OCR
RECOGNISING ACHIEVEMENT

GCE

Chemistry B (Salters)

Advanced Subsidiary GCE

Unit **F331:** Chemistry for Life

Mark Scheme for June 2011

Oxford Cambridge and RSA Examinations

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OCR Publications
PO Box 5050
Annesley
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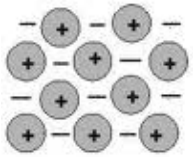
NG15 0DL

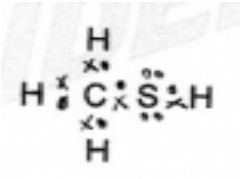
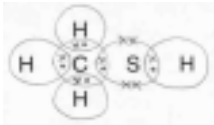
Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

Question	Answer	Mark	Guidance
1 (a) (i)	$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$	1	**ALLOW** multiples/halves etc
(ii) Use ticks (with ecf's) and x's	(Bonds broken: {(2x347) + (8x413) + (5x498)}) = 6488 ✓ (Bonds formed: {(6x805) + (8x464)}) = 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 x 36/42 = 85.7 % / 86 ✓	1	**ALLOW** 2 or more sf 85 does not score
(iii)	(Due to a higher % carbon) incomplete combustion (in 1996 torch) ✓ (causing glowing) carbon particles/particulates ✓	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 ✓ <u>delocalised/sea of</u> electrons labelled ✓ 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) ✓	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 ✓	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**	

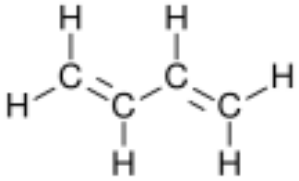
Question	Answer	Mark	Guidance
2 (a)	<table><tr><td></td><td></td><td></td><td></td></tr><tr><td>Isotope</td><td>protons</td><td>electrons</td><td>neutrons</td></tr><tr><td>^{18}O</td><td>8</td><td>8</td><td>10</td></tr><tr><td>^{16}O</td><td>8</td><td>8</td><td>8</td></tr></table> ✓	1	all correct for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

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)	$^{4}_{2}$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 x 10^{-10} on answer line scores both marks **ALLOW** 1 or more sf 7.69 x10^{-10} (Z used) scores 1
(b) (i)	C_3H_6SO ✓	1	ANY order **DO NOT ALLOW** lower case h

Question	Answer	Mark	Guidance
(ii) Use ticks and x's	'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** ✓ <u>Areas of electron density</u>/<u>electrons</u> repel ✓ as far apart as possible / minimise electron repulsion ✓	**4**	Ticks needed **IGNORE** references to shapes **ALLOW** 'groups/sets of electrons' **NOT** 'bonds' (unless qualified by reference to containing electrons), **NOT** electronegativity 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 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
(c)	advantage: large reserves/supply/abundance (of coal) AW ✓ disadvantage: (sulfur burns to become) SO_2/SO_x **OR** acid rain ash formed smoke/soot/particulates smog a named relevant health issue e.g. bronchitis, asthma Any **two** of disadvantages ✓✓	**3**	**IGNORE** references to CO_2 production / greenhouse gases **DO NOT ALLOW** readily available / easier to mine / renewable **DO NOT ALLOW** more energy per mole If a consequence is cited and incorrect, this **CONS** this disadvantage e.g. SO_2 giving photochemical smog **ALLOW** words i.e. sulphur oxides / sulphur compounds **IGNORE** pollutants and harmful by-products Mark whole list

Question	Answer	Mark	Guidance
(d)	200 x 4.2 x 25 ✓ = 21000 J ✓	2	**ALLOW** 21 kJ if printed unit adjusted **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 ✓ S – (small) molecules / (simple) molecular **AND** C – giant structure / network / lattice ✓	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)	 all correct ✓	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)	a**d**sorption of reactants onto (surface of) catalyst ✓	4	QWC a**d**sorption/a**d**sorb (not a separate mark) **NOT** adsorped/adsorbtion Note: If QWC 'word' not there or spelt incorrectly the first mark is not scored
	bonds break within/in reactant / molecules **OR** intramolecular bonds break **OR** bonds break between atoms in reactants / molecules ✓		**NOT** bonds between – 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
	new bonds form **OR** bonds form in products ✓		'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
	product molecules desorb / diffuse / leave / released from catalyst (surface) ✓		**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 (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.)
	Total	**13**	

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

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Facsimile: 01223 552627
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