ORGANIC CHEMISTRY

HALOGEN DERIVATIVE

1. Match the reactions in List-I with the features of their products in List-II and choose the correct option.

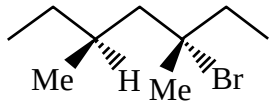
[JEE(Advanced) 2023]

List-I **List-II**

(P) (-)-1-Bromo-2-ethylpentane (single enantiomer) $\xrightarrow[S_N2 \text{ reaction}]{\text{aq. NaOH}}$ (1) Inversion of configuration

(Q) (-)-2-Bromopentane (single enantiomer) $\xrightarrow[S_N2 \text{ reaction}]{\text{aq. NaOH}}$ (2) Retention of configuration

(R) (-)-3-Bromo-3-methylhexane (single enantiomer) $\xrightarrow[S_N1 \text{ reaction}]{\text{aq. NaOH}}$ (3) Mixture of enantiomers

(S) 

(Single enantiomer) $\xrightarrow[S_N1 \text{ reaction}]{\text{aq. NaOH}}$ (4) Mixture of structural isomers

(5) Mixture of diastereomers

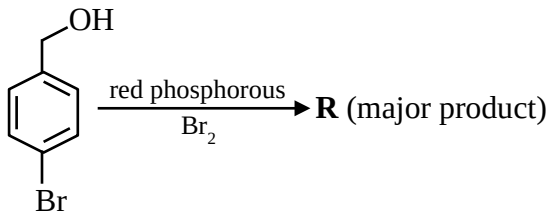
(A) P → 1; Q → 2; R → 5; S → 3

(B) P → 2; Q → 1; R → 3; S → 5

(C) P → 1; Q → 2; R → 5; S → 4

(D) P → 2; Q → 4; R → 3; S → 5

2. Consider the following reaction. **[JEE(Advanced) 2022]**

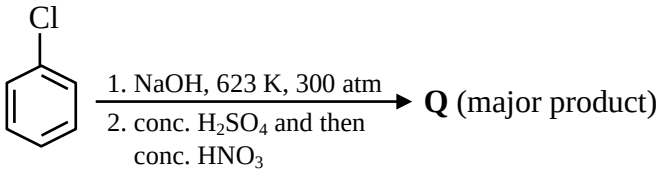


On estimation of bromine in 1.00 g of **R** using Carius method, the amount of AgBr formed (in g) is _____.

[Given : Atomic mass of H = 1, C = 12, O = 16, P = 31, Br = 80, Ag = 108]

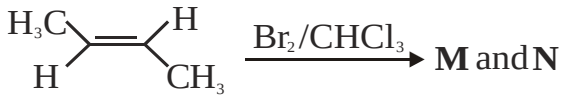
3. The weight percentage of hydrogen in **Q**, formed in the following reaction sequence, is _____.

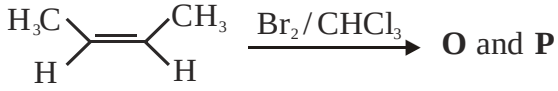
[JEE(Advanced) 2022]



[Given : Atomic mass of H = 1, C = 12, N = 14, O = 16, S = 32, Cl = 35]

4. The correct statement(s) for the following addition reactions is(are) **[JEE(Advanced) 2017]**

(i) 

(ii) 

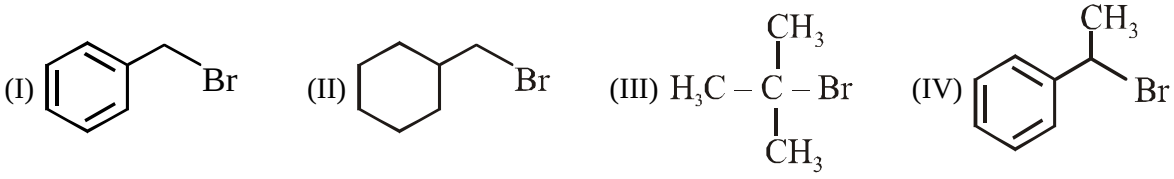
(A) (**M** and **O**) and (**N** and **P**) are two pairs of diastereomers

(B) Bromination proceeds through *trans*-addition in both the reactions

(C) **O** and **P** are identical molecules

(D) (**M** and **O**) and (**N** and **P**) are two pairs of enantiomers

5. For the following compounds, the correct statement(s) with respect of nucleophilic substitution reactions is(are): **[JEE(Advanced) 2017]**



(A) I and II follow S_N2 mechanism

(B) The order of reactivity for I, III and IV is : IV > I > III

(C) I and III follow S_N1 mechanism

(D) Compound IV undergoes inversion of configuration

6. Which of the following combination will produce H_2 gas? **[JEE(Advanced) 2017]**

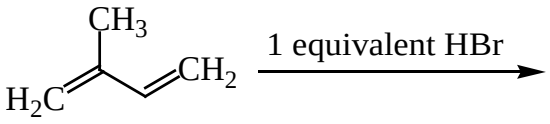
(A) Zn metal and NaOH(aq)

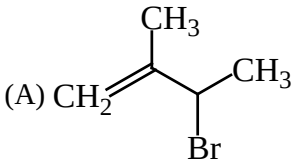
(B) Au metal and NaCN(aq) in the presence of air

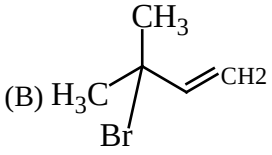
(C) Cu metal and conc. HNO_3

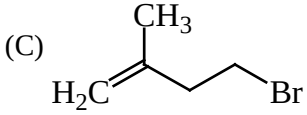
(D) Fe metal and conc. HNO_3

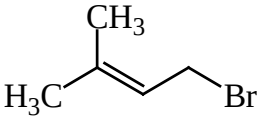
7. In the following reaction, the major product is - **[JEE(Advanced) 2015]**



(A) 

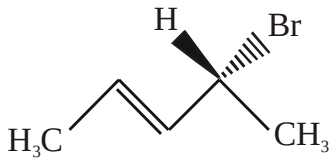
(B) 

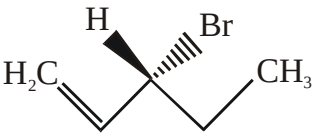
(C) 

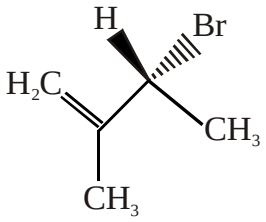
(D) 

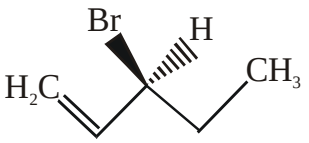
8. Compound(s) that on hydrogenation produce(s) optically inactive compound(s) is (are) –

[JEE(Advanced) 2015]

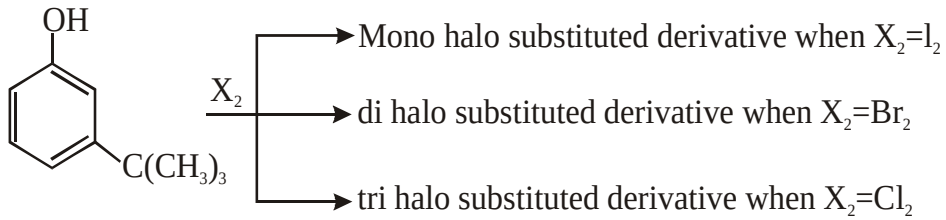
(A) 

(B) 

(C) 

(D) 

9. The reactivity of compound Z with different halogens under appropriate conditions is given below-



The observed pattern of electrophilic substitution can be explained by - **[JEE(Advanced) 2014]**

(A) The steric effect of the halogen

(B) The steric effect of the tert-butyl group

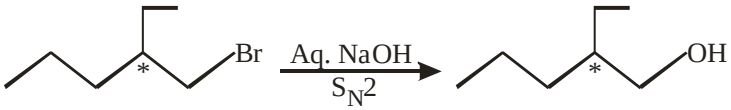
(C) The elctronic effect of the phenolic group

(D) The electronic effect of the turt-butyl group

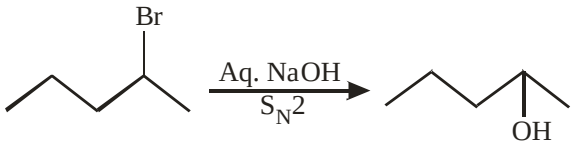
SOLUTIONS

1. Ans. (B)

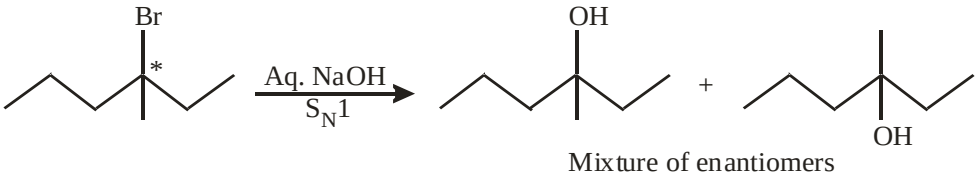
Sol. P → 2, Q → 1, R → 3, S → 5

(P) 

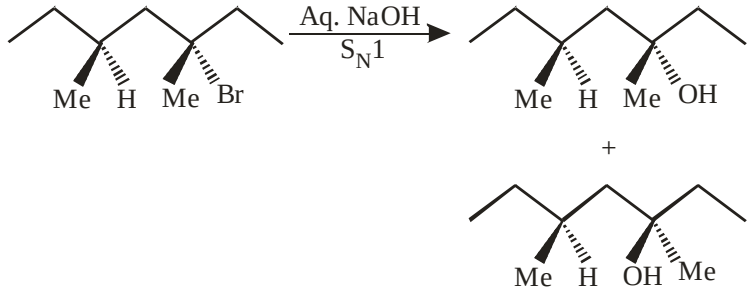
Retention of configuration

(Q) 

Inversion of configuration

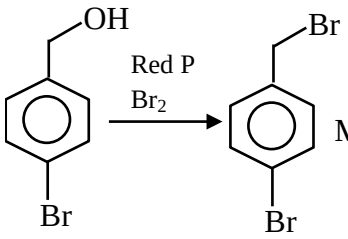
(R) 

Mixture of enantiomers

(S) 

Diastereomeric mixture

2. Ans. (1.49 - 1.51)

Sol. 

M.W. = 250 g/mol

(R)

$1g\ R \rightarrow \frac{1}{250} moles$

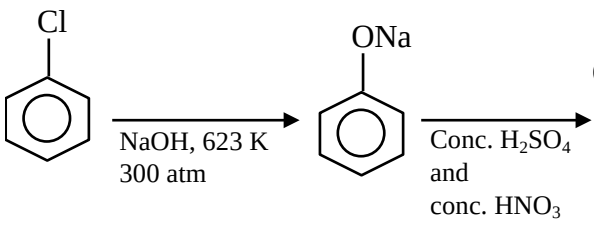
No. of Br Atoms $\rightarrow \frac{2}{250} moles$

Moles of AgBr $\rightarrow \frac{2}{250} moles$

Mass of AgBr = $\frac{2}{250} \times (108+80) = 1.504$

3. Ans. (1.30 - 1.32)

Sol.



Picric acid

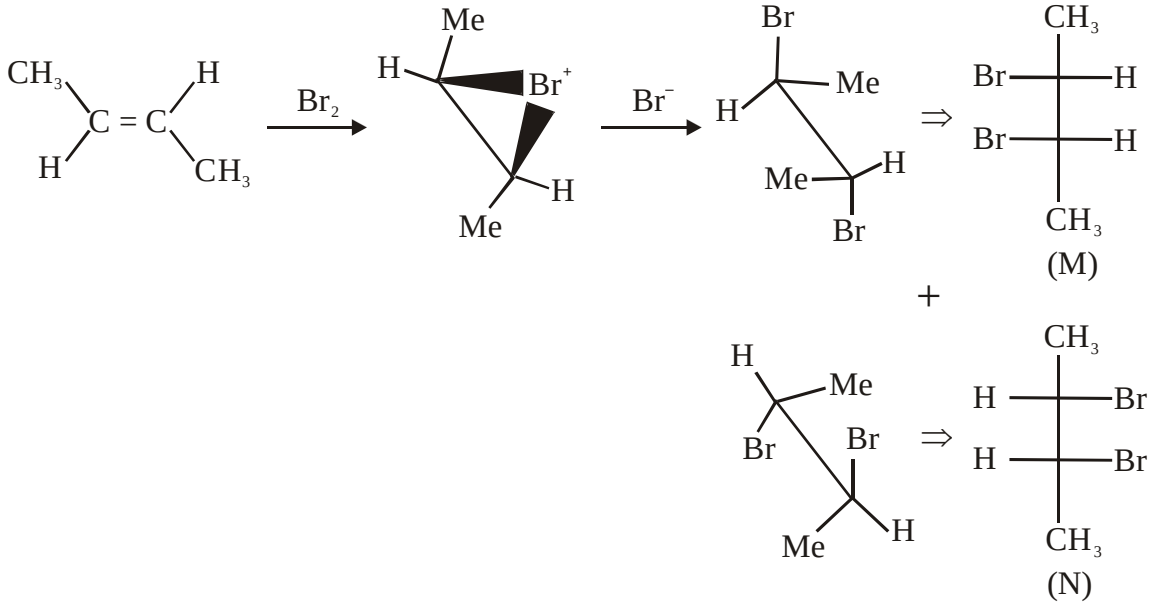
$C_6H_3N_3O_7$

Mass % of H

$= \frac{3}{229} \times 100 = 1.31\%$

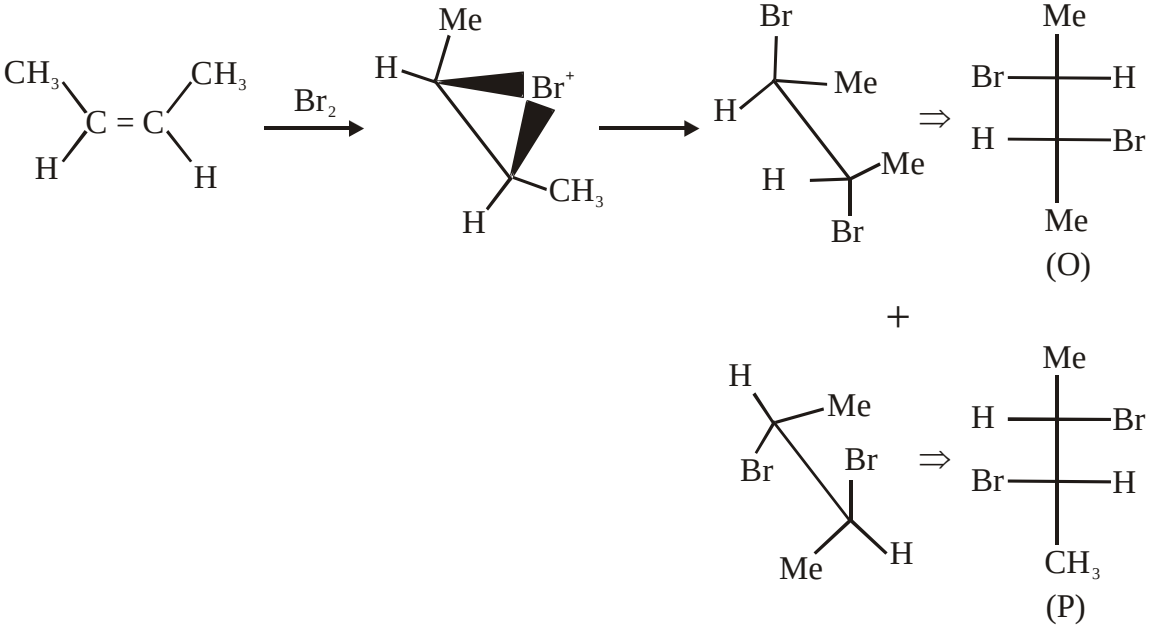
4. Ans. (A, B)

Sol. **(i)**



(M) and (N) are identical meso compounds

(ii)



(O) and (P) are enantiomers

Explanation of 4 options :

(A) (M) and (O) are distereomers of each other.

(N) and (P) are distereomers of each other.

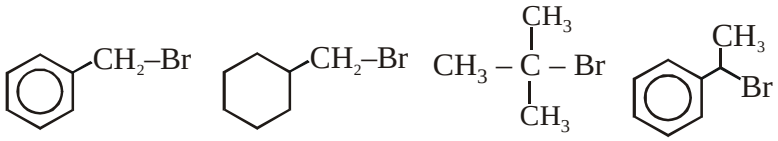
(B) Addition of Br_2 on alkene follows non-classical carbocation mechanism. It is anti or trans addition.

(C) (O) and (P) are enantiomers

(D) (M) and (N) are identical and (O) and (P) are enantiomers.

(M and O) are distereomers and (N and P) are distereomers.

5. Ans. (A, B, C, D)

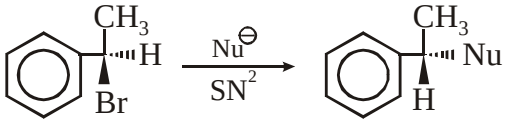
Sol. 

(A) I and II follow S_N2 mechanism as they are primary

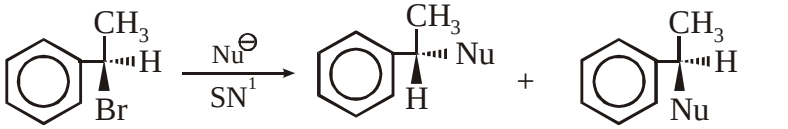
(B) Reactivity order IV > I > III

(C) I and III follows S_N1 mechanism as they form stable carbocation

(D) Compound IV undergoes inversion of configuration.



(inverted product)



(inverted product) (retained product)

6. Ans. (A)

Sol. (A) $Zn + 2NaOH \longrightarrow Na_2ZnO_2 + H_2$

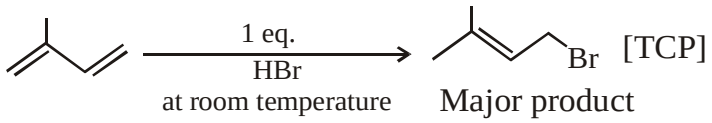
(B) $4Au + 8NaCN + O_2 + 2H_2O \longrightarrow 4Na[Au(CN)_2] + 4NaOH$

(C) $Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

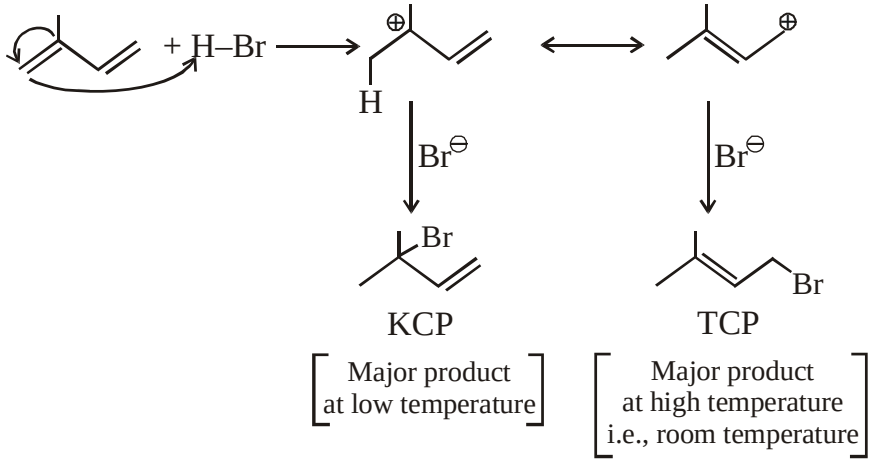
(conc.)

(D) Formation of passive layer of Fe_2O_3 on the surface of Fe and NO_2 gas is evolved.

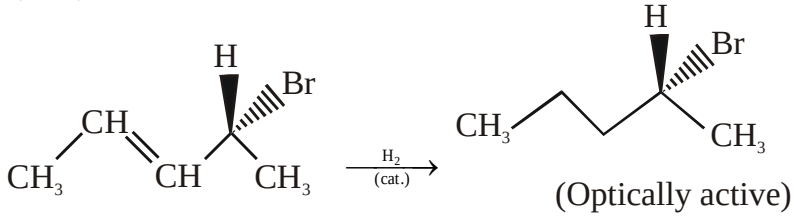
7. Ans. (D)

Sol. 

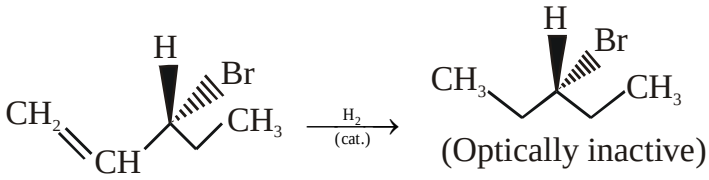
Machanism :



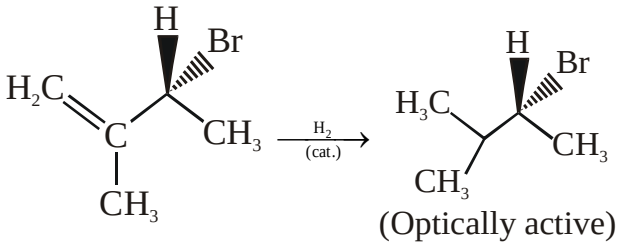
8. Ans. (B, D)

Sol. (A) 

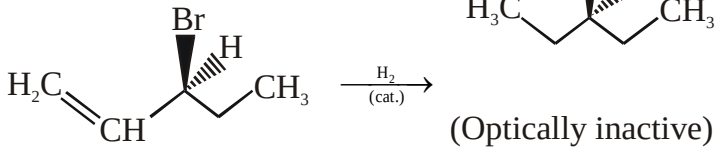
(Optically active)

(B) 

(Optically inactive)

(C) 

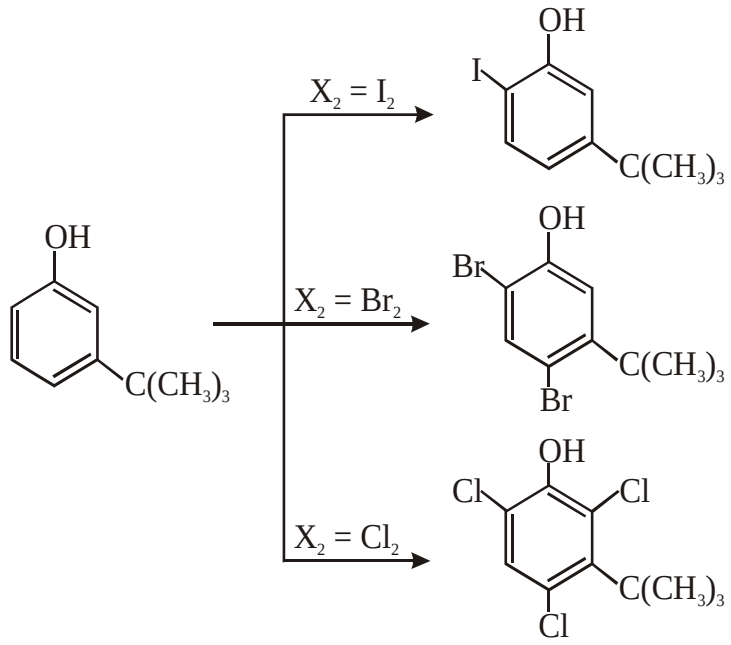
(Optically active)

(D) 

(Optically inactive)

9. Ans. (A, B, C)

Sol.



Orientation in electrophilic substition reaction is decided by

(A) The steric effect of the halogen

(B) The steric effect of the tert-butyl group

(C) The electronic effect of the phenolic group