

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.

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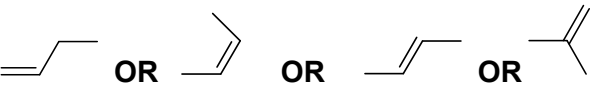
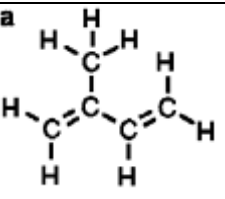
1. These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation	Meaning
	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.
	Benefit of doubt
	Contradiction
	Cross
	Error carried forward
	Ignore
	Not answered question
	Benefit of doubt not given
	Not good enough
	Rounding error
	Repeat
	Noted but no credit given
	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.

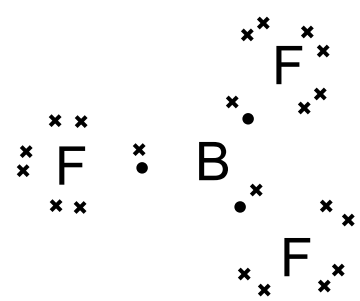
Question			Answer	Marks	Guidance
1	(a)		Process: <u>fractional</u> distillation } Property: boiling point /condensation point } ✓	1	both required for 1 mark IGNORE references to length of hydrocarbon chain number of carbons/mass/volatility Watch for CONS eg 'boiling pt and melting pt'
	(b)	(i)	$ \begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array} \quad \begin{array}{c} \text{H} & & \text{H} \\ & \diagdown & / \\ & \text{C}=\text{C} & -\text{C}-\text{H} \\ & / & \\ \text{H} & & \text{H} \end{array} \quad \checkmark $	1	IGNORE bond angles and any other formulae NOT lower case 'h'
		(ii)	unsaturated ✓	1	ALLOW minor spelling errors
	(c)	(i)	$\text{C}_{10}\text{H}_{22} \rightarrow \text{C}_2\text{H}_4 + \text{C}_8\text{H}_{18}$ ✓	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

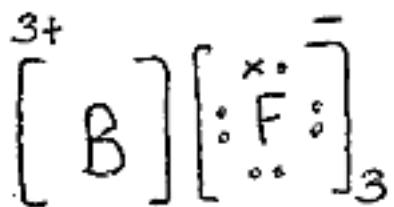
Question			Answer	Marks	Guidance
	(d)	(i)	different structural formulae for the same molecular formula ✓	1	ALLOW same molecular formula different arrangement/order of atoms/different structure (AW) ALLOW same <u>number and type</u> of atoms for molecular formula NOT 'same chemical/physical properties' IGNORE references to functional groups
		(ii)	 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)		$2\text{SO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g or l}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{SO}_4(\text{aq})$ 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° (allow $115 - 125^\circ$) ✓	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 <i>much</i> as possible' IGNORE 'push' NOT 'atoms repel' IGNORE 'bonds repel' ALLOW for 'electrons': 'these' (if 1 st mpt scored) or any of the terms allowed for the first mpt NO ecf (eg 4areas/109)
	(d)		$100 \div 32.1$ ✓ (3.112 or 3.125 if 32 used) answer to first marking point x 64.1 (64) and correctly evaluated (=199.7 or 200.31) ✓	2	ALLOW working or answer for 1 st marking pt. 199.7/200 on answer line scores both marks
	(e)		advantage – no $\text{CO}_2/\text{CO}/\text{NO}_x/\text{particulates}$ ✓ disadvantage – (disposal of) radioactive waste ✓	2	NOT 'less' $\text{CO}_2/\text{CO}/\text{NO}_x/\text{particulates}$. 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	

Question			Answer				Marks	Guidance											
3	(a)		<table><tr><td>Isotope</td><td>Number of protons</td><td>Number of neutrons</td><td>Number of electrons</td></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> ✓	Isotope	Number of protons	Number of neutrons	Number of electrons	Boron-10	5	5	5	Boron-11	5	6	5			1	All correct for the mark
Isotope	Number of protons	Number of neutrons	Number of electrons																
Boron-10	5	5	5																
Boron-11	5	6	5																
	(b)	(i)	(percentage)abundance/amount/intensity (of the isotopes)✓				1	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											
		(ii)	Mass of each isotope multiplied by abundance/peak height/frequency/amount/intensity/value ✓ (calculate) average/mean ✓				2	ALLOW sum of isotopic mass x % abundance (scores both marks) ALLOW sum divided by total abundance for 2 nd mpt ALLOW ÷ 100 (y axis not labelled) 2 nd mark depends on first being scored											
		(iii)	(accelerated to) same KE ✓ heavy/heavier <u>ions</u> : move slower OR reach detector later/last ✓ AW any reference to KE made up of mass and velocity terms or KE = ½mv ² ✓				3	IGNORE 'atoms' for 1 st mpt DO NOT ALLOW reference to negative ions for 2 nd mark ALLOW 'Heavier ions are accelerated less' ORA for 3rd mp.											

Question			Answer	Marks	Guidance																		
	(c)	(i)	<table border="1"><thead><tr><th></th><th colspan="2">Ionising radiation</th></tr><tr><th>Property</th><th>alpha (α)</th><th>beta (β)</th></tr></thead><tbody><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></tbody></table> one for each column ✓✓		Ionising radiation		Property	alpha (α)	beta (β)	Relative mass	4	0	Relative charge	+2	-1	Deflection by electrical field	small	large	Stopped by a minimum of	paper	Al foil	2	Large/small swapped scores 1 mark if all else correct
	Ionising radiation																						
Property	alpha (α)	beta (β)																					
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Relative charge	+2	-1																					
Deflection by electrical field	small	large																					
Stopped by a minimum of	paper	Al foil																					
		(ii)	$^{10}_5\text{B} + ^1_0\text{n} \rightarrow ^4_2\text{He} \checkmark + ^7_3\text{Li} \checkmark$	2	ALLOW α symbol instead of He ALLOW ecf for 2 nd 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																		
3	(c)	(iii)	lack of penetration AW ✓	1	ALLOW ideas of stopped by container/Al foil/clothing etc ALLOW “don’t travel far”																		
	(d)		 shared electrons ✓ lone pairs ✓	2	For covalent structure IGNORE bond angles Only one electron symbol used maximum 1 A lone pair appearing on B CONS 2 nd 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)																		

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 $1672 \div 0.143$ (or 1672×7) = 11700 or 11.7 (ignore units) ✓ +12 ✓	3	ALLOW either working or evaluation for 1 st mark 2 nd 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 3 rd marking point is for sig fig, sign and expressing answer to 2 nd 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 1 st mp of 4a(ii) ✓ vol = 3.4(3) OR 'answer to 1 st 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 1 st mp of 4a(ii) x 3 x 24 evaluated scores 1 mark overall 2 nd 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 2 nd mark must describe an endothermic process NOT 'more bonds broken than made' NOT 'energy needed to make bonds' for 2 nd 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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