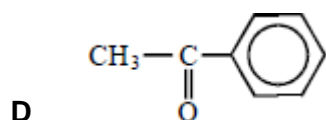
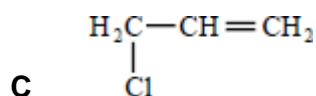
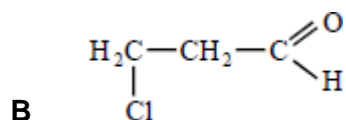
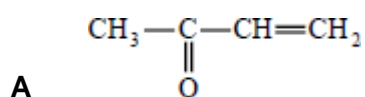


**Q1.** Which one of the following isomers is not oxidised under mild reaction conditions?

- A**  $(\text{CH}_3)_2\text{CHCH}(\text{OH})\text{COCH}_3$
- B**  $(\text{CH}_3)_2\text{C}(\text{OH})\text{CH}_2\text{COCH}_3$
- C**  $(\text{CH}_3)_2\text{CHCH}(\text{OH})\text{CH}_2\text{CHO}$
- D**  $(\text{CH}_3)_2\text{C}(\text{OH})\text{CH}_2\text{CH}_2\text{CHO}$

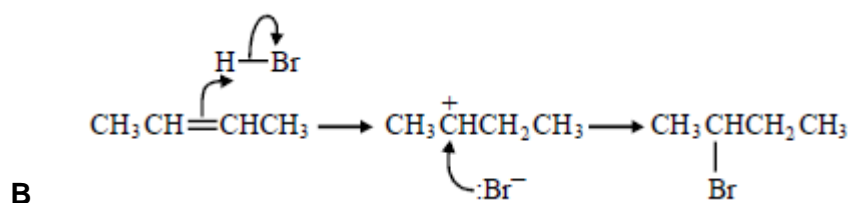
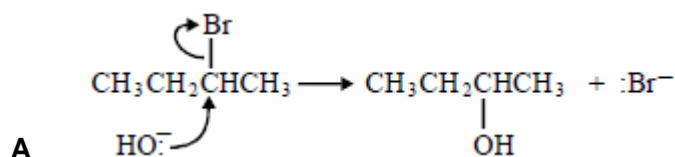
(Total 1 mark)

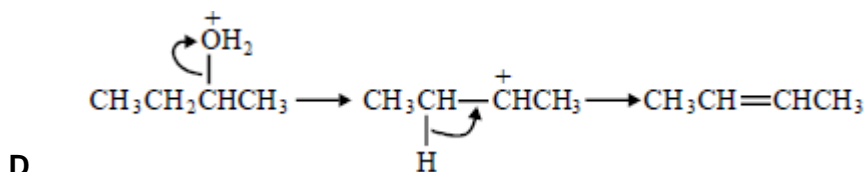
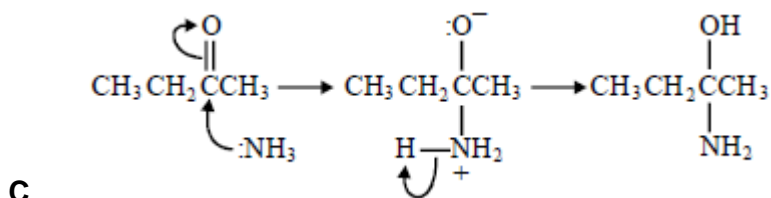
**Q2.** Which one of the following can react both by nucleophilic addition and by nucleophilic substitution?



(Total 1 mark)

**Q3.** In which of the following is a curly arrow used incorrectly?





(Total 1 mark)

Q4. Which one of the following will undergo nucleophilic addition?

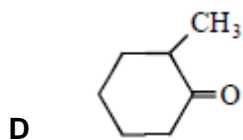
- A hex-3-ene
- B hexan-3-one
- C 3-bromohexane
- D hexan-3-ol

(Total 1 mark)

Q5. The compound lithium tetrahydridoaluminate(III),  $\text{LiAlH}_4$ , is a useful reducing agent. It behaves in a similar fashion to  $\text{NaBH}_4$ . Carbonyl compounds and carboxylic acids are reduced to alcohols. However,  $\text{LiAlH}_4$  also reduces water in a violent reaction so that it must be used in an organic solvent.

Which one of the following can be reduced by  $\text{LiAlH}_4$  to a primary alcohol?

- A
- B
- C



(Total 1 mark)

Q6. How many structural isomers, which are aldehydes, have the molecular formula  $C_5H_{10}O$ ?

- A 2
- B 3
- C 4
- D 5

(Total 1 mark)

Q7. On reduction, a racemate can be formed by

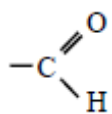
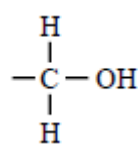
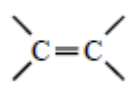
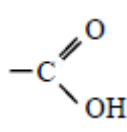
- A  $CH_3CH_2CH_2CH_2CHO$
- B  $CH_3CH_2CH_2COCH_3$
- C  $CH_3CH_2COCH_2CH_3$
- D  $CH_3CH=CHCH_2CHO$

(Total 1 mark)

Q8. Certain chemical tests were performed on the pain-relief drug ibuprofen. The results of these tests are given in the table below.

Test	Result
Aqueous sodium carbonate	Effervescence
Bromine water	Remained orange
Acidified potassium dichromate(VI) and heat	Remained orange
Fehling's solution and heat	Remained blue

Which one of the following functional groups do these results suggest that ibuprofen contains?

- A 
- B 
- C 
- D 

(Total 1 mark)

Q9. Which one of the following can act as an oxidising agent but not as a reducing agent?

- A  $\text{CH}_3\text{CHO}$
- B  $\text{Fe}^{2+}$
- C  $\text{I}^-$
- D  $\text{MnO}_4^-$

(Total 1 mark)

Q10. Which one of the following would **not** reduce an acidified aqueous solution of potassium dichromate(VI)?

- A  $\text{CH}_3\text{COOH}$
- B Zn
- C  $\text{CH}_3\text{CHO}$
- D  $\text{Fe}^{2+}(\text{aq})$

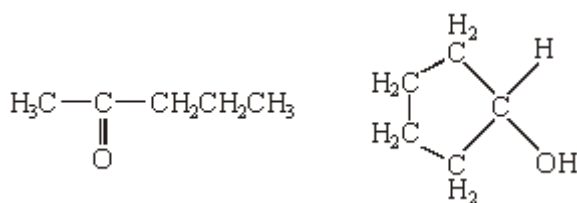
(Total 1 mark)

**Q11.** Which one of the following statements about but-2-enal,  $\text{CH}_3\text{CH}=\text{CHCHO}$ , is **not** true?

- A** It has stereoisomers.
- B** It shows a strong absorption in the infra-red at about  $1700\text{ cm}^{-1}$ .
- C** It will turn an acidified solution of potassium dichromate(VI) green.
- D** It can be dehydrated by concentrated sulphuric acid.

(Total 1 mark)

**Q12.** Compounds **C** and **D**, shown below, are isomers of  $\text{C}_5\text{H}_{10}\text{O}$



**C**

**D**

- (a) Name compound **C**.

.....

(1)

- (b) Use **Table 2** on the Data Sheet to help you to answer this question.

- (i) Suggest the wavenumber of an absorption which is present in the infra-red spectrum of **C** but not in that of **D**.

.....

- (ii) Suggest the wavenumber of an absorption which is present in the infra-red spectrum of **D** but not in that of **C**.

.....

(2)

- (c) Deduce the number of peaks in the proton n.m.r. spectrum of **C**.

.....

(1)

- (d) Identify a reagent that you could use to distinguish between **C** and **D**. For each of **C** and **D**, state what you would observe when the compound is treated with this reagent.

Reagent .....

Observation with **C** .....

Observation with **D** .....

(3)

- (e) Compound **E**,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$ , is also an isomer of  $\text{C}_5\text{H}_{10}\text{O}$

Identify a reagent which will react with **E** but not with **C** or **D**. State what you would observe when **E** is treated with this reagent.

Reagent .....

Observation with **E** .....

(2)

(Total 9 marks)

**Q13.** Which one of the following is **not** a correct general formula for the non-cyclic compounds listed?

- A** alcohols  $\text{C}_n\text{H}_{2n+2}\text{O}$
- B** aldehydes  $\text{C}_n\text{H}_{2n+1}\text{O}$
- C** esters  $\text{C}_n\text{H}_{2n}\text{O}_2$
- C** primary amines  $\text{C}_n\text{H}_{2n+3}\text{N}$

(Total 1 mark)

**Q14.(a)** Outline a mechanism for the reaction of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$  with  $\text{HCN}$  and name the product.

*Mechanism*

Name of product .....

(5)

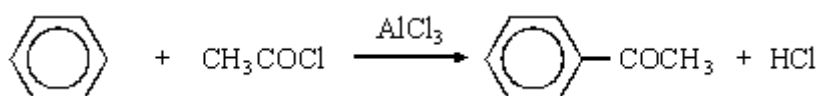
- (b) Outline a mechanism for the reaction of  $\text{CH}_3\text{OH}$  with  $\text{CH}_3\text{CH}_2\text{COCl}$  and name the organic product.

*Mechanism*

Name of organic product .....

(5)

- (c) An equation for the formation of phenylethanone is shown below. In this reaction a reactive intermediate is formed from ethanoyl chloride. This intermediate then reacts with benzene.



- (i) Give the formula of the reactive intermediate.

.....

- (ii) Outline a mechanism for the reaction of this intermediate with benzene to form phenylethanone.

(4)  
(Total 14 marks)

**Q15.** The three compounds  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ ,  $(\text{CH}_3)_3\text{COH}$  and  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$  can be distinguished by use of the following three reagents

1. potassium dichromate(VI) acidified with dilute sulphuric acid
2. Tollens' reagent
3. ethanoic acid, together with a small amount of concentrated sulphuric acid.

(a) Identify which of these three organic compounds would reduce acidified potassium dichromate(VI). Give the structures of the organic products formed. Write a half-equation for the reduction of dichromate(VI) ions in acidic solution.

(6)

(b) Identify which one of these three organic compounds would reduce Tollens' reagent. Give the structure of the organic product formed. Write a half-equation for the reduction of Tollens' reagent.

(3)

(c) Identify which of these three organic compounds would react with ethanoic acid in the presence of concentrated sulphuric acid. In each case, give the structure of the organic product formed.

(4)

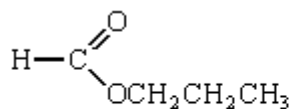
(d) State the number of peaks in the proton n.m.r. spectra of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$  and of  $(\text{CH}_3)_3\text{COH}$ . (Analysis of peak splitting is not required.)

(2)

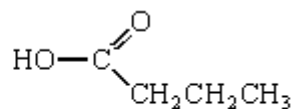
(Total 15 marks)



**Q16.** (a) Consider the following pair of isomers.



**C**



**D**

(i) Name compound **C**.

.....

(ii) Identify a reagent which could be used in a test-tube reaction to distinguish between **C** and **D**. In each case, state what you would observe.

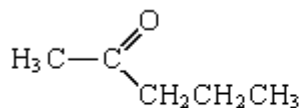
*Reagent* .....

*Observation with C* .....

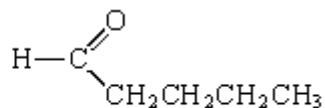
*Observation with D*.....

(4)

(b) Consider the following pair of isomers.



**E**



**F**

(i) Name compound **E**.

.....

(ii) Identify a reagent which could be used in a test-tube reaction to distinguish between **E** and **F**. In each case, state what you would observe.

*Reagent* .....

Observation with **E** .....

Observation with **F**.....

(4)

(c) Draw the structure of the chain isomer of **F** which shows optical isomerism.

(1)

(Total 9 marks)