

GCE

Chemistry B (Salters)

Unit **F331**: Chemistry for Life

Advanced Subsidiary GCE

Mark Scheme for June 2017

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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.

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Annotations

Please annotate **every** response, even if no credit is given.

Annotation	Meaning
	Benefit of Doubt
	Cross
	Not answered question
	Tick
	Contradiction
	Error carried forward
	Ignore
	Power of 10 error
	Omission mark
	Error in number of significant figures
	Rounding error

Highlighting is also available to highlight any particular points on the script.

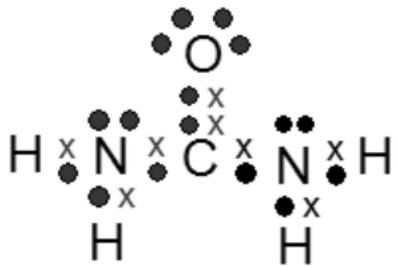
'SEEN' to be inserted on every blank page

Subject-specific Marking Instructions

Some questions may have a 'Level of Response' mark scheme.

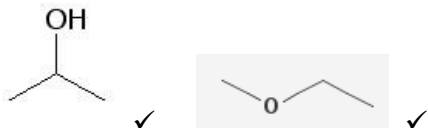
The following guidelines on the **quality of written communication** are embedded into the Levels of Response mark scheme used for question 3:

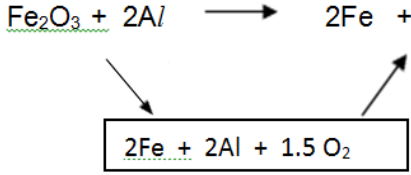
- Level 4:** Complex ideas have been expressed clearly and fluently using a style of writing which is appropriate to the complex subject matter. Sentences and paragraphs, consistently relevant, have been well structured, using appropriate technical terminology. There may be few, if any, errors of spelling, punctuation and grammar.
- Level 3:** Relatively straightforward ideas have been expressed with some clarity and fluency. Arguments are generally relevant, though may stray from the point of the question. There will be some errors of spelling, punctuation and grammar, but these are unlikely to be intrusive or obscure meaning.
- Level 2:** Some simple ideas have been expressed in an appropriate context. There are likely to be some errors of spelling, punctuation and grammar of which some may be noticeable and intrusive.
- Level 1:** Some simple ideas have been expressed. There will be some errors of spelling, punctuation and grammar

Question			Expected Answers	Marks	Additional Guidance
1	a	i	$2 \text{CO}(\text{NH}_2)_2 + 4 \text{NO} + \text{O}_2 \rightarrow 4 \text{N}_2 + 4 \text{H}_2\text{O} + 2 \text{CO}_2$ ✓	1	all correct
		ii	moles of urea = $\frac{10.0}{60} = 0.167$ ✓ max. moles of NO reacted = $2 \times 0.167 = 0.334$ ✓ mass of NO reacted = 10.02g ✓	3	10g on answer line scores all three marks (ignore decimal places) ALLOW ecf from earlier steps and from equation in (a)(i)
	b	i	reaction only takes place on <u>surface</u> ✓	1	IGNORE reference to cost
		ii	catalyst poison adsorbed (more strongly) on surface ✓ blocks surface preventing catalysis/other substances, molecules cannot adsorb, bond with surface ✓	2	QWC adsorb/adsorbed/adsorption must be spelled correctly for this mark If term adsorbed/adsorb used don't need specific mention of surface ALLOW active site blocked (any reference to enzymes CON this mark) IGNORE active sites but in terms of enzyme is CON
	c	i	 ✓ ✓	2	one mark for correct lone pairs one mark for bonding electrons correct
		ii	120° ✓ 3 sets/groups of electrons around central C ✓ repel to get away as far as possible/minimise electron repulsion ✓	3	ALLOW $118-122^\circ$ ALLOW 'areas/regions of electron density' IGNORE 'bonds' and 'electron pairs' IGNORE 'repel as much as possible'

Question		Expected Answers	Marks	Additional Guidance
	d	reaction between nitrogen and oxygen in <u>air/atmosphere</u> ✓ at high temperatures (in engine) ✓ burning of hydrogen produces <u>higher</u> temp (than hydrocarbon based fuels). ✓	3	Nitrogen and oxygen bond/ equation as long as from air atmosphere made clear High temps. In exhaust is CON IGNORE references to rate of reaction
Total			15	

Question			Expected Answers	Marks	Additional guidance												
2	a	i	<table border="1"> <thead> <tr> <th>Isotope</th> <th>Number of protons</th> <th>Number of neutrons</th> <th>Number of electrons</th> </tr> </thead> <tbody> <tr> <td>¹H</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>²H</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table> ✓	Isotope	Number of protons	Number of neutrons	Number of electrons	¹ H	1	0	1	² H	1	1	1	1	BOTH rows fully correct for 1 mark
Isotope	Number of protons	Number of neutrons	Number of electrons														
¹ H	1	0	1														
² H	1	1	1														
		ii	isotopes ionised ✓ (accelerated to) same kinetic energy/KE ✓ heavy/heavier ions: move slower OR reach detector later/last ✓ ORA any reference to KE made up of mass and velocity terms OR $KE = \frac{1}{2}mv^2$ ✓	4	Allow ‘sample’ ionised ALLOW any reference to (positive) ions (reference to negative ions is CON) NOT larger/bigger/smaller ALLOW ‘Heavier ions are accelerated less’ ORA for 3rd mp. MP3 and 4 can be in either order												
	b	i	$ \begin{array}{c} 244 \\ \text{Cm} \\ 96 \end{array} \rightarrow \begin{array}{c} 4 \\ \text{He} \\ 2 \end{array} + \begin{array}{c} 240 \\ \text{Pu} \\ 94 \end{array} $ ✓ ✓	2	one mark for correct mass and atomic number one mark for <i>Pu</i>												
			$ \begin{array}{c} 239 \\ \text{Pu} \\ 94 \end{array} + \begin{array}{c} 4 \\ \text{He} \\ 2 \end{array} \rightarrow \begin{array}{c} 242 \\ \text{Cm} \\ 96 \end{array} + \begin{array}{c} 1 \\ \text{n} \\ 0 \end{array} $ ✓ ✓	2	one mark for neutron one mark for rest correct												
	b	iii	overcome repulsion ✓ (between) positive nuclei ✓	2	electromagnetic repulsion is a CON nuclei is sufficient												

	c	i		2	Bond to O, but allow in middle (not to H) Do not allow propan-1-ol for isomer but see below
	c	ii	(secondary) alcohol ✓ ether ✓	2	ALLOW alkoxyalkane ALLOW <u>secondary</u> and <u>primary</u> alcohol here, if propan-1-ol drawn above)
			Total	15	

Question			Expected Answers	Marks	Additional guidance
3	a	i	$\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$ 	2	one mark for cycle ALLOW ' in bottom box just names/symbols (latter must be correct) or the word "elements" Ignore direction and values on arrows one mark for -780.
		ii	state at 1 atm pressure (and at a stated temp, often 298)✓ (all) solid ✓	2	
	b	i	(atomic) emission	1	
		ii	(a) energy absorbed/heating causes electrons to be excited/promotion to higher energy levels (electron shells allowed here – see diagram mark) ✓ (b) drop back emitting photon/light/em radiation/visible spectrum (ASSUME wave means light) ✓ (c) energy levels quantised/specific OR shown in diagram as discrete lines with energy/electronic levels labelled OR energy on vertical axis ✓ (d) therefore lines of specific/certain frequency/wavelength formed OR $E = hf / \lambda$ ✓	4	Maximum 3 if no appropriate diagram Please annotate the marking points i.e. tick next to marking point NOT energy from light for first mp ALLOW emits frequencies References to atoms moving up/down energy levels penalise once only (a), (b), (c) can be scored from a diagram To score (c) from diagram: MUST have energy/energy levels (not shells), label on axis OR $n=1, n=2, n=3$ and

					etc. Diagram: at least three levels upper gap smaller than lower but need not have energy label or transitions shown. Circles or horizontal lines.
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c		2	charge on Al must be correct ignore references to 'pool' or 'mobile' electrons
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d	<table border="1"> <thead> <tr> <th>Reactant/Product</th> <th>Melting point</th> <th>Conduction of electricity</th> <th>Bonding</th> <th>Structure</th> <th></th> </tr> </thead> <tbody> <tr> <td>SiO₂</td> <td>very high</td> <td>does not conduct in solid or when molten</td> <td>covalent</td> <td>Giant</td> <td>✓</td> </tr> <tr> <td>Si</td> <td>(very) high</td> <td>semi-conductor</td> <td>covalent</td> <td>Giant</td> <td>✓</td> </tr> <tr> <td>MgO</td> <td>very high</td> <td>conducts when molten</td> <td>ionic</td> <td>giant</td> <td>✓</td> </tr> </tbody> </table>	Reactant/Product	Melting point	Conduction of electricity	Bonding	Structure		SiO ₂	very high	does not conduct in solid or when molten	covalent	Giant	✓	Si	(very) high	semi-conductor	covalent	Giant	✓	MgO	very high	conducts when molten	ionic	giant	✓	3	one mark for each correct <u>row</u> Allow Conducts when liquid but not dissolved/in solution
Reactant/Product	Melting point	Conduction of electricity	Bonding	Structure																							
SiO ₂	very high	does not conduct in solid or when molten	covalent	Giant	✓																						
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MgO	very high	conducts when molten	ionic	giant	✓																						

			Total	14
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Question			Expected Answers					Marks	Additional guidance
4	a	i	Name	Molecular formula	Empirical formula	Skeletal formula	Structural formula	4	one mark for each correct column (not of course last column!) IGNORE gaps, dashes and commas in name
			icosane	C ₂₀ H ₄₂	C ₁₀ H ₂₁		CH ₃ (CH ₂) ₁₈ CH ₃		
			2,7-dimethyloctane	C ₁₀ H ₂₂	C ₅ H ₁₁		CH ₃ CH(CH ₃)(CH ₂) ₄ CH(CH ₃) ₂		
			2,3-dimethylpentane	C ₇ H ₁₆	C ₇ H ₁₆		CH ₃ CH(CH ₃)CH(CH ₃)CH ₂ CH ₃		
			cyclohexane	C ₆ H ₁₂	CH ₂				
			methoxypropane	C ₄ H ₁₀ O	C ₄ H ₁₀ O		CH ₃ OCH ₂ CH ₂ CH ₃		
			✓	✓	✓	✓			
	a	ii	boiling point ✓					1	Do NOT allow: Condensation points
	b	i	mass of butane burnt = 1.98g ✓ moles of fuel burnt = $\frac{1.98}{58}$ (= 0.03414) ✓ volume occupied by one mole = $\frac{800}{0.03414}$ = 23433cm ³ (23.4dm ³) ✓ 23dm ³ ✓					4	23 scores 4 marks without reference to working 23.4 scores 3 ALLOW ecf between points Award last mark for 2 sf provided answer is the result of some calculation. ACCEPT, and subsuming BOTH MP2 & 3 a calculation that multiplies the vol of butane (800) by 58/1.98 as an alternative method of determining the vol of one mole of gas.
	b	ii	temperature <u>lower</u> than 'standard'/ room temperature ✓					1	ALLOW 'some gas dissolves' ALLOW 'butane is not an ideal gas'

	c	i	Measurements: ✓ ✓ any two measurements one mark all three measurements required for both marks: mass of butane/fuel burnt AW. temperature change/rise (of water) mass/volume of water Data: (specific) heat capacity of water ✓ M_r of butane or A_r values ✓	4	ALLOW 'mass of butane cylinder before and after' and, 'temperature of water before and after' as one measurement each. Ignore: Comments about SHC of calorimeter
		ii	same number and type of bonds(1) broken and made(1)	2	
			Total	16	

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