OCR
Oxford Cambridge and RSA

GCE

Chemistry B (Salters)

Unit **F331:** Chemistry for Life

Advanced Subsidiary GCE

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.

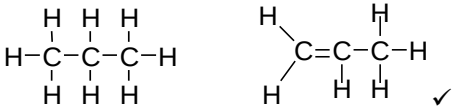
OCR will not enter into any discussion or correspondence in connection with this mark scheme.

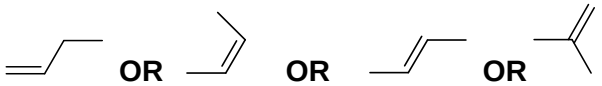
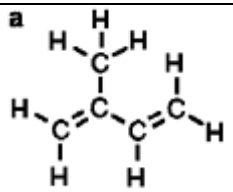
1. These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation	Meaning
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.
BOD	Benefit of doubt
CON	Contradiction
	Cross
ECF	Error carried forward
I	Ignore
NAQ	Not answered question
NBOD	Benefit of doubt not given
NGE	Not good enough
RE	Rounding error
REP	Repeat
SEEN	Noted but no credit given
SF	Error in no. of significant figures
	Tick
^	Omission mark

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

Please tick the place where a candidate scores a mark on **every** question.

Question			Answer	Marks	Guidance
1	(a)		Process: fractional distillation } Property: boiling point /condensation point } ✓	1	both required for 1 mark **IGNORE** references to length of hydrocarbon chain number of carbons/mass/volatility Watch for **CONS** eg 'boiling pt **and** melting pt'
	(b)	(i)	 ✓	1	**IGNORE** bond angles and any other formulae **NOT** lower case 'h'
		(ii)	unsaturated ✓	1	**ALLOW** minor spelling errors
	(c)	(i)	$C_{10}H_{22} \rightarrow C_2H_4 + C_8H_{18}$ ✓	1	
		(ii)	catalyst in different state/phase to reactants ✓ adsorption (on to surface) ✓	2	**IGNORE** "products" **QWC**: adsorption must be spelt correctly for second mark adsorbed etc to be allowed
		(iii)	tendency of fuel to autoignite/pre-ignite/knock/pink ✓ more efficient/stops possible damage ✓	2	**IGNORE** "engine autoignite" **ALLOW** 'better mileage'/better performance **IGNORE** 'less knocking' AW **IGNORE** incomplete combustion
		(iv)	wedge going in front (of plane of paper) and dotted line behind AW ✓	1	must have both **ALLOW** (atoms) coming out, going behind linked to wedges and dots
		(v)	hydrogen/H_2 ✓	1	**DO NOT ALLOW** 'H' alone

Question			Answer	Marks	Guidance
	(d)	(i)	different structural formulae for the same molecular formula ✓	1	**ALLOW** same molecular formula different arrangement/order of atoms/different structure (AW) **ALLOW** same <u>number and type</u> of atoms for molecular formula **NOT** 'same chemical/physical properties' **IGNORE** references to functional groups
		(ii)	 **OR** **OR** **OR** **three** correct isomers score both marks ✓✓ **two** correct one mark ✓	2	Three correct full structural formulae scores max of 1 mark
1	(e)		a  ✓✓ 2 marks if completely correct 1 mark for correct two double bonds	2	**DO NOT ALLOW** condensed formulae e.g. CH_3 **IGNORE** bond angles **ALLOW** one mark for all correct skeletal structure
			Total	15	

Question			Answer	Marks	Guidance
2	(a)		$2SO_2(g) + 2H_2O(g \text{ or } l) + O_2(g) \rightarrow 2H_2SO_4(aq)$ correct species and balance ✓ states ✓	2	**ALLOW** 'half' or multiples **DO NOT ALLOW** (l) for sulfuric acid **ALLOW** 'state' mark if species correct but equation unbalanced
	(b)		CaO/it is basic ✓	1	**ALLOW** alkaline instead of basic And answers like.. "it is an acid/base reaction and the acidic sulfur dioxide is neutralised by the CaO"
	(c)		carbon dioxide has two sets/groups of electrons/areas of electron density ✓ sulfur dioxide has three sets etc.✓ electrons repel as far as possible/minimise repulsion ✓ (three groups gives) 120^0 (allow 115 -125^0) ✓	4	**IGNORE** references to bonding pairs Watch for **CON** "three **bonding** groups in SO_2" Watch out for **CON** – "repel as far apart as possible" for one species, but "don't repel ……."for the other **IGNORE** 'repel as *much* as possible' **IGNORE** 'push' **NOT** 'atoms repel' **IGNORE** 'bonds repel' **ALLOW** for 'electrons': 'these' (if 1st mpt scored) or any of the terms allowed for the first mpt **NO** ecf (eg 4areas/109)
	(d)		100 ÷ 32.1 ✓ (3.112 or 3.125 if 32 used) answer to first marking point x 64.1 (64) and correctly evaluated (=199.7or 200.31) ✓	2	**ALLOW** working or answer for 1st marking pt. 199.7/200 on answer line scores both marks
	(e)		advantage – no CO_2/CO/NOx/particulates✓ disadvantage – (disposal of) radioactive waste ✓	2	**NOT** 'less' CO_2/CO/NOx/particulates. **IGNORE** references to abundance/availability of either fuel/greenhouse gases must have idea waste is radioactive

Question			Answer	Marks	Guidance
	(f)		carbon: **covalent; giant /network** ✓ sulfur: **covalent; (simple) molecular/ small molecules**✓	2	**IGNORE** 'covalent' in right-hand column **IGNORE** 'lattice/molecular/molecules' in top right box **ALLOW** id-id for sulfur in bottom left box **ALLOW** 'simple molecule' in bottom right box
			Total	13	

<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>
<table>
<tr><th>Isotope</th><th>Number of protons</th><th>Number of neutrons</th><th>Number of electrons</th></tr>
<tr><td>Boron-10</td><td>5</td><td>5</td><td>5</td></tr>
<tr><td>Boron-11</td><td>5</td><td>6</td><td>5</td></tr>
</table>
✓</td><td>1</td><td>All correct for the mark</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>(percentage)abundance/amount/intensity (of the isotopes)✓</td><td>1</td><td>ALLOW ‘their %’s in a sample of boron’ AW
ALLOW answers which say there is more boron-11 ora
ALLOW relative (isotopic) abundance
IGNORE ‘abundance of peaks’
IGNORE references to masses</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Mass of each isotope multiplied by abundance/peak height/frequency/amount/intensity/value ✓

(calculate) average/mean ✓</td><td>2</td><td>ALLOW sum of isotopic mass x % abundance (scores both marks)

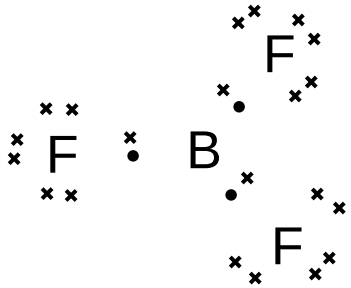
ALLOW sum divided by total abundance for 2nd mpt
ALLOW ÷ 100 (y axis not labelled)
2nd mark depends on first being scored</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>(accelerated to) same KE ✓

heavy/heavier ions:
move slower
OR reach detector later/last ✓ AW

any reference to KE made up of mass and velocity terms or KE = ½mv² ✓</td><td>3</td><td>IGNORE ‘atoms’ for 1st mpt

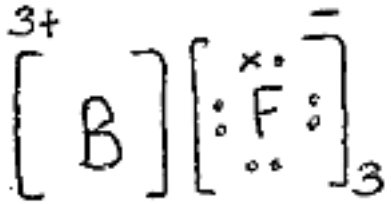
DO NOT ALLOW reference to negative ions for 2nd mark

ALLOW ‘Heavier ions are accelerated less’ ORA for 3rd mp.</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>
<table>
<tr><td></td><td colspan="2">Ionising radiation</td></tr>
<tr><td>Property</td><td>alpha (α)</td><td>beta (β)</td></tr>
<tr><td>Relative mass</td><td>4</td><td>0</td></tr>
<tr><td>Relative charge</td><td>+2</td><td>-1</td></tr>
<tr><td>Deflection by electrical field</td><td>small</td><td>large</td></tr>
<tr><td>Stopped by a minimum of</td><td>paper</td><td>Al foil</td></tr>
</table>
one for each column ✓✓</td><td>2</td><td>Large/small swapped scores 1 mark if all else correct</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>$^{10}_{5}B + {}^{1}_{0}n \rightarrow {}^{4}_{2}He$ ✓ + $^{7}_{3}Li$ ✓</td><td>2</td><td>ALLOW α symbol instead of He
ALLOW ecf for 2nd nucleon after wrong numbers on He
MAX one mark if any number on right e.g Li^{7}_{3}
DO NOT ALLOW He on top of arrow
DO NOT ALLOW charges on He/Li</td></tr>
<tr><td>3</td><td>(c)</td><td>(iii)</td><td>lack of penetration AW ✓</td><td>1</td><td>ALLOW ideas of stopped by container/Al foil/clothing etc
ALLOW “don’t travel far”</td></tr>
<tr><td></td><td>(d)</td><td></td><td> 

shared electrons ✓ lone pairs ✓</td><td>2</td><td>For covalent structure
IGNORE bond angles
Only one electron symbol used maximum 1
A lone pair appearing on B CONs 2nd mark

ALLOW correct ionic dot-and-cross with 1 mark for correct B structure including charge and 1 for 3 correct fluorides including charges (see below)</td></tr>
</table>

Question			Answer	Marks	Guidance
					 **ALLOW** 2 electrons on B for ionic structure
	(e)	**(i)**	Time taken for half the radioactive nuclei to decay **OR** mass to decrease by half **OR** radioactivity to reduce by a half **OR** time taken for count rate / amount to drop by half ✓	**1**	Must mention time/how long for something to reduce by half: nuclei, atoms, substance, isotope(s), radioactivity, mass **NOT** nucleus, "a nuclei", atom (ie in singular) **DO NOT ALLOW** 'decompose' for 'decay'
		(ii)	(mass)ratio of U-235 to lead/parent to daughter or vice-versa ✓ an indication of time/age being related to number of half-lives elapsed✓	**2**	First mark for idea that <u>both</u> lead and uranium need measuring Mark separately proportion/amount/ratio of **lead to uranium** gives indication of age of material/rock/mineral (ora) scores 2
		(iii)	Age of material small **compared** to half life (AW) **OR answer** that links unreliability/inaccuracy of measurement with **so little decay** (AW) ✓	**1**	**IGNORE** 'half-life too long' (in stem)
		(iv)	light nuclei/atoms (of elements) [must be plural] fuse/join to give heavier nucleus/nuclei/element(s)/atom(s) ✓	**1**	Either 'light' or 'heavy' must be mentioned but not necessarily both. E.g. "two light nuclei join to give a new nucleus" scores. **IGNORE '**small nuclei' **OR** 'large nuclei' ie small light nuclei join to form large heavy(ier) nucleus scores But "two light nuclei fuse" alone does not score
			Total	19	

Question			Answer	Marks	Guidance
4	(a)	(i)	1672J ✓	1	**ALLOW** 1670/1700 **IGNORE** sign
		(ii)	moles of sodium bicarbonate (= 12 / 84) = 0.143 or 1/7 ✓ enthalpy change per mole 1672 ÷ 0.143 (or 1672 x 7) = 11700 or 11.7 (ignore units)✓ +12 ✓	3	**ALLOW** either working or evaluation for 1st mark 2nd mark is for evaluation **ALLOW** ecf from 4a(i) and from moles bicarbonate 11700 or 11.7 or ecf from 4a(i) gains first two marking pts 3rd marking point is for sig fig, sign and expressing answer to 2nd mp in kJ +12 on answer line scores all three marks 12 scores 2; -12 scores 2 (and max 1 for any other negative number from ecf) +12000, 12000 or -12000 scores two
		(iii)	energy/heat transfer between the surroundings and the solution ✓	1	**NOT** 'heat loss' **ALLOW** 'heat gain from surroundings' **ALLOW** 'calorimeter' for 'surroundings' **ALLOW** non-standard conditions AW **ALLOW** 'specific heat is only approximate' AW
		(iv)	moles of CO_2 = 12/84 **OR** 0.143 **OR** 1/7 **OR** answer to 1st mp of 4a(ii) ✓ vol = 3.4(3) **OR** 'answer to 1st mp of 4a(ii) x 24' evaluated ✓	2	3.4(3 etc) scores both marks 72 scores 0 10.285/10.29/10.3 scores 1 overall vol = answer to 1st mp of 4a(ii) **x 3** x 24 evaluated scores 1 mark overall 2nd mark - **ALLOW** ecf only from incorrect Mr of $NaHCO_3$

Question			Answer	Marks	Guidance
	(b)		**bond breaking endothermic** AND **bond making exothermic** ✓ more energy taken in to break bonds than released when bonds form **OR** value of endothermic processes larger (than the exothermic) ORA ✓	**2**	Both needed to score first mark 2nd mark must describe an endothermic process **NOT** 'more bonds broken than made' **NOT** 'energy needed to make bonds' for 2nd mark
	(c)		a measure of the disorder/ways of arranging particles ✓ entropy of gases>liquids>solids ora ✓ solid (and liquid) on LHS/reactants to gases (and liquids)on RHS/products ora ✓ More moles/molecules of product than reactant ✓	**4**	**ALLOW** references to chaos/randomness of system **ALLOW** 'atoms', 'molecules' for 'particles' **IGNORE** 'ways of arranging a particle/molecule/ atom' (singular) **IGNORE** 'ways of arranging atoms in a molecule' **ALLOW** 'gases have highest entropy, solids have lowest' **ALLOW** 'more gases are formed' **ALLOW** 'more moles/molecules are formed **OR** greater amount of particles are formed' but **IGNORE** "more moles/molecules of gases are formed" for this mark.
			Total	13	

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