Mark Scheme (Results)

June 2019

Pearson BTEC Level 3 Nationals Certificate in Applied Science/Forensic and Criminal Investigation

Unit 1: Principles and Applications of Science (Chemistry)

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk for our BTEC qualifications.
Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

If you have any subject specific questions about this specification that require the help of a subject specialist, you can speak directly to the subject team at Pearson.
Their contact details can be found on this link: www.edexcel.com/teachingservices.

You can also use our online Ask the Expert service at www.edexcel.com/ask. You will need an Edexcel username and password to access this service.

Pearson: helping people progress, everywhere
Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

June 2019
Publications Code 31617HC_1906_MS

Unit 1: Principles and Applications of Science I

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.

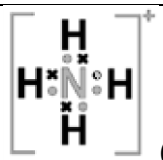
When using a levels-based mark scheme, the 'best fit' approach should be used.

- 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)	high melting point / high boiling point / (usually) form crystals / (usually) soluble (in water)		1
1 (a)(ii)	**C** ions are free to move		1
1 (b)	any three from **Route 1** OR **Route 2**: **Route 1** calcium has stronger metallic bonding than potassium (1) calcium donates two electrons to sea of electrons but potassium only donates one / calcium donates more electrons to the sea of electrons (1) {calcium ion/+2 ion} will have a stronger (electrostatic) attraction to the {sea of / delocalised} electrons (1) requires {more energy /more heat / harder} to break the (metallic) bond / more energy required to melt (1) OR **Route 2** calcium has stronger metallic bonding than potassium (1) calcium has {a greater nuclear charge/smaller radius} (1) (greater) {positive / nuclear} charge more attracted to {sea of /delocalised} electrons (1) requires {more energy /more heat / harder} to break the (metallic) bond / more energy required to melt (1)	allow ORA throughout ignore references to intermolecular forces allow calcium has more delocalised electrons allow calcium ion has a charge of +2 but potassium ion only has a charge of +1 / calcium has a greater charge than potassium allow calcium has more protons (in the nucleus) if no other marks are scored allow calcium has 2 electrons in its outer shell whereas potassium has 1	3

1 (c)(i)	**A** MgO		1
1 (c)(ii)	+3 / plus three	do not allow Cr^{+3}/Cr^{3+} allow 3+ / 3 do not allow 3- or -3	1
		total	7 marks

Question Number	Answer	Additional Guidance	Mark
2 (a)	substitution (1) 14 + (1x4) + 35.5 = evaluation (1) 53.5	allow full marks for correct answer of 53.5 with no working scores 2 marks if no other marks allow 1 mark for 28 OR 1 mark for 50.5	2
2 (b)	$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$ (2) OR H_2SO_4 (1) 2 in front of NH_3 (1)	allow multiples allow SO_4H_2 etc reject H2SO4, H^2SO^4 etc for MP1 marks are independent	2
2 (c)	 (2) OR correct electron arrangement for ion (1) four hydrogens around nitrogen (1)	allow dots or crosses	2

2 (d)	moles of ammonium nitrate (1) $\frac{5}{80}$ (= 0.0625) mass of ammonia (1) (0.0625) x 17 evaluation (1) = 1.06(25) OR ratio of ammonia to ammonium nitrate $\frac{17}{80}$ (=0.2125) (1) mass of ammonia (0.2125) x 5 (1) evaluation = 1.06(25) allow other alternative methods	allow full marks for correct answer of 1.06(25) with no working scores 3 marks allow ECF throughout	3
		total	9 marks

Question Number	Answer	Additional Guidance	Mark
3 (a)(i)	**A** alkali metals		1
3 (a)(ii)	$1s^2\ 2s^1$		1
3 (a)(iii)	Li (g) → Li^+ (g) + e^- (2) OR Li → Li^+ (1) OR state symbols correct (1)	allow Li (g) – e^-→ Li^+ (g) (2)	2
3 (b)	any four from: there are more shells (of electrons) / atomic radius increases (1) the <u>outer</u> {electron/shell} is further from the nucleus (1) there is more shielding (1) nuclear attraction decreases (1) less energy required remove the (outer) electron / (outer) electron is easier to remove (1)	allow 'down the group' for atomic number increases	4 expert
		total	8 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. General • Both substances have weak intermolecular forces between the molecules • This requires a low amount of energy to break the forces (of attraction)/ separate the molecules • The intermolecular forces (of attraction) in water are stronger than those in methane • Van der Waals, (permanent) dipole-dipole, and hydrogen bonding are all types of intermolecular force Water • Water has van der Waals, (permanent) dipole-dipole, and hydrogen bonding between molecules • Therefore more energy is needed to overcome all of these forces • Van der Waals forces - movement of electrons in molecules creates a temporary dipole and induces a dipole in another molecule • (Permanent) dipole-dipole forces - oxygen is much more electronegative than hydrogen therefore O-H bond / water molecule has a permanent dipole / is polar • Hydrogen bonding - the O-H bond is very polar and lone pair of electrons on oxygen of one water molecule is attracted to (deshielded) hydrogen on another molecule Methane • Methane only has van der Waals forces between the molecules • Therefore less energy is needed to overcome just this force • Van der Waals forces - movement of electrons in molecules creates a temporary dipole and induces a dipole in another molecule • Carbon and hydrogen have a similar electronegativity, therefore methane has no permanent dipole / is not polar • Carbon has no lone pairs of electrons (and no deshielded hydrogen atoms), therefore methane has no hydrogen bonding Allow London dispersion forces/induced dipole/temporary dipole-dipole for van der Waals throughout

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
	0	No awardable content
Level 1	1-2	· Demonstrates adequate knowledge of scientific facts/concepts with generalised comments 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	· Demonstrates good knowledge and understanding by selecting and applying some relevant scientific knowledge facts/concepts to provide the discussion being presented. · 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	· Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of scientific facts/concepts to provide the discussion being presented. · 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

For more information on Edexcel qualifications, please visit our website
www.edexcel.com

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE