OCR
RECOGNISING ACHIEVEMENT

GCE

Chemistry B (Salters)

Advanced Subsidiary GCE

Unit **F331:** Chemistry for Life

Mark Scheme for June 2013

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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.

Annotations

Annotation	Meaning
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

Subject-specific Marking Instructions

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
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
ORA	Or reverse argument

All questions must be annotated with a tick where the mark is given (please refer to Scoris Annotations document from your Team Leader).

Additional objects: You **must** annotate the additional objects for each script you mark. If no credit is to be awarded for the additional object, please use a suitable annotation (either ^ or SEEN).

Question			Answer	Marks	Guidance
1	(a)	(i)	methanol ✓	1	methan-1-ol does not score, and if with methanol is a **CON** 'spelling must be unambiguous'
		(ii)	alkene(s) ✓	1	**IGNORE** any references to branching cycloalkene is a **CON**
		(iii)	Skeletal (formula) ✓	1	**ALLOW** 'mis-spellings if meaning is clear' **NOT** skeleton
	(b)	(i)	C_4H_8 ✓	1	**ALLOW** reversed
		(ii)	fractional distillation ✓	1	**NOT** distillation on own **ALLOW** 'fractionation' **ALLOW** mis-spellings if meaning is clear
		(iii)	$C_{12}H_{26} \rightarrow C_4H_8 + C_8H_{18}$ ✓	1	No **ECF** from wrong formula in **(b)(i)** **ALLOW** structural formulae
		(iv)	Reactants/molecules/substances **adsorbed** on catalyst (surface) ✓ bonds (with)in/intramolecular bonds in <u>reactants</u> (weaken and) break ✓ new bonds form **OR** bonds form in products ✓ product/new molecules desorb/diffuse off/leave catalyst (surface) ✓	4	QWC: **Adsorbed/adsorption/adsorb SPG;** must be spelled correctly to score first marking point, but does not score on own. 'Their bonds' **AW** is ok if reactants have been mentioned in first marking point **NOT** 'bonds between reactants break' Any reference to new bonds forming **IGNORE** comments about catalyst surface providing reaction route of lower Ea or explanation of heterogeneous
	(c)	*(i)*	$C_5H_{12}O(l) + 7½O_2(g) \rightarrow 5CO_2(g) + 6H_2O(l)$ ✓	1	**DO NOT ALLOW** multiples etc (question asks per mole burnt) **ALLOW** 7.5 **OR** 15/2

Question			Answer	Marks	Guidance
1	(c)	(ii)	burns <u>more</u> completely / <u>more</u> complete combustion / <u>less</u> incomplete combustion ✓ already partially/slightly oxidised/contains an O (atom) in molecule **OR** pentane only has C and H (atoms)/no O atoms ✓	2	Assume answer refers to MTBE unless otherwise stated. **Must be comparative** statement to score first mark **IGNORE** ideas about CO being formed then further oxidised **IGNORE** 'clean burning' **IGNORE** MTBE is an oxygenate **IGNORE** reference to number of moles of oxygen needed by pentane/MTBE **CON** O_2 or 'oxygen molecule'
		(iii)	nitrogen **AND** carbon dioxide ✓	1	**both needed** **ALLOW** correct formulae (with upper case – **BOD** if unclear) **IGNORE** formulae if names present
	(d)	(i)	wedges: bonds in front of plane of paper and dashed line: bonds behind ✓	1	any indication that wedge sticks out and dashed goes in scores this mark
		(ii)	(molecules with) same molecular formula but different structural formula/arrangement of atoms ✓ (MTBE and ETBE) do not have same molecular formula ✓	2	**NOT** '(chemical) formula' **ALLOW** 'same number of each atom' or 'same number and types of atoms' **ALLOW** different arrangement (of atoms) **ALLOW** different skeletal formulae **ALLOW** 'do not have same <u>number</u> of atoms' **OR** answer in terms of 'more C or H' If formulae are written they must be correct or this will **CON** second mark
	(e)		comes from crops which can be re-grown/AW ✓ plants take in/absorb/use CO_2 for photosynthesis/growth ✓ (roughly) balances out CO_2 produced on burning ✓	3	vital word is 'grow/growing/growth' etc in the context that they can be replenished **NOT** just 'while living' To score both points 2 and 3, CO_2 must be mentioned or implied in both the answers If no reference to idea of balance maximum total mark is 2 **IGNORE** references to C or CO
			Total	**20**	

Question			Answer	Marks	Guidance
2	(a)		$Mg(OH)_2(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + 2H_2O(l)$ formulae **and** balancing ✓ state symbols (ss) ✓	2	**ALLOW** multiples etc Award ss mark alone for unbalanced equation with the correct formulae and correct ss or balanced equation but incorrect formulae for Mg hydroxide and chloride but correct ss
	(b)	(i)	less heat transfer to surroundings (in polystyrene cup) ✓	1	**ALLOW** better (thermal) insulator / reduces heat loss / minimise heat loss **ALLOW** 'less heat absorbed by/lost to cup' / worse conductor Answer must be comparative **IGNORE** safety points eg broken glass
		(ii)	*Mark any two from those below:* ✓✓ • (specific) heat capacity of HC*l*/solution same as water / 4.18 • mass of water same as mass of HC*l*/solution • negligible/little/no heat loss to surroundings • volume of solution = mass of solution **OR** density of solution is 1 g cm^{-3} / same as water	2	**IGNORE** 'specific heat capacity of water is 4.18'. 4.2 is incorrect **IGNORE** references to volume changes/evaporation **IGNORE** 'all solid reacts' **IGNORE** references to Joules **IGNORE** reference to standard conditions
	(c)		more <u>hydroxide ions</u> in (a mole of) aluminium hydroxide **OR** more/three <u>hydroxide ions</u> (per mole) **ORA** ✓	1	Assume 'it' refers to one mole of aluminium hydroxide **ALLOW** '(aluminium hydroxide) requires three moles HC*l*' **ALLOW** OH^- groups but not OH^- molecules **ALLOW** OH^- / 'OH ions' instead of hydroxide ions **DO NOT ALLOW** 'higher concentration' of hydroxide ions **IGNORE** references to alkalinity, bases

Question			Answer	Marks	Guidance
2	(d)	(i)	molar mass of $MgCO_3$ = 84.3 ✓ moles of $MgCO_3$ = 0.2 ÷ 84.3 = 0.00237(2) /0.0024 ✓ (dividing 0.2 by a number and working out answer correctly) volume = 0.0024 x 24000 = 57 cm^3 ✓ (multiplying some calculated number by 24000 and working out answer correctly)	3	**ALLOW** 84 **ALLOW** two or more sf's **NB** If 84 used **ALLOW 57.14(...)** must not be rounded to fewer than 2sf **NB 56.88 or 56.9(…) or 57 or 57.14(…) or 57.6 or 58 on answer line scores all three marks**
		(ii)	measure of disorder/chaos/number of 'ways of arranging' ✓ gas on product side/formed have <u>more</u> disorder/ways of arrangement/chaos **OR** gases formed have greater entropy (than solid/liquids) ✓	2	**Just 'how particles can be arranged' too vague** **DO NOT ALLOW** 'ways of arranging atoms' or 'ways <u>a</u> molecule can be arranged' or 'disorder of atoms' **ALLOW** 'ways of arranging a compound/substance' Must be implication that gas is a product **NOT just** 'increased entropy' (in stem) **ALLOW** more chemical species/substances/products on product side but **NOT** more moles/particles on RHS
			Total	**11**	

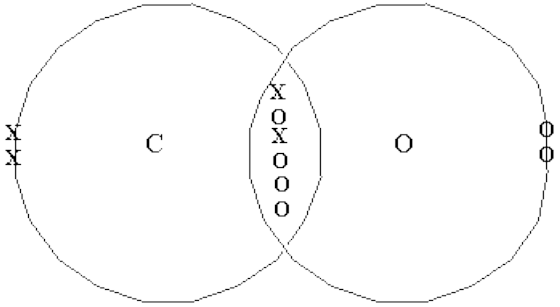
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td></td><td>in the same group as carbon / same number of outer electrons / can form four covalent bonds ✓</td><td>1</td><td>If ‘below’ is used it must be directly below
Wrong group no. or number of electrons/bonds CON</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th rowspan="2">Substance</th><th colspan="2">Type of structure</th><th colspan="2">Melting point</th></tr>
<tr><th>Simple molecular</th><th>Covalent network</th><th>High</th><th>Low</th></tr>
<tr><td>C (diamond)</td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>silicon</td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>CO_2</td><td>✓</td><td></td><td></td><td>✓</td></tr>
<tr><td>SiO_2</td><td></td><td>✓</td><td>✓</td><td></td></tr>
</table>
</td><td>1</td><td>ALLOW other symbols eg x’s</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>linear / 180 (^{o}) ✓

two set of electrons/regions of negative charge around carbon/central atom ✓

repel as far as possible/minimise electron repulsion ✓</td><td>3</td><td>IGNORE straight or planar

MUST mention electrons or negative centres/regions somewhere to be able to gain third mp

IGNORE ‘repel as much as possible’</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>dative/co-ordinate (covalent) ✓</td><td>1</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
3	(c)	(iii)	 lone pairs ✓ **correct** six electrons in shared area (**need <u>NOT</u> have circles**) ✓	2	**Check there are two C electrons and four O electrons matching lone pair symbols.** Ignore arrow. **IGNORE** any brackets around symbols **ALLOW** central electrons in any order or arrangement
	(d)	**(i)**	$^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$ one mark for correct beta particle on right hand side ✓ $^{14}_{6}C \rightarrow {}^{14}_{7}N$ ✓	2	**ALLOW**: – (**minus**) beta particle on left hand side of equation **DO NOT ALLOW** e^- **ALLOW** β symbol instead of e Numbers on right of symbols scores **one mark** if all correct
		(ii)	3 half-lives elapsed ✓ 3 x 6000 = 18,000 years ✓	2	**100>50>25>12.5** scores first marking point **ALLOW** ecf from clearly stated number of half-lives **both marks** scored if 18,000 on answer line
		(iii)	*Mark any two from those below:* ✓✓ • half-life unaffected by temp/pressure; • no <u>loss</u> **OR** <u>gain</u> of radioisotope/C-14/C-12/C/organic material; • all count rate comes from carbon-14; • amount of carbon-14/count (rate) in living material today is the same as when organism died; • levels of C14 in <u>atmosphere</u> have remained constant.	2	**IGNORE** 'rate of decay constant' **IGNORE** 'daughter' product **ALLOW '**changed by metamorphic events' **ALLOW** the last ice age was less than 50,000 years ago
			Total	**14**	

Question			Answer	Marks	Guidance
4	(a)	(i)	protons **38** electrons **38** neutrons **50**	1	
		(ii)	(84 x 0.560) + (86 x 9.86) + (87 x 7.02) + (88 x 82.56) ✓ ÷ 100 = 87.7102 ✓ = 87.7 to **3 sig figs** ✓	3	**IGNORE** any units given Any number to 3 sf from a correctly evaluated calculation scores sf mark 87.7 on answer line scores all three and 87.71(02) scores two marks
	(b)		2+	1	**must show charge; ALLOW** +2; **ALLOW** complete species eg Sr^{2+} **ALLOW** words
	(c)		*Any two of:* ✓✓ • Gas/hydrogen/H_2 given off/fizzing/bubbling/effervescence • goes cloudy/white/milky ppt or solid • gets warm/exothermic • calcium dissolves / disappears	2	**If list** mark first two and **IGNORE** the rest **CON first point** mention of any gas other than hydrogen Wrong substance as a precipitate is a **CON** on 2nd point **DO NOT ALLOW** 'H' **IGNORE** equations
	(d)	(i)	$SrCO_3 \rightarrow SrO + CO_2$ ✓	1	'Heat' in equation is **CON** (ignore if on arrow) Any wrong symbol scores zero **IGNORE** state symbols

Question			Answer	Marks	Guidance
4		(ii)	Bubble gases through lime water/calcium hydroxide solution/ correct formula ✓ lime water cloudy/white/milky/ppt forms ✓ longer time or slower (to give gas) has greater (thermal) stability ora ✓ strontium (carbonate) has greater (thermal) stability ora ✓	4	*First mark for a viable technique* (Heat samples and) collect gas in syringe etc. or measure (loss of) mass ✓ Production of gas / change of mass or volume is found ✓ Final two marking points as on left Must be a 'time element' eg rate of gas production *Question requires a general answer so **IGNORE** references to amount/mass/volume etc of chemicals*
	(e)	(i)	(relative) abundance ✓	1	**IGNORE** qualification **ALLOW** amount/concentration/'how much'/percentage **NOT** 'percentage intensity' **IGNORE** mass of isotope
		(ii)	$H_2O^+/H_2{}^{16}O^+$ ✓	1	No alternatives
		(iii)	O-18 (isotope in water molecule) ✓	1	**ALLOW** D_2O or O-20 or THO or $H_3{}^{17}O^+$ **ALLOW** O with 12 neutrons
			Total	**15**	

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