Mark Scheme (Results)

January 2019

BTEC Level 3 National in Applied Science/Forensic and Criminal Investigation
Unit 1: Principles and Applications of Science I – Chemistry (31617H/1C)

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Unit 1: Applications of Science I – sample marking grid

General marking guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Marking grids should be applied positively. Learners must be rewarded for what they have shown they can do, rather than be penalised for omissions.
- Examiners should mark according to the marking grid, not according to their perception of where the grade boundaries may lie.
- All marks on the marking grid should be used appropriately.
- All the marks on the marking grid are designed to be awarded. Examiners should always award full marks if deserved. Examiners should also be prepared to award zero marks, if the learner's response is not rewardable according to the marking grid.
- Where judgement is required, a marking grid will provide the principles by which marks will be awarded.
- When examiners are in doubt regarding the application of the marking grid to a learner's response, a senior examiner should be consulted.

Specific marking guidance

The marking grids have been designed to assess learner work holistically.
Rows in the grids identify the assessment focus/outcome being targeted. When using a marking grid, the 'best fit' approach should be used.

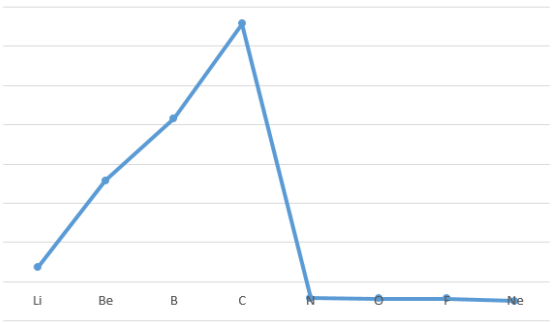
- Examiners should first make a holistic judgement on which band most closely matches the learner's response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer, in response to the assessment focus/outcome and will be modified according to how securely all bullet points are displayed at that band.
- Marks will be awarded towards the top or bottom of that band, depending on how they have evidenced each of the descriptor bullet points.

Section B – Periodicity and properties of elements

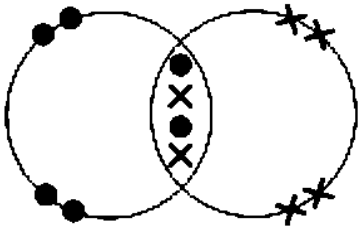
Question Number	Answer	Additional Guidance	Mark
1 (a)(i)	electrical conductivity / lightweight / high melting point / low density	allow malleable allow conducts a current allow resistant to corrosion / does not corrode allow durable ignore does not rust ignore thermal conductor / conducts heat ignore high boiling point ignore conducts alone ignore strong ignore references to delocalised electrons alone	1
1 (a)(ii)	award one mark for an identification and one mark for a linked expansion <u>identification</u> {atoms / ions / cations} are arranged in (regular) layers / atoms are all the same size (1) <u>and expansion</u> {atoms / ions / cations / layers } can {slide / move} over one another (easily) (1) OR without breaking the (metallic) bonding (1)	allow annotated diagrams for both mark points reject molecules allow rows / sheets for layers ignore reference to delocalised electrons carrying a current reject references to intermolecular forces	2
1 (b)(i)	**B** ionic		1

1 (b)(ii)	award two identification marks and two marks for linked expansions <u>identification</u> (redox reactions) involve oxidation and reduction / increase and decrease in oxidation state (1) oxidation is {loss of electrons / gain of oxygen / increase in oxidation state} (1) reduction is {gain of electrons / loss of oxygen / decrease in oxidation state} (1) **and** <u>two expansion points:</u> aluminium {gains oxygen/goes from oxidation state 0 to +3/ is oxidised/ loses electrons} (1) <u>iron oxide</u> loses oxygen / <u>iron</u> (ion in iron oxide) {goes from oxidation state +3 to 0 / is reduced / gains electrons} (1)	allow symbols instead of names throughout allow correct half equations allow (redox reactions) involve loss and gain of {oxygen / hydrogen / electrons} allow oxidation is loss of hydrogen ignore references molecules allow reduction is gain of hydrogen reject aluminium gains electrons reject iron ions lose electrons ignore iron loses oxygen ignore iron oxide is reduced ignore incorrect numbers as long as direction of transfer is correct ignore aluminium displaces iron ignore involves a transfer of electrons alone if no other marks scored allow 1 compensatory mark for OILRIG alone / oxidation is loss reduction is gain alone	4
		total	8 Marks

Question	Answer	Additional	Mark

Number		Guidance	
2 (a)(i)	**B** ▲		1
2 (a)(ii)	**D** ★		1
2 (b)(i)	p (block)	ignore references to groups	1
2 (b)(ii)	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$		1
2 (c)(i)	 (2) OR increase from beryllium up to boron and then carbon on graph (1) decrease from carbon to nitrogen (1)	allow ECF	2

2 (c)(ii)	award one mark for an identification and two marks for the linked expansion <u>identification</u> (higher atomic number means) more electrons (1) **and** two expansion points (more electrons means) temporary dipoles become larger (1) {Van der Waals / intermolecular} forces become stronger (1) requires more {heat/energy} to {separate the <u>molecules</u> / break the (intermolecular) forces} (1)	allow ORA throughout allow London forces / dispersion forces / induced dipole / temporary dipole-dipole / instantaneous dipole for Van der Waals ignore more shells alone reject more electrons in outer shell reject hydrogen bonding ignore electrostatic attraction / forces reject more energy required to break the bonds alone ignore references to ions / ionisation energies	3
		total	9 Marks

Question Number	Answer	Additional Guidance	Mark
3 (a)	 (2) OR (two) shared pair(s) of electrons between two oxygen atoms (1) (two shared pairs and) rest of molecule correct (1)	allow dots or crosses or a mixture of both ignore any inner shells drawn reject diagrams that show electron transfer or ionic bonds max 1 mark if a charge is drawn on an otherwise fully correct molecule	2
3 (b)(i)	**division (1)** 1.40 / 2.00 **percentage (1)** Their fraction x 100	allow full marks for correct answer of 70 with no working power of ten error gains 1 mark	2
3 (b)(ii)	**calculation of RFM of MgO (1)** 24.3 + 16 = 40.3 **calculation of number of moles of Mg (1)** 2.43 / 24.3 (=0.1) **calculation of mass of MgO (1)** 0.1 x 40.3 = 4.03 allow other alternative methods	allow full marks for correct answer of 4.03 with no working. allow ECF throughout allow 2 x (24.3 + 16) = 80.6 (1) allow 2.43 / 2 x 24.3 = (0.05) (1) allow 0.05 x (80.6) allow use of 24 throughout	3
		total	7 Marks

Question number	Indicative content
4	Answers will be credited according to the learner's demonstration of knowledge and understanding of the material, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content but learners should be rewarded for other relevant answers. • fluorine and oxygen are in the same period • fluorine has a smaller atomic/ionic radius than oxygen • larger number of protons • but shielding is constant • increasing nuclear charge pulls electrons in more tightly • sulfur and oxygen are in the same group • sulfur has a larger atomic radius than oxygen and/or fluorine • (because there is an) extra shell of electrons • {ions / ionic radius} are larger than the {atoms / atomic radius} from the same element • electrons have been added • same nuclear charge / same number of protons • same amount of shielding • nucleus required to attract more electrons / effective nuclear charge is reduced • fluoride ion is smaller than the oxide and sulfide ion • fluorine forms a -1 charged ion whereas oxygen and sulfur form -2 charged ions / because 1 electron is added instead of 2 • (therefore) effective nuclear charge is reduced further with oxygen and sulfur than it is for fluorine allow ORA throughout ignore ideas about electronegativity or bonding pairs of electrons ignore references to sharing electrons ignore values quoted from the table alone

Mark scheme (award up to 6 marks) refer to the guidance on the cover of this document for how to apply levels-based mark schemes*.		
Level	**Mark**	**Descriptor**
Level 0	0	No rewardable material.
Level 1	*1-2*	Adequate interpretation, analysis and/or evaluation of the scientific information with generalised comments being made Generic statements may be presented rather than linkages being made so that lines of reasoning are unsupported or partially supported The discussion shows some structure and coherence
Level 2	*3-4*	Good analysis, interpretation and/or evaluation of the scientific information. Lines of argument mostly supported through the application of relevant evidence The discussion shows a structure which is mostly clear, coherent and logical
Level 3	*5-6*	Comprehensive analysis, interpretation and/or evaluation of all pieces of scientific information Line(s) of argument consistently supported throughout by sustained application of relevant evidence The discussion shows a well-developed structure which is clear, coherent and logical
		Total 6 Marks