

Chemistry B (Salters)

Advanced Subsidiary GCE

Unit **F331**: Chemistry for Life

Mark Scheme for June 2012

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

© OCR 2012

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

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

Annotations

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
	benefit of the doubt
	benefit of the doubt not given
	error carried forward
	information omitted
	Ignore

Subject-specific Marking Instructions

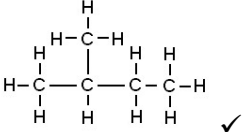
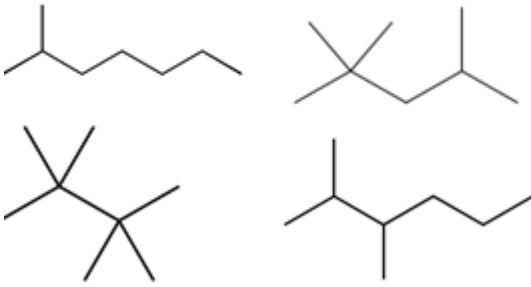
Please use ticks on the following questions: 1aii; 1cii; 3d (unless fully correct); 4a

Question			Answer	Marks	Guidance												
1	(a)	(i)	<table border="1"> <tr> <td>stopped by paper</td> <td></td> </tr> <tr> <td>charged particles</td> <td></td> </tr> <tr> <td>highly penetrating</td> <td>✓</td> </tr> <tr> <td>deflected by magnetic fields</td> <td></td> </tr> <tr> <td>electromagnetic radiation</td> <td>✓</td> </tr> <tr> <td>unaffected by electric fields</td> <td>✓</td> </tr> </table>	stopped by paper		charged particles		highly penetrating	✓	deflected by magnetic fields		electromagnetic radiation	✓	unaffected by electric fields	✓	3	<p>If 4 responses, maximum mark 1 More than 4 responses, no marks</p>
stopped by paper																	
charged particles																	
highly penetrating	✓																
deflected by magnetic fields																	
electromagnetic radiation	✓																
unaffected by electric fields	✓																
		(ii)	<p>Time taken for half the radioactive nuclei to decay OR mass to decrease by half OR radioactivity to reduce by a half ✓</p> <p><i>Longer than</i> – could cause long term effects/harm/damage/ionise to cells/named body part/tissue OR too faint/not enough to detect ✓</p> <p><i>Shorter than</i> – not long enough to be able to detect/travel round body <i>AW</i> OR could cause damage (same rules as above) ✓</p>	3	<p>Please make annotations where marks are scored</p> <p>Must mention time/how long for something to reduce by half: nuclei, atoms, substance, isotope(s), radioactivity, mass NOT nucleus, atom (ie in singular) DO NOT ALLOW 'decompose' for 'decay'</p> <p>For first alternative could suggest specific damage (eg mutation) must be 'to cells/named body part/tissue' not just 'to patient/people/humans/body' 'Cancer' on its own is too vague</p> <p>For first alternative, answer must link time for detection/ travelling round body/ tracing/ producing image/ 'use' to short half life (and not just 'difficult to detect') ALLOW 'too much decay before use' <i>AW</i></p>												
	(b)	(i)	<p>Calculation to show (181 is) the molecular mass of FDG ✓</p> <p>FDG ionised OR this is the molecular ion/cation ✓</p>	2	<p>Any total not 181 is CON of first mark</p> <p>Mark separately</p> <p>ALLOW any reference to charge of +1 or ionisation mentioned (but not to anion/- ion)</p>												

Question			Answer	Marks	Guidance
1	(b)	(ii)	(molecule) has broken (up/down)/fragmented OR two or more electrons knocked off ✓	1	Must imply 'molecule broken' ALLOW 'fragmentation' IGNORE 'lower Mr' NOT decay/decompose IGNORE references to ^{18}F decaying
	(c)	(i)	$[\text{Na}]^+ \quad \left[\begin{array}{c} \times \times \times \\ \times \text{F} \times \times \\ \times \times \times \end{array} \right]^-$ Correct charges on both ions ✓ Correct structures ✓	2	IGNORE inner shell electrons Square brackets not essential ALLOW with 8 electrons around Na Circles not needed Must be two different symbols for electrons ALLOW '1+' and '1-' (or +1 and -1) <u>No charges</u> scores zero; wrong number of ions scores zero
		(ii)	Bond angle = 90 (can be labelled on diagram) ✓ Six pairs/regions/groups/areas of electrons/areas of electron density around S/central atom ✓ Repel (to get) as far (away) as possible OR position (AW) themselves to minimise electron repulsion ✓ Octahedral/octahedron / 'square (based) bipyramid' ✓	4	Please make annotations where marks are scored ALLOW right angle symbol on diagram All three ideas need to be present If central atom named it must be S(ulfur) NOT scored from diagram alone unless labelled NOT 'around central point' NOT 'repel as <i>much</i> as possible' NOT 'push' NOT 'atoms repel' NOT 'bonds repel' unless qualified earlier by mention of electrons being 'in' bonds ALLOW diagram that shows 3D structure unless CON in text
			TOTAL	15	

Question			Answer	Marks	Guidance
2	(a)	(i)	alcohol ✓ alkene ✓	2	ALLOW 'hydroxy(l)' IGNORE 'OH' NOT secondary, tertiary ALLOW <u>carbon - carbon</u> double bond or C=C
		(ii)	C ₉ H ₁₀ O ✓	1	Atoms in any order DO NOT ALLOW 'split answers' eg C ₉ H ₁₀ O/C ₉ H ₉ OH
	(b)	(i)	<u>Fractional</u> distillation ✓	1	ALLOW fractionation
		(ii)	Division by appropriate A _r value ie C 38.7/12 (3.225) O 51.6/16 (3.225) H 9.7/1 (9.7) ✓ evaluation to give empirical formula (CH ₃ O) ✓	2	CH ₃ O scores both marks on its own ALLOW atoms in any order C ₂ H ₃ O ₂ scores one mark ('Z' used) - no other ecf's
		(iii)	Empirical formula is the <u>simplest/lowest/smallest</u> ratio of <u>atoms</u> OR different molecular formulae can have the same <u>simplest/lowest/smallest</u> ratio of <u>atoms</u> OR molecular formula can be multiple of empirical formula ✓	1	'It' cannot be accepted (unless qualified later in the answer) as it could refer to empirical or molecular in this context
		(iv)	Measure of 'number of ways' particles can be arranged OR degree/level/amount of disorder/chaos (in a system) ✓	1	'Number of ways' or 'disorder' can score on own but if elaborated on, must be <u>particles</u> or <u>molecules</u> (must be plural) and not <u>in</u> an element or compound NOT 'atoms' or 'electrons' (for particles)

Question		Answer				Marks	Guidance
2	(c)					3	<i>One mark for each row correctly completed</i> 'Giant covalent' is a CON under 'type of bonding' column
		substance	type of bonding	structure type	characteristic physical property		
		ethylene glycol	<i>covalent</i>	<i>simple molecular</i>	low melting point		
		sodium chloride	ionic	<i>giant OR lattice</i>	<i>soluble in water OR high m/b point OR conduct when molten or in solution</i>		
		paraffin wax	<i>covalent</i>	simple molecular	insoluble in water		
					✓✓✓		
					TOTAL	11	

Question		Answer	Marks	Guidance
3	(a)	Low/reduced/less tendency to auto-ignite/pre-ignite/knocking/pinking ✓	1	DO NOT ALLOW 'no knocking'/'does not knock'
	(b) (i)		1	All bonds to be shown DO NOT ALLOW CH ₃ /CH ₂ groups
	(ii)	<p>Same molecular formula. Different structural formula/structure ✓</p> <p>Any two skeletal isomers of C₈H₁₈ (some possible structures shown opposite) ✓✓</p>	3	<p>NOT 'chemical (formula)' ALLOW 'same number <u>and</u> types of atoms' ALLOW different arrangement (of atoms) ALLOW a description of different structures (eg 'branches in different places')</p> <p>e.g.</p>  <p>NOT straight chain IGNORE any name given ALLOW one mark for two correct non-skeletal formulae IGNORE dots</p>
	(c) (i)	$C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$ ✓	1	<p>ALLOW multiples All must be correct to score. IGNORE state symbols except CON if C₅H₁₂ is given as 'aq'</p>

Question			Answer	Marks	Guidance
3	(c)	(ii)	Breaking bonds is a positive/endergonic (enthalpy change) or absorbs/requires/takes in energy AND forming bonds is negative/exothermic or releases/gives out energy ✓ Value/magnitude of negative (exothermic) value bigger than positive (endergonic) ✓ Award of 2nd mark depends on first being scored	2	e.g. 'more energy given out than taken in' <i>AW</i> references to different <i>number</i> of bonds CONS this mark 'More energy is released in making bonds than in breaking them' scores 1 'More energy is released in making bonds than is used (<i>AW</i>) in breaking them' scores 2 'Enthalpy changes of making the bonds are higher than those of breaking the bonds' scores 2 nd marking point, if first point already scored
		(iii)	Produces only/nearly all carbon dioxide (and water) ora ✓	1	ALLOW 'produces little/no/less CO or C/particulates/soot' ALLOW 'complete combustion' ora IGNORE 'does not release pollutants', references to unburnt hydrocarbons

Question		Answer	Marks	Guidance
3	(c) (iv)	<p><i>Benefit:</i> water is the only product OR no CO₂ ✓</p> <p><i>Problem:</i> storage issues OR leakage OR hydrogen is explosive/highly flammable OR requires changes to engine <i>AW</i> ✓</p>	2	<p>IGNORE <u>no</u> pollution no harmful products Reference to 'less NO_x' is a CON ALLOW 'no CO/SO_x' IGNORE: 'no greenhouse gases'/'carbon neutral'</p> <p><i>The context here is the <u>use</u> of hydrogen</i> IGNORE references to sustainability and source of hydrogen IGNORE 'renewable' IGNORE references to generation of hydrogen needing fossil fuel/availability IGNORE hydrogen fuel not readily available</p>
	(d)	<p>Vol. of oxygen = 12.5 x 60cm³ (750) ✓</p> <p>Vol. of air = 750 x 100/21 (3571) ecf ✓</p> <p>÷ 1000 (3.6 dm³) ecf ✓</p> <p>Answer 3.6 (allow 3.57.....) scores all three marks without reference to working</p>	3	<p>Please make annotations where marks are scored (unless fully correct) If answer is not 3.57 dm³ (to 2 or more sig figs) then award marks for up to two of the following:</p> <ul style="list-style-type: none"> • Multiplying 12.5 by 60 • multiplying a number by 100/21 • dividing by 1000 NB: this may have been done in the first steps i.e. look for '0.06' <p>ALLOW 2 or more sig figs</p>
	(e) (i)	<p>(Catalyst) (it) speeds up a reaction <u>and</u> can be recovered chemically unchanged/unchanged at end</p> <p>OR (it) provides a path/alternative route of lower activation enthalpy/energy ✓</p>	1	ALLOW '..... and not used <u>up</u> in the reaction'
	(ii)	B D A C ✓✓	2	one mark for two in the correct places eg B A D C scores one mark B A C D does not score any marks
TOTAL			17	

Question		Answer	Marks	Guidance
4	(a)	<p><u>Electrons</u> drop to lower <u>energy levels</u> ✓</p> <p>emit light/electromagnetic radiation/photons ✓</p> <p>Energy proportional to frequency OR $E = hv$ OR $E = hf$ ✓</p> <p>(Gaps between) levels unique/different for a particular/different elements ✓</p>	4	<p>Please make annotations where marks are scored</p> <p>ALLOW 'back to ground state' providing energy levels mentioned (see below) 'Shells' must be qualified by reference to energy levels somewhere in answer Reference to energy levels can come from any place in answer</p> <p>ALLOW freq/wavelength <i>related</i> to energy gap/energy lost</p> <p>QWC only award first mark if 'electron'/ 'electrons'/ 'electronic') is spelled correctly at least once</p>
	(b)	left gaps/spaces/blanks (in the order) ✓	1	
	(c) (i)	<p>$\text{Ga(s)} + \text{As(s)} \rightarrow \text{GaAs(s)}$</p> <p>equation ✓ state symbols ✓</p> <p>Standard state is solid for both elements (and compound) because T_m is greater than 298 (K) ✓</p>	3	<p>ALLOW $\frac{1}{2}\text{As}_2$ and $\frac{1}{2}\text{Ga}_2$ and $\frac{1}{4}\text{As}_4$ Equation MUST be to form one mole of GaAs</p> <p>298 must be mentioned (or indicated, eg in subtraction sums)</p>
	(ii)	<p>$\Delta H_1 = \Delta H_2 + \Delta H_3$ ✓</p> <p><u>energy</u> (change) /<u>enthalpy</u> (change)/<u>ΔH</u> (of a particular reaction) independent of route <i>AW</i> ✓</p> <p>providing initial and final <u>conditions</u> the same/<u>conditions</u> remain the same ✓</p>	3	<p>ALLOW $\Delta H_1 = \Delta H_3 + \Delta H_2$ OR $\Delta H_2 = \Delta H_1 - \Delta H_3$ OR $\Delta H_3 = \Delta H_1 - \Delta H_2$ NOT arrow (\rightarrow) instead of =</p> <p>NOT 'starting and finishing points same' ALLOW '(providing) all done under standard conditions'</p>

Question		Answer	Marks	Guidance												
4	(d)	3 outer electrons ✓ In group 3 ✓	2	ACCEPT 4s ² 4p ¹ or s ² p ¹ for first point ALLOW group13 No ecf												
	(e) (i)	(60.1 x 69) + (39.9 x 71) ÷ 100 ✓ sf ✓ 69.8 scores both marks automatically	2	ALLOW sig fig mark for any 3 sig fig answer derived correctly from a calculation												
	(ii)	<table border="1"> <thead> <tr> <th>isotope</th> <th>number of protons</th> <th>number of electrons</th> <th>number of neutrons</th> </tr> </thead> <tbody> <tr> <td>⁶⁹Ga</td> <td>31</td> <td>31</td> <td>38</td> </tr> <tr> <td>⁷¹Ga</td> <td>31</td> <td>31</td> <td>40</td> </tr> </tbody> </table> <p style="text-align: right;">✓✓</p>	isotope	number of protons	number of electrons	number of neutrons	⁶⁹ Ga	31	31	38	⁷¹ Ga	31	31	40	2	One mark for each completely correct row No ecf's
isotope	number of protons	number of electrons	number of neutrons													
⁶⁹ Ga	31	31	38													
⁷¹ Ga	31	31	40													
TOTAL			17													

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

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

© OCR 2012

