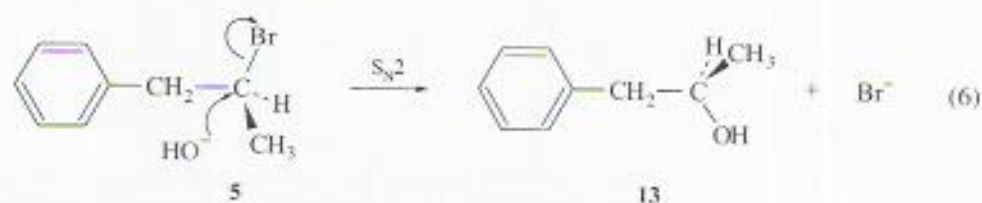


(b) The reaction of Compound **5** with water (a poor nucleophile) proceeds via an S_N1 reaction, so racemization is observed (see part a) with loss of optical activity. However, when Compound **5** is treated with aqueous sodium hydroxide (a good nucleophile), the reaction proceeds via an S_N2 pathway, with inversion of configuration, to give the optically active product **13**:



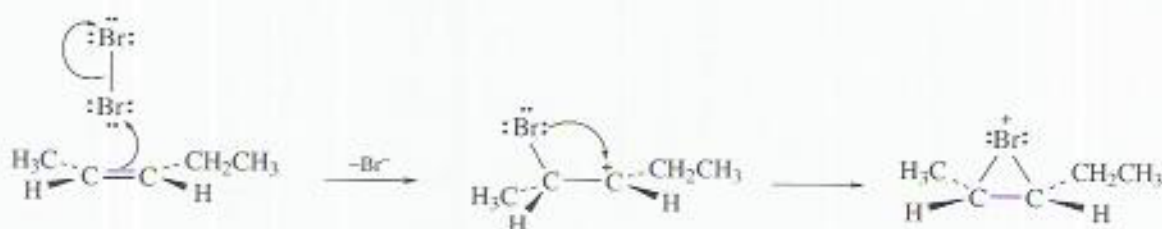
This single-step pathway involves the nucleophile, HO^- , attacking the chiral carbon atom from the side opposite the leaving group, leading to inversion of configuration. The reaction is much faster with HO^- because

$$\text{rate} = \underbrace{k_1[\text{5}]}_{S_N1 \text{ process}} + \underbrace{k_2[\text{5}][\text{HO}^-]}_{S_N2 \text{ process}} \quad (7)$$

So the S_N2 process dominates when it is faster than the S_N1 process ($k_2 > k_1$), and becomes more influential with increasing $[\text{HO}^-]$.

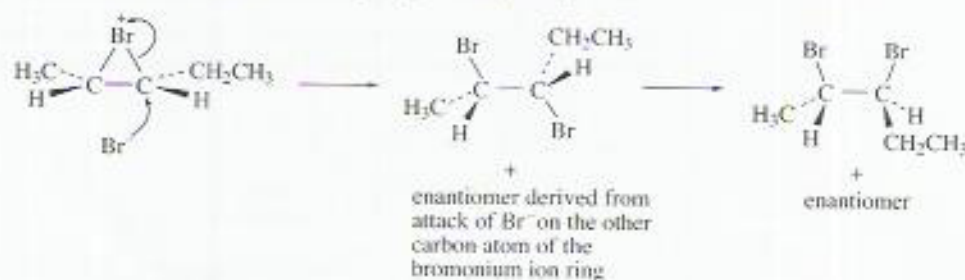
Question 14

(a) (i)



SCHEME 3

The first step is formation of the cyclic bromonium ion as shown in Scheme 3. Attack of Br^- on one of the carbon atoms of the bromonium ion three-membered ring opens the ring, as shown in Scheme 4, giving the required product.



SCHEME 4