OCR
Oxford Cambridge and RSA

GCE

Chemistry B (Salters)

Unit **F331:** Chemistry for Life

Advanced Subsidiary GCE

Mark Scheme for June 2017

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, Cambridge Nationals, Cambridge Technicals, 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.

Annotations

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

Annotation	Meaning
BOD	Benefit of Doubt
	Cross
NAQ	Not answered question
	Tick
CON	Contradiction
ECF	Error carried forward
I	Ignore
POT	Power of 10 error
^	Omission mark
SF	Error in number of significant figures
RE	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.

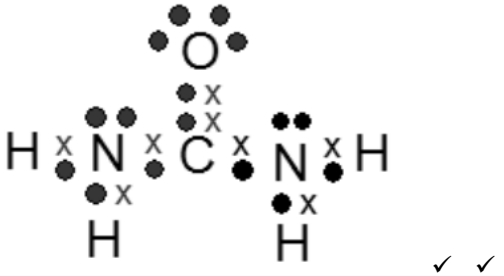
The following guidelines on the **quality of written communication** are embedded into the Levels of Response mark scheme used for question 3:

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.

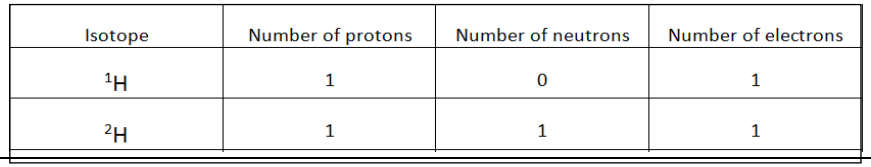
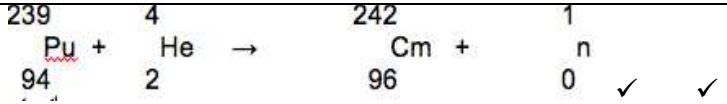
Level 3: Relatively straightforward ideas have been expressed with some clarity and fluency. Arguments are generally relevant, though may stray from the point of the question. There will be some errors of spelling, punctuation and grammar, but these are unlikely to be intrusive or obscure meaning.

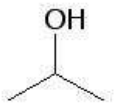
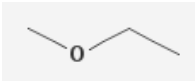
Level 2: Some simple ideas have been expressed in an appropriate context. There are likely to be some errors of spelling, punctuation and grammar of which some may be noticeable and intrusive.

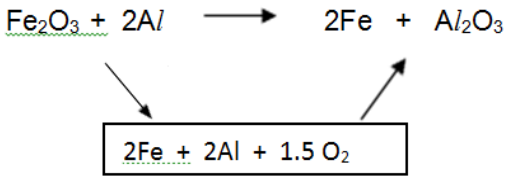
Level 1: Some simple ideas have been expressed. There will be some errors of spelling, punctuation and grammar

Question			Expected Answers	Marks	Additional Guidance
1	a	i	$2\ CO(NH_2)_2 + \underline{4}\ NO + O_2 \rightarrow \underline{4}N_2 + \underline{4}H_2O + .\underline{2}.CO_2$ ✓	1	all correct
		ii	moles of urea = $\frac{10.0}{60}$ = 0.167 ✓ max. moles of NO reacted = 2 x 0.167 = 0.334 ✓ mass of NO reacted = 10.(02)g ✓	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	120^0 ✓ 3 sets/groups of electrons around central C ✓ repel to get away as far as possible/minimise electron repulsion ✓	3	**ALLOW** 118-122^0 **ALLOW** 'areas/regions of electron density' **IGNORE** 'bonds' and 'electron pairs' **IGNORE** 'repel as much as possible'

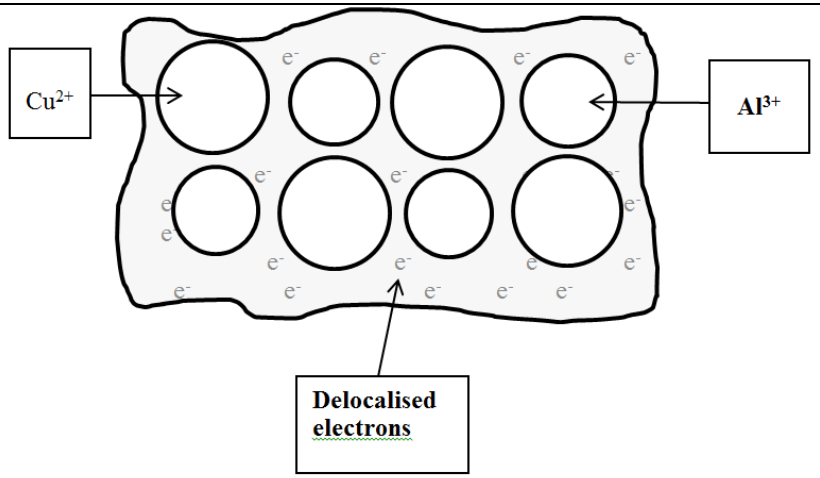
Question			Expected Answers	Marks	Additional Guidance
	d		reaction between nitrogen and oxygen in air/atmosphere ✓ at high temperatures (in engine) ✓ burning of hydrogen produces higher temp (than hydrocarbon based fuels).✓	3	Nitrogen and oxygen bond/ equation as long as from air atmosphere made clear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

Question			Expected Answers	Marks	Additional guidance
2	a	i	 ✓	1	BOTH rows fully correct for 1 mark
		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 = ½mv^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	 ✓ ✓	2	one mark for correct mass and atomic number one mark for *Pu*
			 ✓ ✓	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

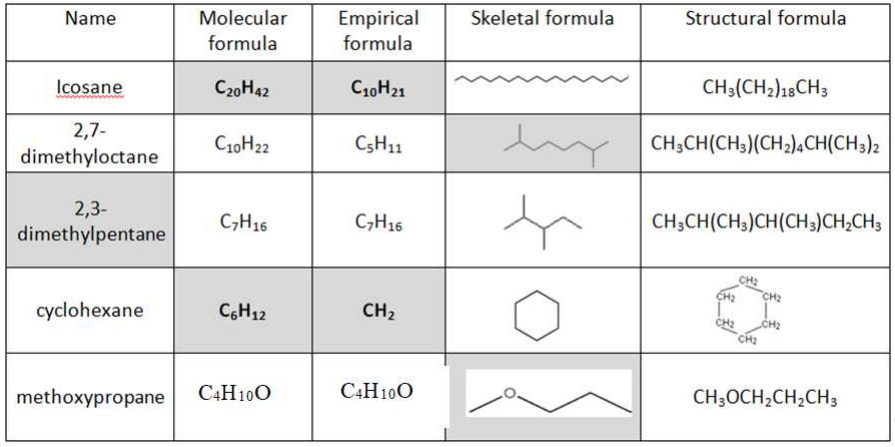
	c	i	 ✓  ✓	2	Bond to O, but allow in middle (not to H) Do not allow propan-1-ol for isomer but see below
	c	ii	(secondary) alcohol ✓ ether ✓	2	**ALLOW** alkoxyalkane ALLOW secondary and primary alcohol here, if propan-1-ol drawn above)
			Total	**15**	

Question			Expected Answers	Marks	Additional guidance
3	a	i	✓ –780 ✓ 	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 / AW ✓	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.

	c		 ✓ ✓	**2**	charge on Al must be correct **ignore** references to 'pool' or 'mobile' electrons
	d		<table><tr><th>Reactant/ Product</th><th>Melting point</th><th>Conduction of electricity</th><th>Bonding</th><th>Structure</th></tr><tr><td>SiO_2</td><td>very high</td><td>does not conduct in solid or when molten</td><td>covalent</td><td>**Giant**</td></tr><tr><td>Si</td><td>**(very) high**</td><td>semi-conductor</td><td>**covalent**</td><td>Giant</td></tr><tr><td>MgO</td><td>very high</td><td>**conducts when molten**</td><td>ionic</td><td>giant</td></tr></table> ✓ ✓ ✓	**3**	one mark for each correct <u>row</u> **Allow** Conducts when liquid but not dissolved/in solution

			Total	14	

Question			Expected Answers	Marks	Additional guidance
4	a	i		4	one mark for each correct column (not of course last column!) **IGNORE** gaps, dashes and commas in name

Name	Molecular formula	Empirical formula	Skeletal formula	Structural formula
Icosane	$C_{20}H_{42}$	$C_{10}H_{21}$		$CH_3(CH_2)_{18}CH_3$
2,7-dimethyloctane	$C_{10}H_{22}$	C_5H_{11}		$CH_3CH(CH_3)(CH_2)_4CH(CH_3)_2$
2,3-dimethylpentane	C_7H_{16}	C_7H_{16}		$CH_3CH(CH_3)CH(CH_3)CH_2CH_3$
cyclohexane	C_6H_{12}	CH_2		
methoxypropane	$C_4H_{10}O$	$C_4H_{10}O$		$CH_3OCH_2CH_2CH_3$

✓ ✓ ✓ ✓

	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 lower than 'standard'/ room temperature ✓	1	**ALLOW** 'some gas dissolves' **ALLOW** 'butane is not an ideal gas'

	c	**i**	Measurements: ✓ ✓ any **<u>two</u>** <u>measurements</u> **<u>one</u>** <u>mark</u> 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**	

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