

Solutions

2.1 C_nH_{2n} .

2.2 Ethanol.

2.3 It is only partially ionised in water; so few H^+ ions form relative to a strong acid of equal concentration.

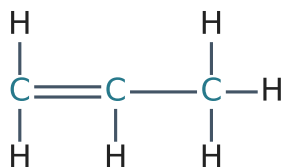
3.1 + hydrogen (nickel catalyst) $\rightarrow$ ethane; + water/steam (phosphoric acid catalyst) $\rightarrow$ ethanol; + bromine $\rightarrow$ dibromoethane, decolourising bromine water.

3.2 Mix sugar solution with yeast; keep warm – around body temperature; exclude oxygen – anaerobic conditions; the yeast's enzymes convert the sugar to ethanol and carbon dioxide, giving a dilute ethanol solution.

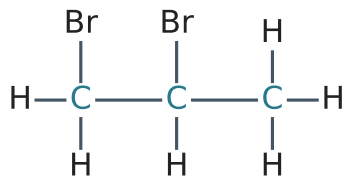
3.3 Ester – ethyl ethanoate + water; condensation/esterification reaction; ethanol carries $-OH$ and ethanoic acid carries $-COOH$.

3.4

Propene: starting molecule

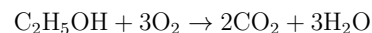


Bromine-addition product: all hydrogens retained



Correct displayed starting structure, $C=C$ becomes $C-C$, one Br on each former $C=C$ carbon with all H retained and valid carbon valencies. Orange $\rightarrow$ colourless. Two Br atoms have been added without removing hydrogen atoms.

3.5 Sodium gives fizzing/hydrogen; oxidation of the taught primary ethanol gives ethanoic acid.



Correct products, C/H balanced, O balanced including ethanol's oxygen. The shown hydration product from propene is not primary ethanol and must not be assigned this oxidation rule blindly.

3.6 B is a yeast-free control to compare gas formation without yeast. Carbon dioxide must escape to prevent pressure build-up in a tightly sealed vessel. Gas measurement

does not measure the proportions of ethanol and water or establish ethanol purity. Other conditions must remain matched.

3.7 The strong acid has lower pH at the same stated concentration, because it ionises more completely and gives more H^+ ; ethanoic acid is partially ionised. Weak describes ionisation, while dilute describes amount per volume.