AS level Chemistry A

H032/02 Depth in chemistry

Question Set 4

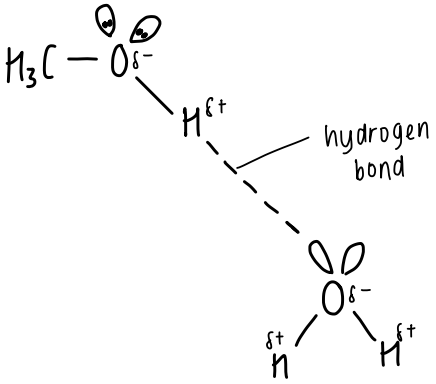
4. The hydroxyl group, –OH, is responsible for many properties of alcohols.

(a) Methanol, CH_3OH, is soluble in water because it has polar bonds.
Pauling electronegativity values for carbon, oxygen and hydrogen are shown below.

Element	Electronegativity
Carbon	2.5
Oxygen	3.5
Hydrogen	2.1

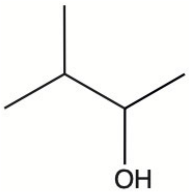
Use a labelled diagram to explain why methanol is soluble in water.

- Use displayed formulae showing one molecule of methanol and one molecule of water.
- Add partial charges $\delta+$ and $\delta-$ to show the two most polar bonds in a methanol molecule and the polar bonds in a water molecule.
- Show all lone pairs.
- Label the most important intermolecular bond between the molecules.



Methanol can form hydrogen bonds in water hence it's soluble in water. **[2]**

(b) Alcohol **C** is analysed using mass spectrometry.

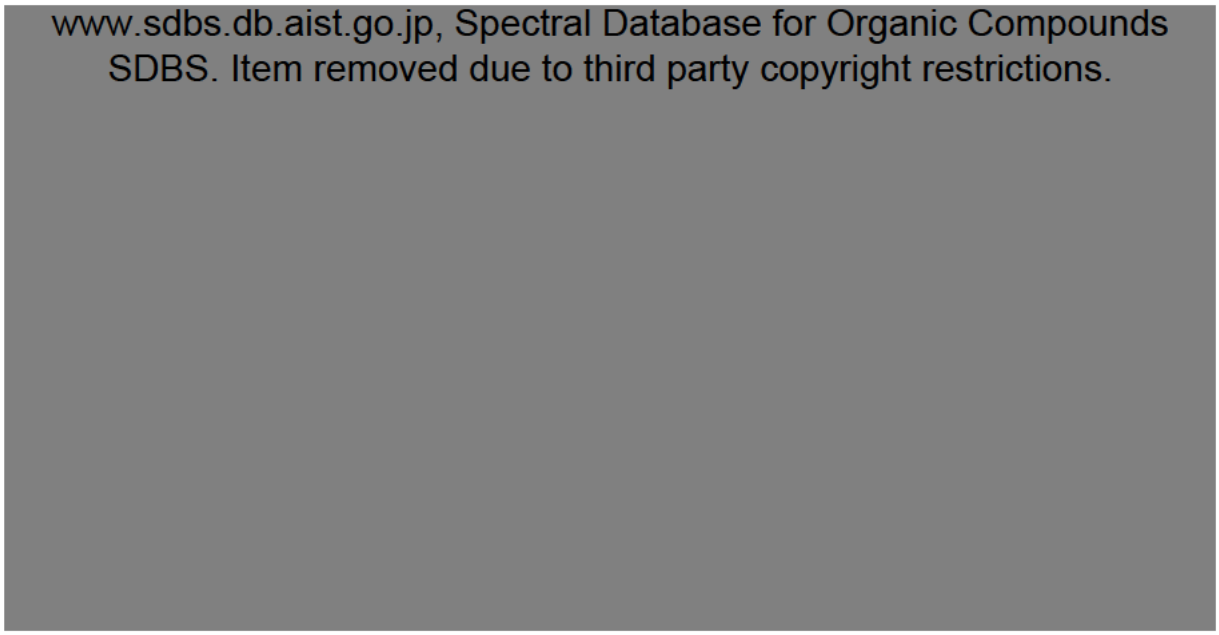


alcohol C

(i) Give the systematic name of alcohol **C**. **[1]**

3-methylbutan-2-ol

(ii) The mass spectrum of alcohol **C** is shown below.



Write structural formulae for the ions responsible for peak **X** and peak **Y**.

[2]

(c)* Describe the oxidation reactions of butan-1-ol forming an aldehyde and a carboxylic acid.

Explain, using a diagram, how the aldehyde can be produced in the laboratory by controlling the reaction conditions.

[6]

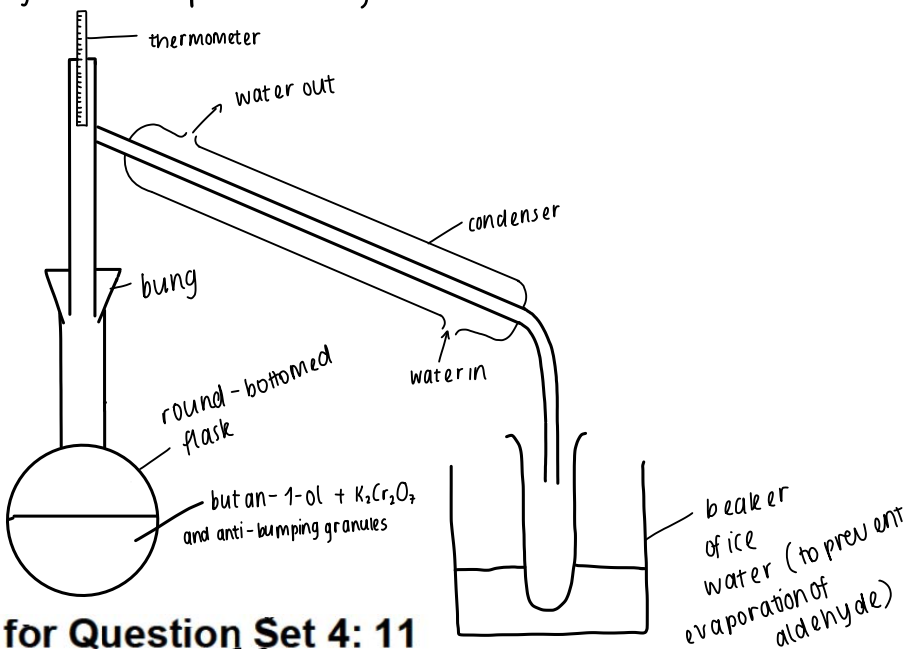
c) butan-1-ol is oxidised to butanal and then further to butanoic acid. The oxidising agent is acidified potassium dichromate ($K_2Cr_2O_7$) where the dichromate ion (Cr^{6+}) is reduced to Cr^{3+}.

The colour change is orange to green.

$$CH_3CH_2CH_2CH_2OH + [O] \longrightarrow CH_3CH_2CH_2CHO + H_2O$$

$$CH_3CH_2CH_2CHO + 2[O] \longrightarrow CH_3CH_2CH_2COOH$$

The aldehyde can be produced by distillation.



Total Marks for Question Set 4: 11