1. $CH_3CH_2CONH_2 \xrightarrow{A} CH_3CH_2NH_2 \xrightarrow{B} CH_3CH_2OH$

What is "A" and "B" in the following reaction?

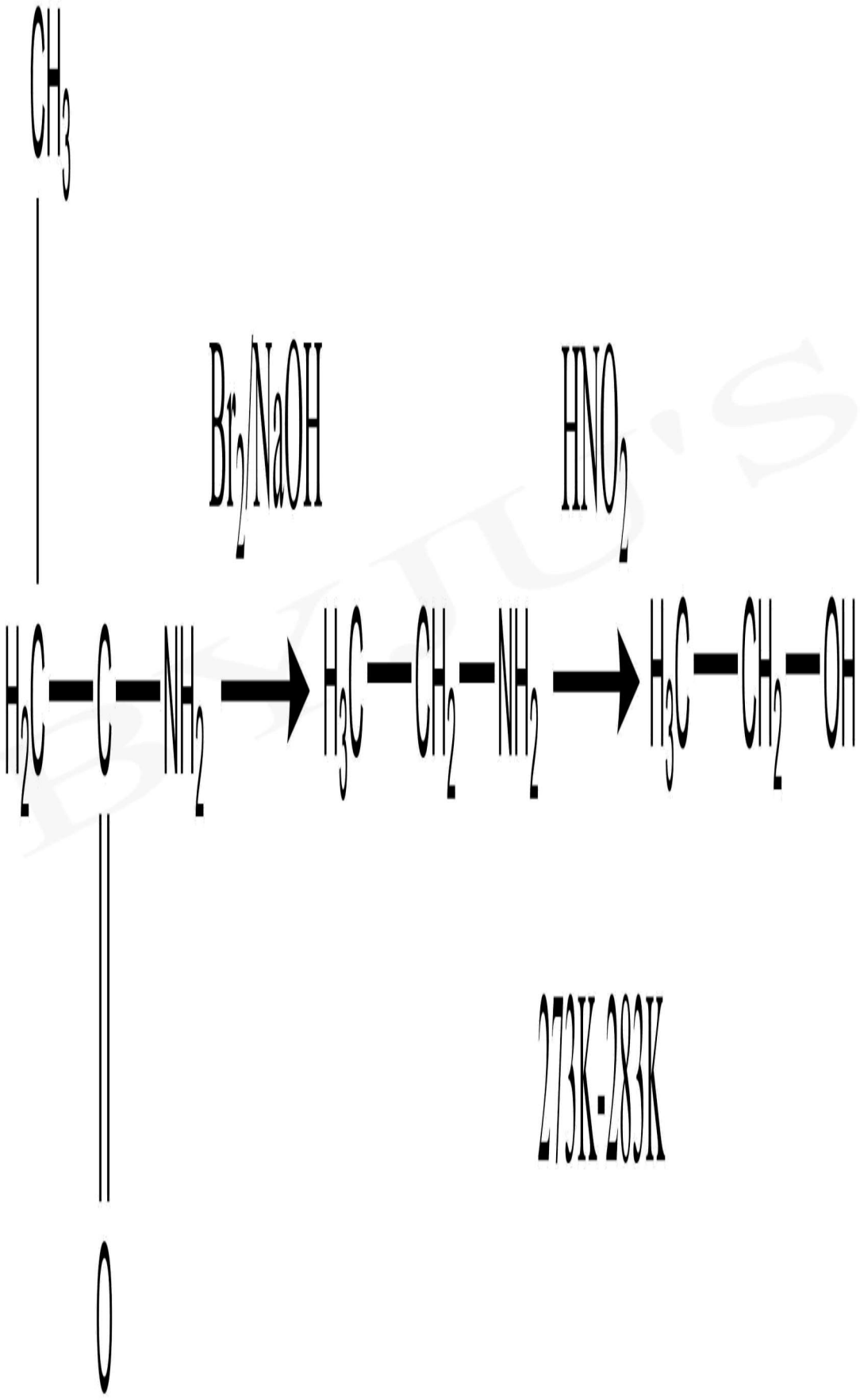
- **A.** $Br_2/NaOH, NaOH$
- **B.** $Br_2/NaOH, HNO_2$
- **C.** $KMnO_4, KOH$
- **D.** $HNO_2, Br/NaOH$

The first reaction is known as Hoffmann degradation of amides.
When an amide is treated with bromine in an aqueous or ethanolic solution of sodium hydroxide, degradation of amide takes place leading to the formation of primary amine. This reaction involving degradation of amide and is popularly known as Hoffmann bromamide degradation reaction. The primary amine thus formed contains one carbon less than the number of carbon atoms in that amide.

The general reaction is as follows:

$$\underset{\text{Amide}}{RCONH_2} \xrightarrow{Br_2+4NaOH} \underset{1^\circ\text{Amine}}{RNH_2} + Na_2CO_3 + 2NaBr + 2H_2O$$

When ethylamine reacts with HNO_2, it forms alcohol.



Thus, A and B are $Br_2/NaOH, HNO_2$ respectively.

2. The end product in the reaction sequence would be:

Ethylamine $\xrightarrow{HNO_2} A \xrightarrow{PCl_5} B \xrightarrow{NH_3} C$

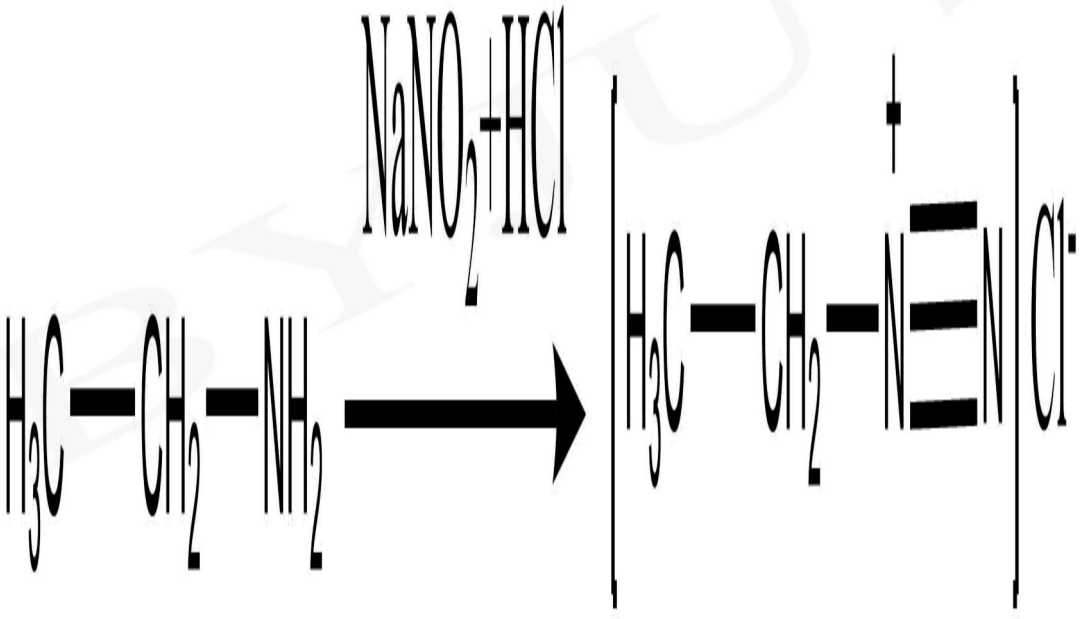
A. Ethyl cyanide

B. Ethyl amine

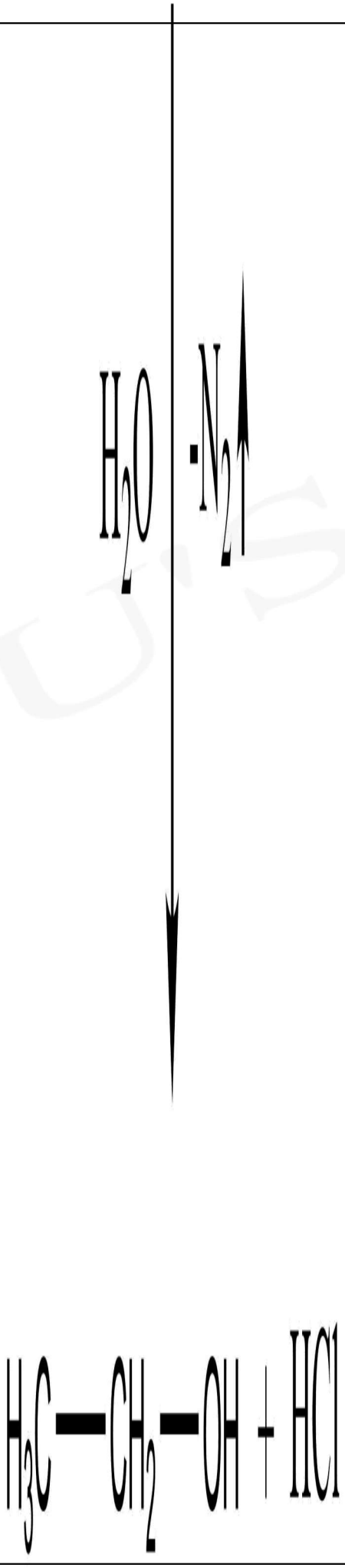
C. Methyl amine

D. Acetamide

Ethylamine reactants with nitrous acid to from ethyl alcohol (compound A)



Ethyldiazonium salt



Ethyl alcohol reacts with PCl_5 to from ethyl chloride (compound B).

Ethyl chloride reacts with ammonia to from ethyl amine (compound C).

The reaction is as follows:

$$C_2H_5NH_2 \xrightarrow{HNO_2} C_2H_5 - OH \xrightarrow{PCl_5} C_2H_5Cl \xrightarrow{NH_3} C_2H_5 - NH_2$$

3. Acylation of amines with acyl halides proceeds by which of the following reaction?

A. electrophilic addition

B. electrophilic substitution

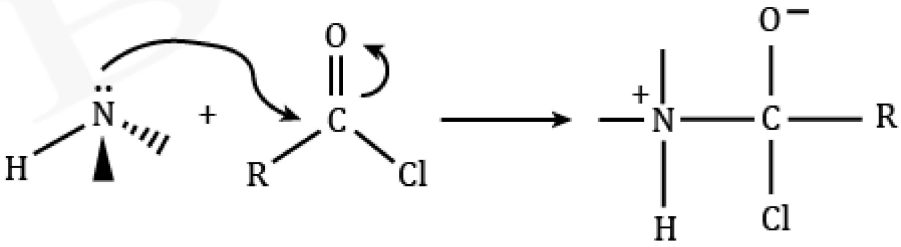
C. nucleophilic addition

D. nucleophilic substitution

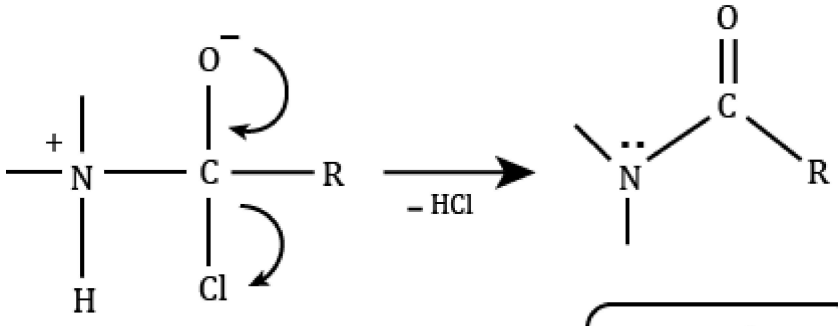
The amines itself acts as nucleophiles and attack the acyl halide at the carbon-halogen bond to substitute the halogen atom by itself. This occurs by production of small amount of acid at each step, which may prevent the reaction by proceeding by protonating the amine.
The reaction is as follows:

$RNH_2 + R'COCl \rightarrow RNHCOR' + HCl$
Here, R = Ph and R' = CH_3
So, product formed will be $PhNHCOCH_3$.
This is commonly known as acetanilide.
Hence, option (d) is correct.

General mechanism of this reaction follows 2 steps:
1) Attack of the nucleophile:



2) Removal of leaving group:



Amide

4. The organic compound that undergoes carbylamine reaction is:

- A. $(C_2H_5)_2NH$
- B. $C_2H_5NH_2$
- C. $(C_2H_5)_3N$
- D. $(C_2H_5)_4N^+I^-$

Carbylamine reaction mechanism includes the addition of amine to the intermediate created from the dehydrohalogenation of chloroform. This intermediate is called dichlorocarbene. The carbylamine reaction is also known as Hoffmann isocyanide synthesis. It is the reaction of a primary amine, chloroform and a base to synthesize isocyanides. The dichlorocarbene intermediate is very important for this conversion. The carbylamine reaction cannot be used to synthesize isocyanides from secondary or tertiary amines.

Carbylamine reaction is given by only primary amine. Hence $C_2H_5NH_2$ gives carbylamine reaction as it is the only primary amine out of the given options.

$R-NH_2+CHCl_3+3KOH(alcoholic) \xrightarrow{\Delta} R-NC+3KCl+3H_2O$

Hence, (b) is the correct option.

5. Which of the following amines will form a product that is soluble in KOH, on reaction with Hinsberg's reagent?

- A. Isopropylamine
- B. Diethylamine
- C. N,N-Dimethylpropylamine
- D. N,N-Dimethylaniline

The reaction of Hinsberg's reagent with Isopropylamine gives N-isopropylbenzene sulphonamide. The lone hydrogen attached to the N atom is strongly acidic due to the presence of strong electron withdrawing sulphonyl group. Hence, is it soluble in alkali like KOH.