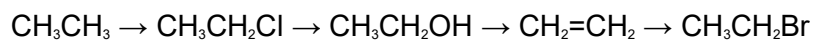


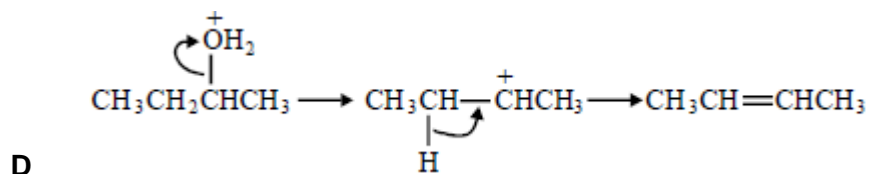
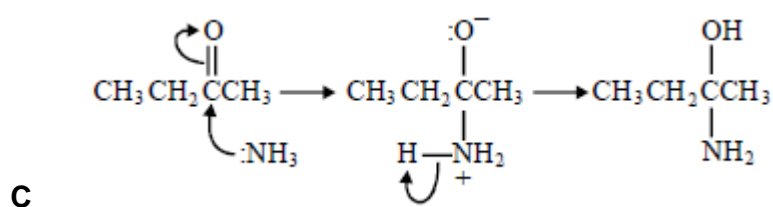
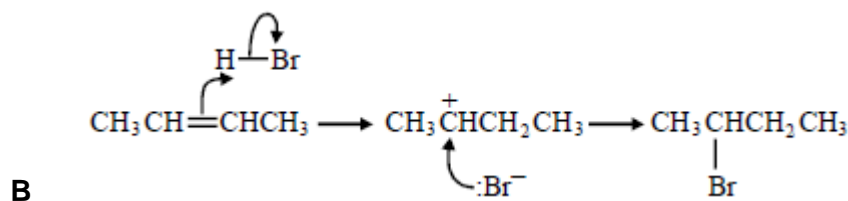
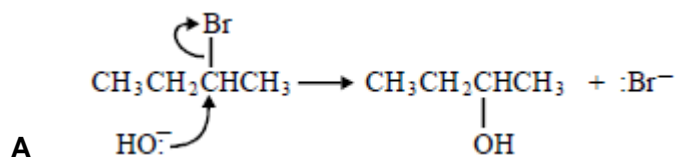
Q1. Which one of the following mechanisms is **not** involved in the reaction sequence below?



- A electrophilic addition
- B electrophilic substitution
- C nucleophilic substitution
- D free-radical substitution

(Total 1 mark)

Q2. In which of the following is a curly arrow used incorrectly?



(Total 1 mark)

Q3. Which one of the following alcohols forms a mixture of alkenes when dehydrated?

- A propan-1-ol

- B propan-2-ol
- C pentan-1-ol
- D pentan-2-ol

(Total 1 mark)

**Q4.** (a) Ethanol can be manufactured by the direct hydration of ethene and by the fermentation of sugars.

(i) State what is meant by the term *hydration*.

.....

(ii) Give **one** advantage and **one** disadvantage of manufacturing ethanol by fermentation rather than by hydration.

Do **not** include energy consumption or cost.

*Advantage* .....

.....

*Disadvantage* .....

.....

(3)

(b) Ethanol can be oxidised to an aldehyde and to a carboxylic acid.

(i) Draw the structure of this aldehyde and of this carboxylic acid.

*Structure of aldehyde*

*Structure of carboxylic acid*

- (ii) Give a suitable reagent and reaction conditions for the oxidation of ethanol to form the carboxylic acid as the major product.

*Reagent* .....

*Conditions* .....

.....

**(5)**

- (c) (i) Draw the structure of an alcohol containing four carbon atoms which is resistant to oxidation.

- (ii) Draw the structure of an alcohol containing four carbon atoms which can be oxidised to a ketone.

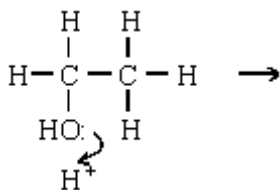
**(2)**

(d) In the presence of a catalyst, ethanol can be dehydrated to ethene.

(i) Give a suitable catalyst for use in this reaction.

.....

(ii) Complete the mechanism for this dehydration reaction.



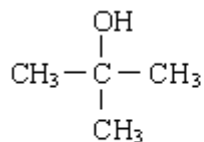
(5)  
(Total 15 marks)

**Q5.** (a) An alcohol containing carbon, hydrogen and oxygen only has 64.9% carbon and 13.5% hydrogen by mass. Using these data, show that the empirical formula of the alcohol is  $\text{C}_4\text{H}_{10}\text{O}$

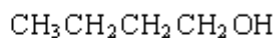
.....  
.....  
.....  
.....

(3)

(b) The structural formulae of two of the four possible alcohols of molecular formula  $\text{C}_4\text{H}_{10}\text{O}$  are shown below.



*Isomer 1*



*Isomer 2*

- (i) What type of alcohol is Isomer 1? Suggest a reason why this type of alcohol is not easily oxidised.

*Type of alcohol* .....

*Reason* .....

- (ii) Draw the structural formulae of the two remaining alcohols of molecular formula  $\text{C}_4\text{H}_{10}\text{O}$

*Isomer 3*

*Isomer 4*

(4)

- (c) Isomer 2 was oxidised by adding it dropwise to acidified potassium dichromate(VI) solution and immediately distilling off the product. When this product was treated with Fehling's solution, a red precipitate was formed.

- (i) State the type of product distilled off during the oxidation by acidified potassium dichromate(VI) solution.

.....

- (ii) Write an equation for the oxidation by potassium dichromate(VI), showing clearly the structure of the organic product. Use [O] to represent the oxidising agent.

.....

- (iii) Name and draw a structure for the organic product formed by the reaction with Fehling's solution.

Name .....

Structure .....

(5)

- (d) State **one** advantage and **one** disadvantage of the production of ethanol by the hydration of ethene compared to the fermentation of glucose.

Advantage .....

Disadvantage .....

(2)

- (e) Outline a mechanism for the dehydration of ethanol to form ethene in the presence of an acid catalyst.

(4)

(Total 18 marks)