



# Mark Scheme (Results)

January 2020

Pearson BTEC Level 3 – Applied Science

Unit 5: Principles and Applications of  
Science II – Chemistry (31627H)

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# **Unit 5: Principles and Applications of Science II – sample marking grid**

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## **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**

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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.

**BTEC Next Generation Mark Scheme Template  
Applied Science Unit 5 – Physics 2001 FINAL**

<b>Question Number</b>	<b>Answer</b>	<b>Additional Guidance</b>	<b>Mark</b>
1 (a)	<b>C</b> It is a base.		1
1 (b)	Award <b>one</b> mark for any of the following: <ul style="list-style-type: none"> <li>• treatment of acidic effluent / acidic gas emissions</li> <li>• {neutralising / treating acidic} soil</li> <li>• making limewater to test for carbon dioxide</li> <li>• flocculant to purify water</li> </ul> Accept any other valid answer.	Allow raising pH of soil	1
1 (c)(i)	289.0 - 273.2 (=15.8)	Award mark for correct answer of 15.8 with no working  Allow 16	1
1 (c)(ii)	<p>Temperature change (1) 292.9 - 289.0 (= 3.9)</p> <p>Substitution (1) 750 x 4.18 x (3.9)</p> <p>Evaluation (1) 12,226.5</p>	<p>Allow <b>full</b> marks for correct answer of 12,226.5 with no working</p> <p>ECF</p> <p>Allow 12,227 / 12,230 / 12,200 / 12,000</p> <p>2 marks for power of ten error</p>	3

1 (d)	<p>Award <b>one</b> mark for identification.</p> <p>(Hydration of ions is) an exothermic process (1)</p> <p>Award <b>up to three marks</b>, for the following expansion points:</p> <p>water molecule is polar/ has a dipole / has a positive and a negative end (1)</p> <p>positive <u>ions</u> attracted to oxygen/negative end of water molecule (1)</p> <p>negative <u>ions</u> attracted to hydrogen/positive end of water molecule (1)</p>	<p>Allow gives out heat / energy</p> <p>If MP3 and MP4 not credited, allow 1 mark for "ion(s) attract water"</p> <p>Reject "ion(s) bond with water"</p> <p>Allow diagrams of +/-ion next to <math>\delta^-/\delta^+</math> end of water for up to 2 marks</p>	4
Total			10 marks

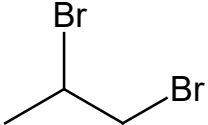
Question Number	Answer	Additional Guidance	Mark
2 (a)(i)	$2\text{C}_6\text{H}_{14} + 19\text{O}_2 \rightarrow 12\text{CO}_2 + 14\text{H}_2\text{O}$ Correct number in front of carbon dioxide (1) Correct number in front of water (1)	Allow multiples only if the number of $\text{C}_6\text{H}_{14}$ and $\text{O}_2$ molecules have been modified	2
2 (a)(ii)	<b>A</b> An excess of oxygen gas is used.		1
2 (b)(i)	3-methylpentane		1
2 (b)(ii)	Molecules with the same <u>molecular</u> formula/same number and type of atoms (1)  But different structural formulae/ different arrangements of the atoms (1)  Accept any other valid answer.	Allow "both (molecules) are $\text{C}_6\text{H}_{14}$ "	2
2 (b)(iii)	Award <b>one</b> mark for identification.  2,2-dimethylbutane (1)  Award <b>one</b> mark for any of the following expansions up to a maximum of two marks.  It has the most branches/it has the shortest chain length (1)  It has the smallest surface area/fewest points of contact (1)  It has the weakest intermolecular forces/ needs the least amount of energy to separate the molecules (1)	Allow "not a straight chain"	3
Total			9 marks



3 (b)(iv)	<p>Award <b>one</b> mark for identification.</p> <p>TiCl<sub>4</sub> offers an alternative pathway (to the mechanism in Table 2) for the reaction (1)</p> <p>Award <b>one</b> mark for any of the following expansion points up to a maximum of two marks.</p> <p>No collision necessary between R and CH<sub>2</sub>=CH<sub>2</sub> (1)</p> <p>(TiCl<sub>4</sub>) weakens the <u>double</u> bond / π bond (in CH<sub>2</sub>=CH<sub>2</sub>) (1)</p> <p>(TiCl<sub>4</sub>) accepts electrons from CH<sub>2</sub>=CH<sub>2</sub> (1)</p> <p>(TiCl<sub>4</sub>) donates electrons back to the R group (1)</p>	<p>Allow adsorb reactants (on surface) / lowers <u>activation</u> energy</p> <p>Allow "makes collisions easier / <u>collisions</u> with less energy"</p> <p>Ignore "more (successful) collisions"</p> <p>Allow "breaks <u>double</u> bond"</p>	3
Total			8 marks



Question Number	Answer	Additional Guidance	Mark
4 (a)	<p>Award <b>one</b> mark for any of the following up to a maximum of four marks.</p> <p><i>Bonding between C<sub>1</sub> and C<sub>2</sub></i></p> <p>{sigma/σ} bond (1)</p> <p>(this is a) single bond (1)</p> <p><i>Bonding between C<sub>2</sub> and C<sub>3</sub></i></p> <p>{sigma/σ} bond <u>and</u> {pi/ π} bond (1)</p> <p>(this is a) double bond (1)</p> <p>Accept any other valid answer.</p>	<p>Allow "sigma/σ orbitals"</p> <p>Allow {head-on/ end-on} overlap of orbitals</p> <p>Allow shared pair of electrons</p> <p>Allow covalent bond</p> <p>Allow "sigma/σ orbitals <u>and</u> pi/ π orbitals"</p> <p>Allow {sideways/partial} overlap of orbitals</p> <p>Ignore reference to number of pi bonds</p> <p>Allow sharing of {four electrons /two pairs of} electrons</p>	4

4 (b)	<p>Award <b>one</b> mark for identification</p> <p>There is a double bond (at bond angle y) (1)</p> <p>Award <b>one</b> mark for any of the following expansions:</p> <p>There are fewer bonds around the (middle) carbon (1)</p> <p>(double bond) can repel more / other bonds further (1)</p> <p>(double bond) gives a trigonal planar shape (1)</p> <p>Accept any other valid answer.</p>	<p>Allow "there are four single bonds at bond angle x"</p> <p>Accept "there are only 3 bonds"</p> <p>Allow (double bond) gives a bond angle of <math>120^\circ</math> / gives a bond angle greater than <math>109.5^\circ</math></p>	2
4 (c)	<p><b>c</b></p>  <p>The diagram shows a skeletal structure of 2-bromo-1-bromopropane. It consists of a three-carbon chain. The first carbon (left) is bonded to two other carbons. The second carbon (middle) is bonded to a bromine atom (Br) above it. The third carbon (right) is bonded to a bromine atom (Br) to its right.</p>		1
Total			7 marks

Question number	Indicative content
5	<p><b>Similarities:</b></p> <ul style="list-style-type: none"> <li>• Elements are formed at the cathode and anode</li> <li>• Non-metals / gases are formed at the anode</li> <li>• Compounds are formed as the other product</li> <li>• Use of electricity to decompose compounds</li> <li>• Both raw materials are ionic compounds</li> <li>• Ions are free to move in both compounds</li> </ul> <p><b>Differences:</b></p> <ul style="list-style-type: none"> <li>• Desired product forms at cathode in electrolysis of alumina but at anode in electrolysis of brine</li> <li>• Alumina is an oxide but brine is a chloride</li> <li>• Alumina is a (molten) liquid but brine is an aqueous solution</li> <li>• Alumina is dissolved in cryolite but sodium chloride is dissolved in water (in brine)</li> <li>• Electrolysis of alumina requires more energy than of brine</li> <li>• Metal forms at the cathode in electrolysis of alumina but non-metal / gas forms in electrolysis of brine</li> <li>• Sodium and hydroxide ions are left behind in the electrolysis of brine, but no other ions left behind in electrolysis of alumina</li> <li>• The carbon anode burns in oxygen to form carbon dioxide in the electrolysis of alumina (but no carbon and oxygen present in electrolysis of brine)</li> <li>• Electrolysis of brine uses a membrane / diaphragm cell (but electrolysis of alumina does not need one)</li> <li>• Sodium hydroxide is a useful product but carbon dioxide is a waste product/pollutant/greenhouse gas</li> </ul>

**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	<ul style="list-style-type: none"> <li>• Demonstrates adequate knowledge and understanding of scientific facts/concepts to the given context with generalised comments made.</li> <li>• Generic statements may be presented rather than linkages to the context being made so that lines of reasoning are unsupported or partially supported</li> <li>• The comparison will contain some similarities and differences showing some structure and coherence</li> </ul>
Level 2	3-4	<ul style="list-style-type: none"> <li>• Demonstrates good knowledge and understanding by selecting and applying some relevant scientific facts/concepts to provide the comparison being presented.</li> <li>• Lines of argument mostly supported through the application of relevant evidence drawn from the context</li> <li>• Demonstrate an awareness of both similarities and differences leading to a comparison which has a structure which is mostly clear, coherent and logical</li> </ul>
Level 3	5-6	<ul style="list-style-type: none"> <li>• Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of scientific facts/concepts to provide the comparison being presented.</li> <li>• Line(s) of argument consistently supported throughout by sustained application of relevant evidence drawn from the context</li> <li>• The comparison shows a logical chain of reasoning which is supported throughout by sustained application of relevant evidence</li> </ul>

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



Llywodraeth Cynulliad Cymru  
Welsh Assembly Government

