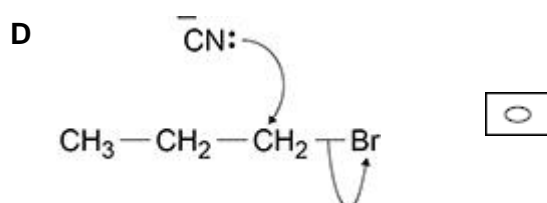
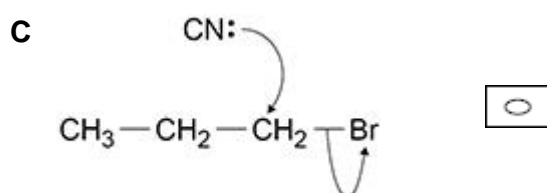
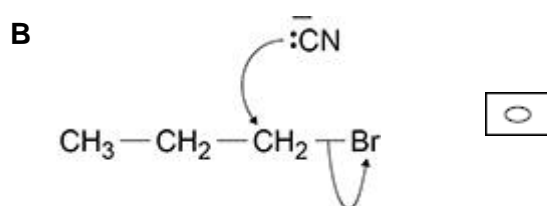
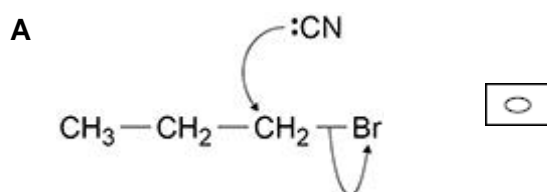


Q1.

The question below refers to the reaction of 1-bromopropane with a solution of potassium cyanide in aqueous ethanol.

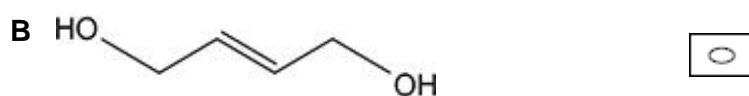
Which is the correct mechanism for the reaction?

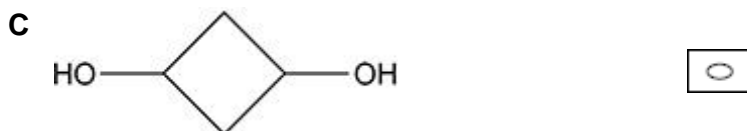


(Total 1 mark)

Q2.

Which compound has a molecular formula that is different from the others?





(Total 1 mark)

Q3.

This question is about isomers with the molecular formula $C_5H_{10}O$

- (a) Draw the skeletal formula of a branched chain aldehyde with molecular formula $C_5H_{10}O$ that is optically active.

(1)

- (b) Describe how you distinguish between separate samples of the two enantiomers of the branched chain aldehyde $C_5H_{10}O$

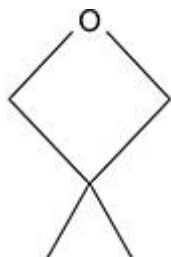
(2)

- (c) Draw the *E* and *Z* forms of a structural isomer of $C_5H_{10}O$ that shows **both** optical and geometric isomerism.

<i>E</i> isomer	<i>Z</i> isomer

(2)

- (d) Isomer J is cyclic and has an ether functional group (C–O–C)
Isomer J has only three peaks in its ^{13}C NMR spectrum.



Isomer J

Draw **two** other cyclic isomers of $\text{C}_5\text{H}_{10}\text{O}$ that have an ether functional group and only three peaks in their ^{13}C NMR spectra.

(2)

(Total 7 marks)

Q4.

Which compound has *E–Z* isomers?

- | | | |
|----------|----------------------------|--------------------------|
| A | $\text{CH}_2=\text{CHBr}$ | <input type="checkbox"/> |
| B | $\text{CH}_2=\text{CBr}_2$ | <input type="checkbox"/> |
| C | $\text{CHBr}=\text{CHBr}$ | <input type="checkbox"/> |
| D | $\text{CBr}_2=\text{CHBr}$ | <input type="checkbox"/> |

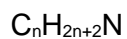
(Total 1 mark)

Q5.

Which is the correct general formula for non-cyclic compounds in the homologous series?

- | | | | |
|----------|-----------|---------------------------------------|--------------------------|
| A | alcohols | $\text{C}_n\text{H}_{2n+2}\text{O}$ | <input type="checkbox"/> |
| B | aldehydes | $\text{C}_n\text{H}_{2n+1}\text{O}$ | <input type="checkbox"/> |
| C | esters | $\text{C}_n\text{H}_{2n+1}\text{O}_2$ | <input type="checkbox"/> |

D primary amines



(Total 1 mark)

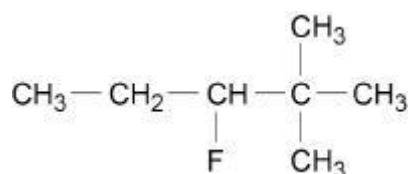
Q6.

Explain the differences between structural isomerism and stereoisomerism. Use examples to show how compounds with the molecular formula C_4H_8 exhibit stereoisomerism and the three types of structural isomerism.

(Total 6 marks)

Q7.

What is the IUPAC name for this compound?



- A 2-dimethyl-3-fluoropentane
- B 2,2-dimethyl-3-fluoropentane
- C 3-fluoro-2,2-dimethylpentane
- D 3-fluoro-2-dimethylpentane

(Total 1 mark)

Q8.

Which compound has the lowest relative molecular mass?

- A ethanoic acid
- B 1-fluoropropane
- C propanenitrile
- D propylamine

(Total 1 mark)**Q9.**Which does **not** contain an asymmetric carbon atom?

- A $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$
- B $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_3$
- C $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{OH}$
- D $\text{CH}_3\text{CH}_2\text{CHClCH}_3$

(Total 1 mark)**Q10.**Which compound is **not** an isomer of the following compound?

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

(Total 1 mark)

Q11.How many isomers are there of C_3H_9N ?

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

(Total 1 mark)**Q12.**

Which species can act as a nucleophile?

- A NH_4^+
- B CH_3OH
- C CH_4
- D H^+

(Total 1 mark)**Q13.**How many structural isomers with an unbranched carbon chain have the molecular formula $C_4H_8Br_2$?

- A 4
- B 5
- C 6
- D 7

(Total 1 mark)

Q14.

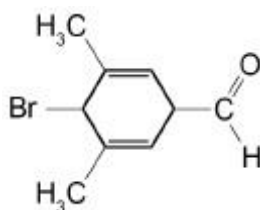
Which can be both an empirical and molecular formula of a stable compound?

- A CH₂O
- B P₄O₁₀
- C NH₂
- D CH₃

(Total 1 mark)

Q15.

Which statement is correct about the molecule shown?



- A It reacts with HBr in an electrophilic substitution reaction.
- B It reacts with NaBH₄ in a nucleophilic addition-elimination reaction.
- C It reacts with ethanolic KOH in an elimination reaction.
- D It reacts with KCN in a nucleophilic substitution reaction.

(Total 1 mark)

Q16.

This question is about the structures of some organic molecules.

- (a) Draw the **skeletal** formula of 3-methylbutanal.

(1)

- (b) Draw the **displayed** formula of $C_5H_{11}Br$ that is the major product of the reaction of 2-methylbut-2-ene with hydrogen bromide.

(1)

- (c) Thermal cracking of hydrocarbons produces molecules that are attacked by electrophiles because they have a region of high electron density.

Draw the structure of one of these molecules that contains four carbon atoms.

(1)

(Total 3 marks)

Q17.

Which compound is a structural isomer of Z-but-2-ene?

- | | | |
|----------|---------------------|--------------------------|
| A | butane | <input type="checkbox"/> |
| B | <i>E</i> -but-2-ene | <input type="checkbox"/> |
| C | cyclobutane | <input type="checkbox"/> |
| D | methylbut-2-ene | <input type="checkbox"/> |

(Total 1 mark)

Q18.

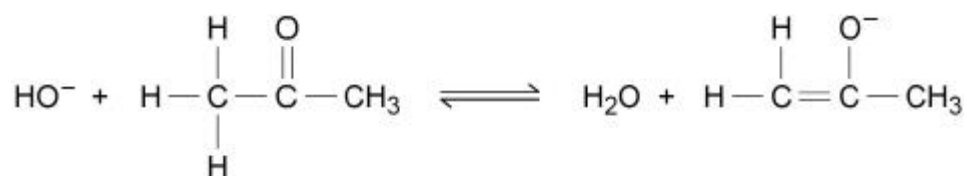
How many structural isomers are there with the molecular formula C₃H₆BrCl?

- A 4
- B 5
- C 6
- D 7

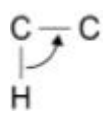
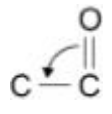
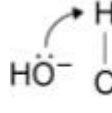
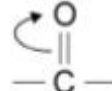
(Total 1 mark)

Q19.

In concentrated alkali, propanone reacts with hydroxide ions to form an equilibrium mixture as shown.



Which curly arrow does **not** appear in the mechanism of this reaction?

- A 
- B 
- C 
- D 

(Total 1 mark)

Q20.

Which compound does **not** show stereoisomerism?

- A 1,2-dichloropropene
- B 1,2-dichloropropane
- C 1,3-dichloropropene
- D 1,3-dichloropropane

(Total 1 mark)

Q21.

Compound **J**, known as leaf alcohol, has the structural formula $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_2\text{CH}_2\text{OH}$ and is produced in small quantities by many green plants.

The *E* isomer of **J** is responsible for the smell of freshly cut grass.

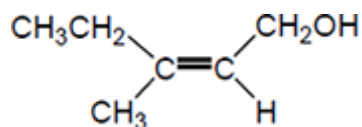
- (a) Give the structure of the *E* isomer of **J**.

(1)

- (b) Give the **skeletal formula** of the organic product formed when **J** is dehydrated using concentrated sulfuric acid.

(1)

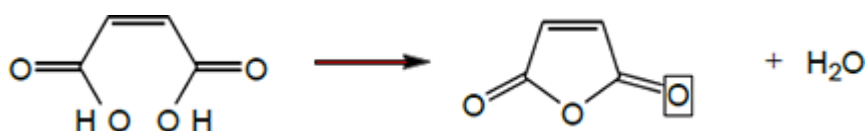
- (c) Another structural isomer of **J** is shown below.



Explain how the Cahn-Ingold-Prelog (CIP) priority rules can be used to deduce the full IUPAC name of this compound.

(6)

- (d) The effect of gentle heat on maleic acid is shown below.



A student predicted that the yield of this reaction would be greater than 80%.

In an experiment, 10.0 g of maleic acid were heated and 6.53 g of organic product were obtained.

Is the student correct? Justify your answer with a calculation using these data.

(2)