OCR
RECOGNISING ACHIEVEMENT

GCSE

Additional Science A

General Certificate of Secondary Education

Unit **A151/02**: Modules B4, C4, P4 (Higher Tier)

Mark Scheme for June 2013

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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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:

	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. 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			**Level 3 (5–6 marks)** Discusses at least **two** differences between A&B with some quantitative information Explains the decrease in terms of reduced function of the enzyme Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Makes clear comparison between the two enzymes but gives a limited or no explanation. May have some weak quantitative information. OR gives no comparison but a good explanation of denaturing. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Limited description or comparison; no explanation. Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Discusses shape of graph without reference to meaning of either axis. 'Peak A is lower than B' Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A.** **Indicative science points may include:** **Descriptions** • activity rises to a peak for both [optimum temperature] • and then falls • activity of A rises faster than B • maximum activity of A is lower than B • maximum activity of A is at a lower temperature than B **Explanations** • rate of reaction increases with temp owtte • enzymes are denatured/stop working/ become inactive at hotter temps • because shape of active site changes **Indicative scientific points at level 1 may include:** • Two pieces of information from the graph **Ignore** general statements about A faster than B unless linked to specific conditions If 'denatured' is implied as occurring predominantly at the peak, do not credit the reference to denatured unless it occurs elsewhere. Assume any changes are with increasing T unless specified otherwise.eg read 'A reaches an activity peak ***before*** B' as 'A reaches an activity peak ***at a lower temperature than*** B'. **Maximum temperature is *not* the same as temperature of maximum activity** Comparisons do not have to be emphasised – eg if the optimum temp for **both** enzymes is mentioned, allow this as a comparison **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
2	(a)		correctly plots points to within ± 1 scale division AND draws line of best fit(1)	1	must look like a straight line by eye
	(b)		from graph [to within ± 1 scale division] (1) idea of no [%] change in length /no osmosis takes place at that concentration (1)	2	 **accept** it is where the line crosses the axis
	(c)		**Either** **one improvement plus reason** [Reproducibility / repeatability] **OR** **any two improvements** repeat the experiment use more cylinders make sure all the cylinders are from the same potato use more concentrations; take the average	2	**ignore** 'confidence' [stem] and 'fair test' **ignore** 'use more accurate equipment'/ use higher sugar concentration / use cylinders of different length / leave for longer / measure change in mass **accept** reference to improved reliability / accuracy **accept** look for outliers **accept** use longer cylinders "repeat – to see if the pattern is the same" = 2
			Total	**5**	

<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></td><td>$6H_2O + 6CO_2 \rightarrow C_6H_{12}O_6 + 6O_2$</td><td>2</td><td>EITHER
1 mark for each correct side of the equation
accept reactants in either order
1 max if clearly incorrect caps / superscripts instead of subscripts

OR
all formulae correct including subscripts by eye = 1
balanced = 1</td></tr>
<tr><td></td><td>(b)</td><td></td><td>any three from
nitrogen [needed] ;
from nitrates ;

enzyme / catalyst ;

energy needed [extra glucose] ;
for / via respiration</td><td>3</td><td>ignore reference to nitrogen dioxide

allow unqualified extra glucose only in the context of energy</td></tr>
<tr><td></td><td>(c)</td><td></td><td>any two from
temperature ;
at the higher temperature the rate is higher ;
increasing CO_2 does not increase the rate</td><td>2</td><td>ignore light intensity</td></tr>
<tr><td></td><td>(d)</td><td></td><td><table><tr><td>Photosynthesis will slow down…</td><td>✓</td><td></td></tr><tr><td>The overall rate of photosynthesis is due to a…</td><td></td><td>✓</td></tr><tr><td>Plants must take in carbon dioxide by diffusion…</td><td></td><td>✓</td></tr><tr><td>More than just the carbon dioxide…</td><td>✓</td><td></td></tr></table></td><td>2</td><td>4 rows correct = 2 marks
2 or 3 rows correct = 1 mark

more than 2 boxes ticked in a column = 0 marks</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>9</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
4			**first marking point** Discusses lines / wavelengths/ frequencies/ positions / pattern [of lines] **and two from** sodium (completely) **matches** the sample ; potassium doesn't match ; idea that sample contains other compounds [beside sodium]	3	One mark reserved for reference to lines / position some lines in the sodium match the sample = 1 some lines in the sample match the sodium = 2 "Both sodium and the sample have bold lines" = 1 for lines, but there is no implication of complete match
			Total	**3**	

Question			Answer	Marks	Guidance
5	(a)		protons 17, neutrons 20	1	
	(b)		2:7	1	accept 2.7.0
	(c)		**any three from** electron [movement] ; one [electron] ; [electron] gain ; to outer shell ; [causing] one more electron than proton	3	Must be in the context of a halogen atom/ ion. Do not apply con, but if the candidate includes incorrect statements, max 2 **accept** in words eg 'single' / 'an' / 'the' [electron] gains one proton into outer shell = 1 for outer shell
	(d)	(i)	aq aq aq s	1	
		(ii)	$Cl_2 + 2KI \rightarrow 2KCl + I_2$	2	Correct formulae correct numbers in front of the formulae **allow** $Cl_2 + 2KI \rightarrow 2KCl + 2I$ (1) $2Cl + 2KI \rightarrow 2KCl + 2I$ scores zero
		(iii)	ion has full outer shell (1) can't take or lose electrons (1)	2	Must be in the context of a chlorine atom/ chloride ion. Do not apply con, but if the candidate includes incorrect statements, max 1 chloride ion has gained an electron = 1
	(e)		the solution contains ions which can move	1	
			Total	**11**	

Question			Answer	Marks	Guidance
6			**Level 3 (5–6 marks)** Discusses two relevant aspects and attempts to explain the significance Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Discusses two relevant aspects but cannot articulate the significance OR Discusses significance correctly and in depth without reference to any of the relevant aspects. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Candidate discusses one of the relevant aspects without reference to significance. Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** The candidate refers to the periodic table but not in the context of the work of Mendeleev	6	**This question is targeted at grades up to A*.** **Indicative science points may include:** **discoveries** • gaps [for unknown / new elements] • fit [in the gaps / table] • in the patterns / trends / similarities [for the *new* elements] • [pattern of] properties **significance** • discusses prediction • suggests that even more elements to be discovered • idea of proof / confirmation / more evidence • confidence increased / it made sense / easier to understand • triggered further work / discoveries by scientists Any mention of specific properties of elements that might have been relevant (actual props of Ga etc not required) **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
7			**Level 3 (5–6 marks)** Correctly discusses more than one scientific point to describe the safety aspects [of what happens in a crash]. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Discusses at least one of the science points correctly. The science may not link directly to the safety aspects, and there may also be some incorrect science. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Describes a safety aspect with little or no explanation OR recognises that the force/impact, or the momentum or energy is a key factor but has little understanding. Quality of written communication impedes 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 C.** **Indicative points may include:** **science points:** • increase stopping distance [for passenger/car] (accept "more to crush") • increase time [for occupants/car] to stop OR of impact • reduce force/impact [on occupants] • needed to reduce their momentum/speed/velocity • because force = momentum change÷time. • Energy argument [1] eg smaller force to do the same work/energy because stopping distance is longer etc. • Energy argument [2] large crumple zones absorb more energy than small ones **safety points:** • increases safety/reduces harm to occupants • Crumple zone damaged instead of occupants Assume that the candidate is talking about larger crumple zones unless specified otherwise. **accept** slows the passenger/car down **ignore** "reaction times", surface area and pressure arguments **ignore** cars with different mass a Level 1 response might be "Reduces the risk of injury – to the occupant" **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Marks	Guidance
8	(a)		recognise that one data point ignored / 0.29 ignored /recognise that not all the values were used (1) identifies this point as an outlier **OR** reason why outlier can be ignored (eg first try is a practice attempt)/should not be ignored (eg you should use all of the data) (1)	2	If a mathematical expression includes 0.29 AND the other 4 values, this is the same as the first marking point = 1 'Danny is wrong as he should add all the results up and divide by 5' = 1 **ignore** 'He should divide by 5' without reference to adding 5 results
	(b)		**any three from:** new mean is 0.18 s ; compared previous mean (0.20 / 0.22 s) ; comparison of both *ranges* (0.18 to 0.22 /0.29) and 0.16 to 0.20) ; compares new mean with old range	3	**ignore** Ellie has had more practice, so was faster 'Her times were quicker' **ignore** simple comparison of specific times
	(c)		discusses gradient / slope / steepness in suitable context (1) ; graph / gradient / line gets ***steeper*** as time/distance increases (2)	2	Curves ***upwards*** = 1 line increases ***more*** rapidly = 1 **ignore** line increases rapidly / line goes up more Shows increased distance travelled for identical time intervals = 1 [no explanation]
			Total	**7**	

Question			Answer	Marks	Guidance
9	(a)		-4.0 m/s^2	2	+4.0 m/s^2 for (1)
	(b)		C	1	
			Total	**3**	

Question			Answer	Marks	Guidance
10	(a)		friction to the left / towards Jim (1) weight/gravity downwards (1) reaction upwards (1)	3	each must have name and direction for (1) **accept** labelled arrows on the diagram, but text has priority Not mass as weight, but accept gravity 'pushing' downwards **accept** 'upthrust' as both force and direction, ignore 'thrust' **ignore** 'air resistance'
	(b)		left - 200 N - the force is half of an interaction pair	1	
			Total	**4**	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Head office
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Facsimile: 01223 552553