

## **AS level Chemistry A**

**H032/02** Depth in chemistry

### **Question Set 4**

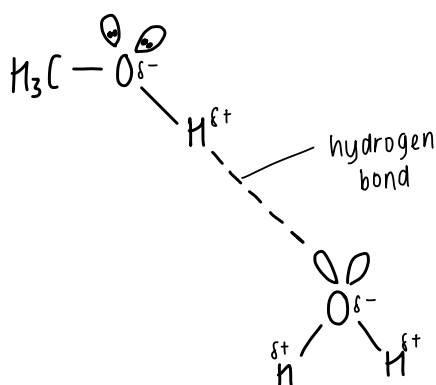
4. The hydroxyl group,  $\text{-OH}$ , is responsible for many properties of alcohols.

(a) Methanol,  $\text{CH}_3\text{OH}$ , 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.

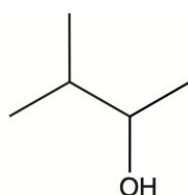
- Use displayed formulae showing one molecule of methanol and one molecule of water.
- Add partial charges  $\delta^+$  and  $\delta^-$  to show the two most polar bonds in a methanol molecule and the polar bonds in a water molecule.
- Show all lone pairs.
- Label the most important intermolecular bond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

www.sdb.sdb.aist.go.jp, Spectral Database for Organic Compounds SDBS. Item removed due to third party copyright restrictions.

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

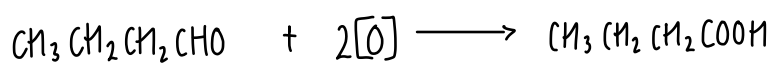
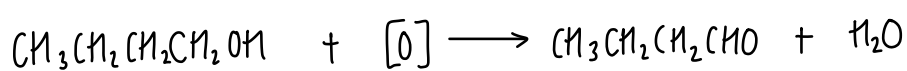
[2]

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

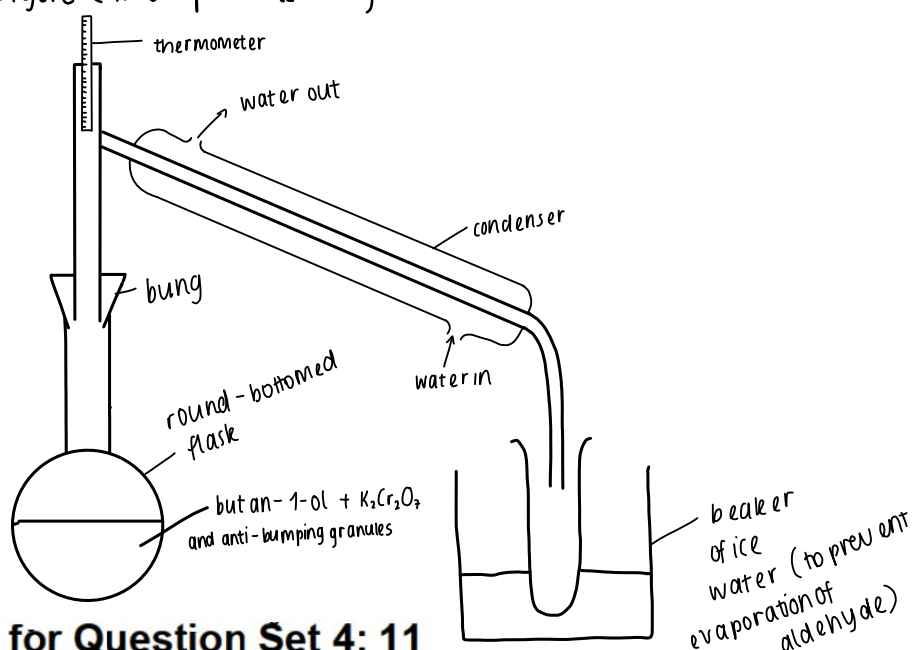
Explain, using a diagram, how the aldehyde can be produced in the laboratory by controlling the reaction conditions.

[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.



The aldehyde can be produced by distillation.



Total Marks for Question Set 4: 11

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