Mark Scheme (Results)

June 2018

BTEC Level 3 National in Applied Science
Unit 1: Principles and Applications of Science – Chemistry (31617H1C)

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Unit 1: Principles and Applications of Science I – sample mark scheme

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.
- Crossed-out work should be marked, UNLESS the learner has replaced it with an alternative response.
- You will not see 'or words to that effect' (OWTTE). Alternative correct wording should be credited in every answer, unless the mark scheme has specified specific wording that must be present.
- Round brackets () indicate words that are not essential, e.g. '(hence) distance is increased'.
- Error carried forward (ECF), means that a wrong answer given in an earlier part of a question is used correctly in a later part of a question.
- / indicates that the responses are alternatives and either answer should receive full credit.

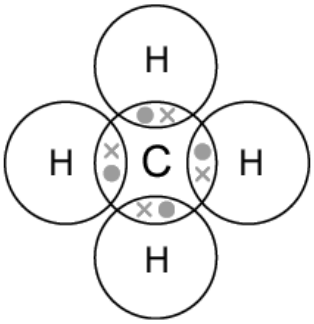
Specific marking guidance for levels-based mark schemes*

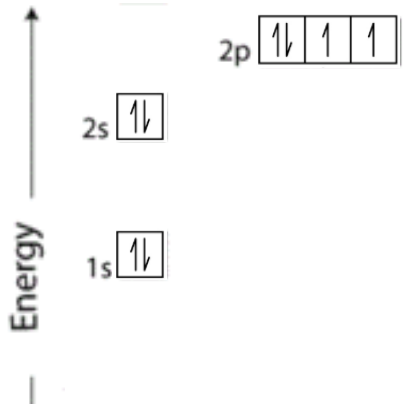
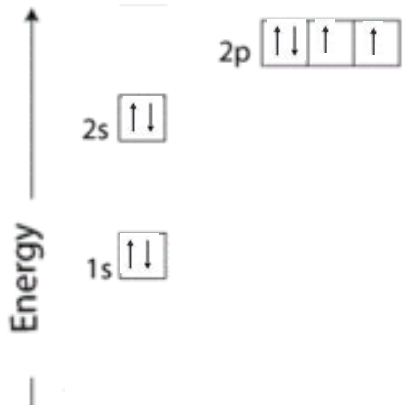
Levels-based mark schemes (LBMS) have been designed to assess learners' work holistically. They consist of two parts: indicative content and levels-based descriptors. Indicative content reflects specific content-related points that a learner might make. Levels-based descriptors articulate the skills that a learner is likely to demonstrate, in relation to the assessment outcomes being targeted by the question. Different rows in the levels, represent the progression of these skills.

When using a levels-based mark scheme, 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/objective 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)	shared (pair of) electrons (1) (strong electrostatic) attraction between nuclei and electrons (1)	reject gives/take electrons no marks if reference made to ions	2
1 (a) (ii)		any 1 shared pair of electrons (between a carbon and a hydrogen) (1) rest of molecule correct (1) ignore any inner shells allow dots or crosses or a mixture of both	2
1 (b)	An explanation linking any three from: (methane has a relatively) low melting point (1) (methane has) van der Waals forces (1) (van der Waals forces) are weak / intermolecular forces are weak / forces <u>between the molecules</u> are weak (1) so small amount of energy required to {overcome (weak intermolecular) forces / to separate the molecules} (1)	 allow London (dispersion) forces/induced dipole interactions reject weak bonds for weak forces in MP3 and MP4	3
		total	7 marks

Question Number	Answer	Additional Guidance	Mark
2 (a)	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$ (2) or correct subshells (1) correct arrangement of electrons (1)		2
2 (b)	 (2) OR  (2) OR correct number of electrons in boxes (1) correct spin on each electron (1)		2
2 (c)	**D** $K(g) \rightarrow K^+(g) + e^-$		1
2 (d)	**C** 4		1
		total	6 marks

Question Number	Answer	Additional Guidance	Mark
3 (a)	calcium + sulfuric acid → calcium sulfate (1) + hydrogen (1)	allow $CaSO_4$ (1) allow H_2 (1) note: formula must be correct if given do not allow calcium sulfite/calcium sulfide.	2
3 (b)	$2Ca + O_2 \rightarrow 2CaO$ correct formula (1) correct balancing (1)	allow correct multiples	2
3 (c)	<u>moles of calcium</u> <u>8.02</u> = (0.2) (1) 40.1 <u>mass of calcium chloride formed =</u> 0.2 x 111.1 = (1) <u>evaluation</u> 22.22 (1) allow other alternative methods	22.2(2) with no working scores 3 marks allow ecf allow 0.2 seen (1)	3
		total	7 marks

Question Number	Answer	Additional Guidance	Mark
4 (a)	An explanation linking {atoms / ions / cations} are in layers (1) (so) {atoms / ions / cation/ layers} can slide (over each other) (1)	allow labelled diagrams for both mark points reject molecules	2
4 (b)	<u>Substitution (1)</u> 39.1 + 54.9 + (4 x 16) = <u>Evaluation (1)</u> 158	158 with no working scores 2 marks allow working using 55 and 39 allow 76 with working (1)	2

Question number	Indicative content
4 (c)	General comments: • transition metals are elements that form more than one stable ion with an incomplete d subshell • transition metals are a subset of d block elements • d block elements are elements where the last electron to fill the atom is placed into a d orbital • manganese and zinc both have electrons in the 3d subshell and so are classified as d block elements • an incomplete d subshell explains some of the key properties of transition metals (such as manganese) e.g forms coloured compounds, can be used as a catalyst Manganese: • manganese (atom) has an incomplete 3d subshell • manganese forms variable oxidation states +2, +4, +7 • manganese forms more than one ion • manganese loses electrons from 4s and 3d subshell to form ions • +2 is [Ar] $3d^5$ / an ion with an incomplete d subshell • +4 is [Ar] $3d^3$ / an ion with an incomplete d subshell • but +7 does not have an incomplete d subshell / is not an ion • manganese forms two different ions with incomplete d subshells so is classified as a transition metal Zinc: • zinc does not have an incomplete d subshell • zinc only forms one oxidation state + 2 • zinc only forms one ion • zinc only loses electrons from 4s subshell to form an ion • +2 is [Ar] $3d^{10}$ / an ion with a complete d subshell • zinc does not form any ions with an incomplete d subshell so is not classified as a transition metal • it does not show properties associated with transition metals e.g zinc forms colourless / white compounds, zinc is not used as a catalyst
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*.	

		ignore any units given	

Level	Mark	Descriptor
	0	No awardable content
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 explanation 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 explanation 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 explanation shows a well-developed structure which is clear, coherent and logical
		Total 12 Marks

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