

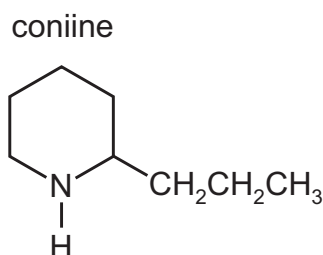
1 Halogenoalkanes react with hot ethanolic potassium cyanide.

☐ The reaction mechanism is either S_N1 or S_N2 .

Which statement is correct?

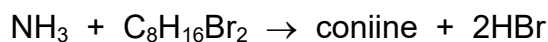
- A** All secondary halogenoalkanes react by the S_N2 mechanism only.
- B** Both the halogenoalkane and the cyanide ion are involved in the initial step of the S_N1 mechanism.
- C** Chloroethane reacts with cyanide ions by the S_N1 mechanism only.
- D** The S_N2 mechanism involves a short-lived negatively charged transition state.

2 The structure of coniine is shown.



Coniine can be synthesised by reacting ammonia with a dibromo compound, X.

X



What is compound X?

- A** 1,1-dibromo-2-propylcyclopentane
- B** 1,2-dibromo-2-propylcyclopentane
- C** $\text{Br}(\text{CH}_2)_3\text{CHBr}(\text{CH}_2)_3\text{CH}_3$
- D** $\text{Br}(\text{CH}_2)_4\text{CHBr}(\text{CH}_2)_2\text{CH}_3$

3 Which reaction is a redox reaction?

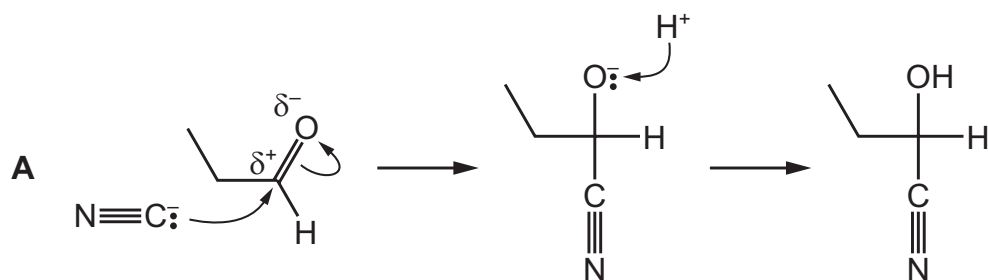
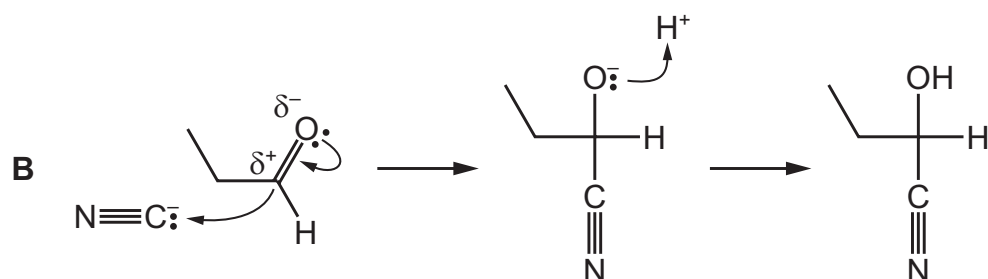
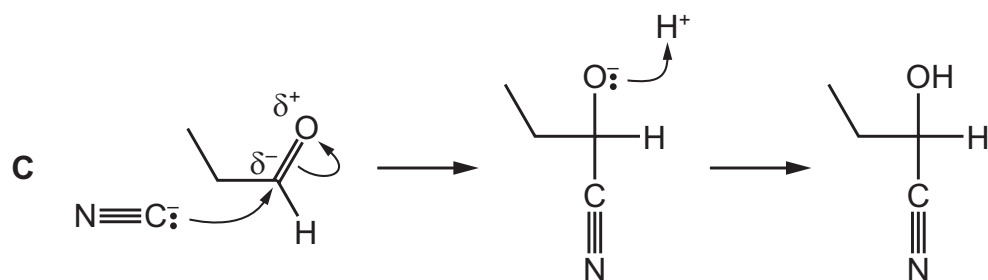
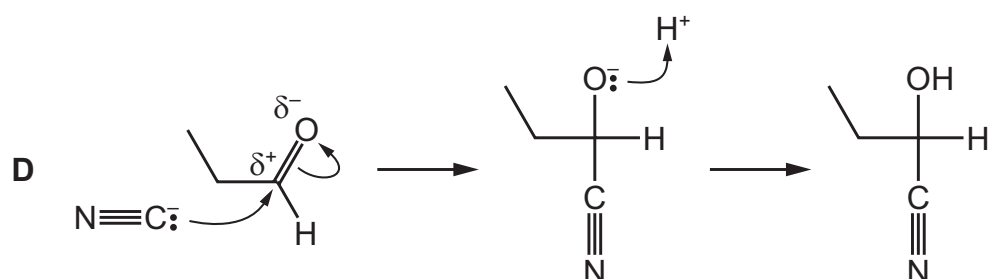


- A** ethanenitrile heated under reflux with dilute hydrochloric acid
- B** ethanoic acid reacted with aqueous sodium hydroxide
- C** ethanoic acid reacted with sodium
- D** ethyl ethanoate heated under reflux with dilute hydrochloric acid

4 Which reaction will form a strong organic base?

- ☐ **A** ethanol and acidified sodium dichromate
- B** ethanol and hot aluminium oxide
- C** ethanol and sodium
- D** ethanol and hydrogen chloride

5 Which reaction mechanism for the formation of $\text{C}_2\text{H}_5\text{CH}(\text{OH})(\text{CN})$ is correct?

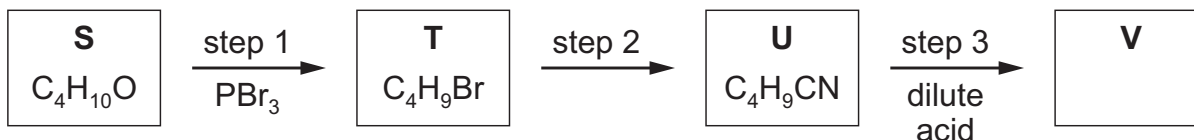


6 S is a secondary alcohol with molecular formula $C_4H_{10}O$.

(a) Draw the displayed formula of **S**.

[1]

(b) **S** is converted to **V** in a three-step reaction sequence.



In step 1, the secondary alcohol **S** reacts with PBr_3 to produce **T**, which has molecular formula C_4H_9Br .

(i) Give the systematic name of **T**.

..... [1]

(ii) Name the type of reaction that occurs in step 1.

..... [1]

(iii) State the reagent(s) and conditions for step 2.

.....
..... [2]

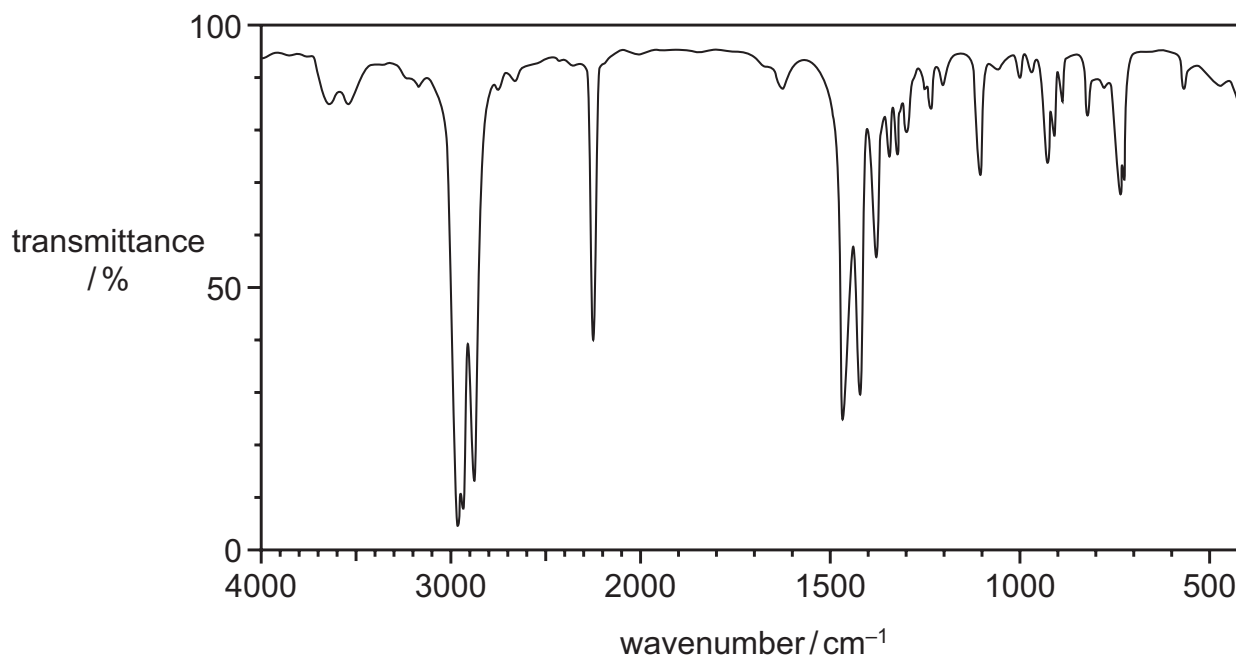
(iv) Step 3 involves heating C_4H_9CN with dilute acid to form **V**.

Complete the equation for this reaction.



(v) An unlabelled sample contains either **S**, **T** or **U**.

The sample produces the infrared spectrum shown.



Explain how this spectrum confirms that the unknown sample contains **U**.

In your answer identify **one** relevant absorption in the infrared spectrum and the bond that corresponds to this absorption in the region above 1500 cm^{-1} .

.....
..... [1]

[Total: 8]