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| **Question** | **Answers** | **Extra information** | **Mark** | **AO / Spec ref.** |
| **01.1** | 15.9  16.2 | Accept 16.1 for 2 marks. | 1 | AO2 |
|  | 2 | Accept 16.5 for 1 mark. |  | C7.2.3 |
|  | = 16.05  = 16.1 (°C) |  | 1 | MS2b |
| **01.2** | Accept any number in range 17.5–18.2 |  | 1 | AO3 C7.2.3 |
| **01.3** | add a lid/add insulation/move flame closer to beaker | Allow add draft shields or less water in the beaker. | 1 | AO3  C7.2.3 AT1, 5 |
| **01.4** | Greater ratio of carbon to hydrogen in larger alcohol molecules **or**  more incomplete/partial combustion. |  | 1 | AO1 C7.2.3 |
| **02** | **Level 3:** There is a reasonably detailed description of both methods giving reactants, products and conditions showing how ethanol is produced from sugar **and** by hydration with steam. This could be achieved by including chemical equations. | | 5–6 | AO1×4 AO2×2 C7.2.2  C7.2.3 WS1.2 |
| **Level 2:** There is a basic description of both methods. There is an attempt to give reactants and some conditions showing ethanol production from sugar and by hydration with steam. | | 3–4 |
|  | **Level 1:** There is a brief description of one method, including reactants**.** Little or no mention of conditions of the two methods of producing ethanol. | | 1–2 |  |
|  | **Level 0:** No relevant content. | | 0 |  |



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|  | **Indicative content:**  Hydration:   * ethene named * steam * high temperature/300 °C * high pressure/60–70 atmospheres * (phosphoric acid) catalyst * equation * only ethanol produced * 100% atom economy * continuous/fast/pure. Sugar: * glucose named * aqueous solution/water * yeast * warm/25–50 °C * anaerobic/fermentation * equation * carbon dioxide also produced * lower atom economy * batch/slow/impure. Comparison: * hydration has 100% atom economy * sugar has lower atom economy * hydration is continuous * hydration is fast/pure * sugar is not continuous / completed in batches * sugar is slow / impure * fermentation uses renewable resource, sugar cane/beet * ethene is derived from products (alkanes) from crude oil – a non- renewable resource.   This indicative content is not exhaustive, other creditworthy responses should be awarded marks as appropriate. | | |  |
| **03.1** | CH3CH2CH2COO− H+ |  | 1  1 | AO2 C7.2.4 |
| **03.2** | sodium propanoate |  | 1 | AO2 C7.2.4 |



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| **03.3** | CH3CH2COONa |  | 1 | AO2 C7.2.4 |
| **03.4** | bubbles of gas/carbon dioxide given off |  | 1 | AO2 C1.1.1 |
| **03.5** | ethanoic acid ethanol |  | 1  1 | AO3 C7.2.4 |
| **04.1** | Contains a double or triple (carbon– carbon) bond. |  | 1 | AO1 C7.2.1 WS1.2 |
| **04.2** | Layout Disk 1:01_Q2A Media:OUP:GCSE Kerboodle Worksheets:Design HO 02/07:z_Source:830885 AQA GCSE Science Kerboodle HO 6 Jan 2017:06 02 17:Priority 1:Priority 1 PNGs:AQA Chemistry Exam-style questions:oxo_AQA16_C10ss_xm02_awfg01.png | Accept Cl in any position on carbon-2 and carbon-1. | 1 | AO2 C7.2.2 |
| **04.3** | C3H8 |  | 1 | AO2 C7.2.2 WS1.2 |
| **04.4** | chlorine – room temperature hydrogen – (nickel or other) catalyst  hydrogen – high(er) temperature/60 to 150 oC |  | 1  1  1 | AO1 C7.2.2 WS1.2 |
| **05.1** |  |  | 1 | AO2 C7.2.4 |
| **05.2** | Butanoic acid is a weak/weaker acid;  because it does not fully ionise. | Allow because it does not fully dissociate;  allow converse for sulfuric acid. | 1  1 | AO1 AO2 C7.2.4 |
| **05.3** | carbon dioxide |  | 1 | AO1 C7.2.4 |
| **05.4** | Slower/fewer bubbles (of gas) for butanoic acid;  because of lower concentration of hydrogen ions/H+(aq) ions in solution of butanoic acid. | Allow converse for sulfuric acid. | 1  1 | AO1 C7.2.2 AT5, 6 |