OCR
Oxford Cambridge and RSA

GCE

Chemistry B (Salters)

Unit **F331:** Chemistry for Life

Advanced Subsidiary GCE

Mark Scheme for June 2015

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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 (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	separates marking points
not	answers which are not worthy of credit and which will CON a correct answer
ignore	statements which are irrelevant and will NOT 'CON' a correct answer
allow	answers that can be accepted
( )	words which are not essential to gain credit
__	underlined words must be present in answer to score a mark
ecf	error carried forward
AW	alternative wording (replaces the old 'or words to that effect')
ora	or reverse argument

Annotations used in scoris:

Annotation	Meaning
✓	correct response
×	incorrect response
bod	benefit of the doubt
nbod	benefit of the doubt **not** given
ECF	error carried forward
^	information omitted
I	Ignore
R	Reject
BP	blank page

Subject-specific Marking Instructions that apply across the whole question paper to be included here.

Use a ✓ for every correct answer where it is scored. Use BP for blank additional sheets. Don't forget to use the chain(link) symbol where answers are on additional sheets.

MARK SCHEME

<table>
<tr><th colspan="3">Question 1</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>
<table>
<tr><th>Isotope</th><th>Number of protons</th><th>Number of neutrons</th><th>Number of electrons</th></tr>
<tr><td>^{28}Si</td><td>14</td><td>14</td><td>14</td></tr>
<tr><td>^{29}Si</td><td>14</td><td>15</td><td>14</td></tr>
<tr><td>^{30}Si</td><td>14</td><td>16</td><td>14</td></tr>
</table>
✓</td><td>1</td><td>All correct</td></tr>
<tr><td></td><td>b</td><td>i</td><td>stage 2: ionisation
stage 3: acceleration
stage 4: drift(ing) (region) ✓</td><td>1</td><td>MUST be in correct order

ALLOW ‘flight’ or ‘flight zone’ or ‘flight path’ for ‘drift’
IGNORE ’time of flight’</td></tr>
<tr><td></td><td>b</td><td>ii</td><td><u>positive</u> ions OR cations✓

accelerated to same <u>Kinetic</u> Energy✓

therefore if mass small then velocity/speed large ora
OR‘ KE = 0.5mv^{2}’✓</td><td>3</td><td>‘ions’ can be implied

QWC kinetic must be spelled correctly once

IGNORE reference to size
IGNORE wrong expressions for KE
ALLOW in terms of take less/more time to reach detector for 3rd m p.</td></tr>
<tr><td></td><td>b</td><td>iii</td><td>(20.55x70)+(27.37x72)+(7.67x73)+(36.74x74)+(7.67x76) ÷ 100 ✓

72.7✓</td><td>2</td><td>

Correct answer on answer line scores both marks;</td></tr>
<tr><td></td><td>b</td><td>iv</td><td>Evidence of use of graph ✓

1.6 – 2(.0)</td><td>2</td><td>First mark for working shown on graph. Could be best fit curve/construction lines or marks on the x axis</td></tr>
</table>

<table>
<tr><th colspan="3">Question 1</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td></td><td>b</td><td>v</td><td>$^{76}_{32}Ge \rightarrow 2\,^{0}_{-1}\beta$ ✓ + $^{76}_{34}Se$ ✓

OR $^{76}_{32}Ge \rightarrow {}^{0}_{-1}\beta + {}^{0}_{-1}\beta + {}^{76}_{34}Se$
✓ ✓</td><td>2</td><td>ALLOW ecf on second mark if only 1 beta particle
ALLOW: – (minus) beta particles on left hand side of equation
ALLOW e symbol instead of β but DO NOT ALLOW e^-
Correct answer but with any superscripts / subscripts on right of symbols scores one mark
ALLOW just – instead of -1 for subscript on beta
Allow two stage process through As
IGNORE gamma decay
No beta decay, no mark</td></tr>
<tr><td></td><td>c</td><td>i</td><td><table><tr><th>Particle</th><th>Relative Mass</th><th>Charge</th></tr><tr><td>proton</td><td>1</td><td>+1</td></tr><tr><td>neutron</td><td>1</td><td>0</td></tr><tr><td>electron</td><td>negligibleORzeroOR1/2000</td><td>-1</td></tr></table>✓</td><td>1</td><td>ALLOW other alternatives for relative mass of an electron
IGNORE + before relative mass but minus is con
Allow signs before or after the number

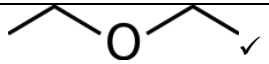
ALLOW between 1/1800-2000 (0.0005-0.0006)
IGNORE (very) small</td></tr>
<tr><td></td><td>c</td><td>ii</td><td>2,8,18,4 ✓</td><td>1</td><td>ALLOW $1s^2 2s^2 2p^6 3s^2 3p^6\ 3d^{10}\ 4s^2\ 4p^2$
NOT [Ar] $3d^{10}\ 4s^2\ 4p^2$
ALLOW 4s and 3d reversed in full structure</td></tr>
<tr><td></td><td>d</td><td></td><td>Without gap properties of elements did not match ✓</td><td>1</td><td>Answer should imply properties of known elements not fitting
Reference to atomic number is a CON because the question concerns what Mendeleev knew.</td></tr>
<tr><td></td><td>e</td><td></td><td>period: number of <u>occupied</u> shells/how many shells of electrons ✓

group: number of electrons in outer shell/valence electrons/outer electron structure ✓</td><td>2</td><td>NOT number of highest filled shell

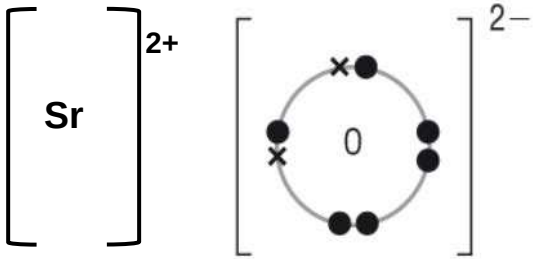
NOT number of outer shells

ALLOW energy level for shell</td></tr>
<tr><td></td><td></td><td></td><td></td><td>16</td><td></td></tr>
</table>

Question 2			Answer	Mark	Guidance
2	a	i	(2x -286) – (2x -188) ✓ -196 ✓	2	Answers of -196 score 2 without reference to working Answers of -98 (omitting 2s) score 1, no other ecf
	a	ii	$H_2(g) + ½O_2(g) \rightarrow H_2O(l)$ Correct balanced equation ✓ Second mark for correct state symbols on correct balanced equation✓	2	 **ALLOW** state symbols mark for: $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$ But zero for any other equation
	a	iii	On right (product side) there are more moles/molecules/particles ✓ gas on right/gases have more entropy/gas product *AW*✓	2	**IGNORE** 'more products'
	b		moles H_2O_2 = 90/34 (= 2.65)✓ 3/2 x 2.65 (=3.97) moles of product ✓ 70 x calculated number of moles and evaluated ✓	3	**ALLOW** ecf including ecf from rounding Answers based on 2.779 x 10^2 score 3 Answers based on 1.853 x 10^2 score 2 Answers based on 5.565 x 10^2 score 2 Answers based on 95.28 (use of 24 not 70) score 2 **ALLOW** 2 or more sf
	c	i	aliphatic: no benzene ring(s) **OR** aromatic: benzene/C_6H_6 rings/arenes ✓	1	Reference to no **rings** in aliphatic is a CON
	c	ii	$C_{10}H_{22} + 15½O_2 \rightarrow 10CO_2 + 11H_2O$	1	**ALLOW** multiples
	c	iii	contains a double/triple bond **OR** C=C **OR** C≡C✓	1	**ALLOW** not all bonds are single
	c	iv	act as catalyst/speed up reaction/reduce activation energy **OR** large surface area for reaction ✓	1	**IGNORE** act as molecular sieves/separate straight chains from branched chains
	d		Produces no CO_2/CO ✓	1	**ALLOW** no carbon emissions/particulates/SO_x **NOT** less CO etc **IGNORE** H_2O_2 only produces water/reference to greenhouse gases/global warming
				14	

Question 3			Answer	Mark	Guidance
3	a	i	 ✓ homologous series: ethers ✓	2	**ALLOW** alkoxyalkane for ether
	a	ii	butan-2-ol✓ $C_4H_{10}O$ ✓	2	Atoms in any order **DO NOT ALLOW** C_4H_9OH **DO NOT ALLOW** but-2-ol **IGNORE** dashes, brackets, commas
	a	iii	Bond/atoms coming out of/above the plane of the paper/towards you ✓	1	**IGNORE** vague statements of 3D **NOT** molecule coming out of the page
	b		$NO/NO_2/N_2O_4$✓ reaction/combustion/bonding/combining of nitrogen and oxygen in air/atmosphere✓ at high temperatures/hot conditions/intense heat (in engine) ✓	3	**NOT** NO_x **ALLOW** correct formulae for second mark (N_2/O_2) **ALLOW** ONE of nitrogen and oxygen being stated as 'from the air' as long as there is not a CON e.g. 'nitrogen from the fuel'. **ALLOW** 'Oxidation of nitrogen in the air' **NOT** 'in exhaust' **NOT** just 'heat (in the engine)' **IGNORE** 'extreme'
	c		$2N_2O \rightarrow 2N_2 + O_2$✓	1	**ALLOW** halved/multiples **IGNORE** state symbols
	d	i	Reforming **AND** hydrogen✓	1	**ALLOW** reformation/reform **ALLOW** H_2 but **IGNORE** H

Question 3			Answer	Mark	Guidance
	d	ii	carbons have four electron pairs/groups/sets **OR** carbons have four regions of electron density ✓ repel to get as far apart as possible/minimise electronic energy✓ (predicted bond angles) of 109 (108-110)✓ CCC bond angle in cyclopropane less/smaller than 109 **OR** is 60✓	4	**2nd marking point must be in terms of electrons (ignore bonds)** **NOT** 'as much as possible' unless qualified with minimise Any angle quoted which is not 60 is con 'Smaller/less' only scores if predicted angle has been stated as 108-110
	d	iii	energy required to break one mole of bond✓ differs (for same bond) in different compounds/molecular environments/types of molecule/AW✓	2	**NOT** 'different molecules'
				16	

Question 4			Answer	Mark	Guidance
4	a	i	in the same group/forms 2+ ions/same charge ✓	1	**ALLOW** similar size ions **ALLOW** statement that they are (both) in group 2 **IGNORE** references to reactivity
	a	ii		2	**One mark for each completely correct ion** **ALLOW** Sr surrounded by eight electrons **ALLOW** any distribution of 6 + 2 electrons on oxygen as long as the 2 electrons match any shown on the Sr **ALLOW** signs before numbers Two correct ions with incorrect/no charges scores 1 Square brackets not essential if clearly ionic Circle not required around O
	a	iii	(a) energy absorbed/ heating causes <u>electrons</u> go into / promoted/up/excited to higher <u>energy levels</u> ✓ (b) drop back emitting energy as light/photons/em (radiation) ✓ (c) energy levels/gaps are quantised/discrete (d) energy is proportional to frequency/E= hf/E=h*v* ✓ (e) (spectra are unique) because (different) elements have different/ unique (gaps between) energy levels/AW ✓	5	**NOT** by photon/light/em radiation unqualified **ALLOW** 'shells' for energy levels **NOT** simply 'radiation' Marking point (c) can be scored from a labelled diagram showing y axis as E/energy/energy levels as label, or labelled Bohr diagram. "Shells" must be qualified by "energy levels" somewhere in the answer to score marking point (e)
	b	i	*Any two from:* Fixed amount/moles of carbonate✓ same temperature/heating conditions✓ Same volume/amount/concentration of lime water✓	2	**IGNORE** mass of carbonate **IGNORE** moles of 'substance'
	b	ii	lime water goes cloudy/milky ✓ observation seen sooner with calcium (carbonate) ora✓	2	**ALLOW** quicker bubbling/more cloudy/ more gas with calcium for second mark **IGNORE** any reference to colour of residue
	c		SiO_3^{2-}✓✓ One mark for any negative ion containing only Si and O;	2	**ALLOW** SiO_4^{4-}
				14	

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