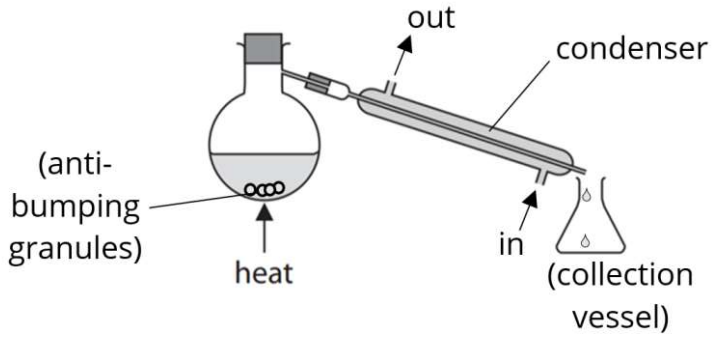
Question Number	Answer	Additional Guidance	Mark
4(a)	An answer that makes reference to the following points: • (from) orange **(1)** • (to) green **(1)**	Allow to blue Allow 1 mark for colours reversed	**2**

Question Number	Answer	Additional Guidance	Mark
4(b)	A diagram that shows: • round-bottomed/pear shaped flask containing the mixture with heat label **(1)** • anti-bumping granules in round-bottomed flask **(1)** • (labelled) sloping condenser with correct direction of water in and out **(1)** • collection vessel and system sealed on the left and open on the right **(1)**	Example of a diagram:  Allow any indication of heat including just an arrow Allow just arrows showing the water direction Ignore inclusion of thermometer/dropping funnel even if incorrectly placed The condenser should have some indication of a water jacket Incorrect labelling, e.g. a round bottom flask labelled as a conical flask, would not be awarded the corresponding mark (M1 in this case) Max 3 for one-piece apparatus NB reflux set up would be able to score M1 and M2	**4**

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	• (alcohols/products are) flammable / may ignite / can burn	Ignore more even heating/avoids hot-spots Ignore easier to control the temperature Ignore heat more safely Ignore references to explosions Ignore references to fire as a hazard Do not award potassium dichromate is flammable	**1**

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	An answer that makes reference to the following point: (2-methylpropan-2-ol resists oxidation because 2-methylpropan-2-ol is a) tertiary (alcohol) / 3°	 Allow tertiary alcohols are resistant to oxidation Allow tertiary (alcohols) cannot be oxidised Ignore no reaction Ignore minor errors in the alcohols name	**1**

Question Number	Answer	Additional Guidance	Mark
4(c)(iii)	A description that makes reference to the following points: • identification of the three oxidation products	Additional guidance: Propanal / CH_3CH_2CHO and propanoic acid / CH_3CH_2COOH (from propan-1-ol) and propanone / CH_3COCH_3 (from propan-2-ol) Accept skeletal/displayed formulae Allow propan-1-al and propan-2-one Ignore carbon dioxide/CO_2 and water/H_2O If both name and formula are given, then both must be correct	**1**

Question Number	Answer	Additional Guidance	Mark
4(c)(iv)	A description that makes reference to the following points: • test for propanal/aldehyde **(1)** • result for propanal **(1)** • test for (propanoic) acid **(1)** • result for propanoic acid **(1)** Note: If extra oxidation products are given, then ignore those with correct tests. An incorrect test or result negates one mark for each extra compound. A near miss on the test would allow the corresponding result mark to be awarded e.g. Add ethanol (no acid catalyst) gives a fruity smell would score 1 mark for M4 If candidates have omitted the names of the compounds being tested then assume the tests are for the correct compounds	Additional guidance: Benedict's or Fehling's solution Accept alkaline copper(II) sulfate solution propanal will form a red precipitate or ammoniacal silver nitrate / Tollen's reagent propanal gives a silver mirror Do not award acidified potassium dichromate(VI) addition of carbonate / hydrogencarbonate (solution) will give effervescence / fizz (of carbon dioxide) / gas given off which turns limewater cloudy or addition of reactive metal will give effervescence / fizz (of hydrogen) / gas given off pops with a lighted splint or addition of a named alcohol and acid catalyst to form a sweet-smelling ester Ignore addition of PCl_5 , gives misty fumes Ignore reference to indicators	**4**

(Total for Question 4 = 13 marks)
(Total for Paper = 50 marks)