OCR
Oxford Cambridge and RSA

GCE

Chemistry B (Salters)

Unit **F331:** Chemistry for Life

Advanced Subsidiary GCE

Mark Scheme for June 2016

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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.

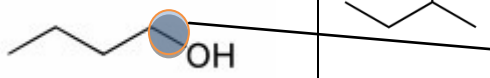
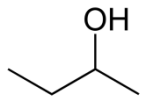
OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Annotations available in Scoris.

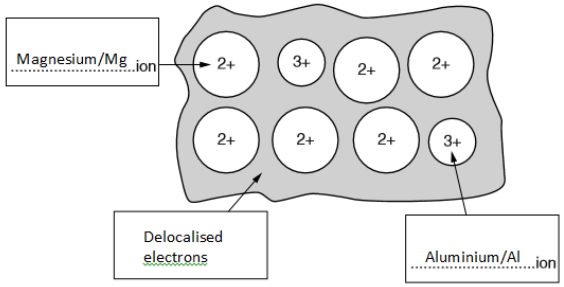
Annotation	Meaning
BOD	Benefit of doubt given
CON	Contradiction
	Incorrect response
ECF	Error carried forward
I	Ignore
NAQ	Not answered question
NBOD	Benefit of doubt not given
POT	Power of 10 error
^	Omission mark
RE	Rounding error
SF	Error in number of significant figures
	Correct response

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

Question			Expected Answers	Marks	Additional Guidance
1	a	i	Same molecular formula different structural/structures✓	1	Allow arrangement of atoms/molecule(s) as an alternative to structure. Do need to say arrangement of what.
		ii	✓ ✓ skeletal formula:   name: butan-1-ol; butan-2-ol	2	one mark for **each pair** of name and formula Allow one mark for either two correct skeletal formulae **OR** two correct names Bond should be to O not H Often small; look for distinct change of angle
		iii	ethers ✓	1	Allow alkoxyalkanes
	b		a measure of the tendency/how likely(AW) to auto/pre-ignite/knock ✓	1	
	c	i	192 x $\frac{100}{23}$ = 835g (834.7826/834.8) ✓	1	Allow 0.835kg Allow 2 or more sig figs
		ii	$\frac{835}{74}$ = 11(.28)/11.3 ✓	1	Allow ecf from c(i)
		iii	more complete/less incomplete combustion AW	1	Allow 'complete combustion'
		iv	moles butanol in 1 kg = 1000/74 = 13.51 ✓ Energy density = 13.51 x 2676 = 36162 kJ kg^{-1} ✓ Answer to 3 sig figs (36200)/3.62 x 10^4 ✓	3	Allow ecf on wrong M_r value from c(ii) ignore any sign Allow ecf sf mark on 'followable' calculation

Question			Expected Answers	Marks	Additional Guidance
	d		any one of; renewable/crops regrown reduced greenhouse gases ✓ lower carbon footprint	1	**Ignore** carbon neutral NOT no greenhouse gases/pollutant/zero carbon footprint
			Total	12	

Question			Expected Answers	Marks	Additional guidance
2	a	i	$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$ ✓ ✓	2	Allow α symbol for He if no **U** then max 1 mark one mark if all correct but with ANY numbers on rhs no ecfs
		ii	$Mg(s) + 2H_2O(l) \rightarrow Mg(OH)_2(aq/s) + H_2(g)$ ✓ ✓ $Mg(s) + 2H_2O(g) \rightarrow MgO(s) + H_2(g)$ Allow 1 mark	2	One mark for balanced equation One mark for state symbols only if eqn correct but see below Maximum 1 mark if MgO used AND must be (s) and H_2O must be (g)
		iii	 both ions correctly labelled ✓ delocalised electrons✓	2	**ignore** references to 'pool' or 'mobile' electrons ignore spelling of delocalised
	b	i	calculate loss in mass of carbonates ✓ loss in mass/moles of CO_2 gets less down group ✓ thermal stability greater down group ✓	4	First mark either for statement or at least one (calculation of a) loss in mass; first mark could be scored by a number(s) in table Second mark for pattern, must say gets less down group – not enough to simply quote two examples e.g. loss greater for Mg than Ba unless group pattern clearly implied in text Third mark straight forward, but again must bring in group, not just two examples

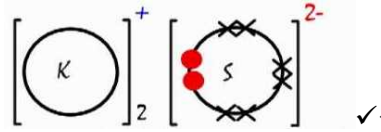
Question			Expected Answers	Marks	Additional guidance
			pass gas through lime water, goes 'cloudy' slower down group✓		ora and AW's for 'cloudy' eg milky Allow less milky (AW) down group again need to encompass all the group/established trend which may have been stated earlier
	b	**ii**	use in fume cupboard because NO_2 toxic/poisonous ✓	**1**	IGNORE any references to masks i.e. no mark NOT 'harmful'/damaging /causes acid rain Allow Causes respiratory/breathing problems NOT well-ventilated need both precaution AND WHY.
	c	**i**	Enthalpy/energy change in route 1 = route 2 ✓ as long as initial and final conditions same ✓	**2**	mark giving idea of overall two routes same, but must mention both enthalpy and a link to routes in figure start and end conditions are the same for both routes (hard mark for detail)
	c	**ii**	m x c/shc x ΔT	**1**	not asking for explanation of symbols but Allow terms written out e.g. 'mass x specific heat capacity x temperature change Allow value 4.18/4.2 used for specific heat capacity and Allow volume for mass
		iii	polystyrene(it) is a <u>better</u> (AW) insulator/has a lower heat capacity therefore less heat transfer to surroundings/cup ✓	**1**	Allow 'less heat/energy loss' – not "**no** heat loss" Allow polystyrene absorbs less heat/energy
		iv	(-90) + (+131) =+ 41 ✓ $kJmol^{-1}$	**1**	**+**41 is the only answer with or without evaluation
		v	non-standard conditions AW ✓	**1**	Allow practical implications such as not stirring; incomplete reaction; evaporation of water NOT…not all reactants reacted NOT incomplete <u>combustion</u>
			Total	**17**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional guidance</th></tr>
<tr><td>3</td><td>a</td><td>i</td><td>
<table>
<tr><td>Property</td><td>Potassium nitrate</td><td>Charcoal (carbon)</td><td>Sulfur</td></tr>
<tr><td>Structure</td><td>giant</td><td>giant</td><td>simple molecular</td></tr>
<tr><td>Bonding</td><td>ionic</td><td>covalent</td><td>covalent</td></tr>
<tr><td>Melting point</td><td>high</td><td>(very)high(er)</td><td>Low(er)</td></tr>
<tr><td>Solubility in water</td><td>soluble/high</td><td>insoluble</td><td>insoluble</td></tr>
<tr><td>Conduction of electricity in solid</td><td>none (AW) doesn't conduct</td><td>conducts</td><td>none</td></tr>
</table>
</td><td>2</td><td>all correct 2 marks

one/two incorrect 1 mark

NOT – conducts in solution or when molten (NATQ)

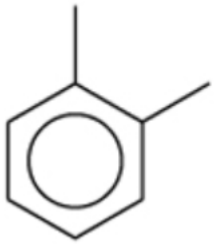
Allow answers in terms of insulation/insulator</td></tr>
<tr><td></td><td></td><td>ii</td><td>3 or more/more than 2 electrons in outer shell/outermost
OR
electrons in p sub shell</td><td>1</td><td>NOT - Number of e in outer shell – hence the group
- Number of e stated rather than the point it is three or more
- in p block</td></tr>
<tr><td></td><td>b</td><td></td><td>B A C E D</td><td>1</td><td></td></tr>
<tr><td></td><td>c</td><td></td><td>KNO_3 75/101 = 0.74(3) C 12.5/12 = 1.0(4) S 12.5/32 = 0.39(1) ✓

Mole % composition of KNO_3 = 0.743/2.174 x100 =34(.18/.14)% ✓</td><td>2</td><td>Allow 2 or more sig figs (use of 101.1 gives 0.74(2) and 32.1 gives 0.389/0.39)</td></tr>
<tr><td></td><td>d</td><td>i</td><td> 

✓✓</td><td>2</td><td>one mark for correct electronic structure
one mark for charges (both) and
2 K^+ ions (either as shown, drawn twice or 'big' 2 used)
Nothing for any covalent attempt</td></tr>
<tr><td></td><td></td><td>ii</td><td>solids to (mainly) gases ✓
gases have high(er) entropy ✓</td><td>2</td><td>NOT 'more moles formed' this is a CON on first mark
Need to mention entropy not just more ways of arranging</td></tr>
</table>

Question			Expected Answers	Marks	Additional guidance
	e	i	Electrons (in higher electronic energy levels/excited electrons) drop back to lower levels ✓ Energy lost as photons ✓ Energy (of photon) directly proportional to frequency/E = hυ ✓ Relating any of lines to appropriate drop i.e. z/red or y/yellow or x/green or w/blue ✓	**4**	photon must be spelt correctly somewhere at least once to score 2nd mark, but must be in the context of loss i.e. second mark not just used. NOT just 'to ground state' Can show colours on energy level diagram with label(s) on level(s), but must include red, - look out for CON in this case
		ii	Frequency → ☑ ✓	**1**	
		iii	position/sequence of lines unique/specific (to an element)	**1**	NOT Spectra is unique to each element(re-states stem) NOT electronic configuration/structure Allow(every element has) unique/specific energy levels/gaps/frequencies NOT 'different'
		iv	**similarity; both have** any one of… ✓ line spectra lines in same places lines get closer towards high frequency **difference: absorption** spectrum bright background/black lines **emission** spectrum black background/coloured lines✓	**2**	Must be comparative between the two, not just a description of either.
		iii	particulate ✓	**1**	NOT soot or **carbon** particulates
			Total	**19**	

Question			Expected Answers	Marks	Additional guidance
4	a	i	Bond angle = 109^0 ✓ Four pairs of electrons/ sets/groups of electrons/areas of electron density around Si/central atom ✓ Repel to get as far away as possible/minimise electron repulsion ✓	3	Allow 107 -110 Not repel as much as possible Stand alone mark NOT bonds repel, NOT bonding pairs repel, must mention electrons/electron density or follow straight from second marking point.
		ii	 Dashes/dotted lines & wedges correct ✓	1	diagram does not have to have either Si or O atoms shown Allow diagram with 2 wedges and a dashed line (between them) or any other correct arrangement dotted line and wedges/solid lines **must not** be directly opposite each other Two lines opposite or a wedge and dotted opposite are wrong
	b	i	catalyst in different phase/state to reactants/oil ✓ catalyst speeds up reaction and can be recovered unchanged at the end / without being used up/reformed at end ✓	2	NOT 'without being used in the reaction', or not taking part in the reaction Allow 'provides route of lower activation enthalpy'
		ii	$C_{10}H_{22} \rightarrow C_3H_6 + C_7H_{16}$ ✓	1	Allow $C_{10}H_{22} \rightarrow 2C_3H_6 + C_4H_{10}$ ✓
	c	i	arene underlined	1	Allow circled if unambiguous

Question			Expected Answers	Marks	Additional guidance
	c	ii	 ✓	**1**	Allow ethyl benzene
		iii	Pore/hole/channel size similar to molecule size ✓ shape of molecule G means it can slip through pores/channels whereas other isomer (F) get stuck ✓	**2**	Allow reference to ‘<u>molecular</u> sieve’ for first mark Allow straight isomers can get through the poresholes/channels and branched can’t. Look out for CON in shapes
		iv	hydrogen/H_2	**1**	
			Total	**12**	

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