

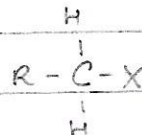
Halogenoalkanes

Q-1) What are halogenoalkanes?

> Halogenoalkanes are alkanes that have one or more hydrogen atoms replaced by a halogen.

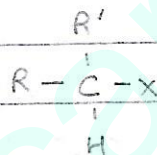
primary haloalkane (1° Rx)

- carbon with 1 alkyl group
+ 2 hydrogen groups.



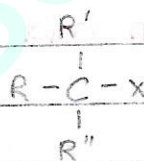
secondary haloalkane (2° Rx)

- carbon with 2 alkyl groups
+ 1 hydrogen atom.



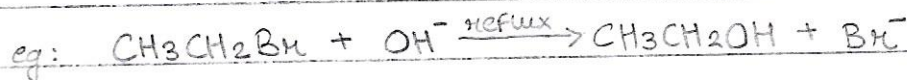
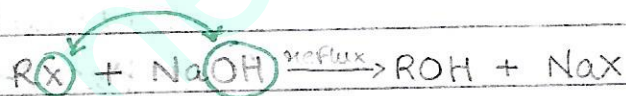
tertiary haloalkane (3° Rx)

- carbon with 3 alkyl groups
+ 0 hydrogen atoms.



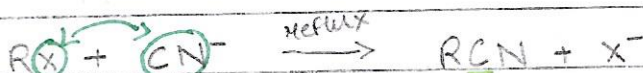
Q-2) Nucleophilic substitution reactions of haloalkanes.

① Reaction with alkali: NaOH / OH⁻ (aq). (or KOH).



A same reaction occurs with water, but slower because the negatively charged OH⁻ ion is a more effective nucleophile than water.

② Reaction with cyanide ions (in ethanol) CN⁻ / KCN (or NaCN)



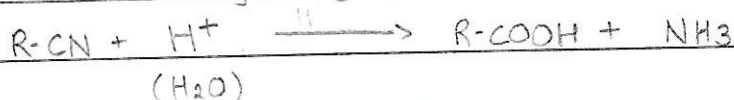
R-CN can be broken down...

Reduction:

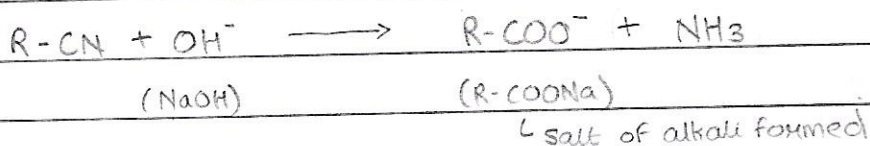


Hydrolysis

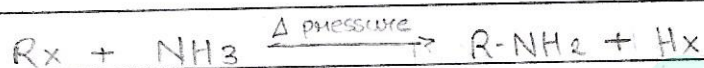
acidic



alkaline



③ Reaction with ammonia (in ethanol) NH₃.



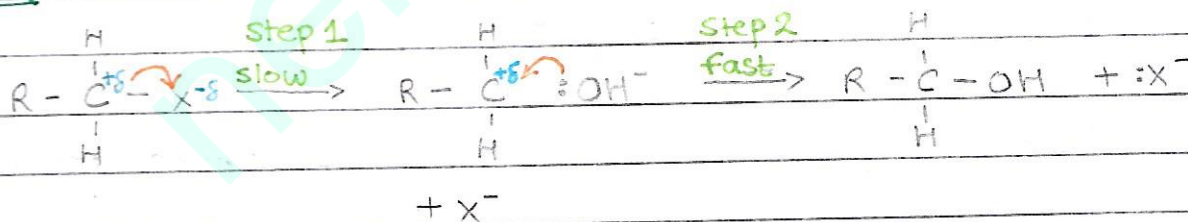
Q-3) Mechanism of nucleophilic substitution of halo-alkanes.

1° R_x = S_N² mechanism

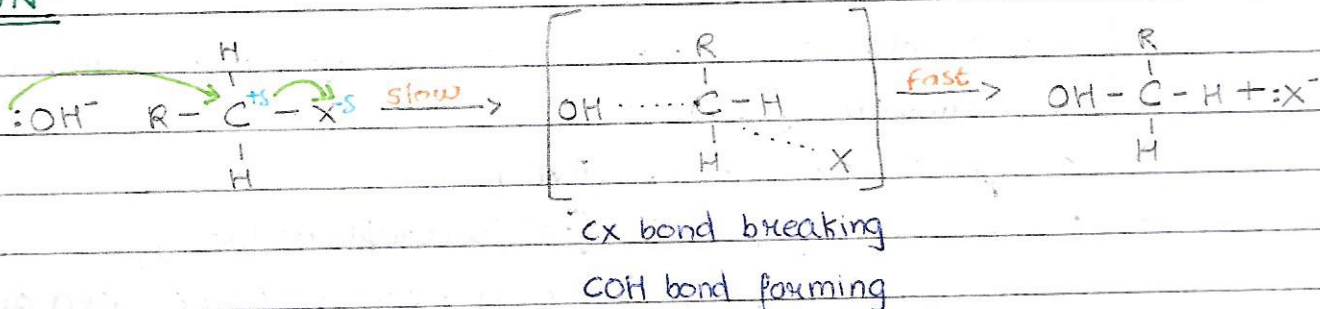
2° R_x =

3° R_x = S_N¹ mechanism.

S_N¹



S_N²



Q-4) Elimination reaction with alcoholic KOH / NaOH.



H from the adjacent C-atom from X is removed.

Q-5) Stability of carbocations?

1°R_x - 1 methyl group transfers e^- (unstable)

\therefore positive charge is not neutralised

2°R_x - 2 methyl groups transfer e^- (slightly unstable)

\therefore positive charge slightly neutralised

3°R_x - 3 methyl groups transfer e^- (stable)

\therefore positive charge neutralised.

$3^\circ > 2^\circ > 1^\circ \text{R}_x$

C-F Down the group atomic size \uparrow

C-Cl \therefore bond length \uparrow

C-Br \therefore bonds are weaker

C-I \therefore less energy is required to break bonds

Q-6) What are haloalkanes used for?

- > anaesthetics (haloethane)
- > flame retardants (introducing a halogen into an alkane reduces its flammability)
- > manufacturing plastics (PVC)
- > non-stick lining of pans [poly(tetrafluoroethene)]

strength of C-F bond means it can be used at high temperatures without breaking.