

Chemguide – answers

ARYL HALIDES: REACTIVITY

1. a) Nucleophilic substitution is a reaction in which part of a molecule is replaced following attack by a nucleophile. A nucleophile is either a negative ion or a molecule with a partial negative charge somewhere. Nucleophiles attack positively charged sites in another molecule or ion.

b) The carbon-bromine bond is polarised because the bromine is more electronegative than the carbon. One of the lone pairs on a hydroxide ion approaches the slightly positively charged carbon and forms a bond with it. In the process the electron pair forming the C-Br bond is pushed entirely onto the bromine which breaks away as a bromide ion.

c) The carbon-bromine bond ionises in a slow and reversible change to produce a carbocation (carbonium ion) and a bromide ion. There is then a fast reaction in which one of the lone pairs on a hydroxide ion forms a new bond between the oxygen and the positively charged carbon atom.

d) The chlorine atom is attached to a carbon atom in a benzene ring, and the incoming hydroxide ion would have to approach the delocalised ring electrons, when it would be repelled.

e) There is interaction between one of the chlorine's lone pairs and the delocalised ring electrons which gives some extra bonding between the chlorine and carbon, strengthening that bond. It is more difficult for the chlorine to break away from a benzene ring than from a carbon chain.