1. For the reaction

$$RCH_2Br + I^- \xrightarrow[\text{major}]{\text{Acetone}} RCH_2I + Br^-$$

The correct statement is

[2023 (06 Apr Shift 1)]

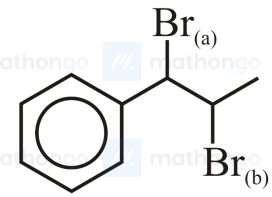
(1) Br^- can act as competing nucleophile.

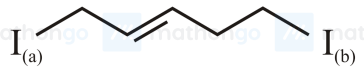
(2) The reaction can occur in acetic acid also.

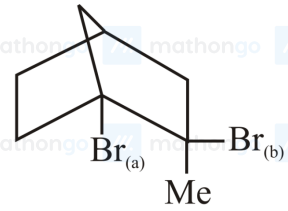
(3) The transition state formed in the above reaction is less polar than the localised anion.

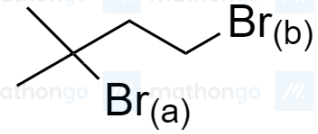
(4) The solvent used in the reaction solvates the ions formed in rate determining step

2. Choose the halogen which is most reactive towards SN1 reaction in the given compounds (A, B, C & D)

A. 

B. 

C. 

D. 

[2023 (08 Apr Shift 1)]

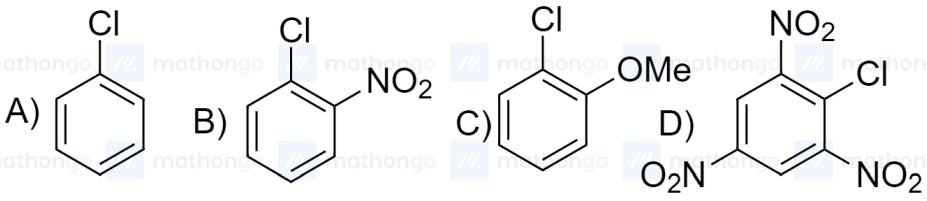
(1) $A - Br_{(b)}; B - I_{(a)}; C - Br_{(a)}; D - Br_{(a)}$

(2) $A - Br(b); B - I_{(b)}; C - Br(b); D - Br(b)$

(3) $A - Br_{(a)}; B - I_{(a)}; C - Br_{(b)}; D - Br_{(a)}$

(4) $A - Br_{(a)}; B - I_{(a)}; C - Br_{(a)}; D - Br_{(a)}$

3. The correct order of reactivity of following haloarenes towards nucleophilic substitution with aqueous NaOH is:



Choose the correct answer from the options given below:

[2023 (08 Apr Shift 2)]

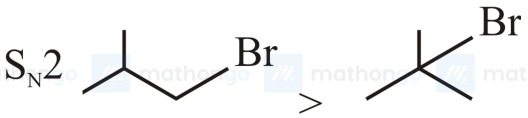
(1) $A > B > D > C$

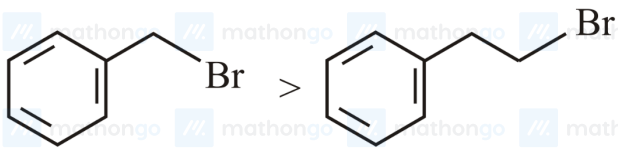
(2) $C > A > D > B$

(3) $D > C > B > A$

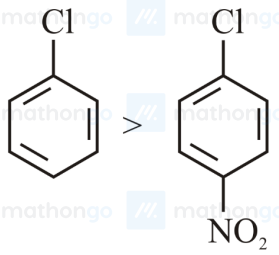
(4) $D > B > A > C$

4. Identify the correct order of reactivity for the following pairs towards the respective mechanism

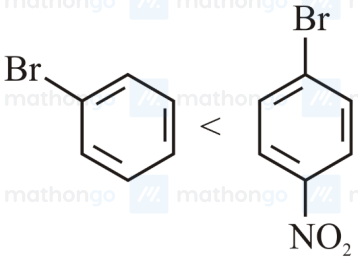
(A) S_N2 

(B) S_N1 

(C) Electrophilic substitution



(D) Nucleophilic substitution



Choose the correction answer from the options given below:

[2023 (10 Apr Shift 1)]

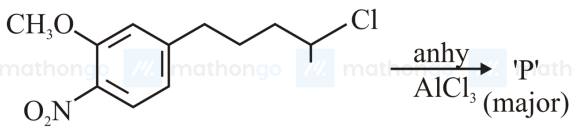
(1) (B), (C) and (D) only

(2) (A), (B), (C) and (D)

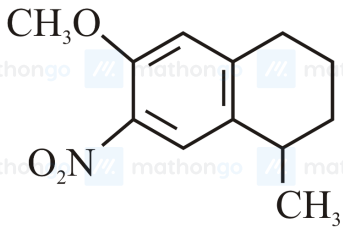
(3) (A), (B) and (D) only

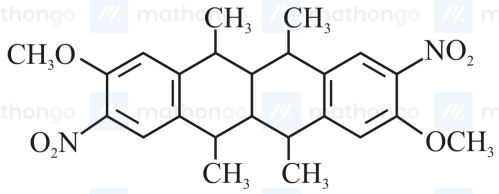
(4) (A), (C) and (D)only

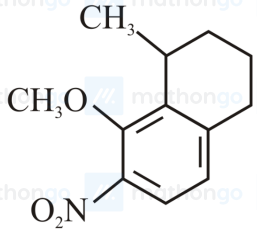
5. The major product 'P' formed in the given reaction is

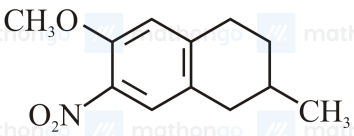


[2023 (10 Apr Shift 2)]

(1)


(2)


(3)


(4)


6. 2−Methyl propyl bromide reacts with $C_2H_5O^-$ and gives 'A' whereas on reaction with C_2H_5 OH it gives 'B'. The mechanism followed in these reactions and the products 'A' and 'B' respectively are:

[2023 (13 Apr Shift 1)]

(1) S_N2, A =iso-butyl ethyl ether;S_N1, B =tert-butyl ethyl ether

(2) S_N1, A =tert-butyl ethyl ether; S_N1, B = 2−butyl ethyl ether

(3) S_N2, A = 2−butyl ethyl ether; S_N2, B =iso-butyl ethyl ether

(4) S_N1, A =tert-butyl ethyl ether; S_N2, B =iso-butyl ethyl ether

7. Match List-I with List-II.

1-Bromopropane is reacted with reagents in List-I to give product in List-II

	List-I Reagent		List-II Product
A.	KOH (alc)	I.	Nitrile
B.	KCN (alc)	II.	Ester
C.	$AgNO_2$	III.	Alkene
D	$H_3CCOOAg$	IV.	Nitroalkane

Choose the correct answer from the options given below

[2023 (13 Apr Shift 2)]

(1) A-III, B-I, C-IV, D-II

(2) A-I, B-II, C-III, D-IV

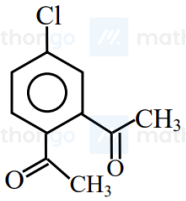
(3) A-I, B-III, C-IV, D-II

(4) A-IV, B-III, C-II, D-I

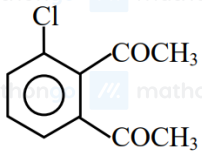
8. The major product formed in the Friedel-Craft acylation of chlorobenzene is

[2023 (15 Apr Shift 1)]

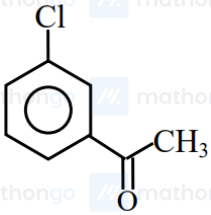
(1)



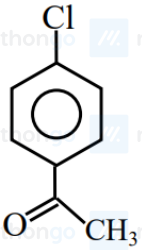
(2)



(3)



(4)



ANSWER KEYS

1. (3) **2.** (3) **3.** (4) **4.** (2) **5.** (1) **6.** (1) **7.** (1) **8.** (4)

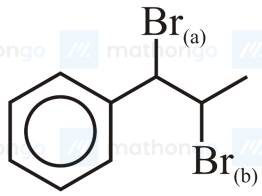
1. (3)

$$R-CH_2-Br+I^- \xrightarrow{\text{Acetone}} R-CH_2-I+Br^-$$

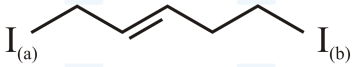
As mentioned the reaction follows S_N2 reaction mechanism. The Finkelstein reaction classically involves the conversion of Alkyl bromides into Alkyl iodides by the treatment with a solution of Sodium iodide in Acetone. NaBr is not readily soluble in acetone and hence reaction shifts in forward reaction. For S_N2 reactions, transition state formed is less polar than the localised anion.

2. (3)

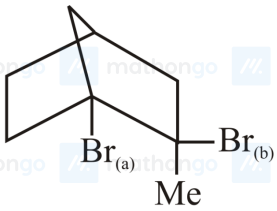
The leaving group which results in the formation of more stable carbocation will be more reactive towards S_N1 reaction.



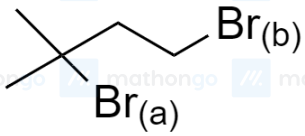
In the above molecule, by leaving of $Br_{(a)}$ benzyl carbocation is formed. Benzyl carbocation is more stable than aliphatic carbocation.



By replacing $I_{(a)}$ in the above molecule, allyl carbocation is formed. Allyl carbocation is more stable than aliphatic carbocation.



In the above molecule, it is difficult to replace $Br_{(a)}$, as carbocation formed at bridge head position is very difficult. Hence, $Br_{(b)}$ is more reactive.

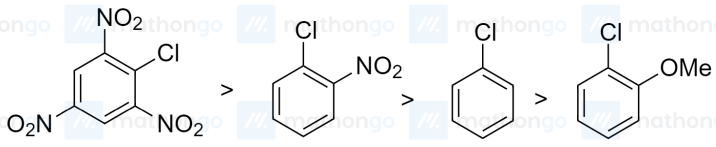


$Br_{(a)}$ is more reactive than $Br_{(b)}$ in the above molecule, because tertiary carbocation is more stable than primary carbocation.
Hence, the correct answer is option (3).

3. (4)

The intermediate formed in aromatic nucleophilic substitution reaction is carbanion. Carbanion stabilised by electron withdrawing groups. Aryl halides are less reactive towards nucleophilic aromatic substitution with aqueous NaOH. Introduction of electron releasing group like OCH_3 group further decreases its reactivity towards nucleophilic substitution. But the introduction of electron withdrawing groups like NO_2 group particularly at the ortho and para position increases its reactivity towards nucleophilic substitution. Higher the number of electron withdrawing groups, higher the reactivity.

∴ The correct reactivity order is



4. (2)

The rate of S_N2 reaction decreases with increase in steric crowding. In the given set of molecules the second molecule(Tertiary alkyl halide) is sterically crowded, hence, it is correct option. More stable carbocation formed, higher will be the reactivity of S_N1. Benzyl carbocation is more reactive than aliphatic carbocation.

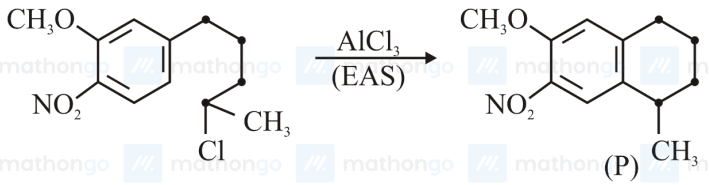
The deactivating groups decreases the rate of electrophilic substitution reaction. NO_2 is strong deactivating group for electrophilic substitution.

In the aromatic nucleophilic substitution reactions, the intermediate formed is carbanion and, it is stabilised by NO_2 at ortho or para positions.

Hence A, B, C, D all are correct.

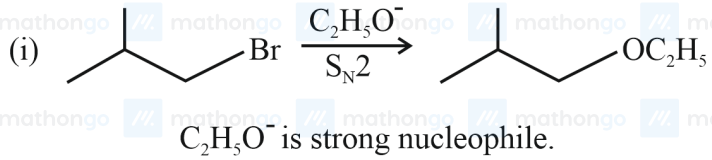
5. (1)

Friedel-Crafts Alkylation refers to the replacement of an aromatic proton with an alkyl group. This is done through an electrophilic attack on the aromatic ring with the help of a carbocation generated from the alkyl halide and Lewis acid aluminium chloride. In the given case ring closure reaction takes place and OCH_3 is ortho/para directing, major product will be obtained from para attack.



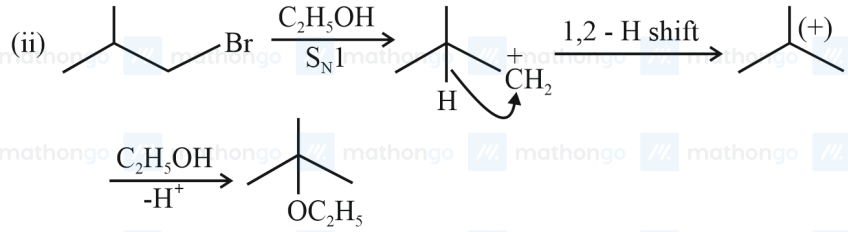
6. (1)

The reaction between methyl propyl bromide and $C_2H_5O^-$ proceeds via an S_N2 (substitution nucleophilic bimolecular) mechanism. In this mechanism, the nucleophile attacks the carbon atom bearing the bromine (the electrophilic carbon) in a single step, leading to the displacement of the bromine atom.



$C_2H_5O^-$ is strong nucleophile.

The reaction between methyl propyl bromide and C_2H_5 OH can proceed via either an S_N1 (substitution nucleophilic unimolecular). Here C_2H_5 OH is a weak nucleophile. During the reaction 1,2-hydrogen shift will occur and tert-butyl ethyl ether is formed.



C_2H_5OH is Week nucleophile.

7. (1)

(A) When 1−bromopropane reacts with alcoholic KOH, the bromine with the alpha H (hydrogen from the carbon alongside the carbon fortified with useful gathering) is eliminated and subsequently forms 1−propene.

$$\underset{\underset{Br}{|}}{CH_2-CH_2-CH_3} \xrightarrow{\text{Alc. KOH}} \underset{\text{(alkene)}}{CH_2=CH_2-CH_3}$$

(B) When 1−Bromo propane reacts with alc KCN it will form butanenitrile.

$$\underset{\underset{Br}{|}}{CH_2-CH_2-CH_3} \xrightarrow{KCN} \underset{\underset{C\equiv N\text{ (nitrile)}}{|}}{CH_2-CH_2-CH_3}$$

(C) When akyl halide reacts with silver nitrite, nitroalkane is formed because the bond between $Ag-OAg-O$ is covalent, the lone pair on nitrogen acts as an attacking site for nucleophilic substitution.

$$\underset{\underset{Br}{|}}{CH_2-CH_2-CH_3} \xrightarrow{AgNO_2} \underset{\underset{\text{(Nitroalkane)}}{NO_2}}{|}CH_2-CH_2-CH_3$$

$$\underset{\underset{Br}{|}}{CH_2-CH_2-CH_3} \xrightarrow{CH_3COOAg} \underset{\underset{\text{(ester)}}{\underset{\underset{O}{\|}}{O-C-CH_3}}}{|}CH_2-CH_2-CH_3$$

(D) When 1−bromopropane reacts with silver acetate, propyl ethanoate and silver bromide are formed.

8. (4)

Friedel-Crafts acylation is a reaction in which the addition of an acyl group to an aromatic ring takes place. The reaction will lead to the aromatic ring being transformed into a ketone.