Carbonyl Compounds

1. Hydroxyethanal, $HOCH_2CHO$, is sometimes referred to as the 'first sugar' as it is the simplest possible molecule that contains both an aldehyde group and an alcohol group.

A biochemist investigated some redox reactions of hydroxyethanal and found that several different products were produced.

(a) The biochemist reacted hydroxyethanal with Tollens' reagent.

(i) State what the biochemist would see when hydroxyethanal reacts with Tollens' reagent.

.....

[1]

(ii) Write the structural formula of the organic product formed when hydroxyethanal reacts with Tollens' reagent.

[1]

(b) The biochemist also reacted hydroxyethanal with acidified dichromate by heating under reflux.

Write an equation for this oxidation.

Use **[O]** to represent the oxidising agent.

[2]

(c) The biochemist then reduced hydroxyethanal using aqueous $NaBH_4$.

(i) Write the structural formula of the organic product.

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[1]

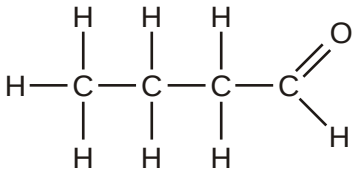
(ii) Outline the mechanism for this reduction.

Use curly arrows and show any relevant dipoles.

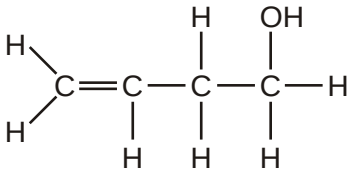
[4]

[Total 9 marks]

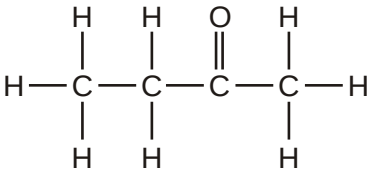
2. An unknown colourless liquid with molecular formula C_4H_8O was thought to be one of butanal, but-3-en-1-ol, or butanone.



butanal



but-3-en-1-ol



butanone

(a) State a simple chemical test that would positively identify:

(i) butanal **only**;

reagent .....

observation .....

organic product .....

[3]

(ii) but-3-en-1-ol **only**.

reagent .....

observation .....

type of reaction .....

[3]

(b) Butanal and butanone both react with 2,4-dinitrophenylhydrazine to produce mixtures containing orange precipitates.

Outline how the mixtures containing these orange precipitates can be used to distinguish between butanal and butanone.

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[3]

[Total 9 marks]