

Chemistry B (Salters)

Advanced Subsidiary GCE

Unit **F331**: Chemistry for Life

Mark Scheme for June 2011

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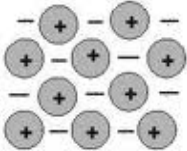
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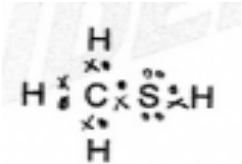
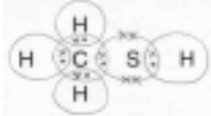
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Question	Answer	Mark	Guidance
1 (a) (i)	$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$	1	ALLOW multiples/halves etc
Use ticks (with ecf's) and x's	(ii) (Bonds broken: $\{(2 \times 347) + (8 \times 413) + (5 \times 498)\} = 6488$ ✓ (Bonds formed: $\{(6 \times 805) + (8 \times 464)\} = 8542$ ✓ answer = -2054 ✓	3	ecf from equation in 1ai ecf's carry forward on first two marks (ignore subsequent calculation if answer correct on answer line) NO ecf if sums for broken and made not obvious NOTE: both sign and value needed for this mark, even using ecf numbers -2054 always scores 3 regardless of equation in 1ai +2054 scores 2
(iii)	Any two of: difficulty using gaseous fuel / gas can escape / not all gas burnt; incomplete combustion / not fully combusted; heat/energy lost/transferred to the surroundings OR not all energy transferred to water ✓✓	2	ALLOW answers in terms of difficulty in measuring mass/amount of gas used 'heat loss' must be to something e.g. surroundings, air, calorimeter AW IGNORE refs to maintaining standard conditions NOT evaporation from wick
(b) (i)	 one mark for each correct structure ✓✓	2	Any skeletal alkane and corresponding alkene shown scores 1 IGNORE dot/cross drafting or dots at junctions Any C atoms shown do not score

Question	Answer	Mark	Guidance
(ii)	$100 \times 36/42 = 85.7\% / 86 \checkmark$	1	ALLOW 2 or more sf 85 does not score
(iii)	(Due to a higher % carbon) incomplete combustion (in 1996 torch) \checkmark (causing glowing) carbon particles/particulates \checkmark	2	ALLOW "this" causes incomplete combustion ALLOW carbon/soot/particulates and etc. <u>burns / combusts / reacts with oxygen</u> with a yellow flame for second mark. To score the second mark it must be clear the candidate is talking about elemental carbon, NOT just the higher percentage carbon in the compound. ALLOW 'unburnt carbon'
(c) (i)	 a structure of circles \checkmark <u>delocalised/sea of</u> electrons labelled \checkmark cations/metal residues shown as in diagram or labelled (incorrect label of cation is CON this mark, if anions and cations are shown CON this mark) \checkmark	3	maximum 2 marks if no diagram drawn structure = at least two rows; need not be 'close packed'. circles may touch IGNORE free/pool/cloud of electrons. ALLOW ring around all the ions labelled 'delocalised/sea of electrons' 'protons'/nuclei/positive metal atoms CONS this ALLOW $Mg^+ / Al^+ / Mg^{2+} / Al^{3+}$ as labels for ions, allow 2+/3+
(ii)	electrons exist in discrete / specific / quantised energy levels \checkmark	1	must say 'electron/electronic' and ALLOW any reference to arrangement e.g. shells/configuration DO NOT ALLOW reference to <u>number</u> of shells CON IGNORE answer in terms of origin of line spectra
	Total	15	

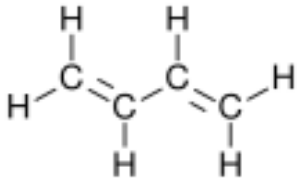
Question	Answer	Mark	Guidance												
2 (a)	<table border="1"> <thead> <tr> <th>Isotope</th> <th>protons</th> <th>electrons</th> <th>neutrons</th> </tr> </thead> <tbody> <tr> <td>¹⁸O</td> <td>8</td> <td>8</td> <td>10</td> </tr> <tr> <td>¹⁶O</td> <td>8</td> <td>8</td> <td>8</td> </tr> </tbody> </table> <p style="text-align: right;">✓</p>	Isotope	protons	electrons	neutrons	¹⁸ O	8	8	10	¹⁶ O	8	8	8	1	all correct for mark
Isotope	protons	electrons	neutrons												
¹⁸ O	8	8	10												
¹⁶ O	8	8	8												
Use ticks and x's (b) (i)	<p>sample ionised / X⁺ produced ✓ (ions) are accelerated / move into acceleration area OR increased velocity (or speed) OR given KE (in electric field/plates) ✓</p> <p>to the <u>same kinetic energy</u> ✓</p> <p>drift region ✓</p> <p>heavier ions move across to <u>detector</u> more slowly (ora) / time taken to reach <u>detector</u> is a measure of its mass / different mass take different times to reach <u>detector</u> ✓</p>	5	<p>Ticks needed ALLOW 'ions are made', negative ions CON DO NOT ALLOW 'by magnetic / electromagnetic field' for this mark CON</p> <p>This statement scores 2nd and 3rd marking points</p> <p>At correct point in sequence, e.g. ionised > drift region scores this mark, BUT ionised>drift region>accelerated does not score</p> <p>IGNORE references to molecules/atoms for last marking point</p> <p>IGNORE references to how detector measures abundance</p> <p>References to larger/smaller ions should be ignored</p>												
(ii)	$\frac{(99.64 \times 16) + (0.36 \times 18)}{100} \checkmark$ <p>=16.007/16.01 OR correct evaluation of their process ✓</p> <p>sig figs ✓</p>	3	<p>No need to evaluate for first mark.</p> <p>Answer 16.01 scores all 3; 16.007() scores 2</p> <p>Process must involve numbers provided in the question</p> <p>sig fig mark only scored if some recognisable working</p>												

Question	Answer	Mark	Guidance
(c)	same group / Group 2/II mentioned ✓ same number of outer (shell) electrons OR same (or similar) chemistry OR both form 2+ ions/lose two electrons OR react in same (or similar) way ✓	2	IGNORE answers in terms of solubility of carbonates/reactivity of elements CON first mark if not talking about calcium and magnesium IGNORE 'properties'
(d) (i)	$\frac{4}{2}\text{He}$ one mark for 4,2 ✓ one for He ✓	2	ecf on Z e.g. 4/3 Li scores 1 4,2 on wrong side does not score this mark He ²⁺ does not score He mark
(ii)	Any two from three below: high temp high kinetic energy / high velocity / high speed high pressure ✓✓ repulsion between nuclei needs to be overcome AW ✓	3	ALLOW 'a lot of heat' AW DO NOT ALLOW just 'heat' 'pressure' or 'hot' High temperature <u>and</u> pressure etc. scores 2 MUST be 'nuclei', not '(positive) atoms/ions' etc.
	Total	16	

Question	Answer	Mark	Guidance
3 (a) (i)	correct bonding electrons ✓  lone pairs on sulfur ✓	2	ALLOW different symbols e.g. triangles etc/ ALLOW outer electron shell circles  Lone pair symbol must be consistent with other electron symbols
(ii)	$M_r = 48.1 / 48$ ✓ $\frac{0.02 \times 10^{-6}}{48(.1)} = 4 \times 10^{-10}$ calculation ✓	2	ecf on M_r 4.16 / 4.166 / 4.2 / 4 / 4.17 or 4.158×10^{-10} on answer line scores both marks ALLOW 1 or more sf 7.69 $\times 10^{-10}$ (Z used) scores 1
(b) (i)	C_3H_6SO ✓	1	ANY order DO NOT ALLOW lower case h

Question	Answer	Mark	Guidance
Use ticks and x's (ii)	<p>'a' – <u>four</u> (bonding) pairs/sets/areas of electron density ✓ 'b' – <u>three</u> (bonding) sets/areas of electron density NOT 3 electron pairs ✓</p> <p><u>Areas of electron density/electrons</u> repel ✓</p> <p>as far apart as possible / minimise electron repulsion ✓</p>	4	<p>Ticks needed IGNORE references to shapes</p> <p>ALLOW 'groups/sets of electrons' NOT 'bonds' (unless qualified by reference to containing electrons), NOT electronegativity</p> <p>electron repulsion mark: 'electrons' can be implied (e.g. 'these repel' after 'groups of electrons' in earlier parts of answer) ALLOW 'bonds repelling' for this mark DO NOT ALLOW <u>atoms</u> repel</p> <p>Must be linked to bonds/electrons/areas of charge/atoms (only for this marking point) repelling Look for a CON e.g. 'repel as much as possible' if this explanation is stated twice</p>
(c)	<p>advantage: large reserves/supply/abundance (of coal) AW ✓</p> <p>disadvantage: (sulfur burns to become) SO₂/SO_x OR acid rain ash formed smoke/soot/particulates smog a named relevant health issue e.g. bronchitis, asthma</p> <p>Any two of disadvantages ✓✓</p>	3	<p>IGNORE references to CO₂ production / greenhouse gases DO NOT ALLOW readily available / easier to mine / renewable DO NOT ALLOW more energy per mole</p> <p>If a consequence is cited and incorrect, this CONS this disadvantage e.g. SO₂ giving photochemical smog ALLOW words i.e. sulphur oxides / sulphur compounds IGNORE pollutants and harmful by-products</p> <p>Mark whole list</p>

Question	Answer	Mark	Guidance
(d)	$200 \times 4.2 \times 25 \checkmark$ $= 21000 \text{ J } \checkmark$	2	ALLOW 21 kJ <u>if printed unit adjusted</u> ALLOW ecf on mass only 10 instead of 200 (1050 scores 1) IGNORE sign
(e)	It (the melting point of S) would be lower ORA \checkmark S – (small) molecules / (simple) molecular AND C – giant structure / network / lattice \checkmark	2	Must be comparative both structures for second mark IGNORE 'covalent' IGNORE reference to intermolecular forces/bonds
	Total	16	

Question	Answer	Mark	Guidance
4 (a) (i)	Arene	1	ALLOW aromatic
(ii)	 <p style="text-align: center;">all correct ✓</p>	1	can be straight line structure
(b) (i)	lower (combustion) temp OR less nitrogen (compounds) in tyres ✓	1	DO NOT ALLOW not enough energy ALLOW 'not so hot' ALLOW no nitrogen (compounds) in tyres Assume 'they' refers to TDF
(ii)	carbon monoxide / CO / sulfur dioxide / SO ₂ / SO _x / sulfur oxide ✓	1	DO NOT ALLOW carbon dioxide
(c) (i)	Unsaturated ✓	1	
(ii)	cycloalkane / arene ✓	1	ALLOW cyclic, aromatic, benzene rings
(iii)	hydrogen/H ₂ ✓	1	
(d) (i)	heterogeneous – catalyst and reactant(s) in different phase / state ✓ catalyst provides a route/pathway/mechanism of lower activation enthalpy/energy OR speeds up a reaction but can be recovered unchanged at the end/regenerated/not used up ✓	2	ALLOW catalyst solid reactants gases/liquids DO NOT ALLOW 'speeds up reaction' without qualification IGNORE reduces activation energy NOT 'not involved'

Question	Answer	Mark	Guidance
(ii)	<p>adsorption of reactants onto (surface of) catalyst ✓</p> <p>bonds break within/in reactant / molecules OR intramolecular bonds break OR bonds break between atoms in reactants / molecules ✓</p> <p><u>new</u> bonds form OR bonds form in products ✓</p> <p>product molecules desorb / diffuse / leave / released from catalyst (surface) ✓</p>	4	<p>QWC adsorption/adsorb (not a separate mark) NOT adsorped/adsorbtion Note: If QWC 'word' not there or spelt incorrectly the first mark is not scored</p> <p>NOT bonds <u>between</u> – it must be clear that it is the bonds within the molecules that are breaking ALLOW 'in molecules / in (or of) reactants' ALLOW reactant(s) bonds break</p> <p>'Bonds form' on its own does not score this marking point NOT 'bonds form between products' it has to be new bonds IGNORE references to 'between' reactants or molecules</p> <p>NOT 'are removed' from surface or 'are dispersed' IGNORE references to bonds formed and broken with catalyst surface If order wrong max 3 Labelled diagrams could score all marks</p> <p>(Note: The marks need not match the number of the step since candidates may have added extra steps or missed steps out, but they must be in the correct order.)</p>
	Total	13	

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