

Solutions

Original marking guidance: M1 method, A1 accuracy, B1 explanation.

2.1 Bromoethane with Mg in dry ether; water reacts with/destroys Grignard reagent.

2.2 Butanoic acid, four carbons: three from propyl plus one from CO₂.

2.3 Ethanal, CH₃CHO; its carbonyl carbon gains CH₃ and becomes bonded to two methyl groups and OH.

3.1 Bromoethane → ethanol: aqueous OH[−], heat. Ethanol → ethanal: controlled oxidation, distil. Ethanal → butan-2-ol: ethylmagnesium bromide/dry ether then acidic work-up. Butan-2-ol → butan-2-one: acidified dichromate oxidation. Grignard reagent is prepared separately.

3.2 Amount = $2.76/138 = 0.0200$ mol; theoretical mass = 3.60 g; yield = $2.52/3.60 \times 100 = 70.0\%$. Water adds mass that is not aspirin.

3.3 Carbonate removes acidic impurity by reaction; anhydrous drying agent removes remaining water. Vent separating funnel to release CO₂/pressure away from people. A dense organic solvent can form the lower layer.