

A-Level Chemistry

Name: _____ Score: _____

1. A halogenoalkane is:
 - ☐ an alkane with one or more halogen atoms in place of hydrogen (a C-X bond)
 - ☐ an alkene with a C=C bond
 - ☐ an alcohol
 - ☐ a carboxylic acid
2. Heating a halogenoalkane with NaOH dissolved in ethanol gives:
 - ☐ an alkene (by elimination)
 - ☐ an alcohol (by substitution)
 - ☐ an alkane
 - ☐ a nitrile
3. A tertiary halogenoalkane has the halogen on a carbon joined to:
 - ☐ three other carbons
 - ☐ one other carbon
 - ☐ two other carbons
 - ☐ no other carbons
4. The SN1 mechanism:
 - ☐ has two steps, going through a carbocation; the rate depends only on the halogenoalkane
 - ☐ is a single step through a transition state
 - ☐ never forms a carbocation
 - ☐ depends on the nucleophile only
5. Warming a halogenoalkane with aqueous NaOH produces:
 - ☐ an alcohol
 - ☐ an alkene
 - ☐ an alkane
 - ☐ a nitrile
6. An SN1 mechanism goes via a carbocation intermediate.
 - ☐ True ☐ False

7. In nucleophilic substitution, OH^- attacks the $\delta+$ carbon and the halogen leaves as a halide ion.
- ☐ True ☐ False
8. The $\text{S}_{\text{N}}2$ mechanism:
- ☐ is one step through a transition state; the rate depends on both reactants
- ☐ has two steps via a carbocation
- ☐ is favoured by tertiary halogenoalkanes
- ☐ depends only on the halogenoalkane
9. Reaction with KCN in ethanol gives a nitrile, which is useful because it:
- ☐ adds one carbon to the chain
- ☐ removes a carbon
- ☐ forms an alkene
- ☐ forms an amine
10. Which halogenoalkane reacts fastest?
- ☐ an iodoalkane (C–I is the weakest bond)
- ☐ a chloroalkane
- ☐ a fluoroalkane
- ☐ they all react at the same rate

A-Level Chemistry

1. an alkane with one or more halogen atoms in place of hydrogen (a C–X bond)

A halogenoalkane has a polar C–X bond, which is the reactive site.

2. an alkene (by elimination)

NaOH in ethanol with heat favours elimination of HX to form an alkene; NaOH in water favours substitution.

3. three other carbons

Primary = 1 carbon attached, secondary = 2, tertiary = 3, on the carbon bearing the halogen.

4. has two steps, going through a carbocation; the rate depends only on the halogenoalkane

SN1: C–X breaks first to a carbocation, then the nucleophile attacks; tertiary halogenoalkanes favour it.

5. an alcohol

NaOH(aq) substitutes the halogen for –OH, giving an alcohol.

6. True

SN2 is a one-step concerted mechanism.

7. True

The C–X bond is polar, so the carbon is $\delta+$ — exactly where an electron-pair donor attacks.

8. is one step through a transition state; the rate depends on both reactants

SN2 is a single concerted step; primary halogenoalkanes favour it and its rate depends on both species.

9. adds one carbon to the chain

The CN group adds a carbon, lengthening the chain; NH₃ instead gives an amine.

10. an iodoalkane (C–I is the weakest bond)

The weaker the C–X bond, the faster the reaction, so C–I (weakest) reacts fastest and C–Cl slowest.