

2.5.2 Alcohol pathways, purification and spectra

Name: _____ Class: _____ Date: _____

Total: 23 marks

KEY WORDS distillation

Objective

Choose oxidation conditions and combine chemical tests with mass and IR evidence. All questions and marking guidance are original.

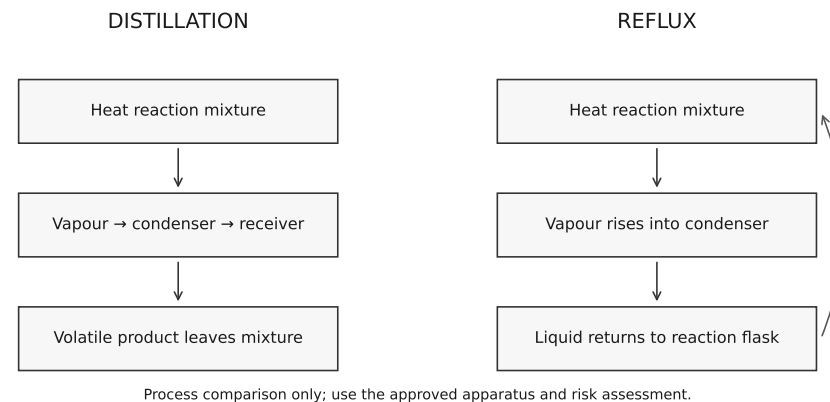
1 Key knowledge and worked examples

Primary alcohol + acidified dichromate gives an aldehyde if distilled as formed, or a carboxylic acid under reflux with excess oxidant. Secondary alcohol gives a ketone. Tertiary alcohol resists these conditions. Reflux returns condensed vapour; distillation removes volatile material.

■ Worked identification

An unknown has formula C_3H_6O , a $C=O$ IR absorption and a positive warm Fehling's test. Propanal, CH_3CH_2CHO , fits all three. Propanone fits the formula and $C=O$ but not the reducing test. A molecular-ion peak gives mass for a singly charged ion; the base peak need not be the molecular ion.

Extract with an immiscible solvent, separate layers using evidence of their identities, dry with a suitable anhydrous salt and remove the drying agent before distilling. A narrow boiling range supports purity but does not alone prove identity.



2 Practice

2.1 Name the products of controlled oxidation of propan-1-ol by immediate distillation, propan-1-ol by reflux with excess oxidant, and propan-2-ol. [3]

2.2 Write the equation using [O] for propan-2-ol oxidation and state the oxidant colour change. [3]

2.3 State the reagent/condition for ethanol dehydration and the organic product. Classify the reaction. [3]

3 Exam-style questions

3.1 An unknown has molecular-ion m/z 60, a C=O absorption and very broad acid O–H absorption. It releases CO₂ with Na₂CO₃. Given C = 12, H = 1, O = 16, assess CH₃COOH and CH₃CH₂CH₂OH as proposals. Explain why one strong IR peak alone is insufficient. [5]

3.2 Explain why reflux is appropriate when making propanoic acid but distillation is useful when making propanal. State two distinct purification actions after a liquid-organic preparation. [4]

3.3 State the reagents used to convert an alcohol to a chloroalkane, bromoalkane and iodoalkane. For 2-methylpropan-2-ol with concentrated HCl, name the organic product and explain why layer identification and drying are separate steps. [5]
