15. Halogen compounds

Starter Quiz ·

A-Level Chemistry Name: _____ Score: _____

1. A halogenoalkane is:

   ☐ a carboxylic acid

   ☐ an alcohol

   ☐ an alkene with a C=C bond

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

2. Heating a halogenoalkane with NaOH dissolved in ethanol gives:

   ☐ a nitrile

   ☐ an alkane

   ☐ an alkene (by elimination)

   ☐ an alcohol (by substitution)

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:

   ☐ depends on the nucleophile only

   ☐ 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

5. Warming a halogenoalkane with aqueous NaOH produces:

   ☐ a nitrile

   ☐ an alcohol

   ☐ an alkane

   ☐ an alkene

6. An SN2 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 SN2 mechanism:

   ☐ has two steps via a carbocation

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

   ☐ is favoured by tertiary halogenoalkanes

   ☐ depends only on the halogenoalkane

9. Reaction with KCN in ethanol gives a nitrile, which is useful because it:

   ☐ forms an alkene

   ☐ forms an amine

   ☐ removes a carbon

   ☐ adds one carbon to the chain

10. Which halogenoalkane reacts fastest?

    ☐ a chloroalkane

    ☐ a fluoroalkane

    ☐ they all react at the same rate

    ☐ an iodoalkane (C–I is the weakest bond)

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Answers ·

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. **False**

   False. SN2 is a one-step concerted mechanism. It is SN1 that goes via a carbocation intermediate.

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; NH_3 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.