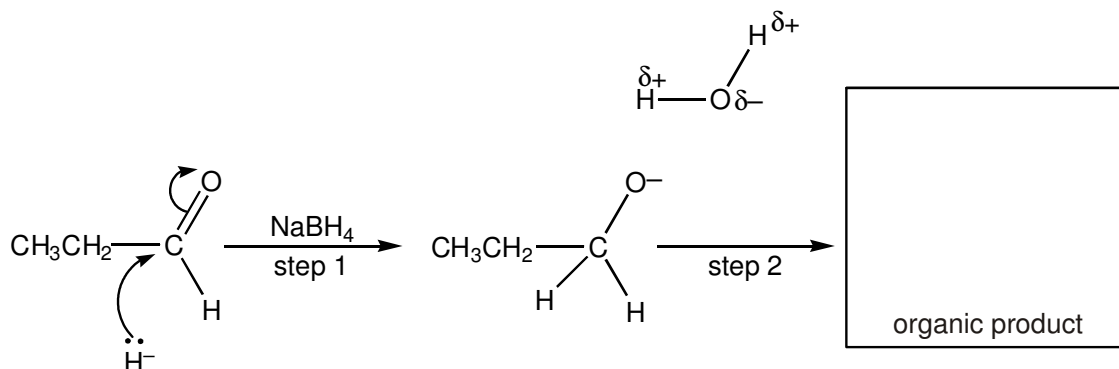


F324 Module 1: HW2

1. Propanal, $\text{CH}_3\text{CH}_2\text{CHO}$, can be used in the synthesis of organic compounds.

$\text{CH}_3\text{CH}_2\text{CHO}$ reacts with NaBH_4 in a nucleophilic addition reaction. The nucleophile can be represented as a hydride ion, H^- . A mechanism for the reaction is shown below.



- (i) Add 'curly arrows' to the mechanism to show how the intermediate reacts with the water molecule in **step 2**.

[2]

- (ii) Draw the structure of the organic product in the box above.

[1]

- (iii) What is meant by the term *nucleophile*?

.....

[1]

- (iv) Describe, in words, exactly what is happening to the electron pairs and bonds in **step 1** of the mechanism above.

.....

.....

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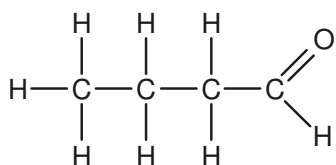
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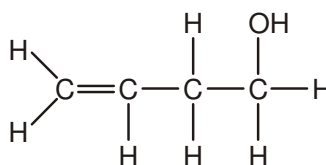
[3]

[Total 7 marks]

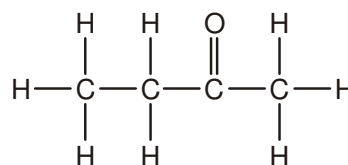
2. An unknown colourless liquid with molecular formula C_4H_8O was thought to be one of butanal, but-3-en-1-ol, or butanone.



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.

.....
.....
.....
.....
.....
.....

[3]

[Total 9 marks]

3. But-2-enal, $\text{CH}_3\text{CH}=\text{CHCHO}$, is a pale yellow, flammable liquid with an irritating odour.

(a) (i) Describe a simple chemical test that would show that but-2-enal is an aldehyde.

.....
.....
.....

[2]

F324 Module 1: HW2

- (ii) Explain why this test gives a different result with aldehydes than it does with ketones.

.....
.....

[1]

- (b) But-2-enal also reacts with sodium borohydride, NaBH_4 .

- (i) Identify the organic compound formed in this reaction.

.....

[1]

- (ii) State the type of chemical reaction occurring.

.....

[1]

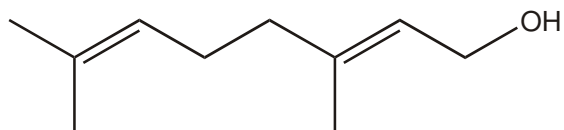
- (c) Precautions must be taken to prevent but-2-enal catching fire.

Construct a balanced equation for the complete combustion of but-2-enal, $\text{C}_4\text{H}_6\text{O}$.

[1]

[Total 6 marks]

4.



geraniol

Mild oxidation of geraniol gives an aldehyde **Y**.

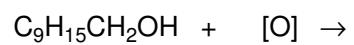
(i) Draw the skeletal formula of aldehyde **Y** below.



aldehyde **Y**

[2]

(ii) Complete the equation for the oxidation of geraniol to aldehyde **Y**.



[2]

[Total 4 marks]

