

**Q1.**

When 2-bromobutane is warmed with potassium hydroxide solution, substitution and elimination reactions both occur.

Which of these compounds is **not** produced?

- A butan-1-ol
- B butan-2-ol
- C but-1-ene
- D *E*-but-2-ene

(Total 1 mark)

Q2.

Which compound is formed from bromoethane in a nucleophilic substitution reaction?

- A CH_3CN
- B $\text{CH}_3\text{CH}_2\text{NH}_2$
- C $\text{CH}_2=\text{CH}_2$
- D $\text{CH}_3\text{CH}_2\text{OSO}_2\text{OH}$

(Total 1 mark)

Q3.

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

What is the organic product of this reaction?

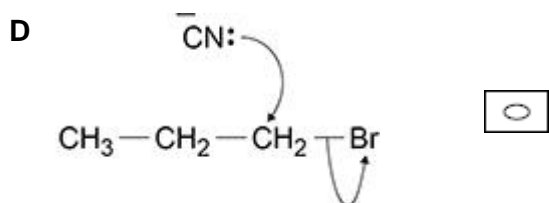
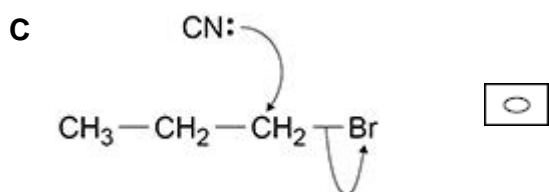
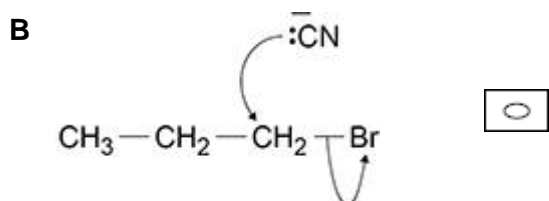
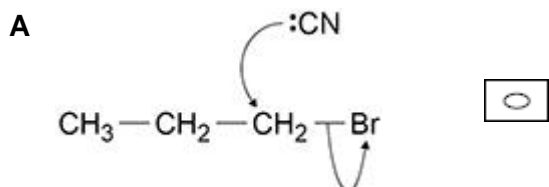
- A propylamine
- B butylamine
- C propanenitrile
- D butanenitrile

(Total 1 mark)

**Q4.**

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)

Q5.

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

The reactions of 1-bromopropane and 1-chloropropane with potassium cyanide in aqueous ethanol occur at different rates under the same conditions.

Which row correctly shows the compound that has a faster rate of reaction and the correct reason for this?

	Compound	Reason	
A	1-bromopropane	C-Br bond weaker than C-Cl bond	<input type="checkbox"/>
B	1-bromopropane	C-Br bond stronger than C-Cl bond	<input type="checkbox"/>
C	1-chloropropane	C-Br bond weaker than C-Cl bond	<input type="checkbox"/>
D	1-chloropropane	C-Br bond stronger than C-Cl bond	<input type="checkbox"/>

(Total 1 mark)

**Q6.**

Which compound can react with ammonia to produce propylamine?

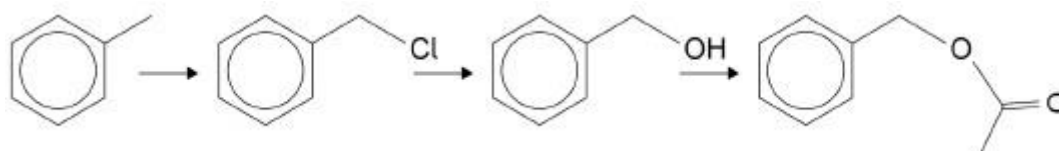
- A $\text{CH}_3\text{CH}=\text{CH}_2$
- B $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- C $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$
- D $\text{CH}_3\text{CH}_2\text{CH}_3$

(Total 1 mark)**Q7.**Which compound could **not** be produced by reacting 2-bromo-3-methylbutane with sodium hydroxide?

- A 2-methylbut-1-ene
- B 3-methylbut-1-ene
- C 2-methylbut-2-ene
- D 3-methylbutan-2-ol

(Total 1 mark)**Q8.**

A possible synthesis of a compound found in jasmine flower oil is shown.



Which mechanism is not used in this synthesis?

- A Electrophilic substitution
- B Nucleophilic substitution
- C Free-radical substitution
- D Nucleophilic addition-elimination

(Total 1 mark)

**Q9.**

Which species could act as a nucleophile?

- A BH_3
- B NH_4^+
- C PH_3
- D SiH_4

(Total 1 mark)**Q10.**

Which compound has the fastest rate of reaction with potassium cyanide to form pentanenitrile?

- A 1-bromobutane
- B 1-chlorobutane
- C 1-fluorobutane
- D 1-iodobutane

(Total 1 mark)**Q11.**Which of the following mechanisms does **not** occur in reactions of bromoethane?

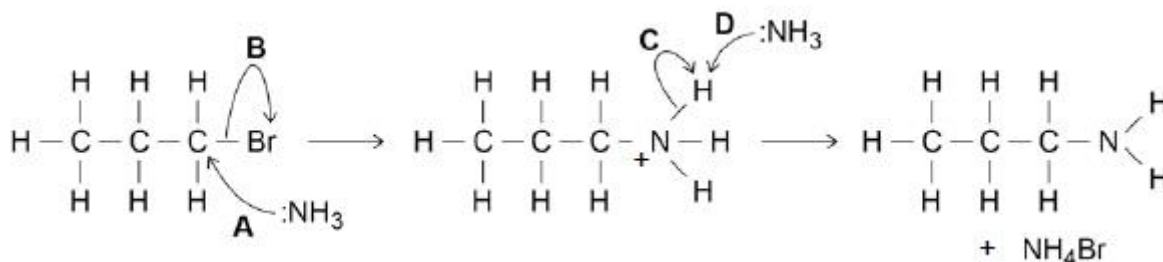
- A Electrophilic addition
- B Elimination
- C Nucleophilic substitution
- D Radical substitution

(Total 1 mark)



Q12.

Which of the arrows, labelled **A**, **B**, **C** or **D** in the mechanism in the diagram, is **not** correct?

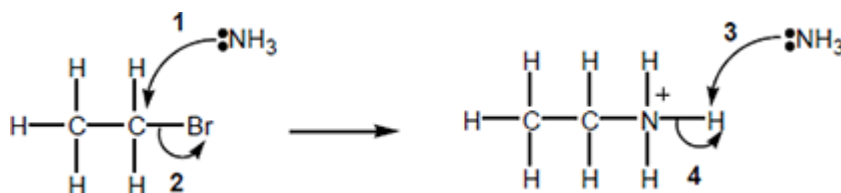
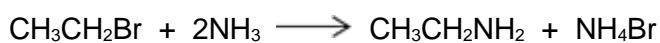


- A
- B
- C
- D

(Total 1 mark)

Q13.

This question is about a method that can be used to prepare ethylamine.



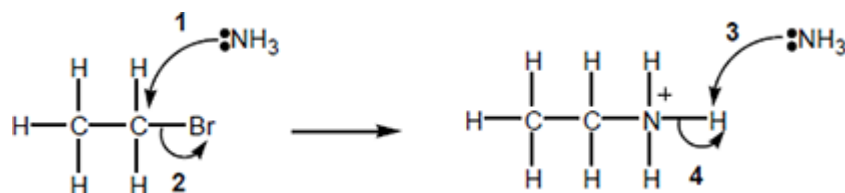
Which of the curly arrows in the mechanism is **not** correct?

- A 1
- B 2
- C 3
- D 4

(Total 1 mark)

**Q14.**

This question is about a method that can be used to prepare ethylamine.



Which statement about the reaction is **not** correct?

- A** Ethylamine is a primary amine.
- B** The mechanism is a nucleophilic substitution.
- C** Using an excess of bromoethane will prevent further reaction to form a mixture of amine products.
- D** Ammonium bromide is an ionic compound.

(Total 1 mark)

Q15.

Why are fluoroalkanes unreactive?

- A** Fluorine is highly electronegative.
- B** The F⁻ ion is very stable.
- C** They are polar molecules.
- D** The C-F bond is very strong.

(Total 1 mark)

**Q16.**

Pentanenitrile can be made by reaction of 1-bromobutane with potassium cyanide.

Which of these is the correct name for the mechanism of this reaction?

- A Electrophilic addition
- B Electrophilic substitution
- C Nucleophilic addition
- D Nucleophilic substitution

(Total 1 mark)

Q17.

Which one of the following statements explains best why fluoroalkanes are the least reactive haloalkanes?

- A Fluorine is much more electronegative than carbon.
- B The F^- ion is the most stable halide ion.
- C The C–F bond is the most polar carbon–halogen bond.
- D The C–F bond is the strongest carbon–halogen bond.

(Total 1 mark)

Q18.

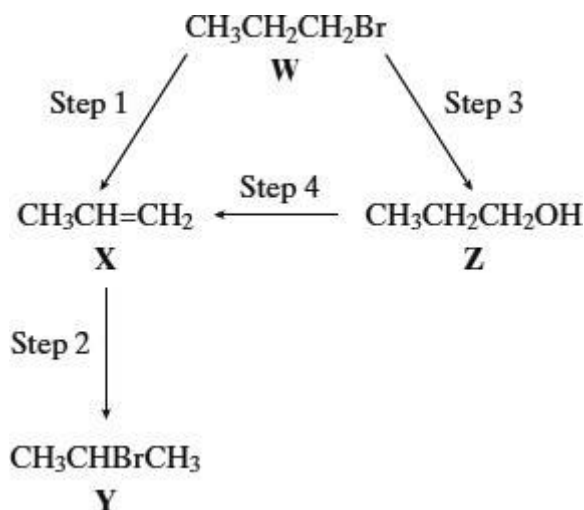
Which one of the following reactions does **not** involve donation of an electron pair?

- A $H^+ + CH_3NH_2 \rightarrow CH_3NH_3^+$
- B $AlCl_3 + Cl^- \rightarrow AlCl_4^-$
- C $CH_3Cl + CN^- \rightarrow CH_3CN + Cl^-$
- D $\frac{1}{2}Cl_2 + I^- \rightarrow Cl^- + \frac{1}{2}I_2$

(Total 1 mark)

**Q20.**

For this question refer to the reaction scheme below.



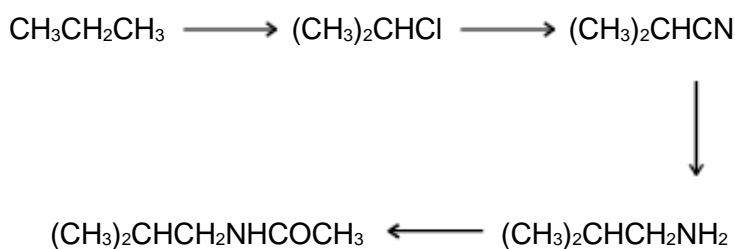
Which one of the following reagents would **not** bring about the reaction indicated?

- A Step 1 : alcoholic KOH
- B Step 2 : aqueous Br_2
- C Step 3 : aqueous NaOH
- D Step 4 : concentrated H_2SO_4

(Total 1 mark)

Q21.

Which one of the following types of reaction mechanism is **not** involved in the above sequence?



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

(Total 1 mark)



Q22.

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

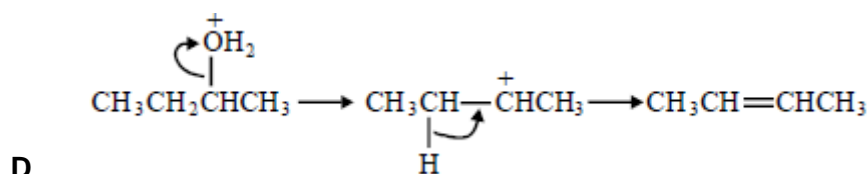
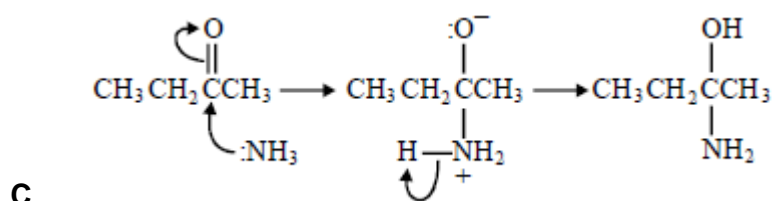
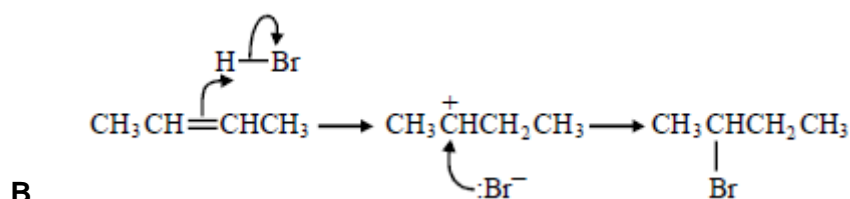
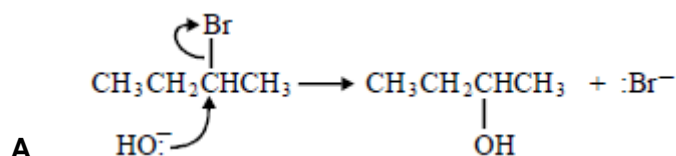


- A electrophilic addition
- B electrophilic substitution
- C nucleophilic substitution
- D free-radical substitution

(Total 1 mark)

Q23.

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

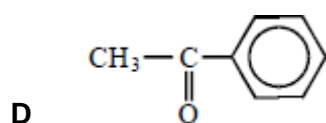
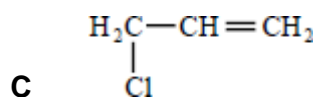
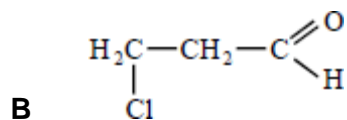
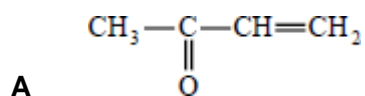


(Total 1 mark)



Q24.

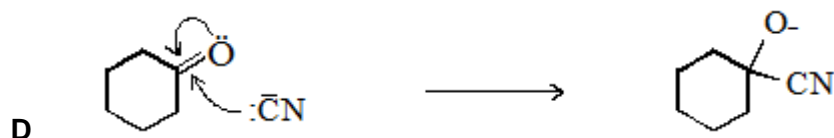
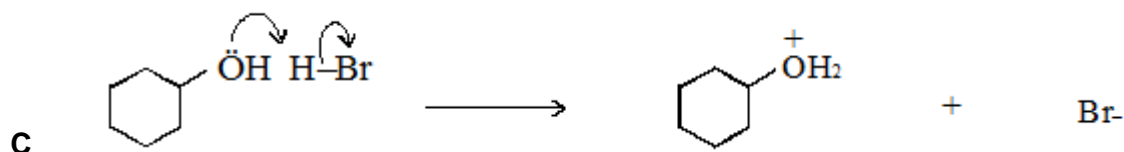
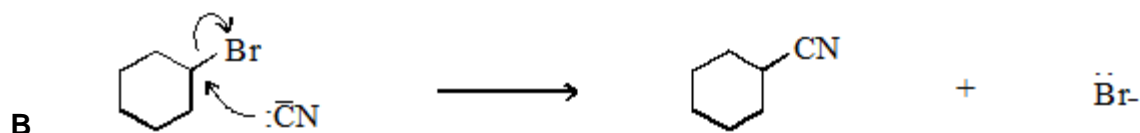
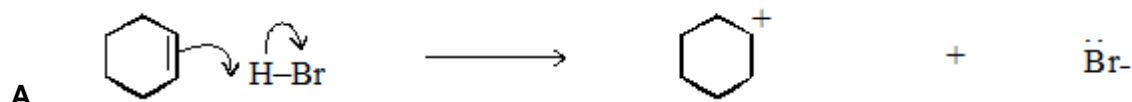
Which one of the following can react both by nucleophilic addition and by nucleophilic substitution?



(Total 1 mark)

Q25.

In which one of the following are the curly arrows **not** used correctly?



(Total 1 mark)

**Q26.**

Which one of the following is **not** a suitable method for the preparation of ethanol?

- A oxidation of ethane
- B hydration of ethene
- C reduction of ethanal
- D hydrolysis of bromoethane

(Total 1 mark)

Q27.

Which one of the following reactions involves nucleophilic addition?

- A $\text{CH}_3\text{CH}=\text{CH}_2 + \text{HBr} \rightarrow \text{CH}_3\text{CHBrCH}_3$
- B $\text{CH}_3\text{CH}_2\text{CH}_3 + \text{Cl}_2 \rightarrow \text{CH}_3\text{CHClCH}_3 + \text{HCl}$
- C $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{NaOH} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{NaBr}$
- D $\text{CH}_3\text{CH}_2\text{CHO} + \text{HCN} \rightarrow \text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CN}$

(Total 1 mark)



Mark schemes

Q1.

A

butan-1-ol

[1]

Q2.

B

 $CH_3CH_2NH_2$

[1]

Q3.

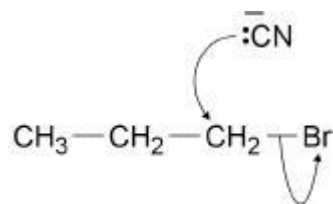
D

butanenitrile

[1]

Q4.

B



[1]

Q5.

A

1-bromopropane, C-Br bond weaker than C-Cl bond

[1]

Q6.

C

 $CH_3CH_2CH_2Br$

[1]

Q7.

A

2-methylbut-1-ene

[1]

Q8.



A

[1]

Q9.

C

[1]

Q10.

D

[1]

Q11.

A

[1]

Q12.

C

[1]

Q13.

D

[1]

Q14.

C

[1]

Q15.

D

[1]

Q16.

D

[1]

Q17.

D

[1]

Q18.

D

[1]



Q19.

A

[1]

Q20.

B

[1]

Q21.

C

[1]

Q22.

B

[1]

Q23.

C

[1]

Q24.

B

[1]

Q25.

D

[1]

Q26.

A

[1]

Q27.

D

[1]