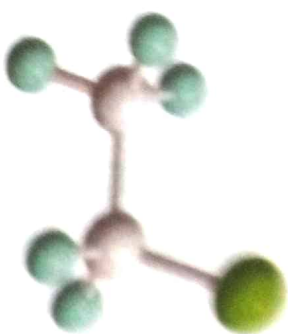


liquid, it is easier to handle than methyl chloride (a gas) and is used a great deal as a solvent in organic synthesis.

### ETHYL CHLORIDE, Chloroethane, $\text{CH}_3\text{CH}_2\text{Cl}$



**Preparation.** It can be prepared : (1) By passing dry HCl into ethyl alcohol in the presence of zinc chloride.

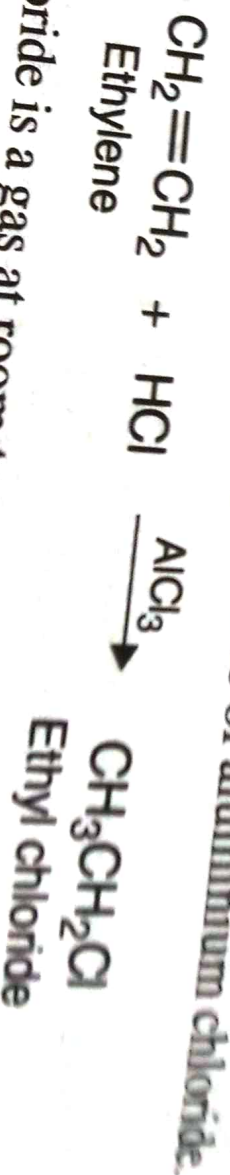


(2) By the chlorination of ethane at  $400^\circ\text{C}$ .



Ethyl chloride is separated by fractional distillation.

(3) By the addition of HCl to ethylene in the presence of aluminium chloride.



**Properties.** Ethyl chloride is a gas at room temperature, bp  $12.5^\circ\text{C}$ . It is used as a solvent agent and in the manufacture of tetraethyllead.

## CHLOROFORM, Trichloromethane, $\text{CHCl}_3$

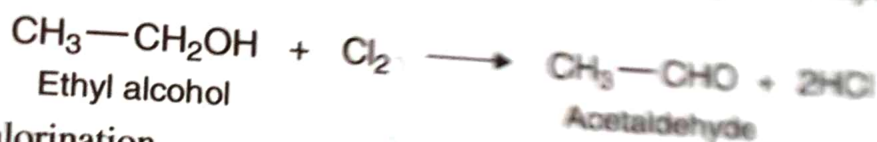


Chloroform is an important trihalogen derivative of methane. In the past chloroform was extensively used as a general anesthetic for surgery but it is rarely used for this purpose now because it causes extensive liver damage.

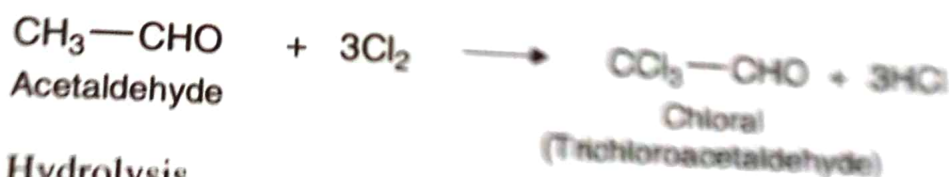
**Preparation.** Chloroform is prepared :

(1) **From Ethyl Alcohol (or Acetone) and Bleaching Powder.** By heating ethyl alcohol or acetone with bleaching powder,  $\text{Ca(OCl)}_2$ . The bleaching powder acts as source of chlorine and calcium hydroxide. This method is used to make chloroform in the laboratory and on commercial scale. Reaction of ethyl alcohol with bleaching powder takes place by the following three steps.

**Step 1. Oxidation**



**Step 2. Chlorination**



**Step 3. Hydrolysis**



Reaction of acetone with bleaching powder takes place by the following two steps.

**Step 1. Chlorination**



**Step 2. Hydrolysis**



(2) **From Methane.** By chlorination of methane at  $400^\circ\text{C}$

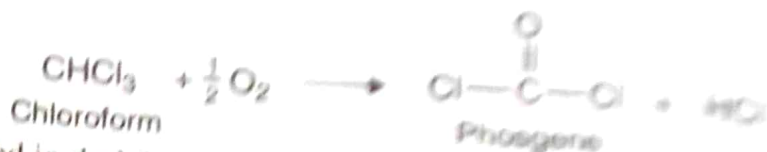


Chloroform is separated from the products by fractional distillation. Today most of the chloroform is manufactured by this method.

**Properties (Physical).** Chloroform is a colorless liquid with a characteristic, slightly sweet, odor. It is almost insoluble in water but is soluble in most organic solvents. Chloroform vapors may cause temporary unconsciousness.

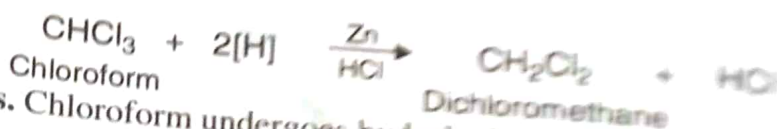
**(Chemical).** The chemical properties of chloroform are as follows:

(1) **Oxidation.** Chloroform undergoes oxidation in the presence of light and air to form phosgene (carbonyl chloride).

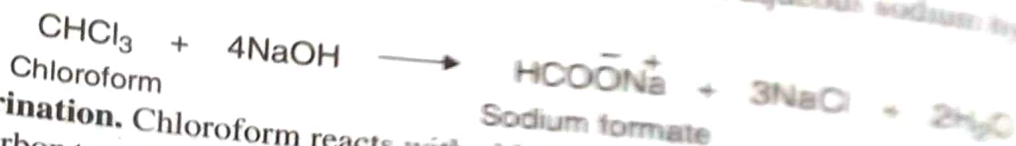


Chloroform is stored in dark brown bottles to prevent the formation of phosgene, which is poisonous.

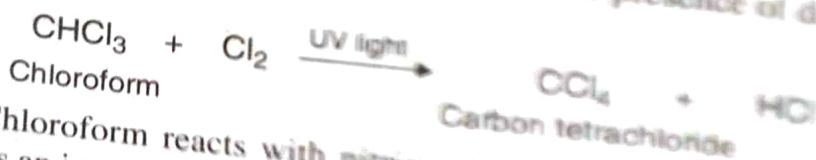
(2) **Reduction.** It undergoes reduction with zinc and hydrochloric acid in the presence of alcohol to form dichloromethane.



(3) **Hydrolysis.** Chloroform undergoes hydrolysis with hot aqueous sodium hydroxide to form sodium formate.



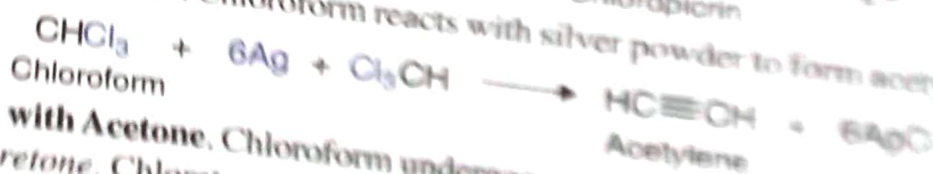
(4) **Chlorination.** Chloroform reacts with chlorine in the presence of diffused sunlight to form carbon tetrachloride.



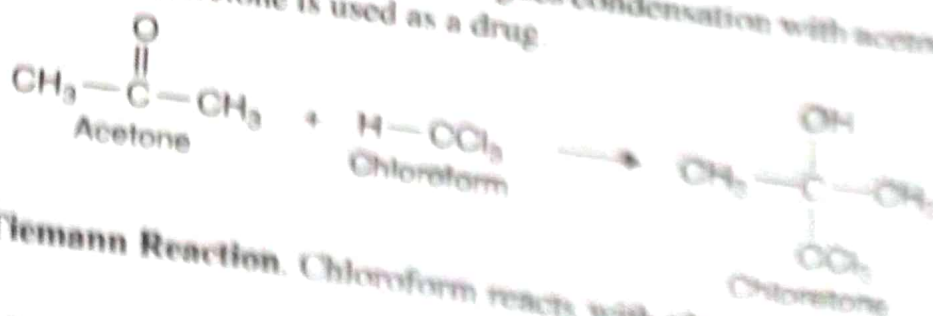
(5) **Nitration.** Chloroform reacts with nitric acid to form chloropicrin or nitrochloroform. Chloropicrin is used as an insecticide.



(6) **Reaction with Silver.** Chloroform reacts with silver powder to form acetylene.



(7) **Reaction with Acetone.** Chloroform undergoes condensation with acetone in the presence of alkali to form chloroform. Chloroform is used as a drug.



(8) **Reimer-Tiemann Reaction.** Chloroform reacts with phenol in sodium hydroxide solution to form salicylaldehyde.

