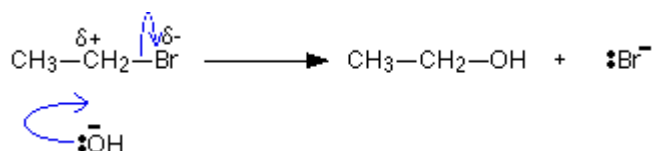


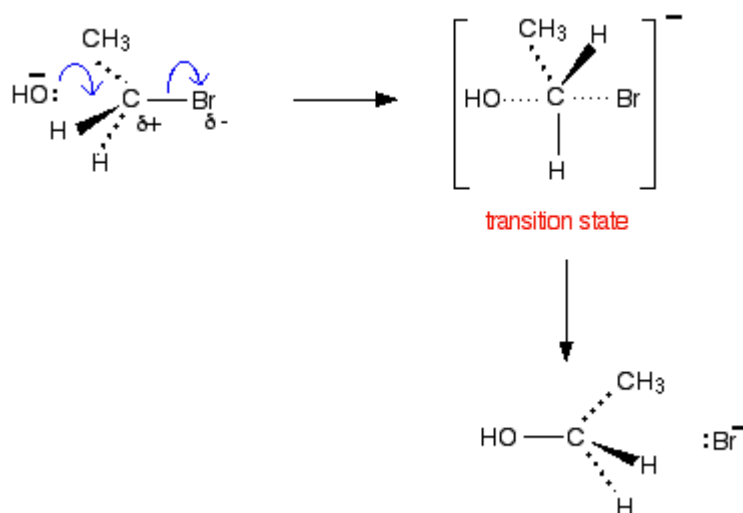
Chemguide – questions

NUCLEOPHILIC SUBSTITUTION

1. Draw the structural formula of
 - a) a primary halogenoalkane containing 4 carbon atoms;
 - b) a secondary halogenoalkane containing 4 carbon atoms;
 - c) a tertiary halogenoalkane containing 4 carbon atoms.
2.
 - a) What is a nucleophile?
 - b) Examples of nucleophiles include hydroxide ions, OH^- , cyanide ions, CN^- , and ammonia, NH_3 . Explain why each of these is a nucleophile.
3. Bromoethane reacts with sodium hydroxide solution to give ethanol. The mechanism is often written as:



- a) Describe and explain what is going on in the reaction.
- b) The mechanism is sometimes expanded to show the transition state, the mid-point during the reaction:

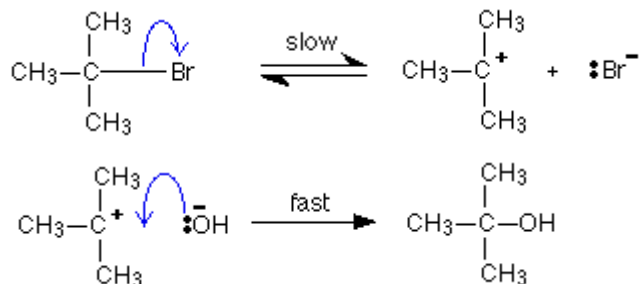


Describe what all the different bond symbols in the transition state mean.

Chemguide – questions

4. This question needs you to understand about the S_N1 mechanism for nucleophilic substitution in a tertiary halogenoalkane. If you are sure that this isn't on your syllabus, ignore this question.

a) The mechanism for the reaction between 2-bromo-2-methylpropane and hydroxide ions is



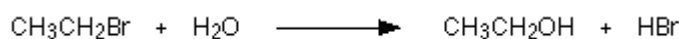
(i) Explain why tertiary halogenoalkanes like 2-bromo-2-methylpropane don't use the same mechanism as a primary halogenoalkane such as bromoethane.

(ii) Explain why a primary halogenoalkane like bromoethane doesn't use the same mechanism as 2-bromo-2-methylpropane.

b) Write the mechanism for the reaction between 2-bromo-2-methylpropane and cyanide ions.

5. Write the mechanism for the reaction between bromoethane and cyanide ions to give propanenitrile.

6. If you heat bromoethane with water, there is a slow reaction in which ethanol is formed.



The conversion to ethanol is much faster if you use sodium hydroxide solution.

a) Write the mechanism for the conversion of bromoethane into ethanol using water as the nucleophile.

b) The mechanism for the reaction with the hydroxide ions in sodium hydroxide solution is given in question 3. Explain why the water reaction is much slower than this.

7. a) Write the mechanism for the reaction between bromoethane and ammonia to produce ethylamine.

b) Write the mechanism to show how you can get further reaction to give diethylamine.

c) Further similar reactions lead to triethylamine and tetraethylammonium bromide. Draw the structures of these two molecules.