bitumen
ignore reference to monomers / polymers / plastics / named polymers / making pharmaceuticals etc
allow making roads</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>The longer the hydrocarbon chains, the larger the forces between them. ✓

Large molecules need more energy to vapourise than small molecules. ✓</td><td>2</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><th></th><th>carbon</th><th>hydrogen</th><th>oxygen</th></tr><tr><td>ethene</td><td>2</td><td>4</td><td>0</td></tr><tr><td>water</td><td>0</td><td>2</td><td>1</td></tr><tr><td>ethanol</td><td>2</td><td>6</td><td>1</td></tr></table></td><td>3</td><td>one mark for each correct row

allow blank spaces in place of zeros</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>7</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
4	(a)		Factors that are not kept constant may affect the outcome. ✓ To compare the flexibility of different fence posts. ✓	2	
	(b)		2500 x 18 / 100 (1) = 450 (1)	2	**accept** correct answer without working = 2 marks

Question			Answer	Marks	Guidance
	(c)		**Level 3 (5–6 marks)** Answer gives detailed explanation of different flexibility related to three or four relevant factors from chain length, plasticizers, cross-linking and crystallinity. Quality of the written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Answer gives some description of different flexibility: related to two relevant factors from chain length, plasticizers, cross-linking and crystallinity. Quality of written communication partially impedes communication of the science at this level. **Level 1 (1–2 marks)** Answer recognises difference in flexibility of different polymers and relates to one relevant factor from chain length, plasticizers, cross-linking and crystallinity. Quality of written communication does impede communication of science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A*** **Indicative scientific points may include:** • order of flexibility A, C, B (most to least) • the polymers have different flexibility • flexibility is affected by plasticizer / chain length / cross-linking / crystallinity • flexibility depends on size of force / attraction between polymer chains • more force / attraction between polymer chains less flexibility • force / attraction between chains lowered by addition of plasticizer • more plasticizer more flexible • force / attraction between chains depends on length of chains • longer chains less flexible • force / attraction between chains depends on cross-linking • more cross linking less flexible • force / attraction between chains depends on crystallinity • more crystalline less flexible **ignore** unqualified comparison of polymers in table **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**10**	

Question			Answer	Marks	Guidance
5	(a)		Whether customers are charged for bags. ✓ Which bags customers prefer to use. ✓	2	
	(b)	(i)	*any two from:* polythene uses least energy (1) polythene uses least fossil fuel (1) polythene produces least solid waste (1) polythene gives least greenhouse gases (1) polythene uses least water (1)	2	**allow** AW for less eg not so much / lower / low etc instead of least all answers must refer to categories in the table **ignore** reference to cost / biodegradability / strength etc
		(ii)	*any two (for or against the ban) from:* bags may be discarded and litter the environment / they take up space in landfill / harm wildlife (1) polythene will not rot / takes a long time to degrade (1) incineration of polythene bags causes pollution (1) polythene made from crude oil which is finite (1) polythene can be recycled and used to make something else (1) bags could be re-used (1)	2	**allow** other valid ideas **ignore** reference to data from table **ignore** reference to cost / strength / durability
			Total	**6**	

Question			Answer	Marks	Guidance
6	(a)		cholera is caused by bacteria (1) chlorine kills bacteria (1)	2	do not allow idea that chlorine stops bacteria entering the water / chlorine cleans / purifies the water allow micro-organisms instead of bacteria, but do not allow germs
	(b)		**Level 3 (5–6 marks)** Answer gives a detailed explanation of how pesticides may contaminate the environment **and** the health threat they may pose. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Answer gives a detailed explanation of how the pesticides may contaminate the environment OR a detailed description of the health threat they may pose OR a less detailed description of both. Quality of the written communication partially impedes communication of the science at this level. **Level 1 (1–2 marks)** Answer attempts some description of how the pesticides may contaminate the environment or the health threat they may pose. Quality of the written communication does impede communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A** **Indicative scientific points may include:** • pesticides are toxic • pesticides may contaminate the environment • pesticides contamination may spread over long distances • pesticides may persist in the environment for a long time • pesticides may kill wildlife / beneficial insects • pesticides may accumulate as they are passed up the food chain • pesticides residues can be present in human food / water supplies • there is insufficient data to judge the threat posed by pesticides. **ignore** reference to environmental or health problems caused by chlorine instead of pesticides **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Marks	Guidance
	(c)		Any three answers Yes because: DDT causes harm to birds (1) some species may become extinct (1) food chain may be disrupted / DDT builds up in food chains (1) DDT may get into human food/water supplies / DDT may cause harm to humans (1) No because: DDT stops people getting malaria (1) saves (human) lives (1) saves cost of medical treatment (1) prevents loss of working population (1) Balance of two arguments: human life is more important than birds / benefit outweighs the risk (1) only ban in countries where there is no malaria/low bird population (1) need to consider long term environmental effects (1)	3	**ignore** unqualified reference to DDT being harmful **ignore** vague reference to preventing disease
	(d)		sodium sulfate (1) sodium nitrate (1)	2	**allow** correct formulae Na_2SO_4 $NaNO_3$ **allow** sodium sulphate do not allow any other answers if name and formula given mark name only
			Total	**13**	

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