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JEE Main 2026 Session 1

Chemistry
Solutions companion

300 questions / NCERT chapter navigation
Answers and available source solutions, in paper order.

Use the question numbers from the companion question paper. Brief source answers are identified wherever a detailed solution is unavailable.

Solutions on your phone

Scan to choose a chapter or question. You can also download all three solutions PDFs together.

learne2i.com/guess-paper/solutions/2026-session-1/

Open the PDF bookmarks panel on the left to jump between chapters. The chapter links in the guide are clickable too.

YOUR PRACTICE ROADMAP

Chapter & topic priorities

For this Session 2 collection, begin with **Hydrocarbons; Alcohols, Phenols and Ethers; Haloalkanes and Haloarenes**. These chapters have the largest share of the selected questions.

Practice weight = questions selected from a chapter / 300. Topic percentages use that chapter's question count. These are practice priorities from the prediction output, not guaranteed exam marks or probabilities.

NCERT chapter / leading topics	Priority	Questions	Weight
Some Basic Concepts of Chemistry Mole concept and stoichiometry: 5 (62.5%) / Mole calculations and concentrations: 1 (12.5%) / Mole concept: 1 (12.5%) / More topics in chapter guide	Next	1-8 (8)	2.7%
Classification of Elements and Periodicity in Properties Periodic trends: 3 (42.9%) / Classification of Elements and Periodicity in Properties: 2 (28.6%) / Electron gain enthalpy trend: 1 (14.3%) / More topics in chapter guide	Next	9-15 (7)	2.3%
Chemical Bonding and Molecular Structure Chemical bonding: 5 (62.5%) / Molecular orbital theory: 2 (25.0%) / Hybridisation: 1 (12.5%)	Next	16-23 (8)	2.7%
Thermodynamics Thermodynamics: 2 (100.0%)	Consolidate	24-25 (2)	0.7%
Equilibrium Chemical and ionic equilibrium: 10 (66.7%) / Chemical equilibrium: 2 (13.3%) / Basic buffer: 1 (6.7%) / More topics in chapter guide	Focus first	26-40 (15)	5.0%
Redox Reactions Oxidation-reduction principles: 2 (50.0%) / Oxidation states and redox reactions: 1 (25.0%) / Redox Reactions: 1 (25.0%)	Consolidate	41-44 (4)	1.3%
Organic Chemistry - Some Basic Principles and Techniques Organic reaction mechanisms: 5 (55.6%) / Organic Chemistry - Some Basic Principles and Techniques: 2 (22.2%) / Reaction intermediates: 1 (11.1%) / More topics in chapter guide	Next	45-53 (9)	3.0%
Hydrocarbons Reactions of hydrocarbons: 116 (93.5%) / Hydrocarbons: 3 (2.4%) / Acid-catalysed alkene reaction: 1 (0.8%) / More topics in chapter guide	Focus first	54-177 (124)	41.3%
Solutions Freezing point depression: 2 (33.3%) / Solution properties: 2 (33.3%) / Boiling point elevation: 1 (16.7%) / More topics in chapter guide	Consolidate	178-183 (6)	2.0%
Electrochemistry Electrochemical cells: 1 (50.0%) / Electrode potentials and electrolysis: 1 (50.0%)	Consolidate	184-185 (2)	0.7%

NCERT chapter / leading topics	Priority	Questions	Weight
Chemical Kinetics Initial-rate method: 1 (50.0%) / Integrated rate laws: 1 (50.0%)	Consolidate	186-187 (2)	0.7%
The p-Block Elements Main group element chemistry: 3 (60.0%) / Gas-evolution reactions: 1 (20.0%) / Group 16 properties: 1 (20.0%)	Consolidate	188-192 (5)	1.7%
The d- and f-Block Elements Properties of transition elements: 5 (62.5%) / The d- and f- Block Elements: 2 (25.0%) / Magnetic properties of transition ions: 1 (12.5%)	Next	193-200 (8)	2.7%
Coordination Compounds Coordination chemistry: 7 (70.0%) / Coordination Compounds: 1 (10.0%) / Coordination number and geometry: 1 (10.0%) / More topics in chapter guide	Next	201-210 (10)	3.3%
Haloalkanes and Haloarenes Nucleophilic substitution: 11 (68.8%) / Haloalkanes and Haloarenes: 2 (12.5%) / Reactivity of aryl halides: 2 (12.5%) / More topics in chapter guide	Focus first	211-226 (16)	5.3%
Alcohols, Phenols and Ethers Reactions of alcohols, phenols and ethers: 19 (59.4%) / Reactions of alcohols and phenols: 4 (12.5%) / Acid-catalysed dehydration: 2 (6.3%) / More topics in chapter guide	Focus first	227-258 (32)	10.7%
Aldehydes, Ketones and Carboxylic Acids Aldehydes, Ketones and Carboxylic Acids: 4 (44.4%) / Cannizzaro reaction: 1 (11.1%) / Carbonyl compounds and carboxylic acids: 1 (11.1%) / More topics in chapter guide	Next	259-267 (9)	3.0%
Amines Amines: 5 (45.5%) / Reactions of amines: 3 (27.3%) / Diazotisation and azo coupling: 1 (9.1%) / More topics in chapter guide	Focus first	268-278 (11)	3.7%
Biomolecules Carbohydrates: 8 (57.1%) / Structure and function of biomolecules: 3 (21.4%) / Biomolecules: 2 (14.3%) / More topics in chapter guide	Focus first	279-292 (14)	4.7%
Practical Chemistry (NCERT Laboratory Manual) Practical and qualitative chemistry: 1 (33.3%) / Qualitative chemical analysis: 1 (33.3%) / Qualitative inorganic analysis: 1 (33.3%)	Consolidate	293-295 (3)	1.0%
Hydrogen Historical appendix / omitted source chapter Hydrogen and its compounds: 1 (50.0%) / Hydrogen and water chemistry: 1 (50.0%)	Historical appendix	296-297 (2)	0.7%
The s-Block Elements Historical appendix / omitted source chapter Uses of alkali metals: 1 (100.0%)	Historical appendix	298-298 (1)	0.3%
Surface Chemistry Historical appendix / omitted source chapter Adsorption: 1 (50.0%) / Adsorption isotherms: 1 (50.0%)	Historical appendix	299-300 (2)	0.7%

How to use the priorities

1. Rank chapters by their selected question counts. Ties follow NCERT book order.
2. Focus first: chapters starting within the first 70% of selected, non-historical questions. Next: the following 20%. Consolidate: the remainder. A chapter crossing a threshold stays together.
3. Topic counts use the question's existing core concept, falling back to topic and then chapter. Each question is counted once. Full topic lists begin each chapter.
4. Historical/omitted chapters stay in a separate appendix. Their presence is not a recommendation that they are in the target examination syllabus.

Names follow NCERT Classes XI and XII. Practical chemistry is identified as a laboratory-manual section. Percentages are rounded and may not add to exactly 100.0%. Chapters with no selected questions are not listed; this does not mean they have no exam importance.

Chapter naming references: NCERT textbooks.

Some Basic Concepts of Chemistry

Question 1

A solution containing 2 g of a non-volatile solute in 20 g of water boils at 373.52 K . The molecular mass of the solute is $\mathbf{gmol^{-1}}$. (Nearest integer)
Given, water boils at $\mathbf{373\ K,\ K_b}$ for water $= \mathbf{0.52\ K\ kg\ mol^{-1}}$

Numerical answer: _____

Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 100

Source solution

100

$\mathbf{\Delta T_b = 373.52 - 373 = 0.52}$

$\mathbf{\Delta T_b = iK_b m \quad i = 1}$

$\mathbf{0.52 = 0.52 \times \frac{2/x}{20} \times 1000}$

$\mathbf{x = 100 gm/mol}$

Question 2

The molarity of the solution prepared by dissolving 6.3 g of oxalic acid $(\mathbf{H_2C_2O_4 \cdot 2H_2O})$ in 250 mL of water in $\mathbf{molL^{-1}}$ is $\mathbf{x \times 10^{-2}}$. The value of x is

. (Nearest integer)

[Atomic mass : $\mathbf{H : 1.0, C : 12.0, O : 16.0}$]

Numerical answer: _____

Enter the requested integer (0 decimal places).

Correct answer: 20

Source solution

$$[\mathbf{H_2C_2O_4 \cdot 2H_2O}] = \frac{\mathbf{weight\ /M_w}}{\mathbf{V(L)}}$$

$$\Rightarrow \mathbf{x \times 10^{-2}} = \frac{\mathbf{6.3/126}}{\mathbf{250/1000}}$$

$$\mathbf{x = 20}$$

Question 3

Quantitative analysis of an organic compound (X) shows following % composition.

C : 14.5%

Cl : 64.46%

H : 1.8%

(Empirical formula mass of the compound $(\mathbf{X})$ is

$\times 10^{-1}$

(Given molar mass in $\mathbf{gmol}^{-1}$ of $\mathbf{C : 12, H : 1, O : 16, Cl : 35.5}$)

Numerical answer: _____

Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 1655

Source solution

	C	Cl	H	O
\%mass	14.5	64.46	1.8	19.24
Molar ratio	$\frac{14.5}{12}$	$\frac{64.46}{35.5}$	$\frac{1.8}{1}$	$\frac{19.24}{16}$
	1.2	1.8	1.8	1.2
Minimum integral ratio	2	3	3	2

Empiricial formula $= \mathrm{C_2H_3Cl_3O_2}$

Mass $= 165.5$

Mass $= 1655 \times 10^{-1}$

Question 4

Match List I with List II

LIST I (molecules/ions)		LIST II (No. of lone pairs of e^- on central atom)	
A.	IF_7	I.	Three
B.	ICl_4^-	II.	One
C.	XeF_6	III.	Two
D.	XeF_2	IV.	Zero

Choose the correct answer from the options given below:

A. A - II, B - III, C - IV, D - I

B. A - II, B - I, C - IV, D - III

C. A - IV, B - I, C - II, D - III

D. A - IV, B - III, C - II, D - I

Correct answer: D

Source solution

Molecule
IF_7
\href{http://l.pe}{l.pe} $^-$of C.M.
ICl_4^-
0
XeF_6
2
XeF_2
1
3

Question 5

Number of molecules having bond order 2 from the following molecule is .

$C_2, O_2, Be_2, Li_2, Ne_2, N_2, He_2$

Numerical answer: _____

Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 2

Source solution

C_2

$(12e^-) : \sigma 1\,s^2, \sigma^* 1\,s^2, \sigma 2\,s^2, \sigma^* 2\,s^2\ [\pi 2p_x^2 = \pi 2p_y^2]$

B.O. $= \frac{8-4}{2} = 2$

O_2

$(16e^-) : \sigma 1\,s^2, \sigma^* 1\,s^2, \sigma 2\,s^2, \sigma^* 2\,s^2, \sigma 2pz^2$

$[\pi 2p_x^2 = \pi 2p_y^2]\ [\pi * 2p_x^1 = \pi^* 2p_y^1]$

B.O. $= \frac{10-6}{2} = 2$

Be_2

$(8e^-)$: $\sigma 1\,s^2, \sigma^* 1\,s^2, \sigma 2\,s^2, \sigma^* 2\,s^2$

B.O. $= \frac{4-4}{2} = 0$

Li_2

$(6e^-) : \sigma 1\,s^2, \sigma^* 1\,s^2, \sigma 2\,s^2$

B.O. $= \frac{4-2}{2} = 1$

Ne_2

$(20e^-) : \sigma 1\,s^2, \sigma^* 1\,s^2, \sigma 2\,s^2, \sigma^* 2\,s^2, \sigma 2pz^2$

$[\pi 2p_x^2 = \pi 2p_y^2]\ [\pi * 2p_x^2 = \pi^* 2p_y^2] \sigma^* 2p_z^2$

B.O. $= \frac{10-10}{2} = 0$

N_2

$(14e^-) : \sigma 1\,s^2, \sigma^* 1\,s^2, \sigma 2\,s^2, \sigma^* 2\,s^2\ [\pi 2p_x^2 = \pi 2p_y^2] \sigma 2p_z^2$

B.O. $= \frac{10-4}{2} = 6$

He_2

$(4e^-) : \sigma 1\,s^2, \sigma^* 1\,s^2$

B.O. $\frac{2-2}{2} = 0$

Question 6

Number of molecules from the following which are exceptions to octet rule is .

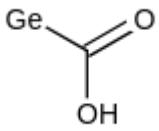
$CO_2, NO_2, H_2SO_4, BF_3, CH_4, SiF_4, ClO_2, PCl_5, BeF_2, C_2H_6, CHCl_3, CBr_4$

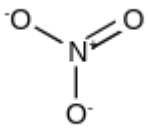
Numerical answer: _____

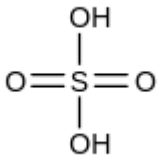
Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

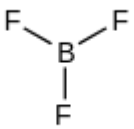
Correct answer: 6

Source solution

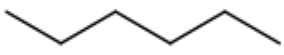




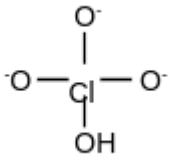


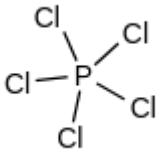


exception to octet rule



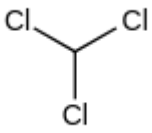




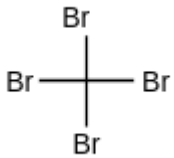


exception exception to $\mathbf{F-Be-F}$ to octet rule octet rule
exception to octet rule

complete octet



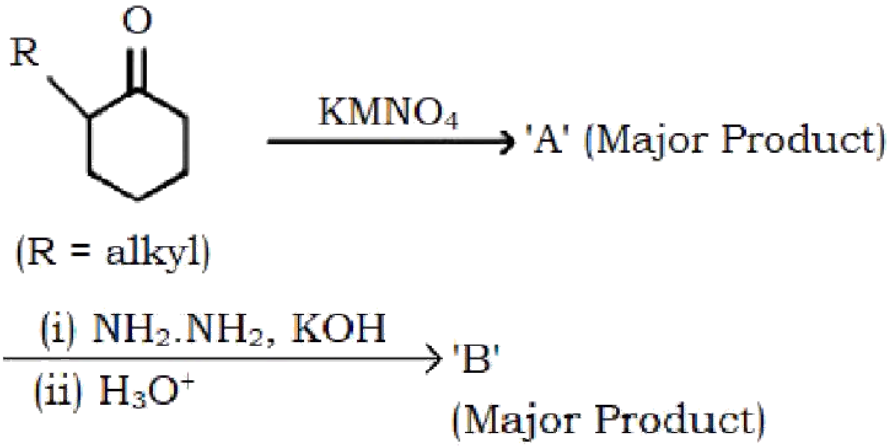
complete octet



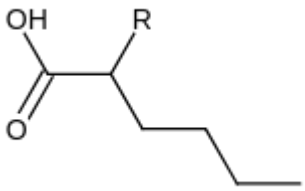
complete octet

Question 7

A' and 'B' in the below reactions are :



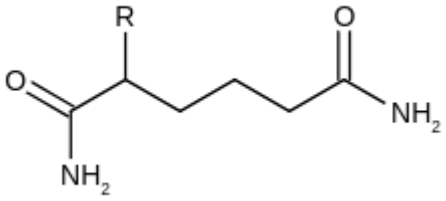
A. $= A$,
$B =$



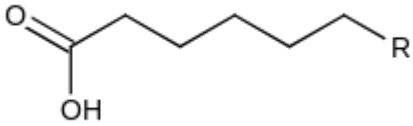
B. =A,
$B =$



C. $B =$



D. = A,
$B =$



Correct answer: D

Source solution

\textbf{Solution:}

The given compound is a cyclohexanone having an alkyl substituent R.

$$\text{Cyclohexanone} \xrightarrow[\text{Hot}]{KMnO_4} A$$

Hot alkaline $\mathbf{KMnO_4}$ oxidatively cleaves the cyclic ketone ring to give the corresponding open-chain carboxylic acid.

Hence, $\boldsymbol{A}$ is

$$\boxed{\mathbf{HOOC-(CH_2)_4-R}}$$

Now,

$$A \xrightarrow[(ii)\ H_3O^+]{(i)\ NH_2NH_2,\ KOH} B$$

The reagent $\mathbf{NH_2NH_2/KOH}$ (Wolff–Kishner reduction) reduces only aldehyde or ketone carbonyl groups to $-CH_2-$.

Since $\boldsymbol{A}$ contains a carboxylic acid group and no aldehyde/ketone group, it remains unchanged under these conditions.

Therefore,

$$\boxed{B = A = \mathbf{HOOC-(CH_2)_4-R}}$$

Hence, the correct option is

$$\boxed{(4)}$$

Question 8

Match List-I with List-II :

	List-I (Species)		List-II (Maximum allowed concentration in ppm in drinking water)
A.	F^-	I.	$< 50ppm$
B.	SO_4^{2-}	II.	$< 5ppm$
C.	NO_3^-	III.	$< 2ppm$
D.	Zn	IV.	$< 500ppm$

A. A-II, B-I, C-III, D-IV

B. A-IV, B-III, C-II, D-I

C. A-I, B-II, C-III, D-IV

D. A-III, B-II, C-I, D-IV

Correct answer: D

Source solution

Correct answer
A-III, B-IV, C-I, D-II

Classification of Elements and Periodicity in Properties

Question 9

Which of the following reaction is correct?

A. $4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 2\ N_2O_4 + O_2$

B. $2LiNO_3 \xrightarrow{\Delta} 2NaNO_2 + O_2$

C. $2LiNO_3 \rightarrow 2Li + 2NO_2 + O_2$

D. $4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 4NO_2 + O_2$

Correct answer: D

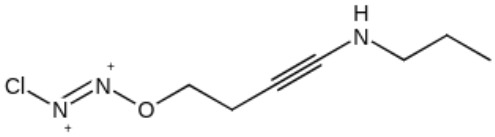
Source solution

$4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 4NO_2 + O_2$

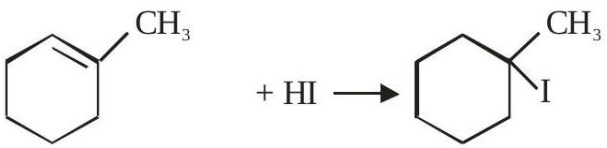
Question 10

Which of the following reaction is correct ?

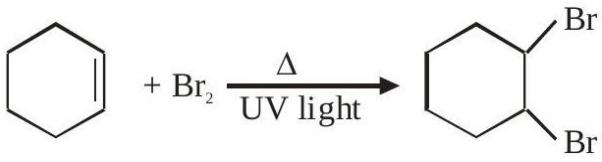
A.



B.



C.

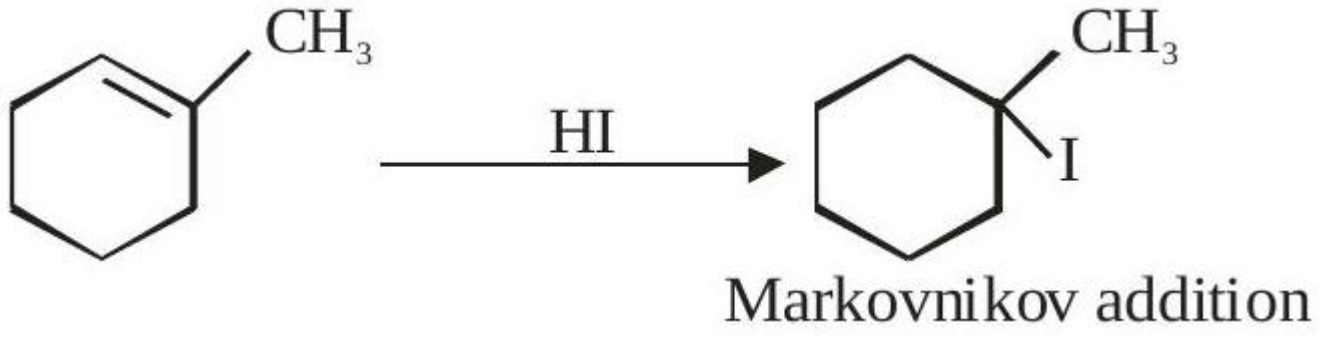


D.

$$C_2H_5CONH_2 + Br_2 + NaOH \rightarrow C_2H_5CH_2NH_2 + Na_2CO_3 + NaBr + H_2O$$

Correct answer: B

Source solution



Question 11

Given below are two statements :

Statement I : Both $CaCl_2 \cdot 6H_2O$ and $MgCl_2 \cdot 8H_2O$ undergo dehydration on heating.
Statement II : BeO is amphoteric whereas the oxides of other elements in the same group are acidic.

In the light of the above statements, choose the correct answer from the options given below :

A. Statement I is false but statement II is true

B. Both statement I and statement II are false

C. Both statement I and statement II are true

D. Statement I is true but statement II is false

TEST PAPER WITH ANSWER & SOLUTION

Correct answer: B

Source solution

(a) $CaCl_2 \cdot 6H_2O \xrightarrow{\Delta} \underset{\text{(Anhydrous)}}{CaCl_2} + 6H_2O$

(b) $MgCl_2 \cdot 8H_2O \xrightarrow{\Delta} MgO + 2HCl + 6H_2O$

The dehydration of hydrated chloride of calcium can be achieved. The corresponding hydrated chloride of magnesium on heating suffer hydrolysis.

(c) $BeO \rightarrow$ Amphoteric

$$\left.\begin{matrix} MgO \\ CaO \\ SrO \\ BaO \end{matrix}\right] \Rightarrow \text{All are basic oxide}$$

Question 12

Match the LIST-I with LIST-II.

LIST-I	Family	LIST-II	Symbol
A.	Pnictogen (Group 15)	I.	Ts
B.	Chalcogen	II.	Og
C.	Halogen	III.	Lv
D.	Noble Gas	IV.	Mc

Choose the correct answer from the options given below.

A. A-IV, B-I, C-II, D-III

B. A-IV, B-III, C-I, D-II

C. A-III, B-I, C-IV, D-II

D. A-II, B-III, C-IV, D-I

Correct answer: B

Source solution

Sol.

$$A \rightarrow \text{Mc (115)}$$
$$B \rightarrow \text{Lv (116)}$$
$$C \rightarrow \text{Ts (117)}$$
$$D \rightarrow \text{Og (118)}$$

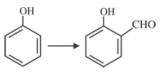
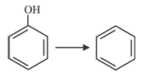
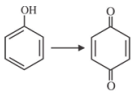
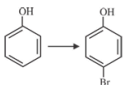
$$A - \text{IV}, \quad B - \text{III}, \quad C - \text{I}, \quad D - \text{II}$$

$$\text{Correct Answer : (2)}$$

Question 13

Match List I with List II

Choose the correct answer from the options given below:

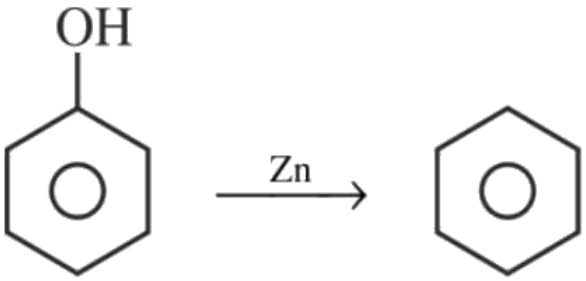
List I	List II
A. 	I. Br_2 in CS_2
B. 	II. $Na_2Cr_2O_7/H_2SO_4$
C. 	III. Zn
D. 	IV. $CHCl_3/NaOH$

A. A-IV, B-III, C-II, D-I

B. A-IV, B-III, C-I, D-II

C. A-II, B-III, C-I, D-IV

D. A-IV, B-II, C-III, D-I



Correct answer: A

Source solution

Sol.

Identify each reaction:

(A)

Phenol is converted into salicylaldehyde (*o*-hydroxybenzaldehyde).

This is the Reimer–Tiemann reaction, which uses

$$\boxed{\mathrm{CHCl_3/NaOH}}$$

Hence,

$$A \rightarrow IV$$

\vspace{0.3cm}

(B)

Phenol is reduced to benzene by distillation with zinc dust.

$$\mathrm{C_6H_5OH \xrightarrow{Zn} C_6H_6}$$

Hence,

$$B \rightarrow III$$

\vspace{0.3cm}

(C)

Phenol is oxidized to p-benzoquinone.

This oxidation is carried out by

$$\boxed{\mathrm{Na_2Cr_2O_7/H_2SO_4}}$$

Hence,

$$C \rightarrow II$$

\vspace{0.3cm}

(D)

Phenol undergoes bromination in a non-polar solvent (CS_2) to give mainly p-bromophenol.

$$\boxed{\mathrm{Br_2 \text{ in } CS_2}}$$

Hence,

$$D \rightarrow I$$

\vspace{0.3cm}

Therefore,

$$\boxed{A - IV,\ B - III,\ C - II,\ D - I}$$

$$\boxed{\text{Correct Answer : (1)}}$$

Question 14

Match List I with List II

List-I		List-II	
A.	Melting point [K]	I.	$\mathbf{Tl > In > Ga > Al > B}$
B.	Ionic Radius [$\mathbf{M^{+3}/pm}$]	II.	$\mathbf{B > Tl > Al \approx Ga > In}$
C.	$\mathbf{\Delta_i H_1}$ [$\mathbf{kJmol^{-1}}$]	III.	$\mathbf{Tl > In > Al > Ga > B}$
D	Atomic Radius [pm]	IV.	$\mathbf{B > Al > Tl > In > Ga}$

Choose the correct answer from the options given below:

A. A-III, B-IV, C-I, D-II

B. A-II, B-III, C-IV, D-I

C. A-IV, B-I, C-II, D-III

D. A-I, B-II, C-III, D-IV

Correct answer: C

Source solution

Melting point : $\mathbf{B > A\ell > T\ell > In > Ga}$
Ionic radius $\left(\mathbf{M^{+3}/pm}\right)$: $\mathbf{T\ell > In > Ga > A\ell > B}$
$\left(\mathbf{\Delta_{IE}\,H}\right)_1 \left[\frac{\mathbf{kJ}}{\mathbf{mol}}\right]$: $\mathbf{B > T\ell > A\ell \approx Ga > In}$
Atomic radius (in pm): $\mathbf{T\ell > In > A\ell > Ga > B}$

Question 15

Match List-I with List-II.

List-I	Elements
A	Cl, S
B	Ge, As
C	Fr, Ra
D	F, O

List-II	Properties
I	Highest electronegativity
II	Largest atomic size
III	Properties of both metals and non-metals
IV	Highest negative electron gain enthalpy

Choose the correct answer from the options given below.

A. A-II, B-III, C-IV, D-I

B. A-III, B-II, C-I, D-IV

C. A-IV, B-III, C-II, D-I

D. A-II, B-I, C-IV, D-III

Correct answer: C

Source solution

Sol.

$$\begin{aligned} \mathrm{F, O} &\\ &\rightarrow \text{Highest electronegativity} \\ \mathrm{Fr, Ra} &\\ &\rightarrow \text{Largest atomic size} \\ \mathrm{Ge, As} &\\ &\rightarrow \text{Metalloids} \\ \mathrm{Cl, S} &\\ &\rightarrow \text{Highest negative electron gain enthalpy} \end{aligned}$$

Therefore,

$$A \to IV$$

$$B \to III$$

$$C \to II$$

$$D \to I$$

$$\boxed{A - IV,\ B - III,\ C - II,\ D - I}$$

Correct Answer: (3)

Chemical Bonding and Molecular Structure

Question 16

Total number of species from the following with central atom utilising $2p^2$ hybrid orbitals for bonding is

.

$NH_3, SO_2, SiO_2, BeCl_2, C_2H_2, C_2H_4, BCl_3, HCHO, C_6H_6, BF_3, C_2H_4Cl_2$

Numerical answer: _____

Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 6

Source solution

Central atom utilising sp^2 hybrid orbitals $SO_2, C_2H_4, BCl_3, HCHO, C_6H_6, BF_3$

Question 17

Match List-I with List-II

List-I (Molecule/Ion)	List-II (Hybridisation)
$A.\ PF_5$	$I.\ dsp^2$
$B.\ SF_6$	$II.\ sp^3d$
$C.\ Ni(CO)_4$	$III.\ sp^3d^2$
$D.\ [PtCl_4]^{2-}$	$IV.\ sp^3$

Choose the correct answer from the options given below.

A. A-II, B-III, C-IV, D-I

B. A-IV, B-I, C-II, D-III

C. A-I, B-II, C-III, D-IV

D. A-III, B-I, C-IV, D-II

Correct answer: A

Source solution

Solution:

$$PF_5$$

$$5 \text{ bond pairs } + 0 \text{ lone pair}$$

$$\Rightarrow sp^3d$$

$$A \rightarrow II$$

$$\mathrm{SF_6}$$

$$\text{6 bond pairs } + 0 \text{ lone pair}$$

$$\Rightarrow \mathrm{sp^3d^2}$$

$$B \rightarrow III$$

$$\mathrm{Ni(CO)_4}$$

$$\text{Tetrahedral complex}$$

$$\Rightarrow \mathrm{sp^3}$$

$$C \rightarrow IV$$

$$\mathrm{[PtCl_4]^{2-}}$$

$$\text{Square planar complex}$$

$$\Rightarrow \mathrm{dsp^2}$$

$$D \rightarrow I$$

$$\boxed{A-II,\ B-III,\ C-IV,\ D-I}$$

Correct Option (1)

Question 18

Match List-I with List-II

List-I (Molecule)	**List-II** (Bond order)
(a) Ne_2	(i) 1
(b) N_2	(ii) 2
(c) F_2	(iii) 0
(d) O_2	(iv) 3

Choose the correct answer from the options given below.

A. (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

B. (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

C. (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

D. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

Correct answer: A

Source solution

Solution

Using Molecular Orbital Theory:

$$Ne_2: \quad \text{Bond Order} = \frac{N_b - N_a}{2} = 0$$

$$\therefore Ne_2 \rightarrow (iii)$$

$$\mathrm{N_2}: \quad \text{Bond Order} = 3$$

$$\therefore \mathrm{N_2} \rightarrow (iv)$$

$$\mathrm{F_2}: \quad \text{Bond Order} = 1$$

$$\therefore \mathrm{F_2} \rightarrow (i)$$

$$\mathrm{O_2}: \quad \text{Bond Order} = 2$$

$$\therefore \mathrm{O_2} \rightarrow (ii)$$

$$\boxed{A \rightarrow III,\ B \rightarrow IV,\ C \rightarrow I,\ D \rightarrow II}$$

$$\boxed{(a)-(iii),\ (b)-(iv),\ (c)-(i),\ (d)-(ii)}$$

$$\boxed{\text{Correct Answer}: (1)}$$

Question 19

Match List-I with List-II

List-I	List-II
A. Molecules obeying octet rule	*I*. NO, NO_2
B. Molecules with incomplete octet	*II*. BCl_3, $AlCl_3$
C. Molecules with odd electron	*III*. H_2SO_4, PCl_5
D. Molecules with expanded octet	*IV*. CCl_4, CO_2

Choose the correct answer from the options given below :

A. A-IV, B-II, C-I, D-III

B. A-III, B-II, C-I, D-IV

C. A-IV, B-I, C-III, D-II

D. A-II, B-IV, C-III, D-I

Correct answer: A

Source solution

Solution

A. Molecules obeying octet rule

CCl_4, CO_2

$\Rightarrow$ (IV)

B. Molecules with incomplete octet

$$BCl_3,\ AlCl_3$$

$$\Rightarrow (II)$$

C. Molecules with odd electron

$$NO,\ NO_2$$

$$\Rightarrow (I)$$

D. Molecules with expanded octet

$$H_2SO_4,\ PCl_5$$

$$\Rightarrow (III)$$

$$\therefore$$

$$A-IV,\quad B-II,\quad C-I,\quad D-III$$

Correct Answer : (1)

Question 20

Match List-I with List-II

List-I	List-II
$A.\ SO_2Cl_2$	$I.$ Paramagnetic
$B.\ NO$	$II.$ Diamagnetic
$C.\ NO_2^-$	$III.$ Tetrahedral
$D.\ I_3^-$	$IV.$ Linear

Choose the correct answer from the options given below :

A. A-IV, B-I, C-III, D-II

B. A-III, B-I, C-II, D-IV

C. A-II, B-III, C-I, D-IV

D. A-III, B-IV, C-II, D-I

Correct answer: B

Source solution

Solution

$$SO_2Cl_2 \Rightarrow \text{Tetrahedral} \Rightarrow (\text{III})$$

$$NO \Rightarrow \text{One unpaired electron} \Rightarrow \text{Paramagnetic} \Rightarrow (\text{I})$$

$$NO_2^- \Rightarrow \text{All electrons paired} \Rightarrow \text{Diamagnetic} \Rightarrow (\text{II})$$

$$I_3^- \Rightarrow \text{Linear} \Rightarrow (\text{IV})$$

$$\therefore A - \text{III}, \quad B - \text{I}, \quad C - \text{II}, \quad D - \text{IV}$$

Correct Answer : (2)

Question 21

Match List I with List II :

List-I (molecule)	List-II (hybridization; shape)
A. XeO_3	I. $sp^3\ d$; linear
B. XeF_2	II. sp^3; pyramidal
C. $XeOF_4$	III. $sp^3\ d^3$; distorted octahedral
D. XeF_6	IV. $sp^3\ d^2$; square pyramidal

Choose the correct answer from the options given below:

A. A-II, B-I, C-IV, D-III

B. A-II, B-IV, C-III, D-I

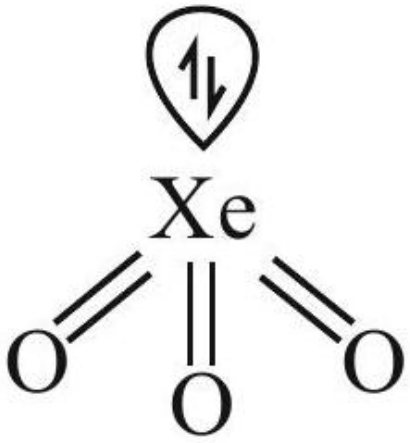
C. A-IV, B-II, C-III, D-I

D. A-IV, B-II, C-I, D-III

Correct answer: A

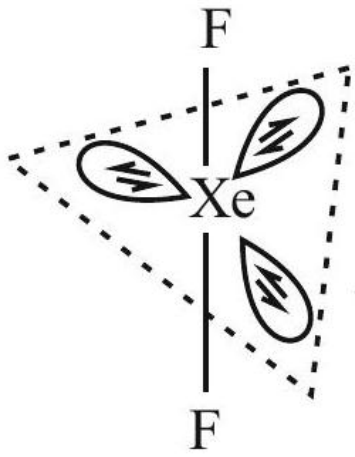
Source solution

(A)



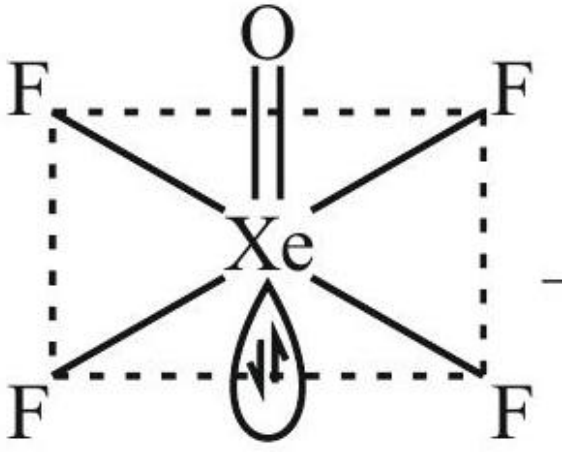
– sp^3 – pyramidal

(B)



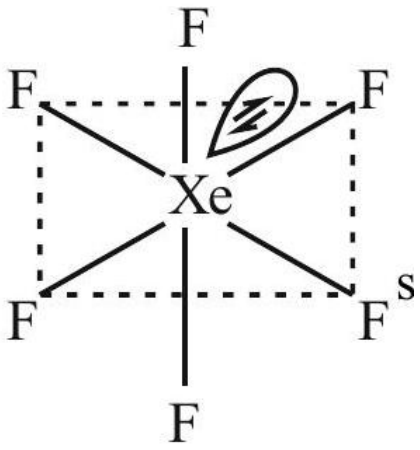
– sp^3d – linear

(C)



$-\mathbf{sp^3\ d^2}-$ square pyramidal

(D)



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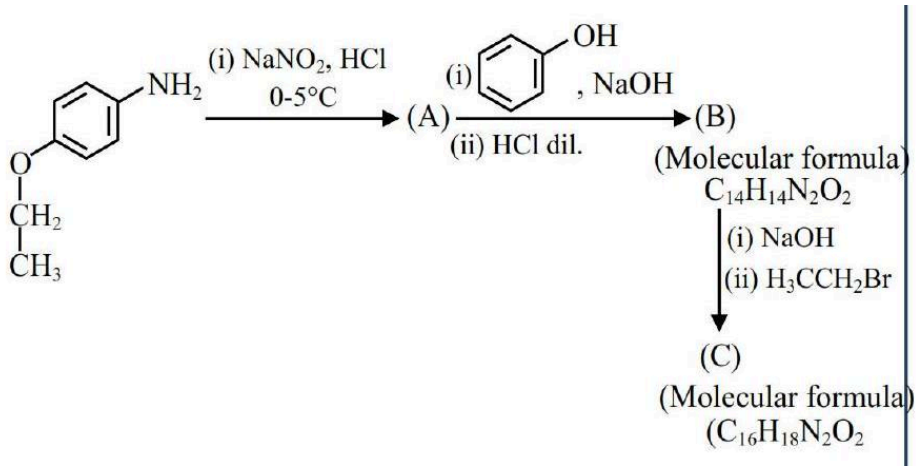
TEST PAPER WITH SOLUTION

Question 22

Consider the following sequence of reactions.



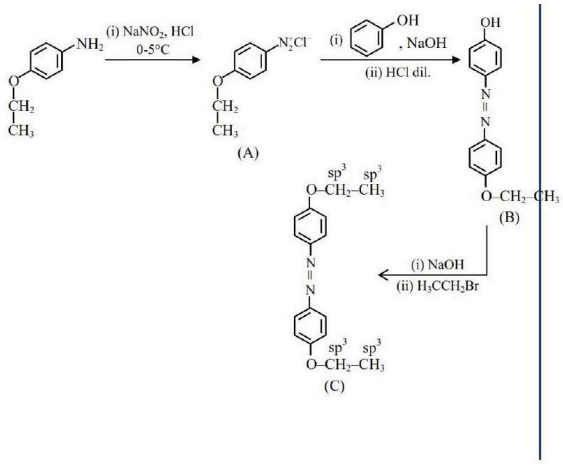
Total number of $\mathbf{sp^3}$ hybridised carbon atoms in the major product C formed is .

Numerical answer: _____

Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 4

Source solution



Question 23

Match List-I with List-II

List-I

(A) $\Psi_{MO} = \Psi_A - \Psi_B$
(B) $\mu = Q \times r$
(C) $\frac{N_b - N_a}{2}$
(D) $\Psi_{MO} = \Psi_A + \Psi_B$

List-II

(I) Dipole moment
(II) Bonding molecular orbital
(III) Anti-bonding molecualr orbital
(IV) Bond order

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

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

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

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

Correct answer: C

Source solution

TEST PAPER WITH SOLUTION

Sol.
(A) $\psi_{MO} = \psi_A - \psi_B$
(III) ABMO
(B) $\mu = Q \times r$
(I) Dipole moment
(C) $\frac{N_b - N_a}{2}$
(IV) Bond order
(D) $\psi_{MO} = \psi_A + \psi_B$
(II) BMO

Thermodynamics

Questions 24-25 / 2 selected / 0.7% practice weight / Consolidate

Question 24

For the reaction $2NO_2(g) \rightleftharpoons N_2O_4(g)$, when $\Delta S = -176.0 JK^{-1}$ and $\Delta H = -57.8\ kJ\ mol^{-1}$, the magnitude of ΔG at 298 K for the reaction is ___ $kJmol^{-1}$. (Nearest integer)

Numerical answer: _____

Enter the requested integer (0 decimal places).

Correct answer: 5

Source solution

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G = 57.8 - \frac{298(-176)}{1000}$$
$$\Delta G = -5.352\ kJ/mol$$

| Nearest integer value |$= 5$

Question 25

For the reaction at $298\ K, 2\ A + B \rightarrow C$. $\Delta H = 400\ kJ\ mol^{-1}$ and $\Delta S = 0.2\ kJ\ mol^{-1}\ K^{-1}$. The reaction will become spontaneous above K.

Numerical answer: _____

Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 2000

Source solution

$\Delta G = 0$
$T = \frac{\Delta H}{\Delta S} = \frac{400}{0.2} = 2000\ K$

Equilibrium

Questions 26-40 / 15 selected / 5.0% practice weight / Focus first

Question 26

For the reaction,
$\mathbf{2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)}$,
$\mathbf{\Delta H = -57.2\ kJ\ mol^{-1}}$ and $\mathbf{K_c = 1.7 \times 10^{16}}$.
Which of the following statement is INCORRECT?

A. The equilibrium constant is large suggestive of reaction going to completion and so no catalyst is required.

B. The addition of inert gas at constant volume will not affect the equilibrium constant.

C. The equilibrium will shift in forward direction as the pressure increases.

D. The equilibrium constant decreases as the temperature increases.

Correct answer: A

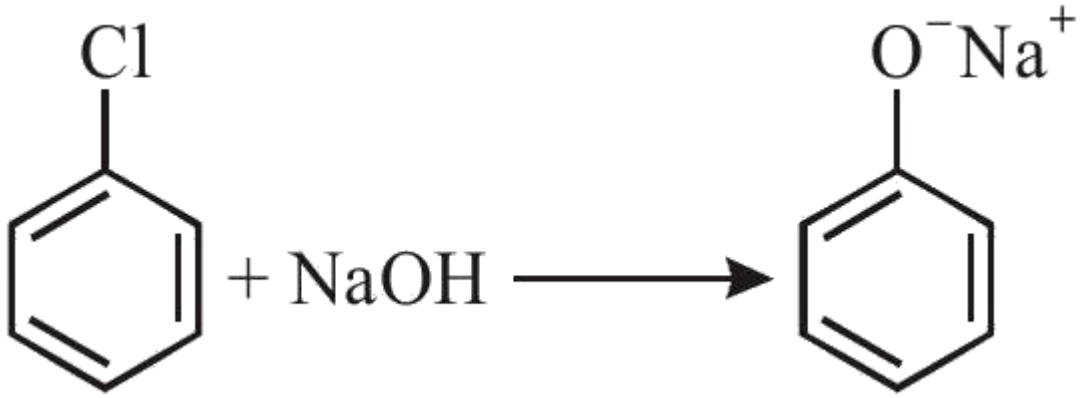
Source solution

Sol. $\mathbf{2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)}$
$\boldsymbol{K_c = 1.7 \times 10^{16}}$ i.e. reaction goes to completion. Equilibrium constant has no relation with catalyst. Catalyst only affects the rate with which a reaction proceeds.

For the given reaction, catalyst $\mathbf{V_2O_5}$ is used to speed up the reaction (Contact process).

Question 27

The above reaction requires which of the following reaction conditions?



A. $573\ K, Cu, 300\ atm$

B. $623\ K, Cu, 300\ atm$

C. $573\ K, 300\ atm$

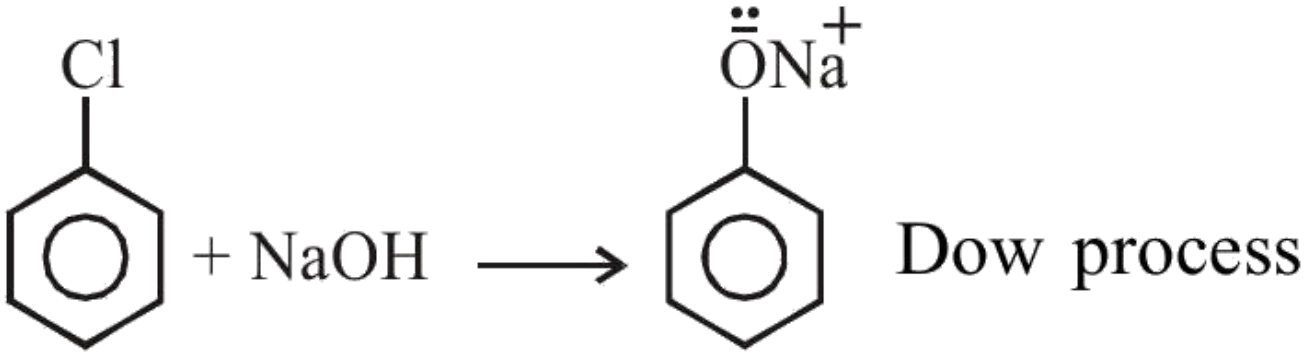
D. $623\ K, 300\ atm$

Correct answer: D

Source solution

Sol.

Temperature = $623\ K$
Pressure = $300\ atm$



Question 28

When 5.1 g of solid $\mathbf{NH_4HS}$ is introduced into a two litre evacuated flask at $\mathbf{27^\circ C, 20\%}$ of the solid decomposes into gaseous ammonia and hydrogen sulphide. The $\mathbf{K_p}$ for the reaction at $\mathbf{27^\circ C}$ is $\mathbf{x \times 10^{-2}}$. The value of $\boldsymbol{x}$ is . (Integer answer)
[Given $\mathbf{R = 0.082\ L\ atm\ K^{-1}\ mol^{-1}}$]

Numerical answer: _____

Enter the requested integer (0 decimal places).

Correct answer: 6

Source solution

moles of $\mathbf{NH_4HS}$ initially taken $= \frac{5.1\ g}{51\ g/mol}$

$$= 0.1\ mol$$

volume of vessel $= 2\ell$

	$\mathbf{NH_4HS_{(s)} \rightleftharpoons}$	$\mathbf{NH_{3(g)} + H_2S_{(g)}}$	
$\mathbf{t = 0}$	0.1 mol		
$\mathbf{t = \infty}$	$\mathbf{0.1(1 - 0.2)}$	$\mathbf{0.1 \times 0.2}$	$\mathbf{0.1 \times 0.2}$

$\Rightarrow$ partial pressure of each component
$\mathbf{P = \frac{nRT}{V} = \frac{0.1 \times 0.2 \times 0.082 \times 300}{2}}$
$\mathbf{= 0.246\ atm}$
$\mathbf{\Rightarrow k_P = P_{NH_3} \times P_{H_2S} = (0.246)^2 = 0.060516}$
$\mathbf{= 6.05 \times 10^{-2}}$
$\mathbf{\Rightarrow 6}$

Question 29

At $-20^{\circ}\mathrm{C}$ and 1 atm pressure, a cylinder is filled with equal number of $\mathrm{H_2}.\mathrm{I_2}$ and HI molecules for the reaction
$\mathrm{H_2(g) + I_2(g) \rightleftharpoons 2HI(g)}$, the $\mathrm{K_P}$ for the process is $\mathrm{x \times 10^{-1}}$. x = ...
[Given : $\mathrm{R = 0.082\ L\ atm\ K^{-1}\ mol^{-1}}$]

A. 2

B. 1

C. 10

D. 0.01

Correct answer: C

Source solution

Sol. $\mathrm{\Delta n_g = 0}$
$\mathrm{K_p = \frac{(n_{HI})^2}{n_{H_2} n_{I_2}} \left(\frac{P_T}{n_T}\right)^{\Delta n_g}}$
$\mathrm{n_{HI} = n_{H_2} = n_{I_2}}$
so $\mathrm{K_P = 1}$
$\mathrm{1 = x \times 10^{-1}}$
$\mathrm{x = 10}$

Question 30

The OH^- concentration in a mixture of 5.0 mL of $0.0504 M NH_4Cl$ and 2 mL of $0.0210 M NH_3$ solution is $x \times 10^{-6} M$. The value of x is .
(Nearest integer)
[Given $K_w = 1 \times 10^{-14}$ and $K_b = 1.8 \times 10^{-5}$]

Numerical answer: _____

Enter the requested integer (0 decimal places).

Correct answer: 3

Source solution

$[NH_4^+] = 0.0504 \& [NH_3] = 0.0210$
So $K_b = \frac{[NH_4^+][HO^-]}{[NH_3]}$
$[HO^-] = \frac{K_b \times [NH_3]}{[NH_4^+]} = 1.8 \times 10^{-5} \times \frac{2}{5} \times \frac{210}{504} = 3 \times 10^{-6}$

Question 31

The equilibrium constant K_c at 298 K for the reaction $A + B \rightleftharpoons C + D$ is 100 . Starting with an equimolar solution with concentrations of A, B, C and D all equal to 1 M , the equilibrium concentration of D is $\times 10^{-2}$ M. (Nearest integer)

Numerical answer: _____

Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 182

Source solution

$A + B \rightleftharpoons C + D : K_{eq} = 100$

$1M \quad 1M \quad 1M \quad 1M$

First check direction of reversible reaction.
Since $Q_C = \frac{[C][D]}{[A][B]} = 1 < K_{eq}$. $\Rightarrow$ reaction will move in forward direction to attain equilibrium state.
$\Rightarrow A + B \rightleftharpoons C + D : K_{eq} = 100$
$\text{to} \quad 1 \quad 1 \quad 1 \quad 1$
$t_{eq.} \; 1-x \quad 1-x \quad 1+x \quad 1+x$
Now : $K_{eq} = 100 = \frac{(1+x)(1+x)}{(1-x)(1-x)}$

$$\Rightarrow \quad 100 = \left(\frac{1+x}{1-x}\right)^2$$

(i) $10 = \left(\frac{1+x}{1-x}\right)$
$\Rightarrow 10 - 10x = 1 + x$
$\Rightarrow 11x = 9$
$\Rightarrow x = \frac{9}{11}$
(ii) $-10 = \frac{1+x}{1-x}$
$\Rightarrow -10 + 10x = 1 + x$
$\Rightarrow -9x = -11$
$\Rightarrow x = \frac{11}{9}$
$\rightarrow 'x'$ cannot be more than one, therefore not valid. therefore equation concretion of (D) $= 1 + x$

$$= 1 + \frac{9}{11} = \frac{20}{11}$$
$$= 1.8181 = 181.81 \times 10^{-2}$$
$$\simeq 182 \times 10^{-2}$$

Question 32

Match List I with List II

LIST I		LIST II	
A.	Chlorophyll	I.	Na_2CO_3
B.	Soda ash	II.	$CaSO_4$
C.	Dentistry, Ornamental work	III.	Mg^{2+}
D.	Used in white washing	IV.	$Ca(OH)_2$

Choose the correct answer from the options given below:

A. A-II, B-I, C-III, D-IV

B. A-III, B-I, C-II, D-IV

C. A-II, B-III, C-IV, D-I

D. A-III, B-IV, C-I, D-II

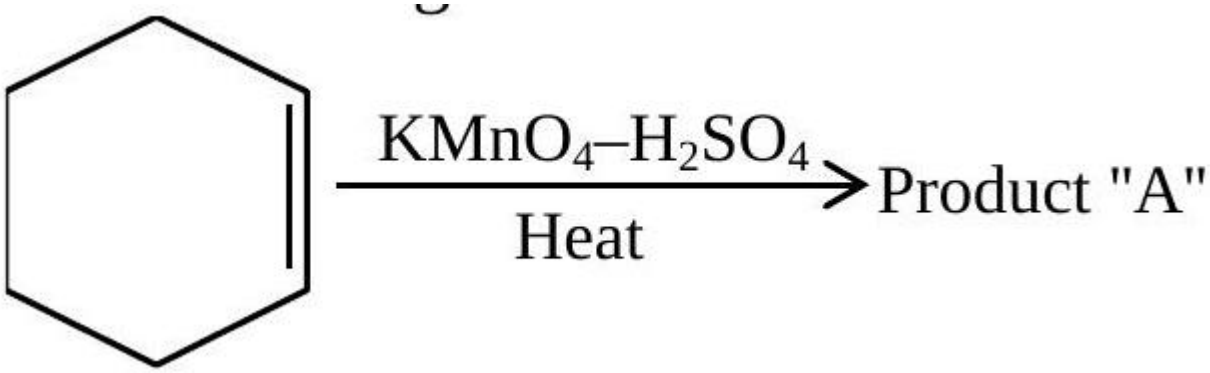
Correct answer: B

Source solution

Chlrophyl $\rightarrow Mg^{2+}$
Sodaash $\rightarrow Na_2CO_3$
Destistry &
ornamental work $\rightarrow CaSO_4$
White washing $\rightarrow Ca(OH)_2$

Question 33

Consider the given chemical reaction :



Product " A " is :

A. picric acid

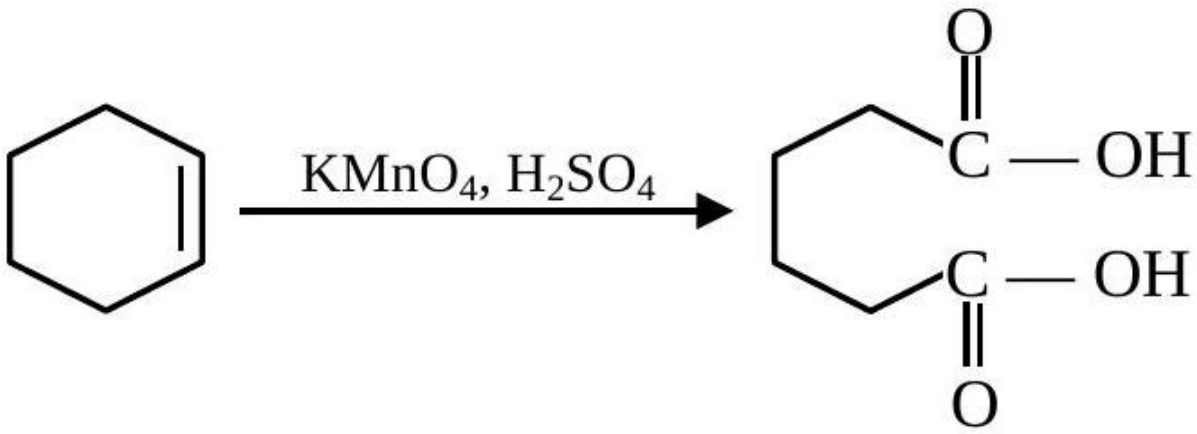
B. oxalic acid

C. acetic acid

D. adipic acid

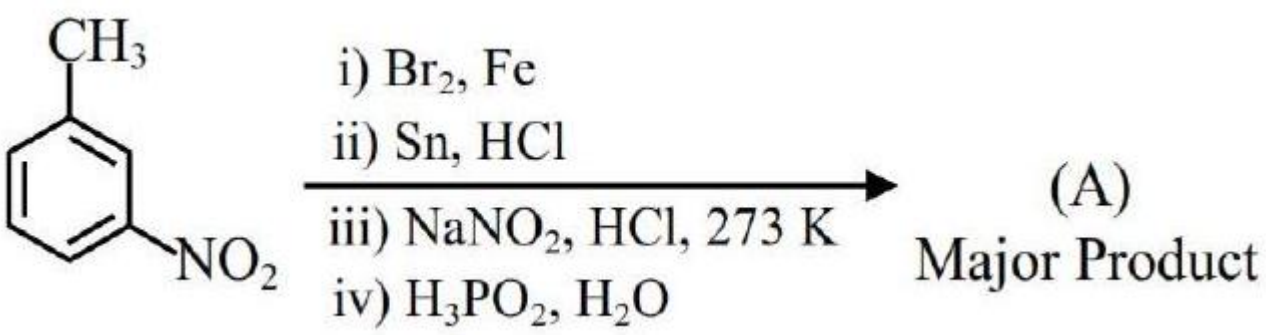
Correct answer: D

Source solution



Question 34

Consider the following sequence of reactions to produce major product (A)



Molar mass of product (A) is gmol^{-1}. (Given molar mass in gmol^{-1} of $\text{C} : 12, \text{H} : 1$, $\text{O} : 16, \text{Br} : 80, \text{N} : 14, \text{P} : 31$)

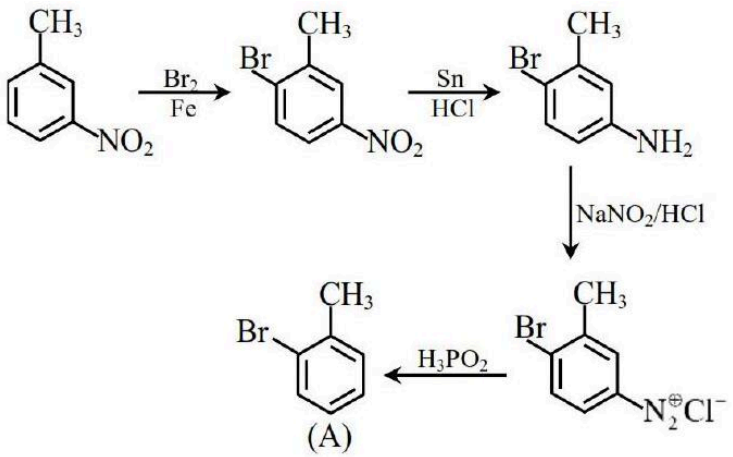
Numerical answer: _____

Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 171

Source solution

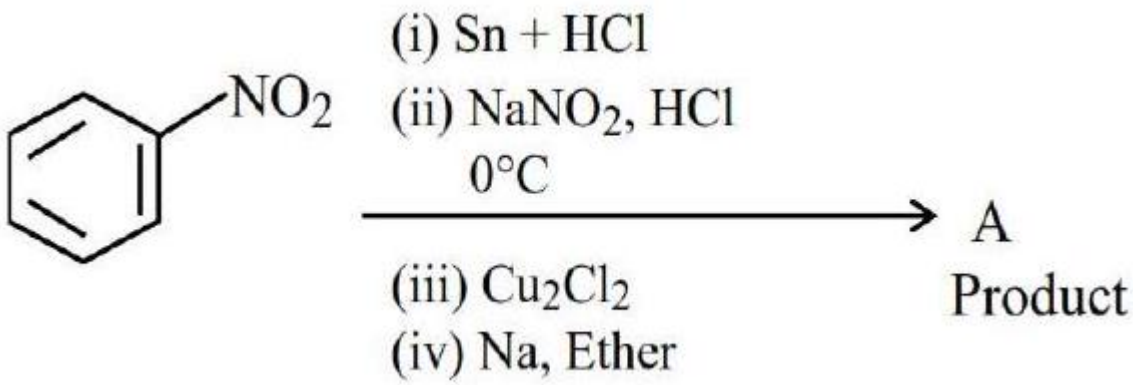
(171)



Molar mass of product $(\text{C}_7\text{H}_7\text{Br})(\text{A})$ is $171\ \text{g mol}^{-1}$

Question 35

Consider the following sequence of reactions :



Molar mass of the product formed (A) is

$\mathrm{gmol^{-1}}$.

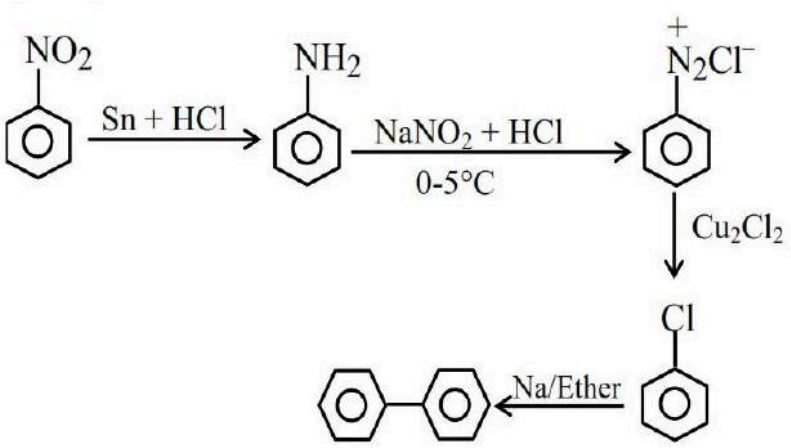
Numerical answer: _____

Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 154

Source solution

Sol.



Question 36

Match List-I with List-II

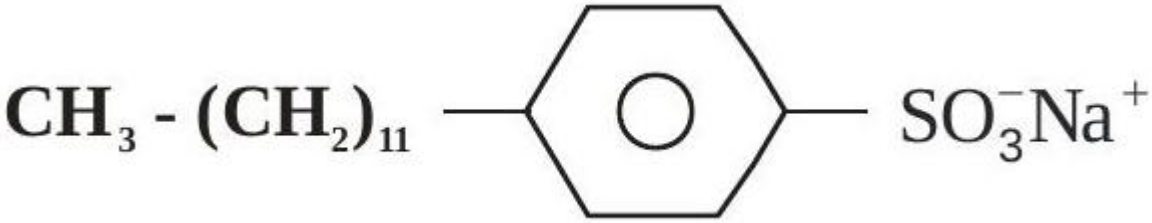
List-I

(A)



Br^-

(B)



(C) $C_{17}H_{35}COO^-Na^+ + Na_2CO_3 +$ Rosinate

(D) $CH_3(CH_2)_{16}COO(CH_2CH_2O)_nCH_2CH_2OH$

List-II

(I) Dishwashing powder
(II) Toothpaste
(III) Laundry soap
(IV) Hair conditioner

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

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

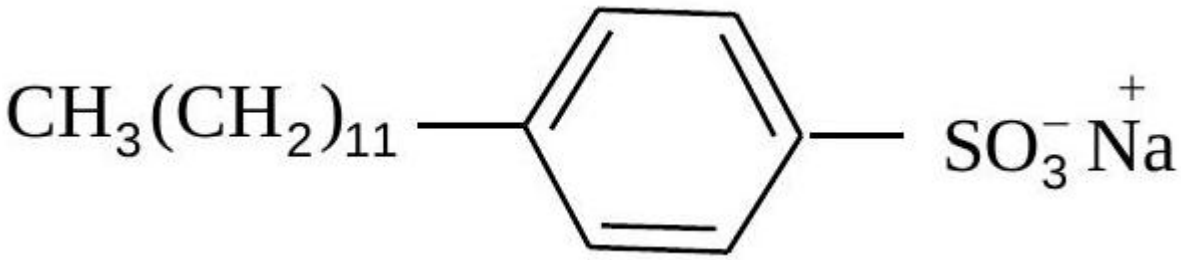
C. (A) - (IV), (B) - (III), (C) - (II), (D) - (I)

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

Correct answer: B

Source solution

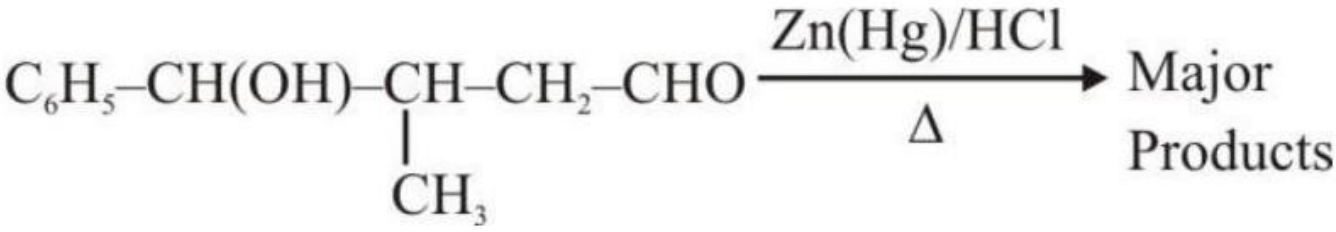
(A) $[CH_3(CH_2)_{15} - N(CH_3)_3]^+Br^-$
is cationic detergents used in hair conditioner
(B)



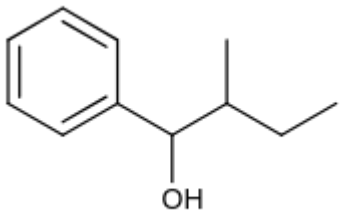
Is anionic detergent used in tooth pastes
(C) $C_{17}H_{35}COO^-Na^+ + Na_2CO_3 +$ Rosinate is used as laundary soap
(D) $CH_3(CH_2)_{16}COO(CH_2CH_2O)_NCH_2CH_2OH$ is non-ionic detergents formed from stearic acid and poly ethylene glycol used as liquid dishwashing detergents

Question 37

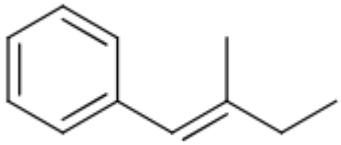
The major product formed in the following reaction is:



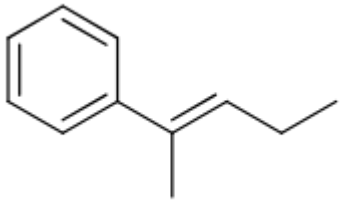
(A)



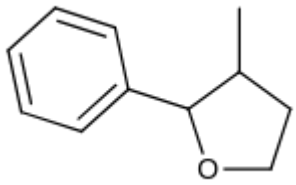
(B)



(C)



(D)



Choose the correct answer from the options given below:

A. A only

B. B only

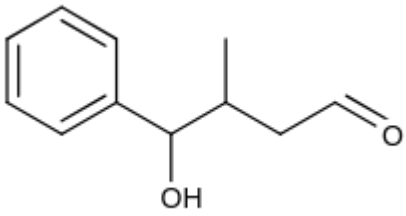
C. C only

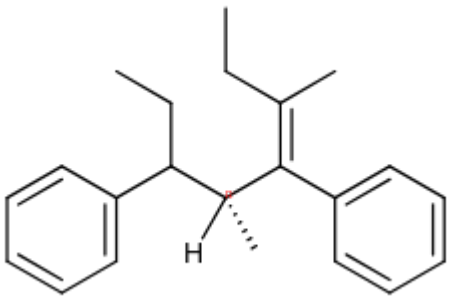
D. D only

Correct answer: B

Source solution

Solution :




H

Question 38

Match List-I with List-II :

List-I

Name of oxo acid
(a) Hypophosphorous acid
(b) Orthophosphoric acid
(c) Hypophosphoric acid
(d) Orthophosphorous acid given below :

A. (a)-(v), (b)-(i), (c)-(ii), (d)-(iii)

B. (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

C. (a)-(iv), (b)-(v), (c)-(ii), (d)-(iii)

D. (a)-(v), (b)-(iv), (c)-(ii), (d)-(iii)

Correct answer: A

Source solution

(iv) +2
(v) +1

Choose the correct answer from the options

List-II

Oxidation state of 'P'
(i) +5
(ii) +4
(iii) +3
(iii) +3
(iv) +2
$+1$
from the options s

Sol. (a) Hypophosphorus acid : H_3PO_2

$$(+1)3 + x + (-2)2 = 0$$
$$x = +1$$

(b) Orthophosphoric acid : $\mathbf{H_3PO_4}$

$$(+1)3 + x + (-2)4 = 0$$
$$x = +5$$

(c) Hypophosphoric acid : $\mathbf{H_4P_2O_6}$

$$(+1)4 + 2x + (-2)6 = 0$$
$$x = +4$$

(d) Orthophosphorous acid : $\mathbf{H_3PO_3}$

$$(+1)3 + x + (-2)3 = 0$$
$$x = +3$$

Question 39

Match List-I with List-II.

List-I (Oxide)		List-II (Nature)	
(A)	Cl_2O_7	(I)	Amphoteric
(B)	Na_2O	(II)	Basic
(C)	Al_2O_3	(III)	Neutral
(D)	N_2O	(IV)	Acidic

Choose the correct answer from the options given below:

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

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

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

D. (A) - (I), (B) - (II), (C) - (IIII), (D) - (IV)

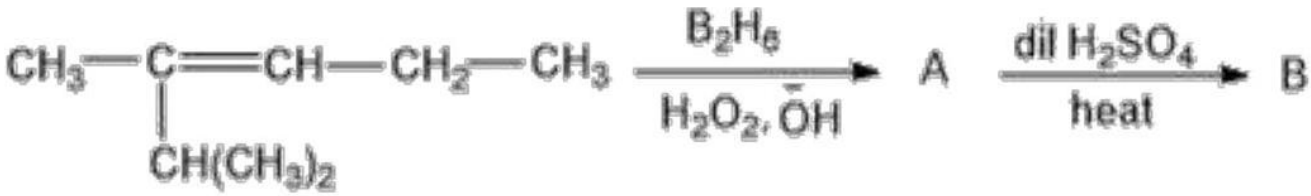
Correct answer: B

Source solution

Cl_2O_7 Acidic
Na_2O Basic
Al_2O_3 Amphoteric
N_2O Neutral

Question 40

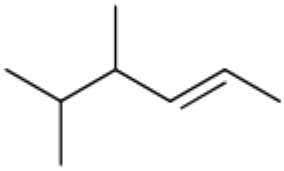
Find the final major product of the following reactions?



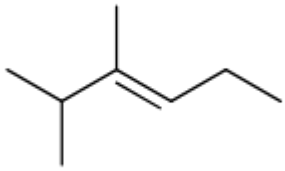
A.



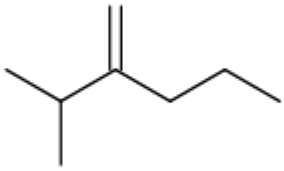
B.



C.



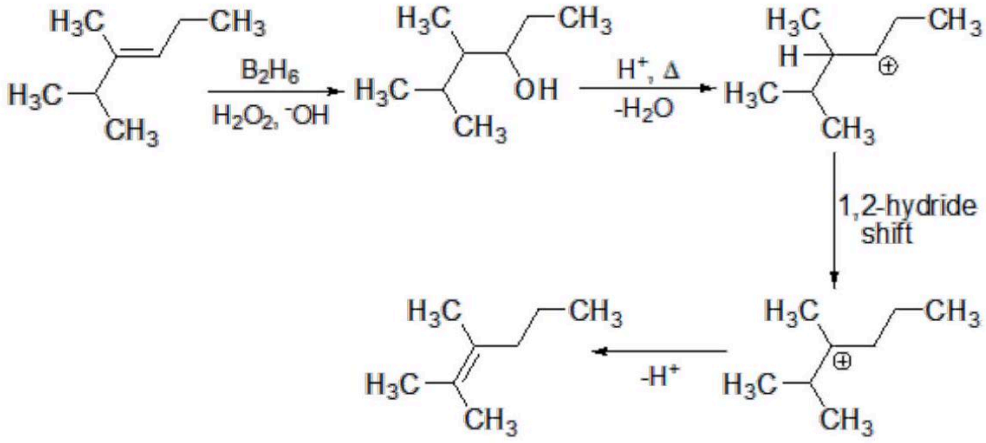
D.



Correct answer: A

Source solution

Solution:


H3C
CH3
H3C
CH3
B2H6
H2O2, -OH
H3C
OH
H3C
CH3
H+, Δ
-H2O
H3C
H
CH3
H3C
CH3
1,2-hydride
shift
H3C
CH3
H3C
CH3
-H+
H3C
CH3
H3C
CH3

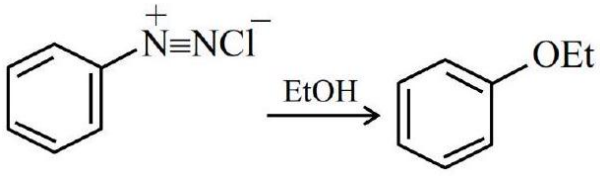
Redox Reactions

Questions 41-44 / 4 selected / 1.3% practice weight / Consolidate

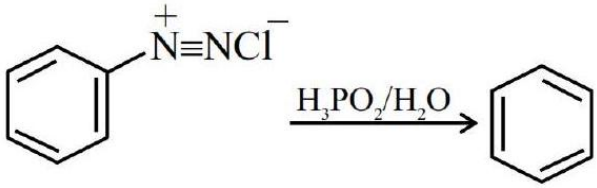
Question 41

In the following reactions, which one is NOT correct?

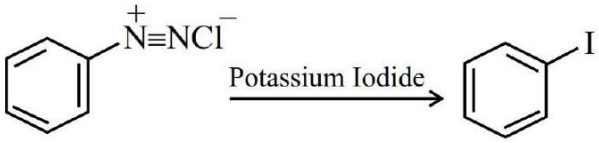
A.



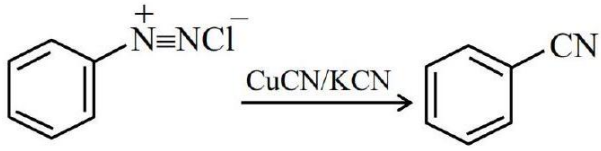
B.



C.

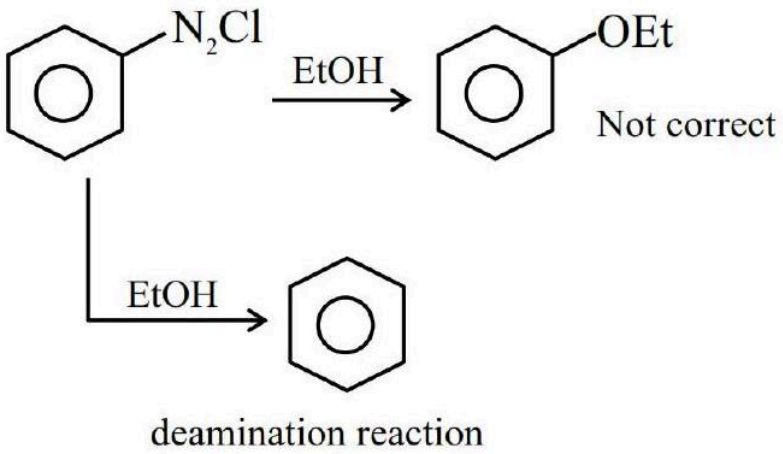


D.



Correct answer: A

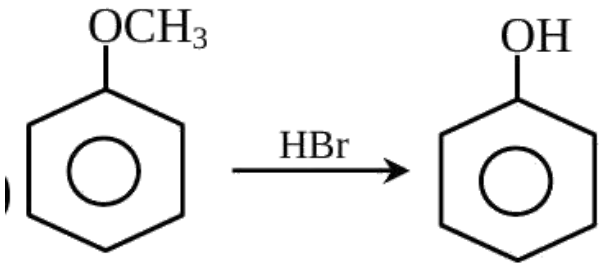
Source solution



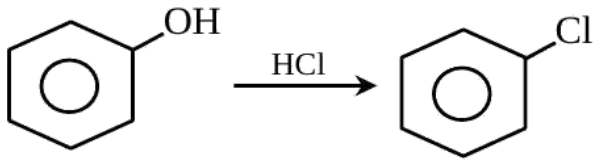
Question 42

Which one of the following reactions is NOT possible?

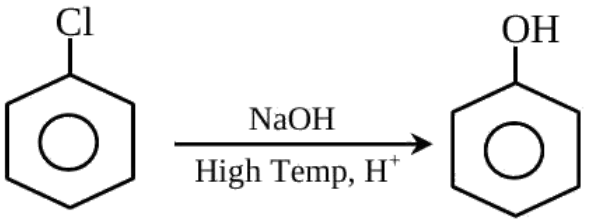
A.



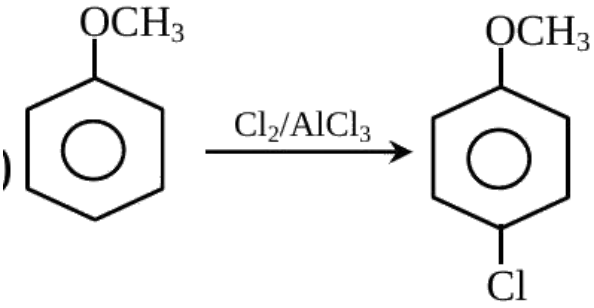
B.



C.



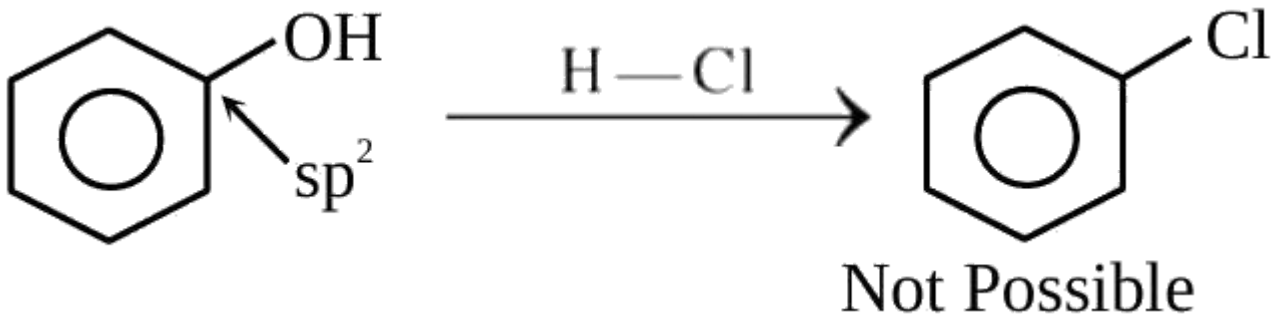
D.



Correct answer: B

Source solution

Sol.



Question 43

The species given below that does NOT show disproportionation reaction is :

A. BrO_4^-

B. BrO^-

C. BrO_2^-

D. BrO_3^-

Correct answer: A

Source solution

in BrO_4^-, Br is in highest oxidation state (+7), So it cannot oxidise further hence it cannot show disproportionation reaction.

Question 44

Match List-I with the List-II

List-I}
Reaction}
(A) $\mathrm{N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}}$
(B) $\mathrm{2\,Pb(NO_3)_{2(s)} \rightarrow 2PbO_{(s)} + 4NO_{2(g)} + O_{2(g)}}$
(C) $\mathrm{2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq.)} + H_{2(g)}}$
(D) $\mathrm{2NO_{2(g)} + 2^{-}OH_{(aq.)}}$
$\mathrm{\rightarrow NO^{-}_{2\,(aq.)} + NO^{-}_{3\,(aq.)} + H_2O_{(1)}}$
Choose the correct answer from the options given below:

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

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

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

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

Correct answer: D

Source solution

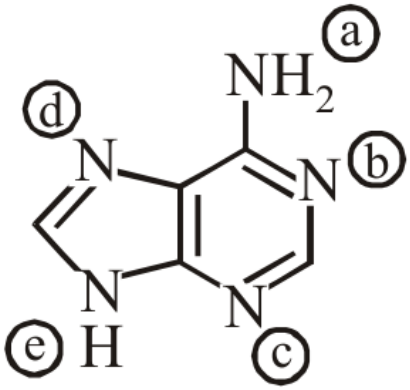
Sol. $\mathrm{A} \rightarrow$ (IV)
B $\rightarrow$ (I)
$\mathrm{C} \rightarrow$ (II)
D $\rightarrow$ (III)

Organic Chemistry - Some Basic Principles and Techniques

Questions 45-53 / 9 selected / 3.0% practice weight / Next

Question 45

In the following compound,
the favourable site/s for protonation is/are :-



A. (b), (c) and (d)

B. (a)

C. (a) and (e)

D. (a) and (d)

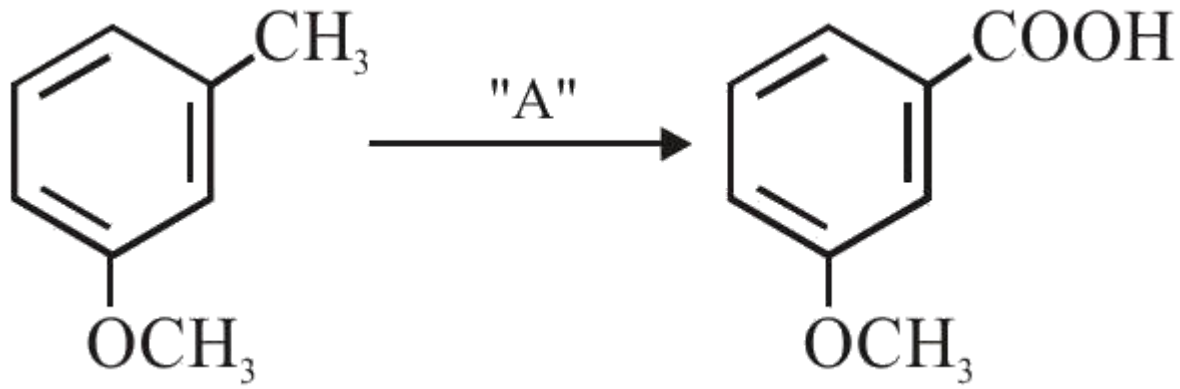
Correct answer: A

Source solution

Sol. Localised lone pair e^-.

Question 46

In the above reaction, the reagent " A " is :



A. $NaBH_4, H_3O^+$

B. $LiAlH_4$

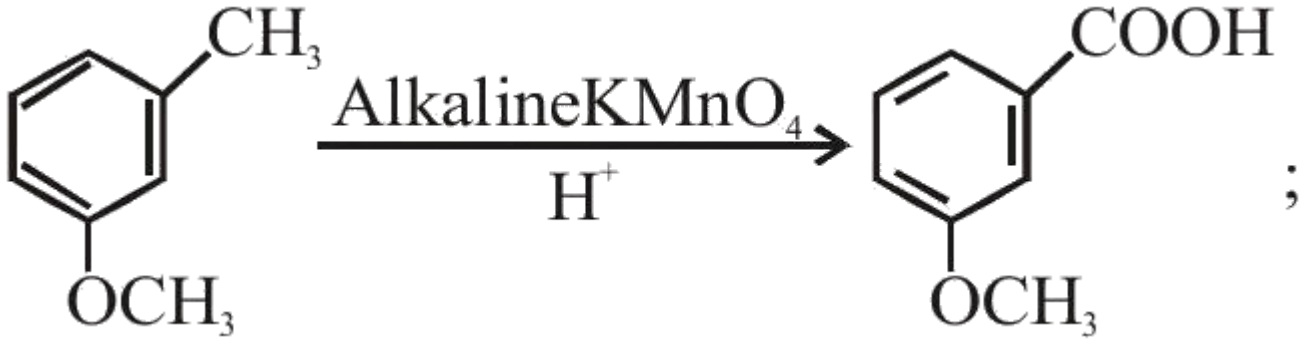
C. Alkaline $KMnO_4, H^+$

D. $HCl, Zn - Hg$

Correct answer: C

Source solution

Sol.



;

Question 47

Match List - I with List - II

	List - I	
(A)	$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	(I)
(B)	$CO(g) + 3H_2(g) \rightarrow CH_4(g) + H_2O(g)$	(II) $Cu/ZnO - Cr_2O_3$
(C) $CO(g) + H_2(g) \rightarrow HCHO(g)$	(III) $Fe_xO_y + K_2O + Al_2O_3$	
(D) $CO(g) + 2H_2(g) \rightarrow CH_3OH(g)$	(IV) Ni	

Choose the correct answer from the options given below:

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

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

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

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

Correct answer: C

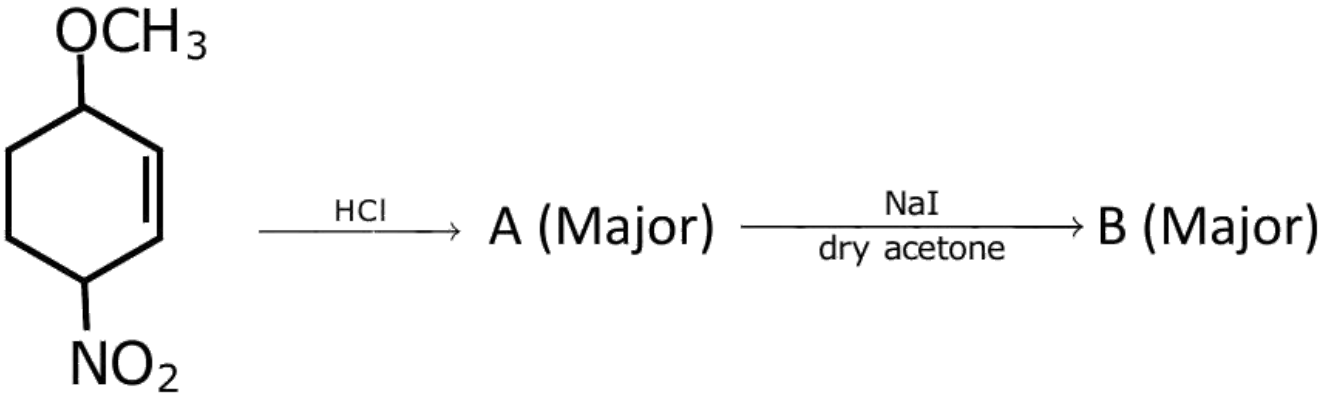
The source provides a brief answer only. A detailed worked solution is not available for this question.

Source solution

Factual

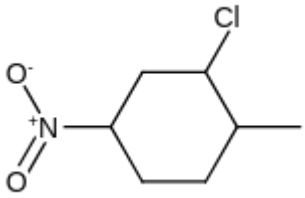
Question 48

Identify A and B in the chemical reaction.

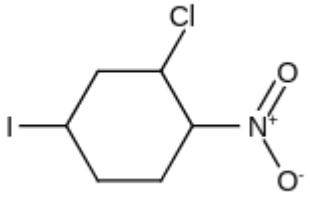


A. $A =$

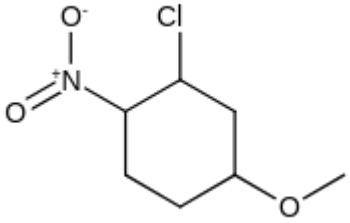
$B =$



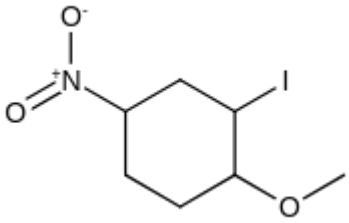
B. $B =$



C. $B =$



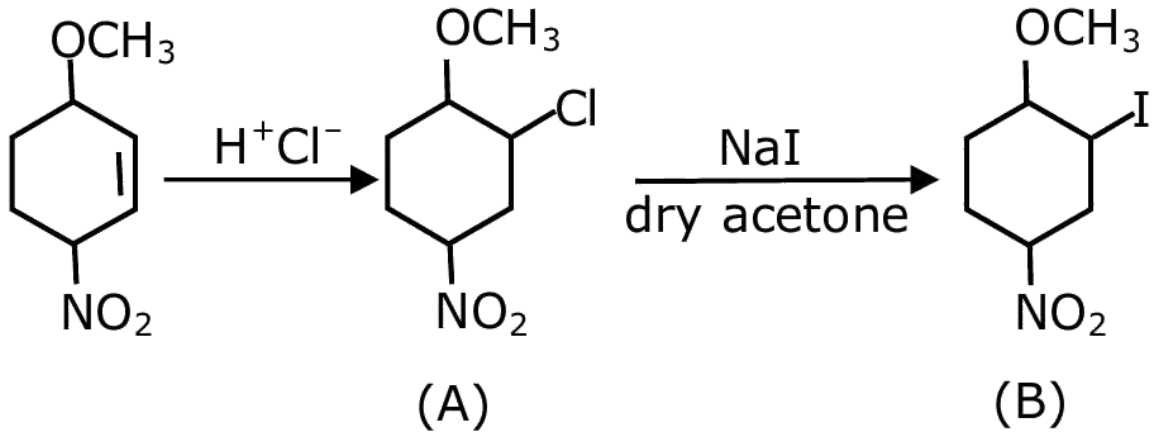
D. $B =$



Correct answer: D

Source solution

Sol. (4)

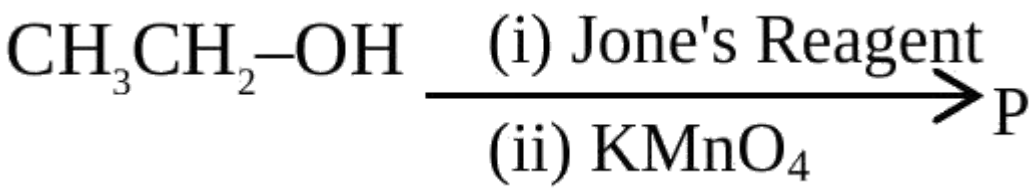


(A) (B)

Question 49

(iii) **NaOH, CaO, Δ**

Consider the above reaction sequence and identify the major product P .



A. Methane

B. Methanal

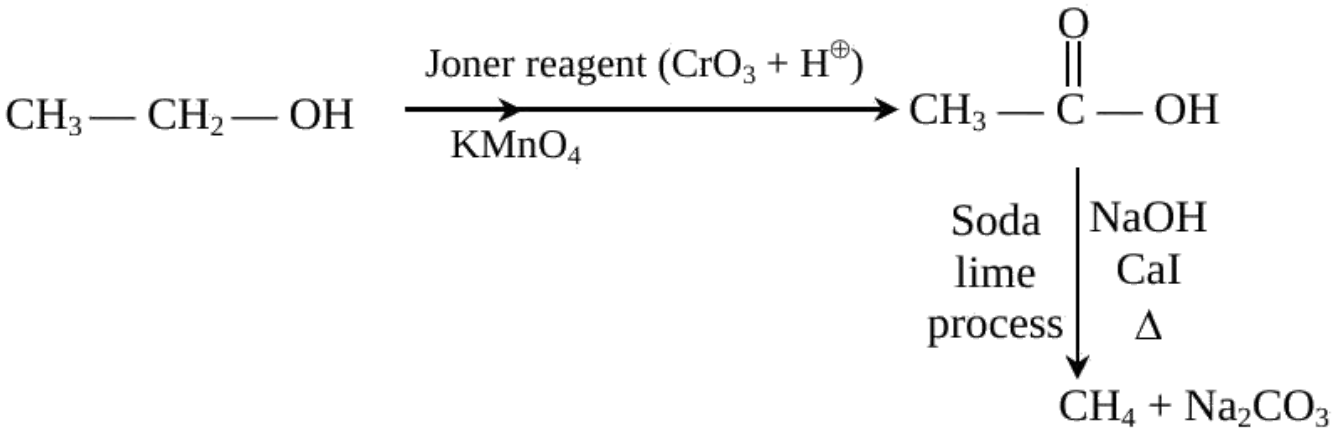
C. Methoxymethane

D. Methanoic acid

Correct answer: A

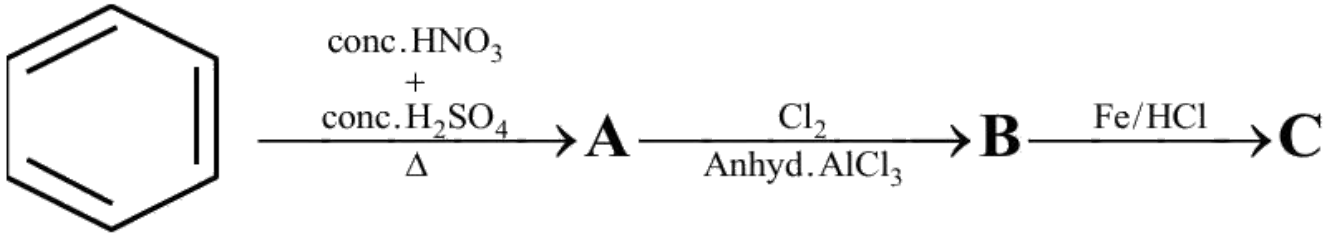
Source solution

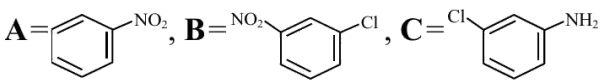
Sol.

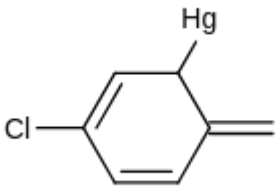


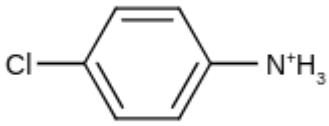
Question 50

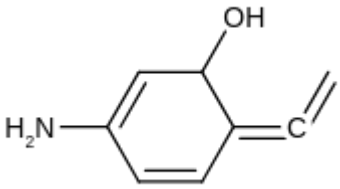
Identify correct **A**, **B** and **C** in the reaction sequence given below :



A. 

B. 

C. 

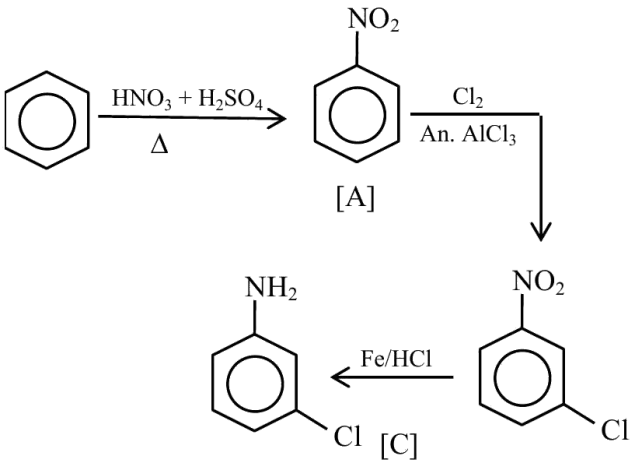
D. 

Correct answer: A

Source solution

Sol.

[B]



Question 51

Match the LIST-I with LIST-II

LIST-I		LIST-II	
A.	Carbocation	I.	Species that can supply a pair of electrons.
B.	C-Free radical	II.	Species that can receive a pair of electrons.
C.	Nucleophile	III.	sp^2 hybridized carbon with empty p-orbital.
D.	Electrophile	IV	sp^2/sp^3 hybridized carbon with one unpaired electron.

Choose the correct answer from the options given below:

A. A-IV, B-II, C-III, D-I

B. A-II, B-III, C-I, D-IV

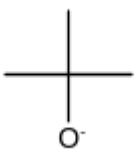
C. A-III, B-IV, C-II, D-I

D. A-III, B-IV, C-I, D-II

Correct answer: D

Source solution

Sol. (A) Carbocation $\rightarrow$ sp^2 hybridised carbon with empty P-orbital
(B) Carbon free radical $\rightarrow$ sp^2/sp^3 hybridised carbon with one unpaired electron.
(C) Nuecleophile $\rightarrow$ species of that can supply a pair of electron.
(D) Electrophile $\rightarrow$ species that can receive a pair of electron.



Question 52

Match List I with List II :

LIST I (Precipitating reagent and conditions)		LIST II (Cation)	
A.	$NH_4Cl + NH_4OH$	I.	Mn^{2+}
B.	$NH_4OH + Na_2CO_3$	II.	Pb^{2+}
C.	$NH_4OH + NH_4Cl + H_2S$ gas	III.	Al^{3+}
D.	dilute HCl	IV.	Sr^{2+}

Choose the correct answer from the options given below:

A. A-IV, B-III, C-II, D-I

B. A-IV, B-III, C-I, D-II

C. A-III, B-IV, C-I, D-II

D. A-III, B-IV, C-II, D-I

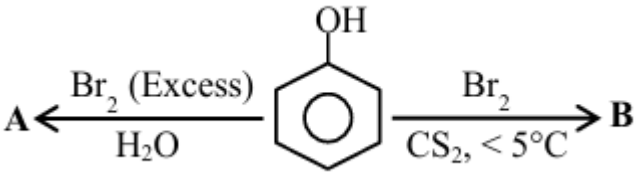
Correct answer: C

Source solution

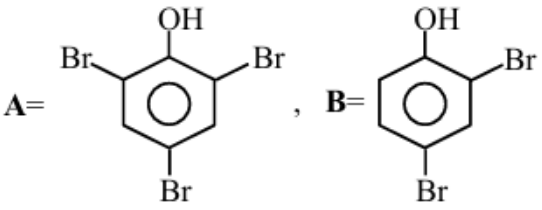
Theory based question

Question 53

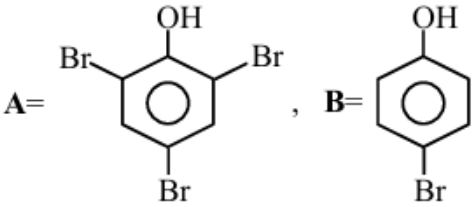
The correct options for the products **A** and **B** of the following reactions are :



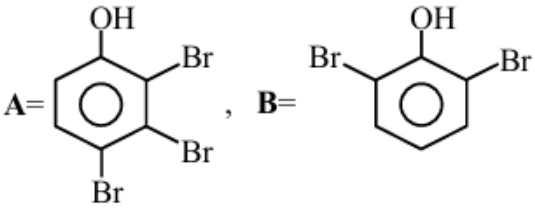
A.



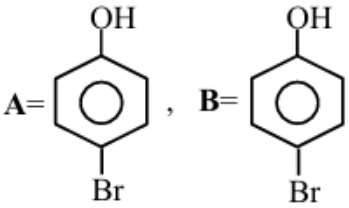
B.



C.



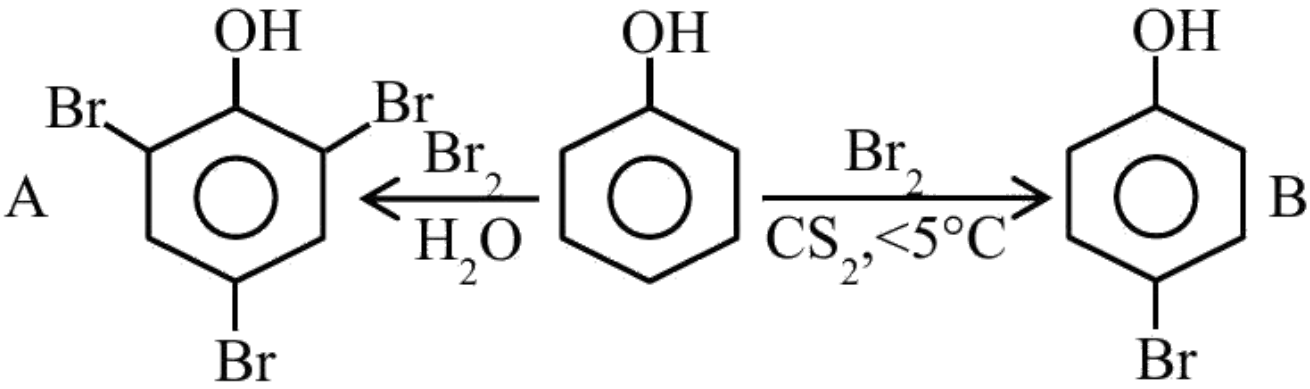
D.



Correct answer: B

Source solution

Sol.



Hydrocarbons

Questions 54-177 / 124 selected / 41.3% practice weight / Focus first

Question 54

Match List I with List II.

	List I	List II
	Reaction	Reagents
	(A) Hoffmann Degradation	(I) Conc.KOH, Δ
	(B) Clemenson reduction	(II) $CHCl_3, NaOH/H_3O^{\oplus}$
	(C) Cannizaro reaction	(III) $Br_2, NaOH$
	(D) Reimer-Tiemann Reaction	(IV) $Zn - Hg/HCl$

Choose the correct answer from the options given below:

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

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

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

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

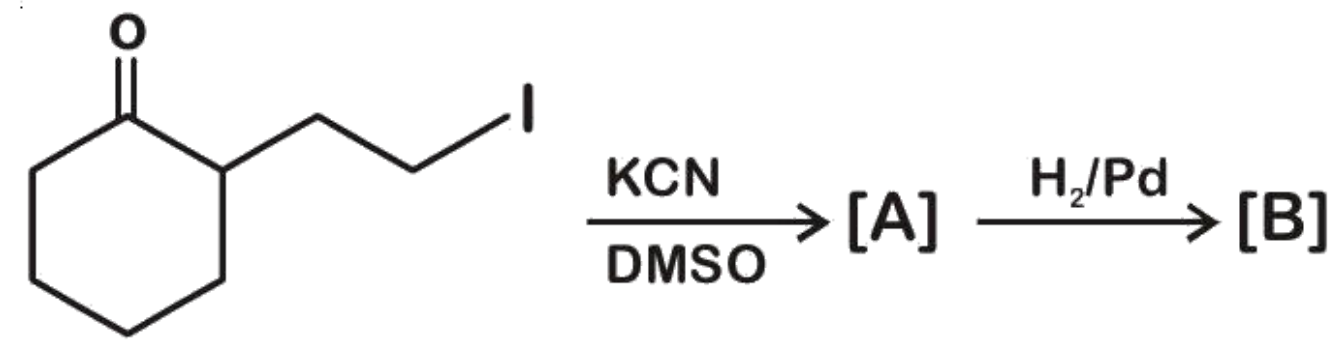
Correct answer: A

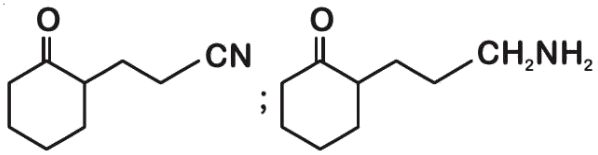
Source solution

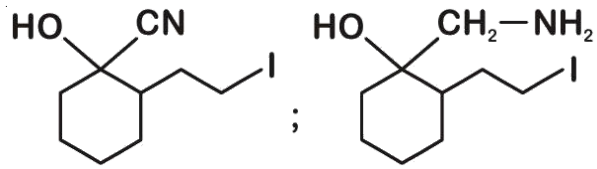
Sol. 1
Hoffmann degradation $\rightarrow Br_2$, NaOH
Clemenson reduction $\rightarrow Zn - Hg/HCl$
Cannizaro reaction $\rightarrow$ Conc. KOH, Δ
Reimer-Tiemann reaction $\rightarrow CuCl_3, NaOH/H_3O^{\oplus}$

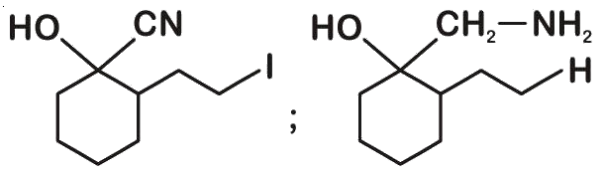
Question 55

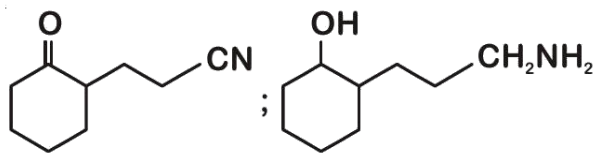
The major products A and B for the following reactions are, respectively



A. 

B. 

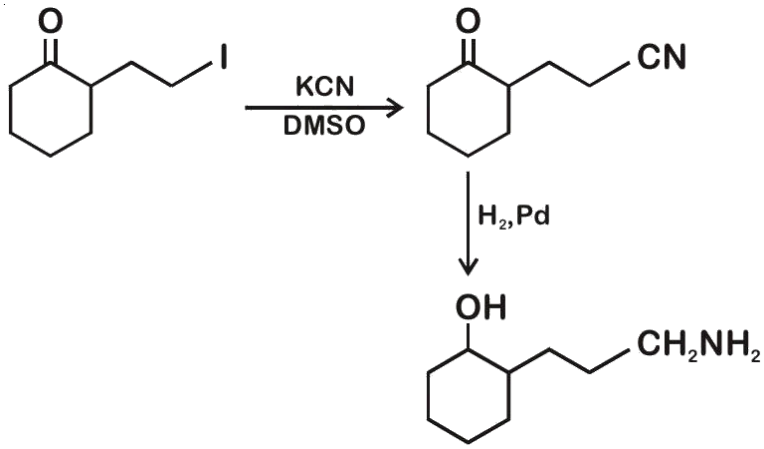
C. 

D. 

Correct answer: D

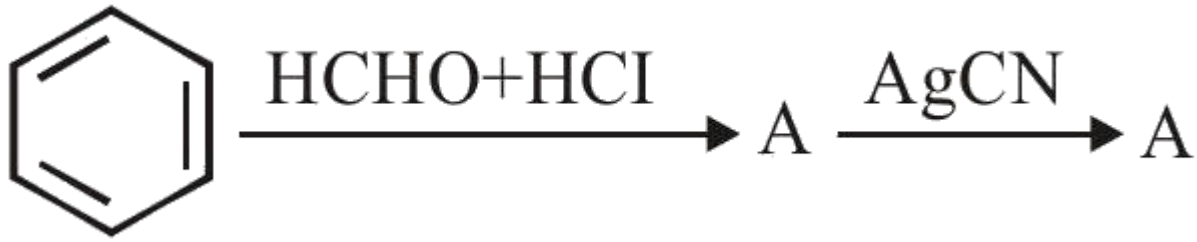
Source solution

Sol.



Question 56

The compounds A and B in the following reaction are, respectively:



A. $\mathbf{A}$ = Benzyl alcohol, $\mathbf{B}$ = Benzyl isocyanide

B. $\mathbf{A}$ = Benzyl alcohol, $\mathbf{B}$ = Benzyl cyanide

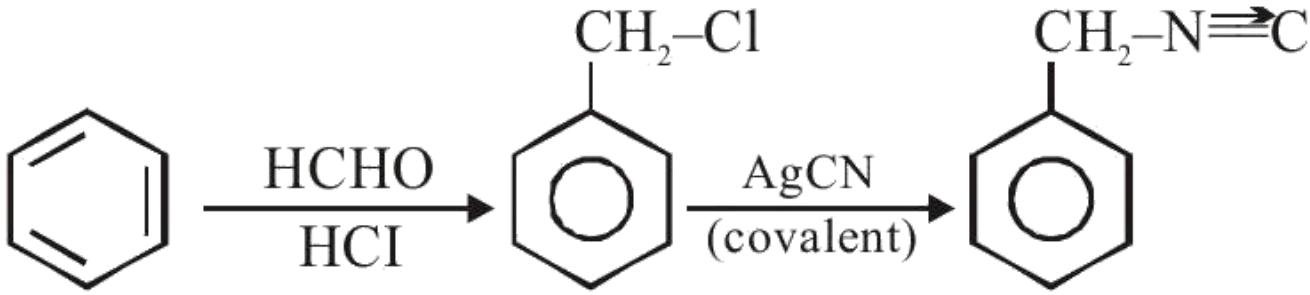
C. $\mathbf{A}$ = Benzyl chloride, $\mathbf{B}$ = Benzyl cyanide

D. A = Benzyl chloride, B = Benzyl isocyanide

Correct answer: D

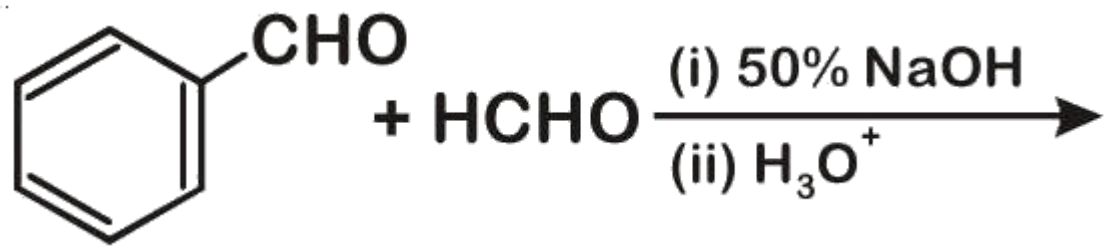
Source solution

Sol.

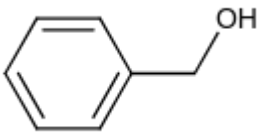


Question 57

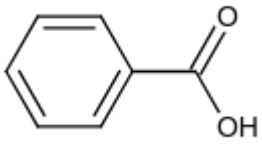
Major products of the following reaction are :



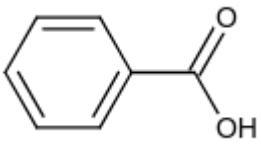
A. HCOOH and



B.



C. CH_3OH and

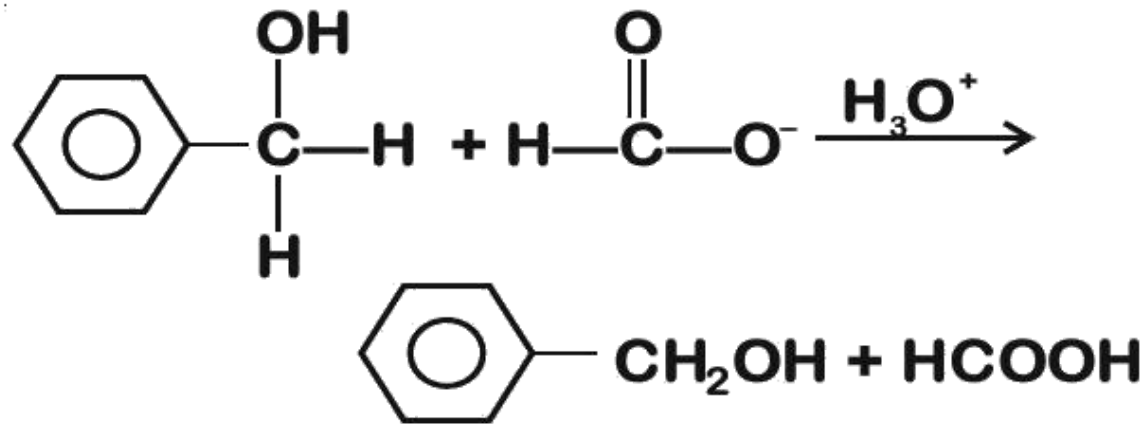


D. CH_3OH and HCO_2H

Correct answer: A

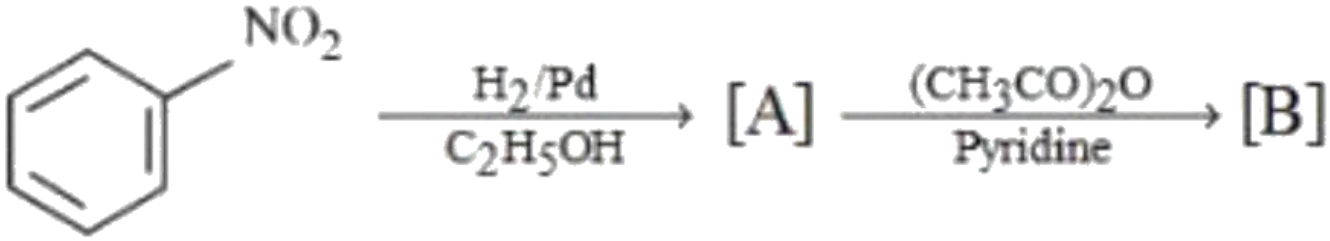
Source solution

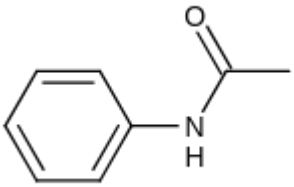
Sol.



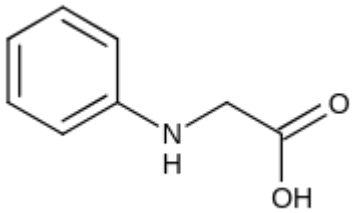
Question 58

Consider the above reaction and identify the product B. Options

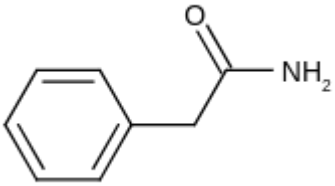




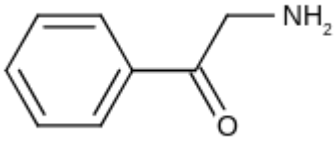
A.



B.



C.

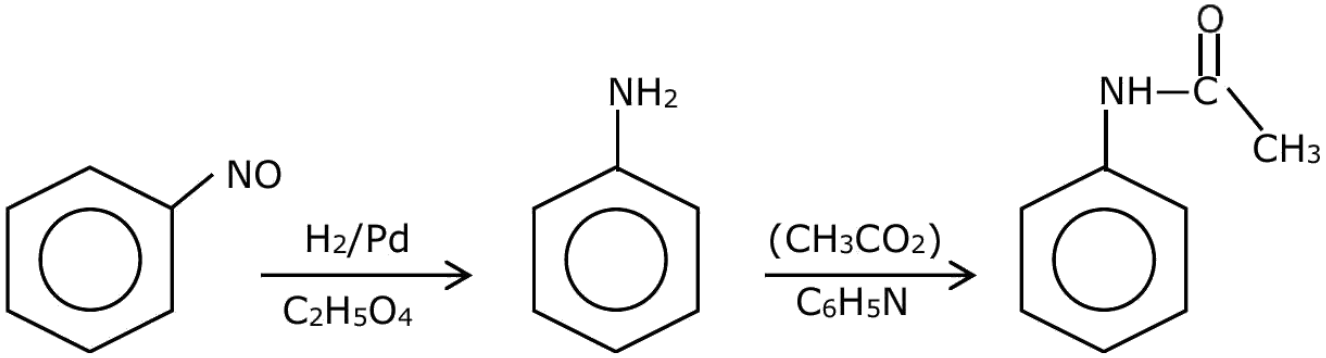


D.

Correct answer: A

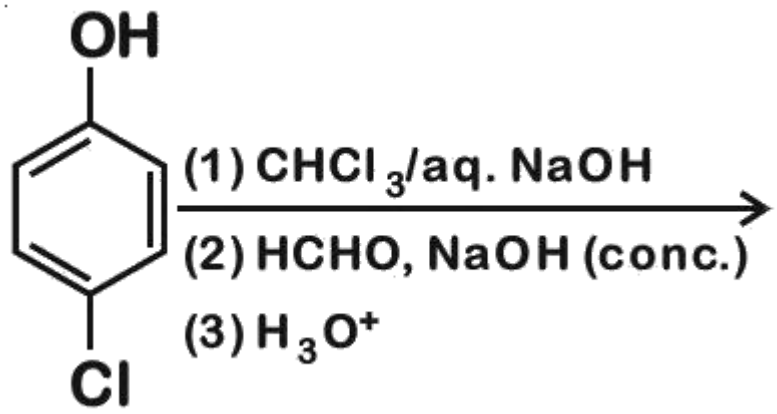
Source solution

Sol. 1

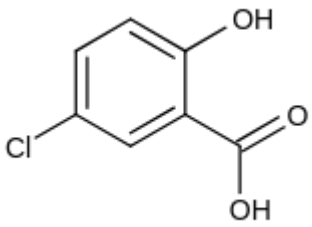


Question 59

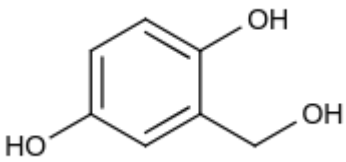
The major products of the following reaction are :



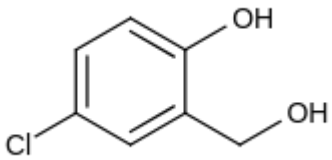
A.



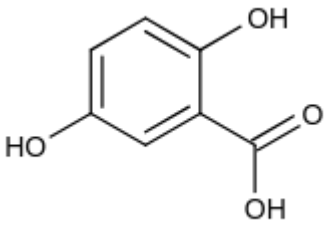
B.



C.



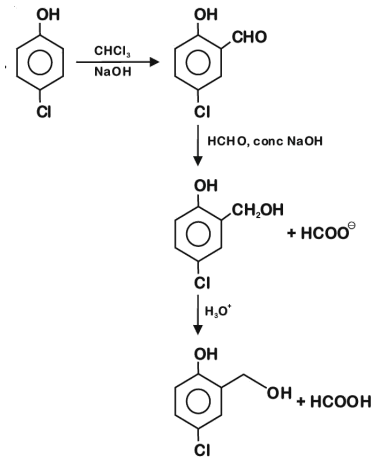
D.



Correct answer: C

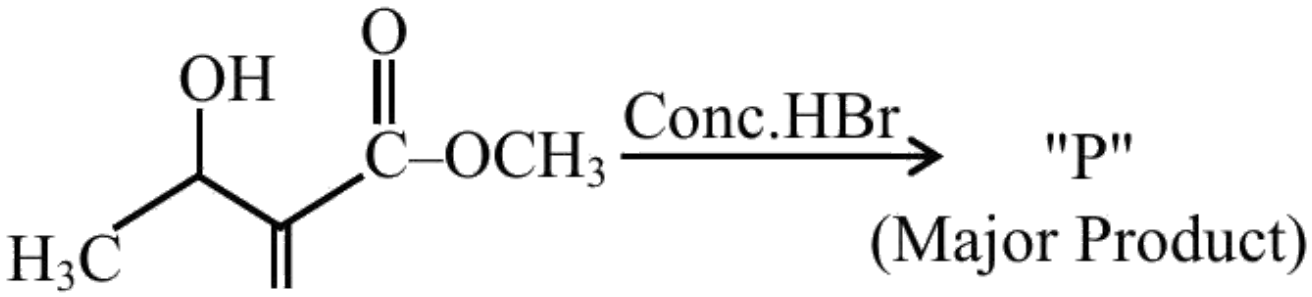
Source solution

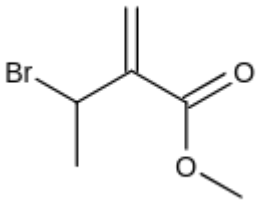
Sol.


OH
Cl
CHCl3
NaOH
OH
CHO
Cl
HCHO, conc NaOH
OH
CH2OH
+ HCOO⊖
Cl
H3O⊕
OH
OH
+ HCOOH
Cl

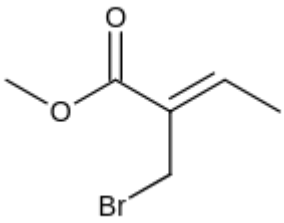
Question 60

Consider the above reaction, the major product "P" formed is :-

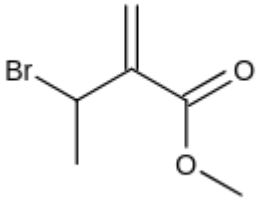




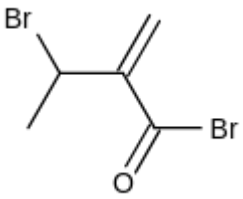
A.



B.



C.



D.

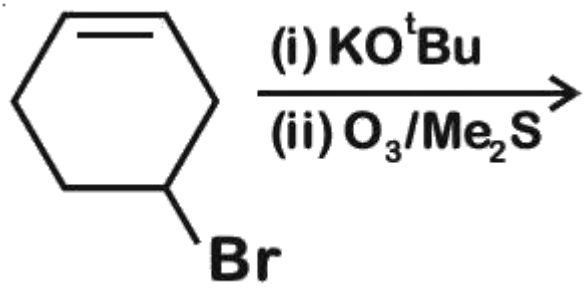
Correct answer: B

The source provides a brief answer only. A detailed worked solution is not available for this question.

Source solution

Question 61

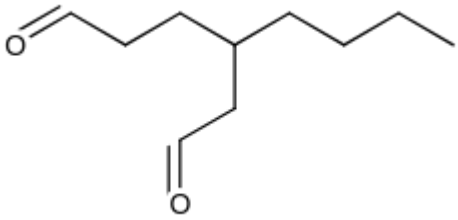
The major product(s) obtained in the following reaction is/are



A.



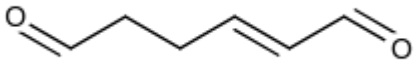
B.



C.



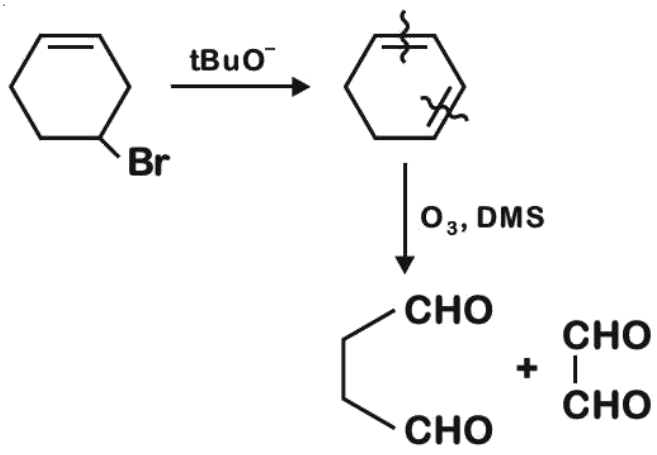
D.



Correct answer: A

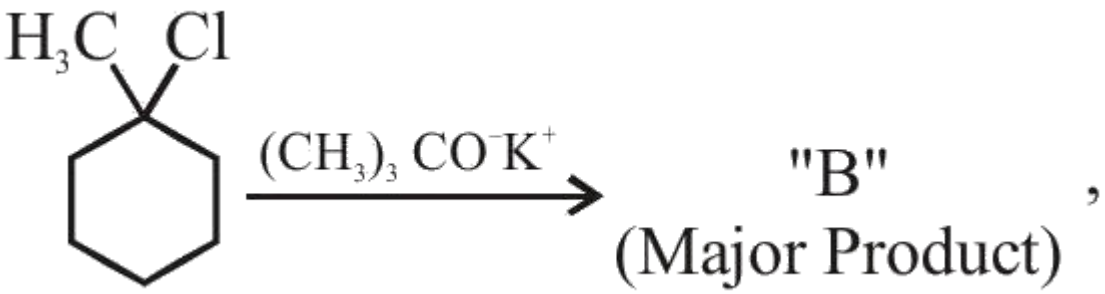
Source solution

Sol.

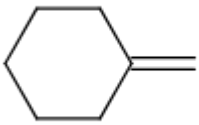


Question 62

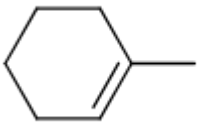
The product " A " and " B " formed in above reactions are :

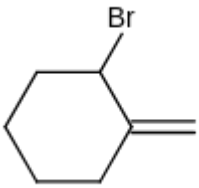


A. B-

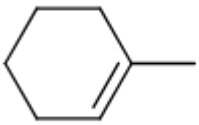


B. B-





C.

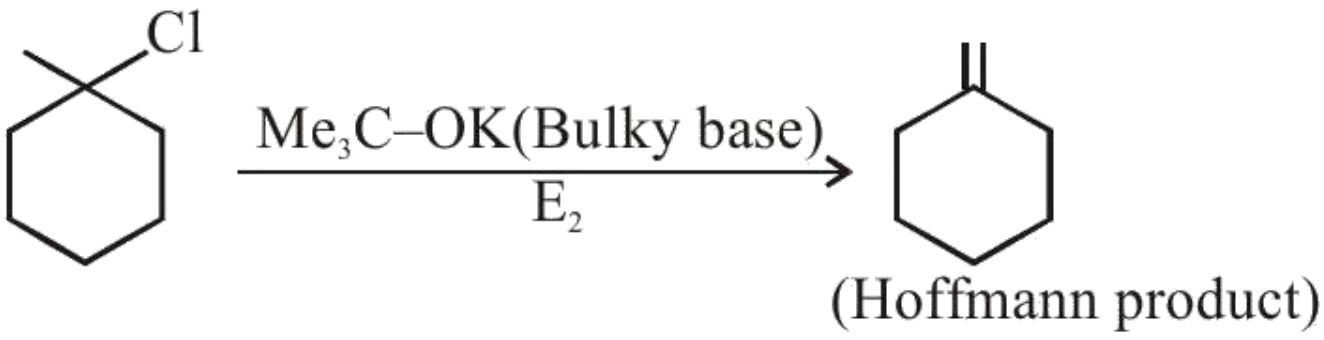


D.

Correct answer: C

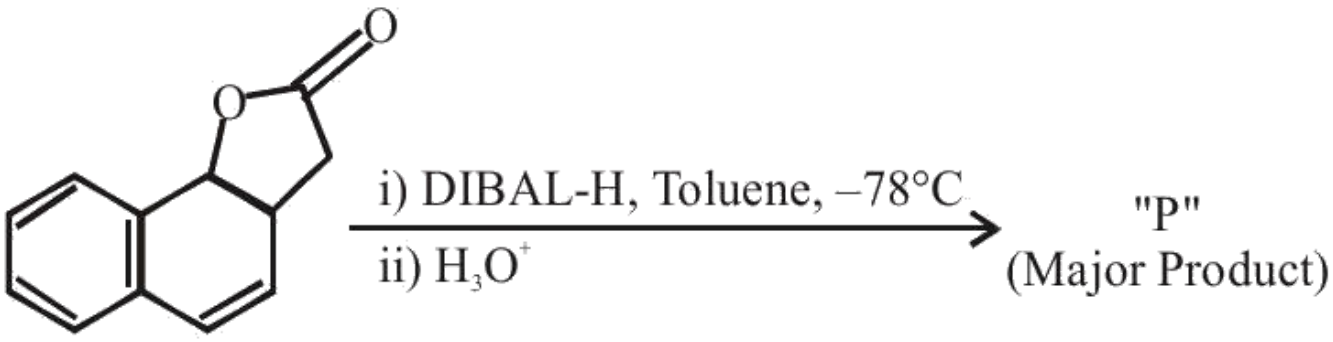
Source solution

Sol.

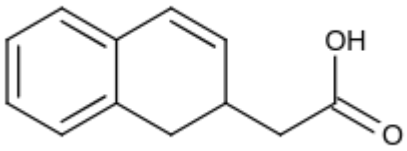


Question 63

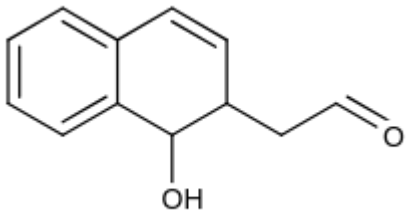
The product " P " in the above reaction is :



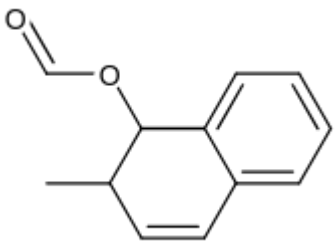
A.



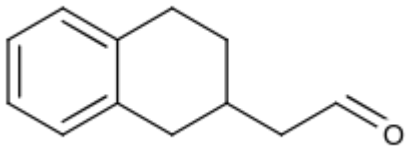
B.



C.



D.



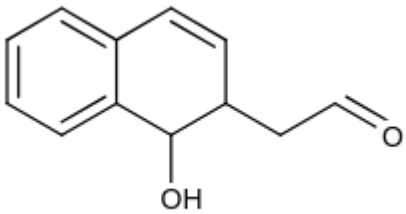
Correct answer: B

Source solution

Sol.

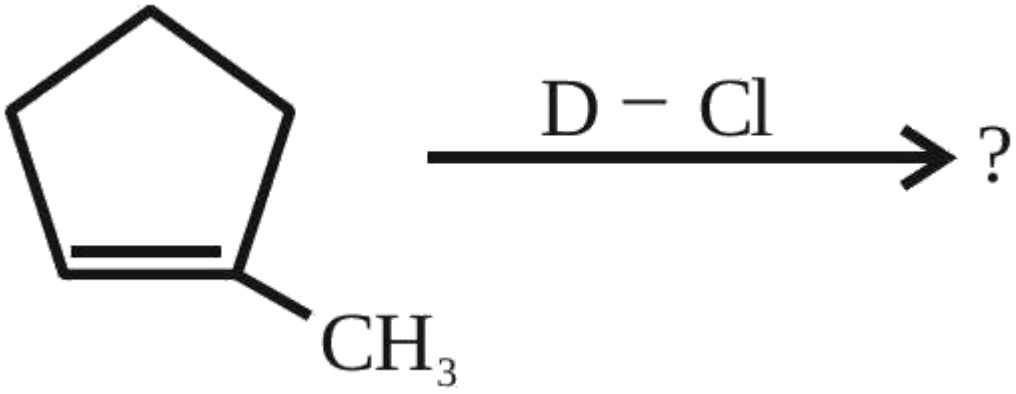
$\xrightarrow{\text{(i) DIBAL-H}}$

DIBAL can not reduce double bond It can reduce cyclic ester.

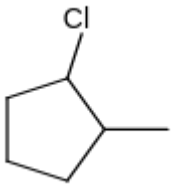

O
OH

Question 64

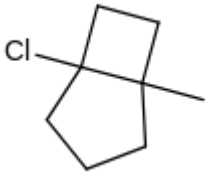
Major product of the following reaction is -



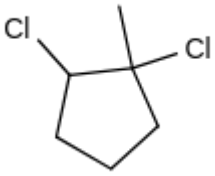
A.



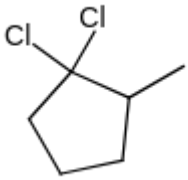
B.



C.



D.



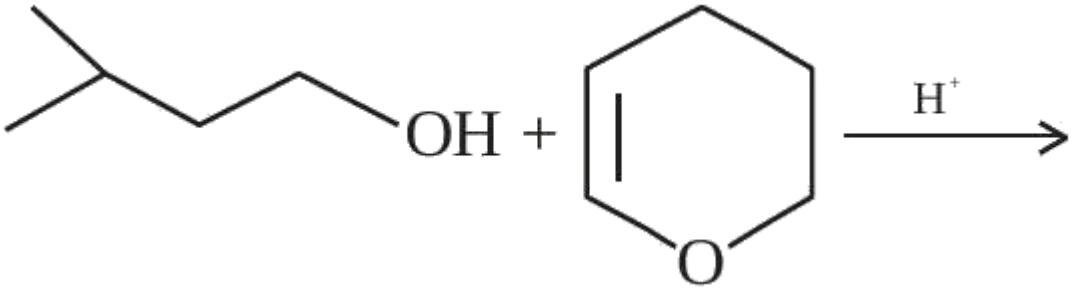
Correct answer: A

The source provides a brief answer only. A detailed worked solution is not available for this question.

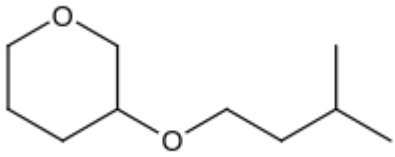
Source solution

Question 65

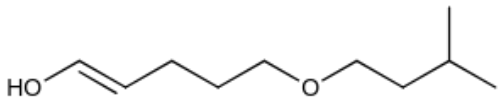
The major product formed in the following reaction, is



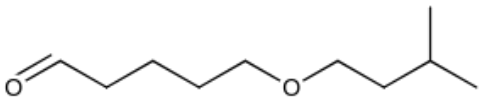
A.



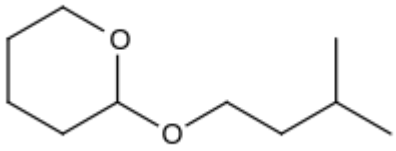
B.



C.



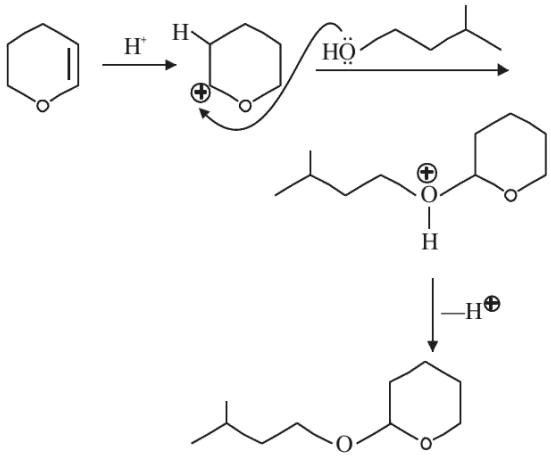
D.



Correct answer: D

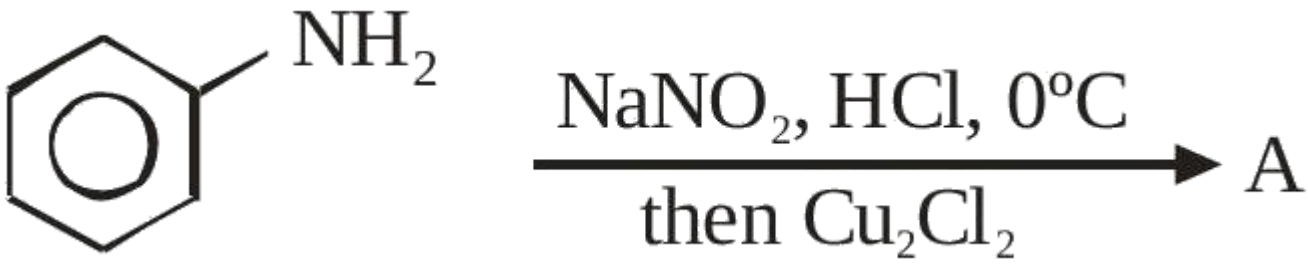
Source solution

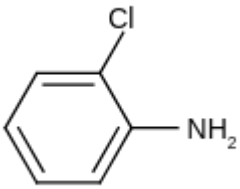
Sol.



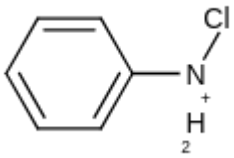
Question 66

The product A formed in the following reaction is:

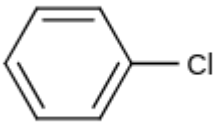




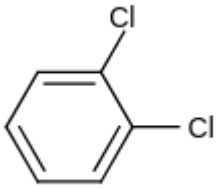
A.



B.



C.

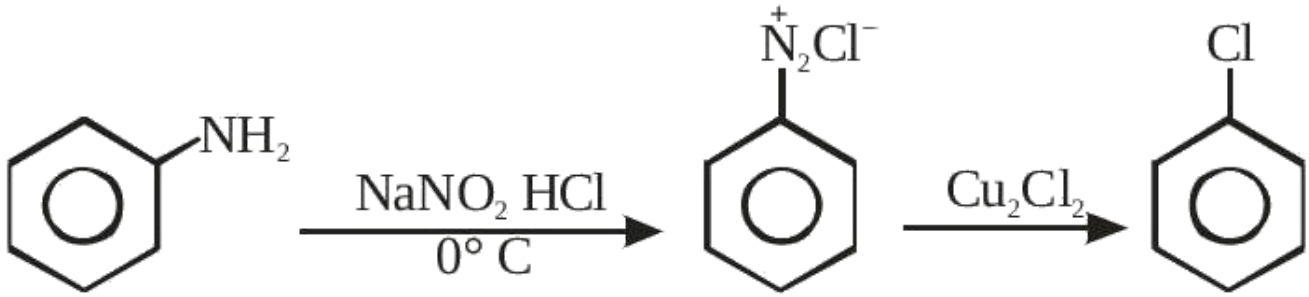


D.

Correct answer: C

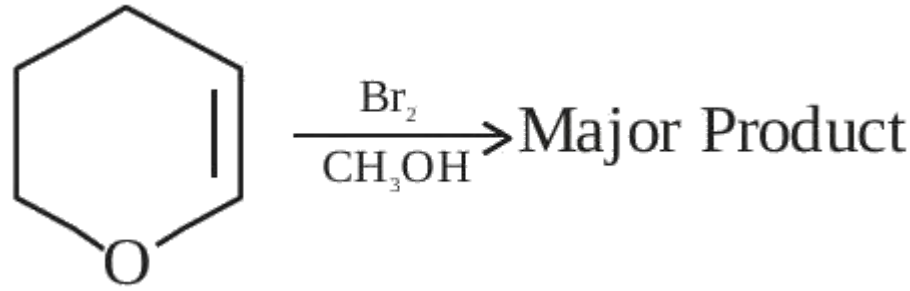
Source solution

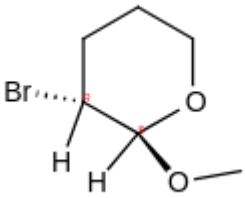
Sol.



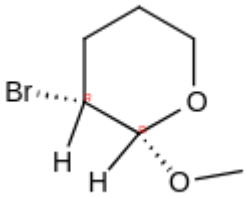
Question 67

Amongst the following, the major product of the given chemical reaction is

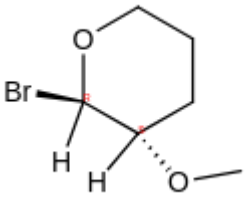




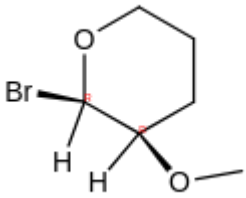
A.



B.



C.

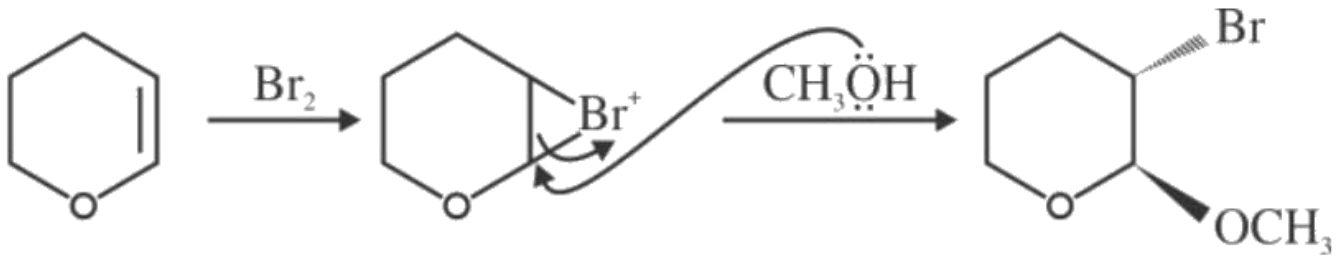


D.

Correct answer: A

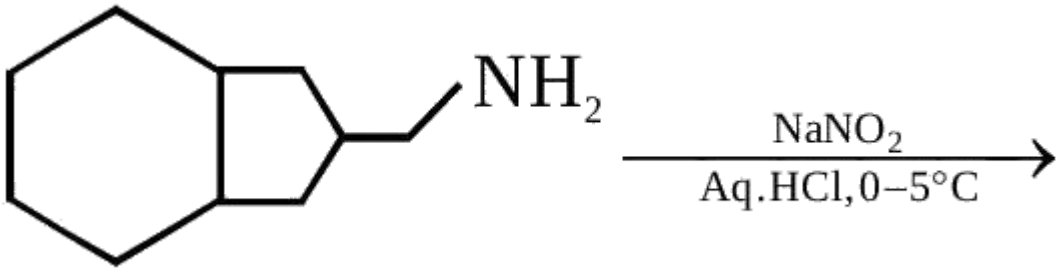
Source solution

Sol.

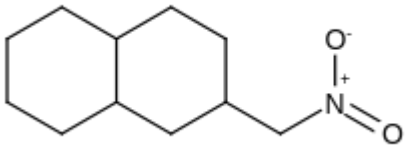


Question 68

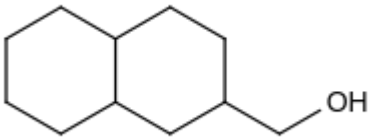
The major product formed in the reaction given below will be :



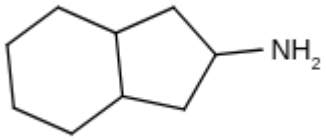
A.



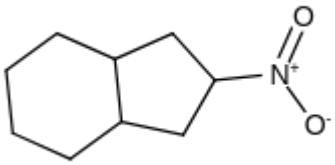
B.



C.



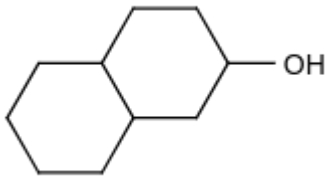
D.



Correct answer: A

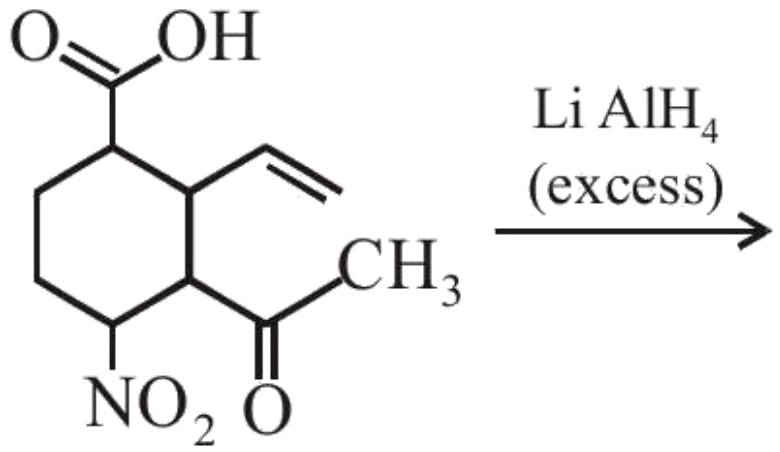
Source solution

Sol. Answer should be

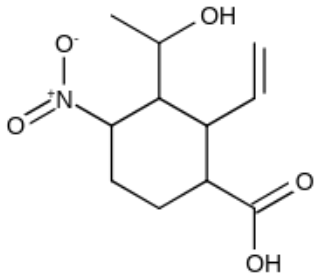


Question 69

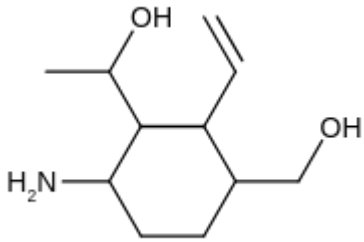
The major product obtained in the following reaction is :-



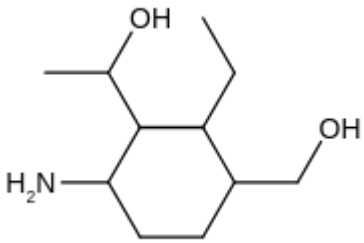
A.



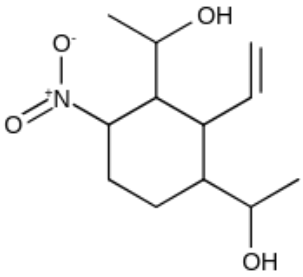
B.



C.



D.

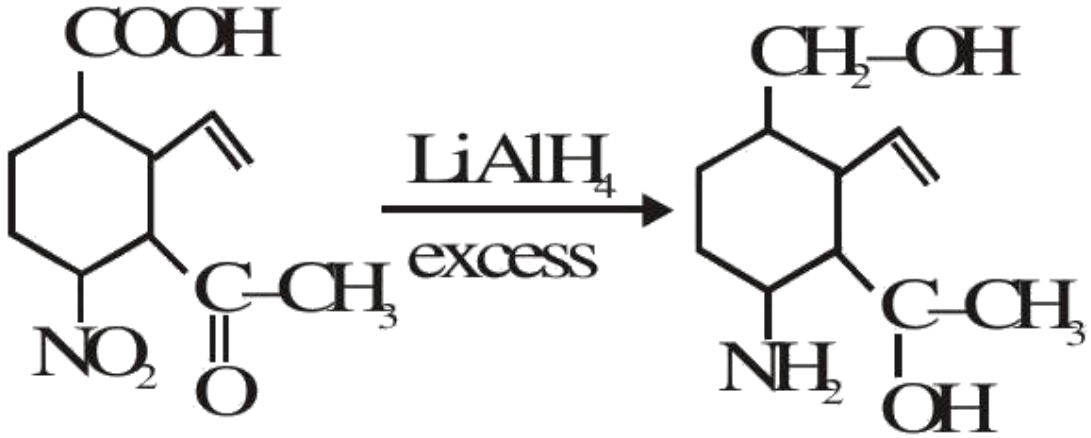


Correct answer: B

Source solution

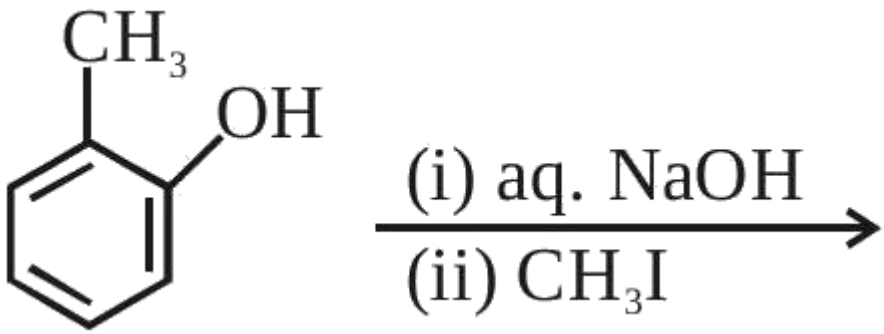
Sol.

$\mathbf{LiAlH_4}$ will not affect $\mathbf{C = C}$ in this compound.

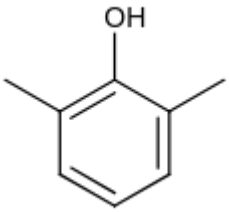

COOH
NO2
C–CH3
O
LiAlH4
excess
CH2–OH
NH2
C–CH3
OH

Question 70

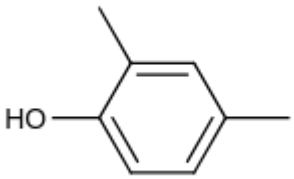
The major product of the following reaction is:



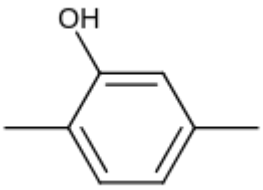
A.



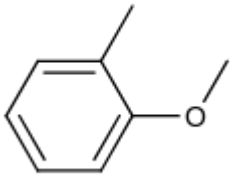
B.



C.



D.



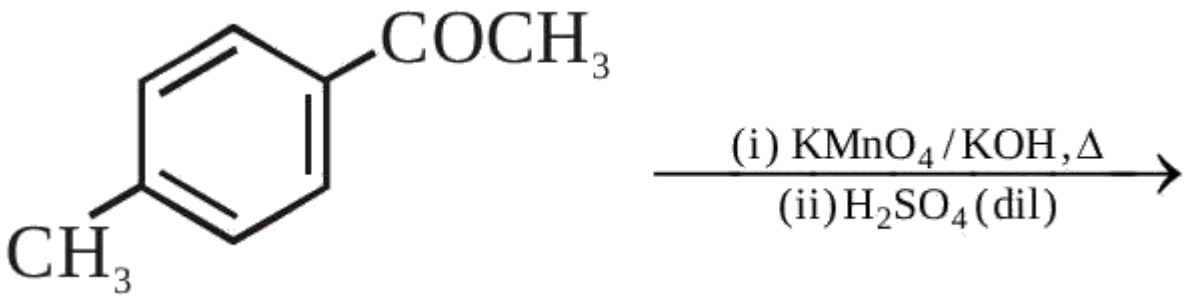
Correct answer: D

The source provides a brief answer only. A detailed worked solution is not available for this question.

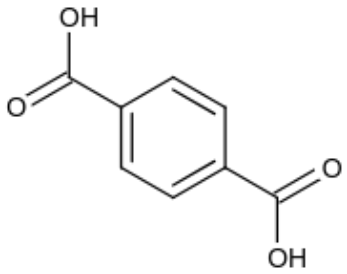
Source solution

Question 71

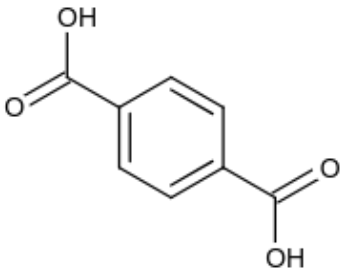
The major product of the following reaction is :



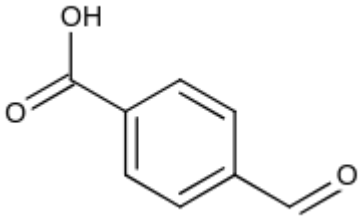
A.



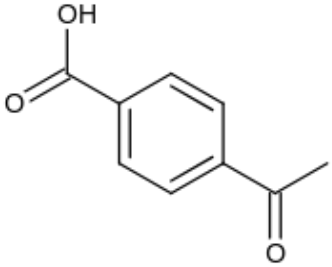
B.



C.



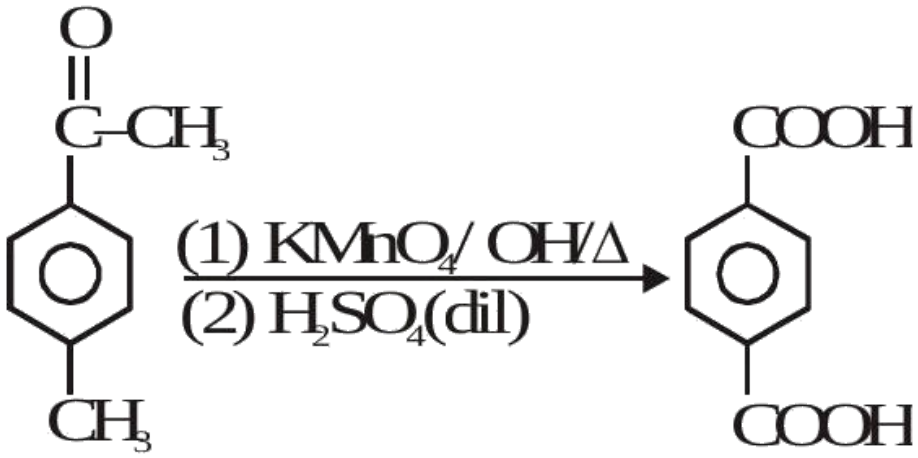
D.



Correct answer: B

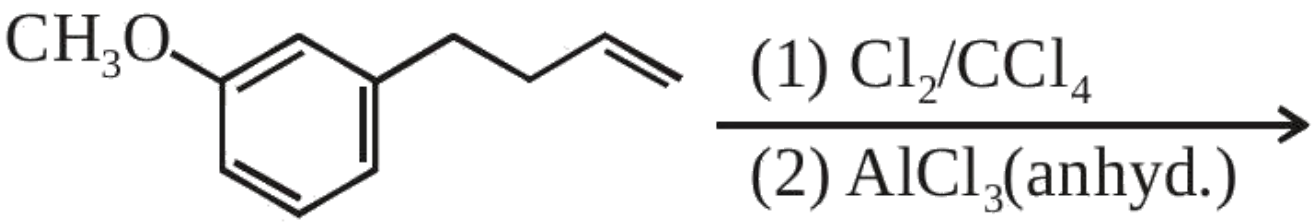
Source solution

Sol.

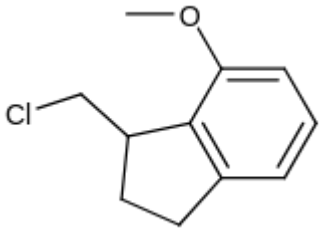

O
C–CH3
CH3
(1) KMnO4/ OH/Δ
(2) H2SO4(dil)
COOH
COOH

Question 72

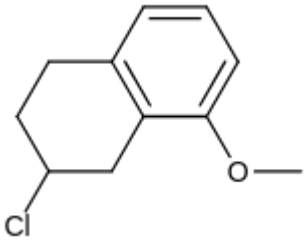
The major product of the following reaction is:



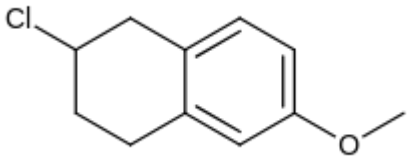
A.



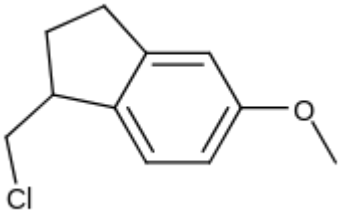
B.



C.



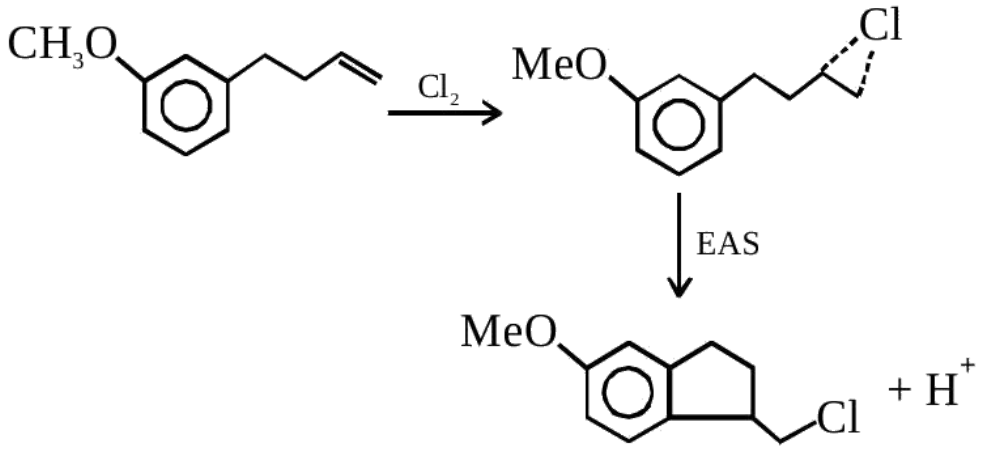
D.



Correct answer: D

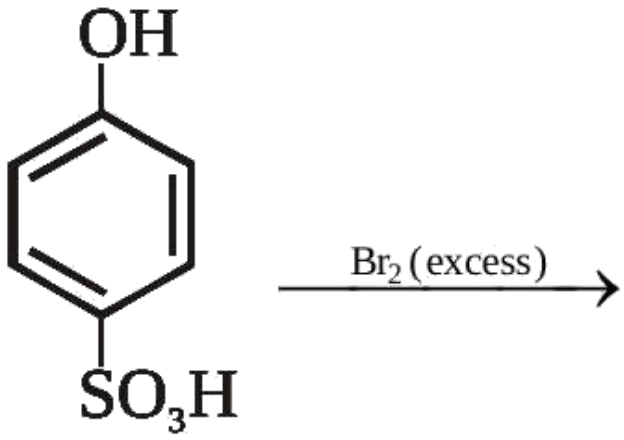
Source solution

Sol.

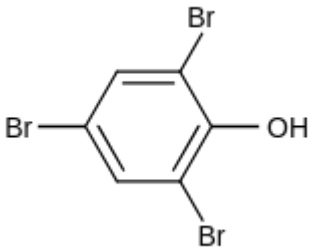

CH3O
Cl2
MeO
Cl
EAS
MeO
Cl
+ H+

Question 73

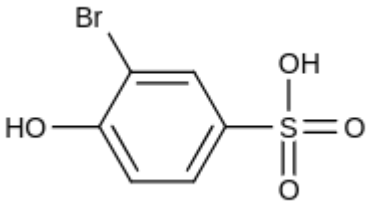
The major product of the following reaction is :



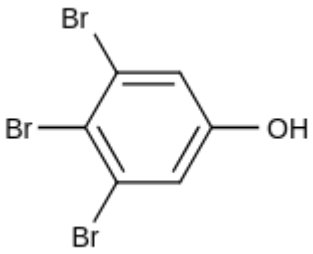
A.



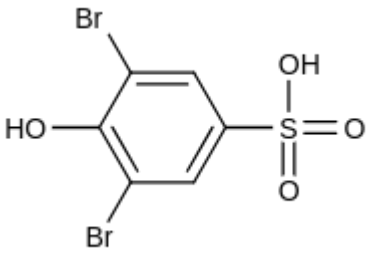
B.



C.



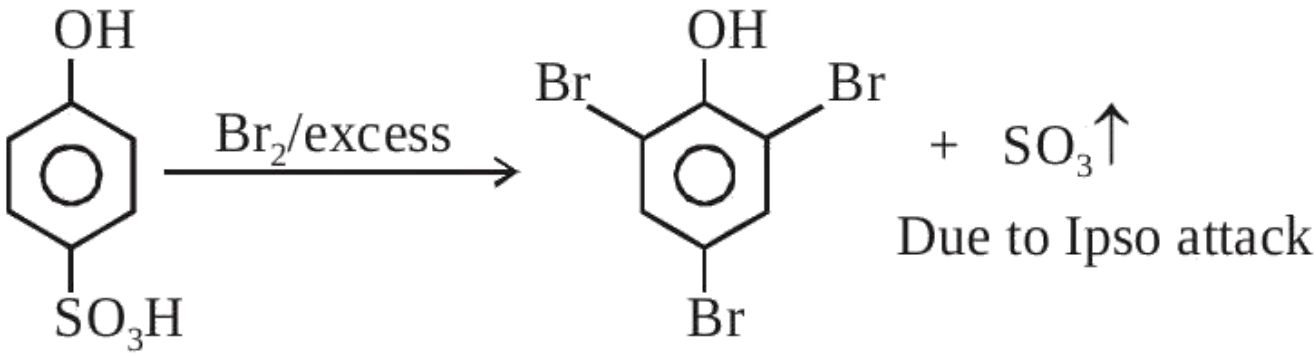
D.



Correct answer: A

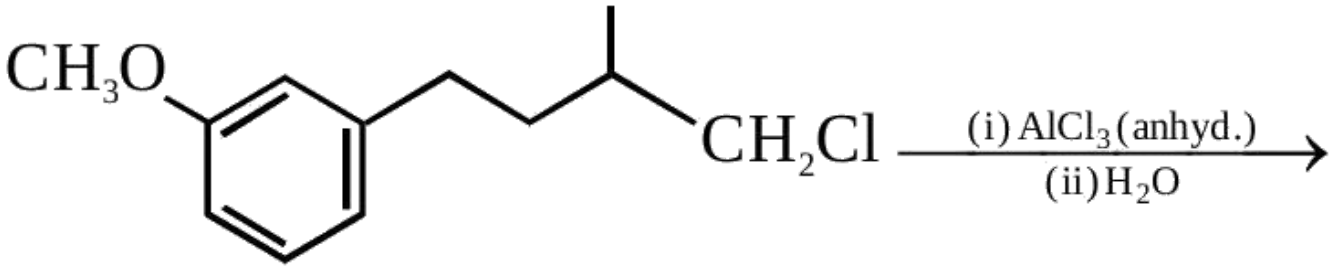
Source solution

Sol.

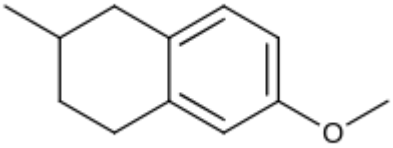

OH
Br_2/excess
SO_3H
OH
Br
Br
Br
+ $SO_3\uparrow$
Due to Ipso attack

Question 74

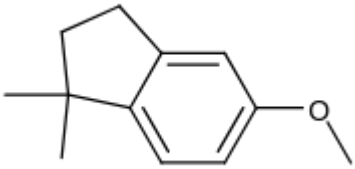
The major product of the following reaction is:



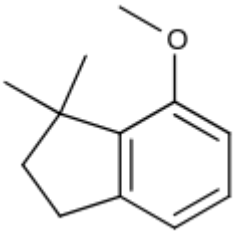
A.



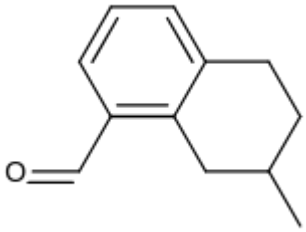
B.



C.



D.

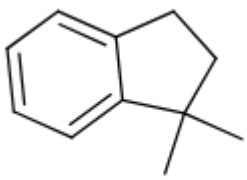


Correct answer: B

Source solution

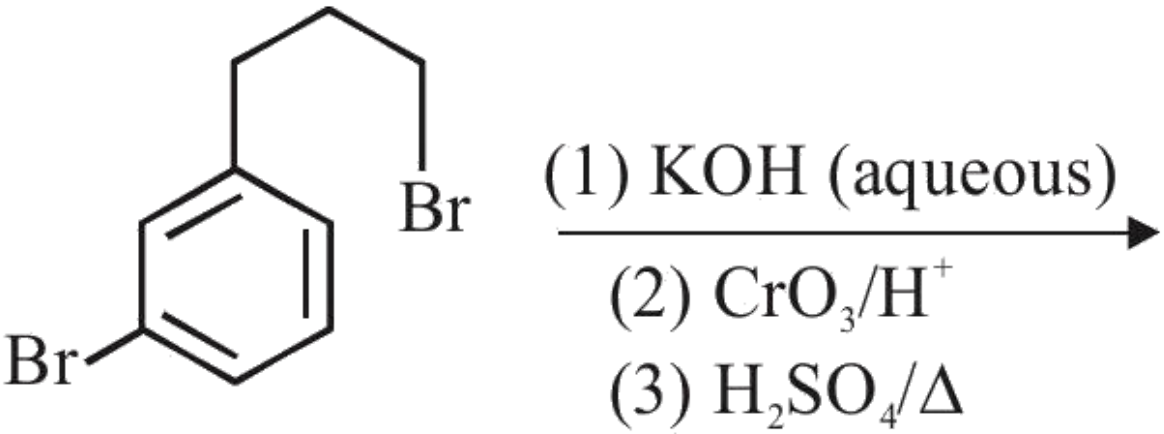
Sol.

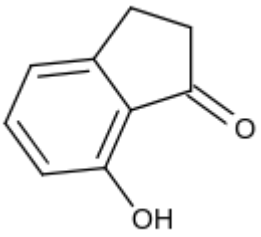
1, 2shift of $\mathbf{H^-}$
int ra F.C.A.



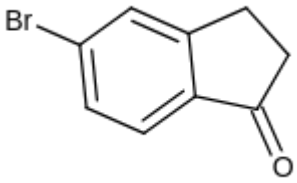
Question 75

The major product of the following reaction is:

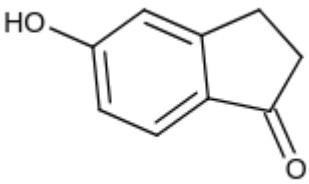




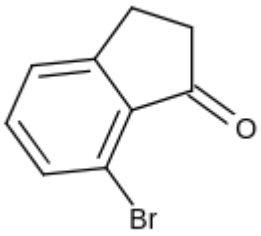
A.



B.



C.



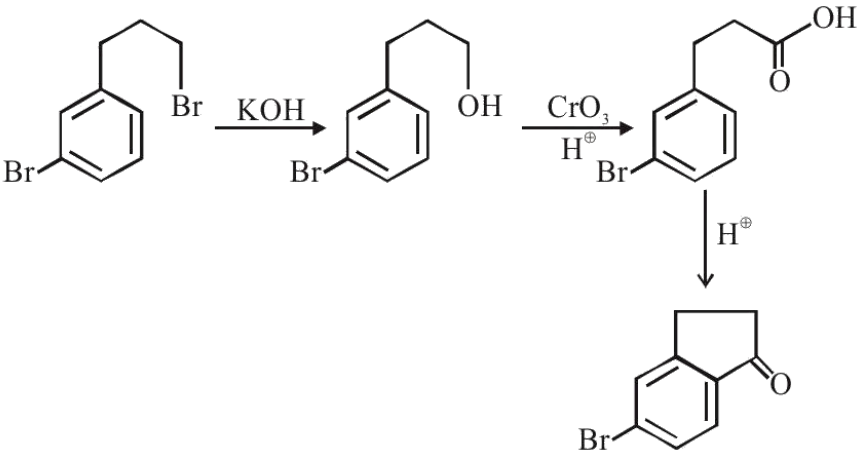
D.

Correct answer: B

Source solution

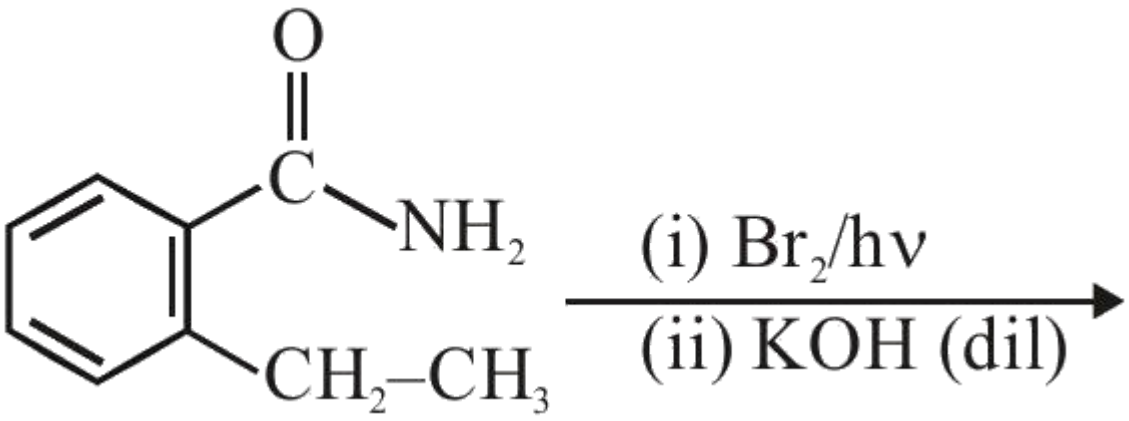
Sol.

During AES Br is o/p directing and major product will be formed on less hindrance p position :

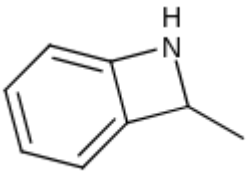

Br
Br
KOH
OH
Br
CrO_3
$H^{\oplus}$
OH
O
Br
$H^{\oplus}$
O
Br

Question 76

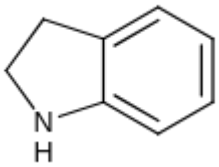
The major product of the following reaction is :



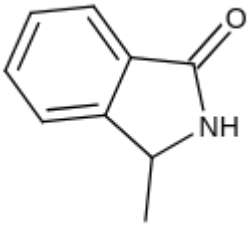
A.



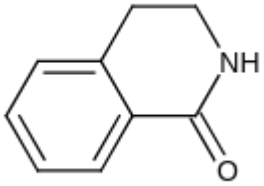
B.



C.



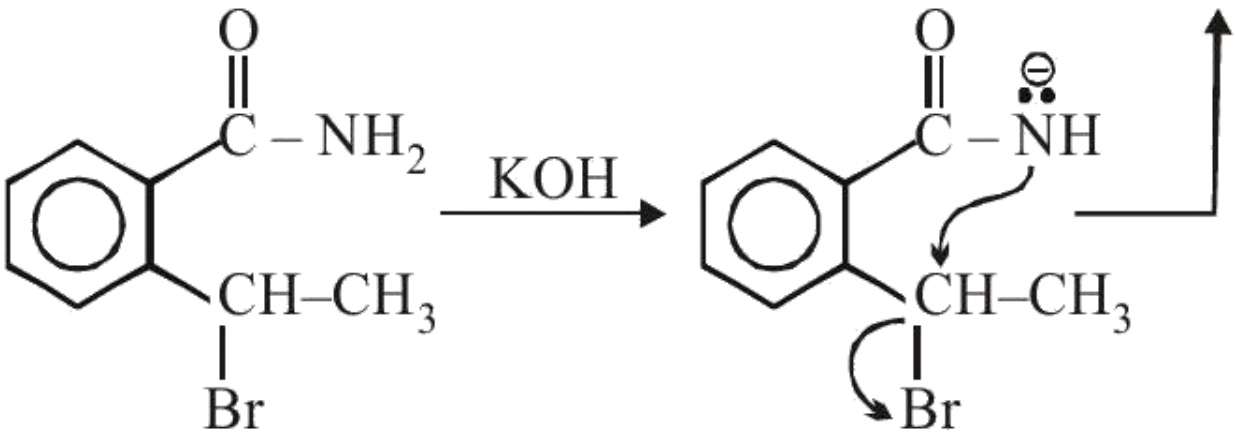
D.



Correct answer: C

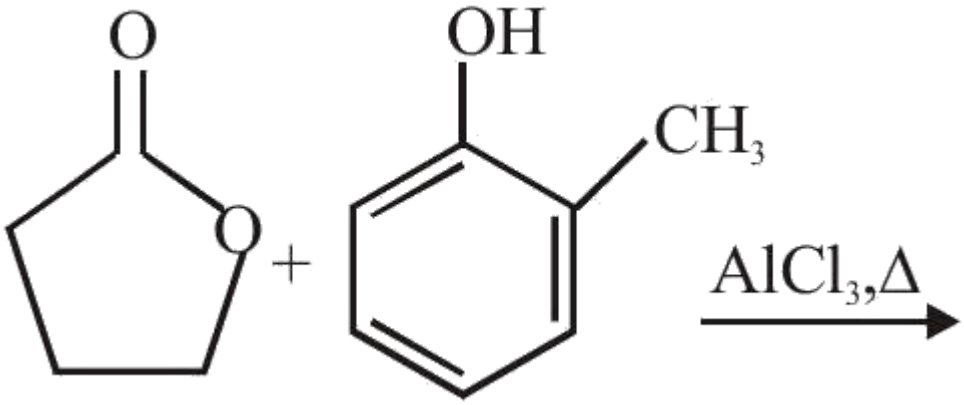
Source solution

Sol.

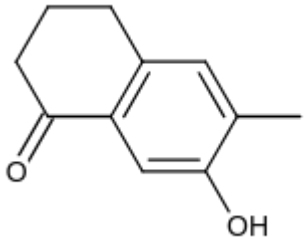

O
C – NH2
KOH
CH–CH3
Br
O
C – NH
CH–CH3
Br

Question 77

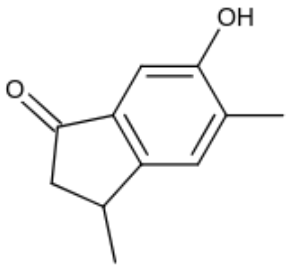
The major product of the following reaction is:



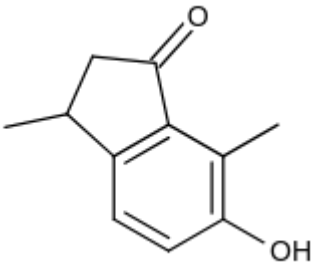
A.



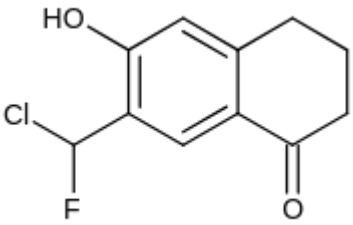
B.



C.



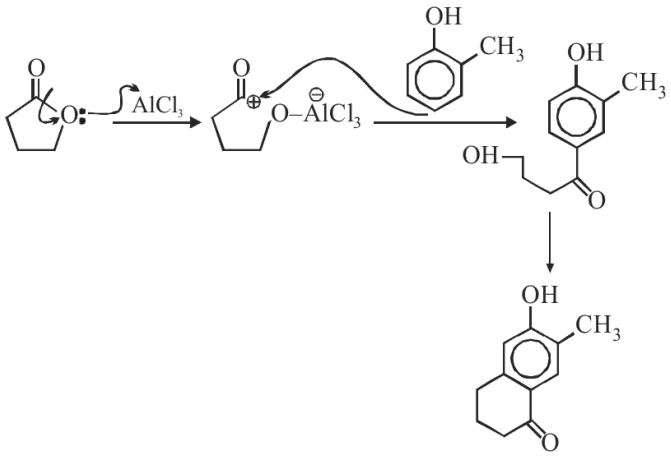
D.



Correct answer: D

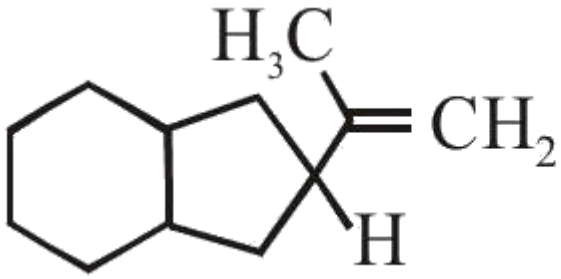
Source solution

Sol.


O
O:
AlCl3
O
O–AlCl3
OH
CH3
OH
CH3
OH
O
OH
CH3
O

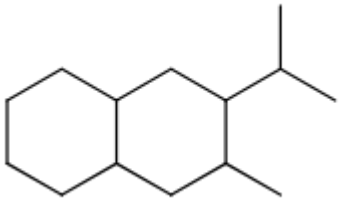
Question 78

The major product of the following reaction is:

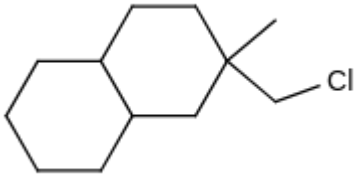




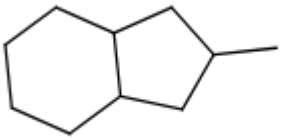
A.



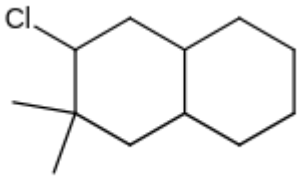
B.



C.



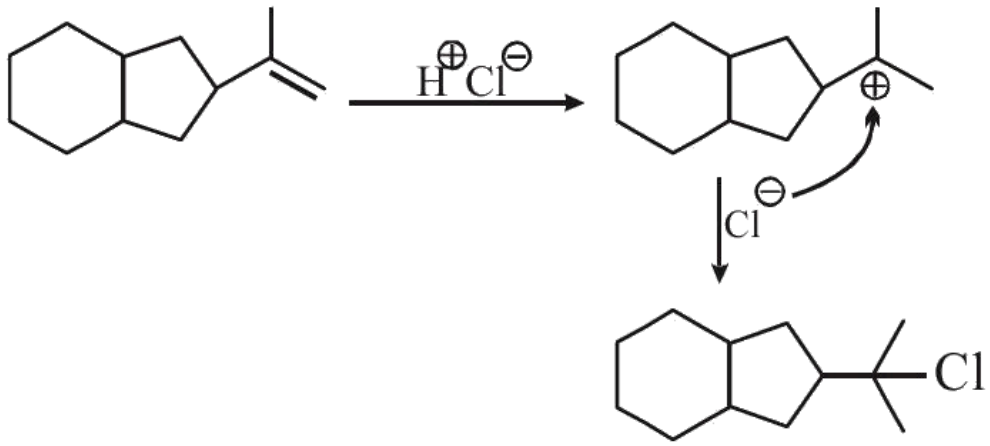
D.



Correct answer: A

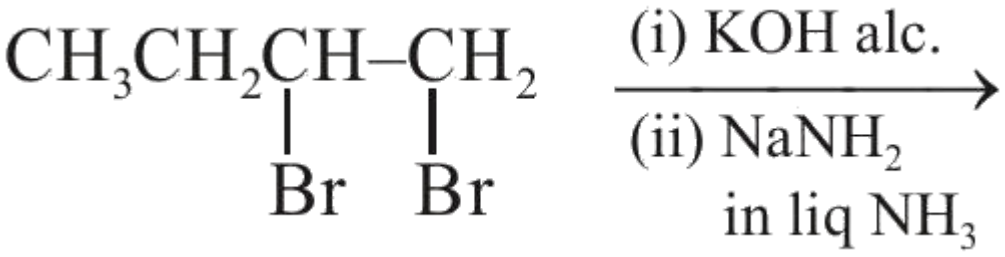
Source solution

Sol.



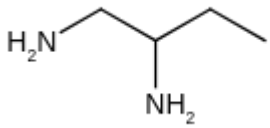
Question 79

The major product of the following reaction is:



A. $CH_3CH_2C \equiv CH$

B.



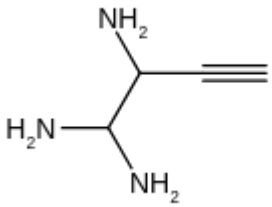
C. $CH_3CH = C = CH_2$

D. $CH_3CH = CHCH_2NH_2$

Correct answer: A

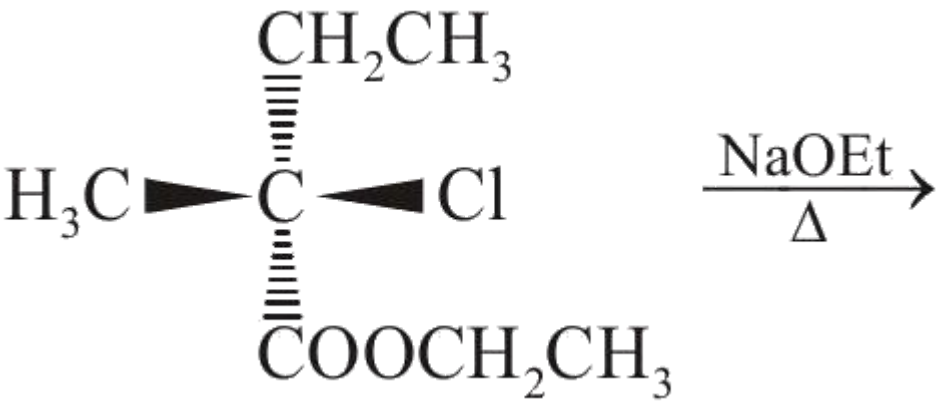
Source solution

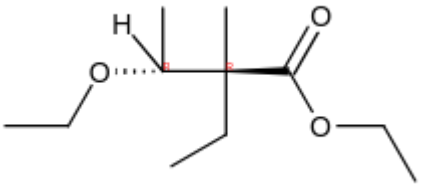
Sol.



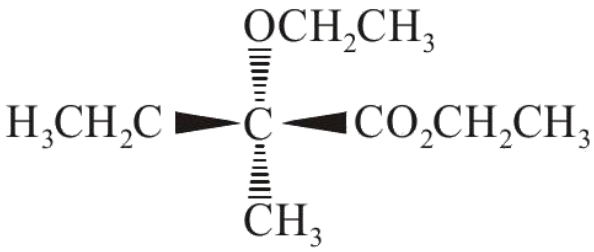
Question 80

The major product of the following reaction is:

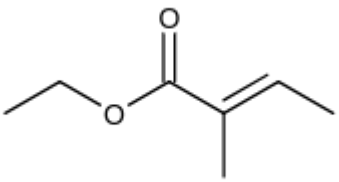




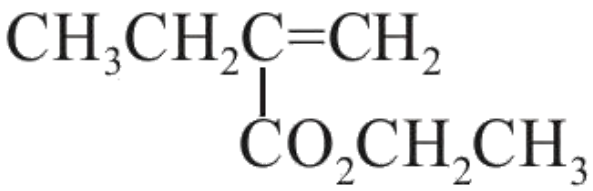
A.



B.



C.

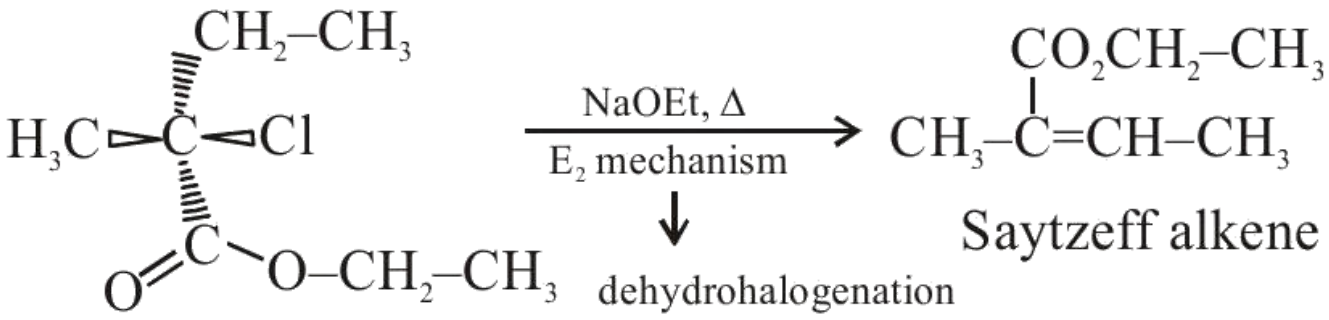


D.

Correct answer: C

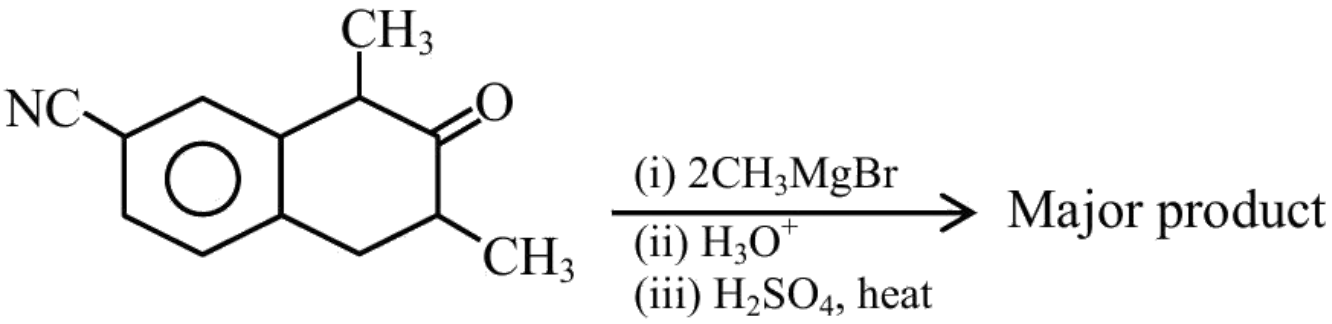
Source solution

Sol.

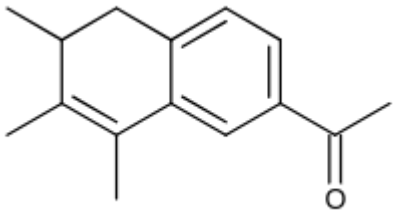

CH2–CH3
H3C
C
Cl
C
O
O–CH2–CH3
NaOEt, Δ
E2 mechanism
dehydrohalogenation
CO2CH2–CH3
CH3–C=CH–CH3
Saytzeff alkene

Question 81

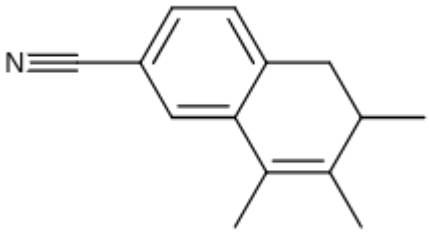
Which one of the following is the major product of the given reaction?



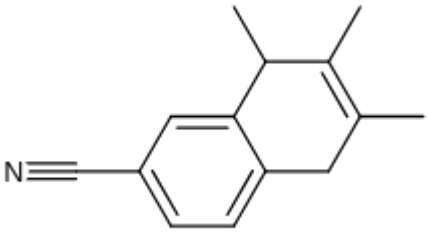
A.



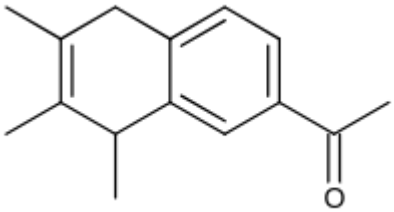
B.



C.



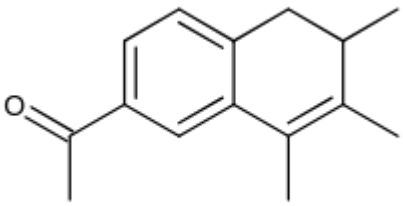
D.



Correct answer: A

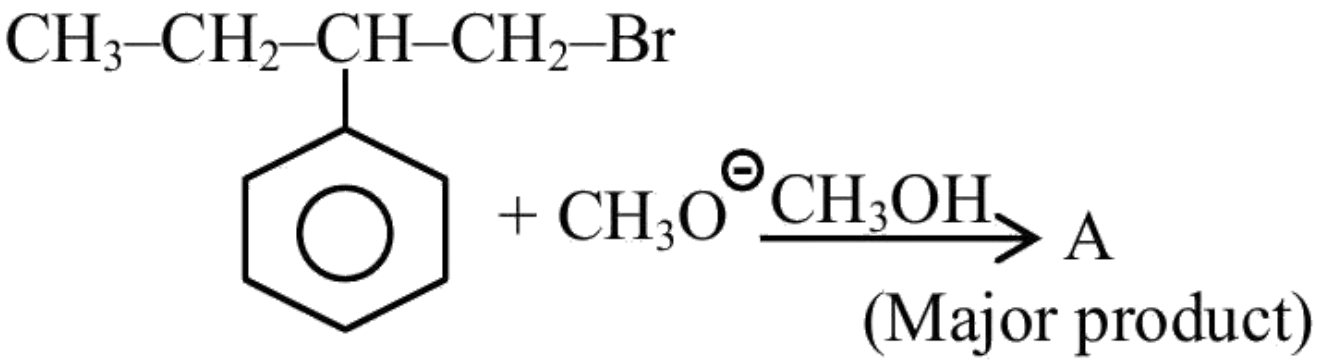
Source solution

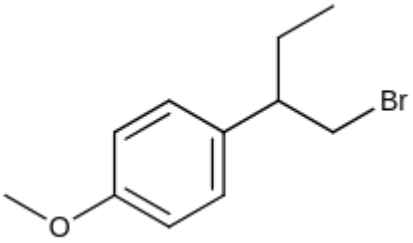
Sol.



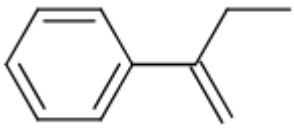
Question 82

The major product (A) formed in the reaction given below is :

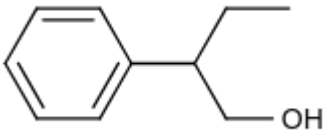




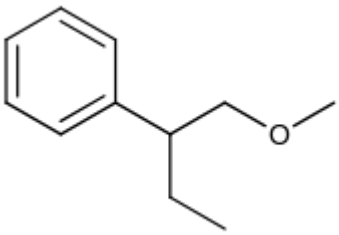
A.



B.



C.

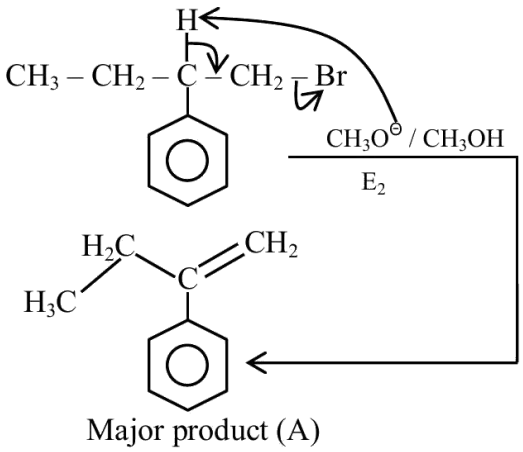


D.

Correct answer: B

Source solution

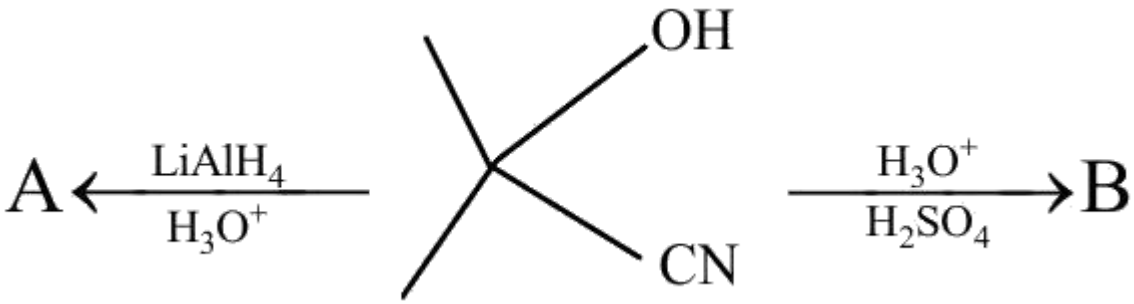
Sol.



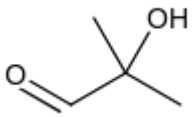
Major product (A)

Question 83

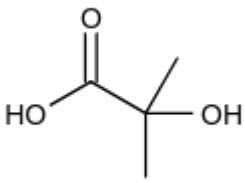
The major products A and B in the following set of reactions are :



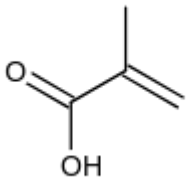
A.



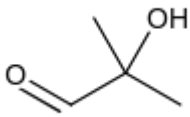
B.



C.



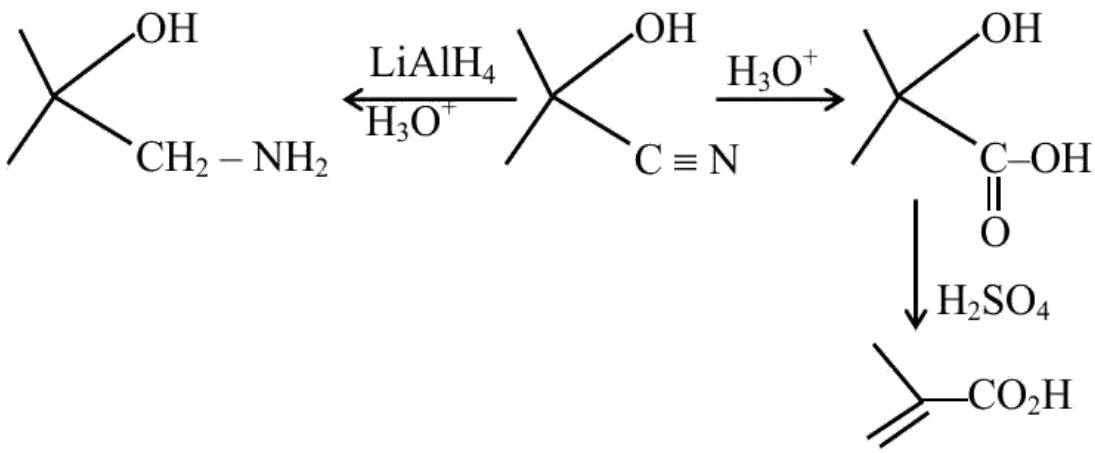
D.



Correct answer: C

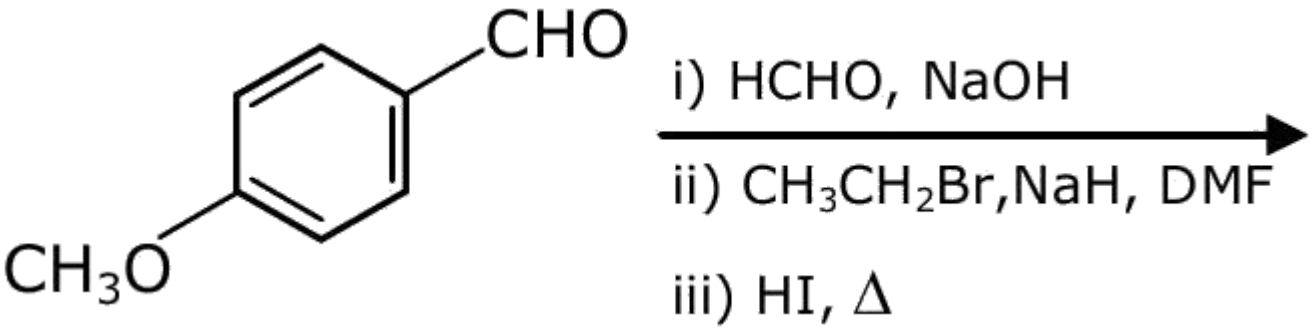
Source solution

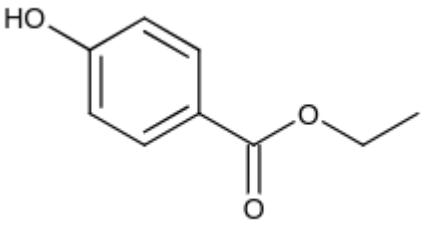
Sol.


OH
CH2 – NH2
LiAlH4
H3O+
OH
C ≡ N
H3O+
OH
C–OH
O
H2SO4
CO2H

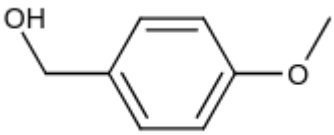
Question 84

Identify A in the following chemical reaction.

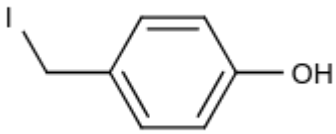




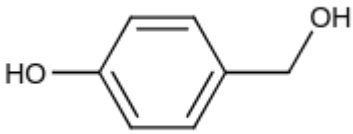
A.



B.



C.

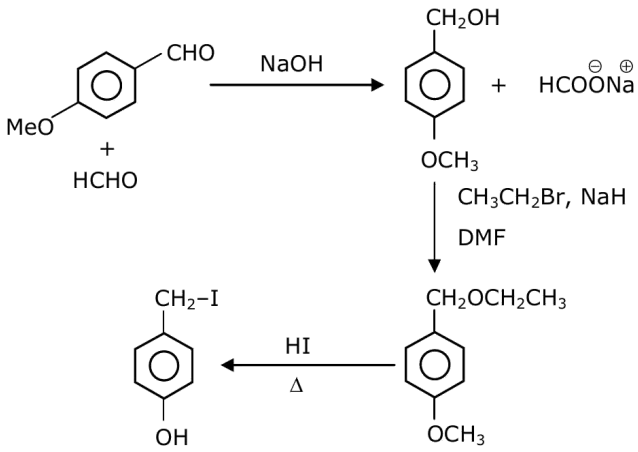


D.

Correct answer: C

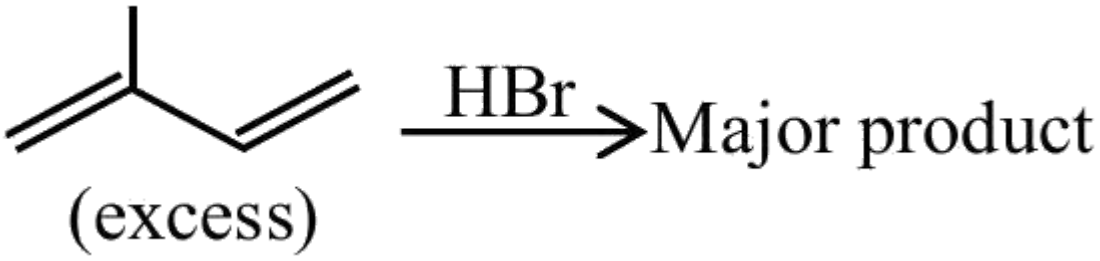
Source solution

Sol.

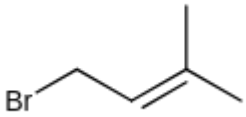

CHO
MeO
+
HCHO
NaOH
CH2OH
OCH3
+
HCOONa
CH3CH2Br, NaH
DMF
CH2OCH2CH3
OCH3
HI
Δ
CH2–I
OH

Question 85

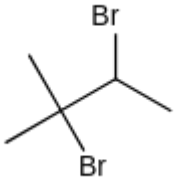
The major product formed in the following reaction is :



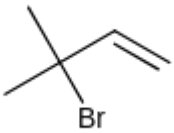
A.



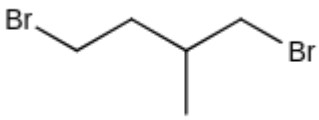
B.



C.



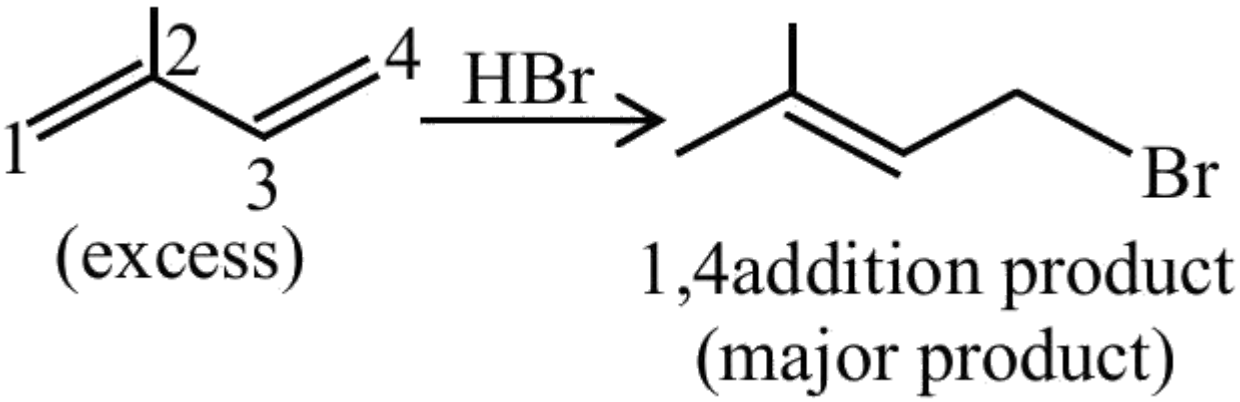
D.



Correct answer: A

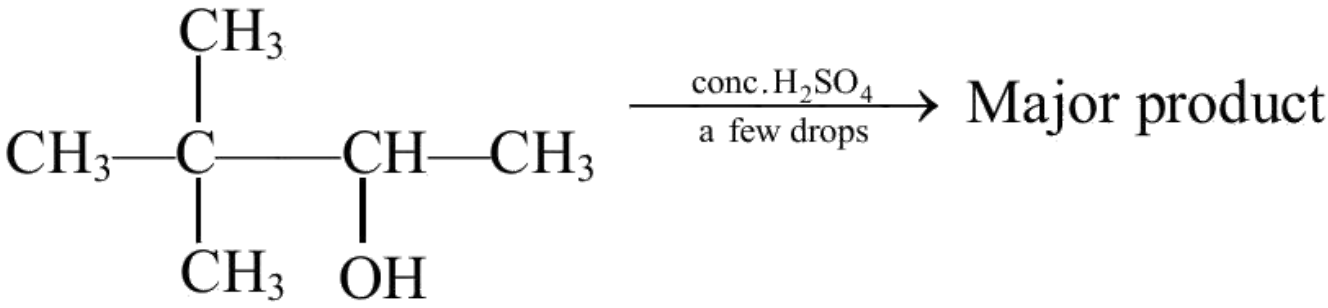
Source solution

Sol.

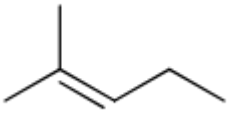


Question 86

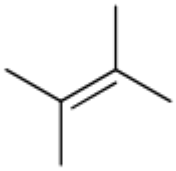
The major product formed in the following reaction is :



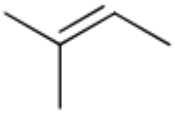
A.



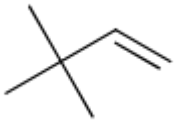
B.



C.



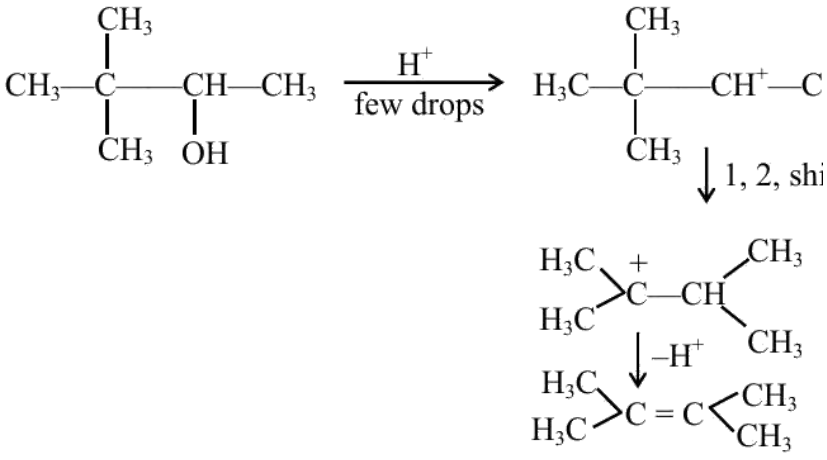
D.



Correct answer: B

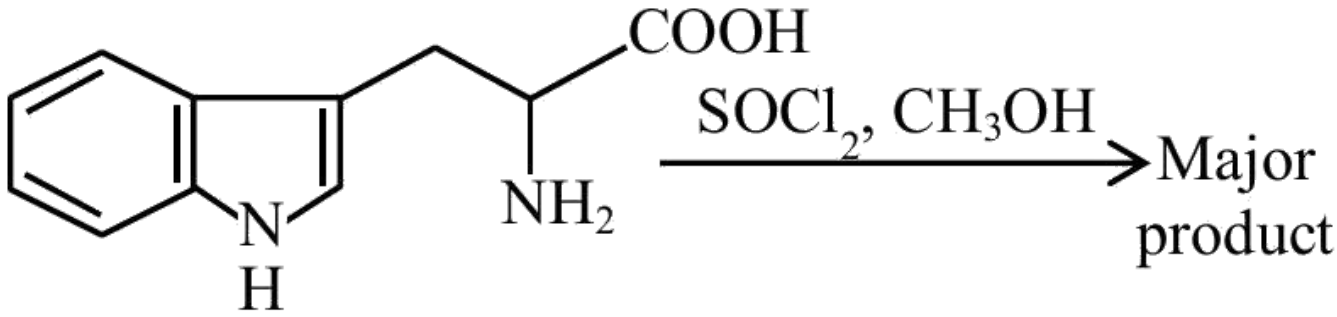
Source solution

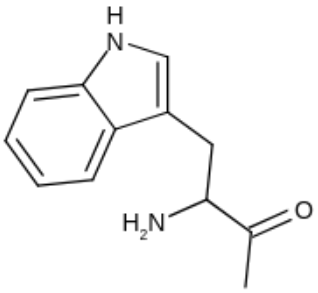
Sol.



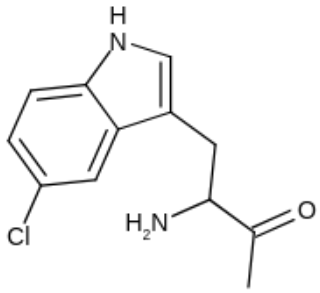
Question 87

The major product formed in the following reaction is :

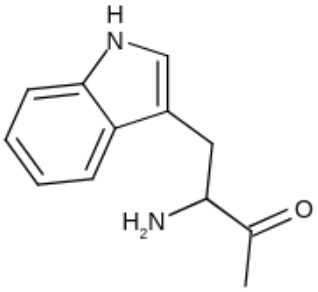




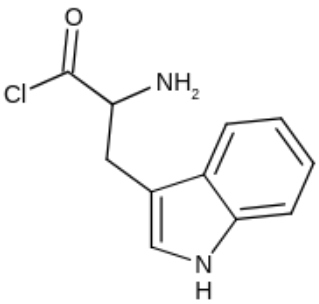
A.



B.



C.

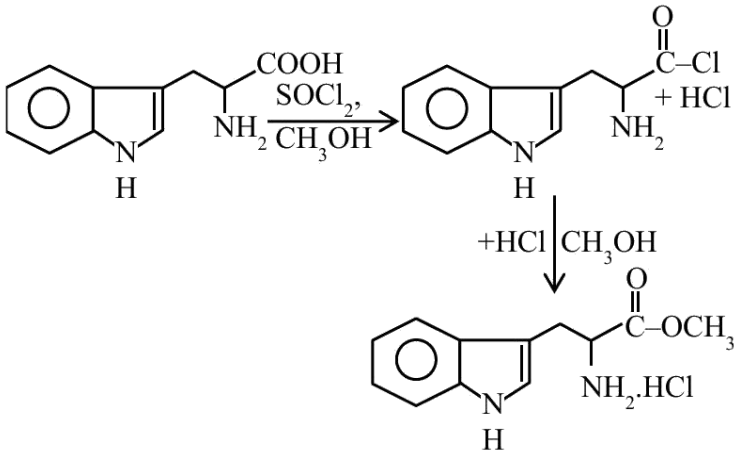


D.

Correct answer: C

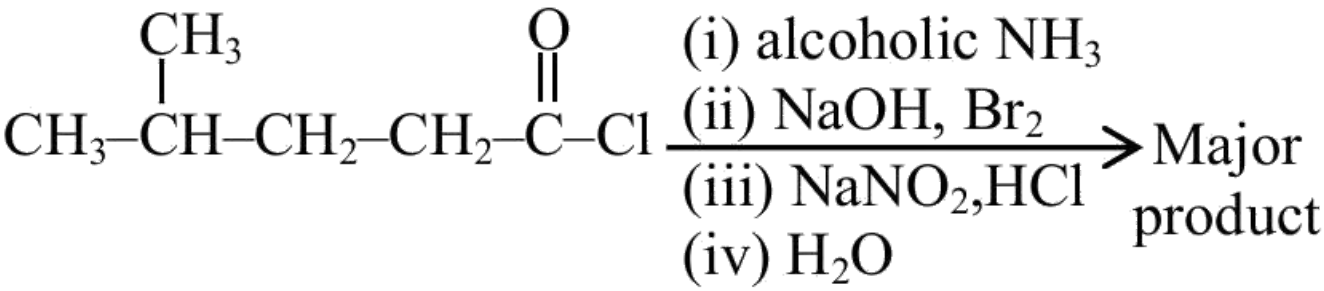
Source solution

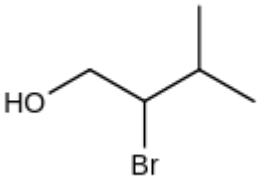
Sol.


COOH
$SOCl_2$,
NH_2 CH_3OH
O
C–Cl
+ HCl
NH_2
N
H
+HCl CH_3OH
O
C–OCH$_3$
NH_2.HCl
N
H

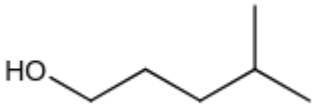
Question 88

The major product of the following reaction is :

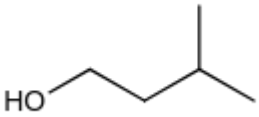




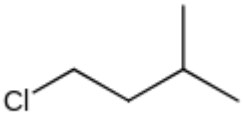
A.



B.



C.

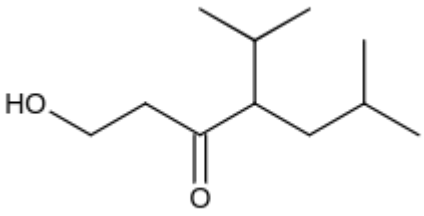


D.

Correct answer: C

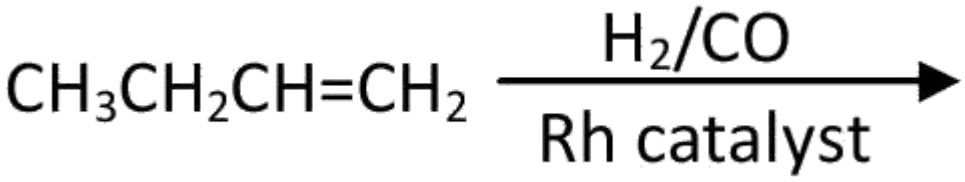
Source solution

Sol.



Question 89

The major product of the following reaction is :



A. $CH_3CH_2CH_2CHO$

B. $CH_3CH_2CH = CH - CHO$

C. $CH_3CH_2CH_2CH_2CHO$

D. $CH_3CH_2C = CH_2$

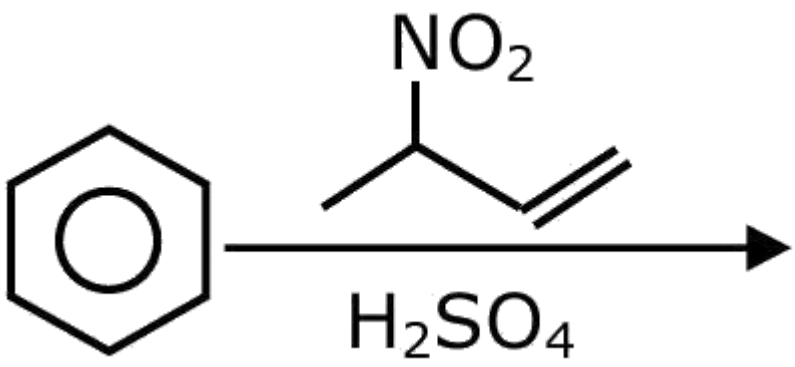
Correct answer: C

Source solution

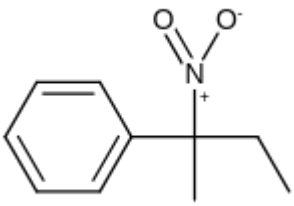
Sol. $CH_3 - CH_2 - CH = CH_2 \xrightarrow[Rh \text{ catalyst}]{H_2/CO} CH_3CH_2CH_2CHO$

Question 90

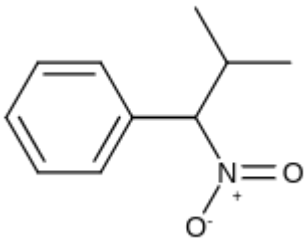
The major product of the following reaction is :



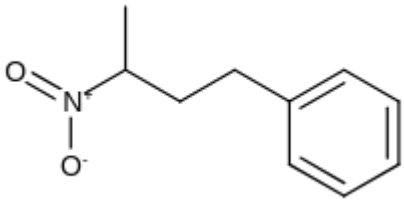
A.



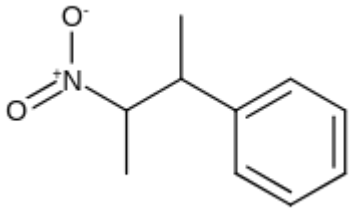
B.



C.



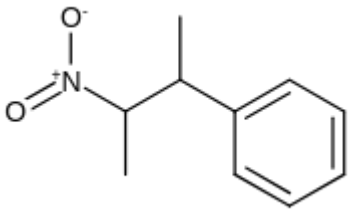
D.



Correct answer: D

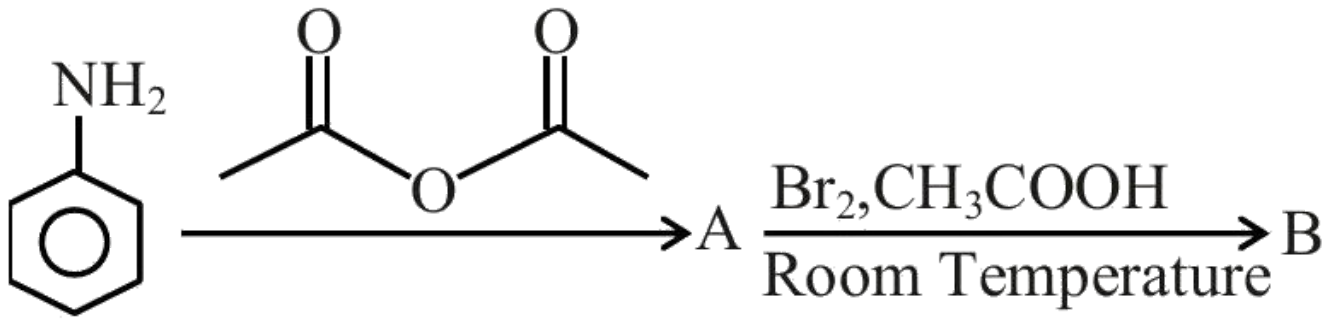
Source solution

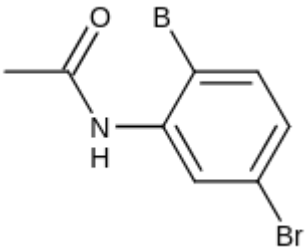
Sol.



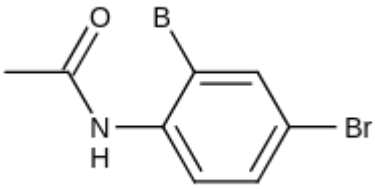
Question 91

The major products A and B formed in the following reaction sequence are :



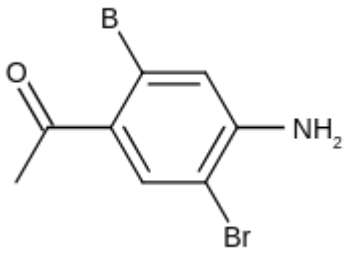


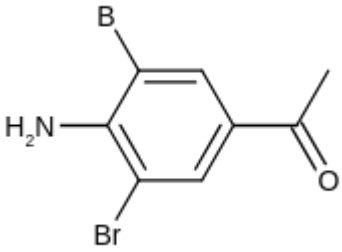
A.



B.

C. ,



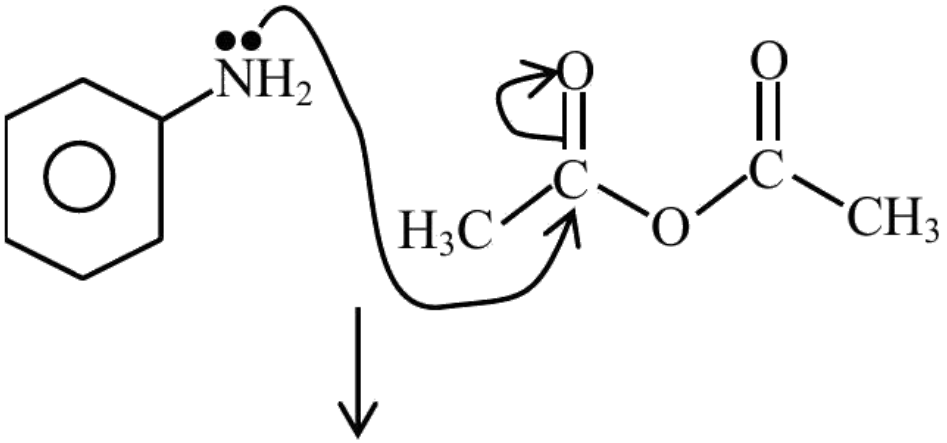


D.

Correct answer: B

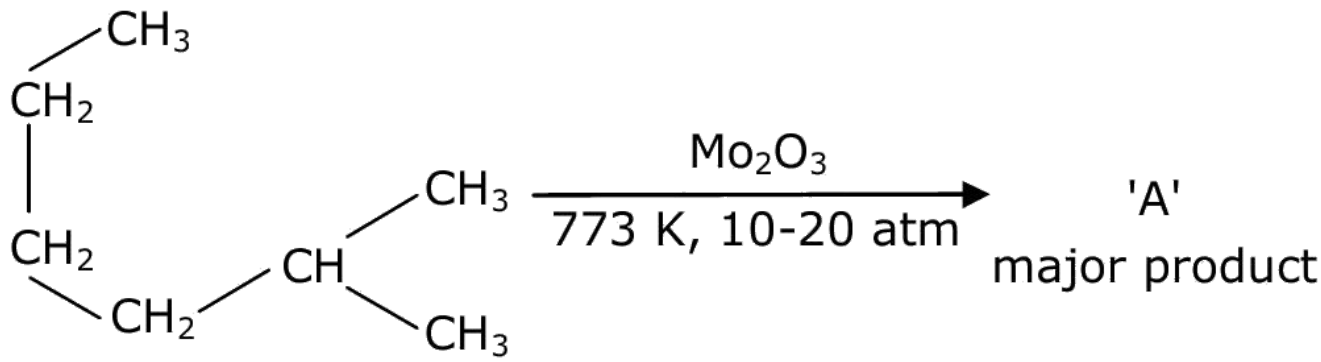
Source solution

Sol.


NH2
O
O
C
C
H3C
O
CH3

Question 92

Identify A in the given chemical reaction.



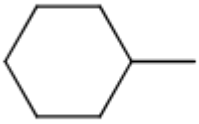
A.



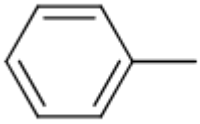
B.



C.



D.

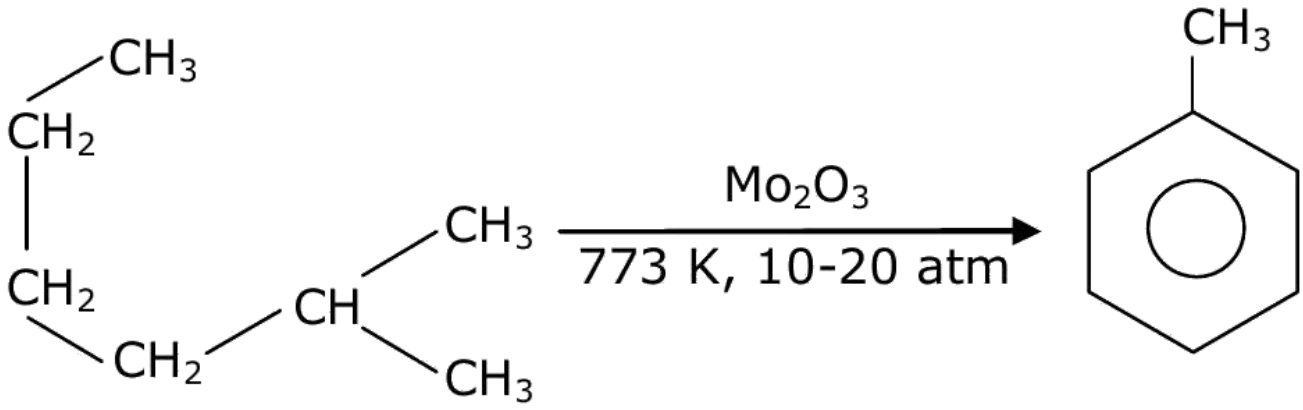


Correct answer: D

Source solution

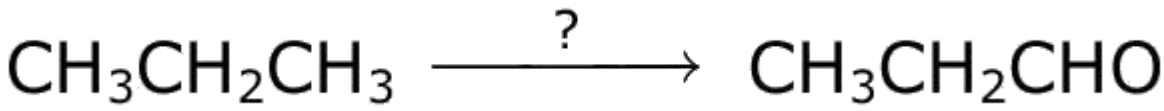
Sol. (4)}

Aromatization reaction or hydroforming reaction.



Question 93

Which of the following reagent is used for the following reaction?



A. Potassium permanganate

B. Molybdenum oxide

C. Copper at high temperature and pressure

D. Manganese acetate

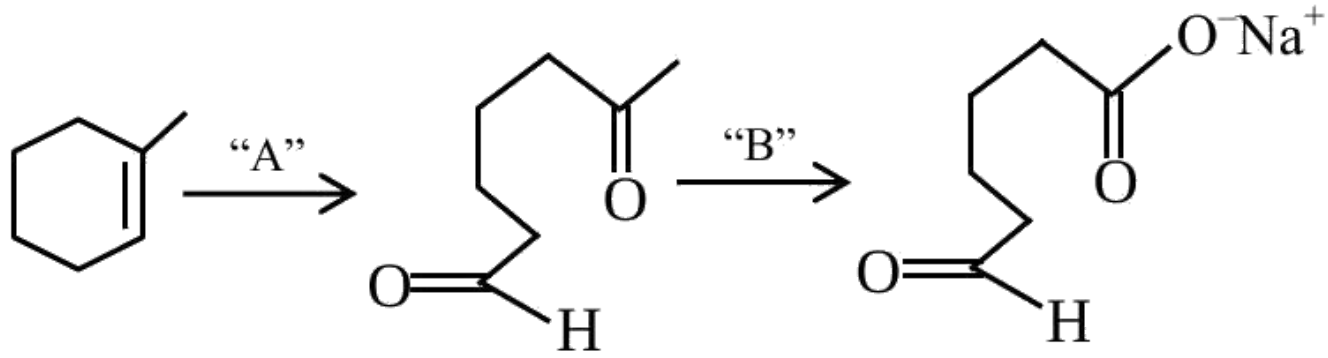
Correct answer: B

Source solution

Sol. $\mathbf{CH_3 - CH_2 - CH_3 \xrightarrow{MO_2O_3} CH_3 - CH_2 - CH = 0}$

Question 94

In the above chemical reaction sequence "A" and " B " respectively are :



A. $O_3, Zn/H_2O$ and $NaOH_{(alc.)}$ /I_2

B. $H_2O, H^+$and $NaOH_{(alc.)}$ /I_2

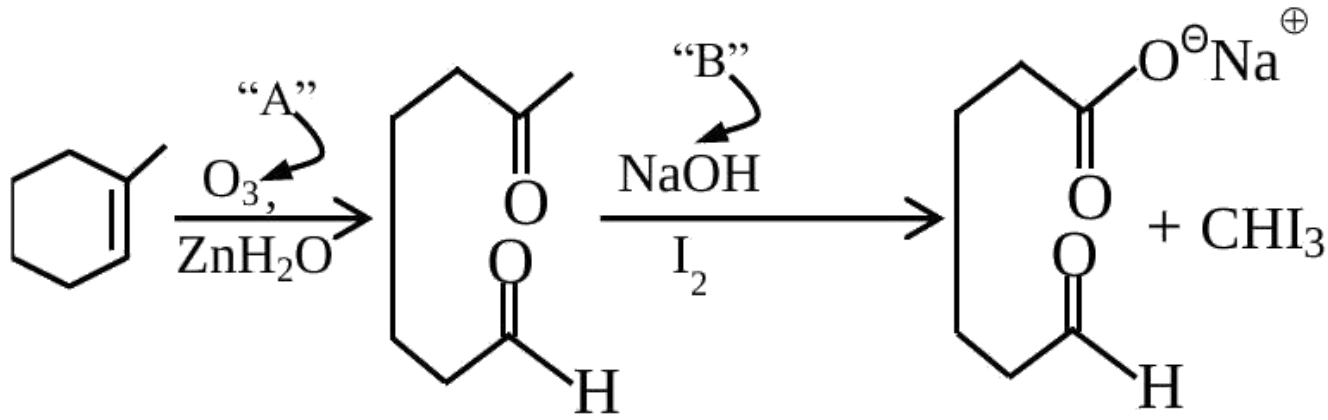
C. $H_2O, H^+$and $KMnO_4$

D. $O_3, Zn/H_2O$ and $KMnO_4$

Correct answer: A

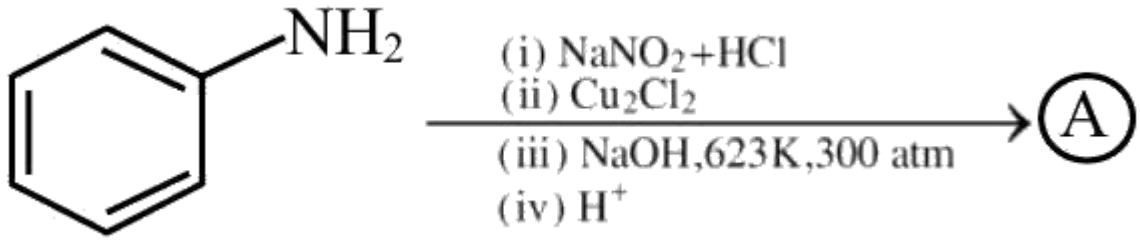
Source solution

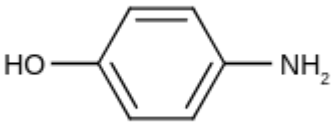
Sol.



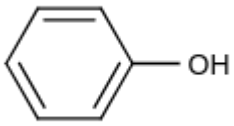
Question 95

Identify the product (A) in the following reaction.

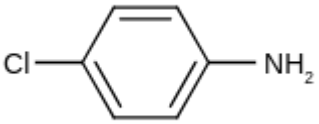




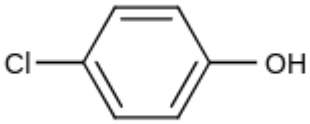
A.



B.



C.

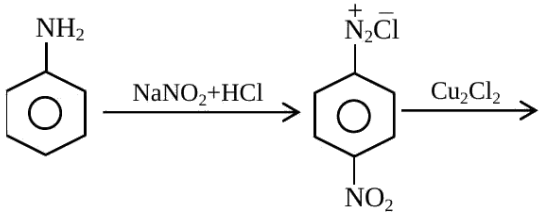


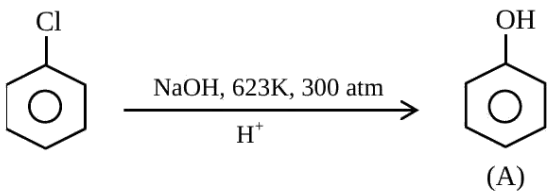
D.

Correct answer: B

Source solution

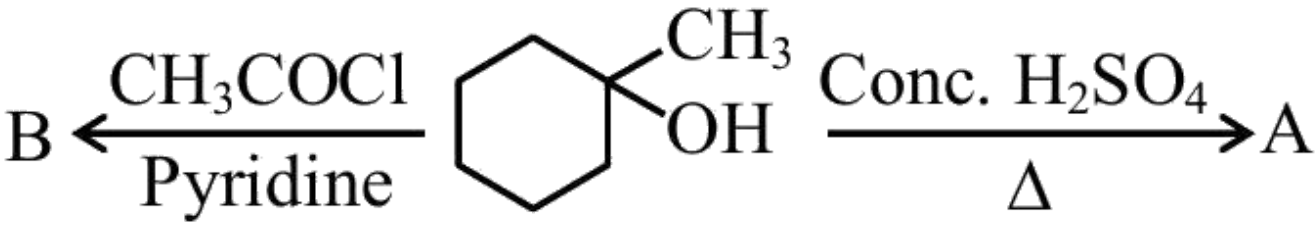
Sol.

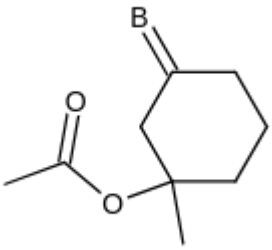




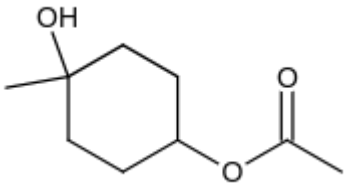
Question 96

Identify the major products A and B respectively in the following set of reactions.

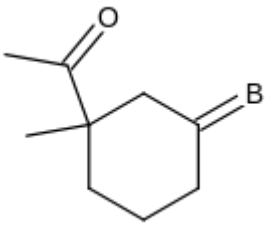




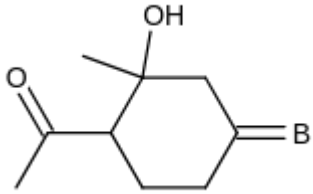
A.



B.



C.

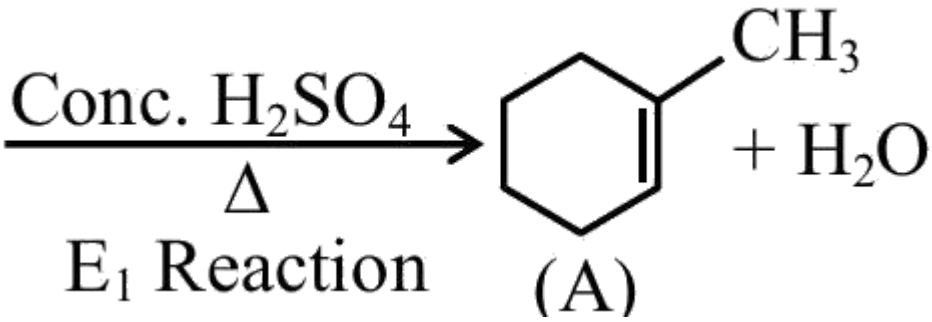


D.

Correct answer: A

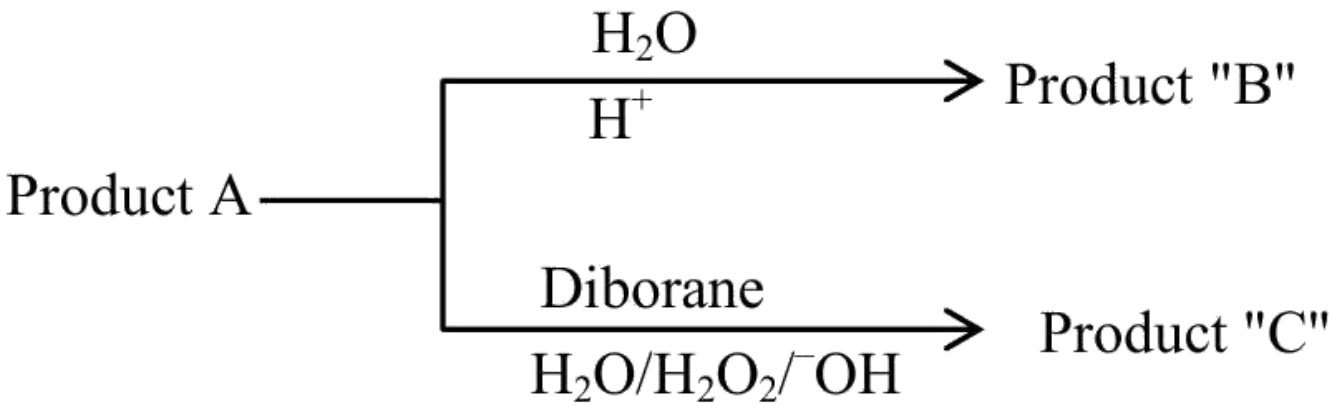
Source solution

Sol.



Question 97

Consider the above reactions, identify product B and product C .



A. $\mathbf{B = C =}$ 2-Propanol

B. $\mathbf{B =}$ 2-Propanol $\mathbf{C =}$ 1-Propanol

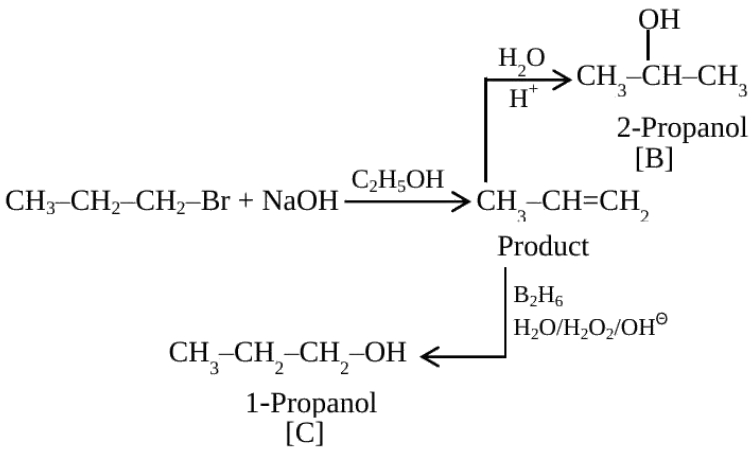
C. $\mathbf{B =}$ 1-Propanol $\mathbf{C =}$ 2-Propanol

D. $\mathbf{B = C =}$ 1-Propanol

Correct answer: B

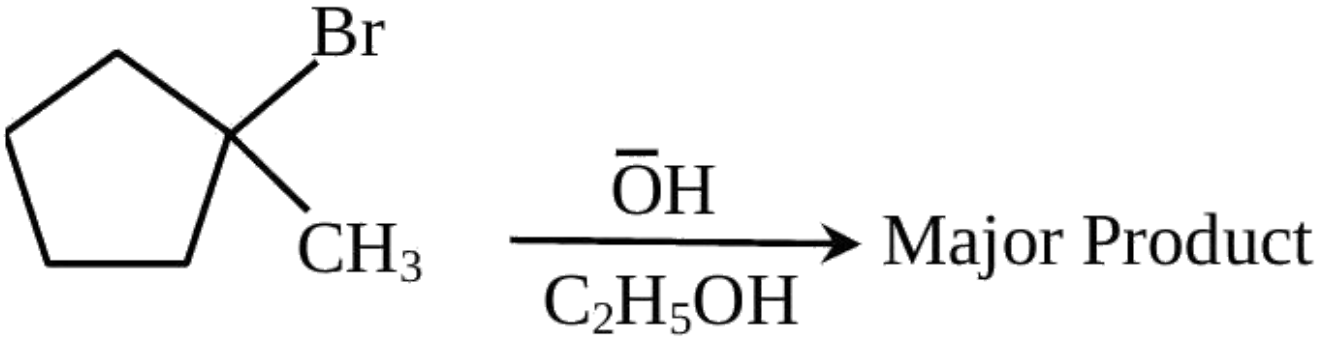
Source solution

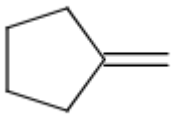
Sol.



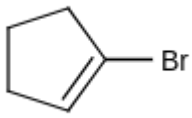
Question 98

Identify the major product in the following reaction.

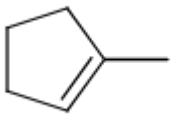




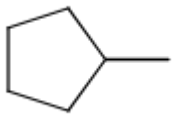
A.



B.



C.

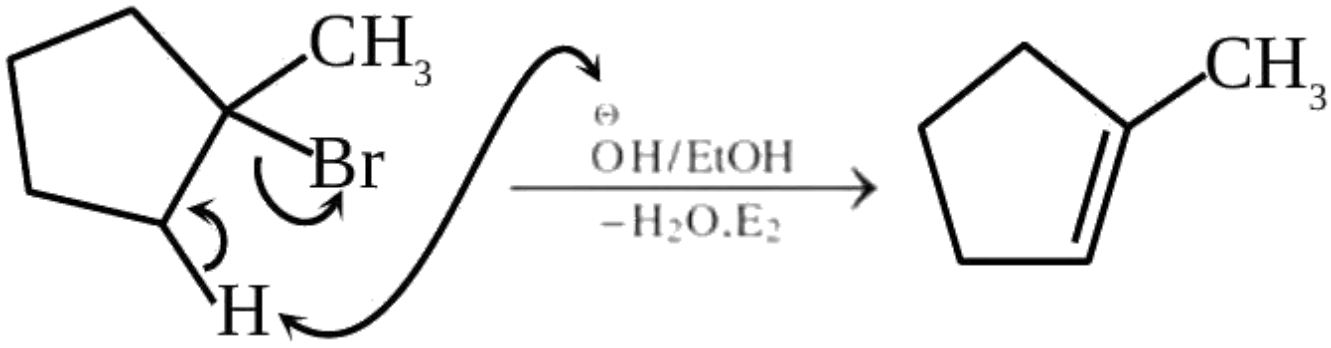


D.

Correct answer: C

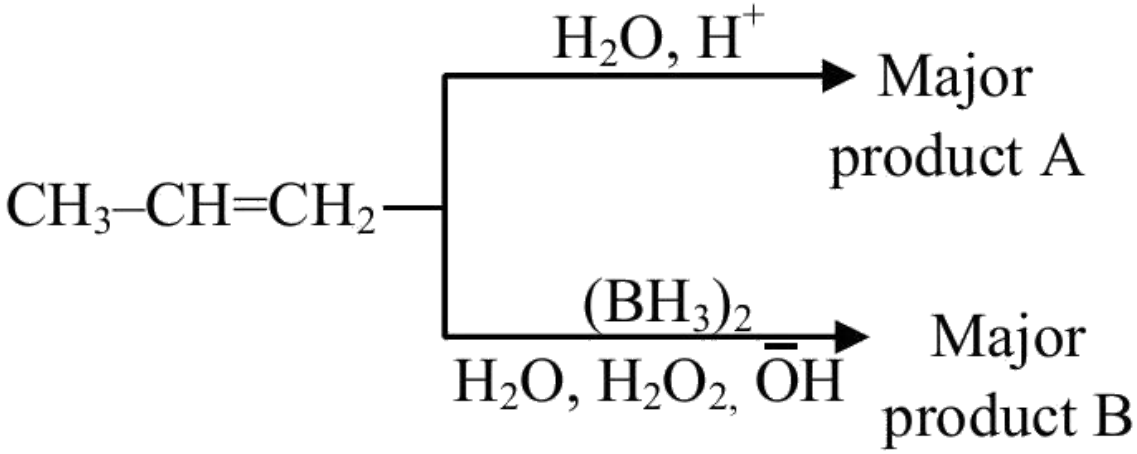
Source solution

Sol.



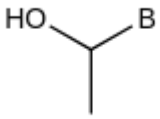
Question 99

Identify the product A and product B in the following set of reactions.



A. $A - CH_3CH_2CH_2 - OH, B - CH_3CH_2CH_2 - OH$

B. $A - CH_3CH_2CH_2 - OH$,



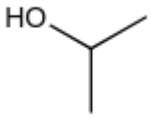
C. (2) Hydroboration Oxidation Reaction :}

(B)

$$3CH_3–CH=CH_2 + B_2H_6 \xrightarrow{THF} 2(CH_3CH_2CH_2)_3B$$

$$(CH_3CH_2CH_2)_3B + 3H_2O_2 \xrightarrow{OH^-} \underset{(B)}{3CH_3CH_2CH_2OH} + H_3BO_3$$

D. (3)

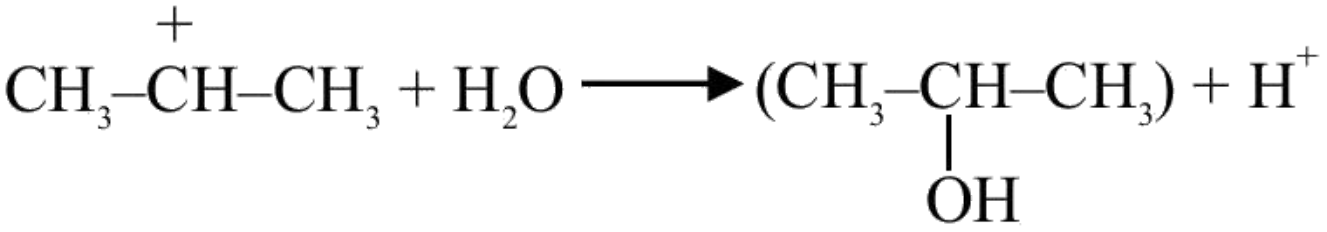


Correct answer: C

Source solution

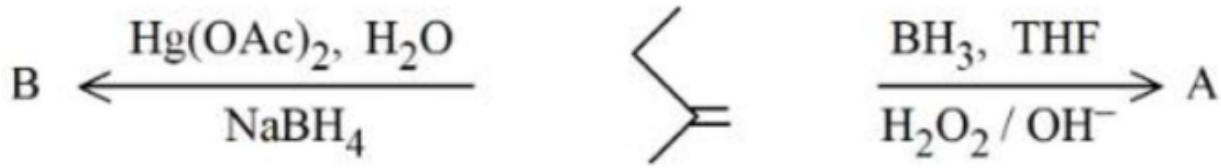
Sol. (1) Hydration Reaction :

(A)



Question 100

Find out the major products from the following reaction



A. 

B. 

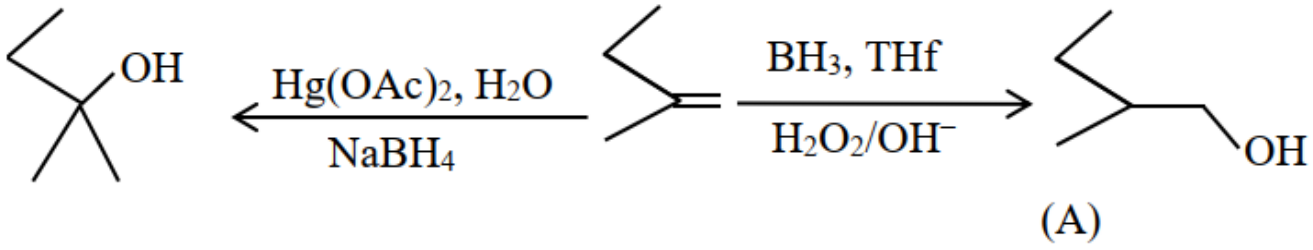
C. 

D. 

Correct answer: B

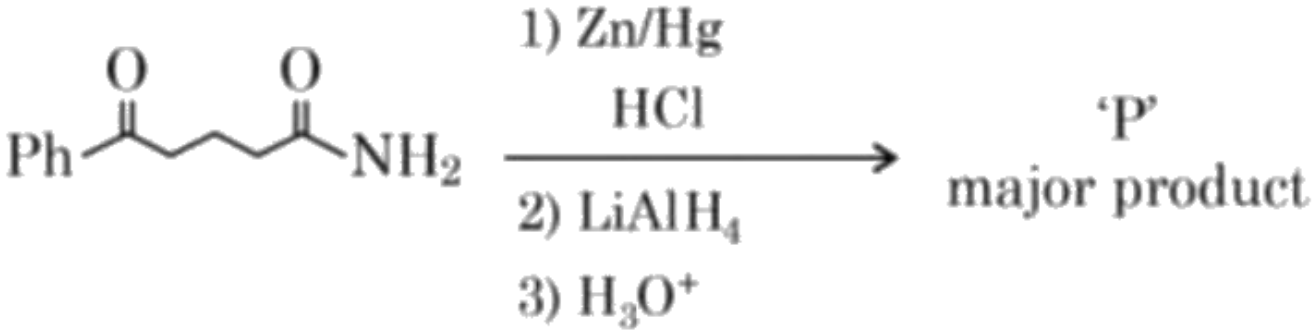
Source solution

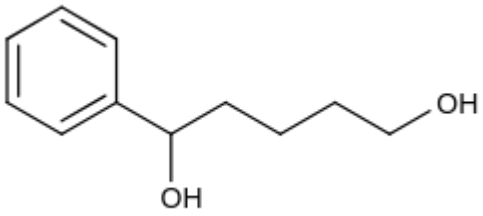
Sol. 2



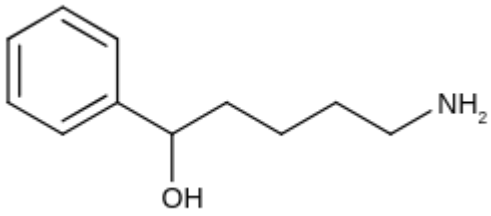
Question 101

The major product ' P ' for the following sequence of reactions is:

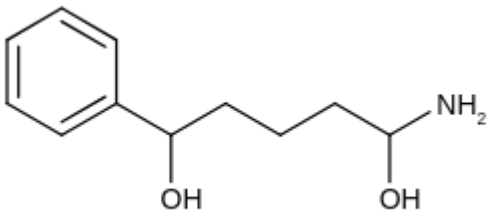




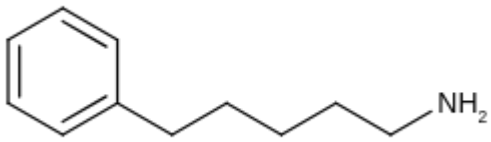
A.



B.



C.

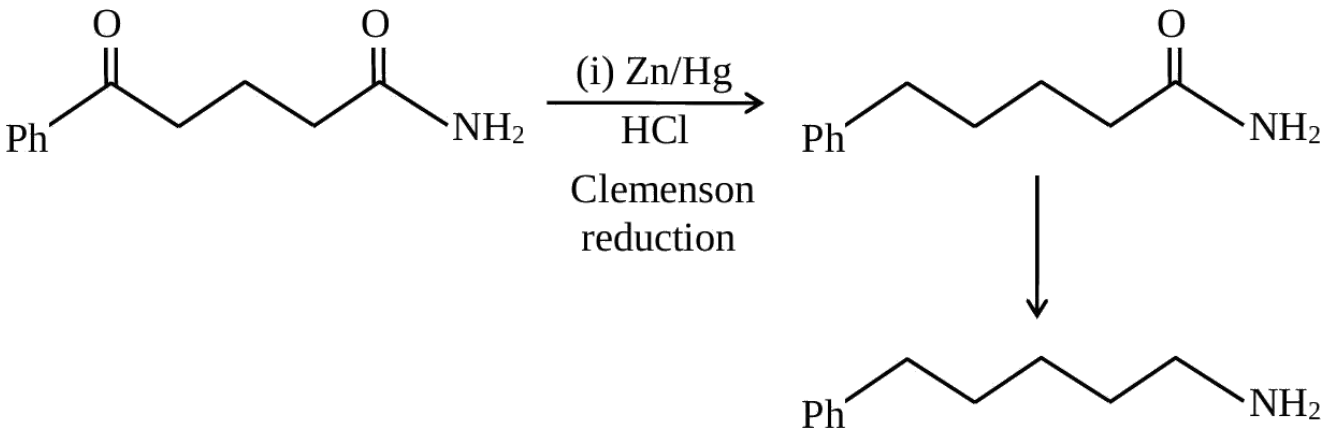


D.

Correct answer: D

Source solution

Sol. 4


O
O
Ph
NH2
(i) Zn/Hg
HCl
Clemenson
reduction
O
Ph
NH2
Ph
NH2

Question 102

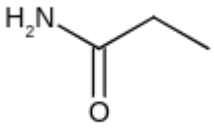
Consider the given reaction, identify the major product P .

$$CH_3-COOH \xrightarrow[(iv)\ H_2O/\bar{O}H,\Delta]{(i)\ LiAlH_4 \quad (ii)\ PCC \quad (iii)\ HCN/\bar{O}H} \text{"P"}$$

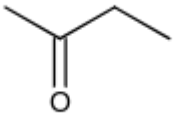
A.



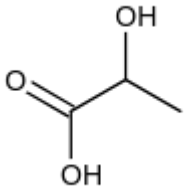
B.



C.



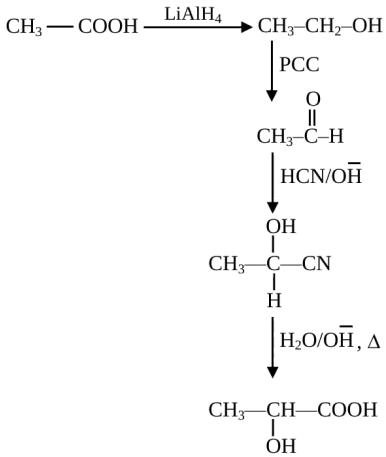
D.



Correct answer: D

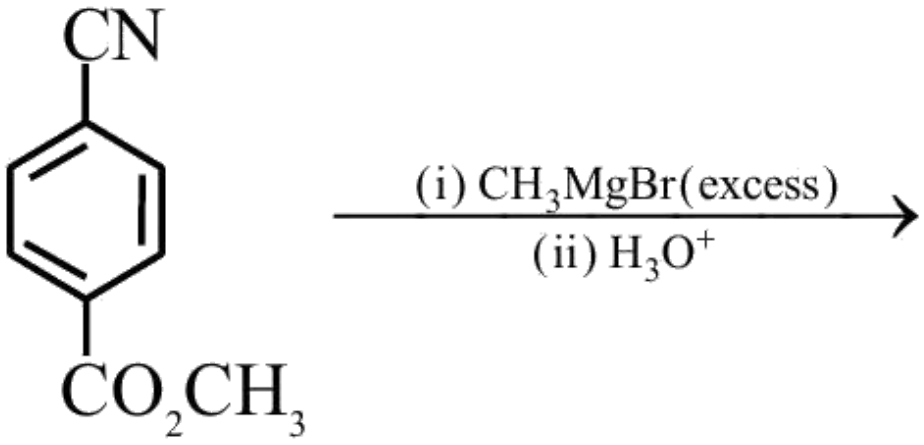
Source solution

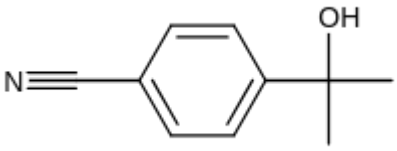
Sol.



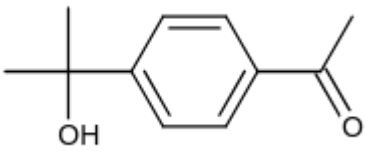
Question 103

Major product of the following reaction is

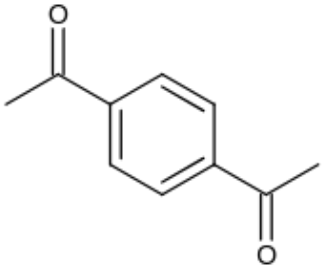




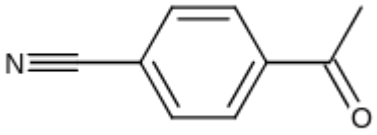
A.



B.



C.

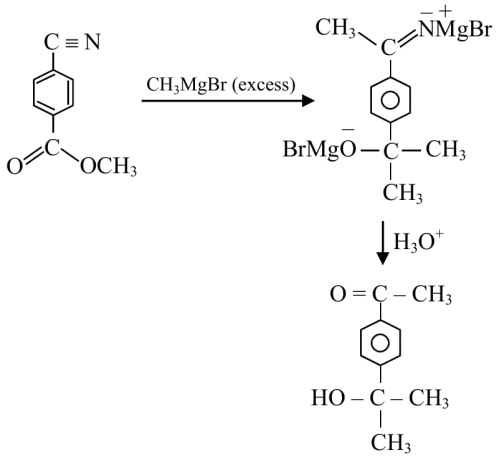


D.

Correct answer: B

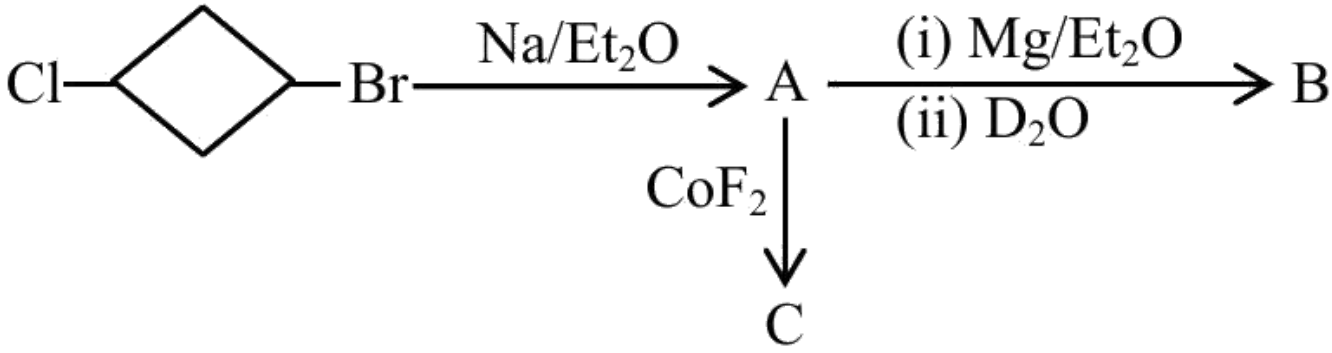
Source solution

Sol.

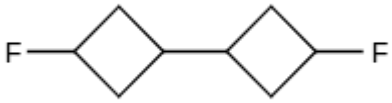

C ≡ N
O
C
OCH3
CH3MgBr (excess)
CH3
C
NMgBr
BrMgO
C
CH3
CH3
H3O+
O = C – CH3
HO – C – CH3
CH3

Question 104

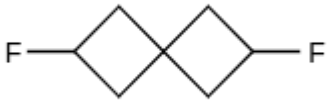
In the following sequence of reaction, the major products B and C respectively are :



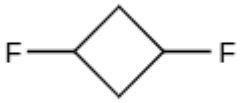
A.



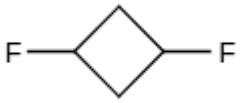
B.



C.



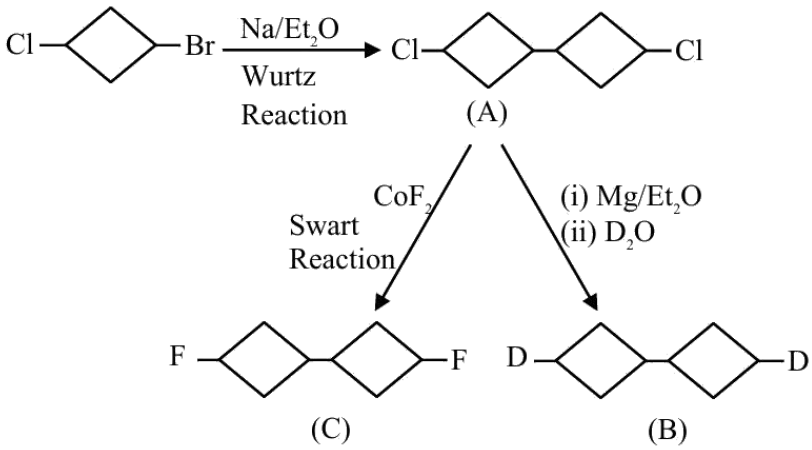
D.



Correct answer: A

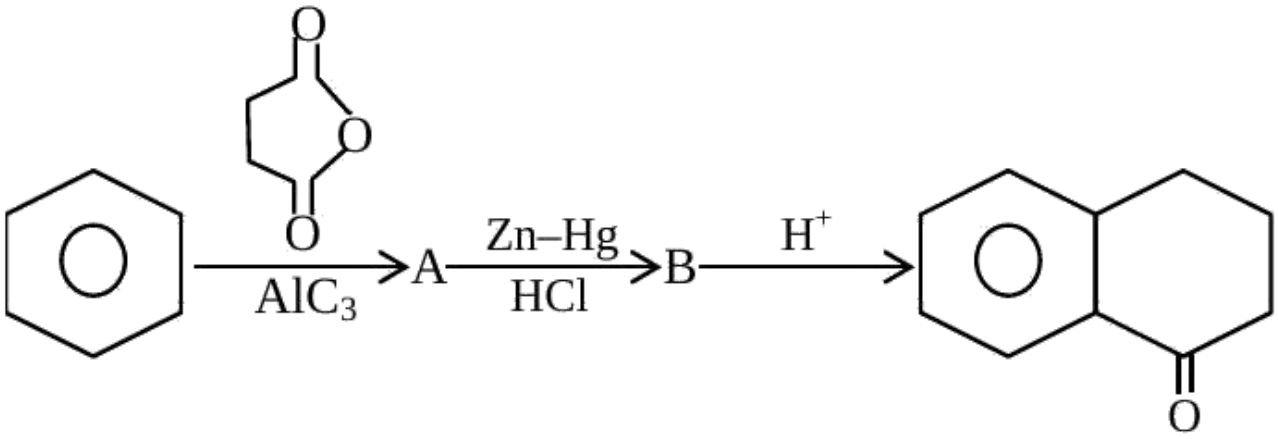
Source solution

Sol.

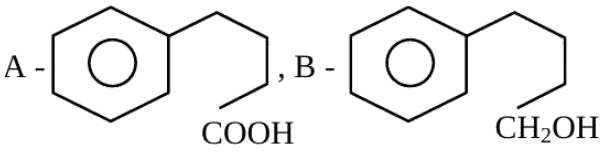


Question 105

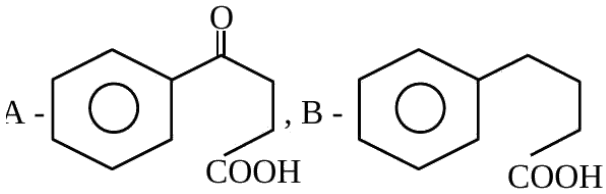
Identify A and B in the given chemical reaction sequence : -



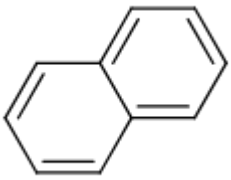
A.



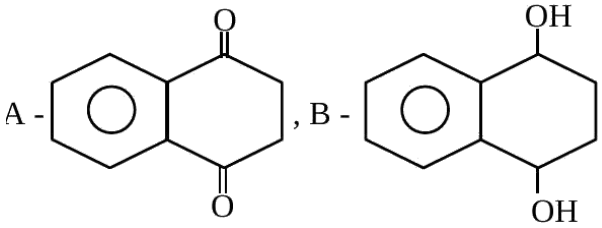
B.



C.



D.



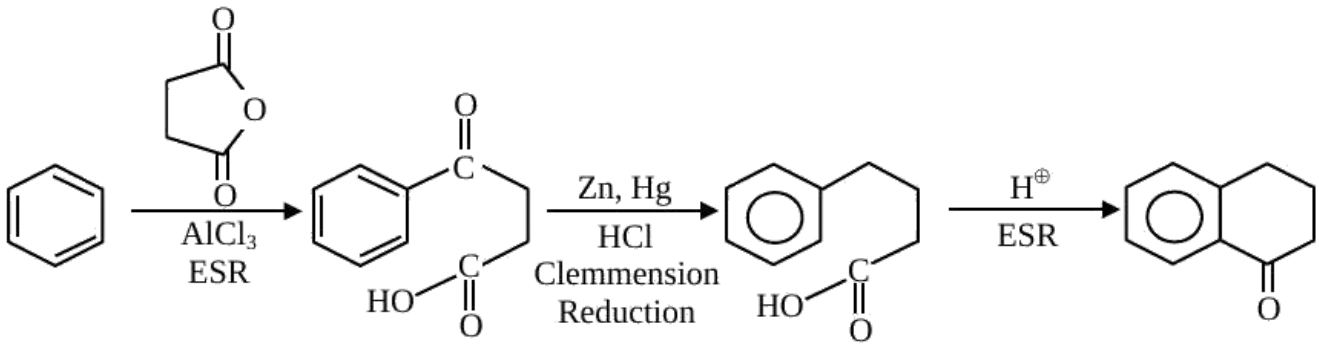
Correct answer: B

Source solution

Sol.

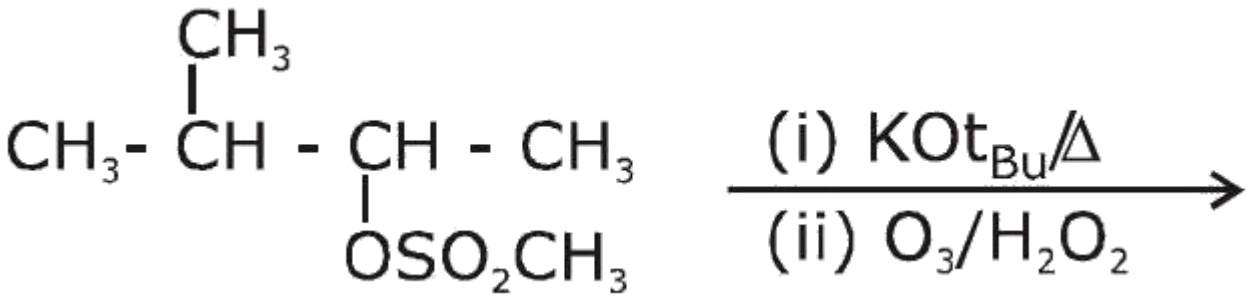
(A)

(B)

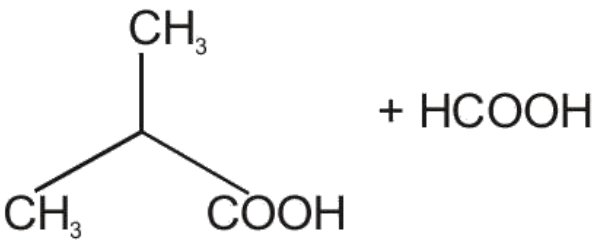

O
O
O
AlCl3
ESR
O
C
HO
C
O
Zn, Hg
HCl
Clemmension
Reduction
HO
C
O
H⊕
ESR
O

Question 106

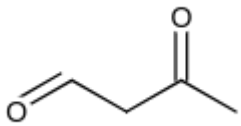
The major products of the following reactions are :



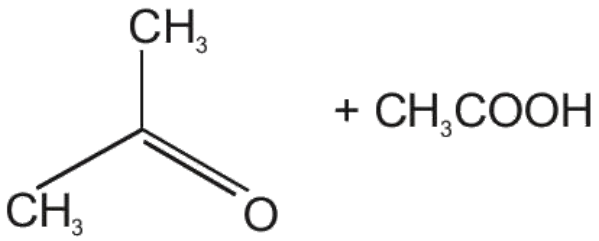
A.



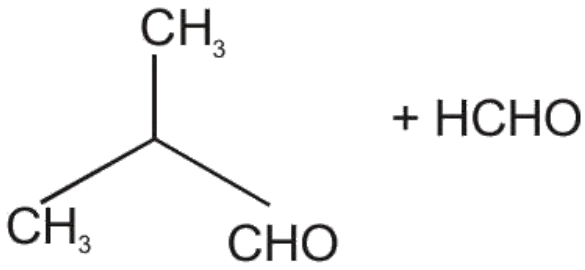
B.



C.



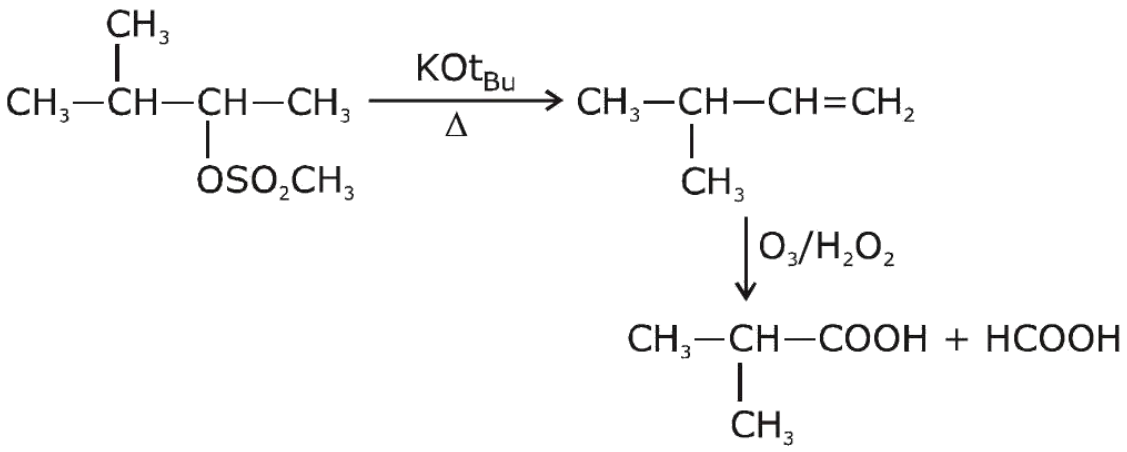
D.



Correct answer: A

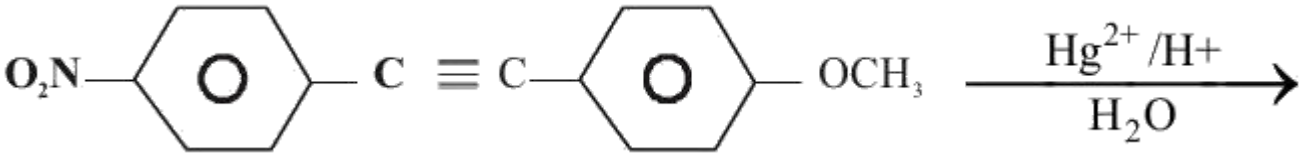
Source solution

Sol. 1}

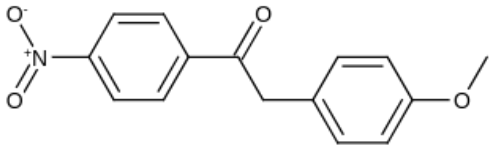

CH3
CH3—CH—CH—CH3
OSO2CH3
KOtBu
Δ
CH3—CH—CH=CH2
CH3
O3/H2O2
CH3—CH—COOH + HCOOH
CH3

Question 107

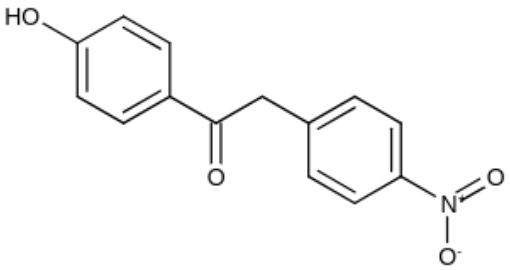
The major product obtained from the following reactions is :



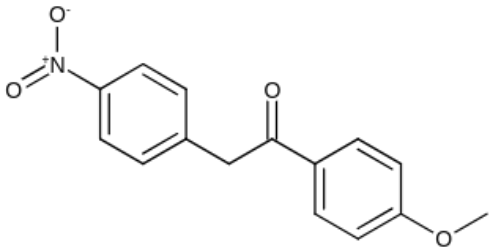
A.



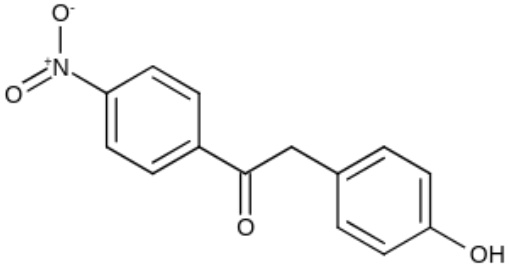
B.



C.



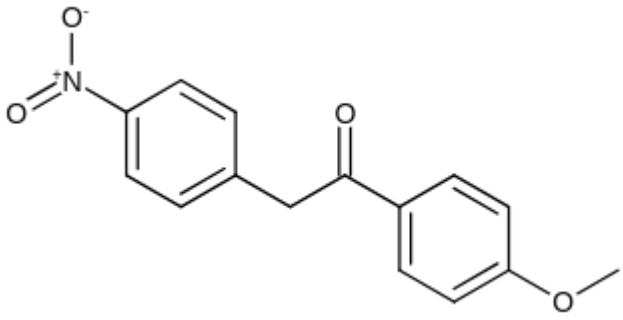
D.



Correct answer: C

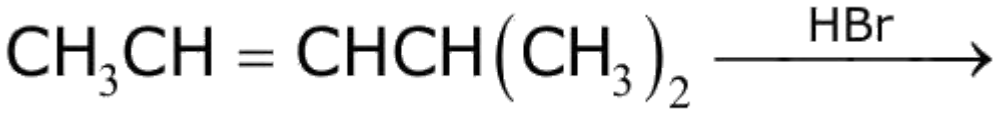
Source solution

Sol. 3}



Question 108

The major product formed in the following reaction is :



A. $CH_3CH(Br)CH_2CH(CH_3)_2$

B. $CH_3CH_2CH_2C(Br)(CH_3)_2$

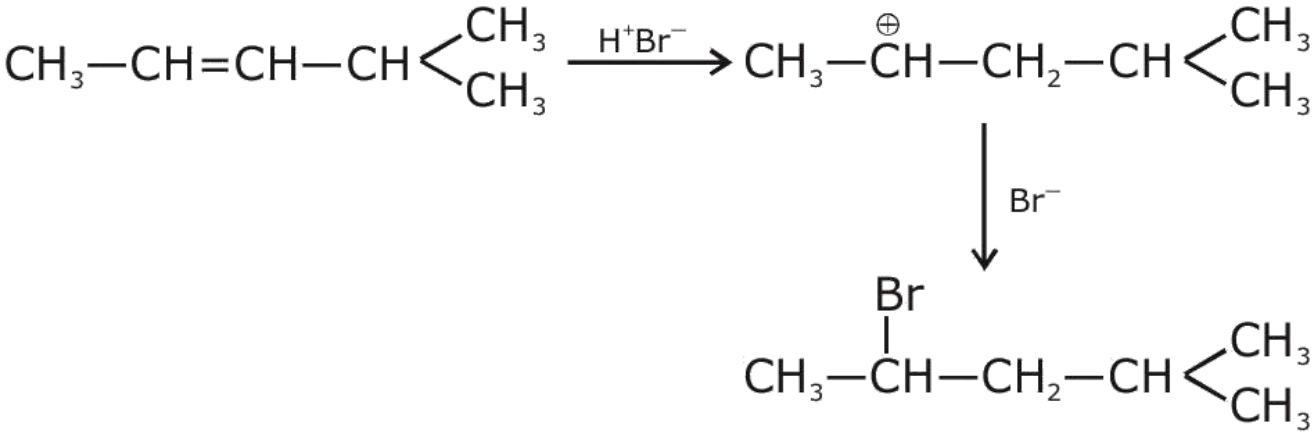
C. $CH_3CH_2CH(Br)CH(CH_3)_2$

D. $Br(CH_2)_3CH(CH_3)_2$

Correct answer: A

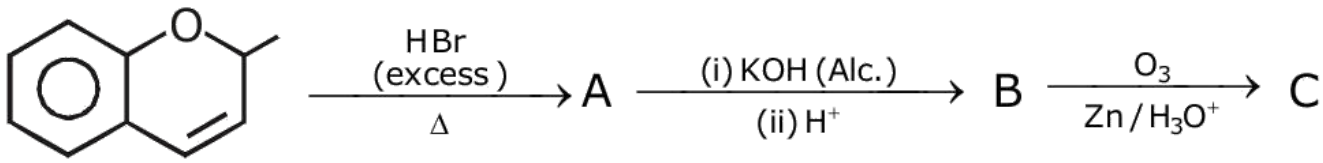
Source solution

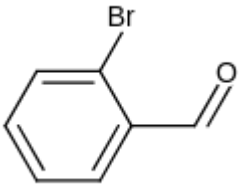
Sol. 1



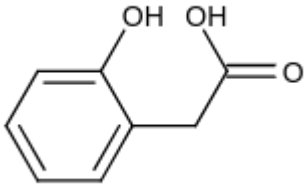
Question 109

The major aromatic product C in the following reaction sequence will be :

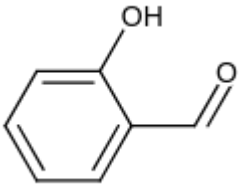




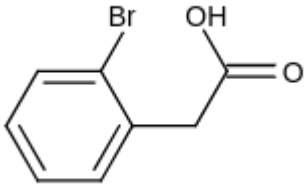
A.



B.



C.



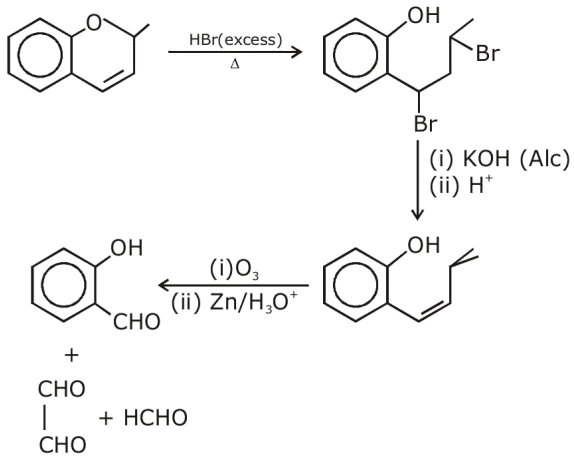
D.

Correct answer: C

Source solution

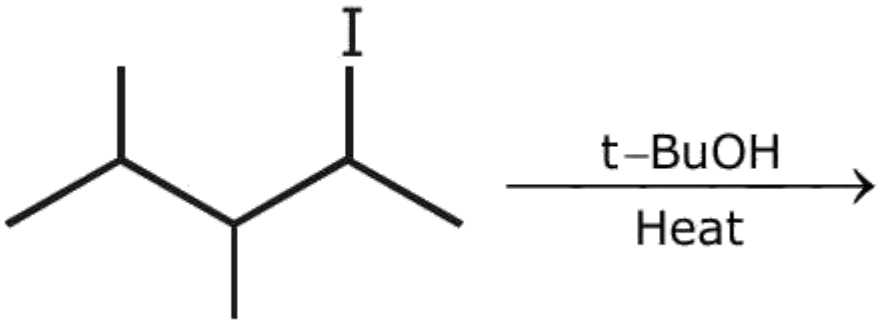
Sol.

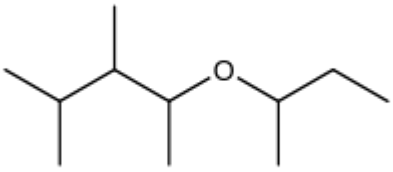
Option (3) is correct answser.



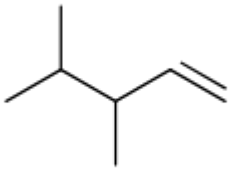
Question 110

The major product in the following reaction is:

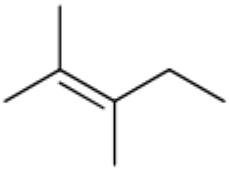




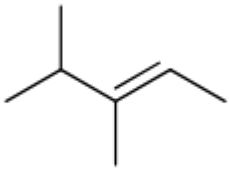
A.



B.



C.

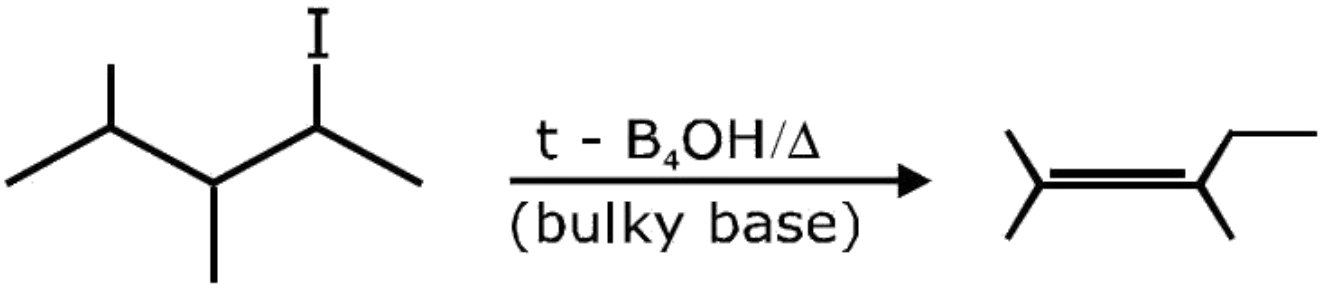


D.

Correct answer: C

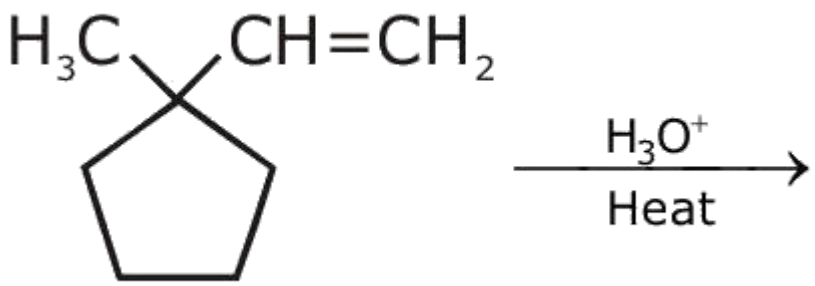
Source solution

Sol. 3}

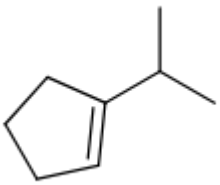


Question 111

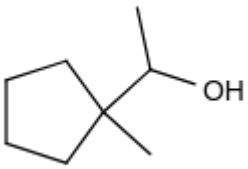
The major product in the following reaction is:



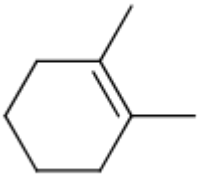
A.



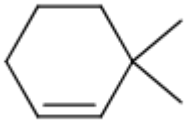
B.



C.



D.

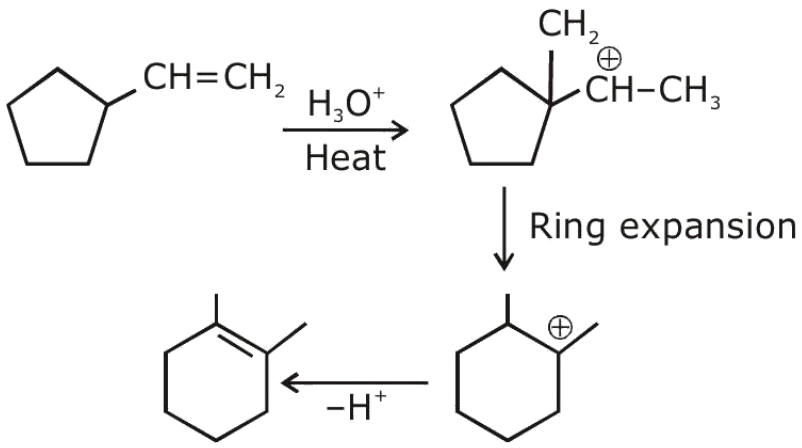


Correct answer: C

Source solution

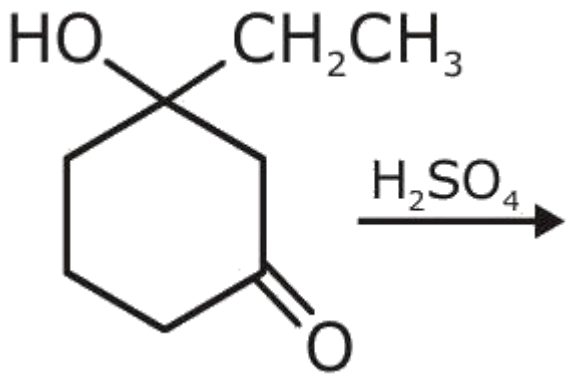
Sol.

Option (3) is correct answer.

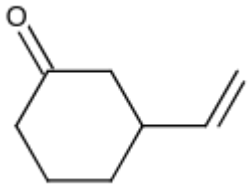

CH=CH2
H3O+
Heat
CH2
CH–CH3
Ring expansion
–H+

Question 112

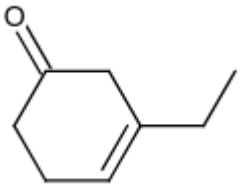
The major product of the following reaction is:



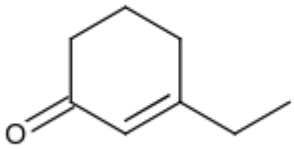
A.



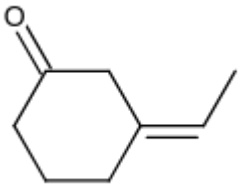
B.



C.



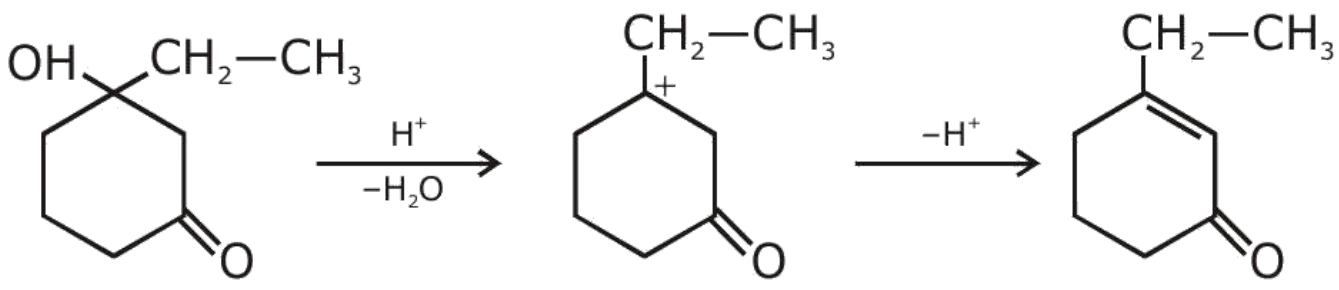
D.



Correct answer: C

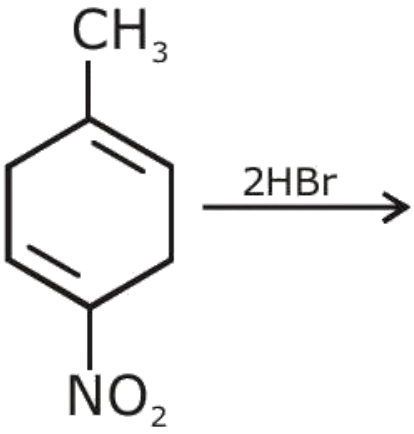
Source solution

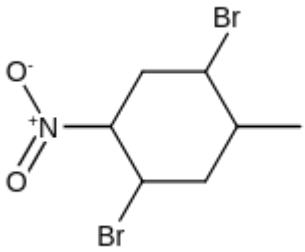
Sol. 3



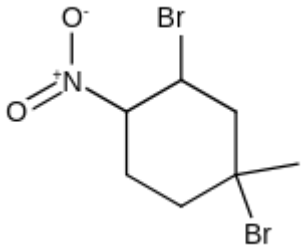
Question 113

The major product of the following reaction is:

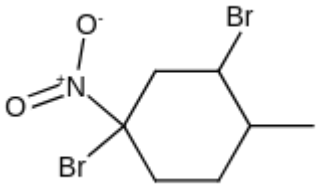




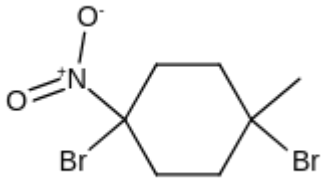
A.



B.



C.

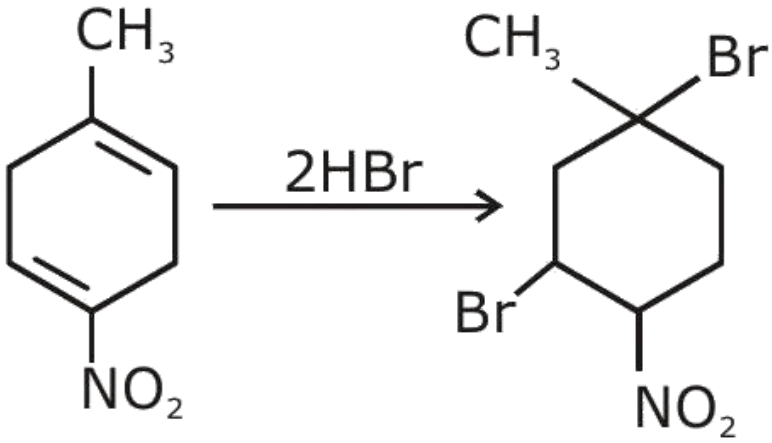


D.

Correct answer: B

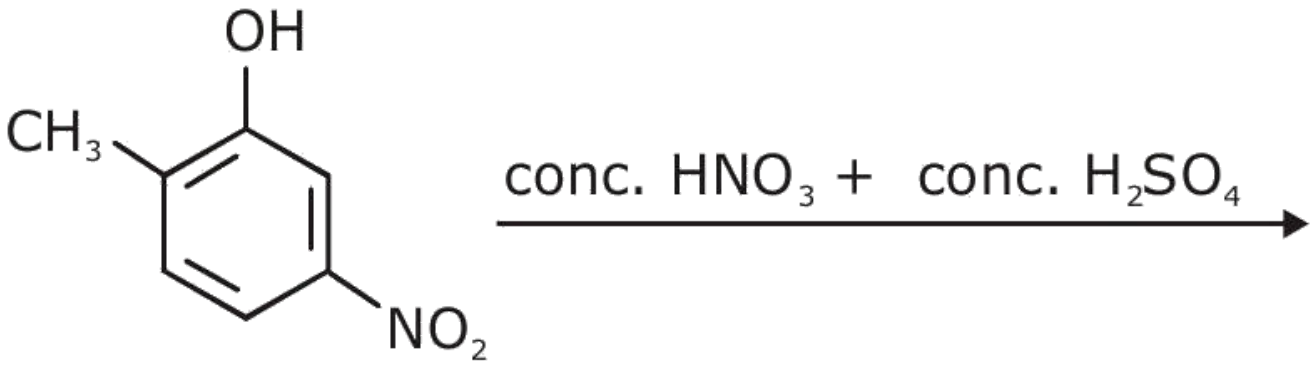
Source solution

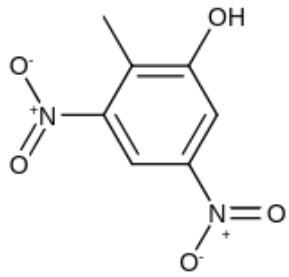
Sol. 2}


CH3
2HBr
NO2
CH3
Br
Br
NO2

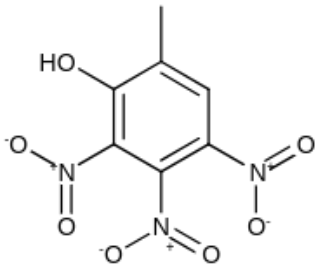
Question 114

The major product of the following reaction is :

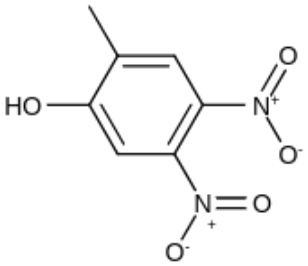




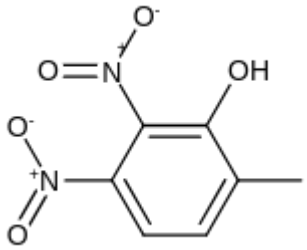
A.



B.



C.

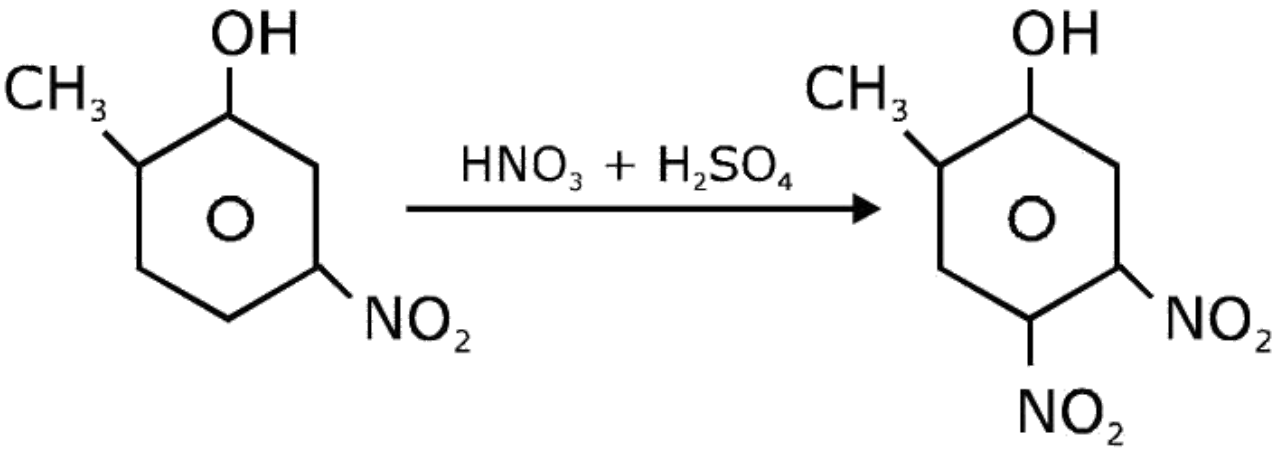


D.

Correct answer: C

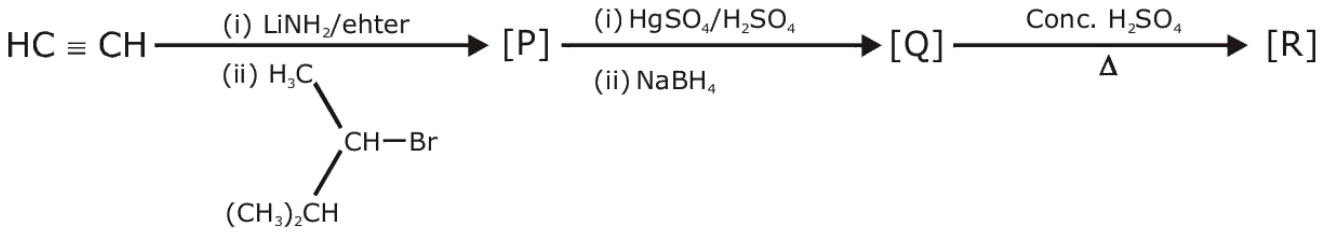
Source solution

Sol. 3}

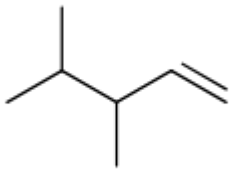

OH
CH3
O
NO2
HNO3 + H2SO4
OH
CH3
O
NO2
NO2

Question 115

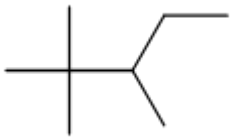
The major product $[R]$ in the following sequence of reactions is :



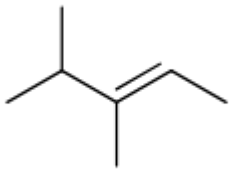
A.



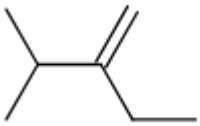
B.



C.



D.

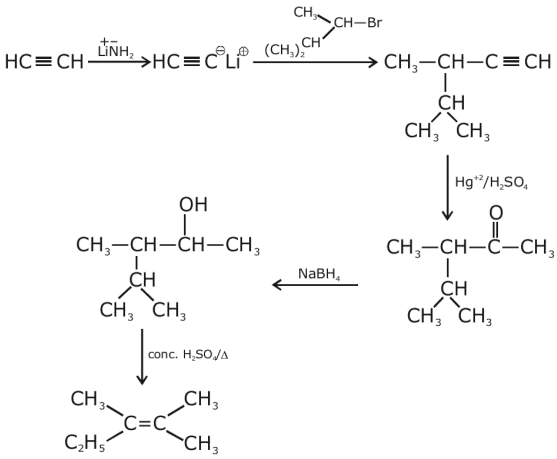


Correct answer: B

Source solution

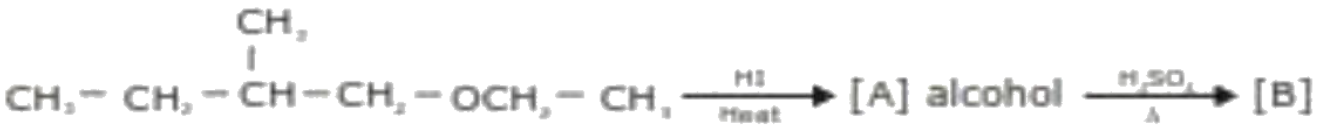
Sol. 2

(R)

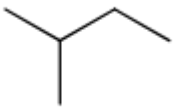


Question 116

The major product $[B]$ in the following reactions is :

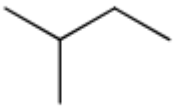


A. $CH_3 - CH_2 - CH = CH - CH_3$



B.

D. $CH_2 = CH_2$

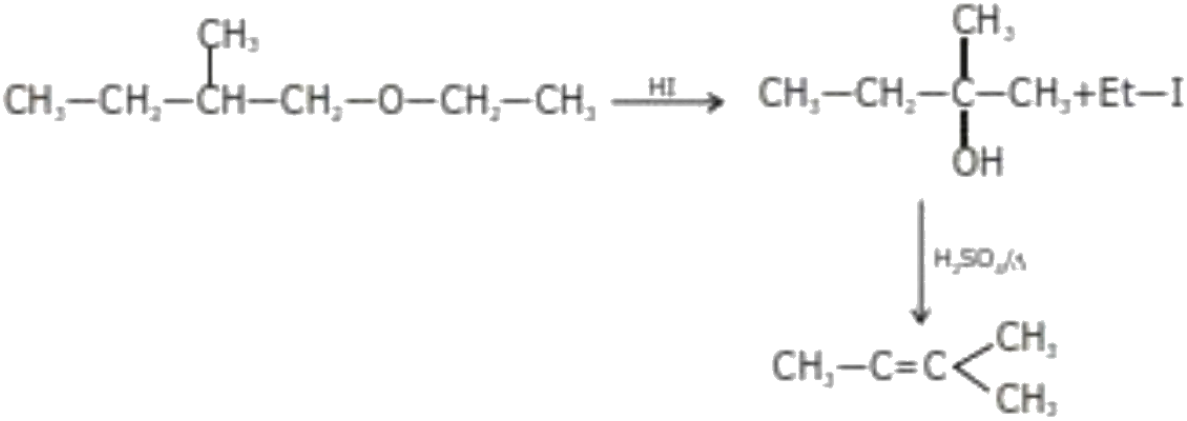


C.

Correct answer: C

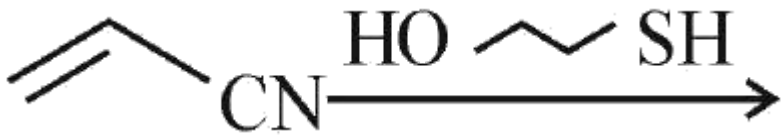
Source solution

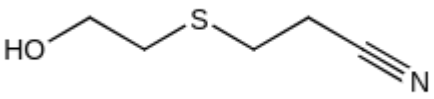
Sol. 3}



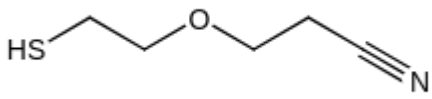
Question 117

The major product for the following reaction is:

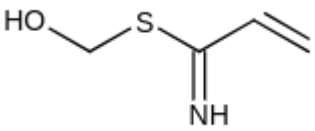




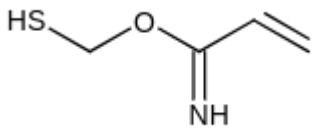
A.



B.



C.

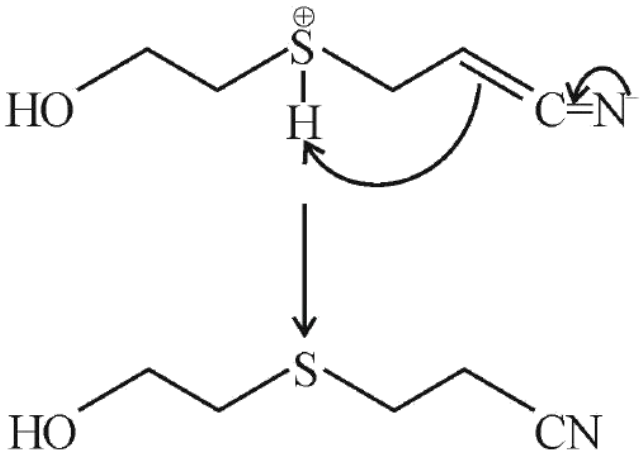


D.

Correct answer: A

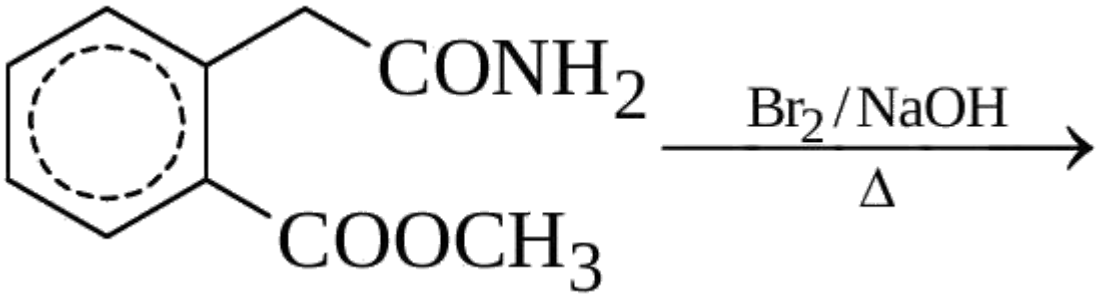
Source solution

Sol.

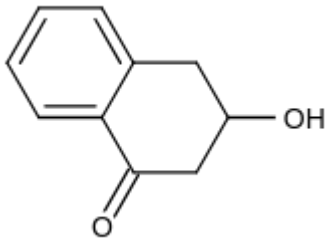


Question 118

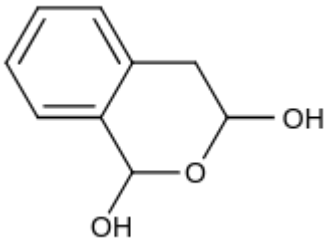
The major product formed in the following reaction is



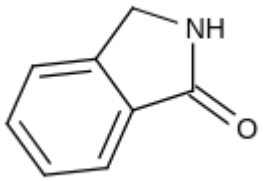
A.



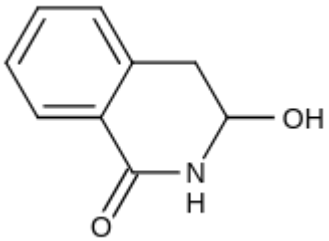
B.



C.



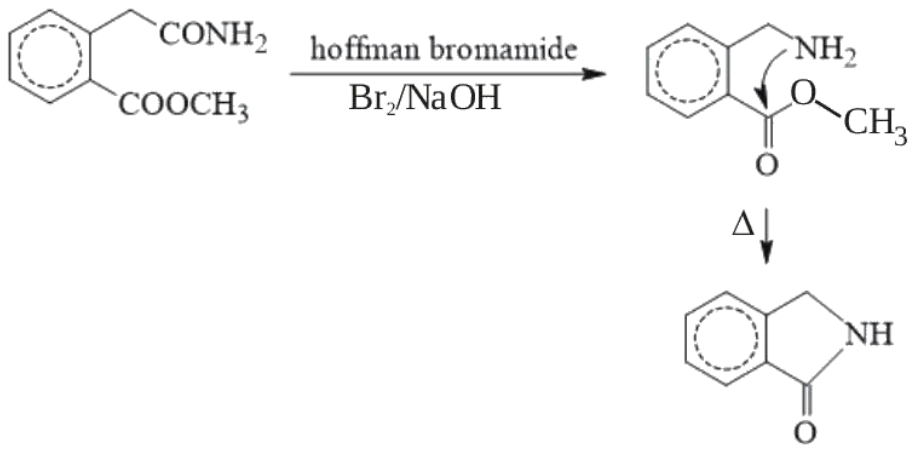
D.



Correct answer: C

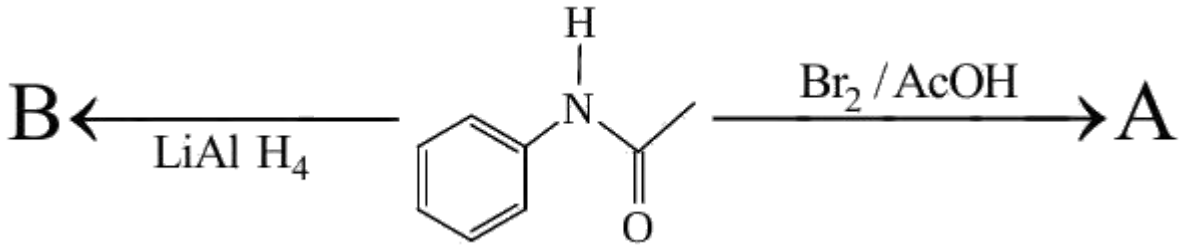
Source solution

Sol.

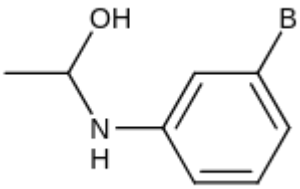

CONH2
COOCH3
hoffman bromamide
Br2/NaOH
NH2
O
CH3
O
Δ
NH
O

Question 119

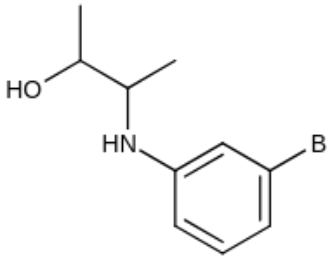
The major products A and B from the following reactions are:



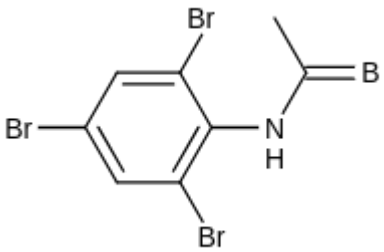
A.



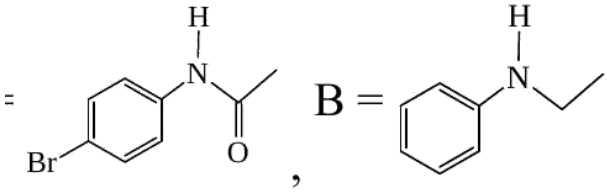
B.



C.



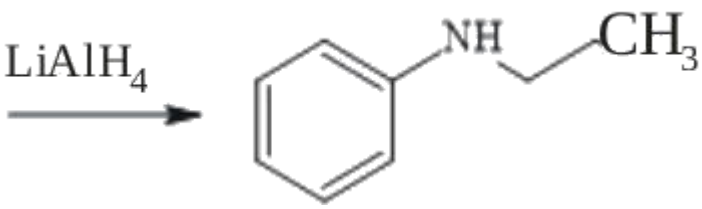
D.



Correct answer: D

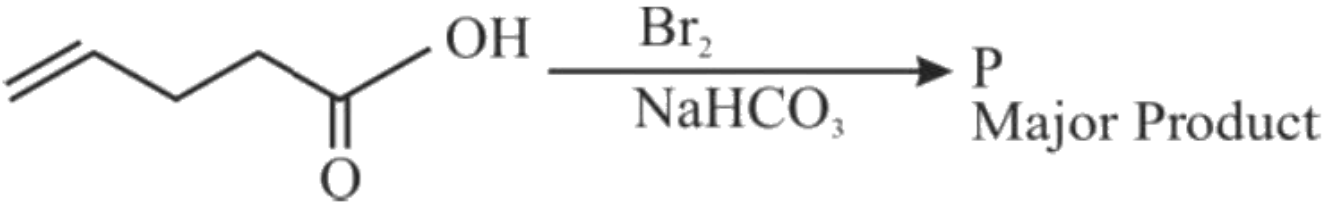
Source solution

Sol.

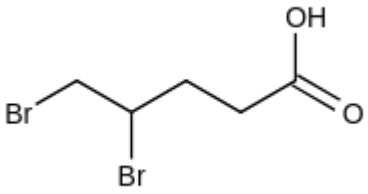


Question 120

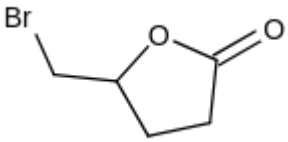
Major product ' P ' formed in the following reaction is :-



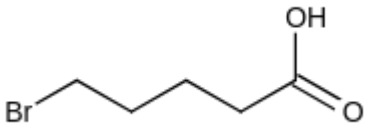
A.



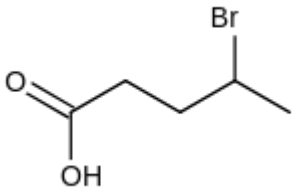
B.



C.



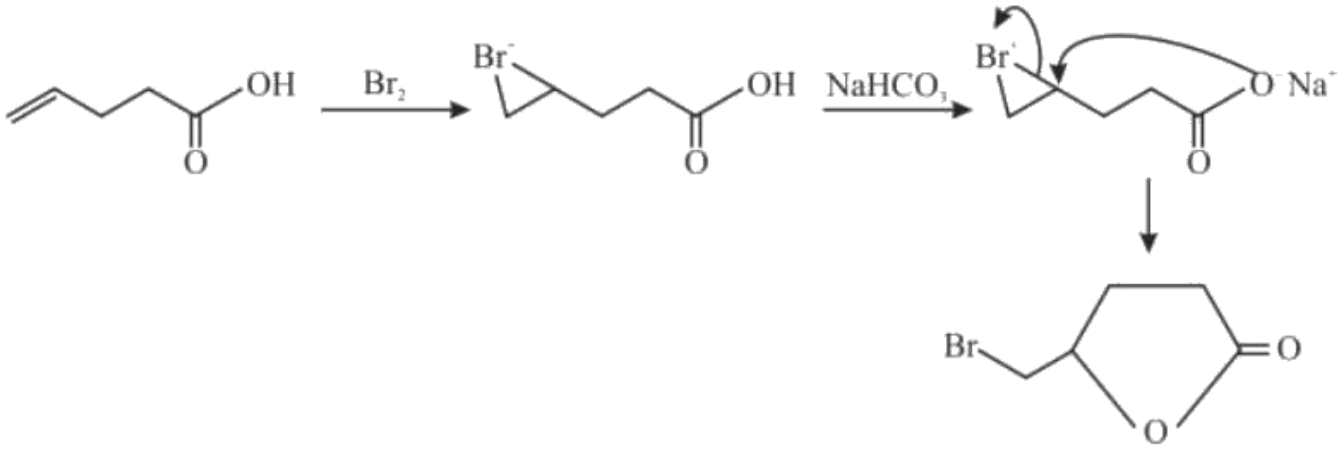
D.



Correct answer: B

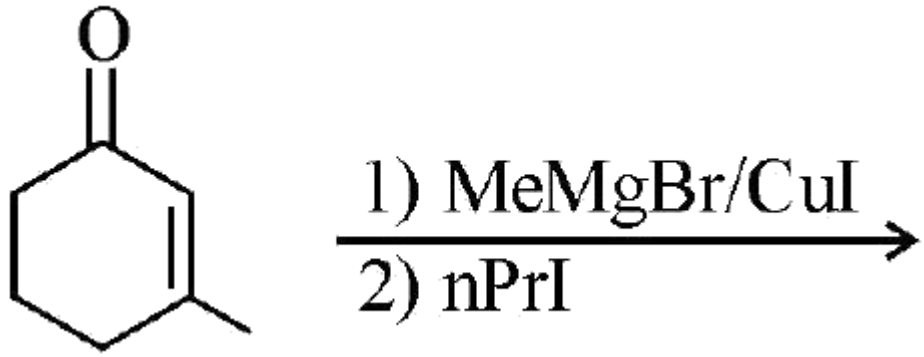
Source solution

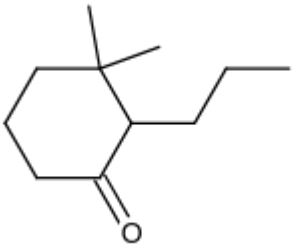
Sol.



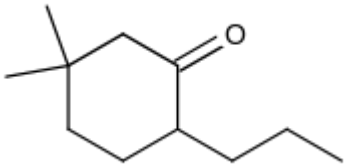
Question 121

Find out the major product from the following reaction

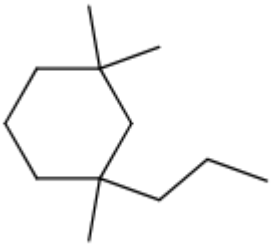




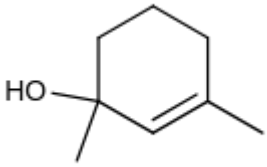
A.



B.



C.

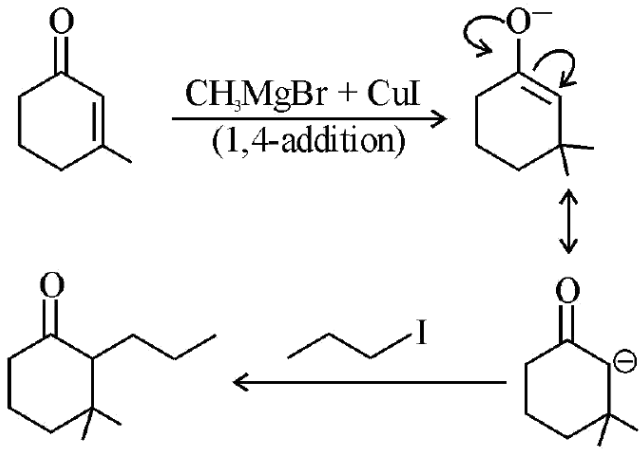


D.

Correct answer: A

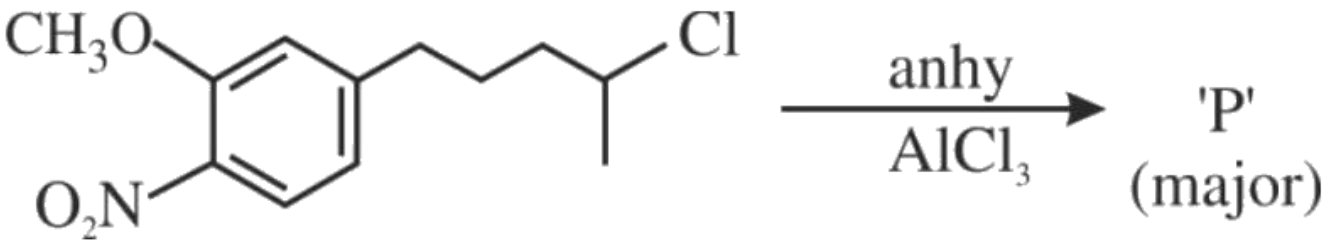
Source solution

Sol.

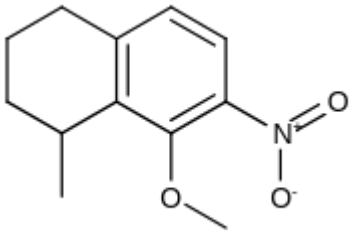

O
CH3MgBr + CuI
(1,4-addition)
O−
O
I
O
⊖

Question 122

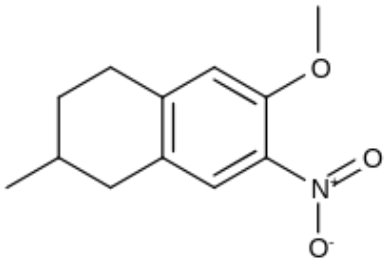
The major product ' P ' formed in the given reaction is:



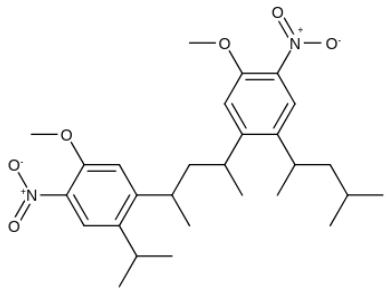
A.



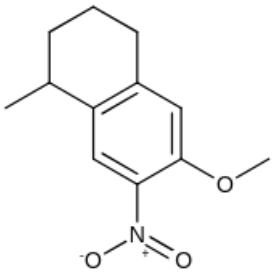
B.



C.



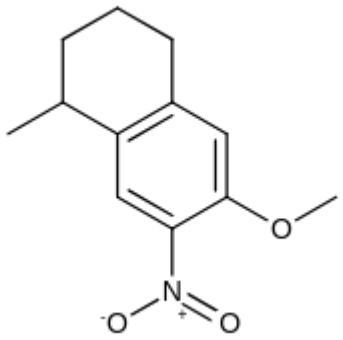
D.



Correct answer: D

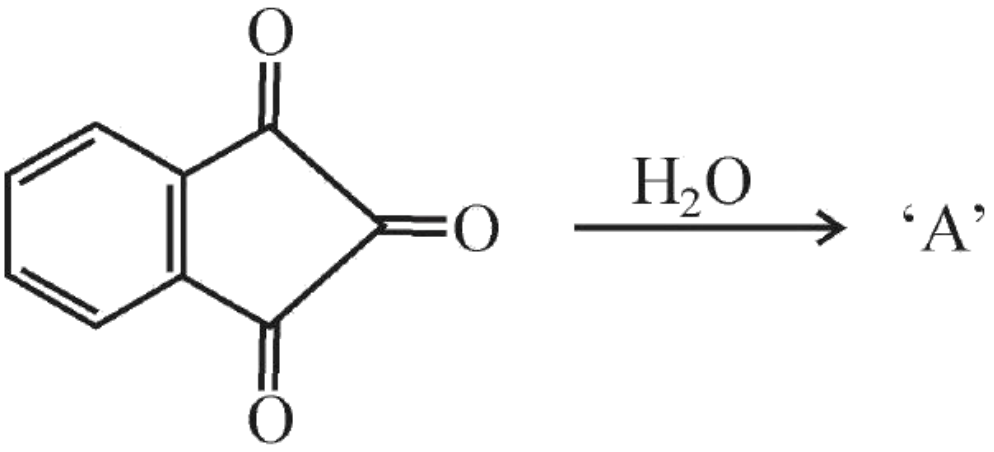
Source solution

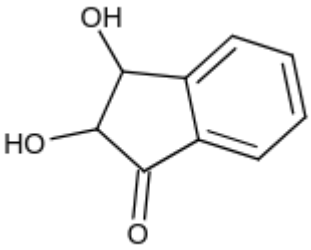
Sol.


O
N
+
-O
O

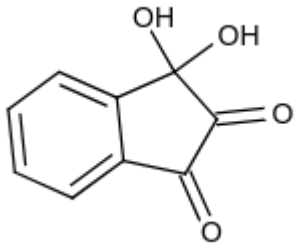
Question 123

major product ' A ' formed in the above reaction is

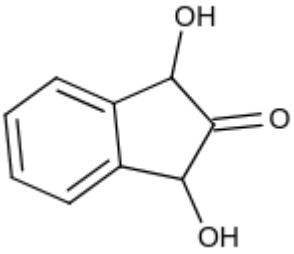




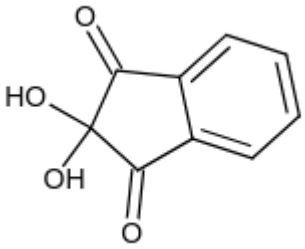
A.



B.



C.

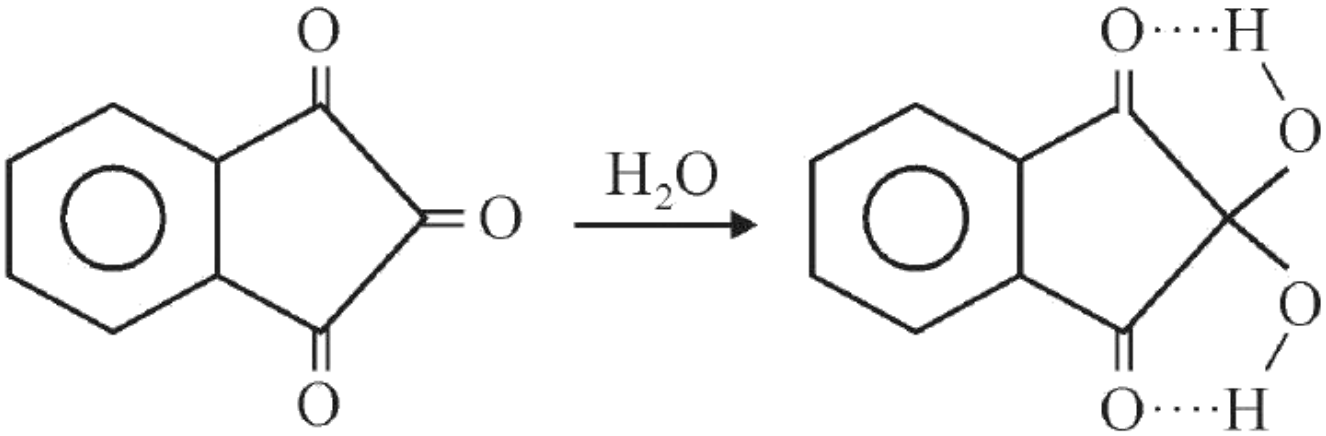


D.

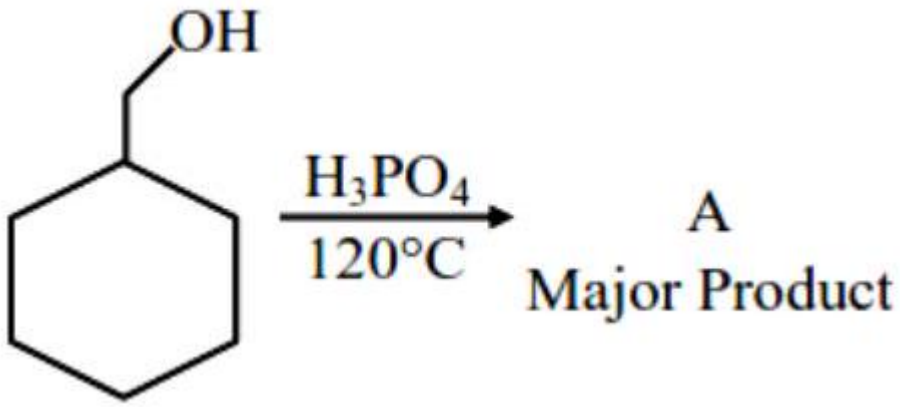
Correct answer: D

Source solution

Sol.

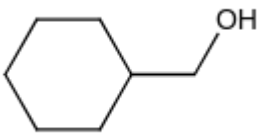

O
O
O
H_2O
O····H
O
O
O····H

Question 124



$$\xrightarrow[H_2O_2/O\bar{H},H_2O]{(BH_3)_2} \underset{\text{Major Product}}{P}$$

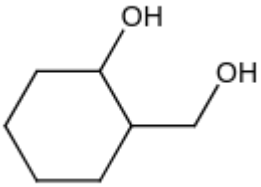
Consider the above reaction and identify the Product P :



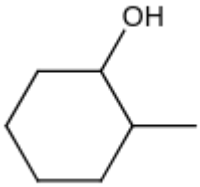
A.



B.



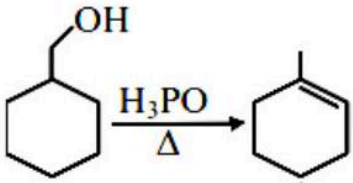
C.



D.

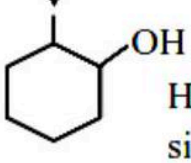
Correct answer: D

Source solution



dehedration of alcohol by E^1 Rxn

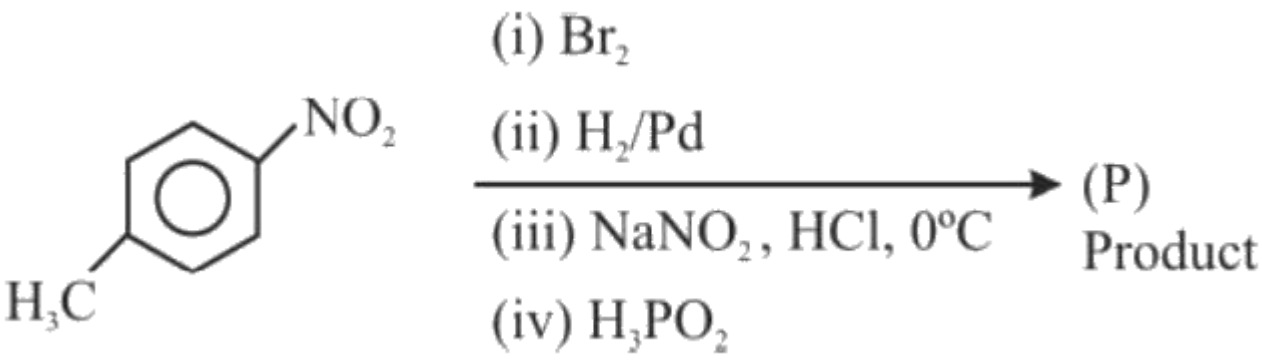
H.B.O



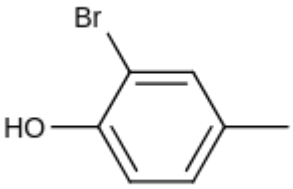
H-attached at more hindard site while OH attached at less hindard site in H.BO. Reaction

Question 125

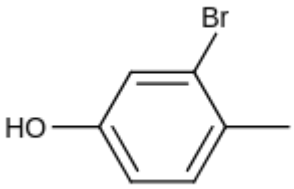
The product (P) formed from the following multistep reaction is :-



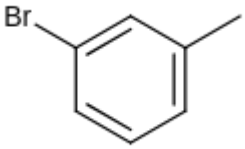
A.



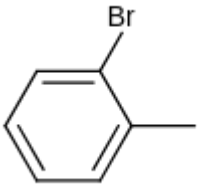
B.



C.



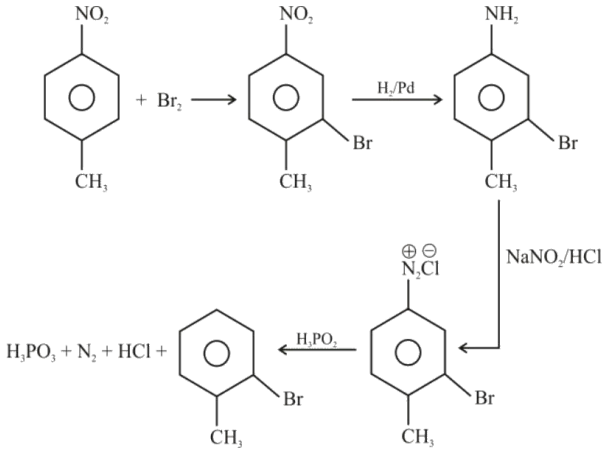
D.



Correct answer: D

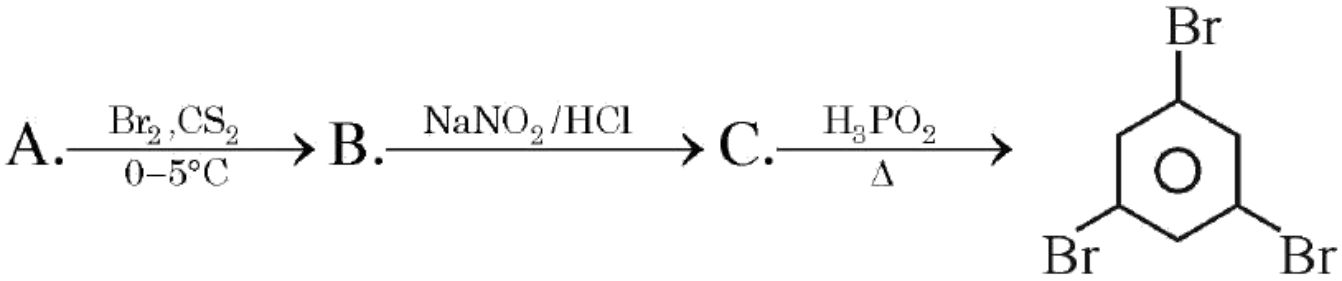
Source solution

Sol.


NO2
+ Br2
NO2
Br
CH3
H2/Pd
NH2
Br
CH3
NaNO2/HCl
⊕ ⊖
N2Cl
Br
CH3
H3PO2
H3PO3 + N2 + HCl +
Br
CH3

Question 126

Compound A from the following reaction sequence is:



A. Benzoic Acid

B. Phenol

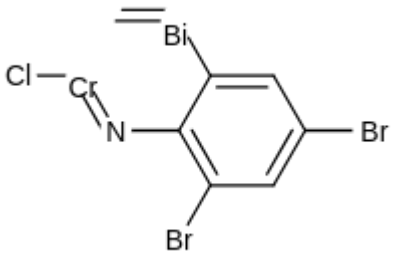
C. Salicylic Acid

D. Aniline

Correct answer: D

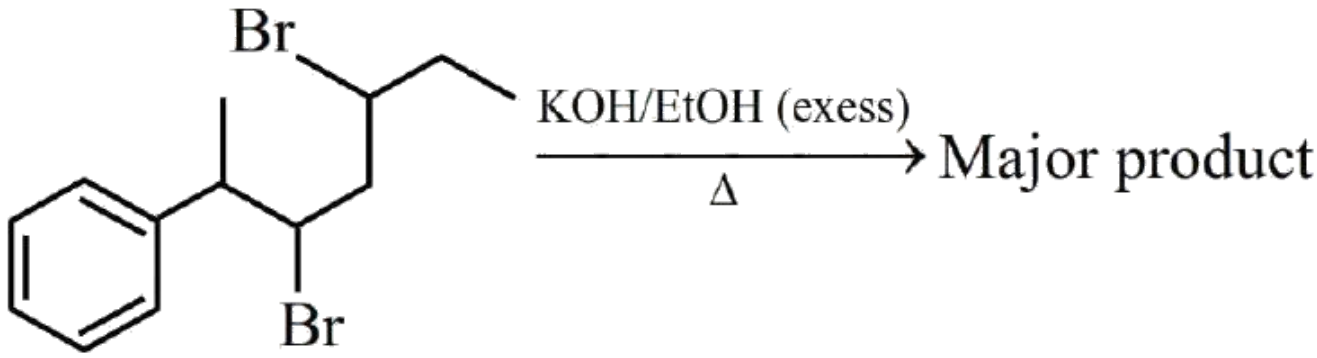
Source solution

Sol.



Question 127

The major product of the following reaction is :



A. 6-Phenylhepta-2,4-diene

B. 2-Phenylhepta-2,5-diene

C. 6-Phenylhepta-3,5-diene

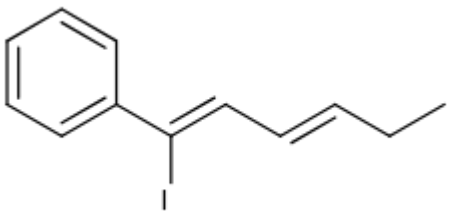
D. 2-Phenylhepta-2,4-diene

Correct answer: D

Source solution

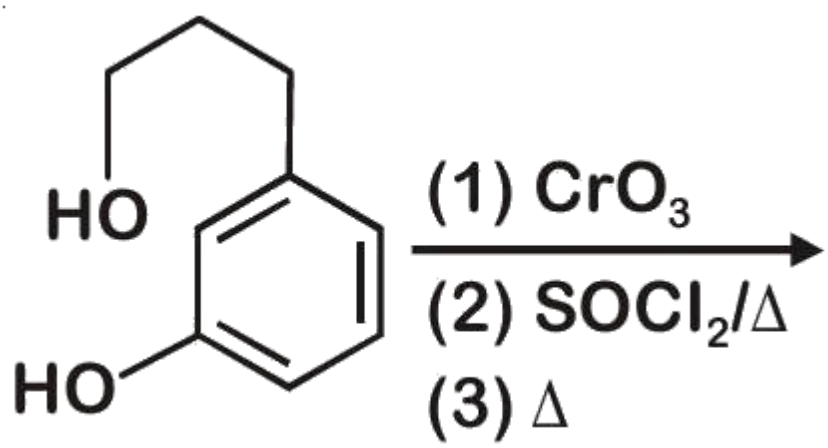
Sol.

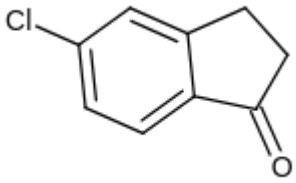
2-Phenylhepta-2,4-diene



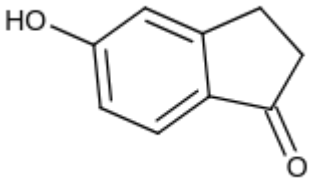
Question 128

The major product of the following reaction is

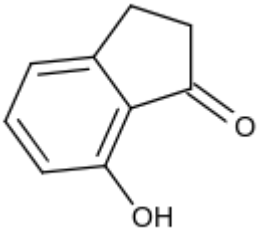




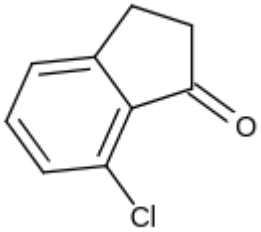
A.



B.



C.

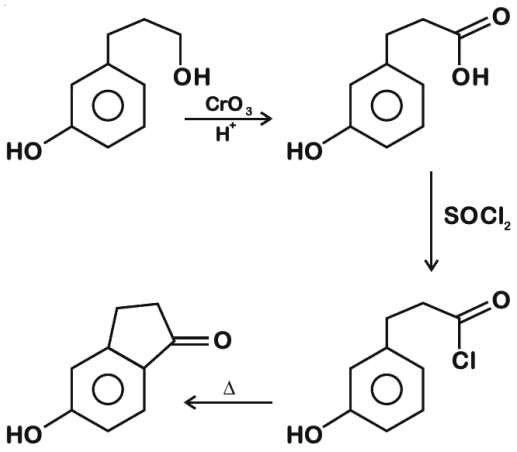


D.

Correct answer: B

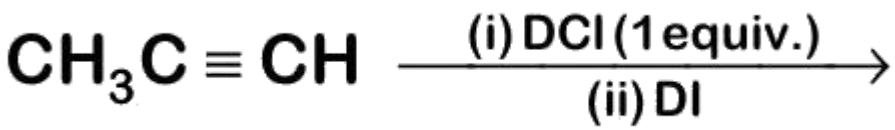
Source solution

Sol.


OH
HO
CrO3
H+
O
OH
HO
SOCl2
O
Cl
HO
Δ
O
HO

Question 129

The major product of the following reaction is



A. $CH_3C(I)(Cl)CHD_2$

B. $CH_3CD(I)CHD(Cl)$

C. $CH_3CD(Cl)CHD(I)$

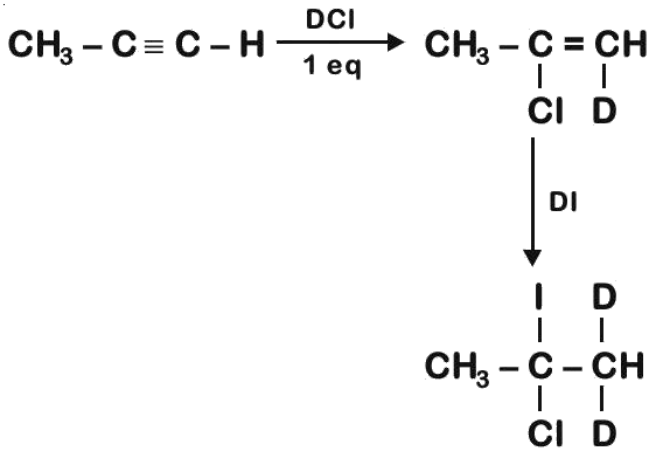
D. $CH_3CD_2CH(Cl)(I)$

Correct answer: A

Source solution

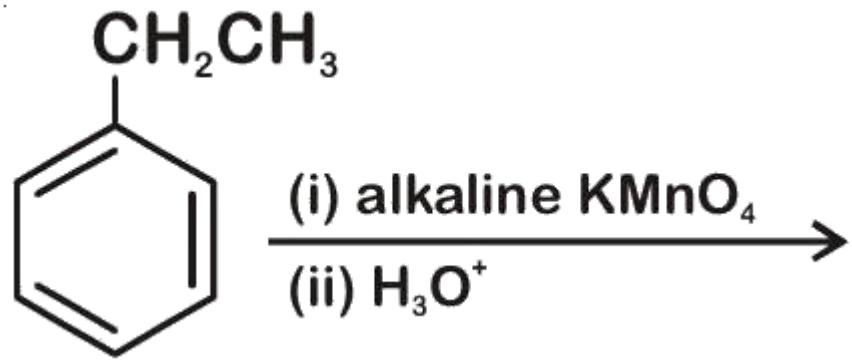
Sol.

Both addition follow Markownikov's rule.

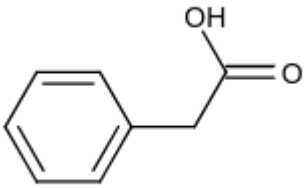


Question 130

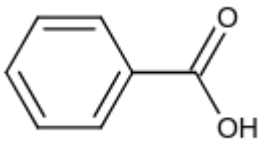
The major product of the following reaction is



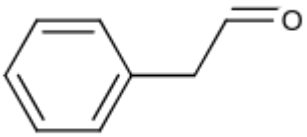
A.



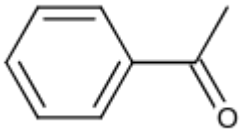
B.



C.



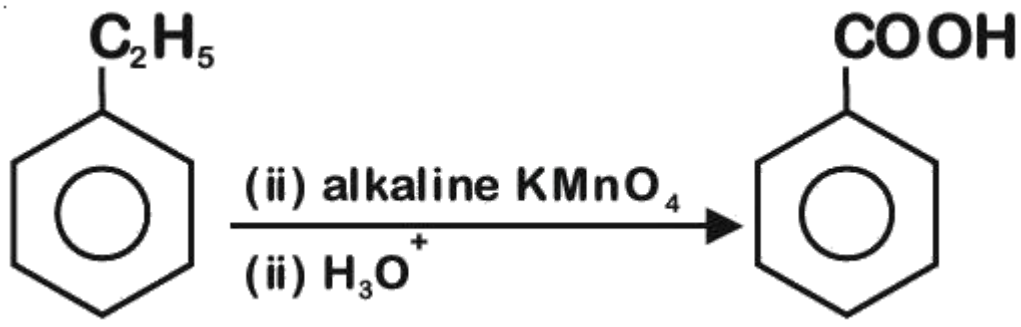
D.



Correct answer: B

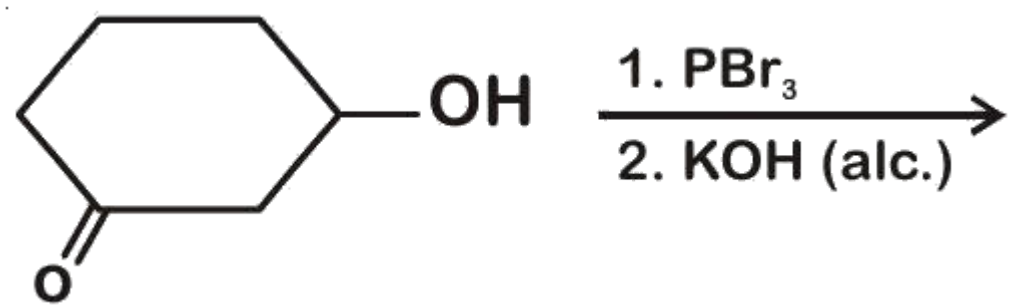
Source solution

Sol. Alkaline $\mathbf{KMnO_4}$ converts

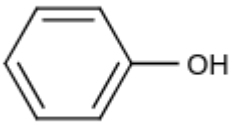


Question 131

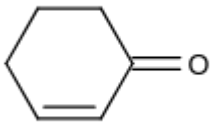
The major product of the following reaction is



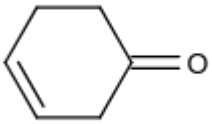
A.



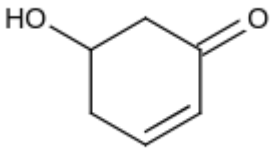
B.



C.



D.

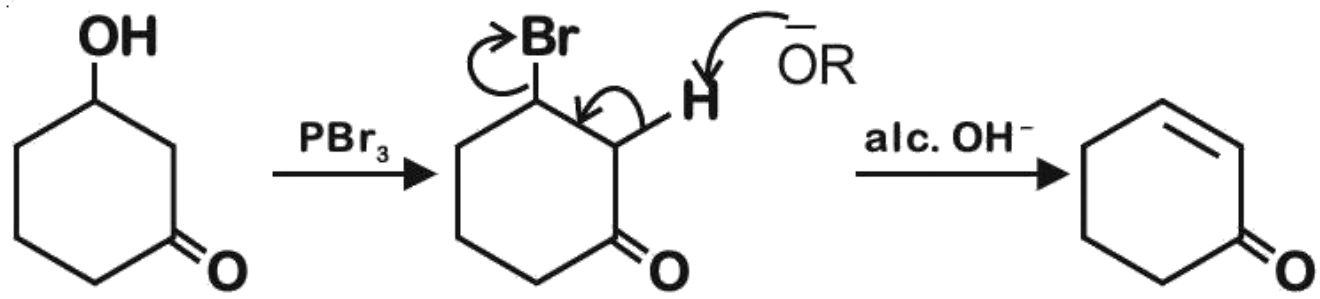


Correct answer: B

Source solution

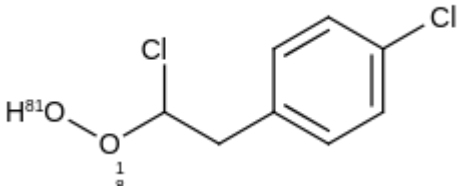
Sol.

More stable product due to conjugation .

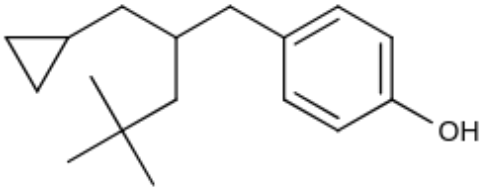


Question 132

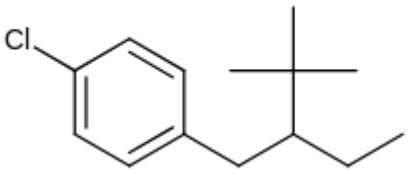
The major product of the following reaction is



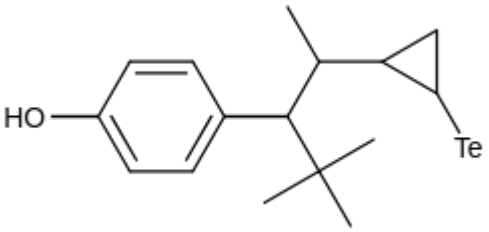
A.



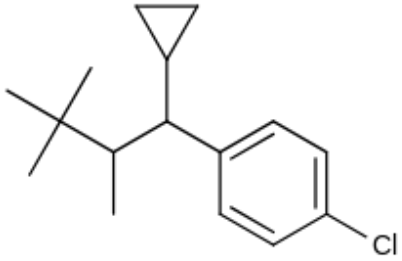
B.



C.



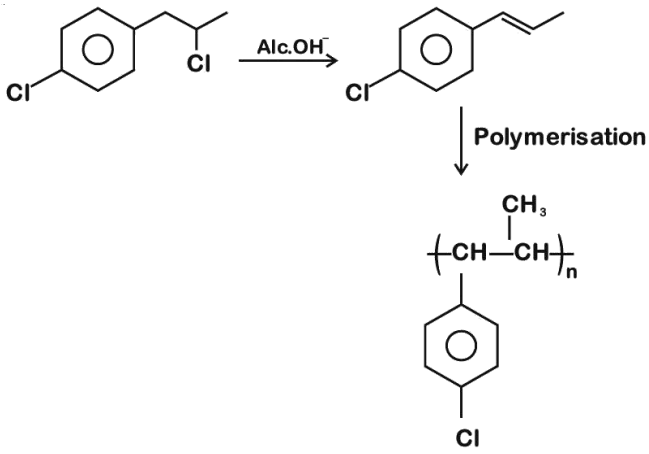
D.



Correct answer: D

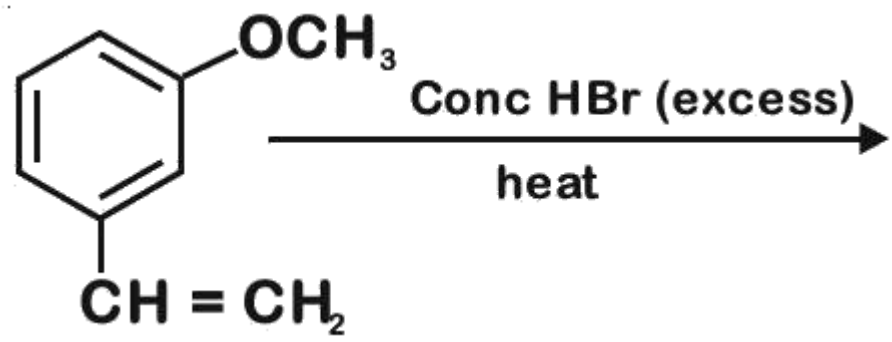
Source solution

Sol.

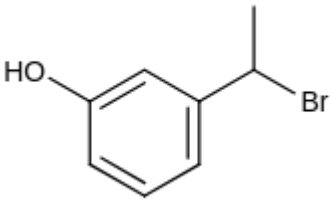


Question 133

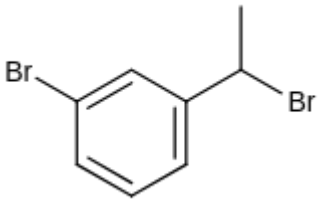
The major product of the following reaction is



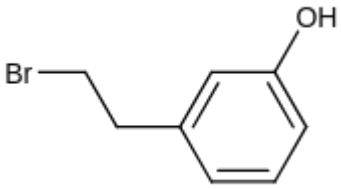
A.



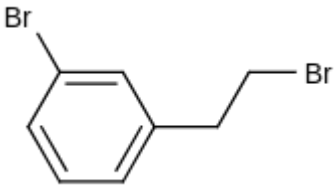
B.



C.



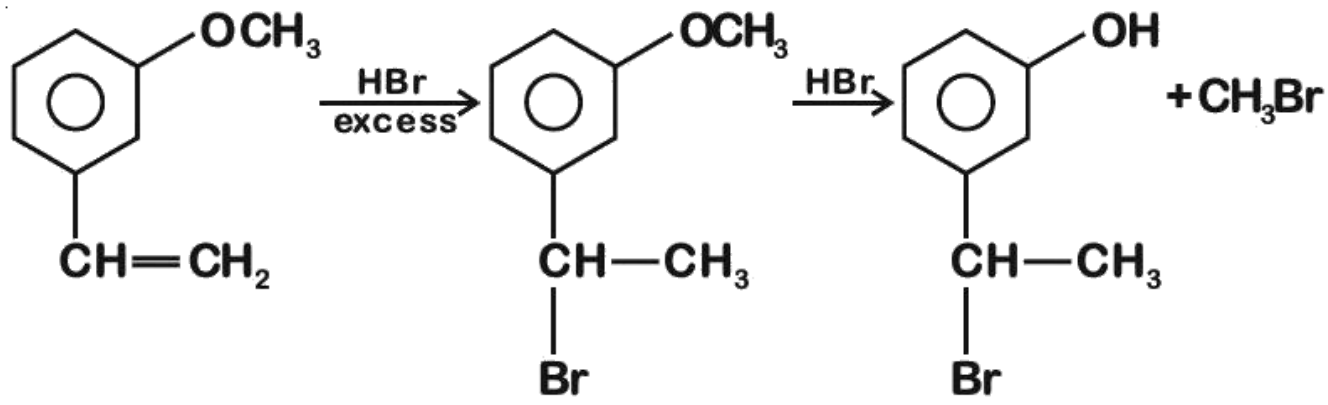
D.



Correct answer: A

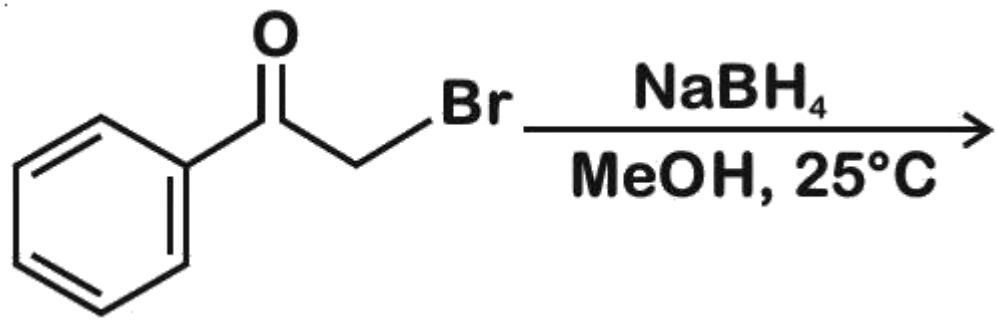
Source solution

Sol.

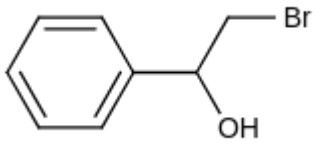

OCH3
HBr
excess
CH=CH2
OCH3
CH—CH3
Br
HBr
OH
+CH3Br
CH—CH3
Br

Question 134

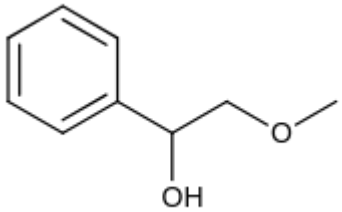
The major product of the following reaction is



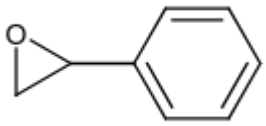
A.



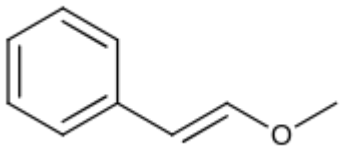
B.



C.



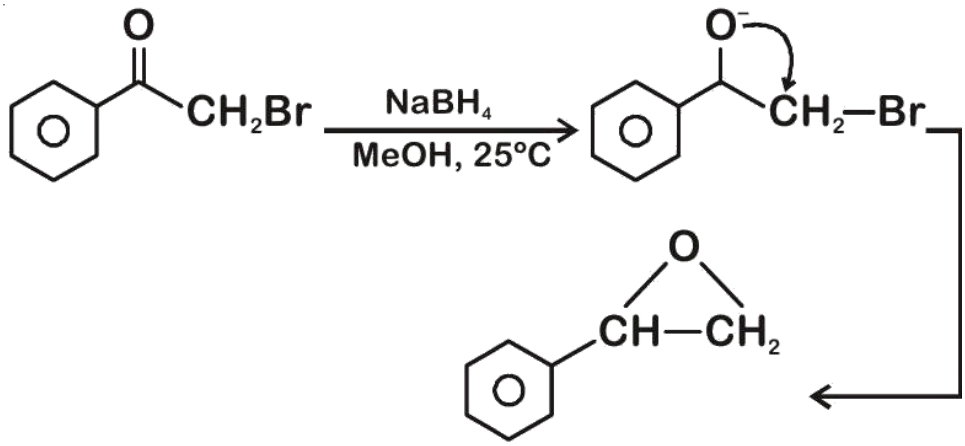
D.



Correct answer: C

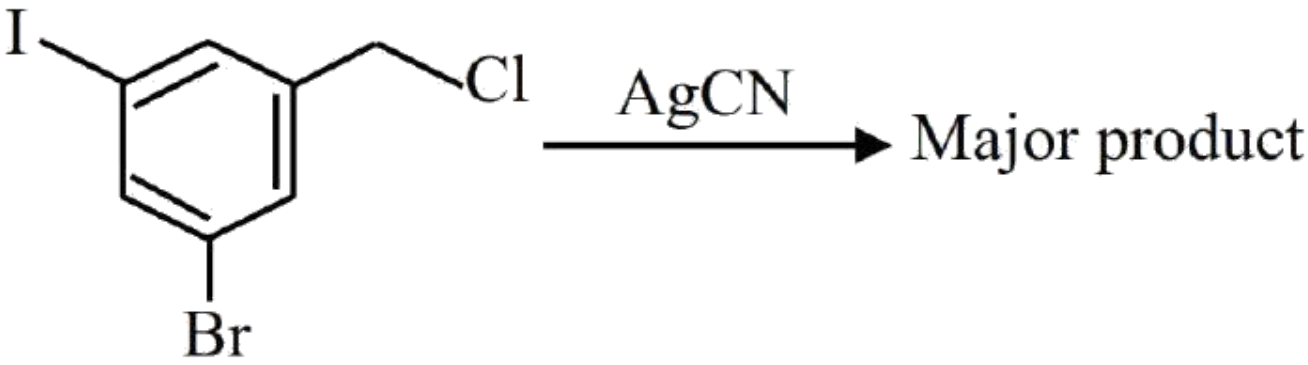
Source solution

Sol.

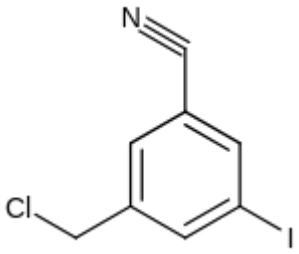

O
CH2Br
NaBH4
MeOH, 25°C
O⁻
CH2—Br
O
CH—CH2

Question 135

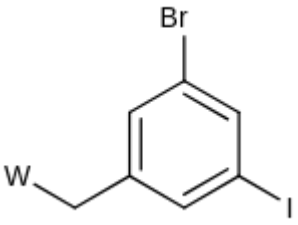
The structure of the major product formed in the following reaction is:



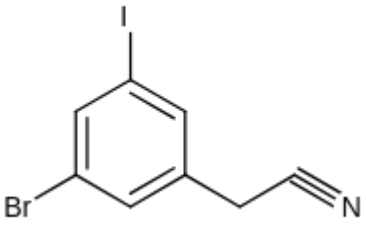
A.



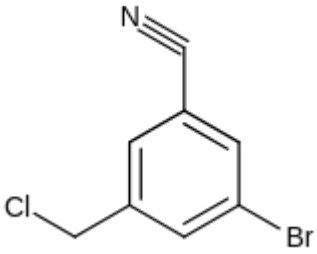
B.



C.



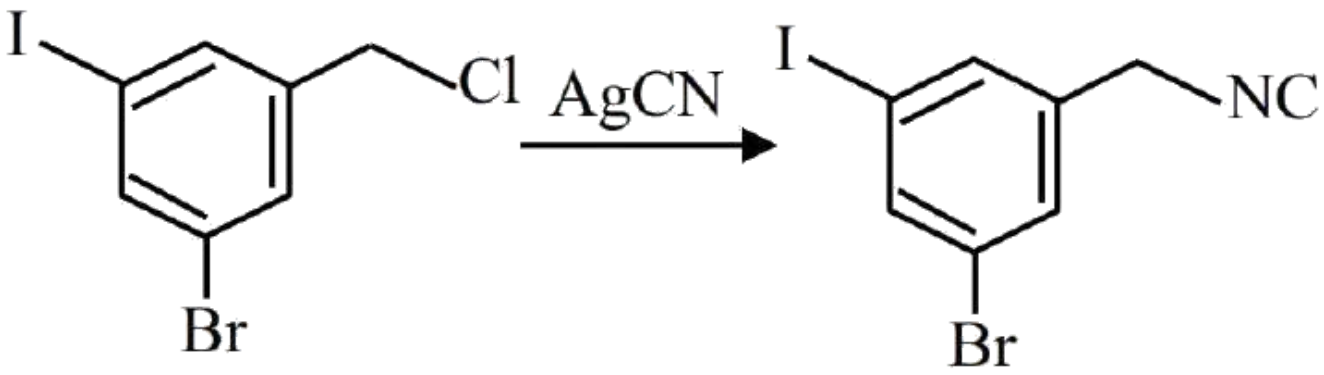
D.



Correct answer: B

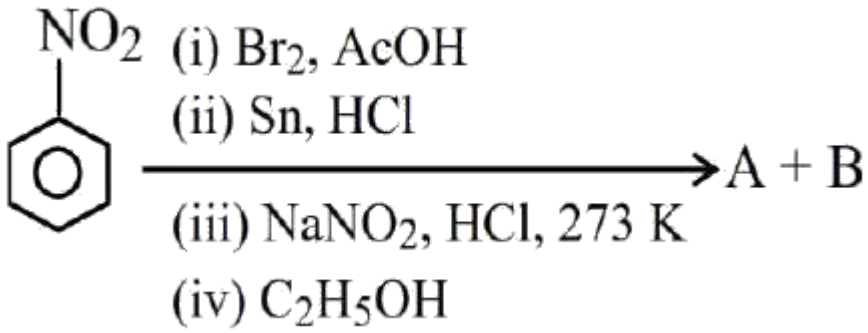
Source solution

Sol.

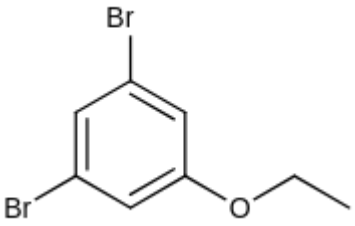

I
Cl
AgCN
Br
I
NC
Br

Question 136

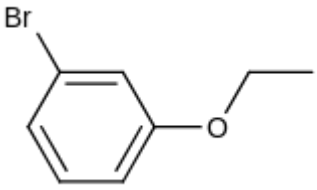
The products formed in the following reaction sequence are :



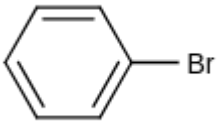
A.



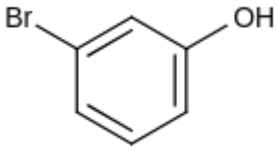
B.



C. $CH_3 - CHO$



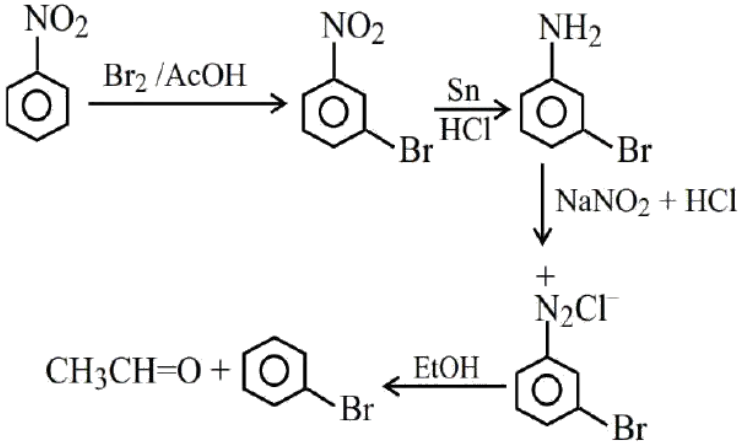
D.



Correct answer: C

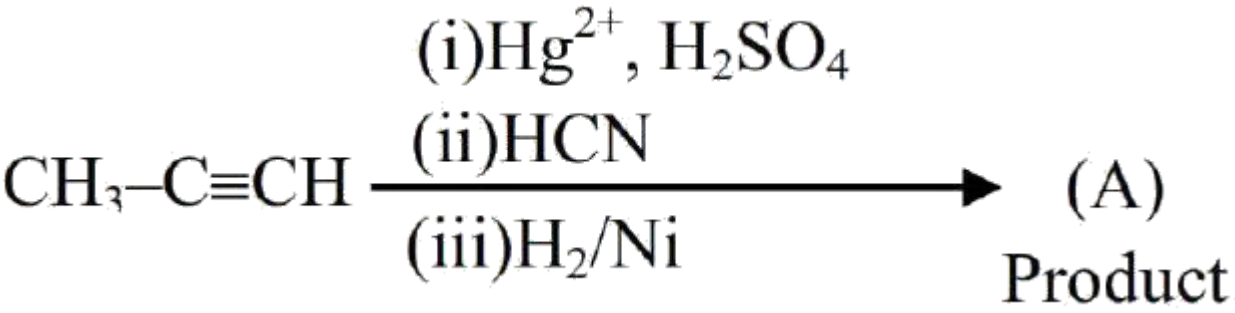
Source solution

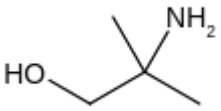
Sol.


NO2
Br2 /AcOH
NO2
Br
Sn
HCl
NH2
Br
NaNO2 + HCl
+
N2Cl⁻
Br
EtOH
CH3CH=O +
Br

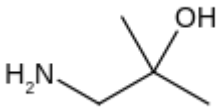
Question 137

The product (A) formed in the following reaction sequence is :

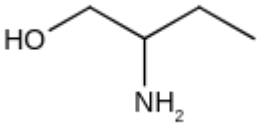




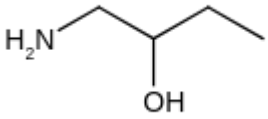
A.



B.



C.



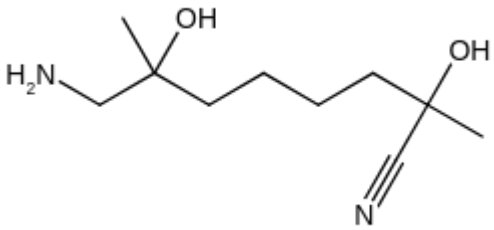
D.

Correct answer: B

Source solution

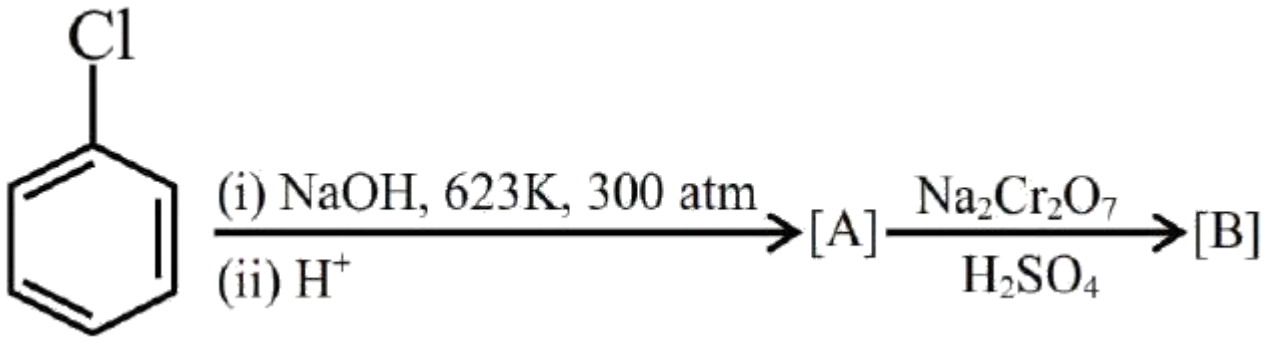
Sol.

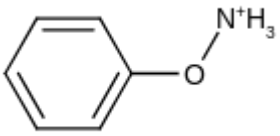
SECTION-B}



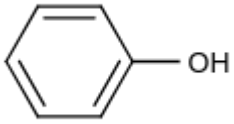
Question 138

Identify the products [A] and [B], respectively in the following reaction :





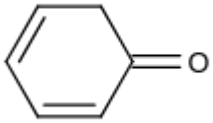
A.



B.



C.



D.

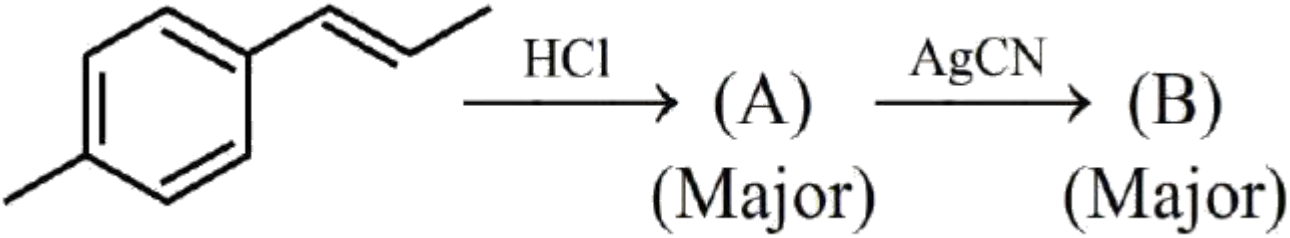
Correct answer: C

Source solution

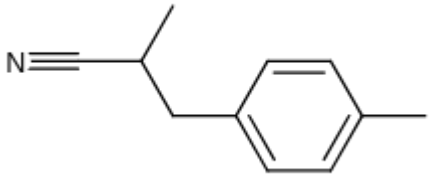
Sol. A is phenol and B is para benzoquinone.

Question 139

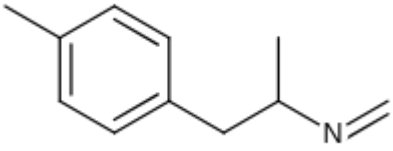
The product B formed in the following reaction sequence is :



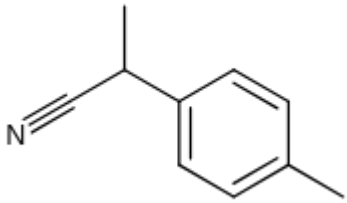
A.



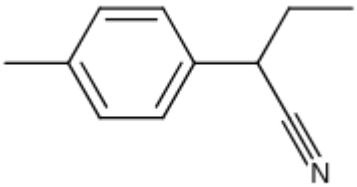
B.



C.



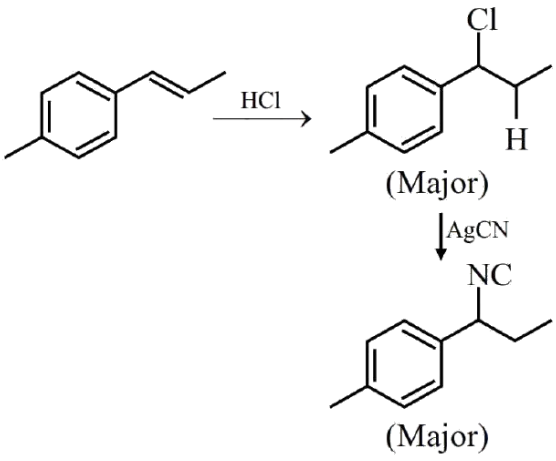
D.



Correct answer: D

Source solution

Sol.



Question 140

Decreasing order of reactivity towards electrophilie substitution for the following compounds is :

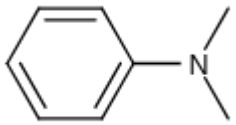
(a)

(b)

(c)

(d)

(e)



A. $c > b > a > d > e$

B. $e > d > a > b > c$

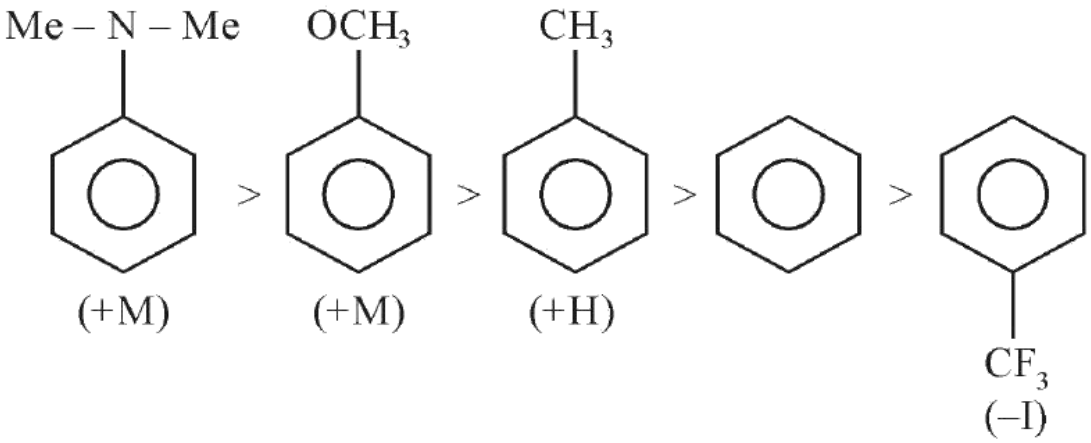
C. $a > d > e > b > c$

D. $d > a > e > c > b$

Correct answer: B

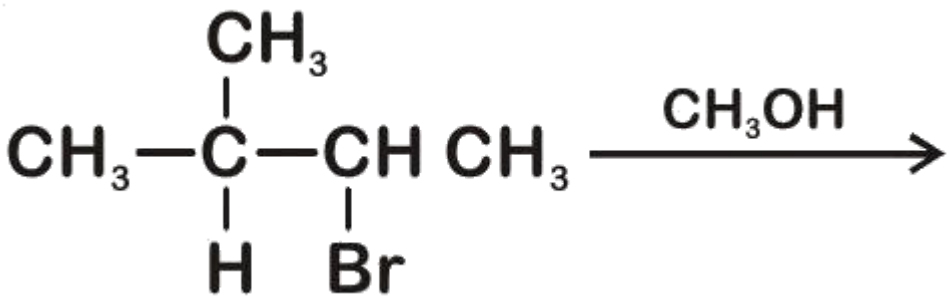
Source solution

Sol. Higher the electron density on Benzene Ring, Higher its Reactivity towards electrophilic substitution Reaction



Question 141

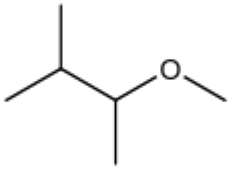
The major product of the following reaction is :



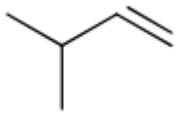
A.



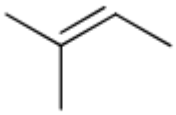
B.



C.



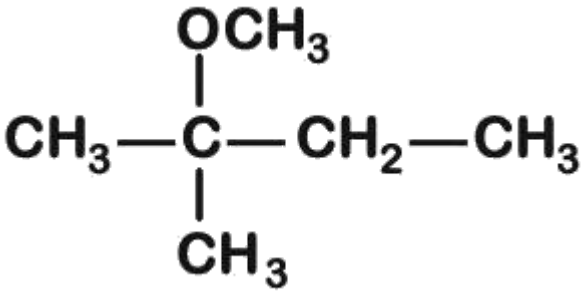
D.



Correct answer: A

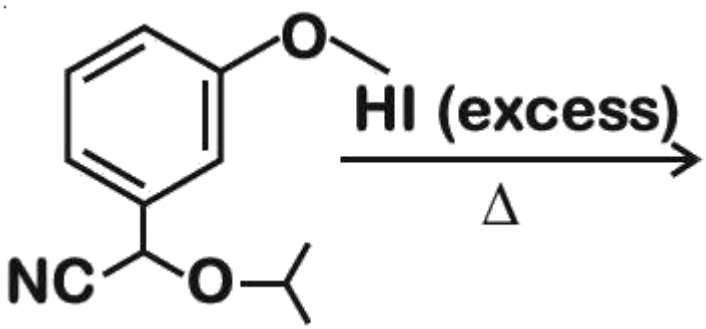
Source solution

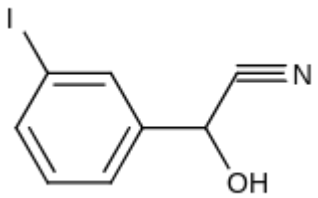
Sol.



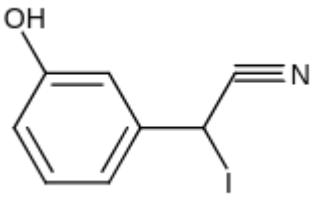
Question 142

The major product of the following reaction is:

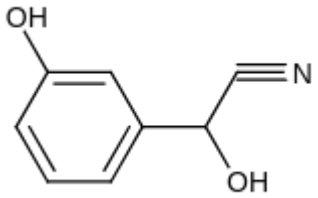




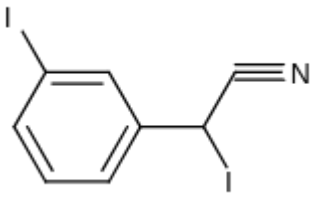
A.



B.



C.

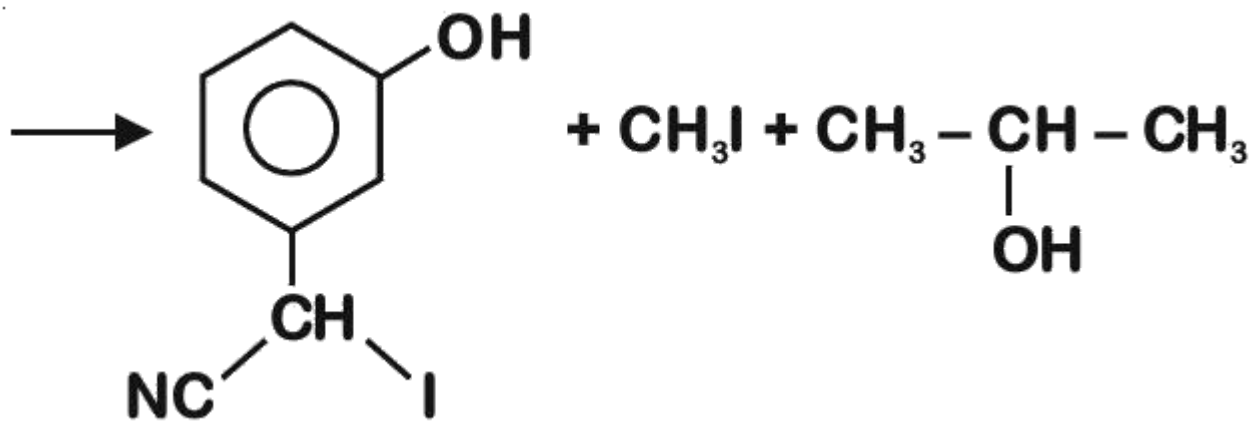


D.

Correct answer: B

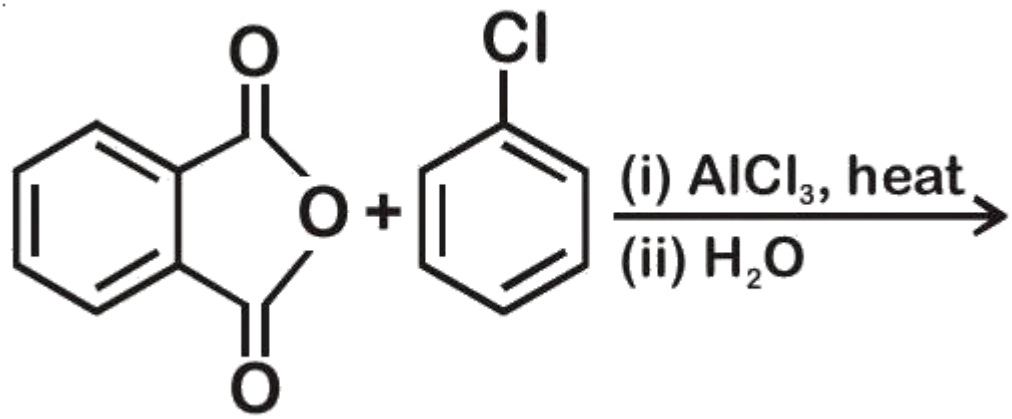
Source solution

Sol.

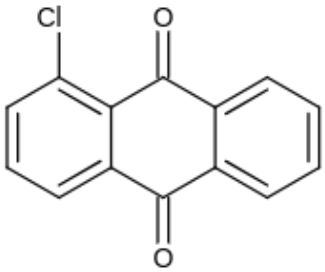

OH
CH
NC
I
+ CH3I + CH3 – CH – CH3
OH

Question 143

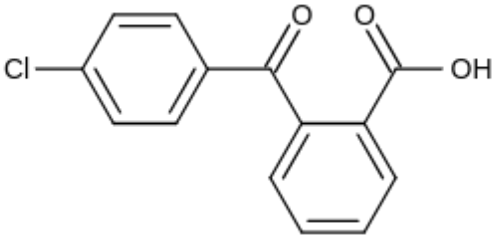
The major product of the following reaction is :



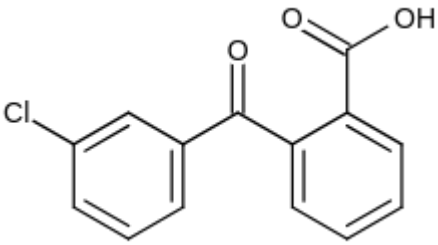
A.



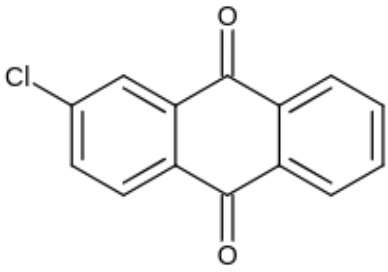
B.



C.



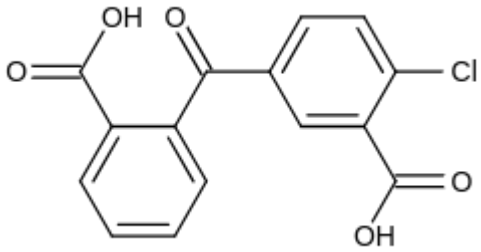
D.



Correct answer: B

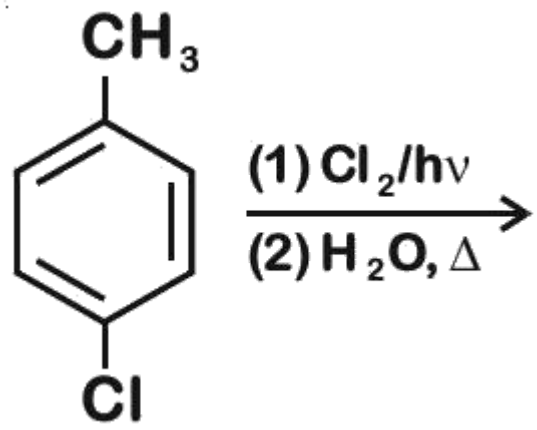
Source solution

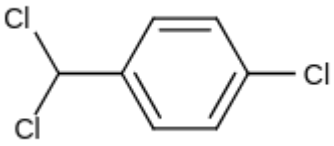
Sol.


OH
O
O
Cl
O
OH

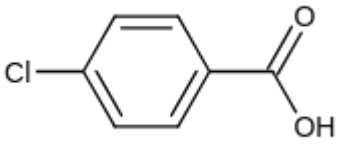
Question 144

The major product of the following reaction is:

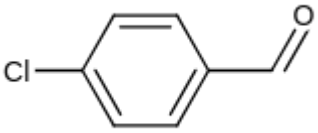




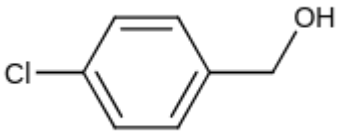
A.



B.



C.

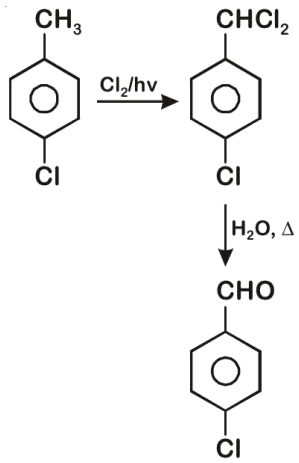


D.

Correct answer: C

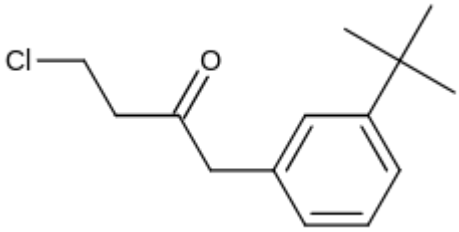
Source solution

Sol.

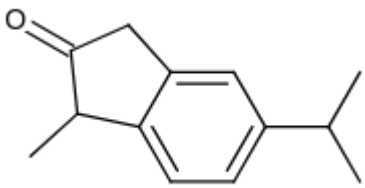

CH3
Cl2/hv
CHCl2
Cl
H2O, Δ
CHO
Cl

Question 145

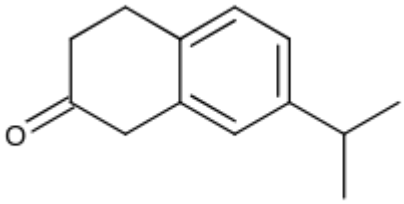
The major product of the following reaction is :



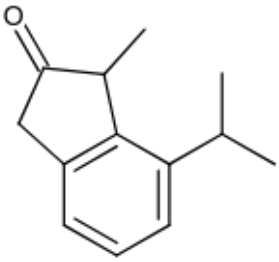
A. $\xrightarrow[(2)\ \text{Conc. } H_2SO_4/\Delta]{(1)\ t\ BuOK}$



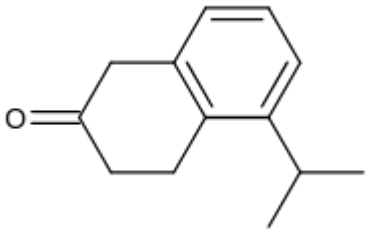
B.



C.



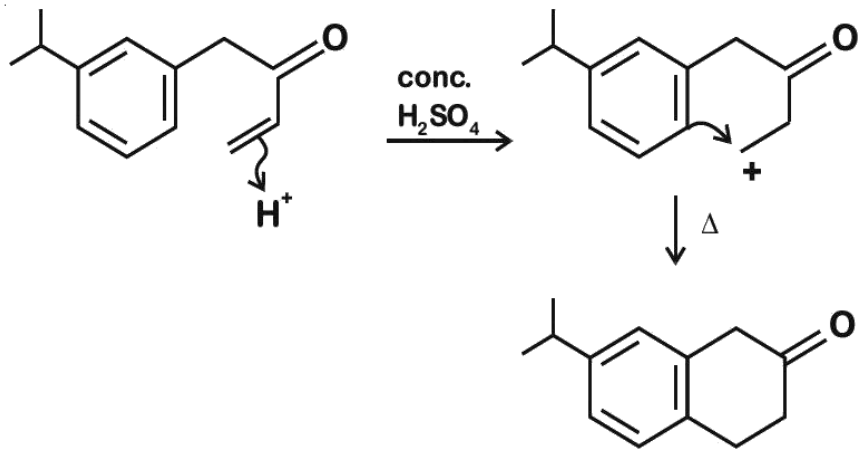
D.



Correct answer: B

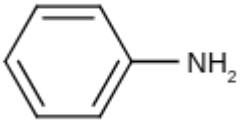
Source solution

Sol.

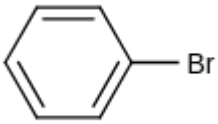

O
conc.
H_2SO_4
H^+
+
Δ
O
O

Question 146

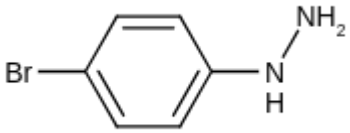
Identify the major product formed in the following sequence of reactions :



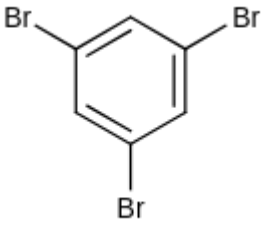
A.



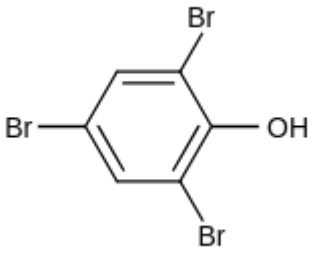
B.



C.



D.



Correct answer: C

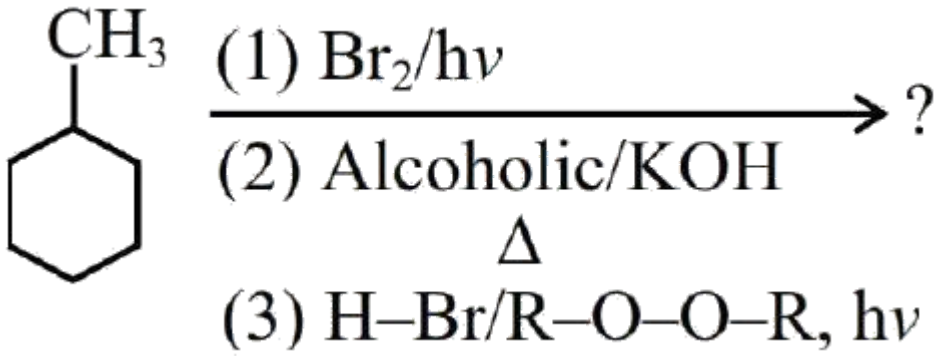
The source provides a brief answer only. A detailed worked solution is not available for this question.

Source solution

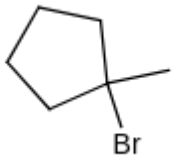
Sol.

Question 147

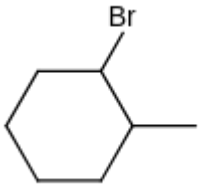
Predict the major product of the following reaction sequence :-



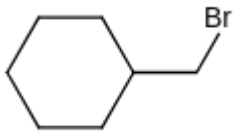
A.



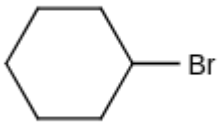
B.



C.



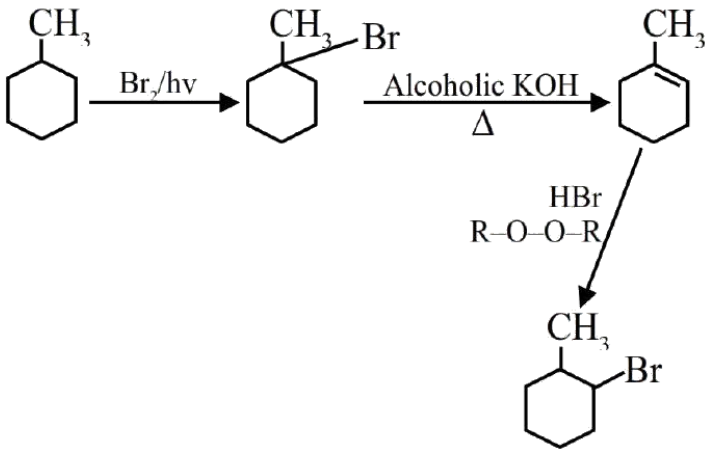
D.



Correct answer: B

Source solution

Sol.

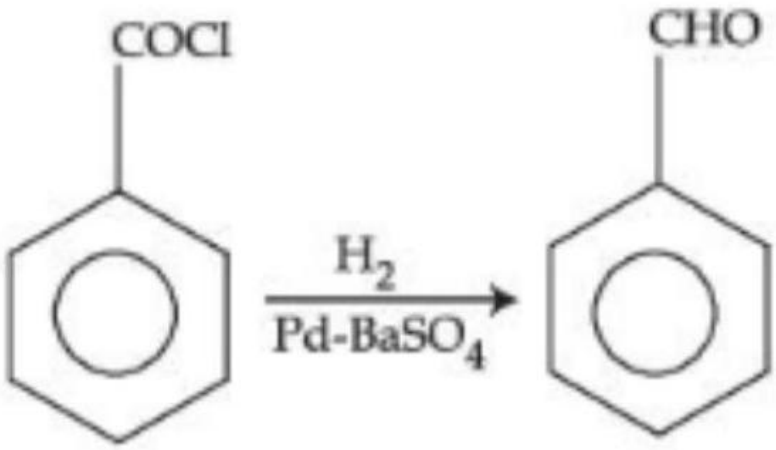

CH3
Br2/hv
CH3
Br
Alcoholic KOH
Δ
CH3
HBr
R–O–O–R
CH3
Br

Question 148

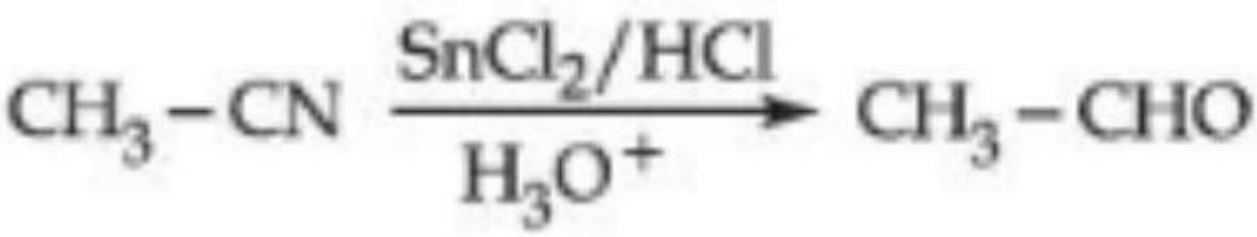
Match List-I with List-II.

List-I

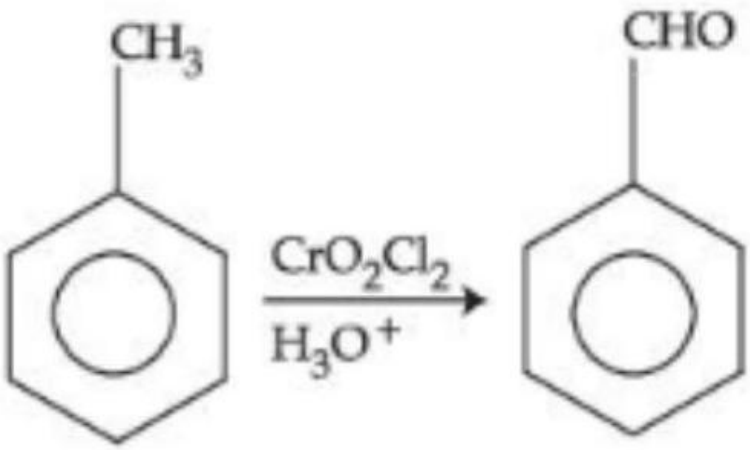
(A)



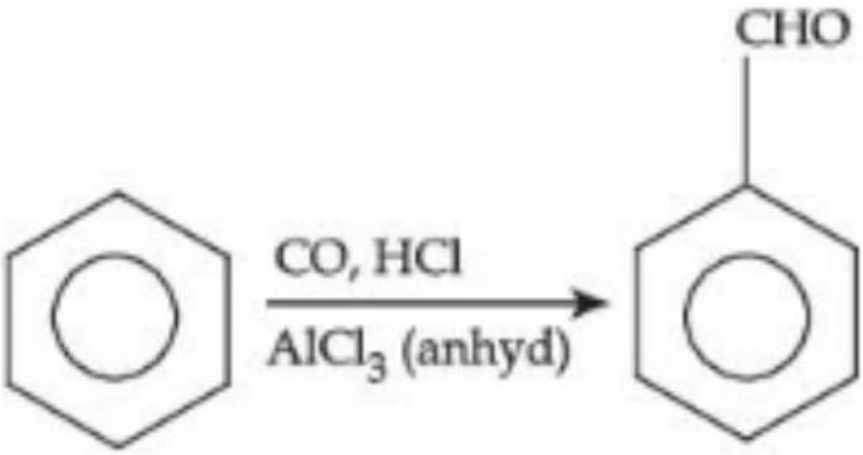
(B)



(C)



(D)



Lits-II

(I) Gatterman Koch reaction
(II) Etard reaction
(III) Stephen reaction
(IV) Rosenmund reaction

Choose the correct answer from the options given below:

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

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

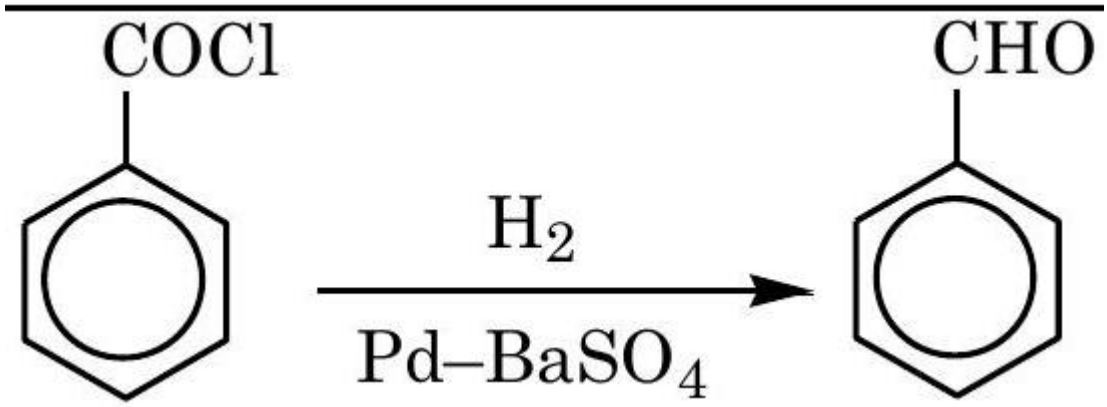
C. (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

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

Correct answer: A

Source solution

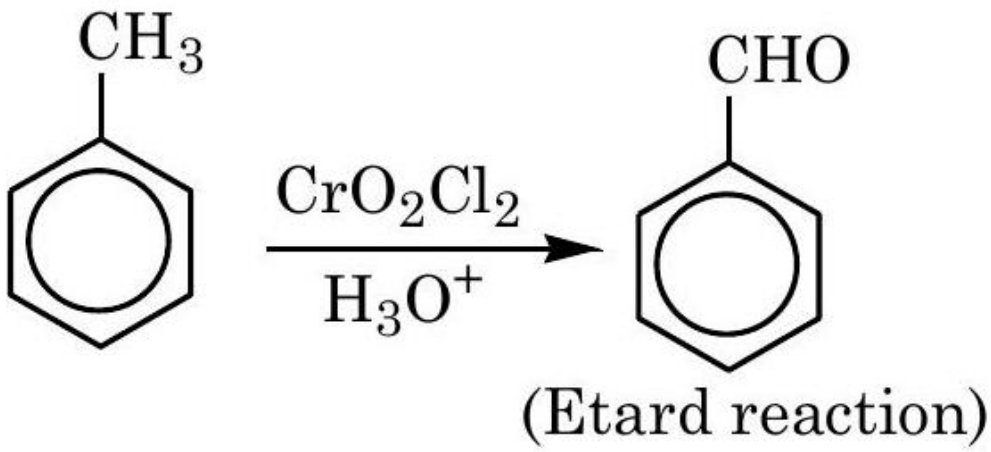
(A)



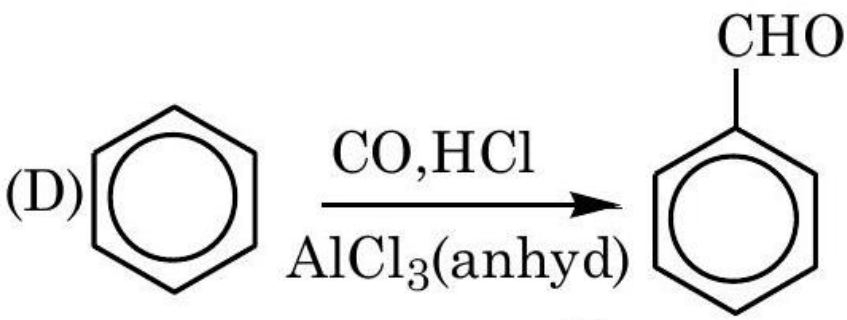
(Rosenmund reaction)

(B) $CH_3 - C \equiv N \xrightarrow[H_3O^+]{SnCl_2-HCl} CH_3 - CHO$

(C)



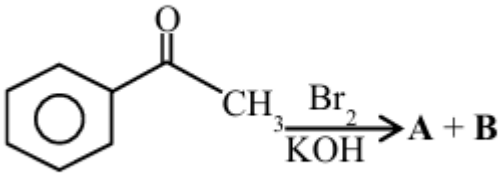
(Etard reaction)



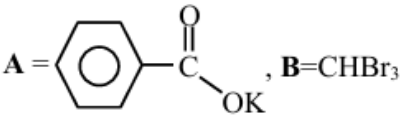
(Gattermann Koch reaction)

Question 149

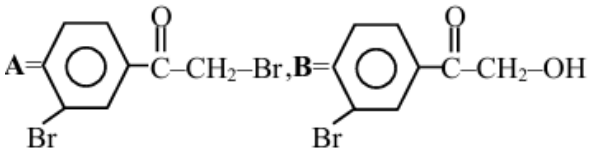
The major products formed in the following reaction sequence **A** and **B** are :



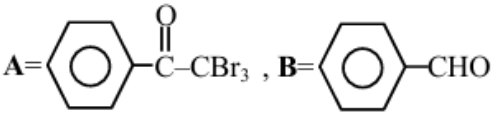
A.



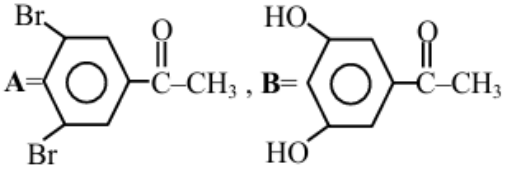
B. -2



C.



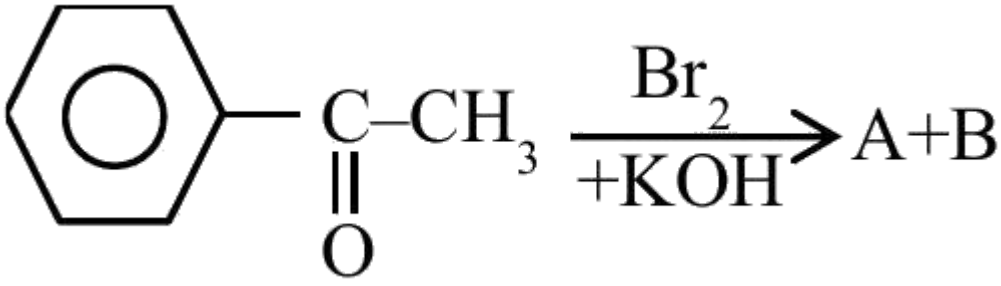
D.



Correct answer: A

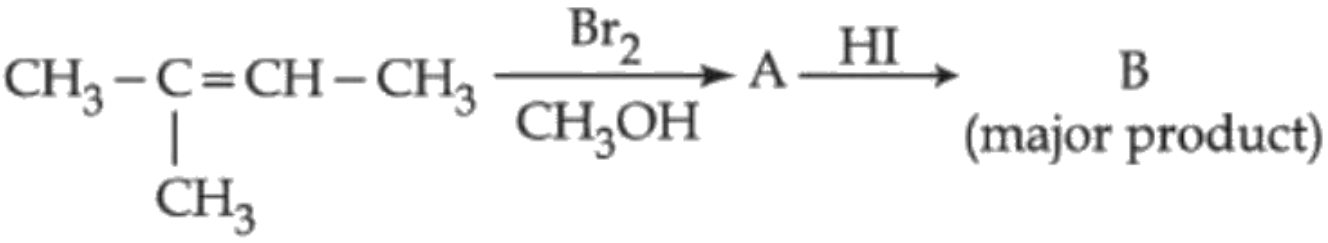
Source solution

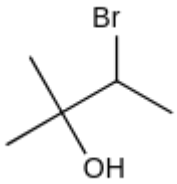
Sol.



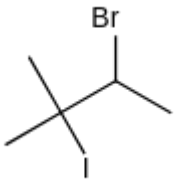
Question 150

Major product ' B ' of the following reaction sequence is:

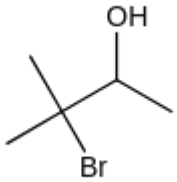




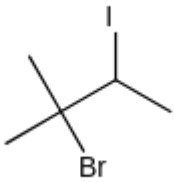
A.



B.



C.



D.

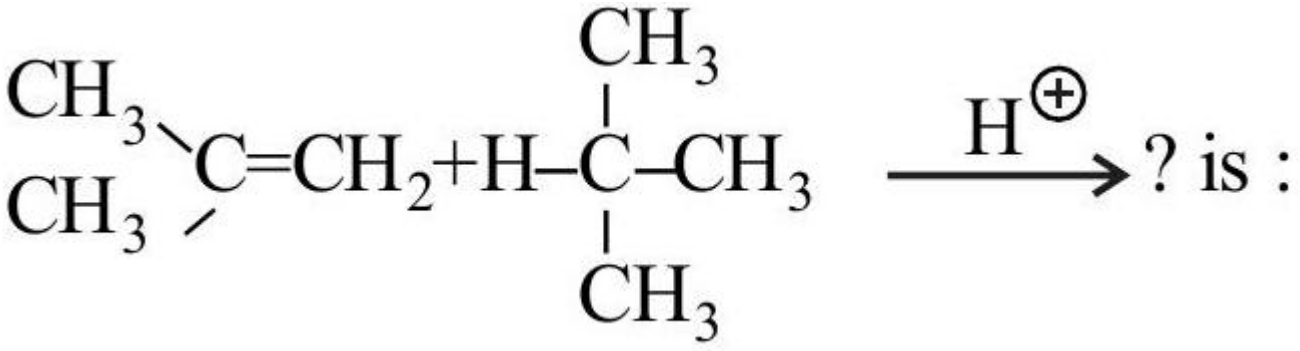
Correct answer: B

The source provides a brief answer only. A detailed worked solution is not available for this question.

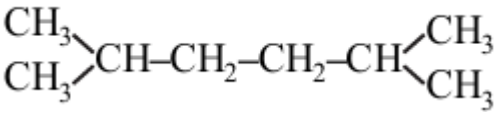
Source solution

Question 151

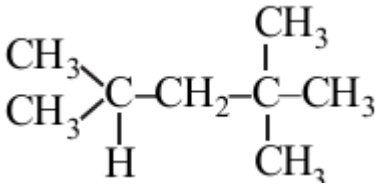
The products formed in the following reaction.



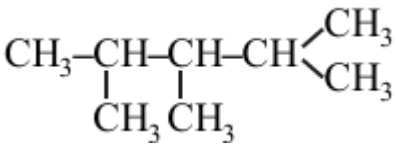
A.



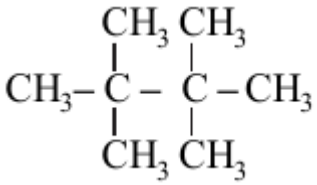
B.



C.



D.



Correct answer: B

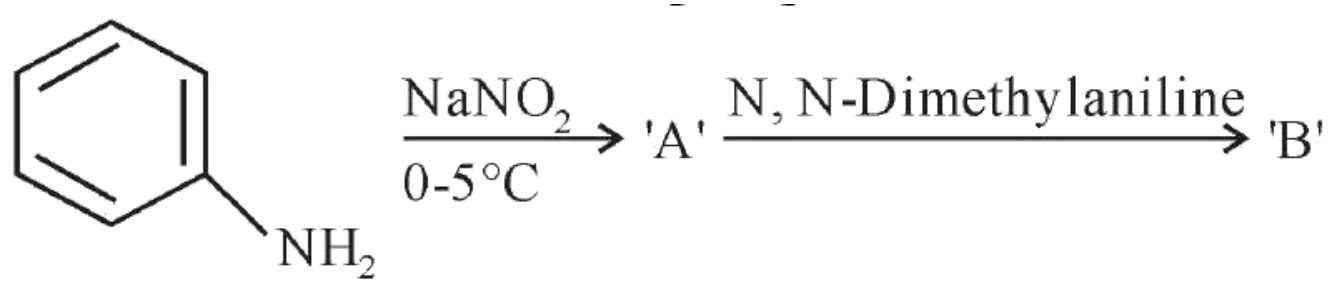
Source solution

Acid protonates the alkene, forming a tertiary carbocation. Addition to a second alkene and hydride transfer from isobutane give 2,2,4-trimethylpentane, the structure in option 2.

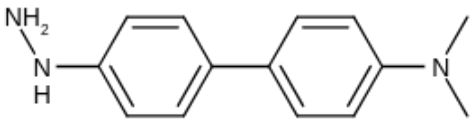
Question 152

Consider the following sequence of reactions:

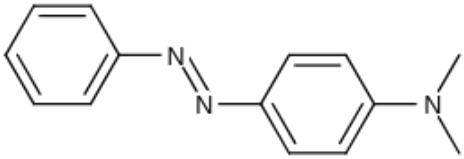
The product ' B ' is



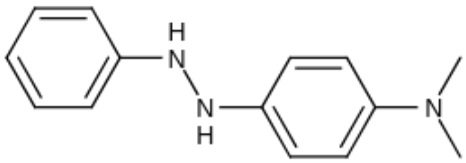
A.



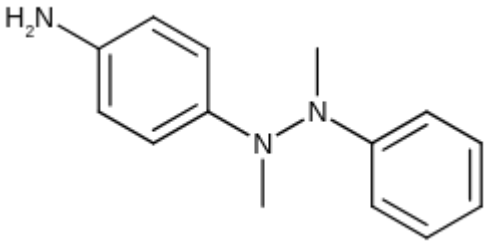
B.



C.



D.

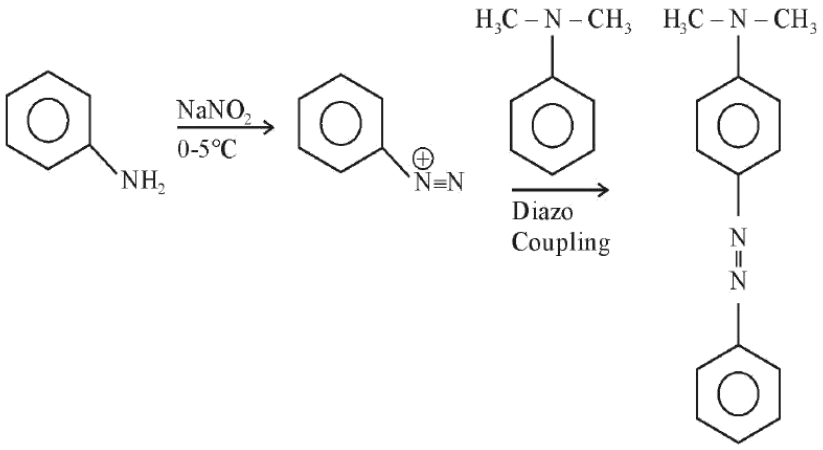


Correct answer: B

Source solution

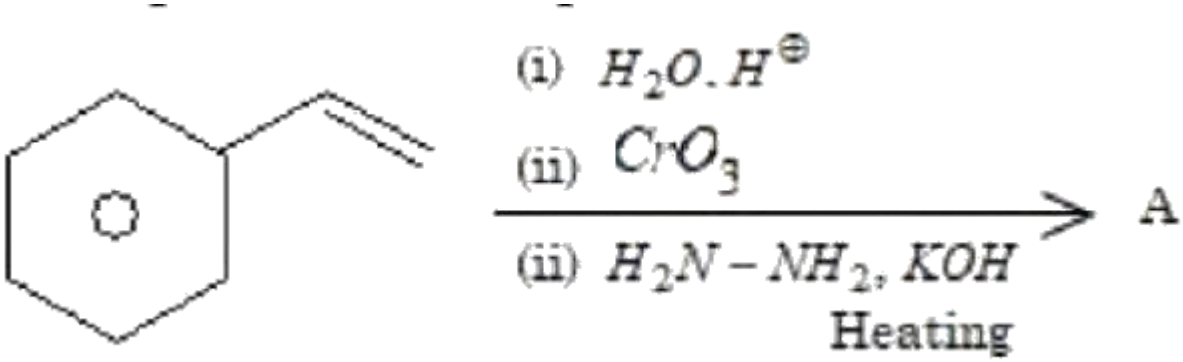
Sol.

Sol.

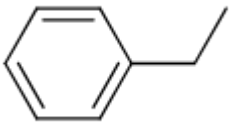


Question 153

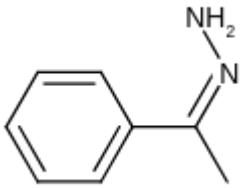
The final product A formed in the following multistep reaction sequence is



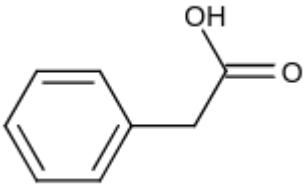
A.



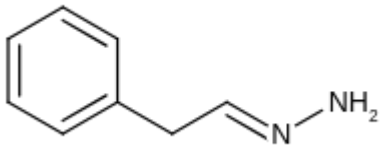
B.



C.



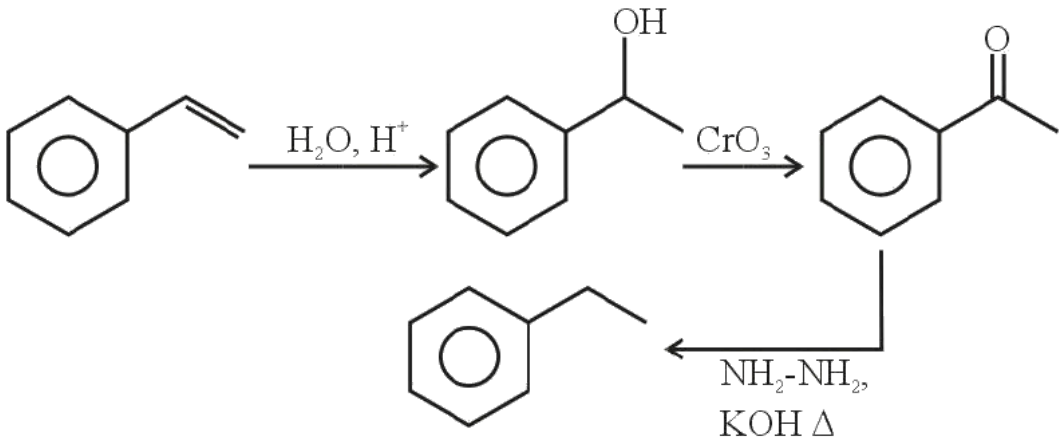
D.



Correct answer: A

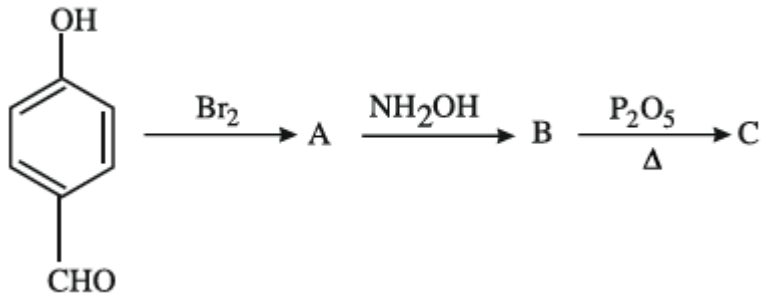
Source solution

Sol.

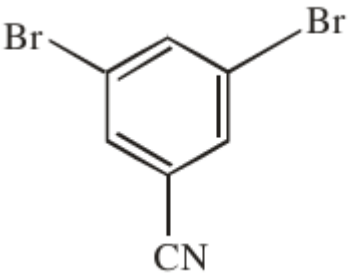

OH
O
H_2O, H^+
CrO_3
NH_2-NH_2,
KOH Δ

Question 154

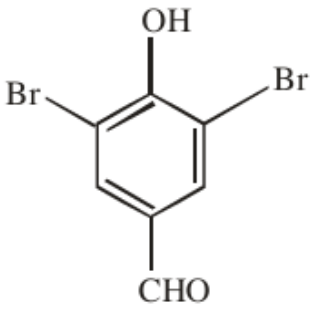
Consider the above reaction sequence, the Product ' C ' is :



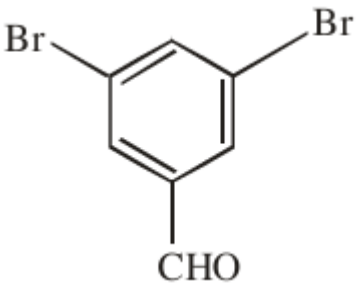
A.



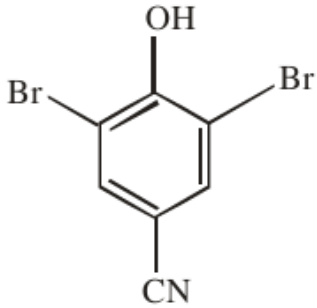
B.



C.



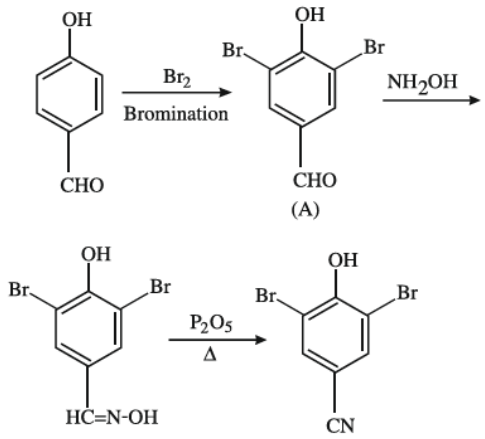
D.



Correct answer: D

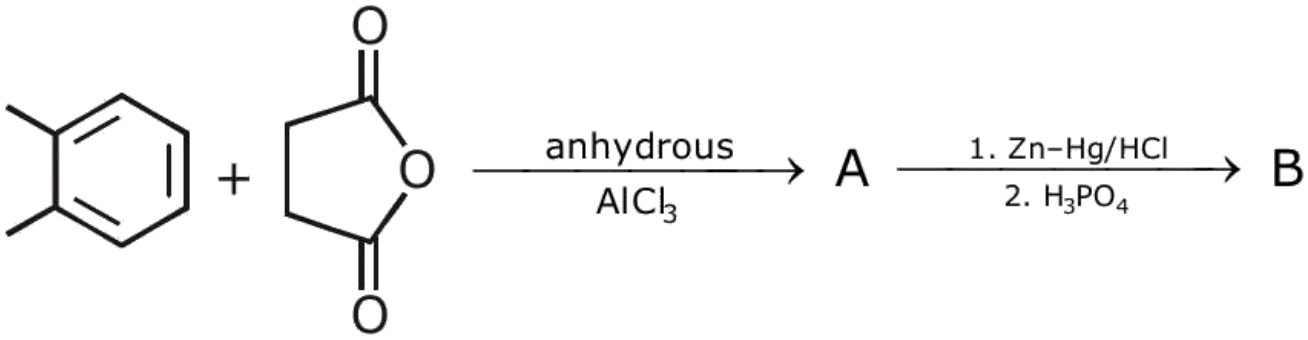
Source solution

Sol.

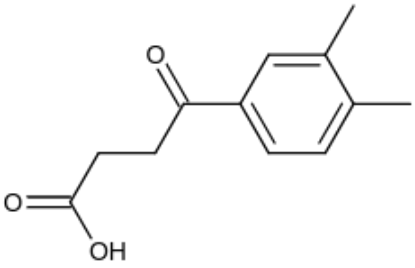

OH
CHO
Br_2
Bromination
OH
Br
Br
CHO
(A)
NH_2OH
OH
Br
Br
HC=N-OH
P_2O_5
Δ
OH
Br
Br
CN

Question 155

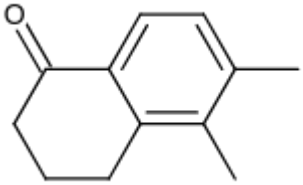
In the following reaction sequence the major products A and B are:



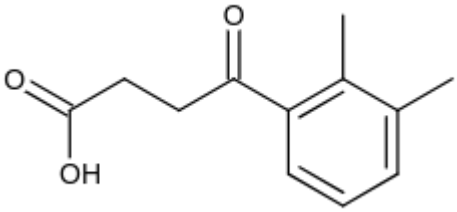
A. $A =$



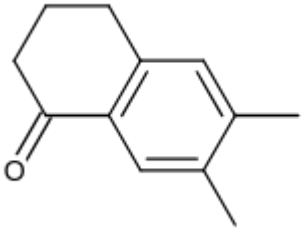
B. $A =$



C. $A =$



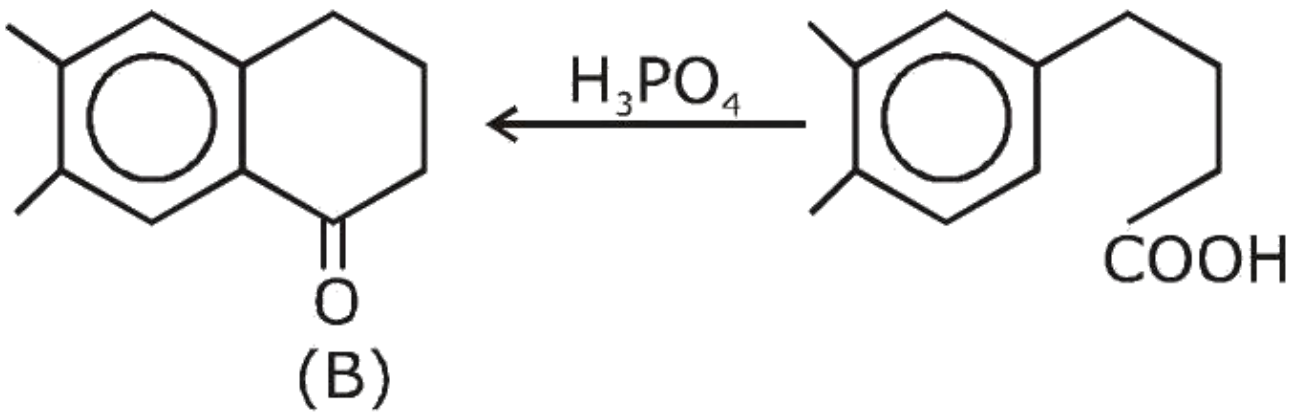
D. $A =$



Correct answer: D

Source solution

Sol. 4}

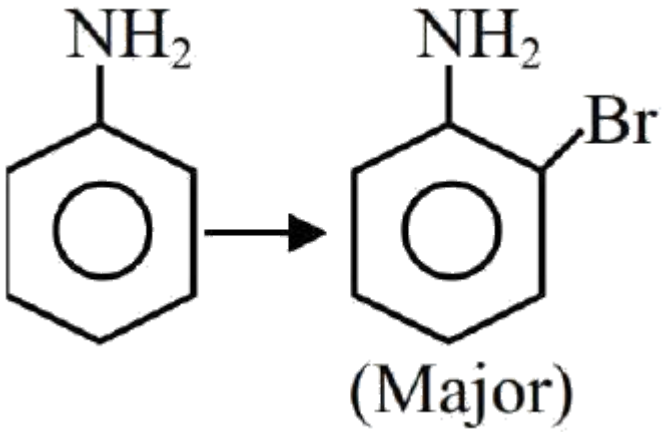


(B)

Question 156

For reaction

The correct order of set of reagents for the above conversion is :



A. $Br_2 \mid FeBr_3, H_2O(\Delta), NaOH$

B. $H_2SO_4, Ac_2O, Br_2, H_2O(\Delta), NaOH$

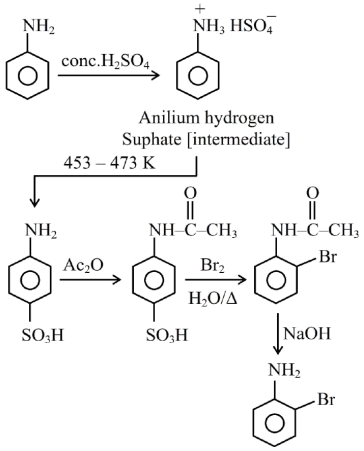
C. $Ac_2O, Br_2, H_2O(\Delta), NaOH$

D. $Ac_2O, H_2SO_4, Br_2, NaOH$

Correct answer: B

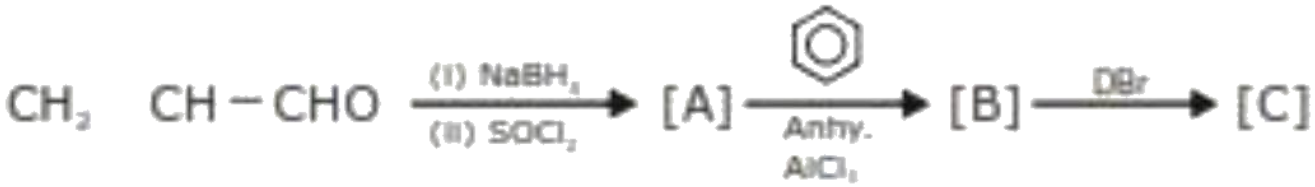
Source solution

Sol.

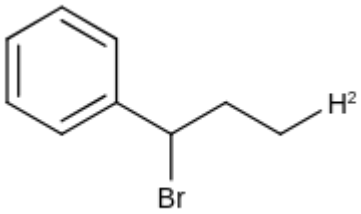


Question 157

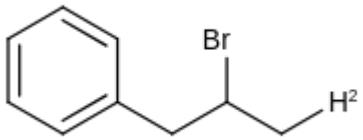
The major product [C] of the following reaction sequence will be :



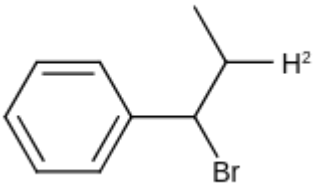
A.



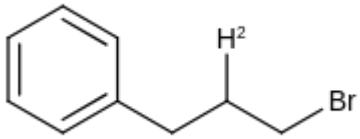
B.



C.



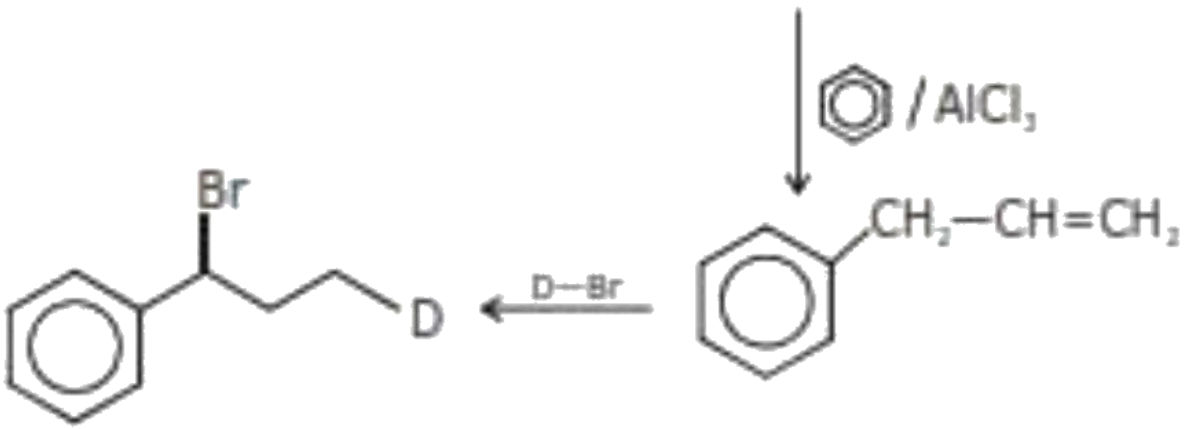
D.



Correct answer: A

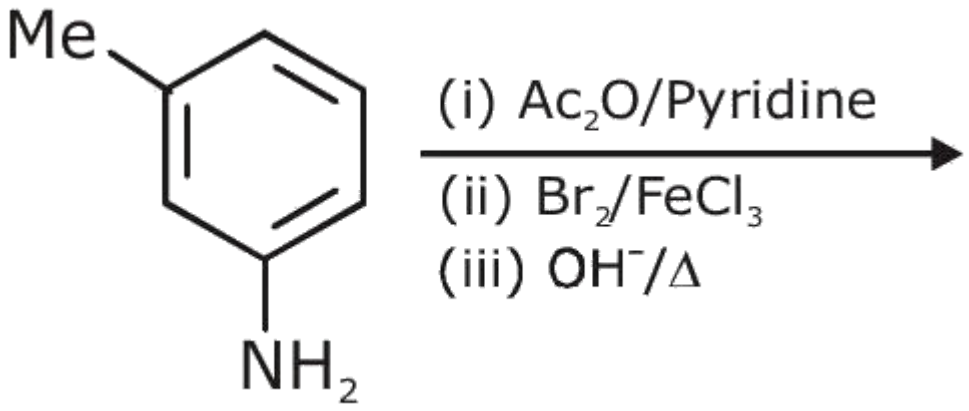
Source solution

Sol. 1}

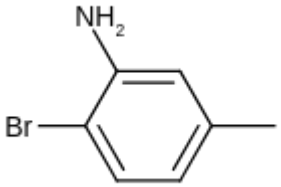


Question 158

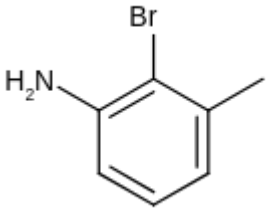
The final major product of the following reaction is :



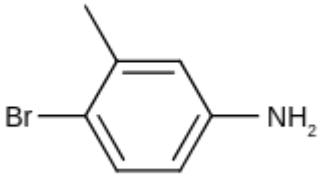
A.



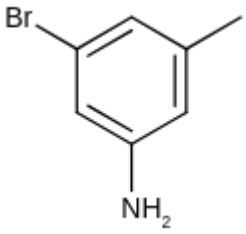
B.



C.



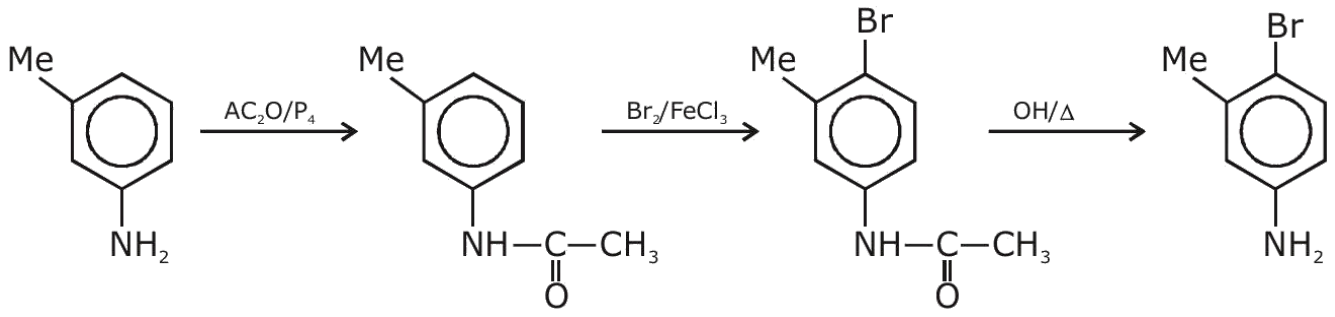
D.



Correct answer: C

Source solution

Sol. 3


Me
NH2
AC2O/P4
Me
NH—C—CH3
O
Br2/FeCl3
Br
Me
NH—C—CH3
O
OH/Δ
Br
Me
NH2

Question 159

Match List I with List II

LIST-I (Test)		LIST-II (Observation)	
A.	Br_2 water test	I.	Yellow orange or orange red precipitate formed
B.	Ceric ammonium nitrate test	II.	Reddish orange colour disappears
C.	Ferric chloride test	III.	Red colour appears
D.	2, 4-DNP test	IV.	Blue, Green, Violet or Red colour appear

Choose the correct answer from the options given below:

A. A-I, B-II, C-III, D-IV

B. A-II, B-III, C-IV, D-I

C. A-III, B-IV, C-I, D-II

D. A-IV, B-I, C-II, D-III

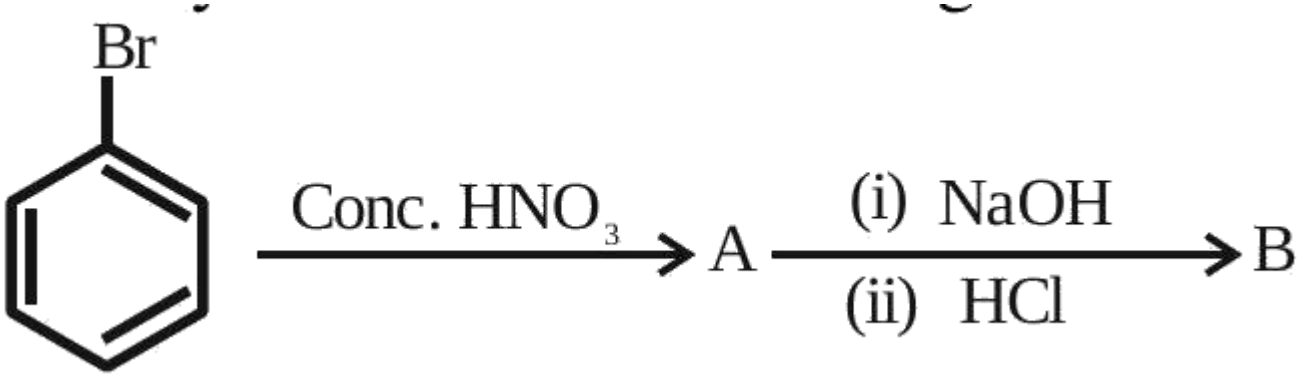
Correct answer: B

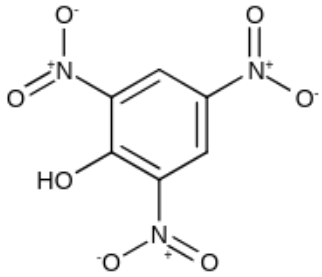
Source solution

Sol. (A) Br_2 water test is test of unsaturation in which reddish orange colour of bromine water disappears.
(B) Alcohols given Red colour with ceric ammonium nitrate.
(C) Phenol gives Violet colour with natural ferric chloride.
(D) Aldehyde & Ketone give Yellow/Orange/Red Colour compounds with 2, 4-DNP i.e., 2, 4-Dinitrophenyl hydrazine.

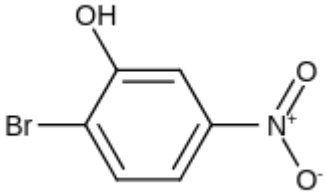
Question 160

Identify A and B in the following reaction sequence.



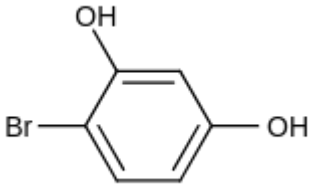


A.

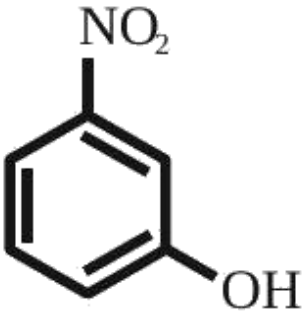


B.

C. B=



D. A =



Correct answer: A

The source provides a brief answer only. A detailed worked solution is not available for this question.

Source solution

Sol:-

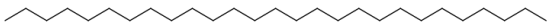
Question 161

What will be the major product of following sequence of reactions?

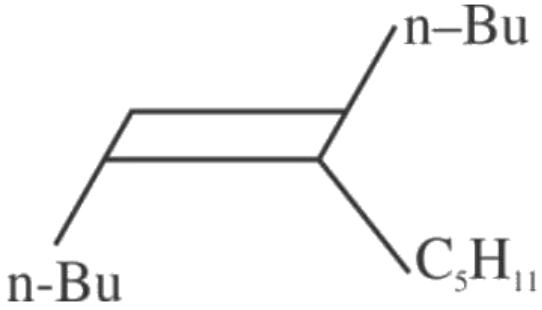
(i) $\mathbf{n-BuLi}$,

$\mathbf{n-Bu-\equiv \xrightarrow[\text{(ii) Lindlar cat, } H_2]{n-C_5H_{11}Cl}}$

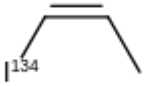
A.



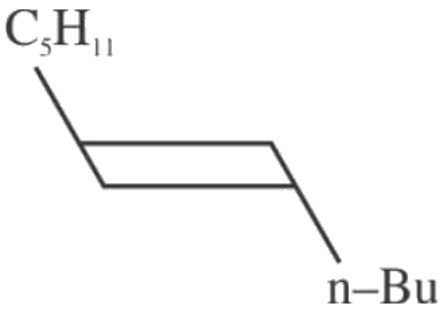
B.



C.



D.



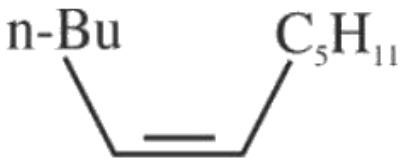
Correct answer: C

Source solution

Sol. $\mathbf{n-Bu-C\equiv CH}$

$\mathbf{n-Bu-C\equiv C^{-}Li^{+}}$

$$n-C_5H_{11}Cl \downarrow \text{(SN reaction)}$$



$$\xleftarrow[\text{Lindlar's Catalyst}]{H_2} n-Bu-C\equiv C-C_5H_{11}$$

Question 162

The major product of the following reaction is P .

$$CH_3C \equiv C - CH_3 \xrightarrow[\text{(ii)dil. } KMnO_4,\ 273\ K]{\text{(i) Na/ liq } \cdot NH_3} 'P'$$

Number of oxygen atoms present in product ' P ' is

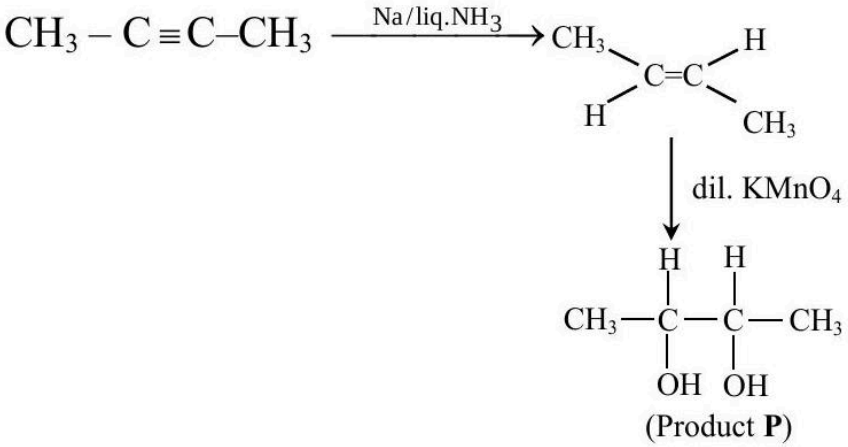
(nearest integer).

Numerical answer: _____

Enter the requested value or coefficient rounded to the nearest integer (0 decimal places).

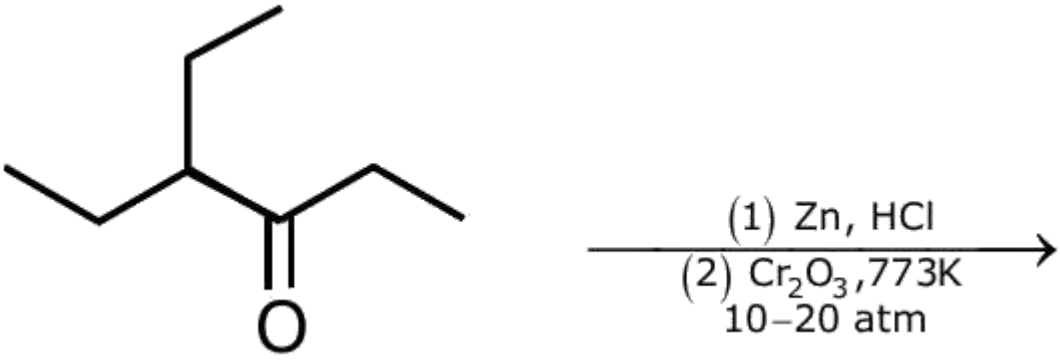
Correct answer: 2

Source solution

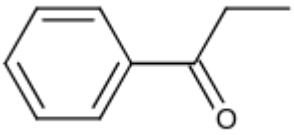


Question 163

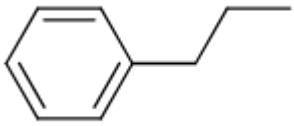
Considering the above reaction, the major product among the following is:



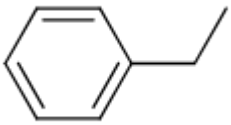
A.



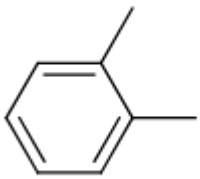
B.



C.



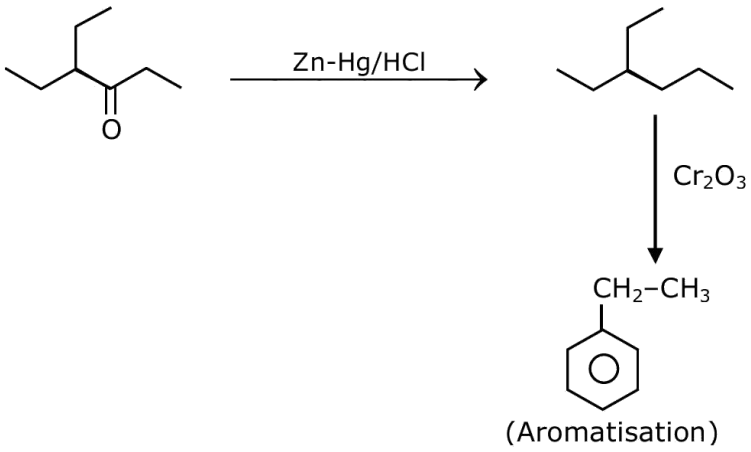
D.



Correct answer: C

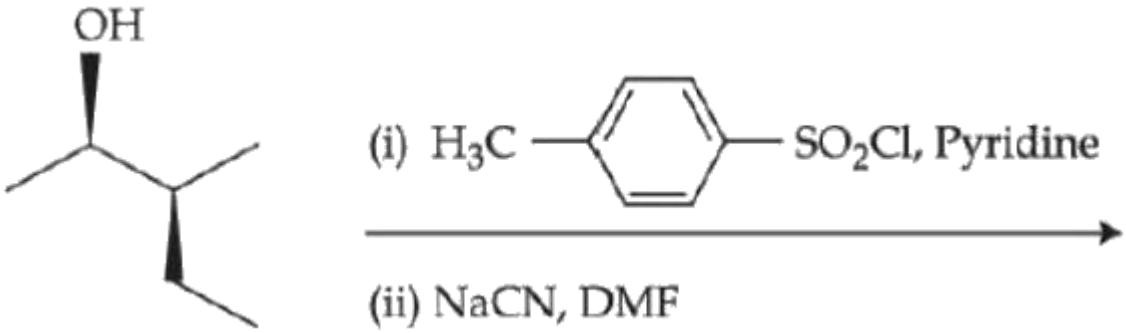
Source solution

Sol.

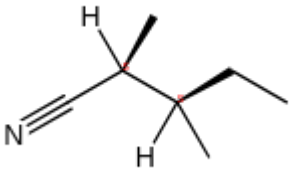

Zn-Hg/HCl
O
Cr_2O_3
$CH_2–CH_3$
(Aromatisation)

Question 164

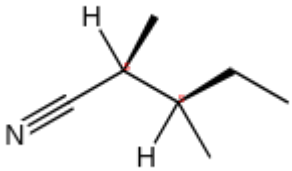
Most stable product of the following reaction is:



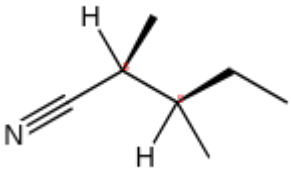
A.



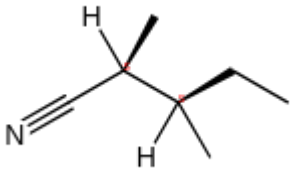
B.



C.



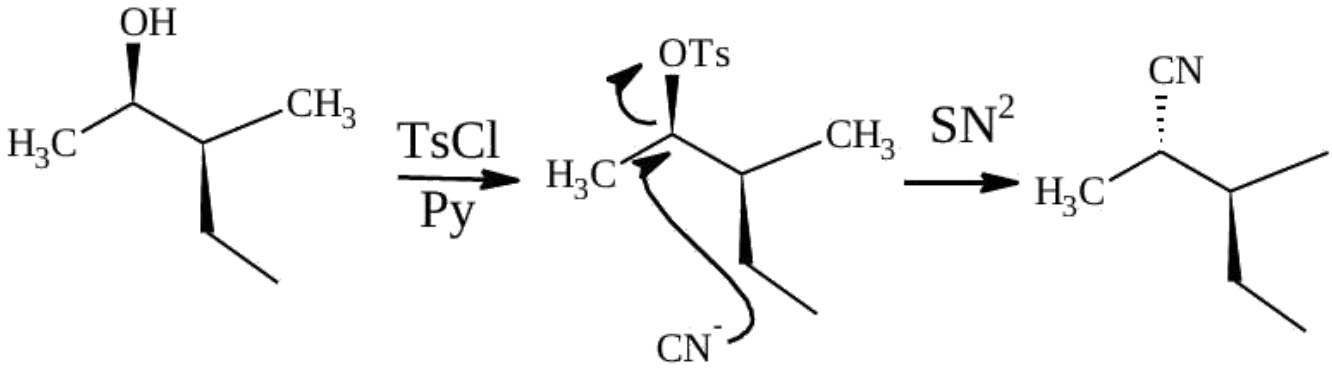
D.



Correct answer: B

Source solution

Sol.

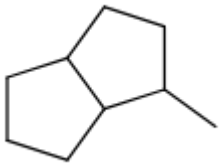


Question 165

Match List - I with List - II.

List - I (Isomers of $C_{10}H_{14}$)	List - II (Ozonolysis product)

Choose the correct answer from the options given below:



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

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

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

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

Correct answer: B

Source solution

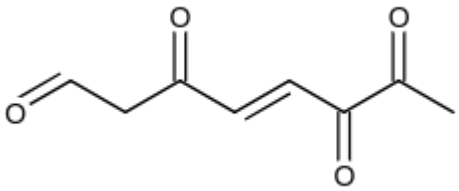
Sol. Ozonolysis product

(A)

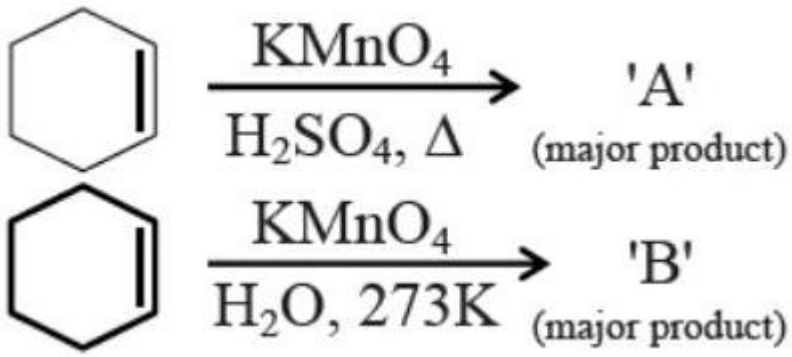
(B)

(C)

(D)



Question 166



For above chemical reactions, identify the correct statement from the following:

A. Both compound 'A' and compound 'B' are dicarboxylic acids

B. Both compound 'A' and compound 'B' are diols

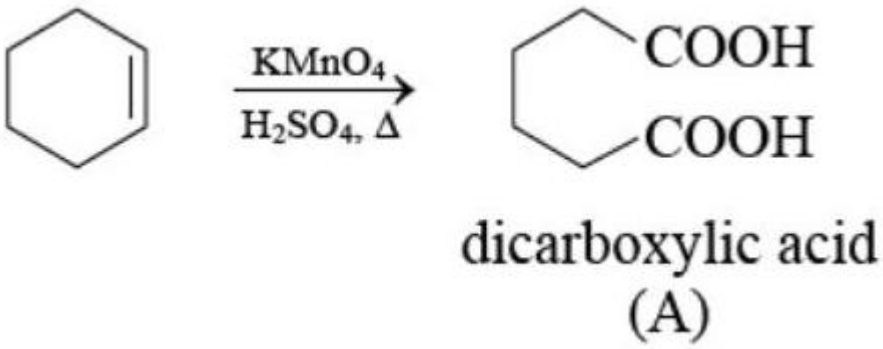
C. Compound 'A' is diol and compound 'B' is dicarboxylic acid

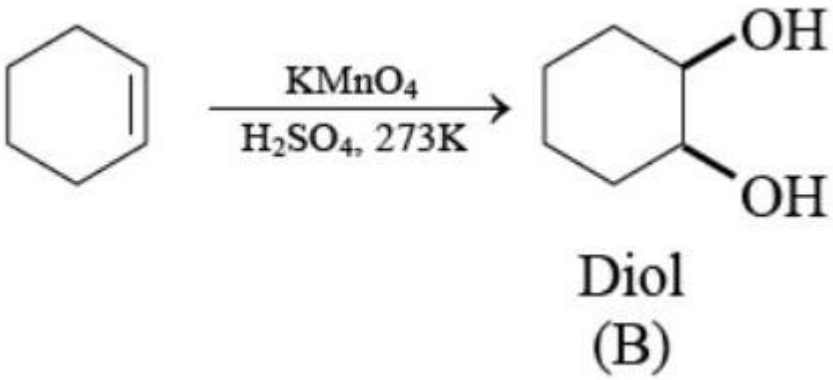
D. Compound 'A' is dicarboxylic acid and compound 'B' is diol

---

Correct answer: D

Source solution

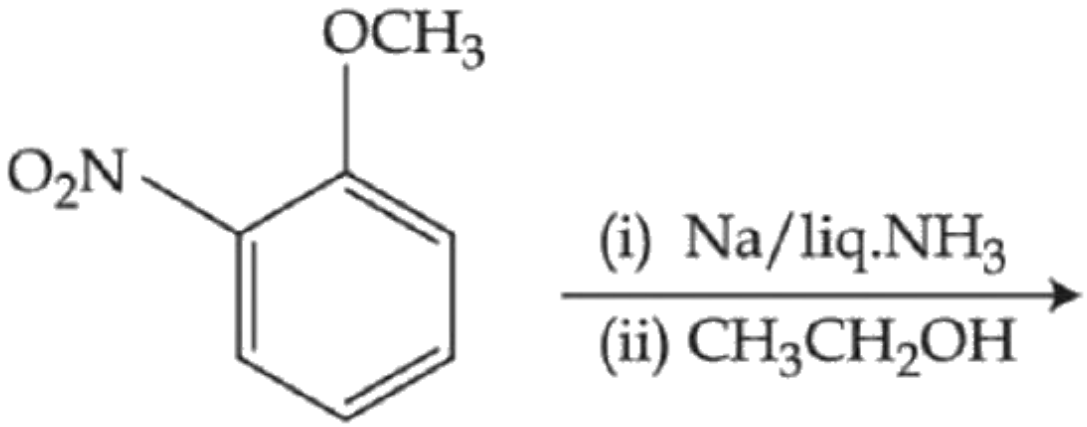




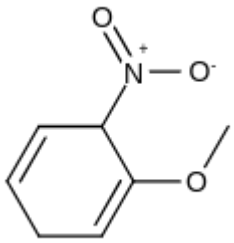
\textbackslash section*\{Section -B\}

Question 167

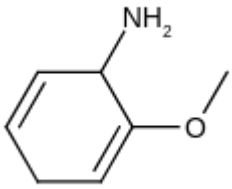
The major product of the following reaction is



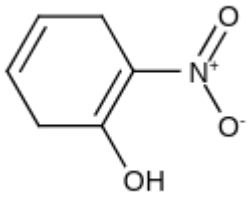
A.



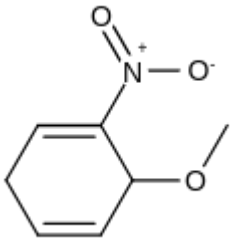
B.



C.



D.

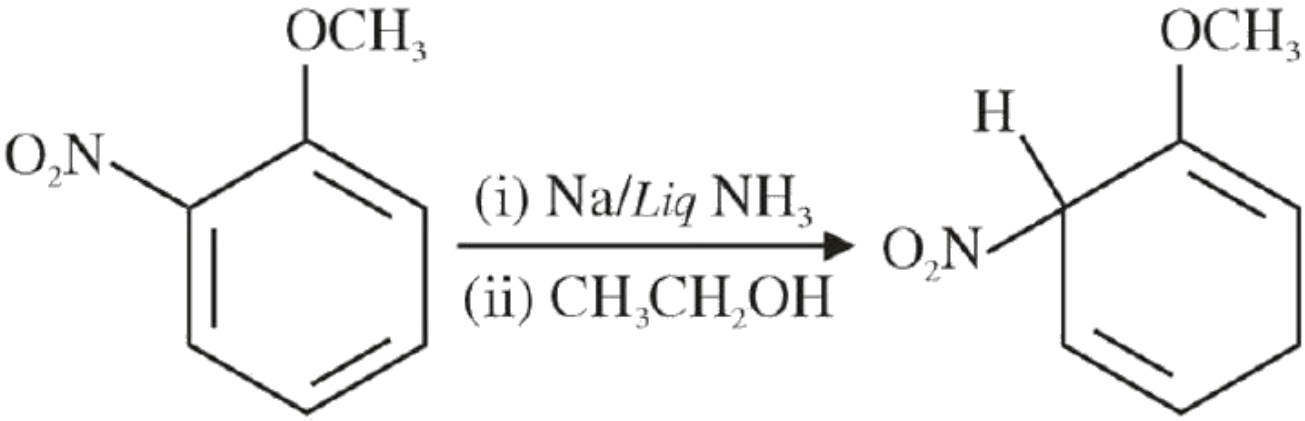


Correct answer: A

Source solution

Sol.

Given reaction is an example of birch reduction.

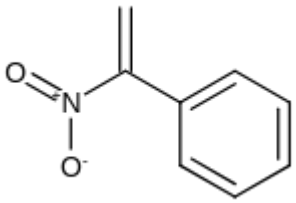

OCH3
O2N
(i) Na/Liq NH3
(ii) CH3CH2OH
OCH3
H
O2N

Question 168

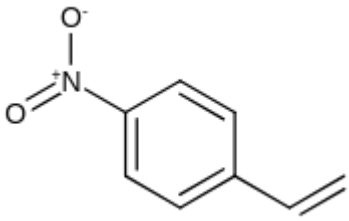
In the given reactions sequence, the major product ' C ' is :

$$C_8H_{10} \xrightarrow[H_2SO_4]{HNO_3} A \xrightarrow[\Delta]{Br_2} B \xrightarrow[KOH]{\text{alcoholic}} C$$

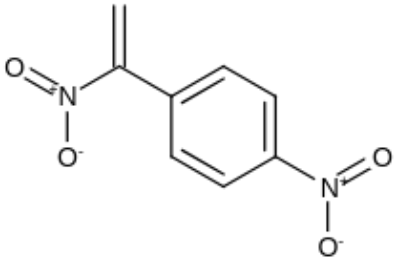
A.



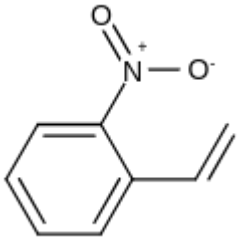
B.



C.



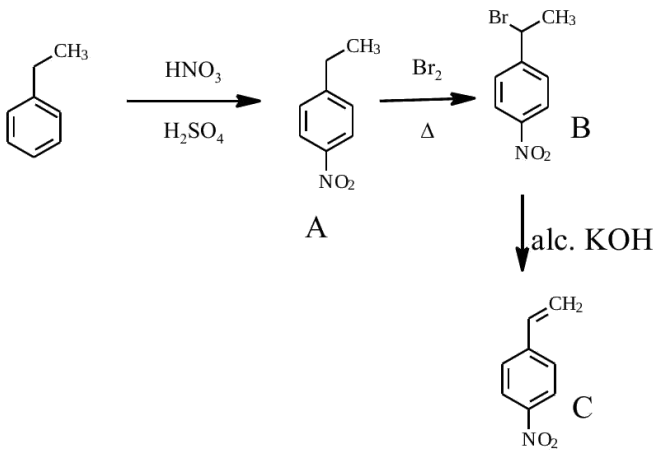
D.



Correct answer: B

Source solution

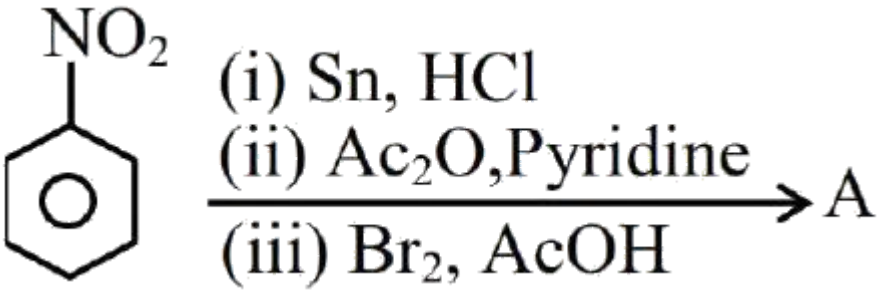
Sol. C_8H_{10} $DU = 9 - 5 = 4$

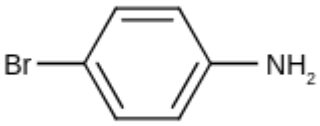


Question 169

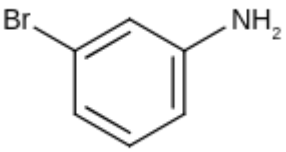
The major product (A) formed in the following reaction sequence is

(iv) $\mathbf{NaOH(aq)}$

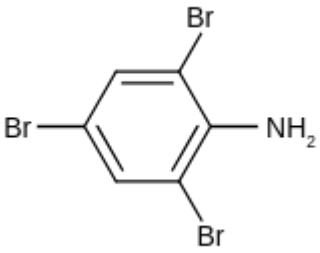




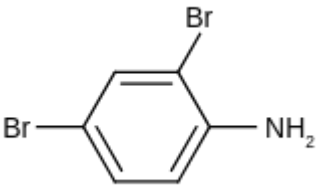
A.



B.



C.

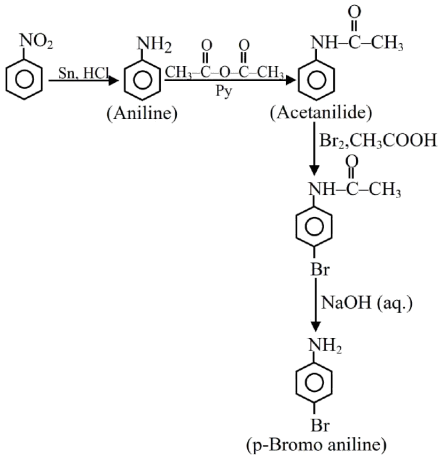


D.

Correct answer: A

Source solution

Sol.


NO2
Sn, HCl
NH2
(Aniline)
CH3–C–O–C–CH3
Py
NH–C–CH3
(Acetanilide)
Br2,CH3COOH
NH–C–CH3
Br
NaOH (aq.)
NH2
Br
(p-Bromo aniline)

Question 170

Match List-I with List-II

List-I}

(A) $\mathbf{RCN} \xrightarrow[\text{(ii) } \mathbf{H_3O^+}]{\text{(i) } \mathbf{SnCl_2,HCl}} \mathbf{RCHO}$

(B)

(C)

(D)

List-II}

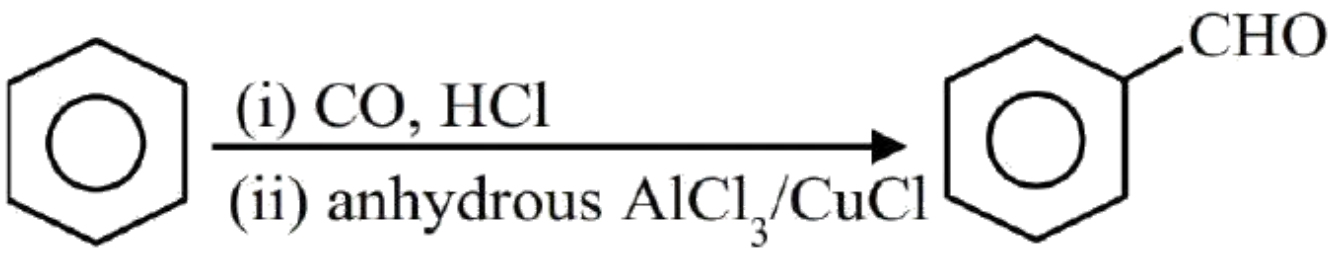
(I) Etard reaction

(II) Gatterman -Koch reaction

(III) Rosenmund reduction

(IV) Stephen reaction

Choose the correct answer from the options given below :



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

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

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

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

Correct answer: A

Source solution

Sol. List-I

(A) $\mathbf{RCN} \xrightarrow[\text{(ii) } \mathbf{H_3O^+}]{\text{(i) } \mathbf{SnCl_2,HCl}} \mathbf{RCHO}$

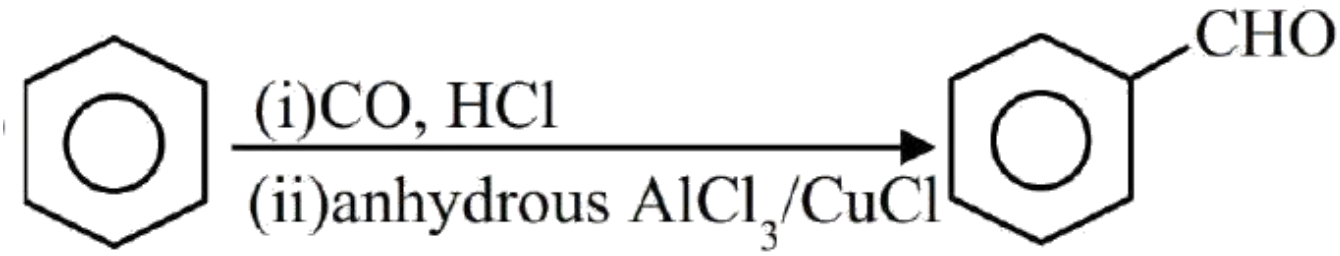
Stephen reaction

(B)

Rosenmund reduction
(C)

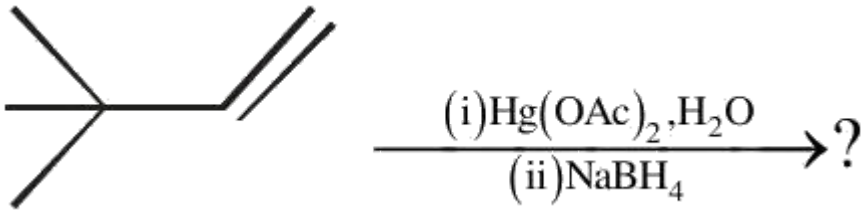
Etard reaction
(D)

Gatterman -Koch reaction

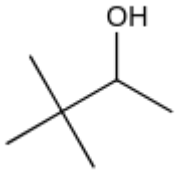


Question 171

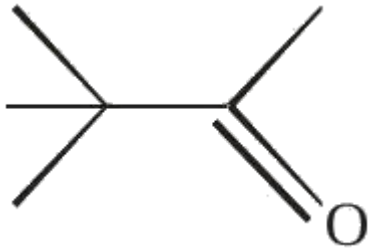
The major product in the following reaction



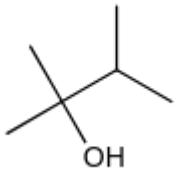
A.



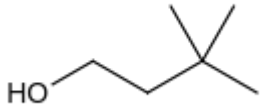
B.



C.



D.

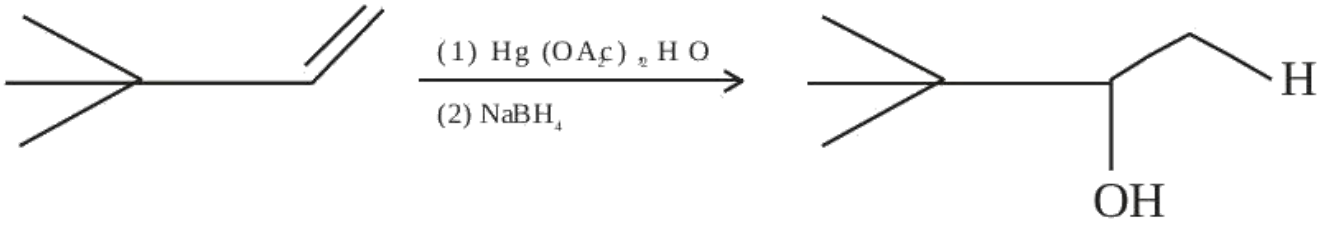


Correct answer: A

Source solution

Sol.

Oxymercuration - Demercuration
Addition of H_2O
Markovnikov's addition without rearrangement

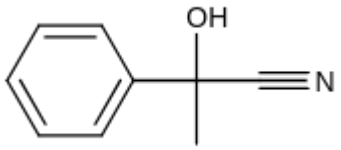


Question 172

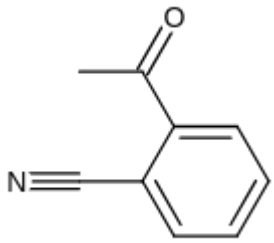
The structure of product C, formed by the following sequence of reactions is :

$$CH_3COOH + SOCl_2 \longrightarrow A \xrightarrow[AlCl_3]{Benzene} B \xrightarrow[-OH]{KCN} C$$

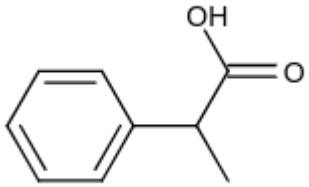
A.



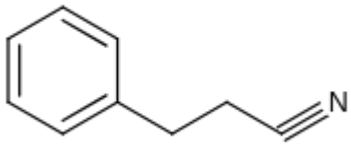
B.



C.



D.

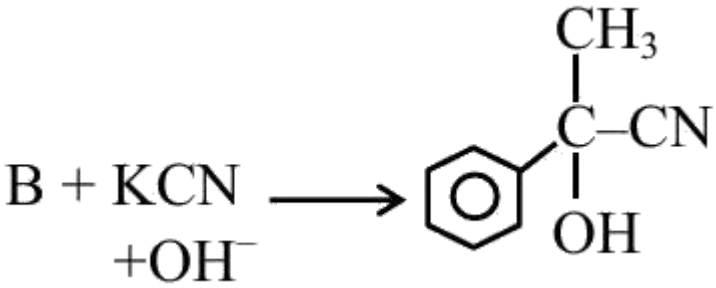


Correct answer: A

Source solution

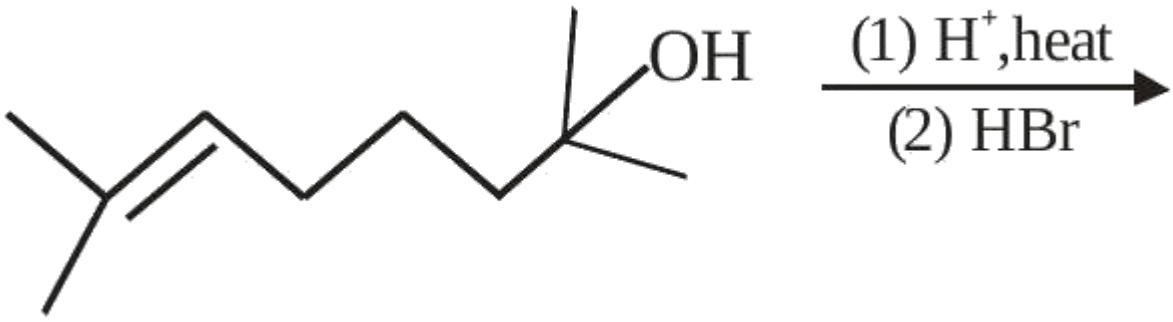
Sol.

SECTION-B}

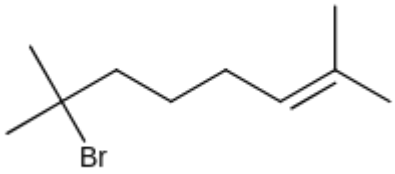


Question 173

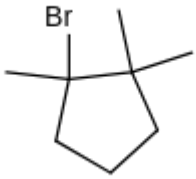
The major product in the given reaction is



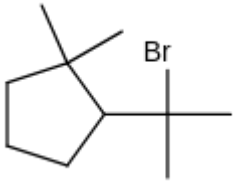
A.



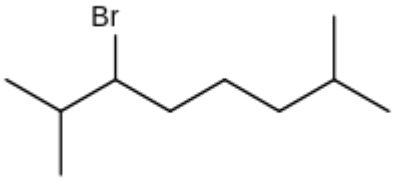
B.



C.



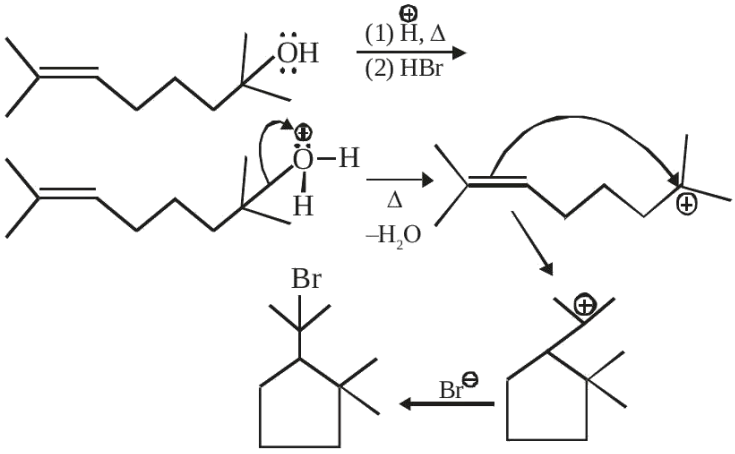
D.



Correct answer: C

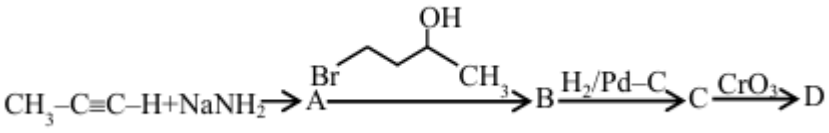
Source solution

Sol.


OH
(1) H⊕, Δ
(2) HBr
O–H
H
Δ
–H2O
Br
Br⊖

Question 174

In the following sequence of reactions, the final product D is :



A. $CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CHO$

B. $CH_3 - CH = CH - CH_2 - CH_2 - CH_2 - COOH$

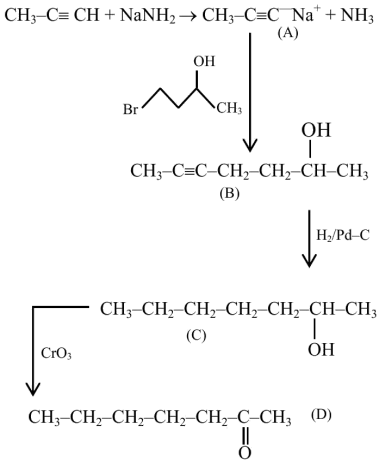
C. $CH_3 - CH = CH - CH(OH) - CH_2 - CH_2 - CH_3$

D. $CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CO - CH_3$

Correct answer: D

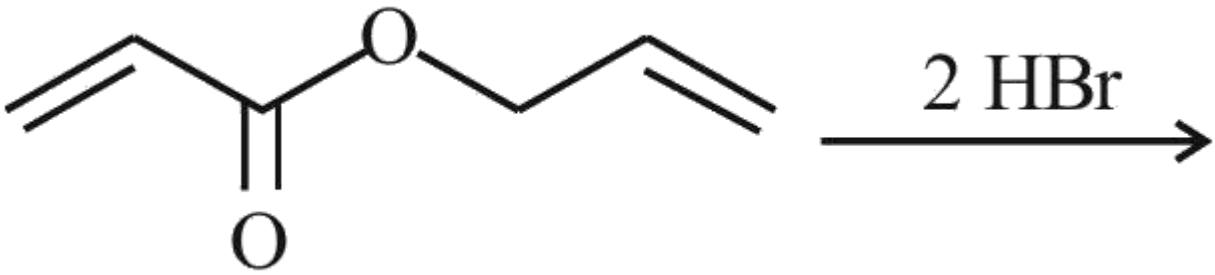
Source solution

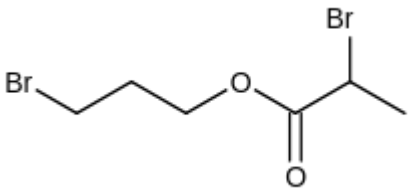
Sol.



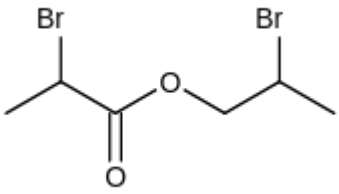
Question 175

Major product of the following reaction is

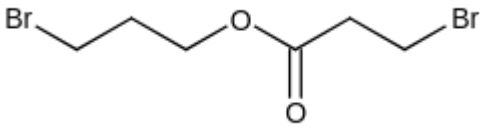




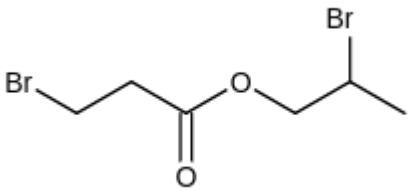
A.



B.



C.

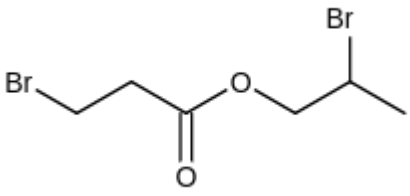


D.

Correct answer: D

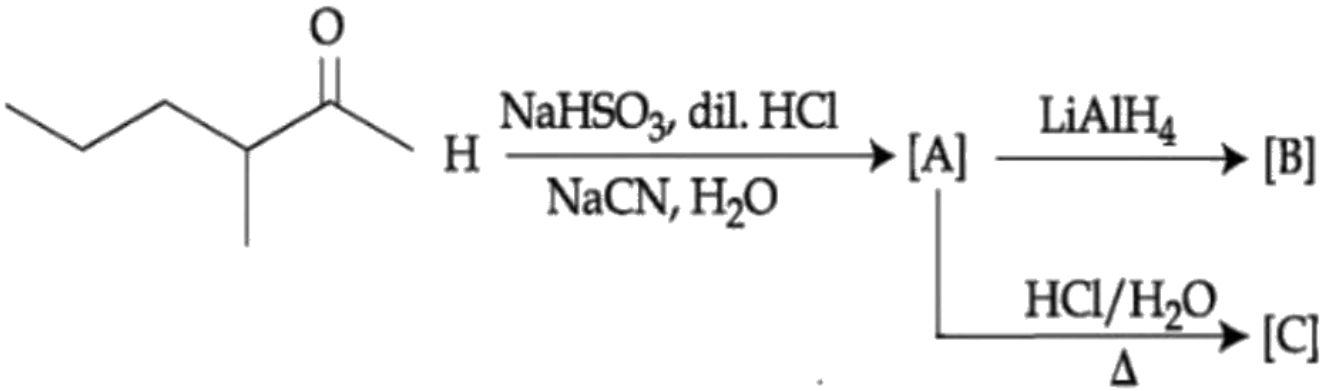
Source solution

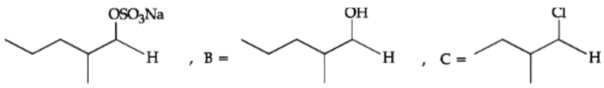
Sol.

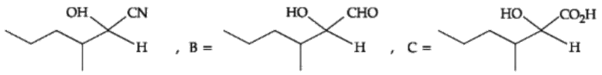


Question 176

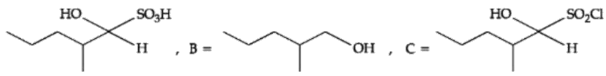
The structures of major products **A, B** and C in the following reaction are sequence.



A. 

B. 

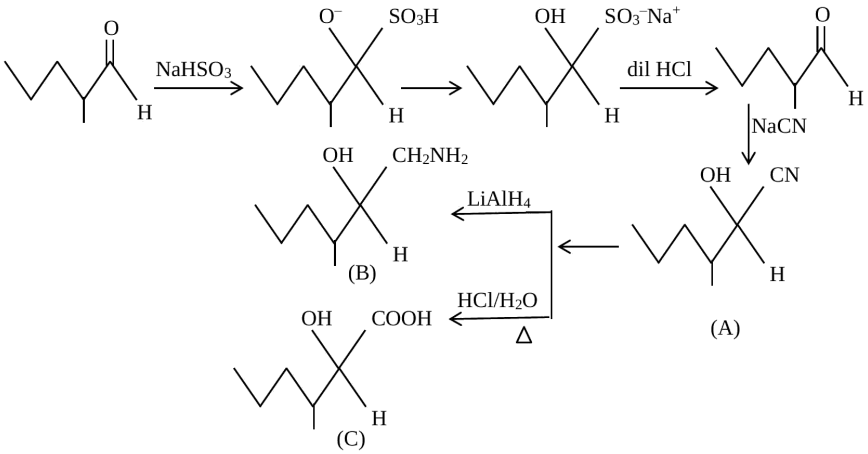
C.

D. 

Correct answer: D

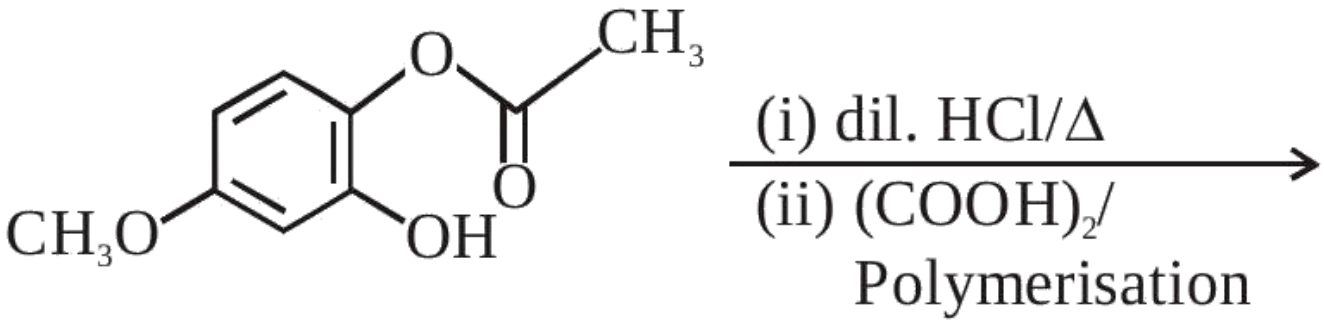
Source solution

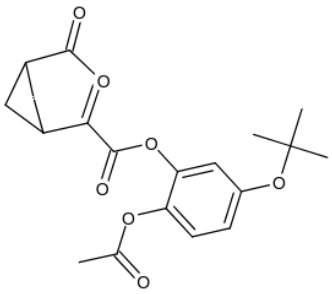
Sol.



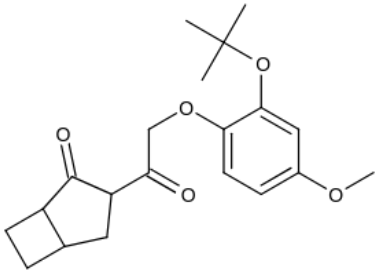
Question 177

The major product of the following reaction is:

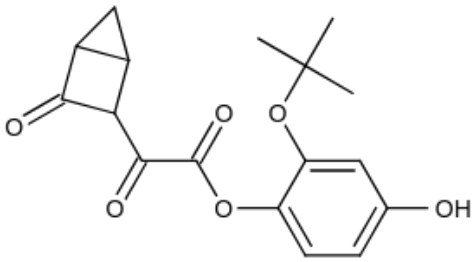




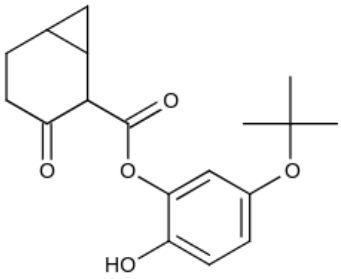
A.



B.



C.



D.

Correct answer: C

The source provides a brief answer only. A detailed worked solution is not available for this question.

Source solution

Solutions

Questions 178-183 / 6 selected / 2.0% practice weight / Consolidate

Question 178

20% of acetic acid is dissociated when its 5 g is added to 500 mL of water. The depression in freezing point of such water is $\times 10^{-3}{}^{\circ}\mathrm{C}$

Atomic mass of C, H and O are 12,1 and 16 a.m.u. respectively.
[Given : Molal depression constant and density of water are $1.86\ \mathrm{K\ kg\ mol^{-1}}$ and $1\ \mathrm{g\ cm^{-3}}$ respectively.

Numerical answer: _____

Enter the requested value or coefficient rounded to the nearest integer (0 decimal places).

Correct answer: 372

Source solution

The van t Hoff factor is $i = 1 + 0.20 = 1.2$. Molality is $(5/60)/0.5 = 1/6$ mol/kg. Thus $\Delta T_f = 1.2 \times 1.86/6 = 0.372$ degrees C, or 372×10^{-3} degrees C.

Question 179

A solution containing 10 g of an electrolyte $\mathbf{AB_2}$ in 100 g of water boils at $\mathbf{100.52^\circ C}$. The degree of ionization of the electrolyte ($\boldsymbol{\alpha}$) is $\quad\times\mathbf{10^{-1}}$.
(nearest integer)
[Given : Molar mass of $\mathbf{AB_2 = 200\ g\ mol^{-1}}$. $\mathbf{K_b}$ (molal boiling point elevation const. of water) $\mathbf{= 0.52\ K\ kg\ mol^{-1}}$, boiling point of water $\mathbf{= 100^\circ C}$;
$\mathbf{AB_2}$ ionises as $\mathbf{AB_2 \rightarrow\ A^{2+} + 2\,B^-}$]

Numerical answer: _____

Enter the requested value or coefficient rounded to the nearest integer (0 decimal places).

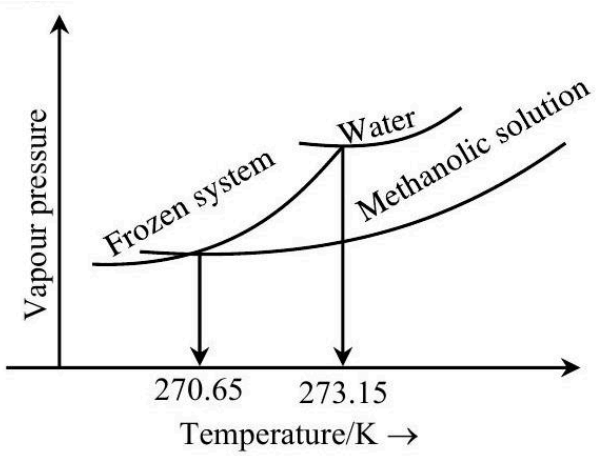
Correct answer: 5

Source solution

$\mathbf{AB_2 \rightarrow\ A^{+2} + 2\,B^{\ominus}}$
$\mathbf{i = 1 + (3 - 1)\alpha}$
$\mathbf{i = 1 + 2\alpha}$
$\mathbf{\Delta T_b = k_b i m}$
$\mathbf{0.52 = 0.52(1 + 2\alpha)\frac{\frac{10}{200}}{\frac{100}{1000}}}$
$\mathbf{1 = (1 + 2\alpha)\frac{10}{20}}$
$\mathbf{2 = 1 + 2\alpha}$
$\mathbf{\alpha = 0.5}$
Ans. $\boldsymbol{\alpha = 5 \times 10^{-1}}$

Question 180

When ' x ' $\times 10^{-2}$ mL methanol (molar mass $=32$ g; density $=0.792\ \mathrm{g/cm^3}$) is added to 100 mL water (density $=1\ \mathrm{g/cm^3}$), the following diagram is obtained.



$\mathrm{x} =$ ..... (nearest integer)

[Given: Molal freezing point depression constant of water at 273.15 K is $1.86\ \mathrm{K\ kg\ mol^{-1}}$]

Numerical answer: _____

Enter the requested value or coefficient rounded to the nearest integer (0 decimal places).

Correct answer: 543

Source solution

$$\Delta \mathrm{T_f} = 273.15 - 270.65 = 2.5\ \mathrm{K}$$

$\Delta \mathrm{T_f} = \mathrm{K_f m} \Rightarrow 2.5 = 1.86 \times \frac{\mathrm{n}}{0.1}$

$\Rightarrow \mathrm{n} = 0.1344$ moles

$\Rightarrow \mathrm{w} = 0.1344 \times 32 = 4.3\ \mathrm{g}$

Volume $= \frac{4.3}{0.792} = 5.43\mathrm{ml} = 543 \times 10^{-2}\mathrm{ml}$

Question 181

25 mL of an aqueous solution of KCl was found to require 20 mL of 1 M AgNO 3 solution when titrated using $\mathbf{K_2CrO_4}$ as an indicator. What is the depression in freezing point of KCl solutions of the given concentration? (Nearest integer).

(Given: $\mathbf{K_f = 2.0\ K\ kg\ mol^{-1}}$)

Assume 1) $\mathbf{100\%}$ ionization and

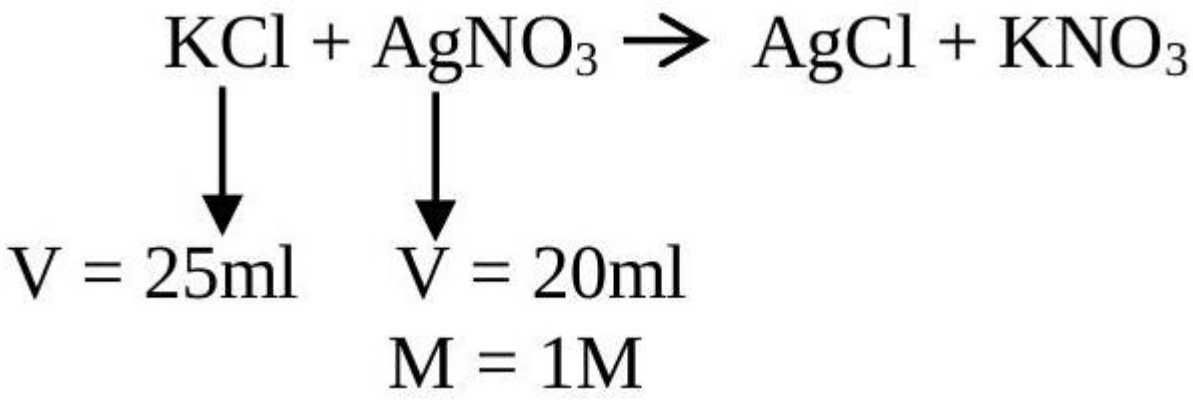
2) density of the aqueous solution as $\mathbf{1\ g\ mL^{-1}}$

Numerical answer: _____

Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 3

Source solution



At equivalence point,

Mmole of $\mathbf{KCl}$ = mmole of $\mathbf{AgNO_3} = \mathbf{20}$ mmole

Volume of solution $= \mathbf{25ml}$

Mass of solution $= \mathbf{25gm}$

Mass of solvent $= \mathbf{25}$ - mass of solute $= \mathbf{25 - \left[20 \times 10^{-3} \times 74.5\right] = 23.51gm}$

Molality of $\mathbf{KCl} = \frac{\text{mole of KCl}}{\text{mass of solvent in kg}}$

$= \frac{20\times10^{-3}}{23.51\times10^{-3}} = 0.85$

i of $\mathbf{KCl} = \mathbf{2}$ (100% ionisation)

$\mathbf{\Delta T_f = i \times K_f \times m}$

$\mathbf{= 2 \times 2 \times 0.85}$

$= 3.4$
$\simeq 3$

Question 182

Match List-I with List-II

List-I (Purification technique)		List-II (Mixture of organic compounds)	
(A)	Distillation (simple)	(I)	Diesel + Petrol
(B)	Fractional distillation	(II)	Aniline + Water
(C)	Distillation under reduced pressure	(III)	Chloroform + Aniline
(D)	Steam distillation	(IV)	Glycerol + Spent-lye

Choose the correct answer from the options given below :

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

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

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

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

Correct answer: D

Source solution

List-I (Purification technique)		List-II (Mixture of organic compounds)	
(A)	Distillation (simple)	(III)	Chloroform + Aniline
(B)	Fractional distillation	(I)	Diesel + Petrol
(C)	Distillation under reduced pressure	(IV)	Glycerol + Spent-lye
(D)	Steam distillation	(II)	Aniline + Water

Question 183

1.24 g of $\mathbf{AX_2}$ (molar mass $\mathbf{124\ g\ mol^{-1}}$) is dissolved in 1 kg of water to form a solution with boiling point of $\mathbf{100.0156^{\circ}C}$, while 25.4 g of $\mathbf{AY_2}$ (molar mass $\mathbf{250\ g\ mol^{-1}}$) in 2 kg of water constitutes a solution with a boiling point of $\mathbf{100.0260^{\circ}C}$.
$\mathbf{K_b\ (H_2O) = 0.52\ K\ kg\ mol^{-1}}$

Which of the following is correct ?

A. $\mathbf{AX_2}$ and $\mathbf{AY_2}$ (both) are completely unionised.

B. $\mathbf{AX_2}$ and $\mathbf{AY_2}$ (both) are fully ionised.

C. $\mathbf{AX_2}$ is completely unionised while $\mathbf{AY_2}$ is fully ionised.

D. $\mathbf{AX_2}$ is fully ionised while $\mathbf{AY_2}$ is completely unionised.

Correct answer: D

Source solution

Sol. For $\mathbf{AX_2}$:- $\mathbf{\Delta T_b = K_b \times m \times i}$
$\mathbf{0.0156 = 0.52 \times \frac{0.01}{1} \times i_{AX_2}}$
$\mathbf{\Rightarrow i_{AX_2} = 3 \Rightarrow}$ complete ionisation
For $\mathbf{AY_2 : -\Delta T_b = K_b \times m \times i}$
$\mathbf{0.026 = 0.52 \times 0.0508 \times i_{AY_2}}$
$\mathbf{\Rightarrow i_{AY_2} \simeq 1 \therefore}$ complete unionisation

Electrochemistry

Questions 184-185 / 2 selected / 0.7% practice weight / Consolidate

Question 184

Match List-I with List-II :

List-I Applications		List-II Batteries/Cell	
(A)	Transistors	(I)	Anode - Zn/Hg; Cathode - HgO + C
(B)	Hearing aids	(II)	Hydrogen fuel cell
(C)	Invertors	(III)	Anode - Zn; Cathode - Carbon
(D)	Apollo space ship	(IV)	Anode - Pb ; Cathode $-\mathbf{Pb} \mid \mathbf{PbO_2}$

Choose the correct answer from the options given below:

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

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

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

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

Correct answer: A

The source provides a brief answer only. A detailed worked solution is not available for this question.

Source solution

Question 185

Match List I with List II

LIST-I (Cell)		LIST-II (Use/Property/Reaction)	
A.	Leclanche cell	I.	Converts energy of combustion into electrical energy
B.	Ni-Cd cell	II.	Does not involve any ion in solution and is used in hearing aids
C.	Fuel cell	III.	Rechargeable
D.	Mercury cell	IV.	Reaction at anode $\mathbf{Zn \rightarrow Zn^{2+} + 2e^-}$

Choose the correct answer from the options given below:

A. A-I, B-II, C-III, D-IV

B. A-III, B-I, C-IV, D-II

C. A-IV, B-III, C-I, D-II

D. A-II, B-III, C-IV, D-I

Correct answer: C

Source solution

Sol. A-IV, B-III, C-I, D-II

Chemical Kinetics

Questions 186-187 / 2 selected / 0.7% practice weight / Consolidate

Question 186

The following data was obtained for chemical reaction given below at 975 K .

$$2NO_{(g)} + 2H_{2(g)} \rightarrow N_{2(g)} + 2H_2O_{(g)}$$

$[NO]$	$[H_2]$	Rate
$molL^{-1}$	$mol\ L^{-1}$	$mol\ L^{-1}\ s^{-1}$

(A) 8×10^{-5} 8×10^{-5} 7×10^{-9}
(B) 24×10^{-5} 8×10^{-5} 2.1×10^{-8}
(C) 24×10^{-5} 32×10^{-5} 8.4×10^{-8}

The order of the reaction with respect to NO is
. [Integer answer]

Numerical answer: _____

Enter the requested integer (0 decimal places).

Correct answer: 1

Source solution

$$7 \times 10^{-9} = K \times \left(8 \times 10^{-5}\right)^{x}\left(8 \times 10^{-5}\right)^{y}$$

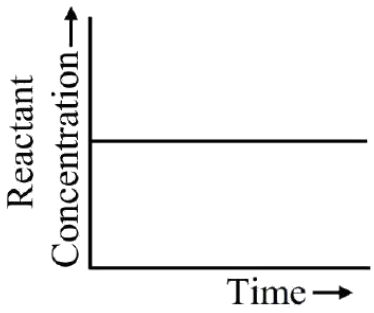
$$2.1 \times 10^{-8} = K \times \left(24 \times 10^{-5}\right)^{x}\left(8 \times 10^{-5}\right)^{y} \quad (1)$$

$$\frac{1}{3} = \left(\frac{1}{3}\right)^{x} \Rightarrow x = 1 \tag{2}$$

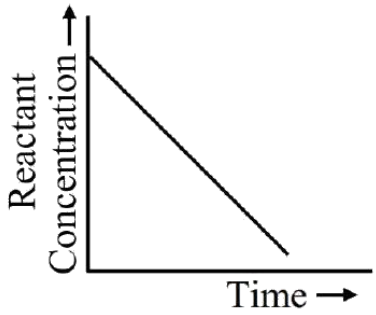
Question 187

Which of the following graphs most appropriately represents a zero order reaction?

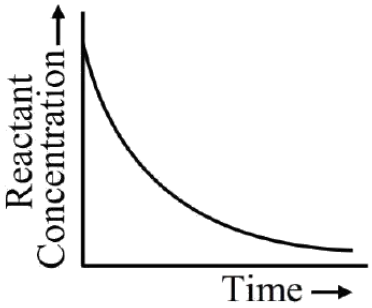
A.



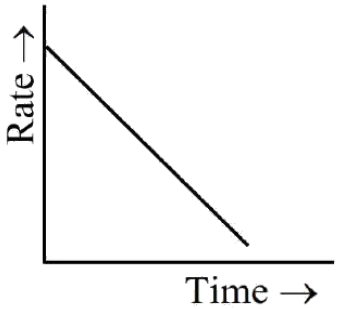
B.



C.



D.



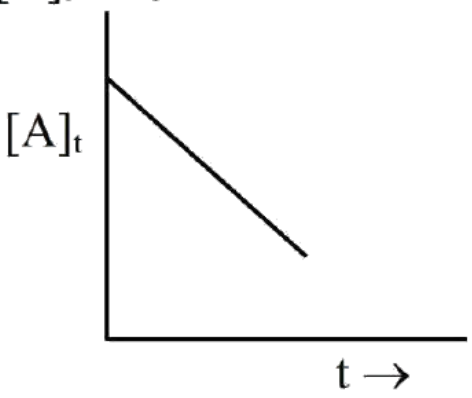
Correct answer: B

Source solution

Sol. For zero order reaction : $\mathbf{A} \rightarrow \mathbf{P}$

Rate $= \mathbf{k}$

$$[A]_t = a_0 - kt$$



The p-Block Elements

Questions 188-192 / 5 selected / 1.7% practice weight / Consolidate

Question 188

Choose the correct statements from the following A. All group 16 elements form oxides of general formula EO_2 and EO_3 where $E = S, Se, Te$ and Po. Both the types of oxides are acidic in nature.
B. TeO_2 is an oxidising agent while SO_2 is reducing in nature.
C. The reducing property decreases from H_2S to H_2Te down the group.
D. The ozone molecule contains five lone pairs of electrons.
Choose the correct answer from the options given below:

A. A and D only

B. B and C only

C. C and D only

D. A and B only

Correct answer: D

Source solution

The original worked solution identifies A and B as correct. The reducing property increases from hydrogen sulphide to hydrogen telluride down the group, so C is false. Ozone contains six lone pairs, so D is false.

Question 189

Match List-I with List-II, match the gas evolved during each reaction.

	List-I		List-II
(A)	$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta}$	(I)	H_2
(B)	$KMnO_4 + HCl \rightarrow$	(II)	N_2
(C)	$Al + NaOH + H_2O \rightarrow$	(III)	O_2
(D)	$NaNO_3 \xrightarrow{\Delta}$	(IV)	Cl_2

Choose the correct answer from the options given below:

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

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

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

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

Correct answer: C

Source solution

$$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2 + Cr_2O_3 + 4H_2O$$
$$KMnO_4 + HCl \rightarrow MnCl_2 + KCl + Cl_2 + H_2O$$
$$Al + NaOH + H_2O \rightarrow H_2 + Na\,[Al(OH)_4]$$
$$NaNO_3 \longrightarrow NaNO_2 + O_2$$

Question 190

Match List I with List II

	List I	List II
(A)	Slaked lime	(I) NaOH
(B)	Dead burnt plaster	(II) $Ca(OH)_2$
(C)	Caustic soda	(III) $Na_2CO_3 \cdot 10H_2O$
(D)	Washing soda	(IV) $CaSO_4$

Choose the correct answer from the options given below:

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

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

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

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

Correct answer: D

Source solution

Slaked Lime $\rightarrow Ca(OH)_2$
Dead burnt plaster $\rightarrow CaSO_4$
Caustic Soda $\rightarrow NaOH$
Washing Soda $\rightarrow Na_2CO_3.10H_2O$

Question 191

Match List I with List-II

List-I (Name of the test)		List-II (Reaction sequence involved) [M is metal]	
A	Borax bead test	I.	$MCO_3 \rightarrow MO \xrightarrow[+\Delta]{Co(NO_3)_2}$ CoO. MO
B.	Charcoal cavity test	II.	$MCO_3 \rightarrow MCl_2 \rightarrow M^{2+}$
C.	Cobalt nitrate test	III	$MSO_4 \xrightarrow[\Delta]{Na_2B_4O_7} M(BO_2)_2 \rightarrow MBO_2 \rightarrow M$
D.	Flame test	IV	$MSO_4 \xrightarrow[\Delta]{Na_2CO_3} MCO_3 \rightarrow MO \rightarrow M$

Choose the correct answer from the option below :

A. A-III, B-I, C-IV, D-II

B. A-III, B-II, C-IV, D-I

C. A-III, B-I, C-II, D-IV

D. A-III, B-IV, C-I, D-II

Correct answer: D

Source solution

Cobalt nitrate test

$MCO_3 \rightarrow MO \xrightarrow[+\Delta]{Co(NO_3)_2}$ CoO. MO

Flame test

$MCO_3 \rightarrow MCl_2 \rightarrow M^{2+}$

Borax Bead test

$MSO_4 \xrightarrow[\Delta]{Na_2B_4O_7} M(BO_2)_2 \rightarrow MBO_2 \rightarrow M$

Charcoal cavity test

$$\mathrm{MSO_4} \xrightarrow[\Delta]{\mathrm{Na_2CO_3}} \mathrm{MCO_3} \rightarrow \mathrm{MO} \rightarrow \mathrm{M}$$

Question 192

Match List I with List II

LIST I		LIST II	
A.	Nitrogen oxides in air	I.	Eutrophication
B.	Methane in air	II.	pH of rain water becomes 5.6.
C.	Carbon dioxide	III.	Global warming
D.	Phosphate fertilisers in water	IV.	Acid rain

Choose the correct answer from the options given below:

A. A-IV, B-III, C-II, D-I

B. A-II, B-III, C-I, D-IV

C. A-I, B-II, C-III, D-IV

D. A-IV, B-II, C-III, D-I

Correct answer: A

Source solution

:

i. $4NO_2(g) + O_2(g) + 2H_2O(\ell) \rightarrow 4HNO_3(aq)$
SO_2&NO_2 have major contribution in acid rain
ii. CO_2, CH_4, O_3, CFC are responsible for global warming
iii. $H_2O(\ell) + CO_2(g) \rightleftharpoons H_2CO_3$ (aq.)

$$H_2CO_3\ (aq.) \rightleftharpoons H^+(aq.) + HCO_3^-(aq.)$$

Rain water has pH of 5.6 due to the Presence of H^+ ions formed by the reaction of rain water with CO_2
iv. Phosphates present in fertilizers contribution for Eutrophication (Process in which nutrient enriched

water bodies support a dense plant population, which kills animal life by depriving it of oxygen and results in subsequent loss of biodiversity is known as Eutrophication.)

The d- and f-Block Elements

Question 193

Match List-I with List-II

\multirow{2}{*}{ List-I Complex }		List-II Primary valency and Secondary valency		
		(I)	3	6
(B)	$[Pt(NH_3)_2Cl(NO_2)]$	(II)	3	4
(C)	$Hg[Co(SCN)_4]$	(III)	2	6
(D)	$[Mg(EDTA)]^{2-}$	(IV)	2	4

Choose the correct answer from the options given below :

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

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

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

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

Correct answer: B

Source solution

Primary valency = Oxidation state Secondary valency = Co-ordination number

	Complex	Primary valency	Secondary
(A)	$[Co(\ en\ )_2Cl_2]Cl$	3	6
(B)	$[Pt(NH_3)_2Cl\,(NO_2)]$	2	4
(C)	$Hg\,[Co(SCN)_4]$	3	4
(D)	$[Mg(EDTA)]^{2-}$	2	6

Question 194

Number of complexes from the following with even number of unpaired " d " electrons is ..... .

$[V(H_2O)_6]^{3+}$, $[Cr(H_2O)_6]^{2+}$, $[Fe(H_2O)_6]^{3+}$, $[Ni(H_2O)_6]^{3+}$, $[Cu(H_2O)_6]^{2+}$

[Given atomic numbers : $V = 23, Cr = 24, Fe = 26, Ni = 28, Cu = 29$]

A. 2

B. 4

C. 5

D. 1

Correct answer: A

Source solution

Sol. $[V(H_2O)_6]^{3+} \rightarrow d^2sp^3$

$_{23}V : -[Ar]3d^3 4s^2$

$V^{+3} : -[Ar]3d^2, n = 2$ (even number of unpaired e^-)

$[Cr(H_2O)_6]^{2+} \rightarrow sp^3 d^2$

$_{24}Cr : -[Ar]3d^5 4s^1$

$Cr^{+2} : -[Ar]3d^4, n = 4$ (even number of unpaired e^-)

$[Fe(H_2O)_6]^{3+} \rightarrow sp^3 d^2$

$Fe^{3+} : -[Ar]3d^5 4s^0$

$n = 5$ (odd number of unpaired e^-)

$[Ni(H_2O)_6]^{3+} \rightarrow sp^3 d^2$

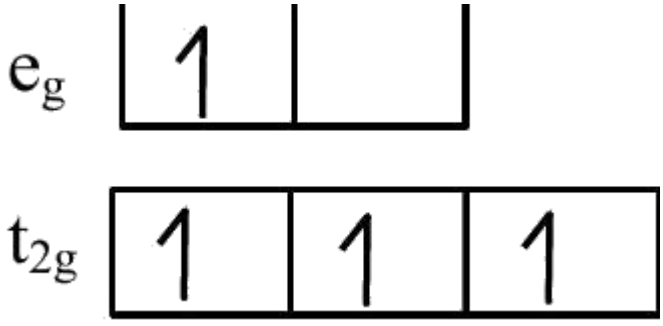
Ni :- $[Ar]3d^8 4s^2$

$Ni^{+3} : -[Ar]3d^7, n = 3$ (odd number of unpaired e^-)

$[Cu(H_2O)_6]^{2+} \rightarrow sp^3 d^2$

$Cu : -[Ar]3d^9 4s^0$

$n = 1$ (odd number of unpaired e^-)



Question 195

Number of complexes with even number of electrons in t_{2g} orbitals is -
$[Fe(H_2O)_6]^{2+}, [Co(H_2O)_6]^{2+}, [Co(H_2O)_6]^{3+},$
$[Cu(H_2O)_6]^{2+}, [Cr(H_2O)_6]^{2+}$

A. 1

B. 3

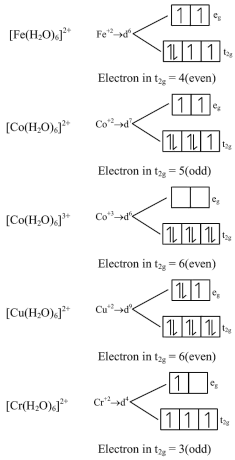
C. 2

D. 5

Correct answer: B

Source solution

Sol.



Question 196

Match List I with List II.

List I Complex		List II Colour	
A.	$Mg(NH_4)PO_4$	I.	Brown
B.	$K_3[Co(NO_2)_6]$	II.	White
C.	$MnO(OH)_2$	III.	Yellow
D.	$Fe_4[Fe(CN)_6]_3$	IV.	blue

Choose the correct answer from the options given below:

A. A-II, B-III, C-I, D-IV

B. A-III, B-IV, C-II, D-I

C. A-II, B-IV, C-I, D-III

D. A-II, B-III, C-IV, D-I

Correct answer: A

Source solution

Solution : $Mg(NH_4)PO_4 \Rightarrow$ White
$K_3[Co(NO_2)_6] \Rightarrow$ Yellow
$MnO(OH)_2 \Rightarrow$ Brown
$Fe_4[Fe(CN)_6]_3 \Rightarrow$ Blue

Question 197

Match items of List-I with those of List-II :

List-I}
(Property)
(a) Diamagnetism
(b) Ferrimagnetism
(c) Paramagnetism
(d) Antiferromagnetism
(i) MnO
(ii) O_2
(iii) NaCl
(iv) Fe_3O_4

List-II}
(Example)

Choose the most appropriate answer from the options given below :

A. (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)

B. (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)

C. (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)

D. (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

Correct answer: C

The source provides a brief answer only. A detailed worked solution is not available for this question.

Source solution

Question 198

Match List-I with List-II.

List-I
(Complex ion)
(A) $[Cr(NH_3)_6]^{3+}$
(B) $[NiCl_4]^{2-}$
(C) $[CoF_6]^{3-}$
(D) $[Ni(CN)_4]^{2-}$

List-II
(Spin only magnetic
moment in B.M.)
(I) 4.90
(II) 3.87
(III) 0.0
(IV) 2.83

Choose the correct answer from the options given below:

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

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

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

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

Correct answer: C

Source solution

Sol. (A) $[Cr(NH_3)_6]^{3+}$
$Cr^{3+} : 3\,d^3$
$n = 3$ (unpaired electrons)
$\mu \simeq 3.87$ B.M. (II)
(B) $[NiCl_4]^{2-}$
$Ni^{2+} : 3\,d^8$
$n = 2$
$\mu \simeq 2.83$ B.M. (IV)
(C) $[CoF_6]^{3-}$
$Co^{3+} : 3\,d^6$

$\mathbf{n = 4}$
$\boldsymbol{\mu \simeq 4.90}$ B.M. (I)
(D) $\mathbf{[Ni(CN)_4]^{2-}}$
$\mathbf{Ni^{2+} : 3\,d^8}$
$\mathbf{n = 0}$
$\boldsymbol{\mu = 0}$ B.M. (III)

SECTION-B}

Question 199

Match List-I with List-II.

List-I
(Transition metal ion) (Spin only magnetic moment (B.M.))
(A) Ti^{3+}
(I) 3.87
(B) V^{2+}
(II) 0.00
(C) Ni^{2+}
(III) 1.73
(D) Sc^{3+}
(IV) 2.84

Choose the correct answer from the options given below:

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

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

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

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

Correct answer: B

Source solution

Sol. $\mathrm{Sc}^{+3} = 3\,\mathrm{d}^{\circ}$
$\therefore \mu_{\text{spin}} = 0$
$\mathrm{V}^{+2} = 3\,\mathrm{d}^{3}$
$\therefore \mu_{\text{spin}} = 3.87$ B.M.
$\mathrm{Ni}^{+2} = 3\,\mathrm{d}^{8}$
$\therefore \mu_{\text{spin}} = 2.84$ B.M.
$\mathrm{Ti}^{+3} = 3\,\mathrm{d}^{1}$
$\therefore \mu_{\text{spin}} = 1.73$ B.M.

Question 200

Match List-I with List-II

List-I}
Species
(A) $\mathbf{Cr^{+2}}$
(B) $\mathbf{Mn^{+}}$
(C) $\mathbf{Ni^{+2}}$
(D) $\mathbf{V^{+}}$

List-II}
Electronic distribution}
(I) $\mathbf{3\,d^8}$
(II) $\mathbf{3\,d^3 4\,s^1}$
(III) $\mathbf{3\,d^4}$
(IV) $\mathbf{3d^5 4s^1}$

Choose the correct answer from the options given below:

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

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

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

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

Correct answer: B

Source solution

Sol. $_{24}\mathbf{Cr} \rightarrow \mathbf{[Ar]3\,d^5 4\,s^1; Cr^{2+} \rightarrow [Ar]3\,d^4}$
$_{25}\mathbf{Mn} \rightarrow \mathbf{[Ar]3\,d^5 4\,s^2; Mn^{+} \rightarrow [Ar]3\,d^5 4\,s^1}$
$_{28}\mathbf{Ni} \rightarrow \mathbf{[Ar]3\,d^8 4\,s^2; Ni^{2+} \rightarrow [Ar]3\,d^8}$
$_{23}\ \mathbf{V} \rightarrow \mathbf{[Ar]3\,d^3 4\,s^2; V^{+} \rightarrow [Ar]3\,d^3 4\,s^1}$

Coordination Compounds

Question 201

Match list I with List II

\multirow{2}{*}{LIST I Coordination entity}		\multirow{2}{*}{ LIST II Wavelength of light absorbed in nm }	
A.	$[CoCl(NH_3)_5]^{2+}$	I.	310
B.	$[Co(NH_3)_6]^{3+}$	II.	475
C.	$[Co(CN)_6]^{3-}$	III.	535
D.	$[Cu(H_2O)_4]^{2+}$	IV.	600

Choose the correct answer from the options given below:

A. A-III, B-I, C-II, D-IV

B. A-IV, B-I, C-III, D-II

C. A-III, B-II, C-I, D-IV

D. A-II, B-III, C-IV, D-I

Correct answer: C

Source solution

$\Delta_o \uparrow \lambda \downarrow$

$$(\text{splitting energy } = \frac{hc}{\lambda_{abs}})$$

Question 202

Identify the homoleptic complexes with odd number of d electrons in the central metal.
(A) $[FeO_4]^{2-}$
(B) $[Fe(CN)_6]^{3-}$
(C) $[Fe(CN)_5NO]^{2-}$
(D) $[CoCl_4]^{2-}$
(E) $[Co(H_2O)_3\ F_3]$

Choose the correct answer from the options given below :

A. (B) and (D) only

B. (C) and (E) only

C. (A), (B) and (D) only

D. (A), (C) and (E) only

Correct answer: A

Source solution

$$\textbf{(A)}\ [FeO_4]^{2-}$$

$$Fe^{6+} : d^2 \Rightarrow \text{even}$$

$$\textbf{(B)}\ [Fe(CN)_6]^{3-}$$

$$Fe^{3+} : d^5 \Rightarrow \text{odd}$$

$$\textbf{(C)}\ [Fe(CN)_5NO]^{2-}$$

$$NO \text{ acts as } NO\hat{}+ \text{ (strong field ligand)}$$

$$\mathrm{Fe}^{2+} : d^6 \Rightarrow \text{even}$$

(D) $[\mathrm{CoCl_4}]^{2-}$

$$\mathrm{Co}^{2+} : d^7 \Rightarrow \text{odd}$$

(E) $[\mathrm{Co(H_2O)_3F_3}]$

$$\mathrm{Co}^{3+} : d^6 \Rightarrow \text{even}$$

Final Answer:

$$\boxed{(B), (D)}$$

Question 203

Complex A has a composition of $H_{12}O_6Cl_3Cr$. If the complex on treatment with conc. H_2SO_4 loses 13.5% of its original mass, the correct molecular formula of A is:
[Given: atomic mass of $Cr = 52$ amu and $Cl = 35$ amu]

A. $[Cr(H_2O)_5Cl]Cl_2 \cdot H_2O$

B. $[Cr(H_2O)_4Cl_2]Cl \cdot 2H_2O$

C. $[Cr(H_2O)_3Cl_3] \cdot 3H_2O$

D. $[Cr(H_2O)_6]Cl_3$

Correct answer: B

Source solution

Let x molecules of water be lost. Then

$$13.5 = \left[\frac{x \times 18}{6 \times 18 + 3 \times 35 + 52}\right] \times 100$$

$$x = 1.99 \approx 2$$

$$\therefore \text{ The complex is } [Cr(H_2O)_4Cl_2] \cdot 2H_2O.$$

Question 204

	List-I (Complex)		List-II (Primary, Secondary Valency)
A	$[Co(NH_3)_6]Cl_3$	I	3, 6
B	$[Pt(NH_3)_2Cl(NO_2)]$	II	3, 4
C	$Hg[Co(SCN)_4]$	III	2, 6
D	$[Mg(EDTA)]^{2-}$	IV	2, 4

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

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

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

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

Correct answer: B

Source solution

$$\text{Primary valency} = \text{Oxidation state}$$

$$\text{Secondary valency} = \text{Coordination number}$$

$$\text{A. } [Co(en)_2Cl_2]Cl$$

$$\text{Primary valency} = 3, \qquad \text{Secondary valency} = 6$$

$$A \rightarrow \text{I}$$

$$\text{B. } [Pt(NH_3)_2Cl(NO_2)]$$

$$\text{Primary valency} = 2, \qquad \text{Secondary valency} = 4$$

$$B \rightarrow \text{IV}$$

$$\text{C. } \mathrm{Hg}\left[\mathrm{Co(SCN)_4}\right]$$

$$\text{Primary valency} = 3, \qquad \text{Secondary valency} = 4$$

$$C \rightarrow \text{II}$$

$$\text{D. } \mathrm{[Mg(EDTA)]^{2-}}$$

$$\text{Primary valency} = 2, \qquad \text{Secondary valency} = 6$$

$$D \rightarrow \text{III}$$

$$\boxed{A - \text{I},\ B - \text{IV},\ C - \text{II},\ D - \text{III}}$$

Question 205

Match the LIST-I with LIST-II

LIST-I (Complex/Species)		LIST-II (Shape & magnetic moment)	
A.	$[Ni(CO)_4]$	I.	Tetrahedral, 2.8 BM
B.	$[Ni(CN)_4]^{2-}$	II.	Square planar, 0 BM
C.	$[NiCl_4]^{2-}$	III.	Tetrahedral, 0 BM
D.	$[MnBr_4]^{2-}$	IV	Tetrahedral, 5.9 BM

Choose the correct answer from the options given below :

A. A-III, B-IV, C-II, D-I

B. A-I, B-II, C-III, D-IV

C. A-III, B-II, C-I, D-IV

D. A-IV, B-I, C-III, D-II

Correct answer: C

Source solution

$$\textbf{A. } [Ni(CO)_4]$$

Ni is in 0 oxidation state: $3d^8 4s^2 \rightarrow d^{10}$ (after bonding picture), CO is strong field → tetrahedral, diamagnetic

$$\boxed{A \rightarrow III}$$

\vspace{0.3cm}

B. $[Ni(CN)_4]^{2-}$

Ni^{2+} = $3d^8$, CN^- strong field → square planar, all paired

$$\boxed{B \to II}$$

\vspace{0.3cm}

C. $[NiCl_4]^{2-}$

Cl^- weak field → tetrahedral, 2 unpaired electrons

$$\mu \approx 2.8 \text{ BM}$$

$$\boxed{C \to I}$$

\vspace{0.3cm}

D. $[MnBr_4]^{2-}$

Mn^{2+} = $3d^5$, tetrahedral high spin → 5 unpaired electrons

$$\mu \approx 5.9 \text{ BM}$$

$$\boxed{D \to IV}$$

\vspace{0.4cm}

$$\boxed{A \to III, \quad B \to II, \quad C \to I, \quad D \to IV}$$

Question 206

The correct order of spin only magnetic moments for the following complex ions is

A. $[Fe(CN)_6]^{3-} < [CoF_6]^{3-} < [MnBr_4]^{2-} < [Mn(CN)_6]^{3-}$

B. $[Fe(CN)_6]^{3-} < [Mn(CN)_6]^{3-} < [CoF_6]^{3-} < [MnBr_4]^{2-}$

C. $[MnBr_4]^{2-} < [CoF_6]^{3-} < [Fe(CN)_6]^{3-} < [Mn(CN)_6]^{3-}$

D. $[CoF_6]^{3-} < [MnBr_4]^{2-} < [Fe(CN)_6]^{3-} < [Mn(CN)_6]^{3-}$

Correct answer: B

Source solution

$$\text{For } [Fe(CN)_6]^{3-}$$

$$Fe^{3+} : 3d^5$$

CN^- is a strong field ligand.

$$t_{2g}^5 e_g^0$$

Number of unpaired electrons $= 1$.

$$\mu = \sqrt{1(1+2)} = \sqrt{3}$$

$$\text{For } [Mn(CN)_6]^{3-}$$

$$Mn^{3+} : 3d^4$$

$\mathbf{CN^-}$ is a strong field ligand.

$$t_{2g}^4 e_g^0$$

Number of unpaired electrons $= \mathbf{2}$.

$$\mu = \sqrt{2(2+2)} = \sqrt{8}$$

$$\mathbf{For\ [CoF_6]^{3-}}$$

$$\mathbf{Co^{3+} : 3d^6}$$

$\mathbf{F^-}$ is a weak field ligand.

$$t_{2g}^4 e_g^2$$

Number of unpaired electrons $= \mathbf{4}$.

$$\mu = \sqrt{4(4+2)} = \sqrt{24}$$

$$\mathbf{For\ [MnBr_4]^{2-}}$$

$$\mathbf{Mn^{2+} : 3d^5}$$

Tetrahedral complex with weak field ligand $\mathbf{Br^-}$.

$$e^2t_2^3$$

Number of unpaired electrons $= 5$.

$$\mu = \sqrt{5(5+2)} = \sqrt{35}$$

Therefore,

$$\sqrt{3} < \sqrt{8} < \sqrt{24} < \sqrt{35}$$

$$\boxed{[Fe(CN)_6]^{3-} < [Mn(CN)_6]^{3-} < [CoF_6]^{3-} < [MnBr_4]^{2-}}$$

Question 207

Match List I with List II

LIST-I

(Substances)
A.Ziegler catalyst
B.Blood Pigment
C.Wilkinson catalyst
D.Vitamin $\mathbf{B_{12}}$

LIST-II

(Element Present)
I.Rhodium
II. Cobalt
III.Iron
IV.Titanium

Choose the correct answer from the options given below:

A. A-II, B-IV, C-I, D-III

B. A-II, B-III, C-IV, D-I

C. A-III, B-II, C-IV, D-I

D. A-IV, B-III, C-I, D-II

Correct answer: D

Source solution

Ziegler catalyst $\rightarrow$ Titanium
Blood pigment $\rightarrow$ Iron
Wilkinson catalyst $\rightarrow$ Rhodium
Vitamin $\mathbf{B_{12}} \rightarrow$ Cobalt

TEST PAPER WITH SOLUTION

Question 208

Consider the following complex ions

$\mathbf{P} = [\mathrm{FeF_6}]^{3-}$

$\mathbf{Q} = [\mathrm{V(H_2O)_6}]^{2+}$

$\mathbf{R} = [\mathrm{Fe(H_2O)_6}]^{2+}$

The correct order of the complex ions, according to their spin only magnetic moment values (in B.M.) is :

A. R < Q < P

B. $\mathbf{R < P < Q}$

C. $\mathbf{Q < R < P}$

D. $\mathbf{Q < P < R}$

Correct answer: C

Source solution

Solution: Spin-only magnetic moment

$$\mu = \sqrt{n(n+2)}\ \text{BM} \quad (\text{where } n = \text{number of unpaired electrons})$$

$$\mathbf{(A)}\ [\mathrm{FeF_6}]^{3-}$$

$$\mathrm{Fe}^{3+} : [Ar]\, 3d^5$$

$$F^- \text{ is a weak field ligand } \Rightarrow \text{high spin}$$

$$n = 5 \Rightarrow \mu = \sqrt{5(5+2)} = \sqrt{35}\ \text{BM}$$

(B) $[\mathrm{V}(\mathrm{H_2O})_6]^{2+}$

$$\mathrm{V}^{2+} : [Ar]\, 3d^3$$

$$n = 3 \Rightarrow \mu = \sqrt{3(3+2)} = \sqrt{15}\ \mathrm{BM}$$

(C) $[\mathrm{Fe}(\mathrm{H_2O})_6]^{2+}$

$$\mathrm{Fe}^{2+} : [Ar]\, 3d^6$$

$$H_2O \text{ is weak field ligand } \Rightarrow \text{high spin}$$

$$n = 4 \Rightarrow \mu = \sqrt{4(4+2)} = \sqrt{24}\ \mathrm{BM}$$

Final results:

$$[\mathrm{FeF_6}]^{3-} : \sqrt{35}\ \mathrm{BM}, \quad [\mathrm{V}(\mathrm{H_2O})_6]^{2+} : \sqrt{15}\ \mathrm{BM}, \quad [\mathrm{Fe}(\mathrm{H_2O})_6]^{2+} : \sqrt{24}\ \mathrm{BM}$$

Question 209

Given below are two statements :

Statement I : $[Mn(CN)_6]^{3-}$, $[Fe(CN)_6]^{3-}$ and $[Co(C_2O_4)_3]^{3-}$ are d^2sp^3 hybridised.
Statement II : $[MnCl_6]^{3-}$ and $[FeF_6]^{3-}$ are paramagnetic and have 4 and 5 unpaired electrons, respectively.
In the light of the above statements, choose the correct answer from the options given below :

A. Statement I is correct but statement II is false

B. Both statement I and statement II are false

C. Statement I is incorrect but statement II is true

D. Both statement I and statement II are are true

Correct answer: D

Source solution

$$[Mn(CN)_6]^{3-},\ [Fe(CN)_6]^{3-},\ [Co(C_2O_4)_3]^{3-}$$

Oxidation states:

$$Mn^{3+} : d^4, \quad Fe^{3+} : d^5, \quad Co^{3+} : d^6$$

CN^- and C_2O_4^{2-} are strong field ligands $\Rightarrow$ low spin octahedral complexes

$$\Rightarrow d^2sp^3 \text{ hybridisation for all three complexes}$$

$$\therefore \text{Statement I is TRUE}$$

Statement II:

$$[MnCl_6]^{3-} \Rightarrow Mn^{3+} : d^4$$

Cl^- is weak field ligand $\Rightarrow$ high spin $\Rightarrow$ 4 unpaired electrons

$$[FeF_6]^{3-} \Rightarrow Fe^{3+} : d^5$$

F^- is weak field ligand $\Rightarrow$ high spin $\Rightarrow$ 5 unpaired electrons

$\therefore$ Statement II is TRUE

Both Statement I and Statement II are correct

Question 210

LIST-I	Complex	LIST-II	Hybridisation
A	$K_2[Ni(CN)_4]$	I	sp^3
B	$[Ni(CO)_4]$	II	sp^3d^2
C	$[Co(NH_3)_6]Cl_3$	III	dsp^2
D	$Na_3[CoF_6]$	IV	d^2sp^3

Choose the correct answer from the options given below:

A. A-III, B-I, C-II, D-IV

B. A-III, B-II, C-IV, D-I

C. A-I, B-III, C-II, D-IV

D. A-III, B-I, C-IV, D-II

Correct answer: D

Source solution

$$\textbf{(A)}\ K_2[Ni(CN)_4]$$

$$Ni^{2+} : [Ar]\ 3d^8$$

CN^- is a strong field ligand → pairing occurs

$$3d \text{ electrons pair up}$$

$$\text{Hybridisation: } dsp^2$$

$$\text{Geometry: Square planar}$$

\vspace{0.4cm}

(B) $[Ni(CO)_4]$

Ni : $[Ar]\,3d^8 4s^2$

CO is a strong field ligand → pairing occurs

Pre-hybridisation: $3d^{10}$

Hybridisation: sp^3

Geometry: Tetrahedral

\vspace{0.4cm}

(C) $[Co(NH_3)_6]Cl_3$

Co^{3+} : $[Ar]\,3d^6$

NH_3 acts as a strong field ligand with Co^{3+} → low spin complex

$t_{2g}^6 e_g^0$

Hybridisation: d^2sp^3

Geometry: Octahedral (inner orbital complex)

\vspace{0.4cm}

(D) $\mathrm{Na_3[CoF_6]}$

$$\mathrm{Co^{3+}} : [Ar]\, 3d^6$$

F^- is a weak field ligand → no pairing

$$t_{2g}^4 e_g^2$$

Hybridisation: sp^3d^2

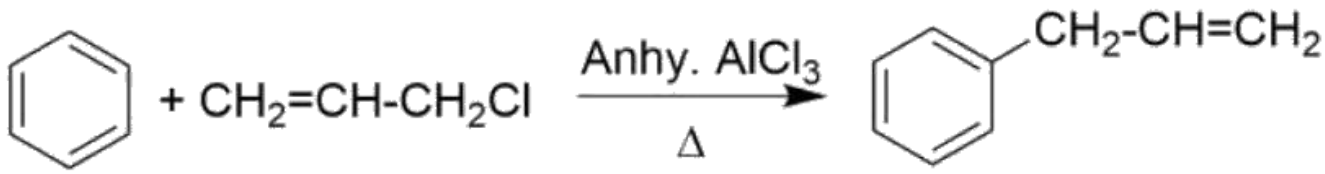
Geometry: Octahedral (outer orbital complex)

Haloalkanes and Haloarenes

Questions 211-226 / 16 selected / 5.3% practice weight / Focus first

Question 211

Which of the following reactions are possible?



A. A, B, C

B. **B, D**

C. A, C, D

D. **A, C**

Correct answer: B

Source solution

Sol:}
In aryl halides, due to the partial double bond character generated by chlorine, the aryl cation is not formed.

Vinyl halides do not give Friedel-Crafts reaction, because the intermediate that is generated (vinyl cation) is not stable.

$H_2C=\overset{+}{C}H$

vinyl

cation

Question 212

With respect to the following reaction, consider the given statements:

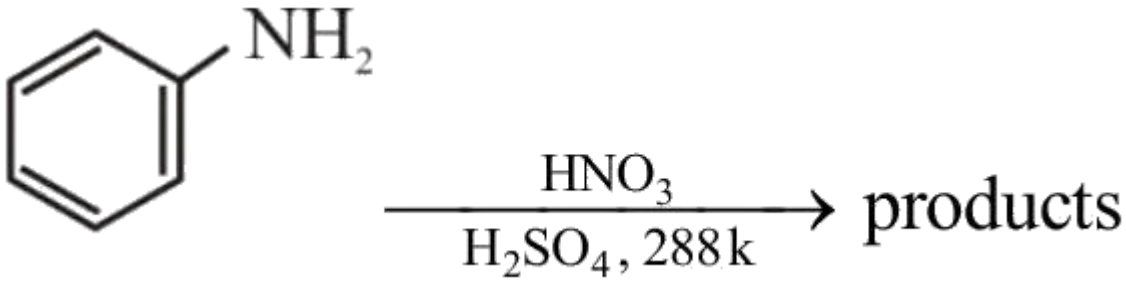
$$C_6H_5NH_2 \xrightarrow[288\ K]{HNO_3/H_2SO_4} \text{products}$$

(A) o-Nitroaniline and p-nitroaniline are the predominant products.

(B) p-Nitroaniline and m-nitroaniline are the predominant products.

(C) HNO_3 acts as an acid.

(D) H_2SO_4 acts as an acid.



A. (A) and (C) are correct statements.

B. (A) and (D) are correct statements.

C. (B) and (D) are correct statements.

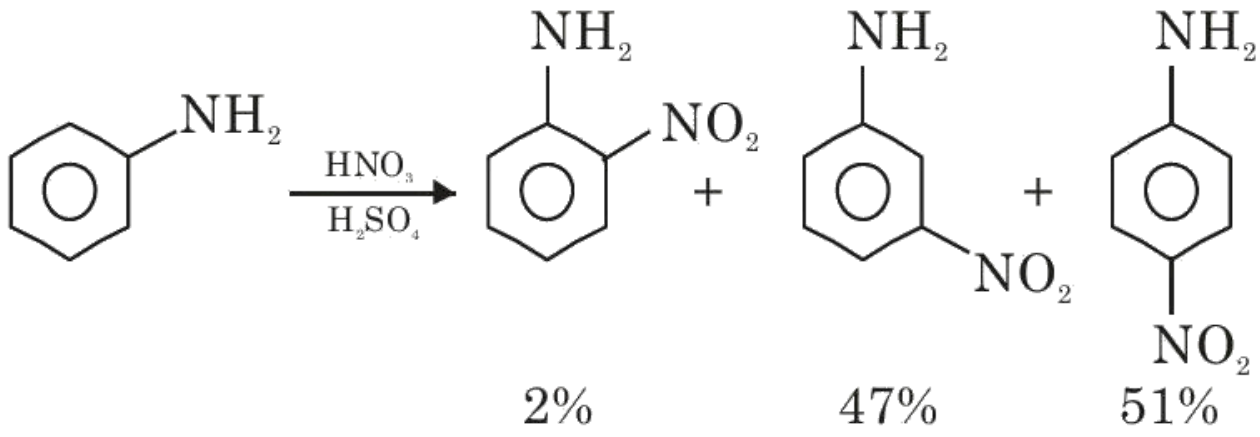
D. (B) and (D) are correct statements.

Correct answer: C

Source solution

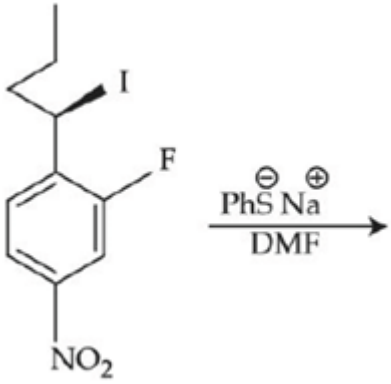
Sol.

$$\underset{\text{Base}}{HNO_3} + \underset{\text{Acid}}{H_2SO_4} \rightarrow NO_2^+$$

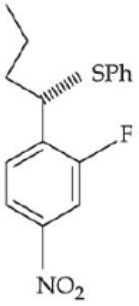

NH2
HNO3
H2SO4
NH2
NO2
+
NH2
+
NO2
NH2
NO2
2%
47%
51%

Question 213

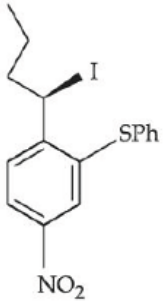
The major product of the following reaction is:



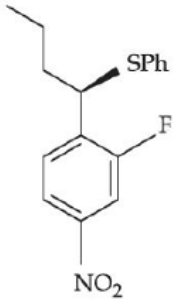
A.



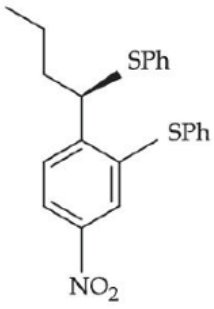
B.



C.



D.

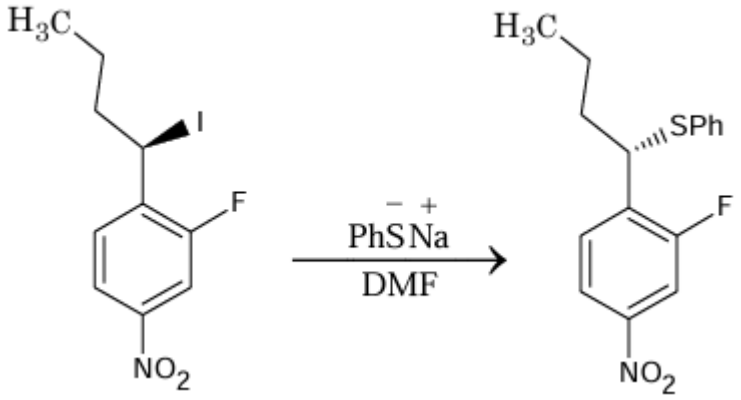


Correct answer: A

Source solution

Sol.

It is bimolecular nucleophilic substitution (SN^2) which occur at benzylic carbon by inversion in contiguration. This reaction cannot undergo substitution at benzene ring

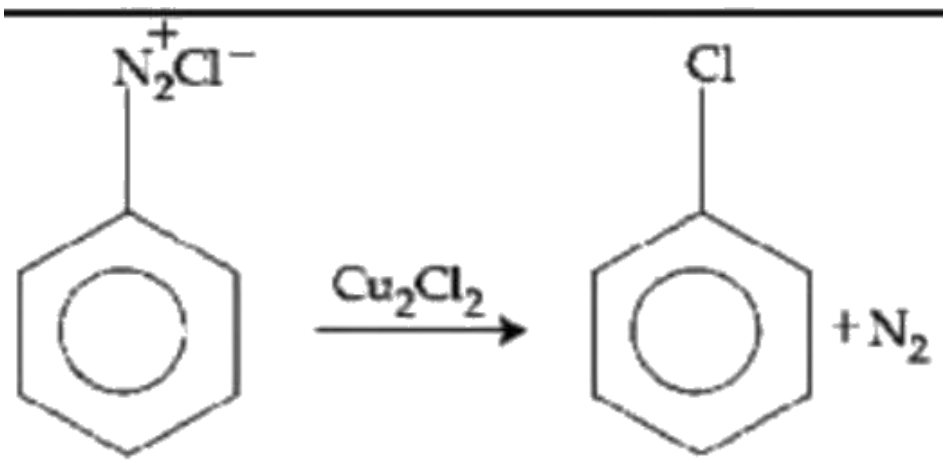

H3C
I
F
NO2
− +
PhSNa
DMF
H3C
SPh
F
NO2

Question 214

Match List I with List II

LIST I			LIST II	
		I.	Fittig reaction	
	II.	Wurtz Fittig reaction		
	III.	Finkelstein reaction		
D.	$C_2H_5Cl + NaI \rightarrow C_2H_5I + NaCl$		IV.	Sandmeyer reaction

Choose the correct answer from the options given below:



A. A - II, B - I, C - IV, D - III

B. A - IV, B - II, C - III, D - I

C. A - III, B - II, C - IV, D - I

D. A - II, B - I, C - III, D - IV

Correct answer: A

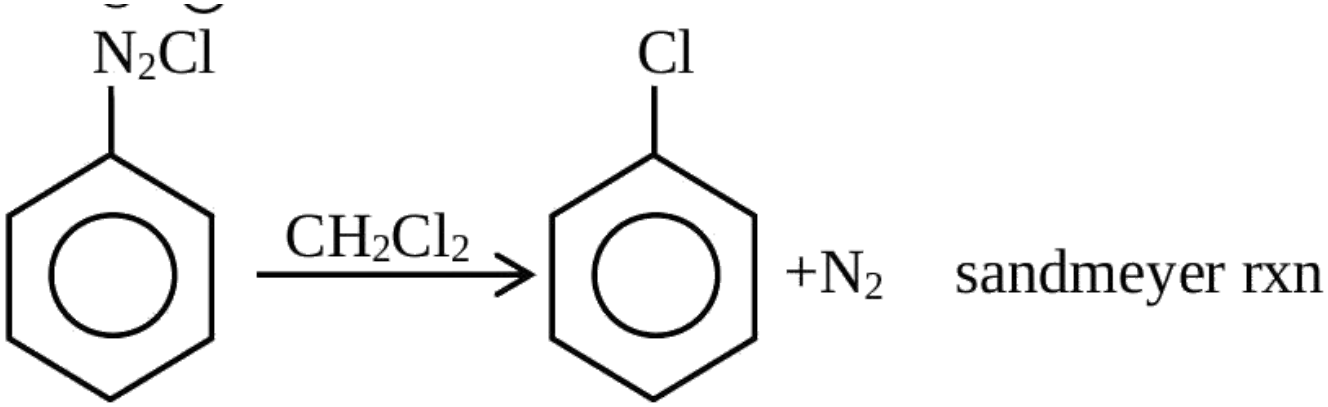
Source solution

Sol. 1
(A)

(B)

(C)

(D) $C_2H_5Cl + NaI \rightarrow C_2H_5I + NaCl$ Finkelstein rxn

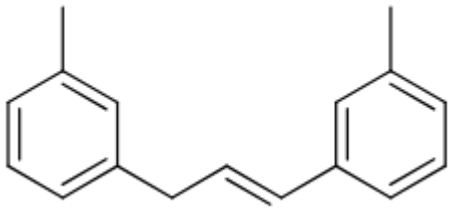


Question 215

Match List-I with List-II

List-I Conversion		List-II Reagents, Conditions used
	(III)	(a) $\mathbf{NaOH, 443\ K}$; (b) $\mathbf{H_3O^+}$
(a) $\mathbf{NaOH, 623\ K}$, 300 atm ; (b) $\mathbf{H_3O}$		

Choose the correct answer from the options given below :



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

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

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

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

Correct answer: C

Source solution

Sol. Aromatic halide give nucleophilic substitution reaction at high temperature or in presence of $-\mathbf{I}/-$ M group rate of reaction high even at low temperature.

A-IV

B-III

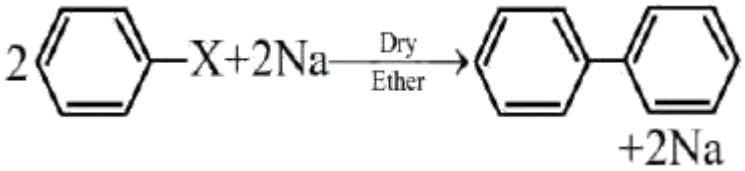
C-II
D-I

Question 216

Match List-I with List-II

List-I (Reaction)		List-II (Name of reaction)	
	(I)	Lucas reaction	
(B)	$ArN_2^+X^- \xrightarrow[HCl]{Cu} ArCl + N_2 \uparrow + CuX$	(II)	Finkelstein reaction
(C)	$C_2H_5Br + NaI \xrightarrow[Acctonc]{Dry} C_2H_5I + NaBr$	(III)	Fittig reaction
(D)	$CH_3C(OH)(CH_3)CH_3 \xrightarrow[ZnCl_2]{HCl} CH_3C(Cl)(CH_3)CH_3$	(IV)	Gatterman reaction

Choose the correct answer from the options given below:



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

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

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

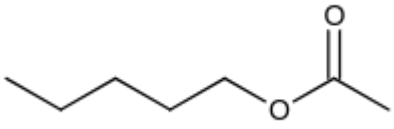
D. (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

Correct answer: B

Source solution

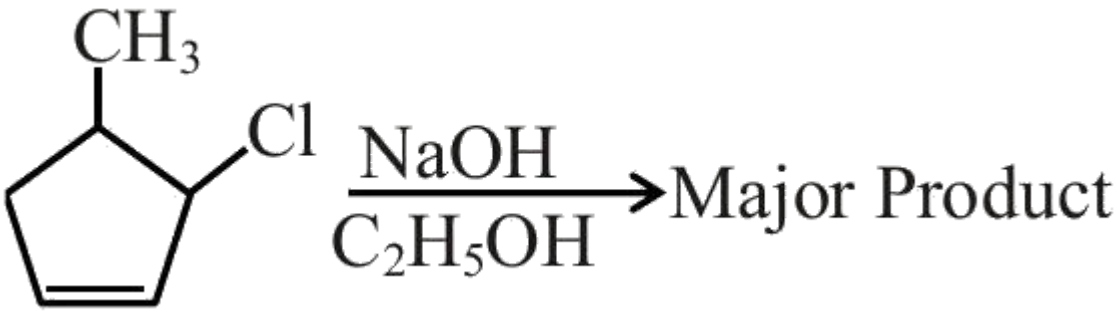
Sol.

List-I (Reaction)		List-II (Name of reaction)	
(B)	$\mathrm{ArN_2^+X^-} \xrightarrow[\mathrm{HCl}]{\mathrm{Cu}} \mathrm{ArCl} + \mathrm{N_2} \uparrow + \mathrm{CuX}$	(IV)	Gatterman reaction
(C)	$\mathrm{C_2H_5Br} + \mathrm{NaI} \xrightarrow[\mathrm{Acctone}]{\mathrm{Dry}} \mathrm{C_2H_5I} + \mathrm{NaBr}$	(II)	Finkelstein reaction

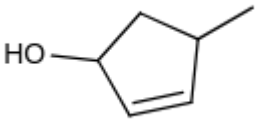


Question 217

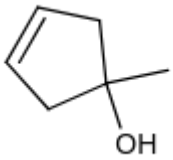
The major product of the following reaction is :



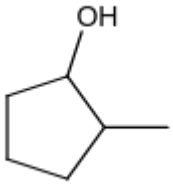
A.



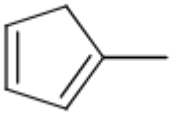
B.



C.



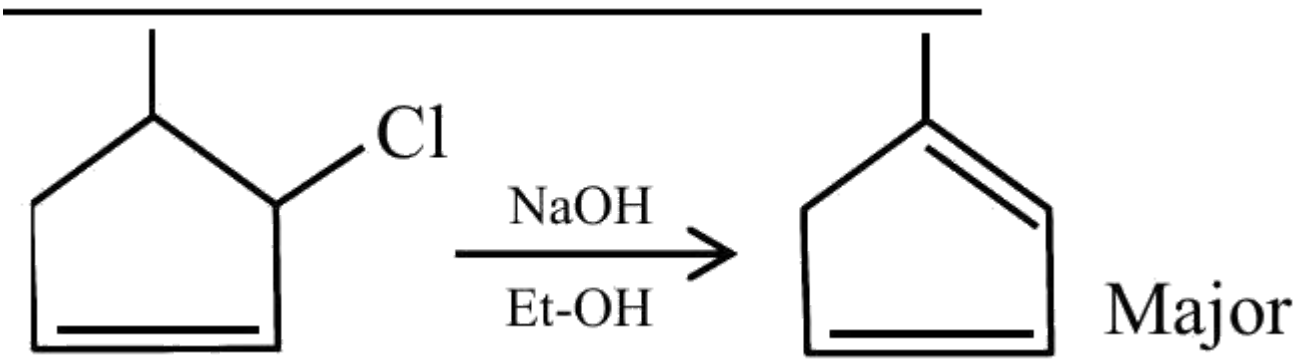
D.



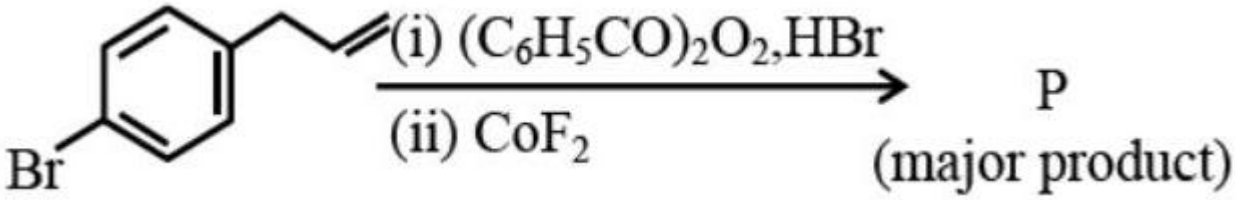
Correct answer: C

Source solution

Sol. $\mathbf{NaOH + EtOH}$ is known as alcoholic NaOH , so it give $\mathbf{E^2}$ reaction with given alkyl halide.

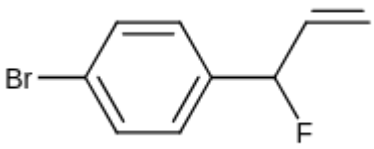


Question 218

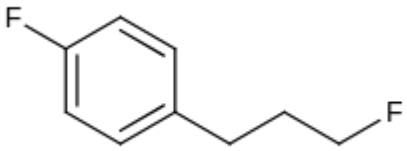


Major product P of above reaction is:

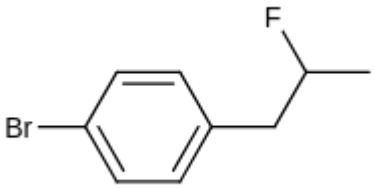
A.



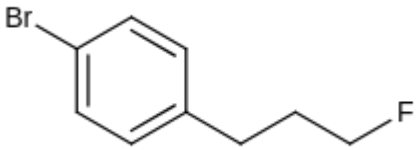
B.



C.

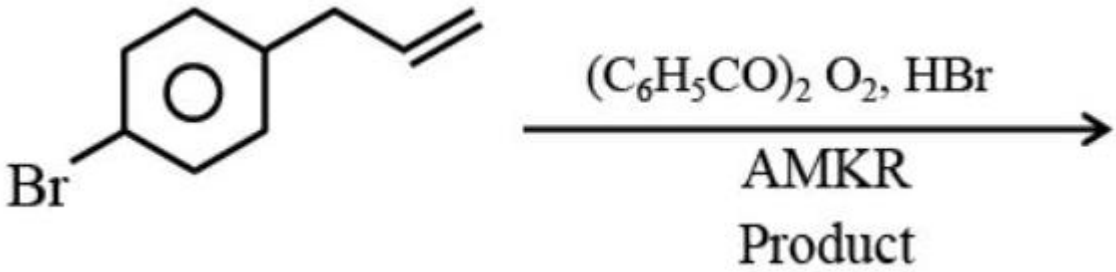


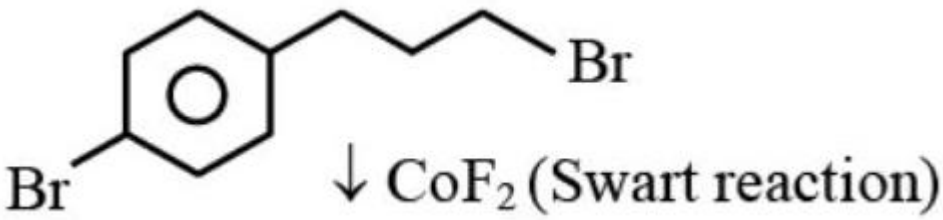
D.

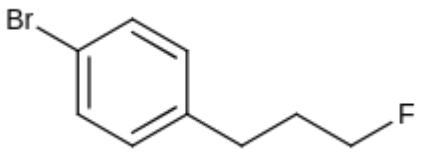


Correct answer: D

Source solution







Question 219

The products A and B in the following reactions, respectively are

$$A \xrightarrow{Ag-NO_2} CH_3-CH_2-CH_2-Br \xrightarrow{AgCN} B$$

A. $CH_3-CH_2-CH_2-ONO, CH_3-CH_2-CH_2-NC$

B. $CH_3-CH_2-CH_2-ONO, CH_3-CH_2-CH_2-CN$

C. $CH_3-CH_2-CH_2-NO_2, CH_3-CH_2-CH_2-CN$

D. $CH_3-CH_2-CH_2-NO_2, CH_3-CH_2-CH_2-NC$

Correct answer: D

Source solution

Sol.

(A)

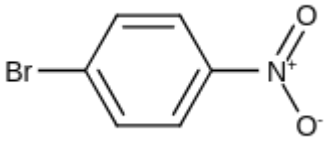
(B)

$$\xrightarrow{AgCN} CH_3-CH_2-CH_2-NC$$

Question 220

Identify the correct order of reactivity for the following pairs towards the respective mechanism
(A)
(B)
(C) Electrophilic substitution
(D) Nucleophilic substitution

Choose the correct answer from the options given below:



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

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

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

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

Correct answer: B

Source solution

Sol.}
All are correct
(A) S_N2 reaction decreases with increase in steric crowding.
(B) S_N1 reaction increases with stability of carbocation.
(C) EAS reaction decreases with decrease in electron density.
(D) Presence of electron withdrawing group at ortho and para-position to a halogen in haloarene increase nucleophilic aryl substitution.

SECTION-B}

Question 221

The correct order of reactivity of following haloarenes towards nucleophilic substitution with aqueous NaoH is :

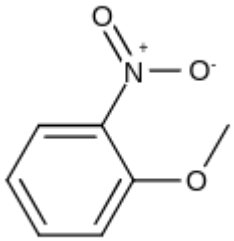
A.

B.

C.

D.

Choose the correct answer from the options given below:



A. $A > B > D > C$

B. $C > A > D > B$

C. $\mathbf{D > C > B > A}$

D. $\mathbf{D > B > A > C}$

Correct answer: D

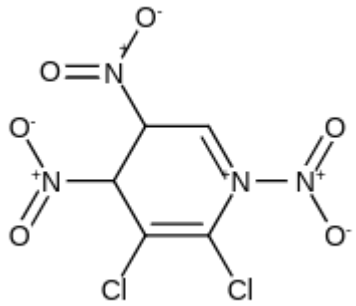
Source solution

Sol.

$\mathbf{D > B > A > C}$

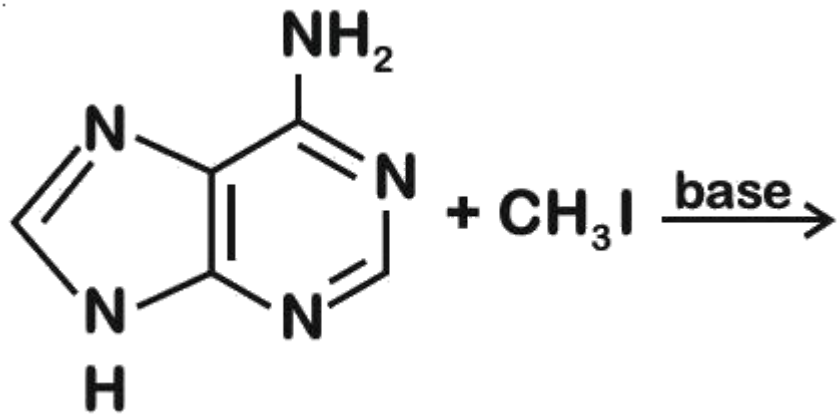
Option (4) is correct.

(- M) group increases reactivity where as (+M) group decreases reactivity of Halobenzene towards Nucleophilic substitution reaction.

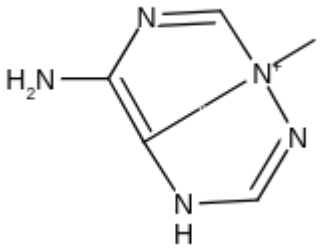


Question 222

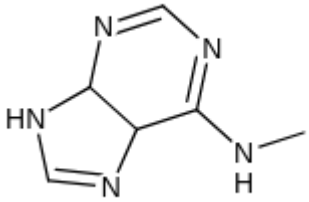
The major product in the following reaction is:



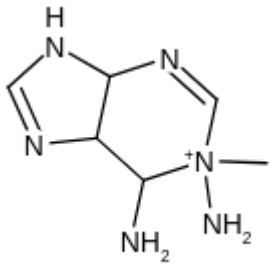
A.



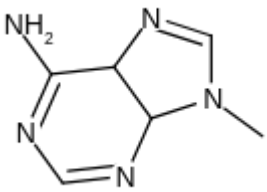
B.



C.



D.

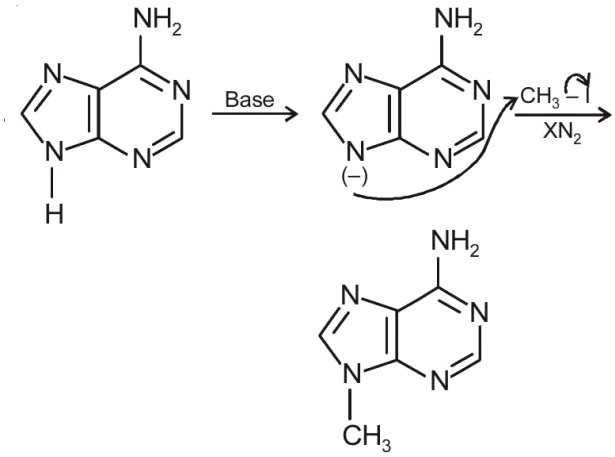


Correct answer: D

Source solution

Sol.

In the given compound, H -atom attached to secondary N -atom is more acidic. The base removes the more acidic H -atom and the conjugate base of the given compound attacks at CH_3 group to give the final product shown above.


NH2
N
N
N
N
H
Base
NH2
N
N
N
N
(–)
CH3 – Cl
XN2
NH2
N
N
N
N
CH3

Question 223

Match the LIST-I with LIST-II

LIST-I Name reaction		LIST-II Product obtainable	
A.	Swarts reaction	I.	Ethyl benzene
B.	Sandmeyer's reaction	II.	Ethyl iodide
C.	Wurtz Fittig reaction	III.	Cyanobenzene
D.	Finkelstein reaction	IV.	Ethyl fluoride

Choose the correct answer from the options given below:

A. A-II, B-III, C-I, D-IV

B. A-IV, B-I, C-III, D-II

C. A-IV, B-III, C-I, D-II

D. A-II, B-I, C-III, D-IV

Correct answer: C

Source solution

Sol. (3)

LIST-I Name reaction		LIST-II Product obtainable	
A.	Swarts reaction	I.	Et-I $\xrightarrow[\text{DMF}]{\text{KF}}$ Et-F
B.	Sandmeyer's reaction	II.	$\text{PhN}_2^{\oplus}\text{Cl}^- \xrightarrow{\text{CuCN/KCN}} \text{PhCN} + \text{N}_2$
C.	Wurtz Fittig reaction	III.	$\text{Ph} - \text{Cl} + \text{EtCl} \xrightarrow[\text{ether}]{\text{Na}}$ $\text{Ph} - \text{Et} + \text{Ph} - \text{Ph} + \text{Et} - \text{Et}$
D.	Finkelstein reaction	IV.	$\text{Et} - \text{Cl} \xrightarrow[\text{acetone}]{\text{NaI}} \text{Et} - \text{I} + \text{NaCl}$

Question 224

Match List I with List II

List I Name of reaction		List II Reagent used	
A	Hell-VolhardZelinsky reaction	I.	$NaOH + I_2$
B	Iodoform reaction	II.	(i) CrO_2Cl_2, CS_2 (ii) H_2O
C	Etard reaction	III.	(i) $Br_2/$ red phosphorus (ii) H_2O
D	Gatterman-Koch reaction	IV.	CO, HCl, anhyd. $A1C1_3$

Choose the correct answer from the options given below:

A. A-III, B-II, C-I, D-IV

B. A-III, B-I, C-IV, D-II

C. A-I, B-II, C-III, D-IV

D. A-III, B-I, C-II, D-IV

Correct answer: D

Source solution

Sol. HVZ reactions $= Br_2/$ red P
Iodoform reaction $= NaOH + I_2$
Etard reaction $=$ (i) CrO_2Cl_2, CS_2 (ii) H_2O
Gatterman-Koch Reaction = CO, HCl, Anhydrous, $AlCl_3$

Question 225

Match List I with List II

List I	List II
A.	I. Br_2 in CS_2
B.	II. $Na_2Cr_2O_7/H_2SO_4$
C.	III. Zn
D.	IV. $CHCl_3/NaOH$

Choose the correct answer from the options given below:

A. A-IV, B-III, C-II, D-I

B. A-IV, B-III, C-I, D-II

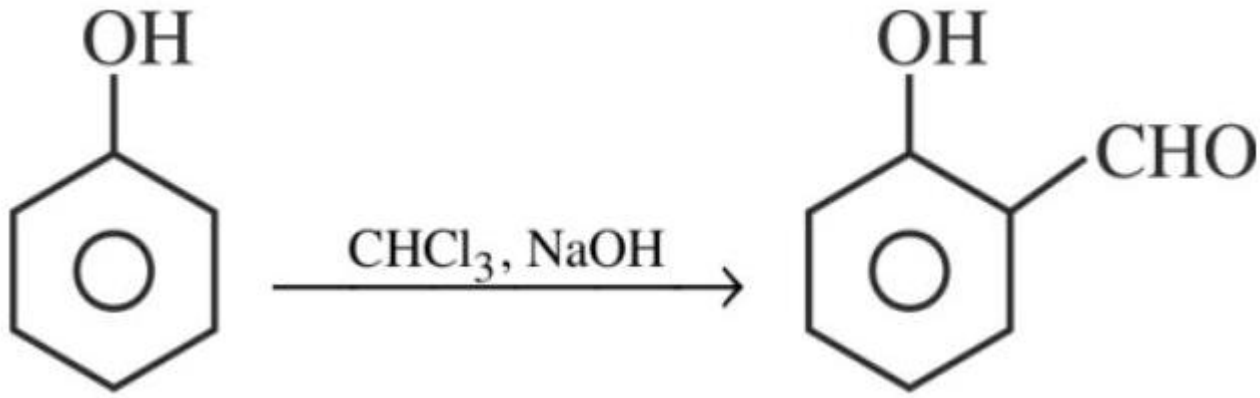
C. A-II, B-III, C-I, D-IV

D. A-IV, B-II, C-III, D-I

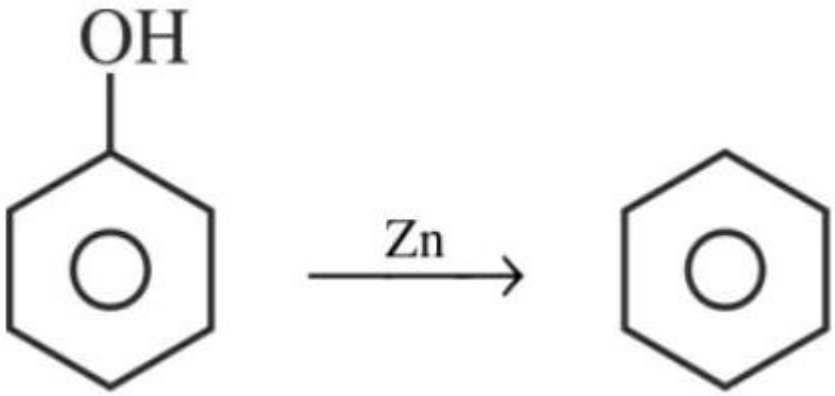
Correct answer: A

Source solution

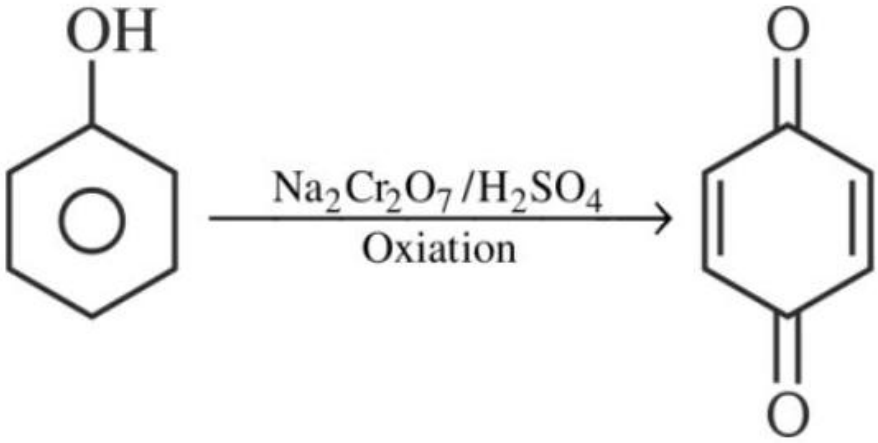
(A)



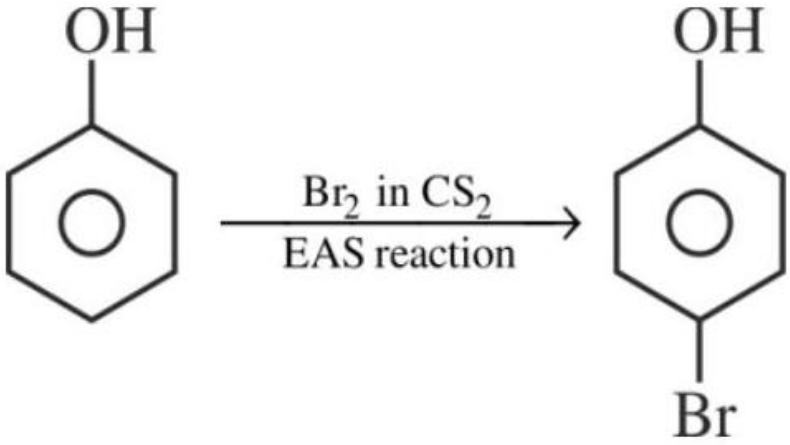
(B)


OH
Zn

(C)


OH
$Na_2Cr_2O_7/H_2SO_4$
Oxiation
O
O

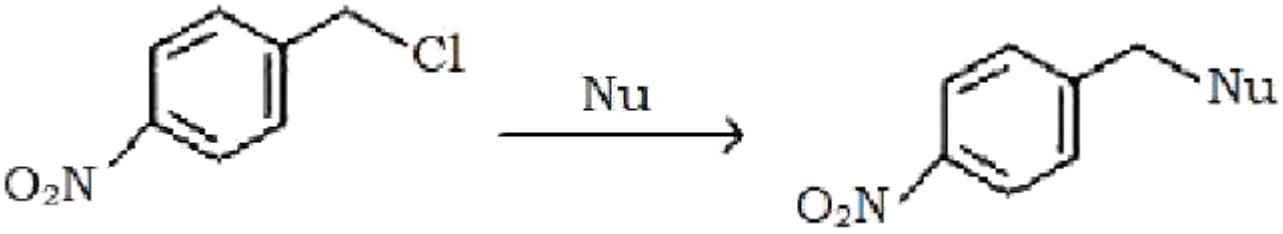
(D)


OH
Br_2 in CS_2
EAS reaction
OH
Br

Question 226

-(II)

Where $\mathbf{Nu} =$ Nucleophile
Find out the correct statement from the options given below for the above 2 reactions.



A. Reaction (I) is of $\mathbf{2^{nd}}$ order and reaction (II) is of $\mathbf{1^{st}}$ order

B. Reaction (I) and (II) both are of $\mathbf{2^{nd}}$ order

C. Reaction (I) is of $\mathbf{1^{st}}$ order and reaction (II) is of $\mathbf{2^{nd}}$ order

D. Reactions (I) and (II) both are of $\mathbf{1^{st}}$ order

---

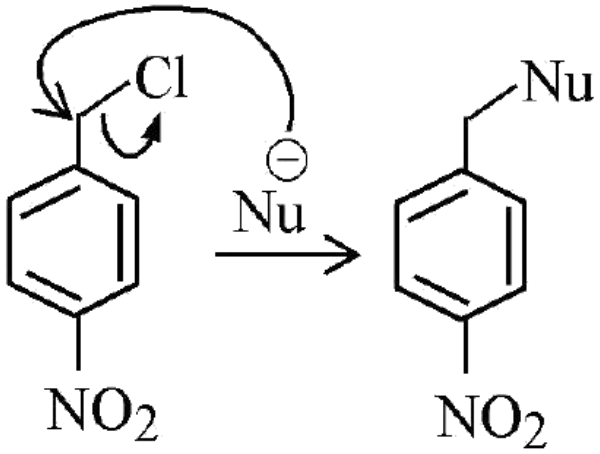
Correct answer: C

Source solution

Sol.

Electron Donating group
$\mathbf{S_N1}$ Mech. : $\mathbf{I^{st}}$ order

Electron withdrawing group
$\mathbf{S_N2}$ Mech : $\mathbf{2^{nd}}$ order


Cl
Nu
Nu
NO2
NO2

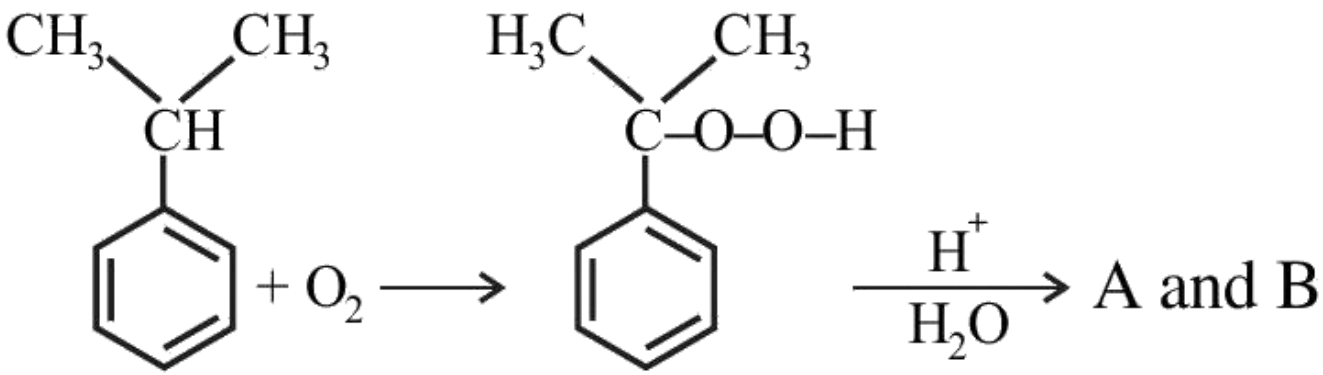
Alcohols, Phenols and Ethers

Questions 227-258 / 32 selected / 10.7% practice weight / Focus first

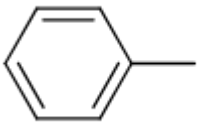
Question 227

In the following reaction:

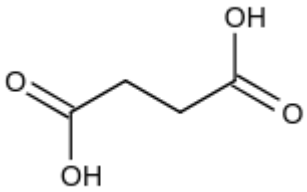
The compounds A and B respectively are :-



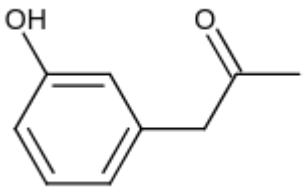
A.



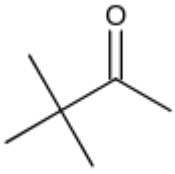
B.



C.



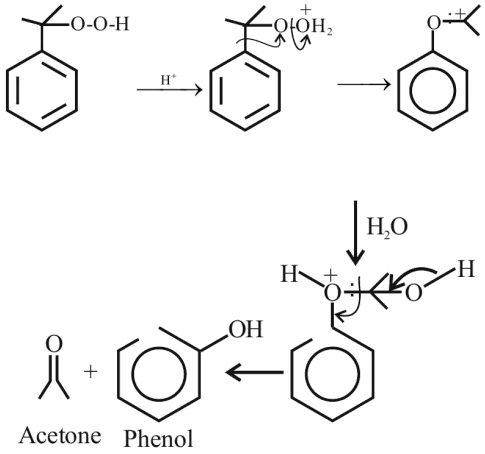
D.



Correct answer: C

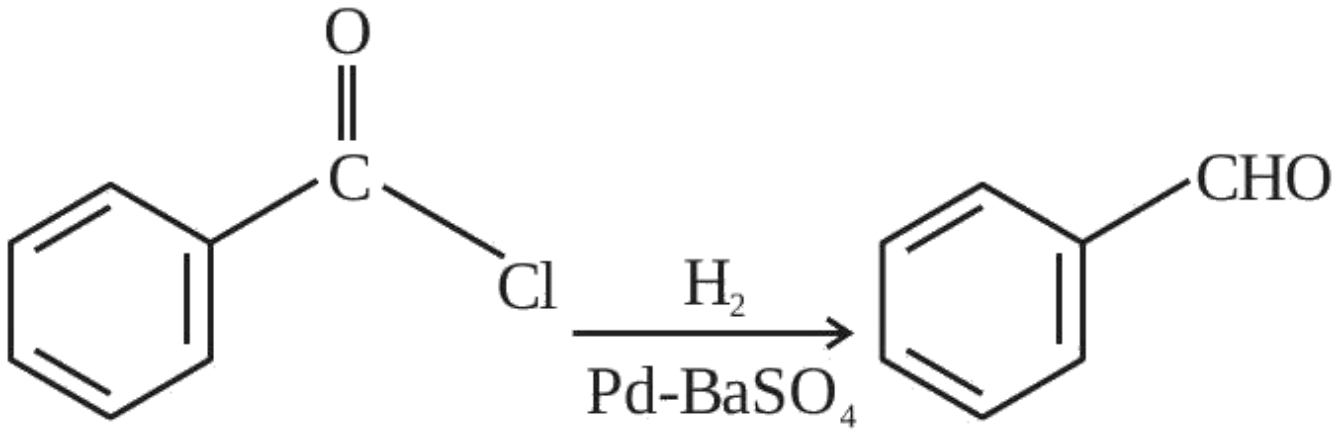
Source solution

Sol. Given reaction is cumene-Peroxide method for the preparation of phenol. In this reaction


O-O-H
H+
OH2
H2O
H
O
H
OH
O
+
Acetone
Phenol

Question 228

This reduction reaction is known as:



A. Rosenmund reduction

B. Wolff-Kishner reduction

C. Stephen reduction

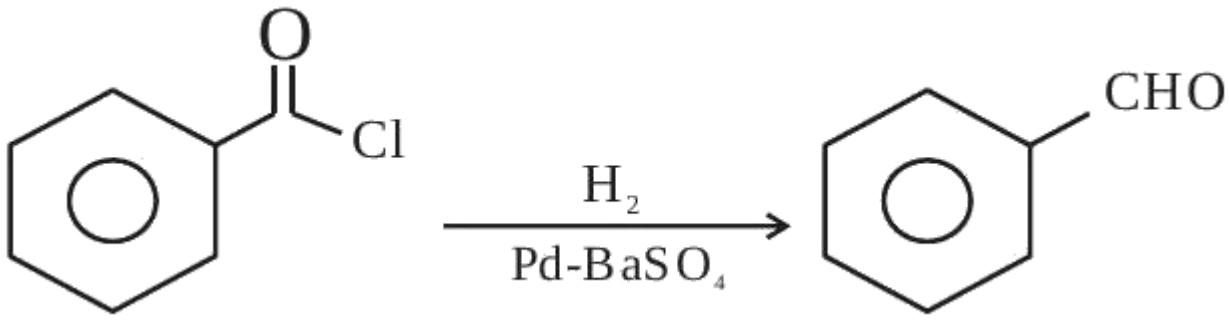
D. Etard reduction

Correct answer: A

Source solution

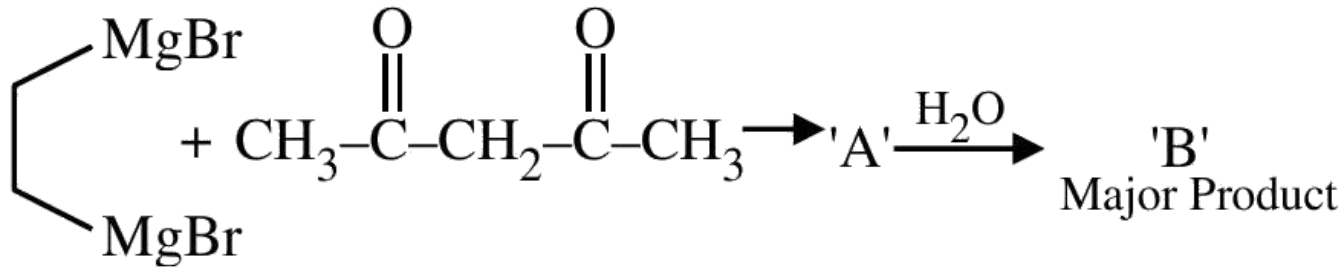
Sol.

It is known as rosenmund reduction that is the partial reduction of acid chloride to aldehyde

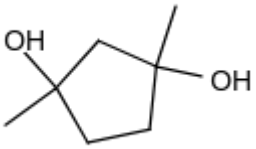


Question 229

Consider the above reaction sequence and identify the product B.



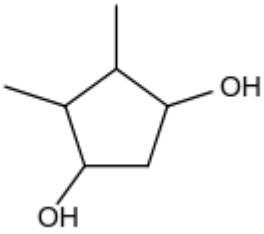
A.



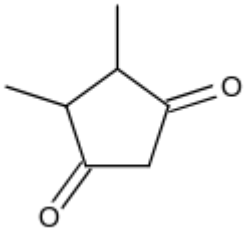
B.



C.



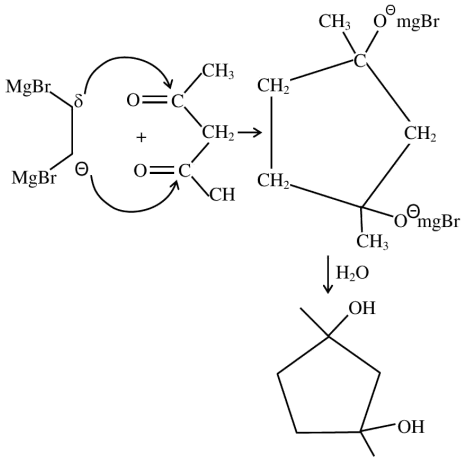
D.



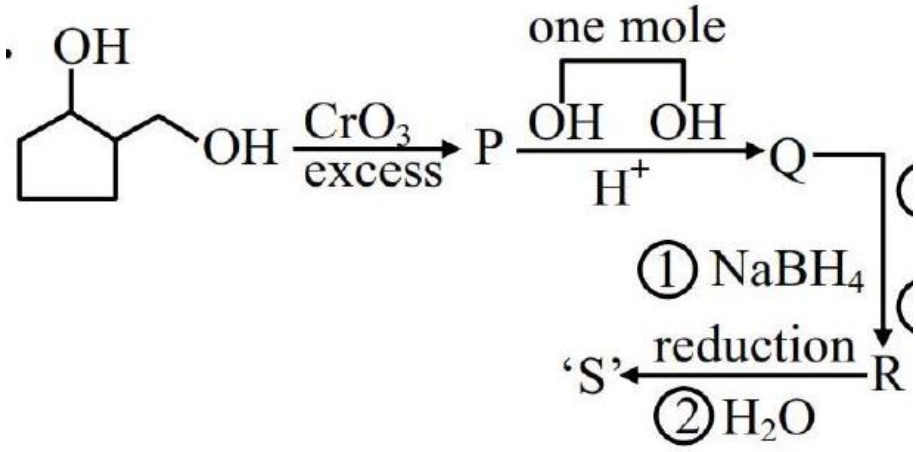
Correct answer: A

Source solution

Sol. Although Acetyl Acetone predominantly gives Acid base reaction with G.R due to Active methylene group but according to given option ans should be based on nucleophilic addition reaction (NAR).


MgBr
δ
MgBr
Θ
O
C
CH3
CH2
+
O
C
CH
CH3
O Θ mgBr
C
CH2
CH2
CH2
O Θ mgBr
CH3
H2O
OH
OH

Question 230



(1) CH_3Mg I in ether

(2) $H_3O^{(+)}$

0.1 mole of compound ' S ' will weigh g.

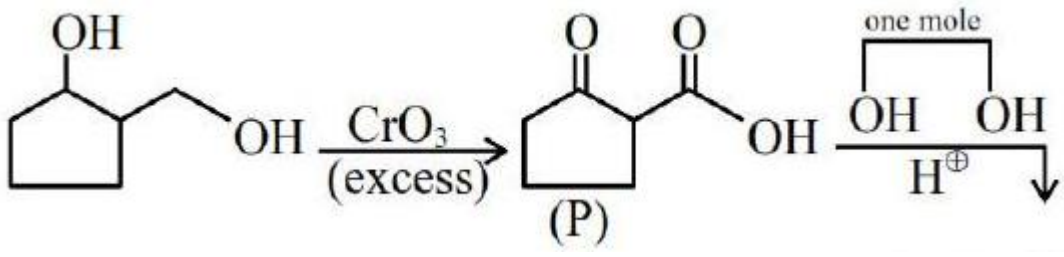
(Given molar mass in $gmol^{-1}$ $C : 12, H : 1, O : 16$)

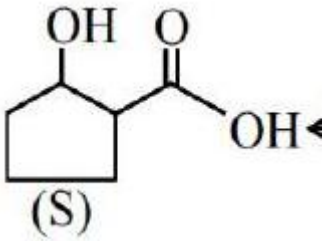
Numerical answer: _____

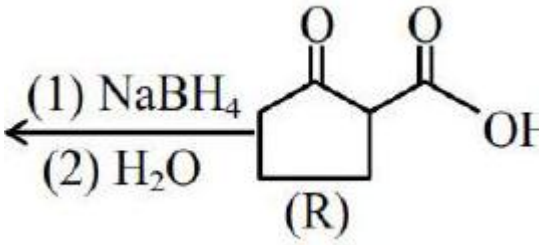
Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 13

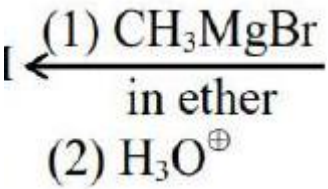
Source solution

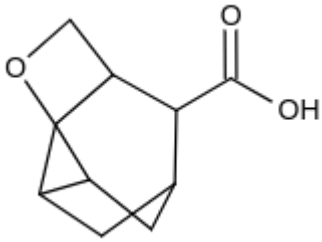






(R)





(2) $\mathbf{H_3O^{\oplus}}$

$\mathbf{CH_4}$

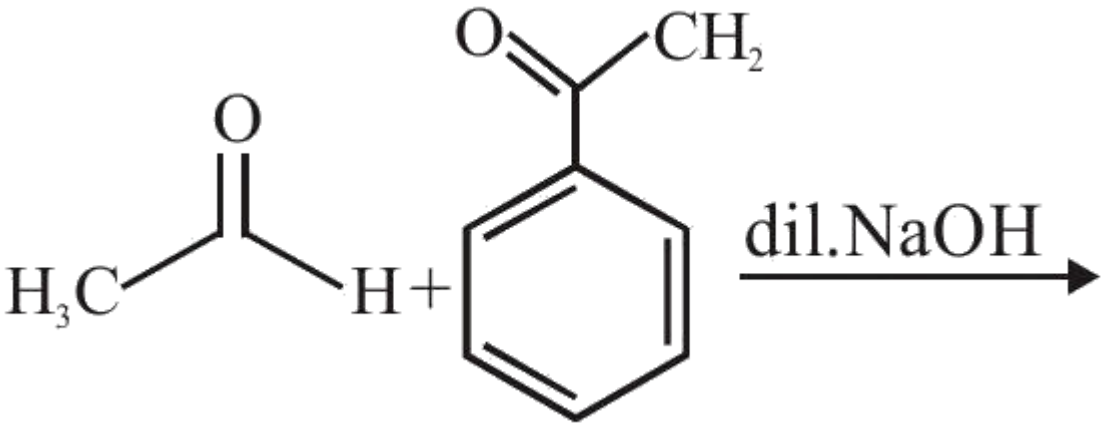
0.1 mole of compound (S) weight in gm

$= \mathbf{0.1}\times$ molar mass of compound $\mathbf{(S)}$

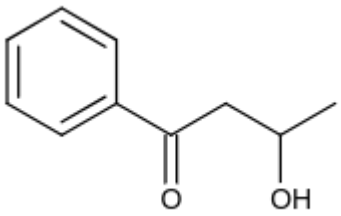
$= \mathbf{0.1 \times 130 = 13gm}$

Question 231

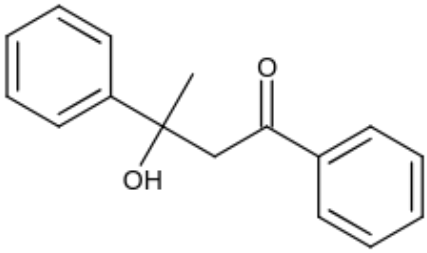
The major product formed in the following reaction is:



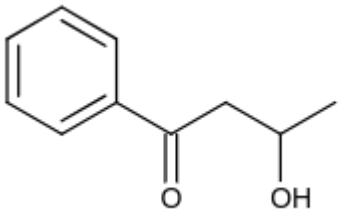
A.



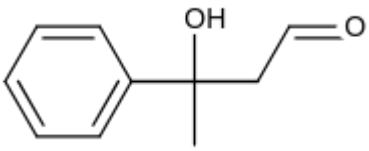
B.



C.



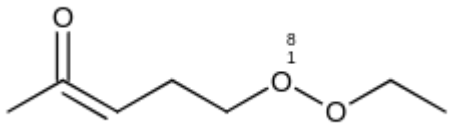
D.



Correct answer: A

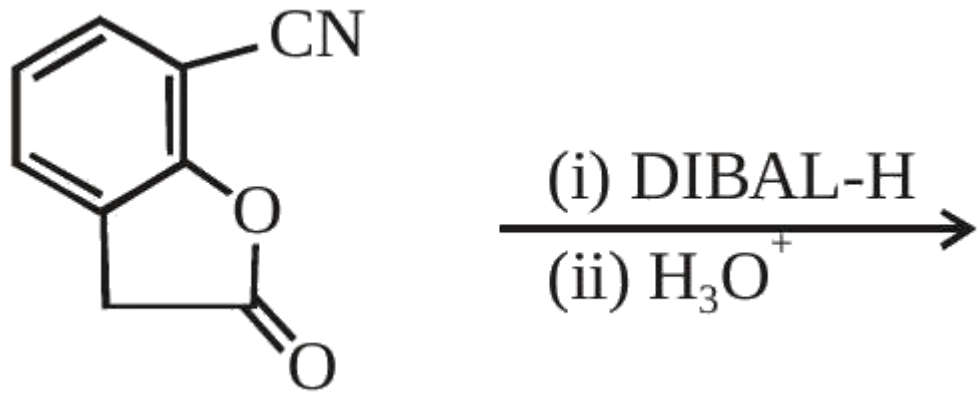
Source solution

Sol. Aldehyde reacts at a faster rate than keton during aldol and stericall less hindered anion will be a better nucleophile so sefl aldol at

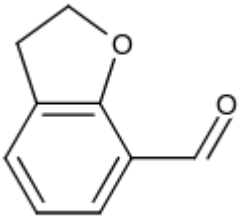

O
8
1
O
O

Question 232

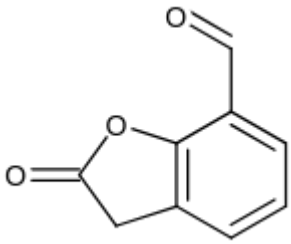
The major product of the following reaction is:



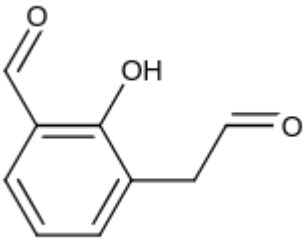
A.



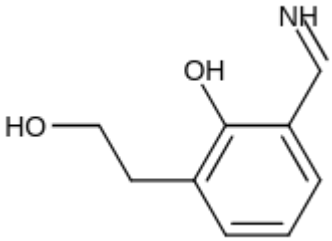
B.



C.



D.

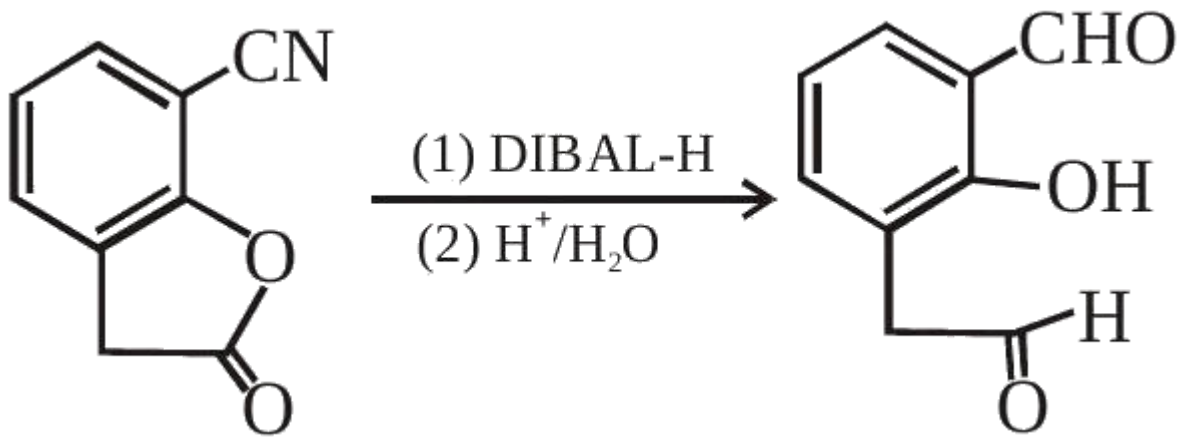


Correct answer: C

Source solution

Sol.

DIBAL-H will reduce cyanides & esters to aldehydes.


CN
O
O
(1) DIBAL-H
(2) H+/H2O
CHO
OH
H
O

Question 233

Match the LIST-I with LIST-II

LIST-I (Reagent)		LIST-II (Functional Group detected)	
A.	Sodium bicarbonate solution	I.	double bond/unsaturation
B.	Neutral ferric chloride	II.	carboxylic acid
C.	ceric ammonium nitrate	III.	phenolic - OH
D.	alkaline $KMnO_4$	IV	alcoholic - OH

Choose the correct answer from the options given below:

A. A-II, B-III, C-IV, D-I

B. A-II, B-III, C-I, D-IV

C. A-III, B-II, C-IV, D-I

D. A-II, B-IV, C-III, D-I

Correct answer: A

Source solution

Sol.

(1) Carboxylic acid gives effervescence with sodium bicarbonate solution.
(2) Phenolic-OH gives violet coloured complex with Neutral $FeCl_3$.
(3) Alcoholic-OH gives red colour with ceric ammonium nitrate.
(4) When alkaline $KMnO_4$ reacts with an unsaturated compound (alkene or alkyne), the purple colour of $KMnO_4$ solution disappears, indicating positive test for unsaturation.

Question 234

Which one of the following reactions will not yield propionic acid?

A. $CH_3CH_2COCH_3 + OI^-/H_3O^+$

B. $CH_3CH_2CH_3 + KMnO_4$ (Heat), OH^-/H_3O^+

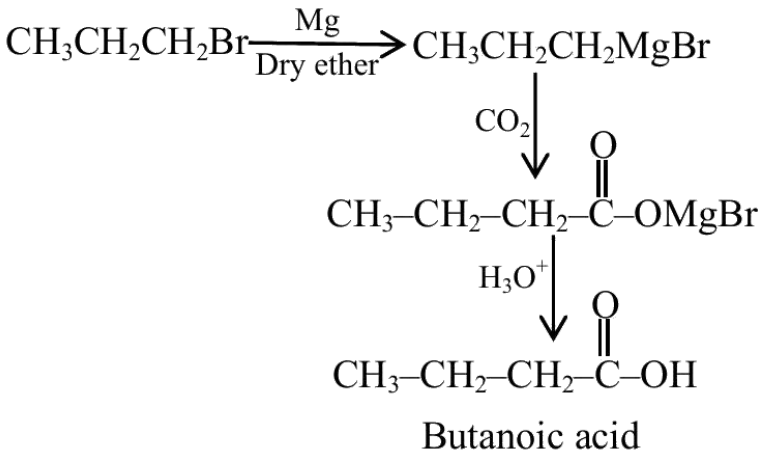
C. $CH_3CH_2CCl_3 + OH^-/H_3O^+$

D. $CH_3CH_2CH_2Br + Mg, CO_2$ dry ether $/H_3O^+$

Correct answer: D

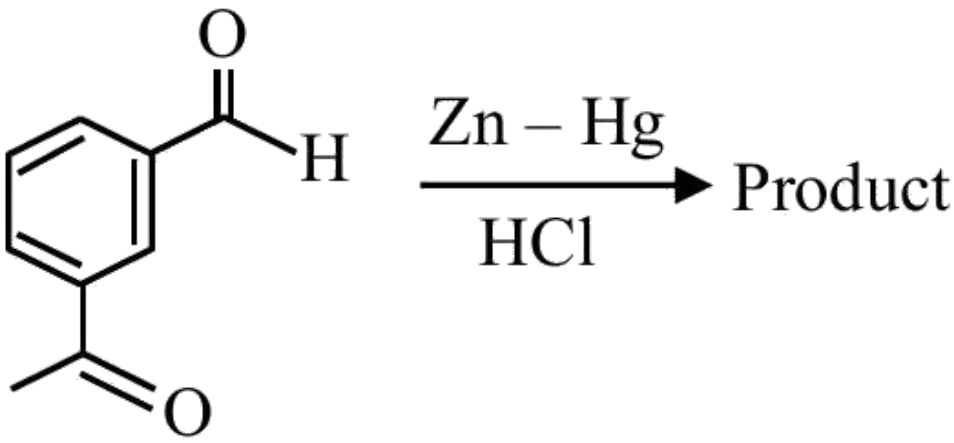
Source solution

Sol. All gives propanoic acid as product but option 4 gives butanoic as product

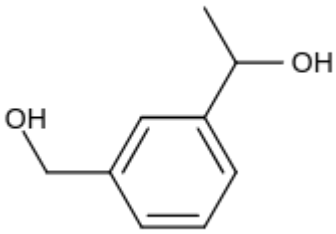


Question 235

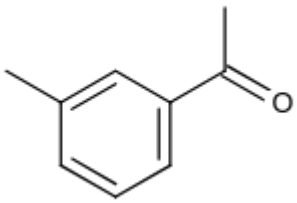
Identify the product in the following reaction :



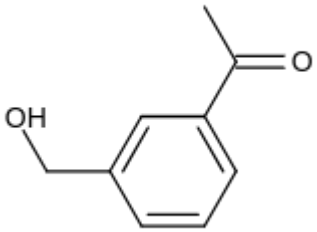
A.



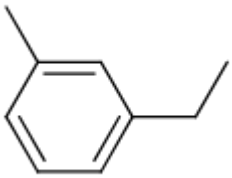
B.



C.



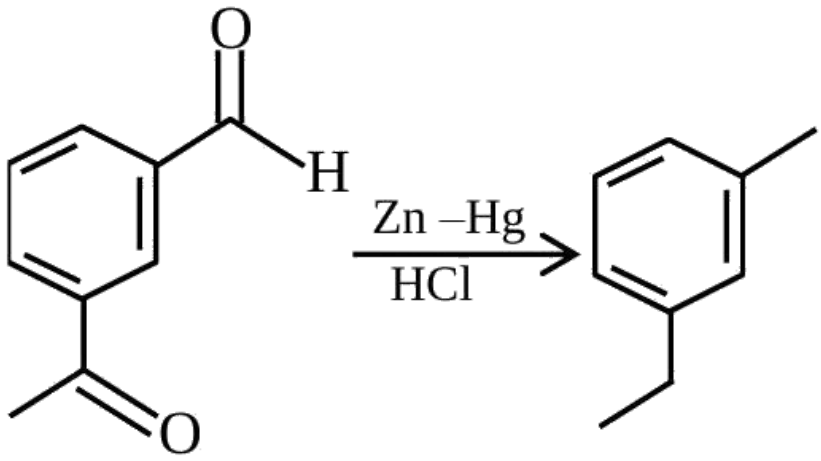
D.



Correct answer: D

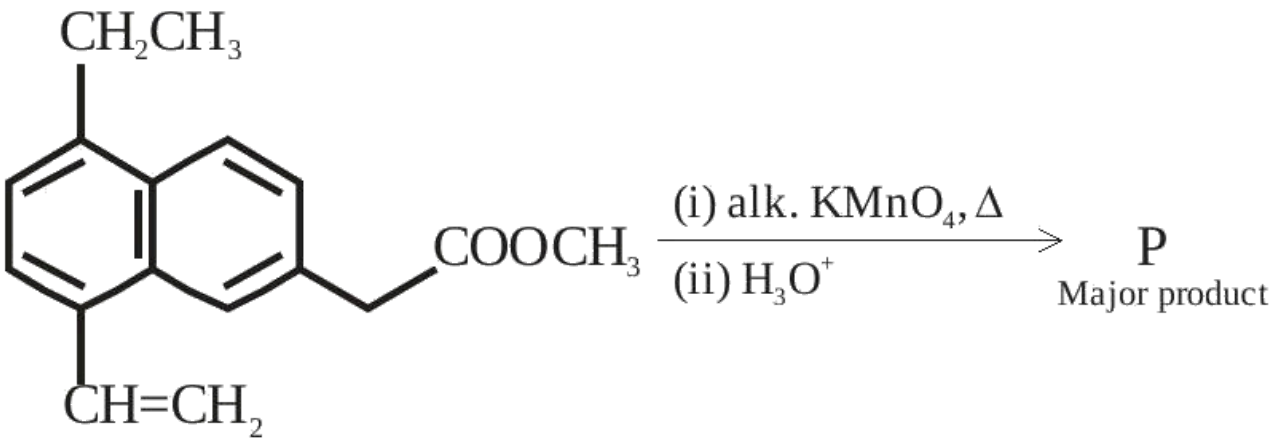
Source solution

Sol.
(Clemmensen reduction)

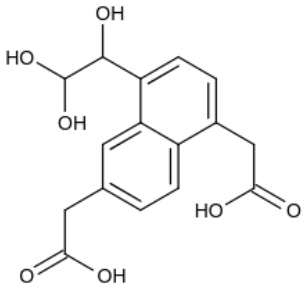

O
H
Zn –Hg
HCl
O

Question 236

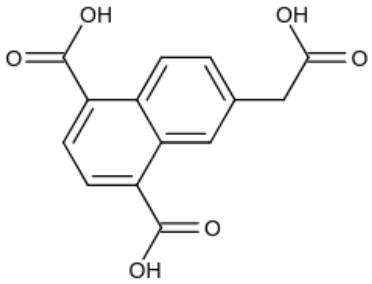
The major product ' P ' formed in the given reaction is



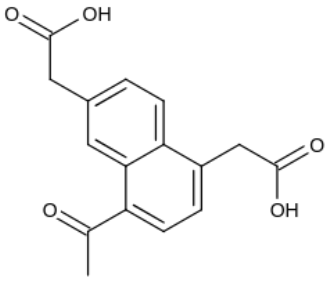
A.



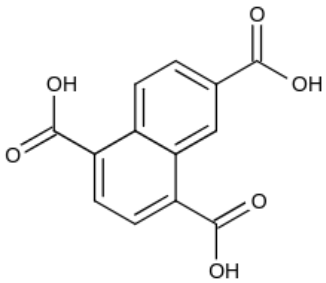
B.



C.



D.

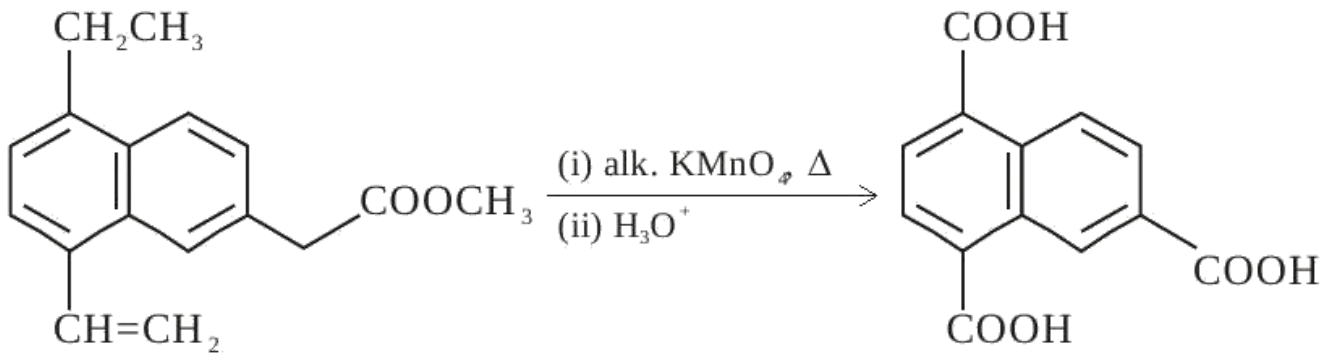


Correct answer: D

Source solution

Sol.}

$\mathbf{KMnO_4}$ oxidises benzylic carbon containing atleast one α-hydrogen atom to -COOH .


CH2CH3
COOCH3
CH=CH2
(i) alk. KMnO4, Δ
(ii) H3O+
COOH
COOH
COOH

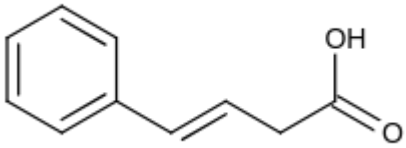
Question 237

The major product ' P ' formed in the following sequence of reactions is

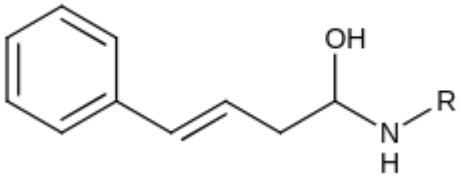
$\xrightarrow[\text{(ii) R–NH}_2]{\text{(i) SOCl}_2}$ 'P' (Major Product)

(iii) $\mathbf{LiAlH_4}$

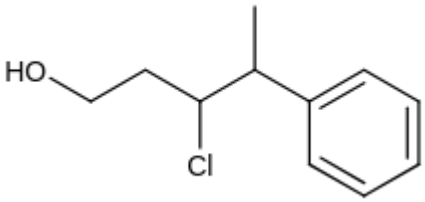
(iv) $\mathbf{H_3O^+}$



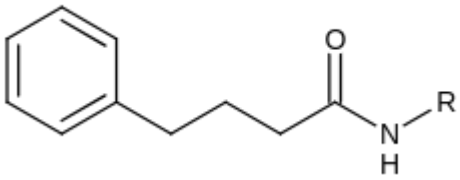
A. $\mathbf{H-N-R}$



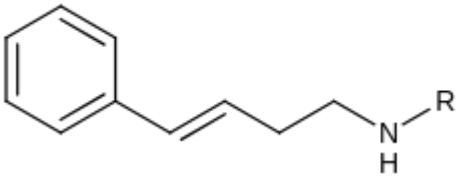
B.



C. H



D.

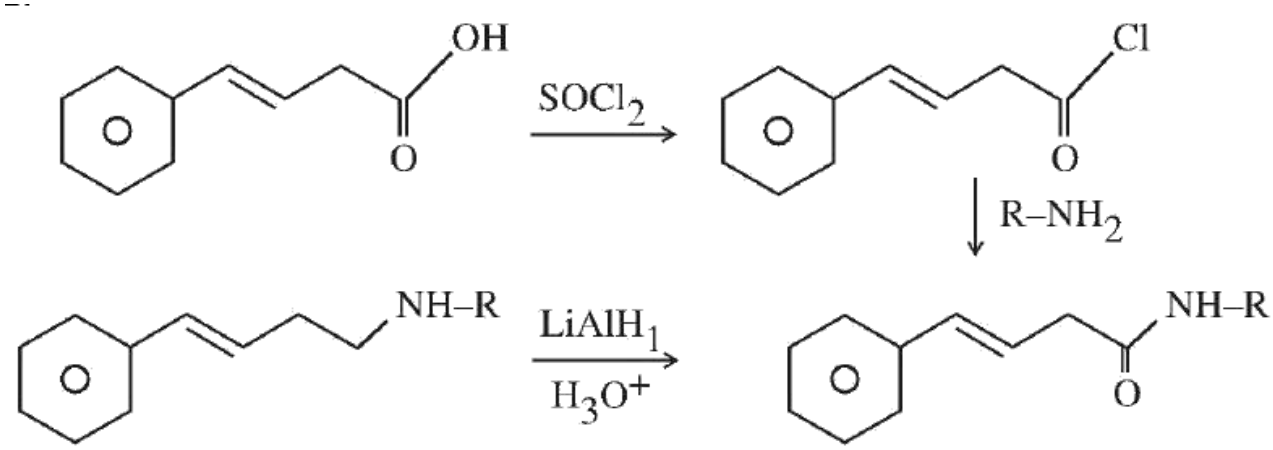


Correct answer: D

Source solution

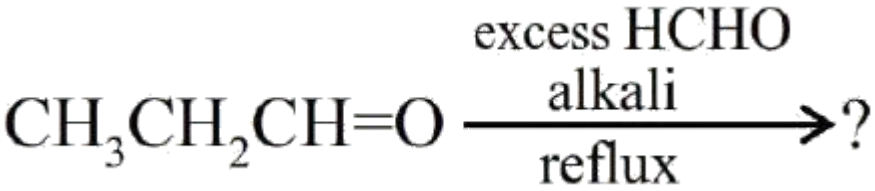
Sol.

SECTION-B}

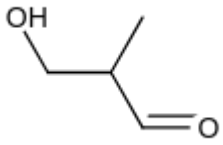

OH
O
SOCl2
Cl
O
R–NH2
NH–R
LiAlH1
H3O+
NH–R
O

Question 238

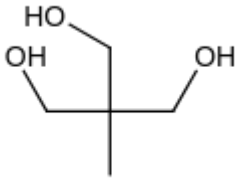
The major product of the following reaction is :



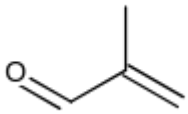
A. $CH_3 - CH_2 - CH_2 - OH$



B.



C.



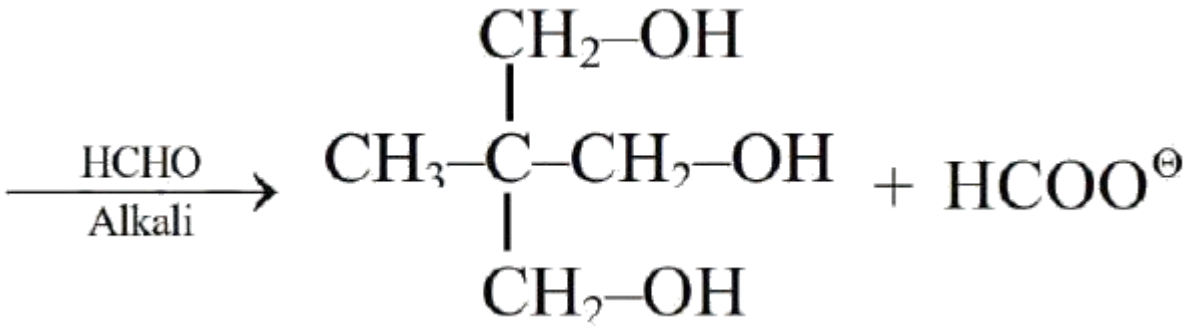
D.

Correct answer: C

Source solution

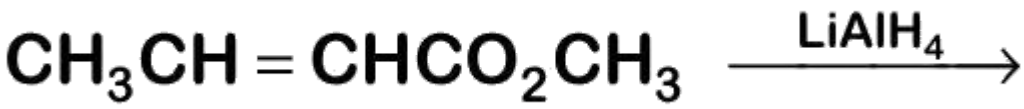
Sol. (3)

This is an example of Tollen's reaction i.e. multiple cross aldol followed by cross Cannizaro reaction



Question 239

The major product of the following reaction is



A. $CH_3CH_2CH_2CH_2OH$

B. $CH_3CH_2CH_2CHO$

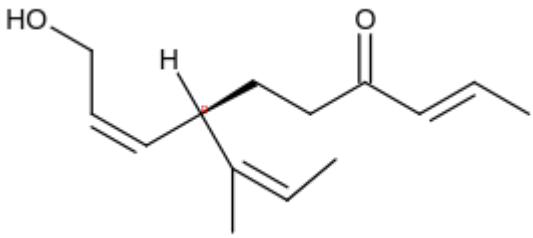
C. $CH_3CH_2CH_2CO_2CH_3$

D. $CH_3CH = CHCH_2OH$

Correct answer: D

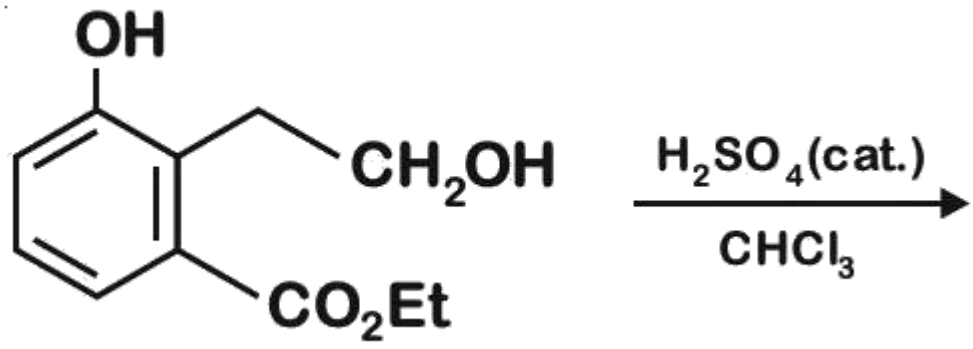
Source solution

Sol. $LiAlH_4$ reduces esters to alcohols but does not reduce $C = C$.

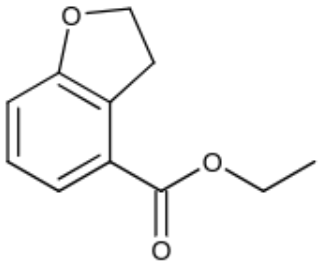


Question 240

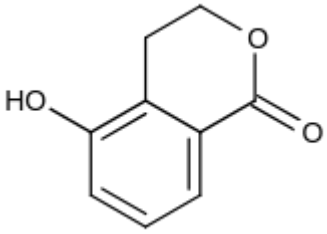
The major product of the following reaction is :



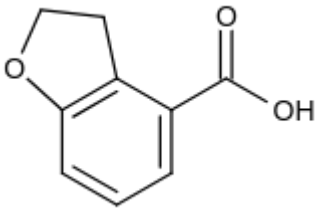
A.



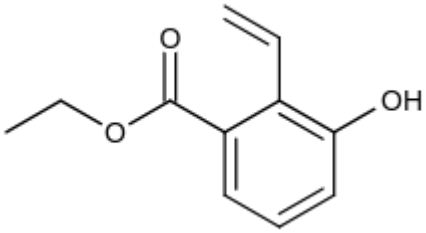
B.



C.



D.

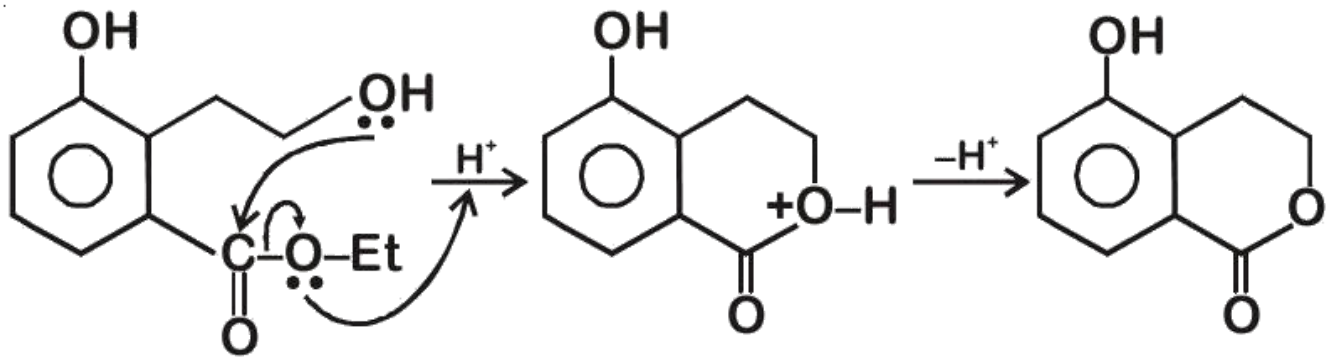


Correct answer: B

Source solution

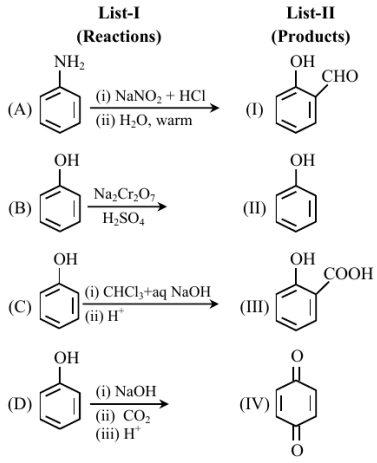
Sol.

Acid catalysed intramolecular esterification


OH
OH
C–O–Et
O
H+
OH
+O–H
O
–H+
OH
O
O

Question 241

Match List-I (Reactions) with List-II (Products):



Choose the correct answer from the options given below.

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

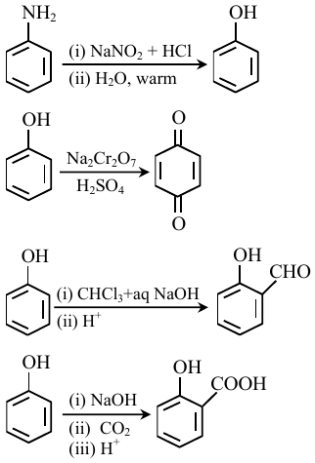
B. (A)-(IV), (B)-(II), (C)-(III), (D)-(I)

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

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

Correct answer: D

Source solution

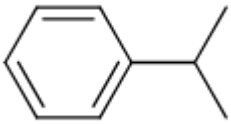


Question 242

The final product A, formed in the following reaction sequence is:

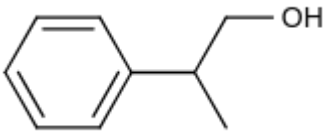
$$\mathrm{Ph{-}CH{=}CH_2} \xrightarrow[\text{(iii) HBr}]{\begin{array}{l}\text{(i) } BH_3\\ \text{(ii) } H_2O_2, \ominus OH\end{array}} A \xrightarrow{\text{(iv) Mg, ether, then } HCHO/H_3O^+}$$

A. $\mathrm{Ph - CH_2 - CH_2 - CH_3}$



B.

D. $\mathrm{Ph - CH_2 - CH_2 - CH_2 - OH}$



C.

Correct answer: D

Source solution

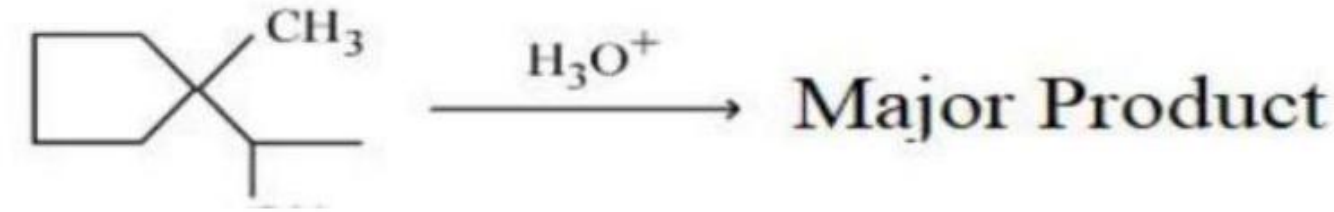
Sol. $\mathrm{PhCH = CH_2 \xrightarrow{B_2H_6/H_2O_2,OH^-} PhCH_2CH_2OH}$

$$\mathrm{PhCH_2CH_2OH + HBr \longrightarrow PhCH_2CH_2Br + H_2O\,(SN^{NGP})}$$

$$\mathrm{PhCH_2CH_2Br \xrightarrow{Mg/dry\ ether} PhCH_2CH_2MgBr \xrightarrow[\text{(II) } H_3O^+]{\text{(I) } H-\overset{\overset{O}{\|}}{C}-H} PhCH_2CH_2CH_2OH}$$

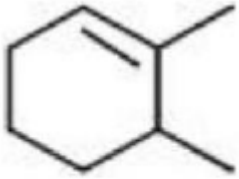
Question 243

Find out the major product for the following reaction.



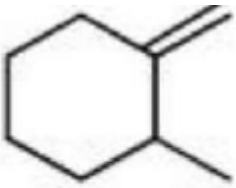


A.

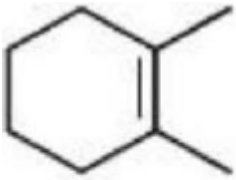


B.

3.



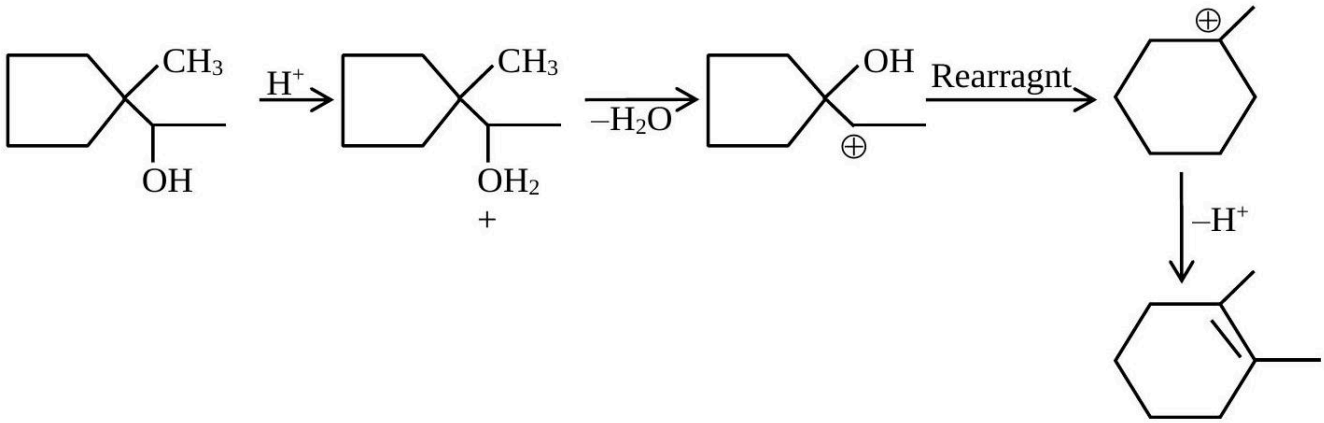
C.



D.

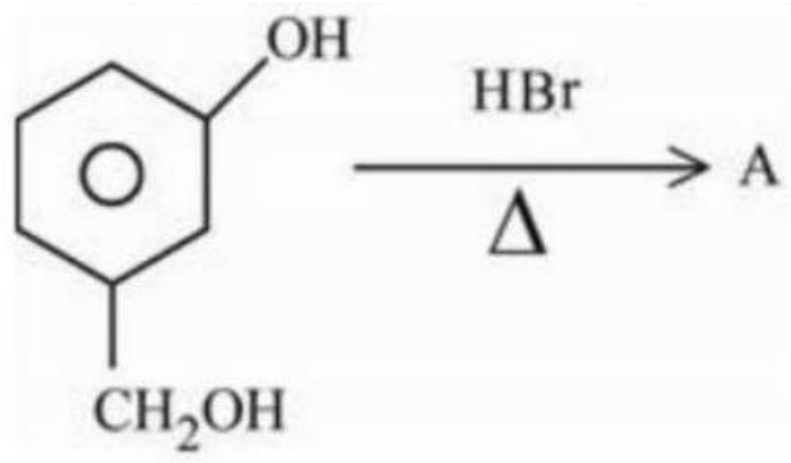
Correct answer: D

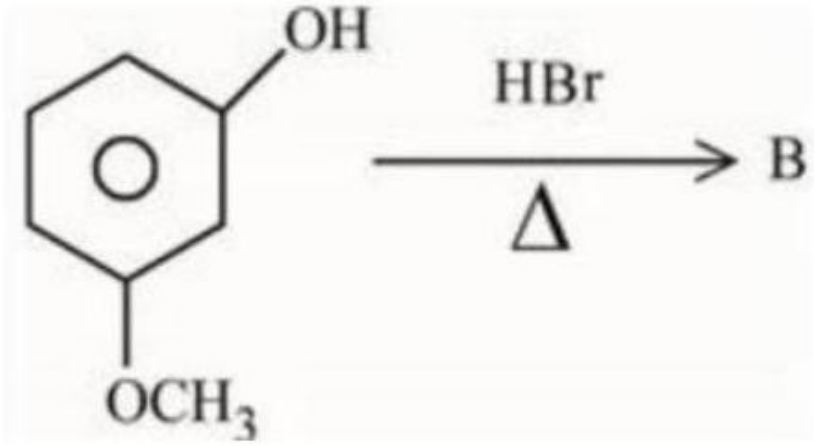
Source solution



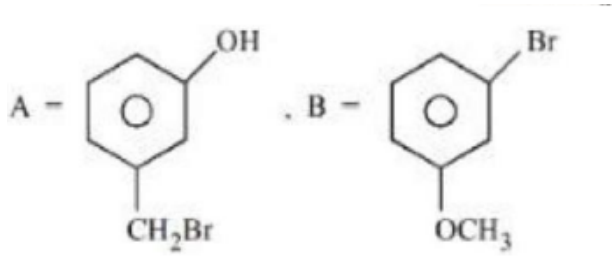
Question 244

' A ' and ' B ' formed in the following set of reactions are:

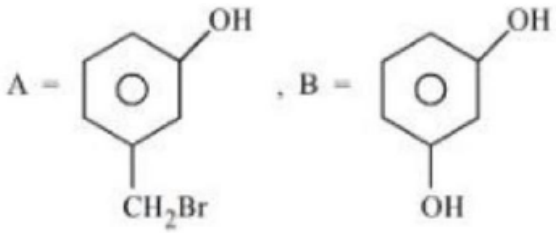




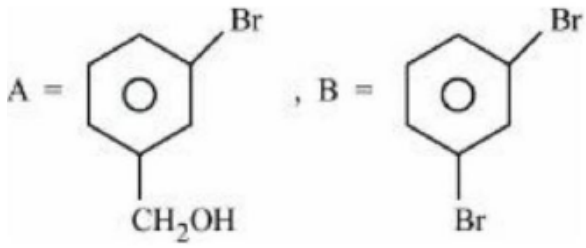
A.



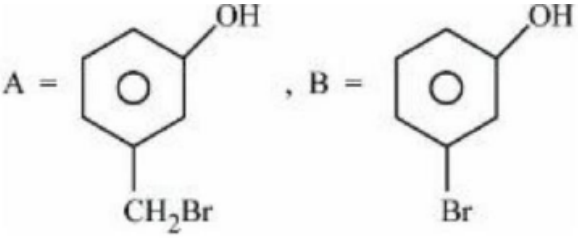
B.



C.



D.



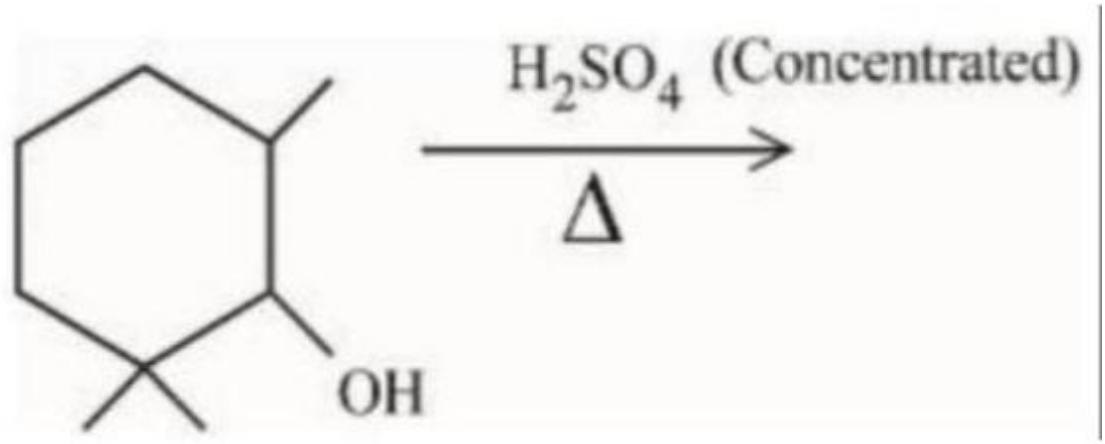
Correct answer: B

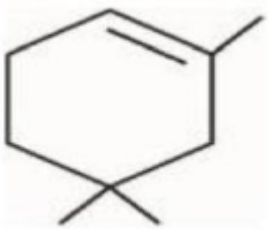
Source solution

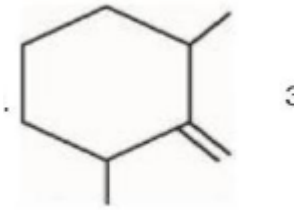
Hot HBr replaces the benzylic alcohol group by bromide in A. In B it cleaves the aryl methyl ether at its methyl group, giving the second phenolic OH group and methyl bromide. The phenolic C-O bonds remain intact; the pair is option 2.

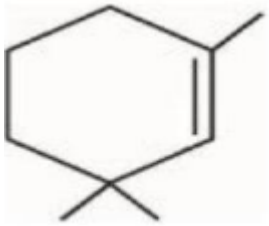
Question 245

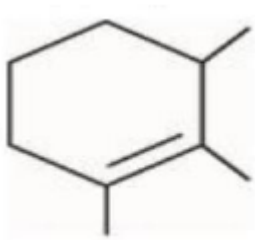
Find out the major product from the following reaction.



A. 

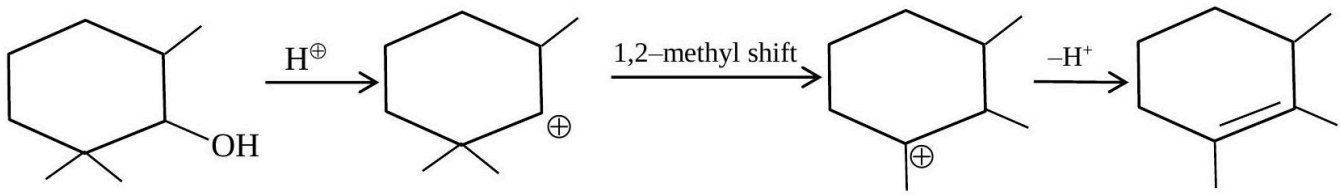
B. 

C. 

D. 

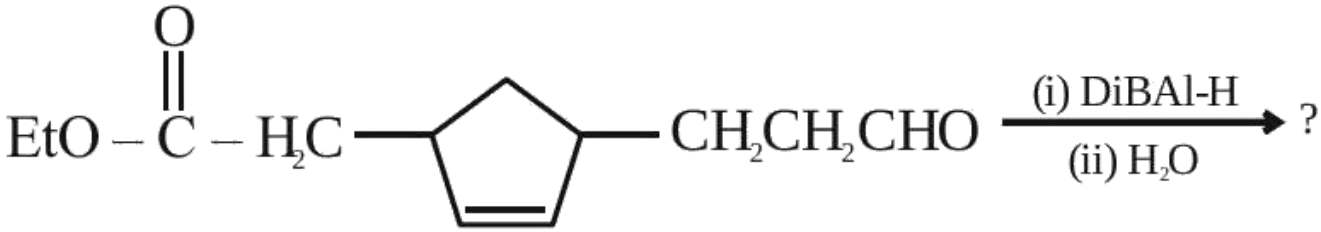
Correct answer: D

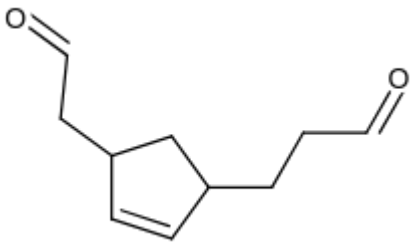
Source solution



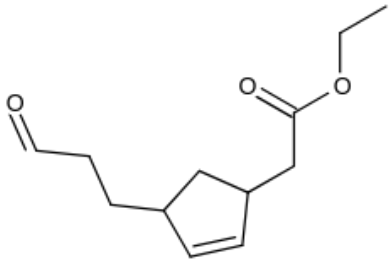
Question 246

Consider the above reaction and predict the major product.

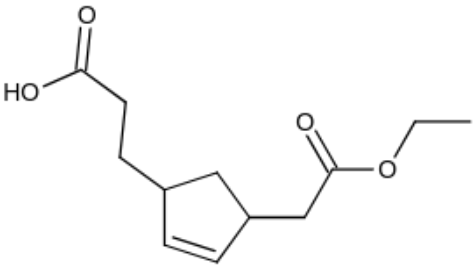




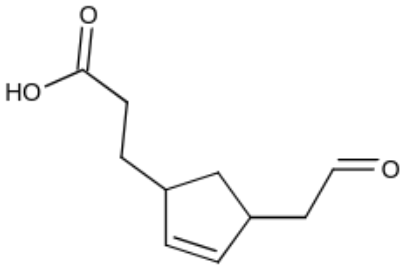
A.



B.



C.



D.

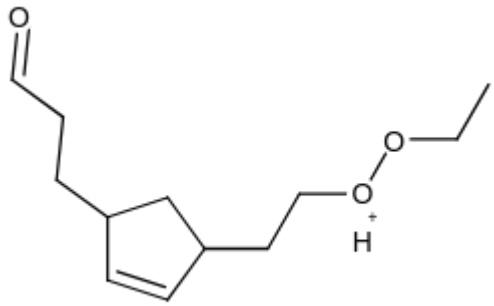
Correct answer: A

Source solution

Sol.

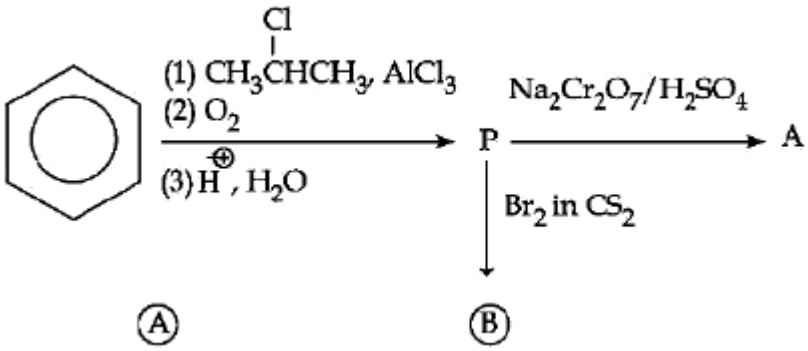
(i) $\mathbf{DiBAL - H}$

(ii) $\mathbf{H_2O}$

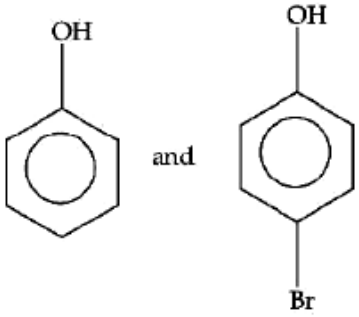

O
O
O
H
+

Question 247

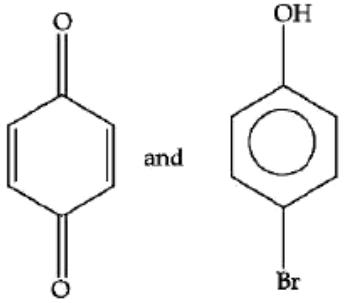
Identify the major products A and B in the following sequence:



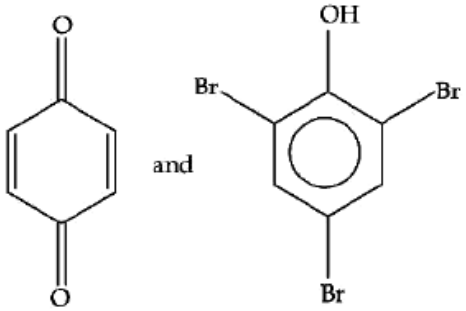
A.



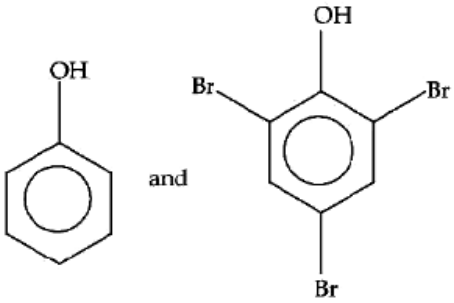
B.



C.



D.



Correct answer: B

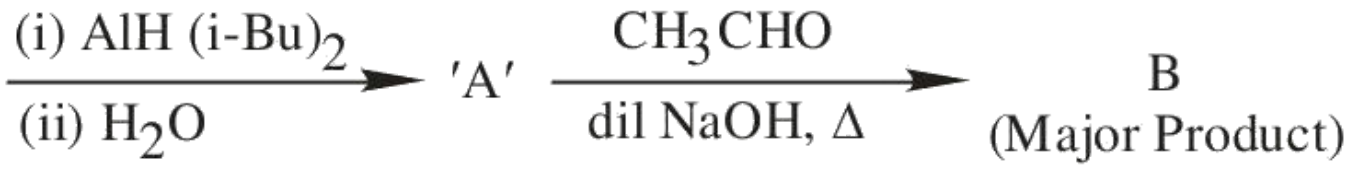
Source solution

The cumene sequence produces phenol P. Oxidation by acidified dichromate gives p-benzoquinone A; bromination in CS2 gives predominantly p-bromophenol B. The pair is option 2.

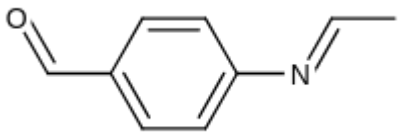
Question 248

Consider the following reaction sequence :

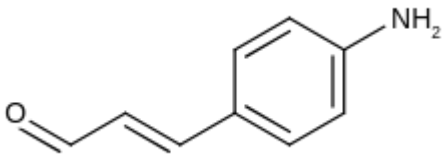
The product ' B ' is :



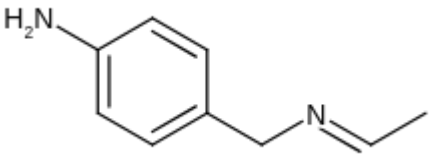
A.



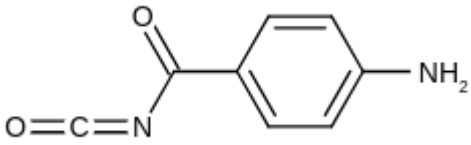
B.



C.



D.

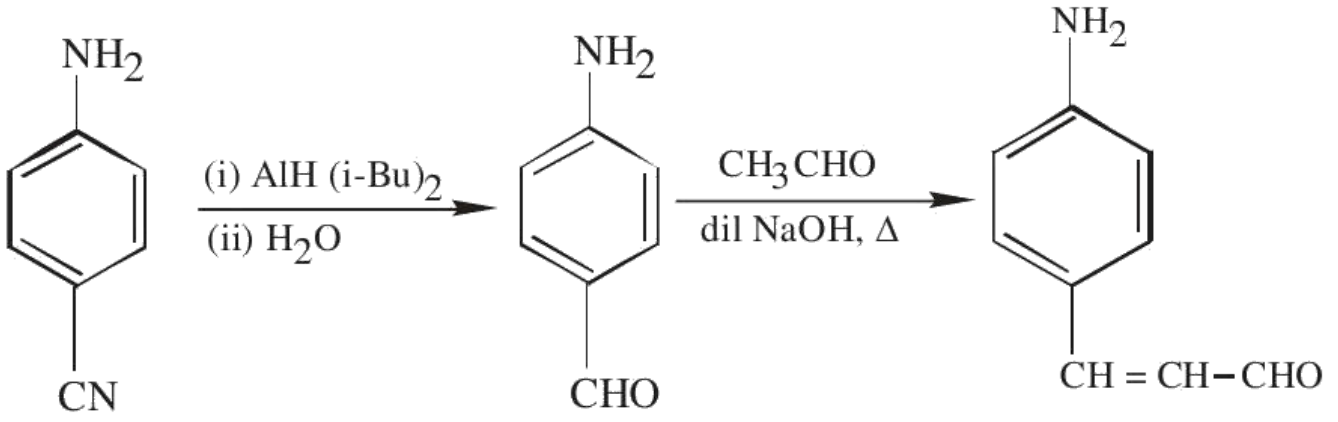


Correct answer: B

Source solution

Sol.

Cross aldol condensation

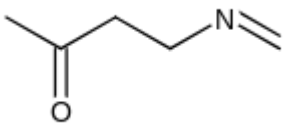


Question 249

Match List-I with List-II :

List-I
(Chemical Reaction)}
List-II}
(Reagent used)
(a) $\mathbf{CH_3COOCH_2CH_3 \rightarrow CH_3CH_2OH}$
(i) $\mathbf{CH_3MgBr/H_3O^+}$
(b) $\mathbf{CH_3COOCH_3 \rightarrow CH_3CHO}$ (1.equivalent)
(ii) $\mathbf{H_2SO_4/H_2O}$
(c) $\mathbf{CH_3C \equiv N \rightarrow CH_3CHO}$
(iii) $\mathbf{DIBAL - H/H_2O}$
(d)
(iv) $\mathbf{SnCl_2, HCl/H_2O}$

Choose the most appropriate match :



A. a-ii, b-iv, c-iii, d-i

B. a-iv, b-ii, c-iii, d-i

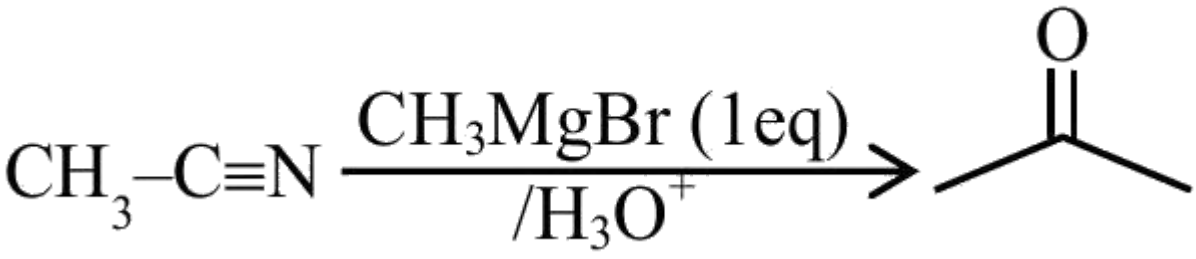
C. a-ii, b-iii, c-iv, d-i

D. a-iii, b-ii, c-i, d-iv

Correct answer: C

Source solution

Sol.


CH3–C≡N
CH3MgBr (1eq)
/H3O+
O

Question 250

Match List I with List II

List I (Compound)		List II (pK_a value)	
A.	Ethanol	I.	10.0
B.	Phenol	II.	15.9
C.	m-Nitrophenol	III.	7.1
D.	p-Nitrophenol	IV.	8.3

Choose the correct answer from the options given below :-

A. A-I, B-II, C-III, D-IV

B. A-IV, B-I, C-II, D-III

C. A-III, B-IV, C-I, D-II

D. A-II, B-I, C-IV, D-III

Correct answer: D

Source solution

Sol. Ethanol $\rightarrow$ $\mathbf{15.9}$
Phenol $\rightarrow$ $\mathbf{10}$
M-Nitrophenol $\rightarrow$ $\mathbf{8.3}$
P-Nitrophenol $\rightarrow$ $\mathbf{7.1}$

Question 251

Match List-I with List-II.

List-I
(Test)}
(A) Bayer's test
(B) Ceric ammonium nitrate test
(C) Phthalein dye test
(D) Schiff's test

List-II
(Identification)}
(I) Phenol
(II) Aldehyde
(III) Alcoholic-OH group
(IV) Unsaturation

Choose the correct answer from the options given below:

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

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

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

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

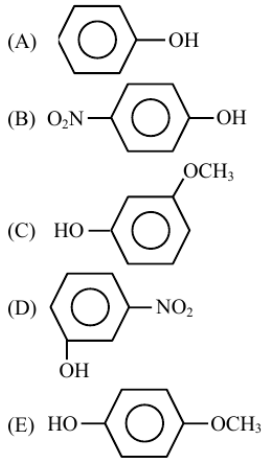
Correct answer: D

Source solution

Sol. (A) Bayer's test $\rightarrow$ Unsaturation
(B) Ceric ammonium nitrate test $\rightarrow$ Alcoholic-OH group
(C) Phthalein dye test $\rightarrow$ Phenol
(D) Schiff's test $\rightarrow$ Aldehyde

Question 252

For the compounds below, choose the correct order of increasing pKa:



A. (E) < (D) < (C) < (B) < (A)

B. (D) < (E) < (C) < (B) < (A)

C. (E) < (D) < (B) < (A) < (C)

D. $(B) < (D) < (C) < (A) < (E)$

This question was incorrect in the original exam paper. ALLEN marked it BONUS because all options were incorrect. For practice, option 4 is corrected to B < D < C < A < E, following the ALLEN worked solution.

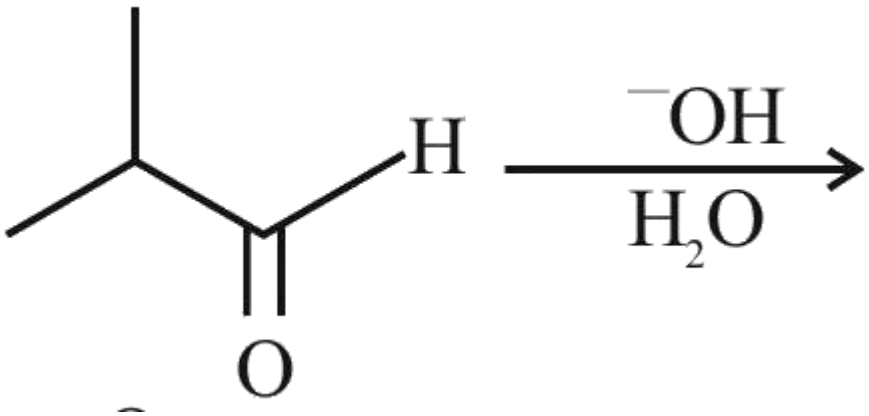
Correct answer: D

Source solution

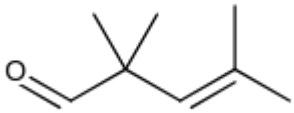
The ALLEN worked solution gives the increasing pKa order $(B) < (D) < (C) < (A) < (E)$. The original four options omitted that order; it is now supplied as corrected option 4.

Question 253

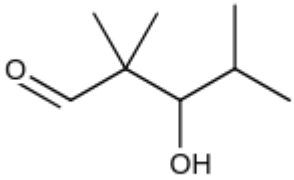
What is the major product of the following reaction?



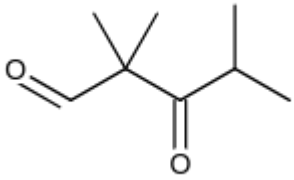
A.



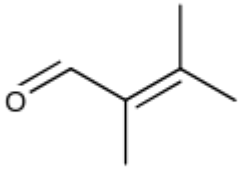
B.



C.



D.

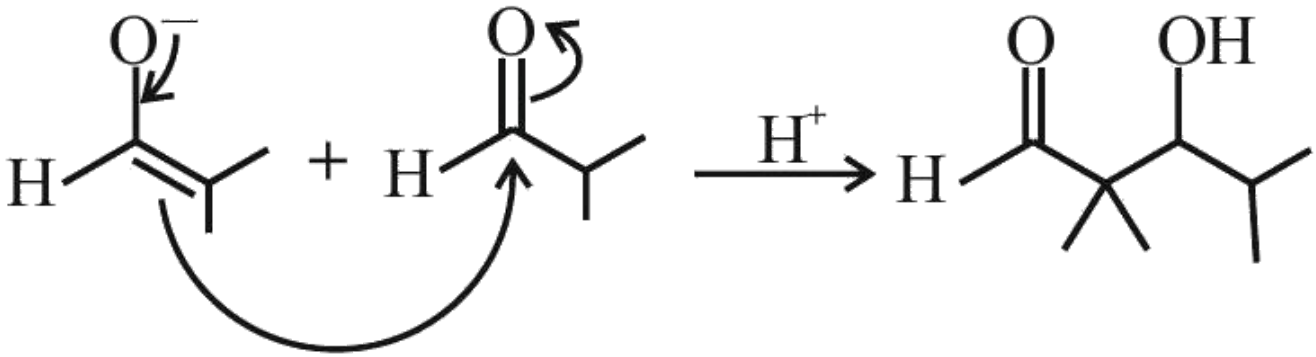


Correct answer: B

Source solution

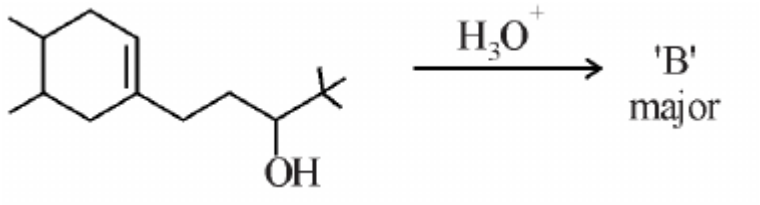
Sol.

Aldol formation takes place.

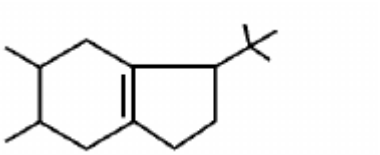

O
H
+
O
H
H+
O
OH
H

Question 254

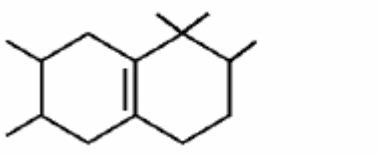
Identify the major product B in the following acid-catalysed reaction:



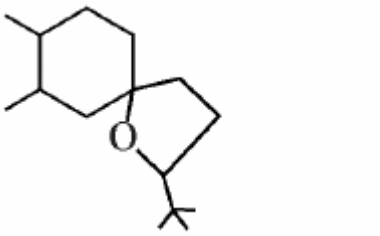
A.



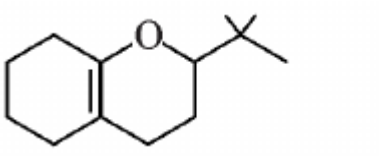
B.



C.

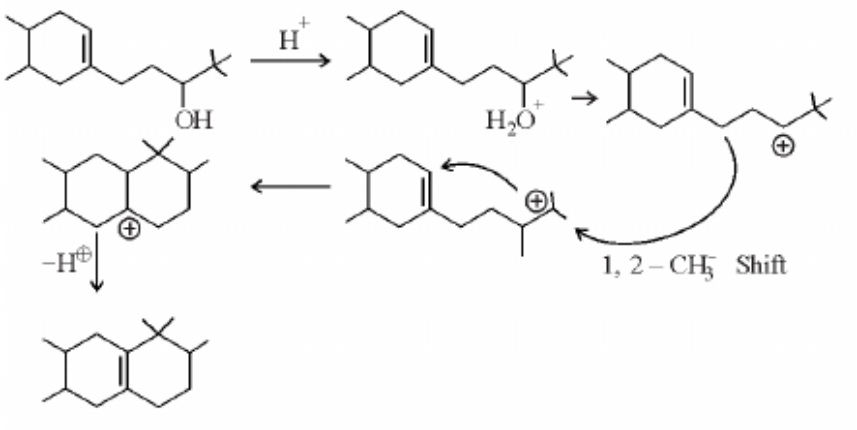


D.



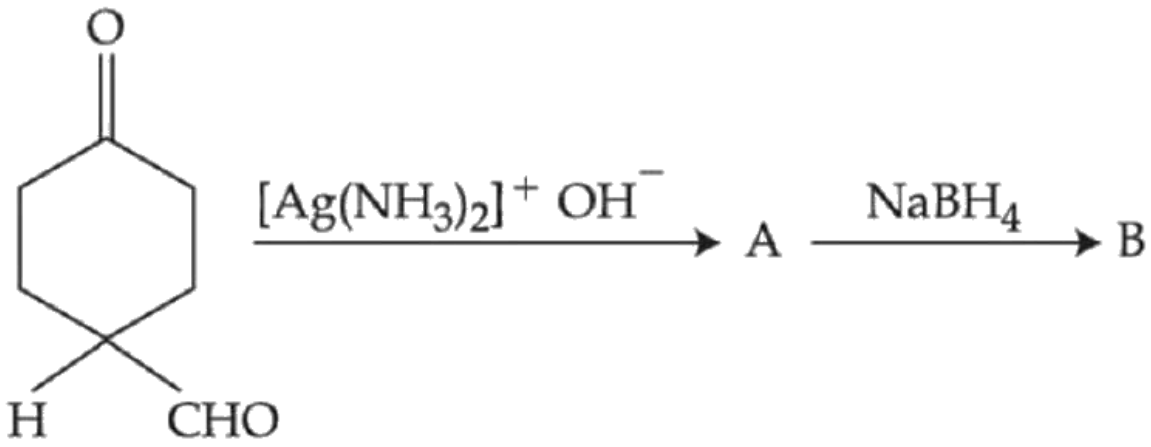
Correct answer: B

Source solution

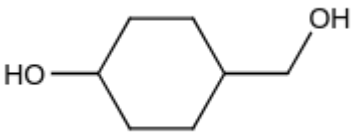


Question 255

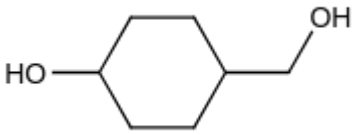
The products formed in the following reaction, A and B are



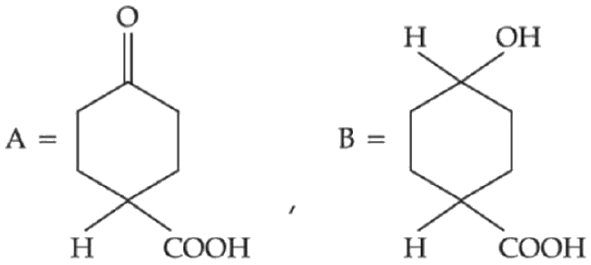
A. B =



B.

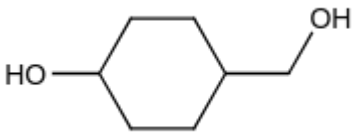


C.



D. $A =$

$B =$

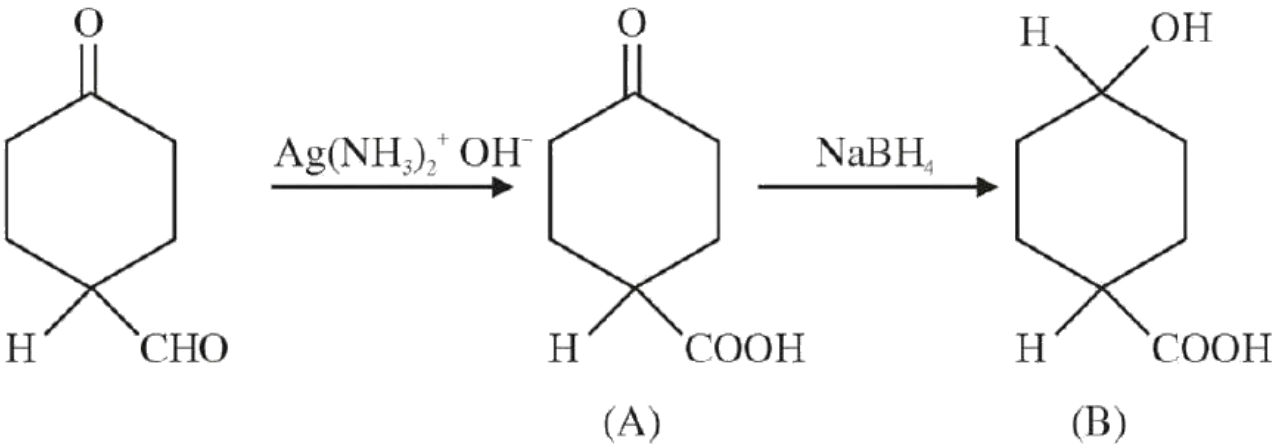


Correct answer: C

Source solution

Sol.

$NaBH_4$ does not reduce carboxylic acid.

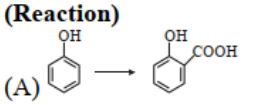
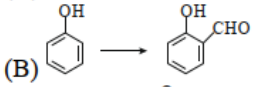
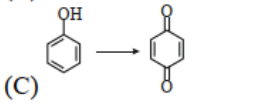
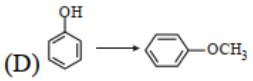


(A) (B)

Question 256

Match List-I with List-II.

Choose the correct answer from the options given

List – I (Reaction)	List – II (Reagent(s))
(A) 	(I) $Na_2Cr_2O_7$, H_2SO_4
(B) 	(II) (i) NaOH (ii) CH_3Cl
(C) 	(III) (i) NaOH, $CHCl_3$ (ii) NaOH (iii) HCl
(D) 	(IV) (i) NaOH (ii) CO_2 (iii) HCl

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

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

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

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

Correct answer: D

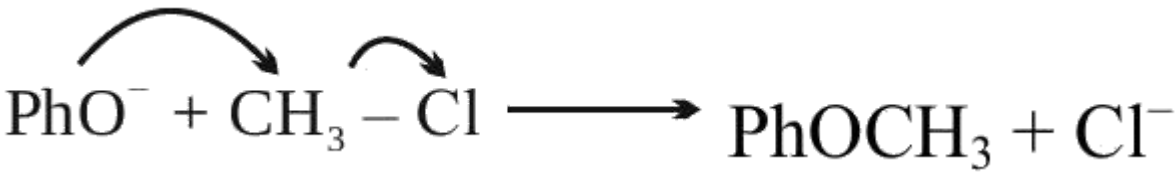
Source solution

Sol. (A) $\rightarrow$ Kolbe Schmidt Reaction

(B) $\rightarrow$ Reimer Riemann Reaction

(C) $\rightarrow$ Oxidation of phenol to p -benzoquinone

(D) $\rightarrow$ $\mathbf{PhOH + NaOH \rightarrow H_2O + PhO^-}$



Question 257

Match List I with List II

\multirow{2}{*}{}	LIST I	LIST II	
	Isomeric pairs		Type of isomers
A.	Propanamine and N-Methylethanamine	I.	Metamers
B.	Hexan-2-one and Hexan-3-one	II.	Positional isomers
C.	Ethanamide and Hydroxyethanimine	III.	Functional isomers
D.	o-nitrophenol and p-nitrophenol	IV.	Tautomers

Choose the correct answer from the options given below:

A. A-II, B-III, C-I, D-IV

B. A-III, B-I, C-IV, D-II

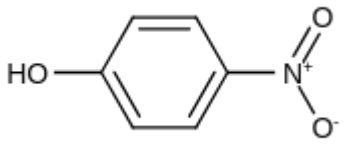
C. A-III, B-IV, C-I, D-II

D. A-IV, B-III, C-I, D-II

Correct answer: B

Source solution

Sol. 2}
(A) $C-C-C-NH_2 \& C-NH-C-C$: functional isomer (III)
(B)
(C)
&
(D)
: Position isomer (II)


HO
O
N+
O-

Question 258

Match List-I and List-II.

List - I

List-II

(a) $\overset{O}{\overset{||}{}}-C-Cl \rightarrow R-CHO$

(i) $Br_2/NaOH$

(b)

(ii) $H_2/Pd-BaSO_4$

(c) $\underset{||}{O}-\underset{|}{C}-NH_2 \rightarrow R-NH_2$

(iii) $Zn(Hg)/$ Conc. HCl

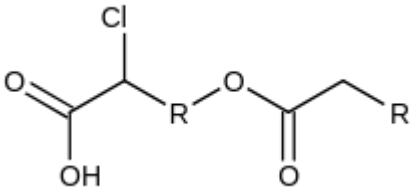
O

II

O

(d) $R-C-CH_3 \rightarrow R-CH_2-CH_3$ (iv) $Cl_2/$ Red P, H_2O

Choose the correct answer from the options given below :



A. (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

B. (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

C. (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

D. (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

Correct answer: D

Source solution

Sol.

(a)

(b)

O

(c) $\mathbf{R-C-NH_2} \xrightarrow{\mathbf{Br_2/NaOH}} \mathbf{R-NH_2}$ (Hoffmann Bromamide reaction)

(d) $\mathbf{R-C-CH_3} \xrightarrow{\mathbf{On(Hg)/\ conc.\ HCl}} \mathbf{R-CH_2-CH_3}$ (Clemmensen reaction)

$$R-CH_2-COOH \xrightarrow{Cl_2/Red\ P,\ H_2O} R-\underset{\displaystyle Cl}{\underset{|}{CH}}-COOH \quad \text{(HVZ reaction)}$$

Aldehydes, Ketones and Carboxylic Acids

Question 259

Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : α-halocarboxylic acid on reaction with dil NH_3 gives good yield of α-amino carboxylic acid whereas the yield of amines is very low when prepared from alkyl halides.
Reason (R) : Amino acids exist in zwitter ion form in aqueous medium.
In the light of the above statements, choose the correct answer from the options given below :

A. Both (A) and (R) are correct and (R) is the correct explanation of (A)

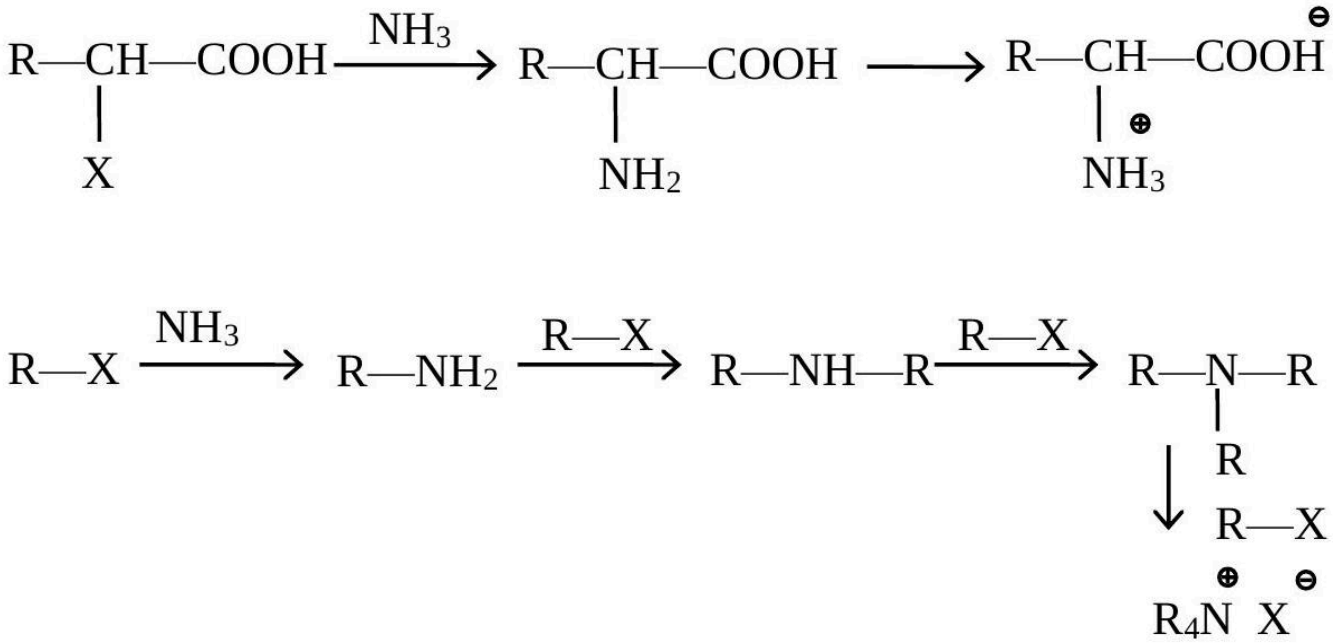
B. (A) is not correct but (R) is correct

C. Both (A) and (R) are correct but (R) is not the correct explanation of (A)

D. (A) is correct but (R) is not correct

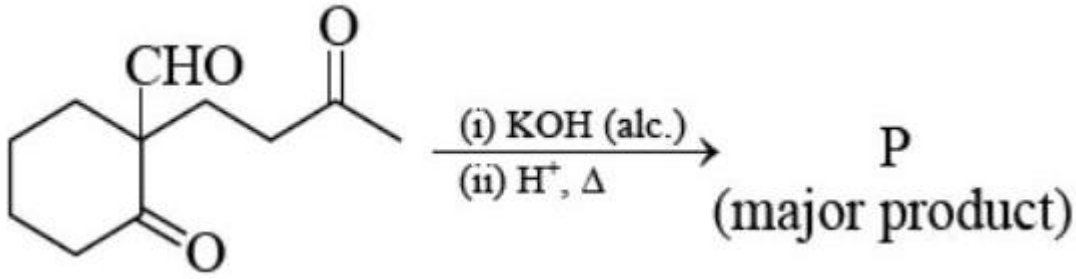
Correct answer: A

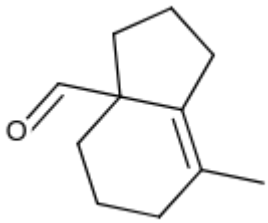
Source solution



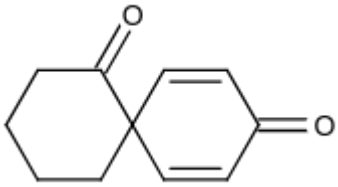
Question 260

The major product (P) in the following reaction is

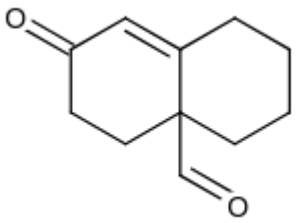




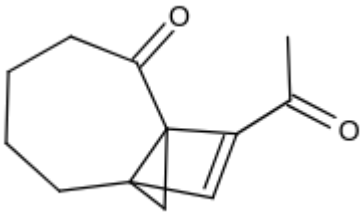
A.



B.



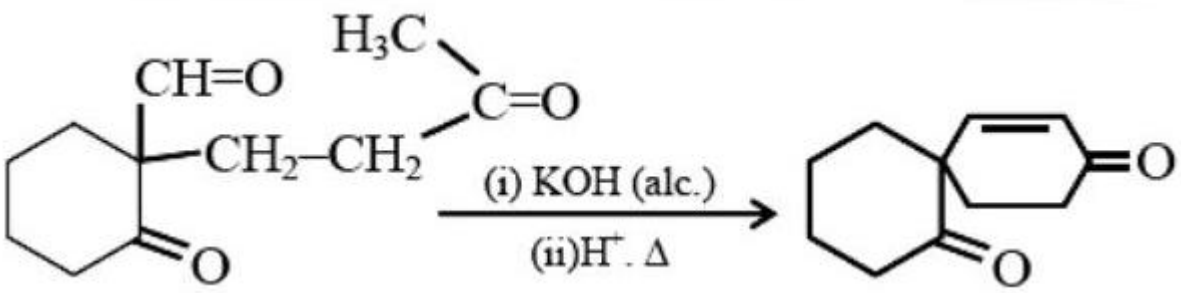
C.



D.

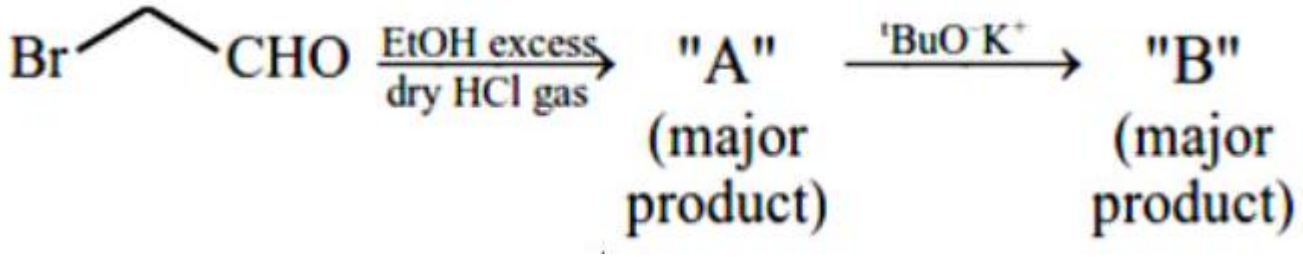
Correct answer: B

Source solution

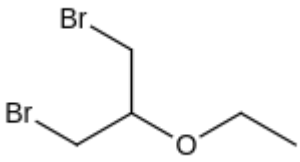


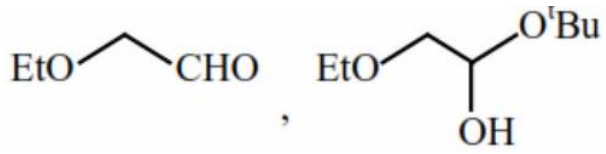
Intramolecular Aldol condenstion (Major Product)

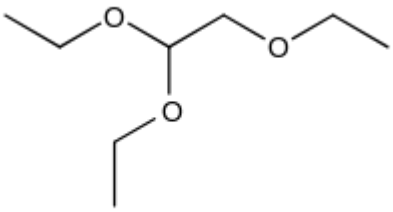
Question 261

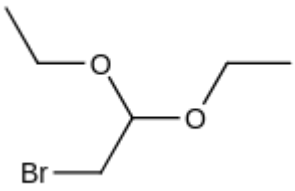


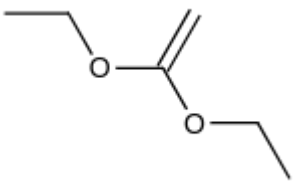
[where $\mathbf{Et} \Rightarrow -\mathbf{C_2H_5}$ $^t\mathbf{Bu} \Rightarrow \mathbf{(CH_3)_3C-}$] Consider the above reaction sequence, Product "A"and Product "B" formed respectively are :

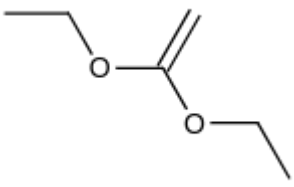
A. 

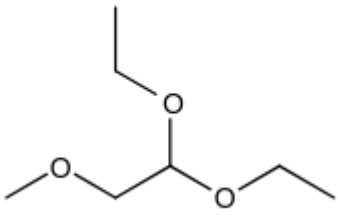
B. 

C. 

D. 

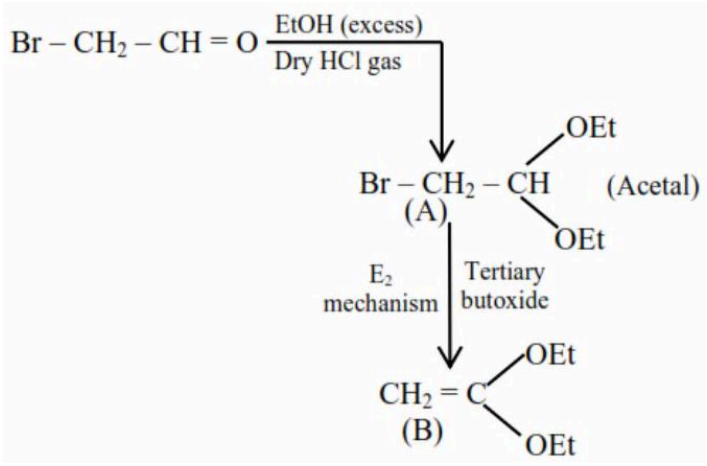




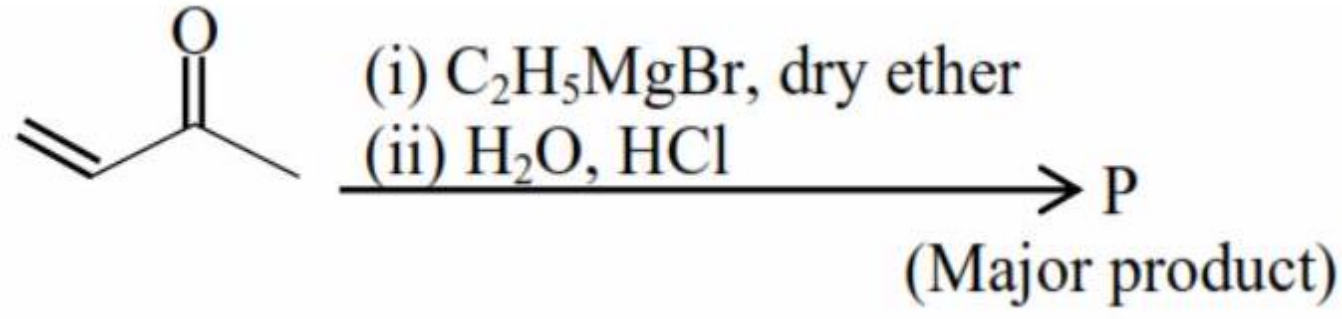


Correct answer: A

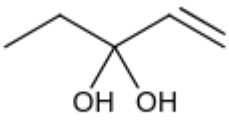
Source solution


Br – CH2 – CH = O
EtOH (excess)
Dry HCl gas
OEt
Br – CH2 – CH
OEt
(A)
(Acetal)
E2
mechanism
Tertiary
butoxide
OEt
CH2 = C
OEt
(B)

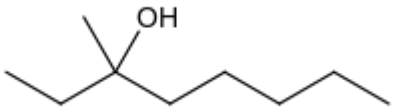
Question 262



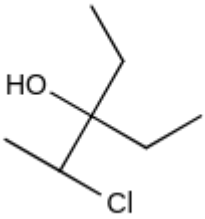
Consider the above reaction, the major product 'P' is:



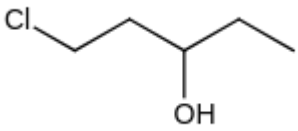
A.



B.



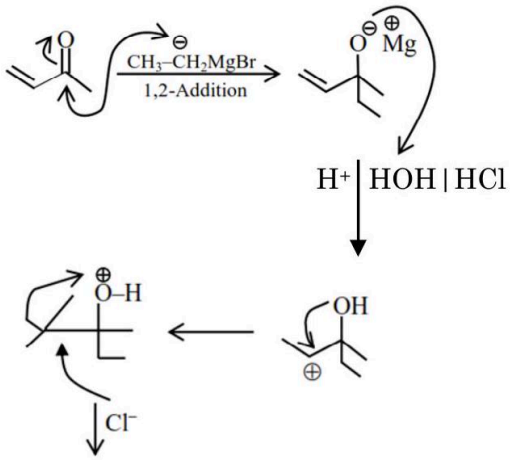
C.

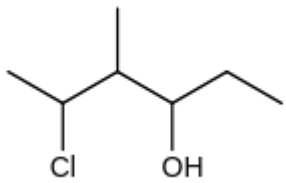


D.

Correct answer: C

Source solution




Cl
OH

Question 263

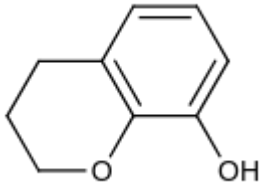
Arrange the following compounds in increasing order of rate of aromatic electrophilic substitution reaction

(a)

(b)

(c)

(d)



A. d, b, c, a

B. b, c, a, d

C. c, a, b, d

D. d, b, a, c

Correct answer: C

Source solution

Sol. Benzene becomes more reactive towards EAS when any substituent raises the electron density.

a

$-\mathrm{CH_2}$ has +H effect

b

-OH has +R while $-\mathrm{CH_2}-$ group has +H effect.

c

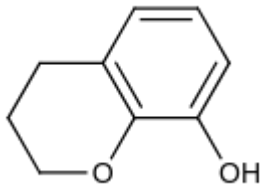
d

-OH and $-\mathrm{O}-$ both

show +R effect

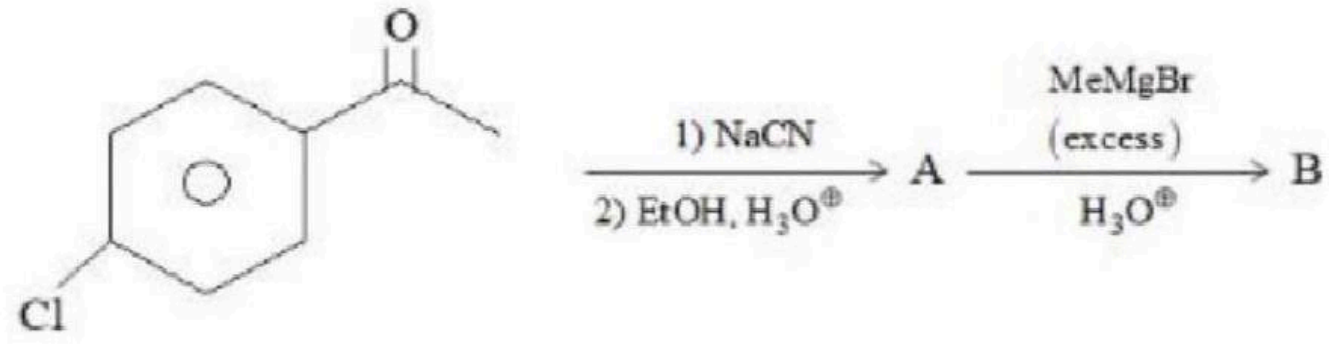
Correct order

$$c < a < b < d$$

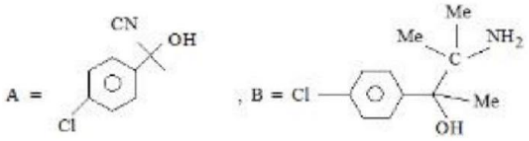

O
OH

Question 264

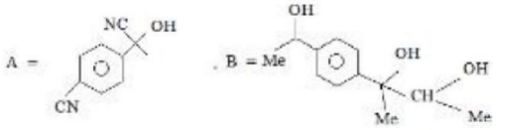
Find out the major products from the following reaction sequence.



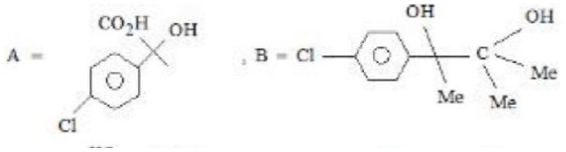
A.



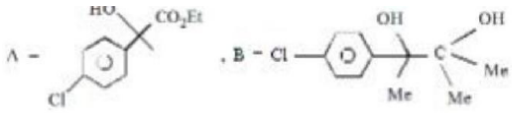
B.



C.

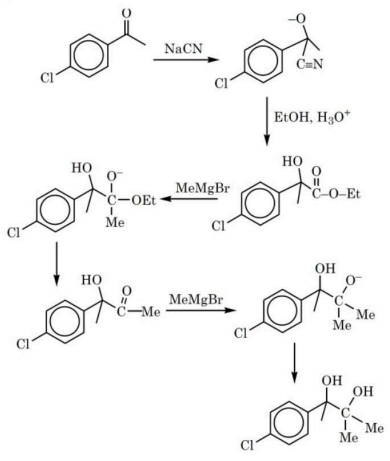


D.



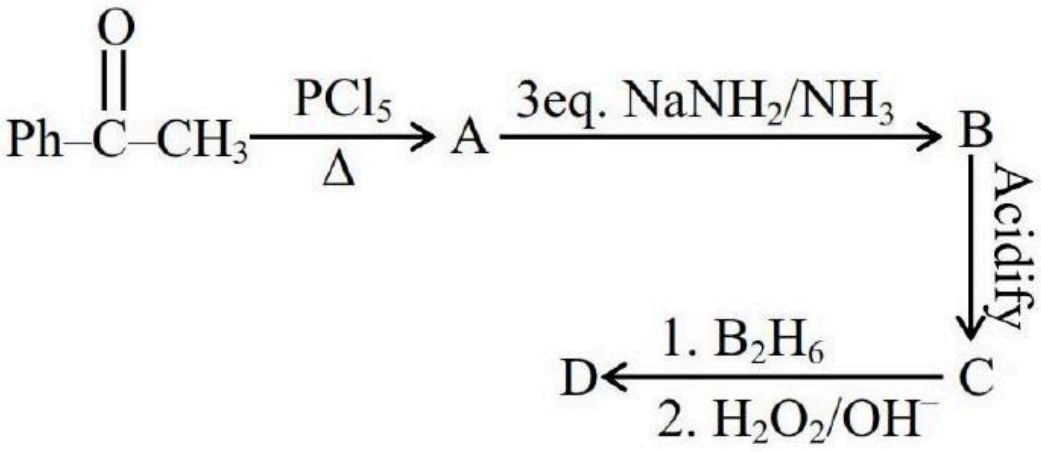
Correct answer: D

Source solution



Question 265

Identify the structure of the final product (D) in the following sequence of the reactions :



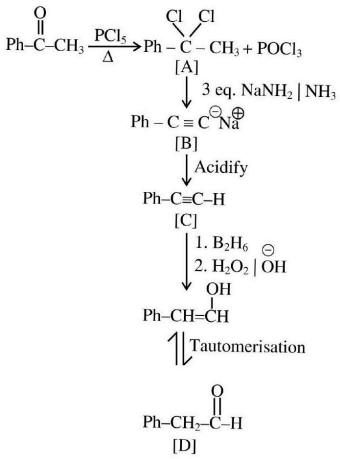
Total number of $\mathbf{sp^2}$ hybridised carbon atoms in product D is.

Numerical answer: _____

Enter an integer (0 digits after the decimal point). Round to the nearest integer where requested; enter the coefficient of any power of ten shown in the question.

Correct answer: 7

Source solution

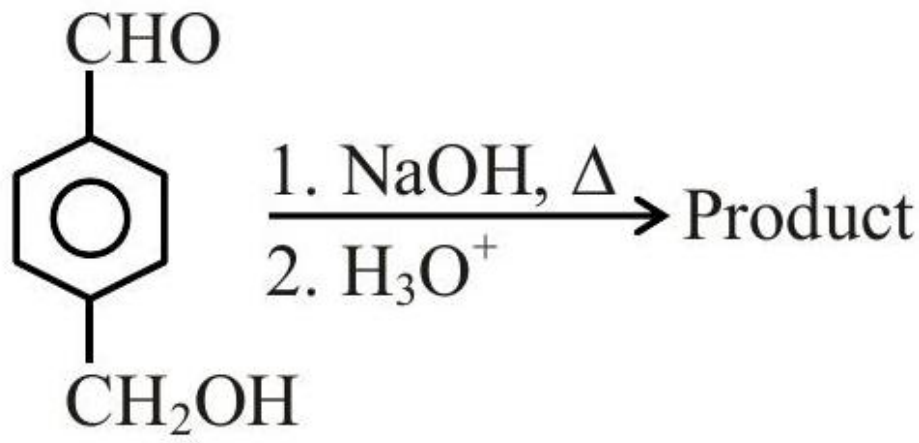


$\Rightarrow$ Number of $\mathbf{sp^2C}$-atoms in product $\mathbf{D = 7}$

NTA Ans. $= 7$ ALLEN Ans. $= 7$

Question 266

For the reaction given below:



. The compound which is not formed as a product is a:

A. Compound with both alcohol and acid functional groups

B. Monocarboxylic acid

C. Dicarboxylic acid

D. Diol

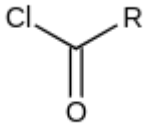
Correct answer: C

Source solution

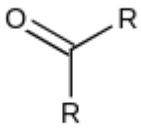
Cannizzaro disproportionation forms a diol and a hydroxy monocarboxylic acid. A dicarboxylic acid is not formed; option 3.

Question 267

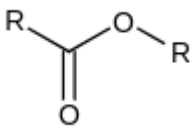
(A)



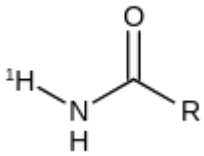
(B)



(C)



(D)



The correct order of their reactivity towards hydrolysis at room temperature is :

A. > (B) > (C) > (D)

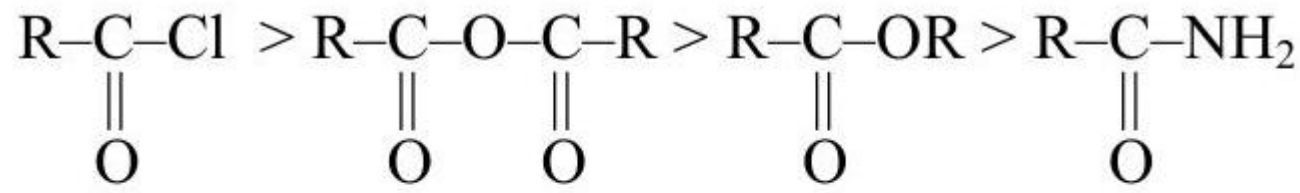
B. (D) > (A) > (B) > (C)

C. (D) > (B) > (A) > (C)

D. (A) > (C) > (B) > (D)

Correct answer: A

Source solution



Reactivity towards Hydrolysis A > B > C > D

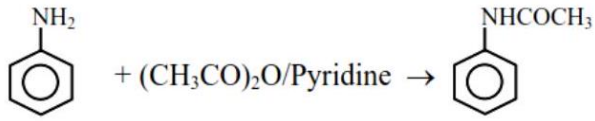
Amines

Questions 268-278 / 11 selected / 3.7% practice weight / Focus first

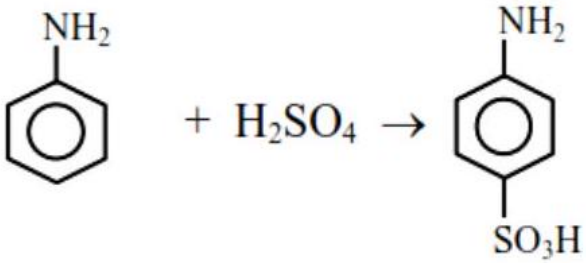
Question 268

Which one of the following reactions does not occur?

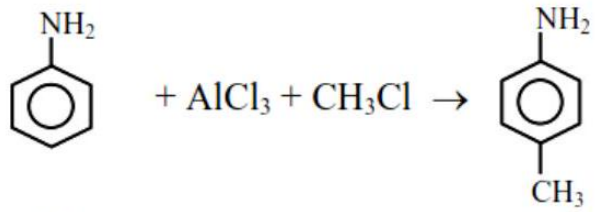
A.



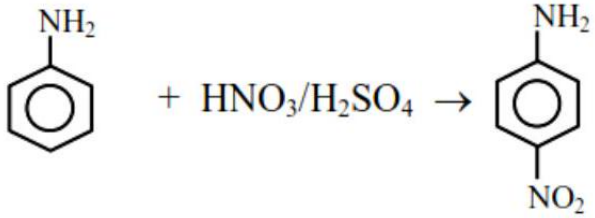
B.



C.

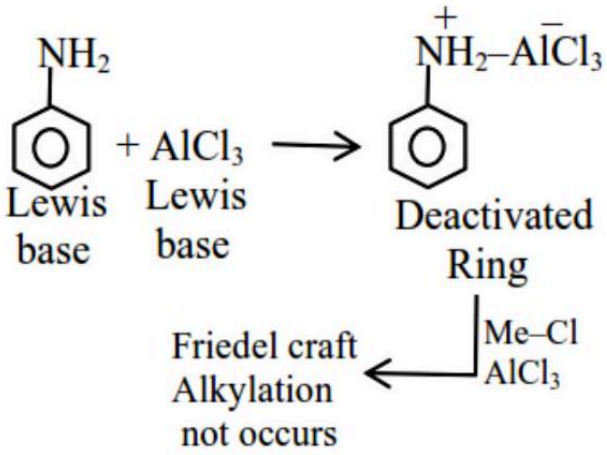


D.



Correct answer: C

Source solution



Aniline is lewis base give acid base reaction with $AlCl_3$ and form Anilinium ion Anilinium ion has strongest deactivated ring so further Friedel craft Alkylation not occurs.

Question 269

Match List I with List II

List I	List II
A. Benzenesulphonyl chloride	I. Test for primary amines
B. Hoffmann bromamide reaction	II. Anti Saytzeff
C. Carbylamine reaction	III. Hinsberg reagent
D. Hoffmann orientation	IV. Known reaction of Isocyanates.

Choose the correct answer from the options given below:

A. A-IV, B -III, C-II, D-I

B. A-IV, B -II, C-I, D-III

C. (2) Hoffmann bromamide reaction $\rightarrow$ known reaction of isocynates

$$\mathbf{R-CO-NH_2 + X_2 + 4NaOH \rightarrow R-NH_2 + 2NaX + Na_2CO_3 + 2H_2O}$$

Intermediate : $\mathbf{R-N=C=O}$ (isocyanate)

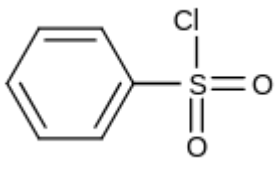
D. (3) A-III, B -IV, C-I, D-II

Correct answer: C

Source solution

Sol. (1)

Benzen sulphonyl chloride



Question 270

Match List I with List II

LIST I (Amines)		LIST II pK_b)	
A.	Aniline	I.	3.25
B.	Ethanamine	II.	3.00
C.	N-Ethylethanamine	III	9.38
D.	N. N-Diethylethanamine	IV.	3.29

Choose the correct answer from the options given below:

A. A-III, B-IV, C-II, D-I

B. A-III, B-II, C-I, D-IV

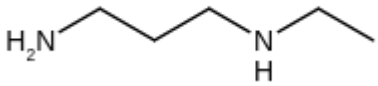
C. A-I, B-IV, C-II, D-III

D. A-III, B-II, C-IV, D-I

Correct answer: A

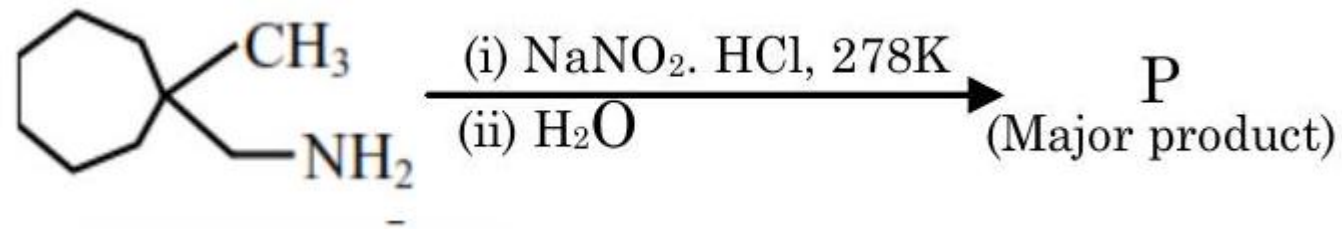
Source solution

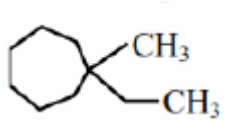
Sol. 1}
Basicity order
pKb : 3.00, pKb : **3.25** pKb : **3.29** pKb : 9.38

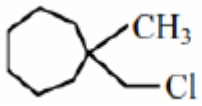


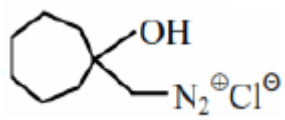
Question 271

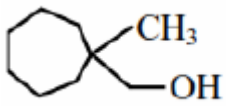
What is the major product "P" of the following reaction ?



A. 

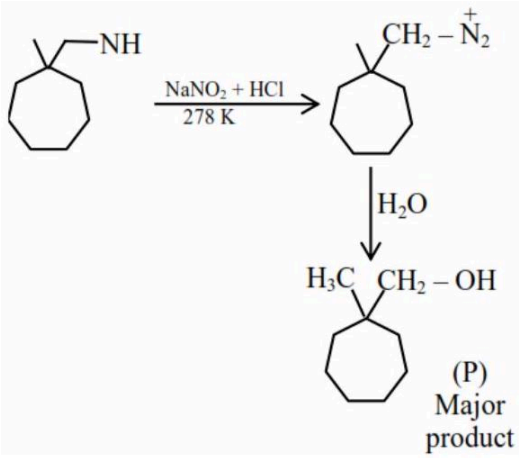
B. 

C. 

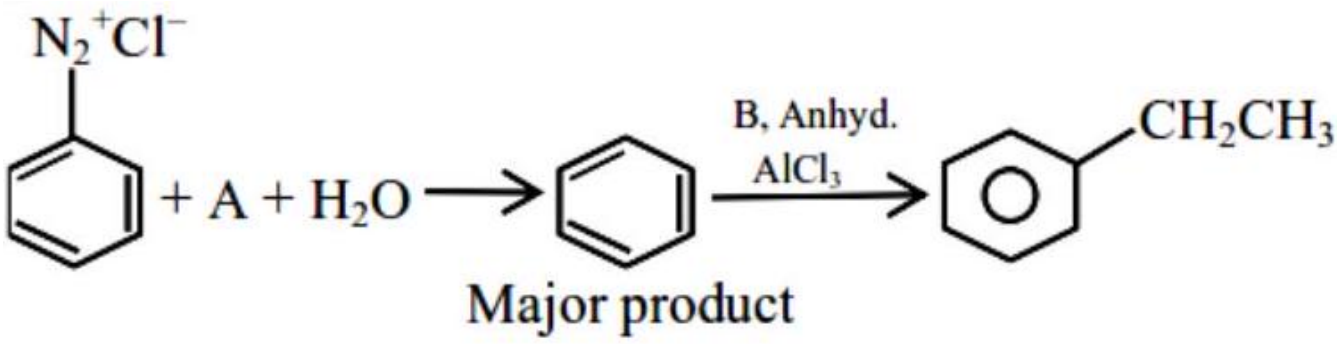
D. 

Correct answer: D

Source solution



Question 272



In the chemical reactions given above A and B respectively are :

A. H_3PO_2 and CH_3CH_2Cl

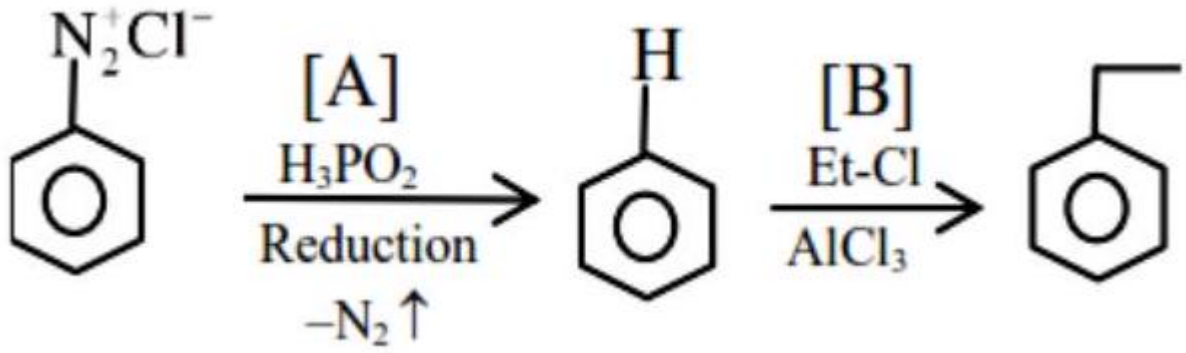
B. CH_3CH_2OH and H_3PO_2

C. H_3PO_2 and $CH_3CH_2PO_2$

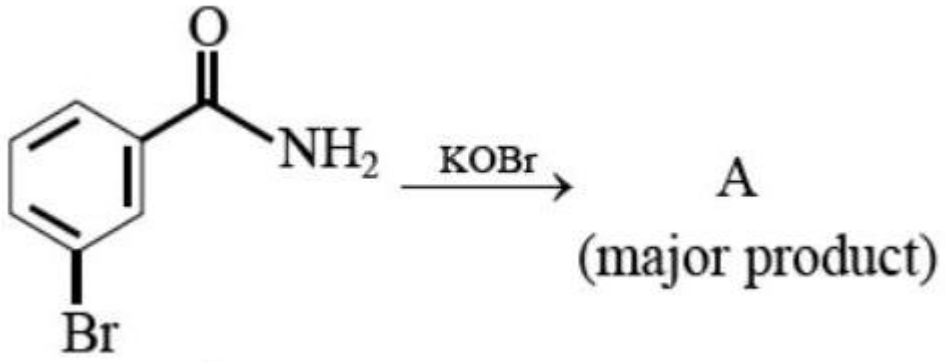
D. CH_3CH_2Cl and H_3PO_2

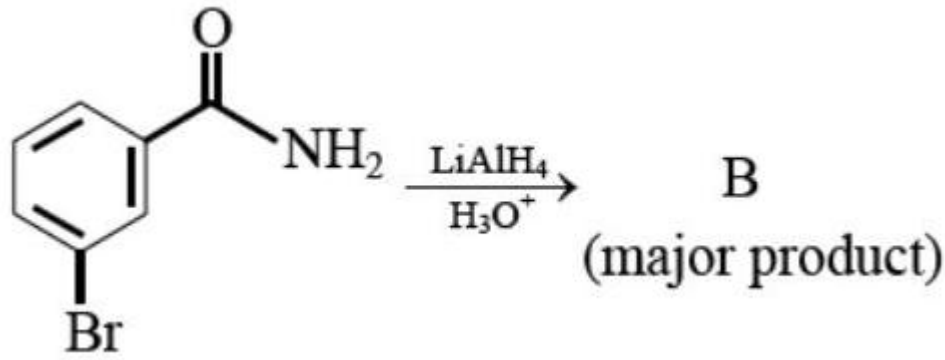
Correct answer: A

Source solution

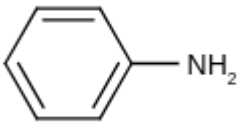


Question 273

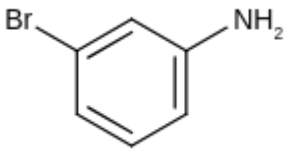




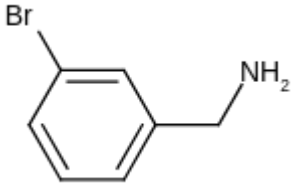
In the above reactions, product A and product B respectively are :

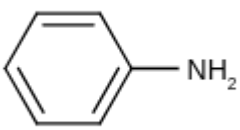


A. ,

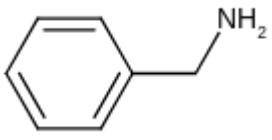


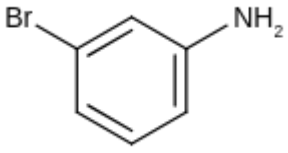
B. ,



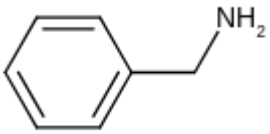


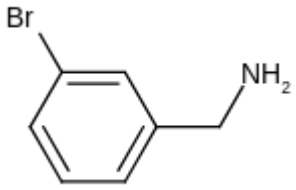
C. ,





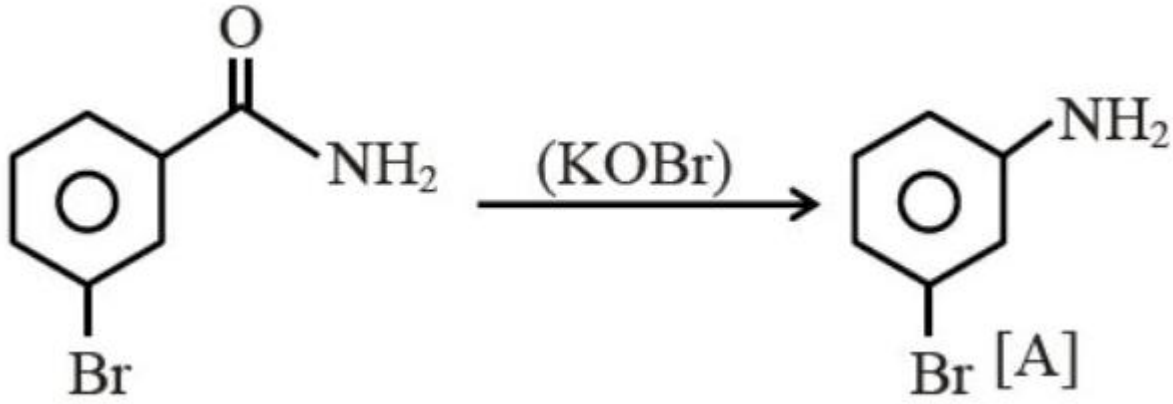
D. ,

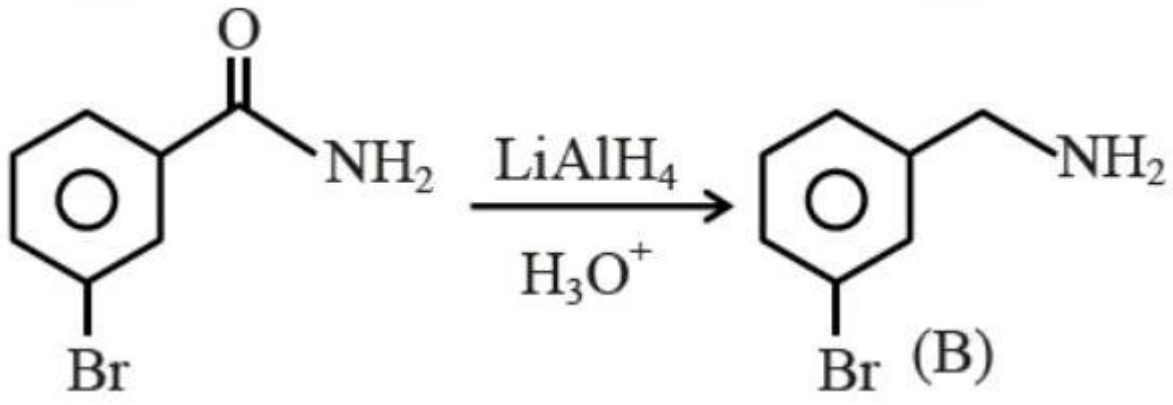




Correct answer: D

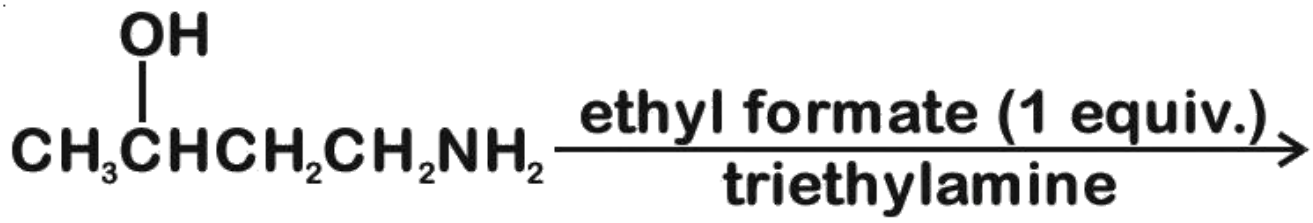
Source solution





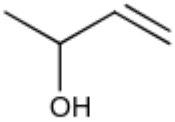
Question 274

The major product of the following reaction is:

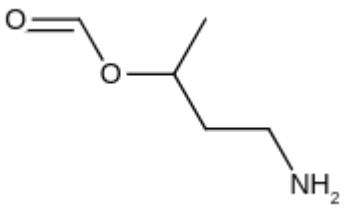


A. $CH_3CH = CH - CH_2NH_2$

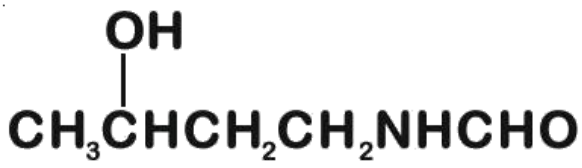
B.



C.



D.

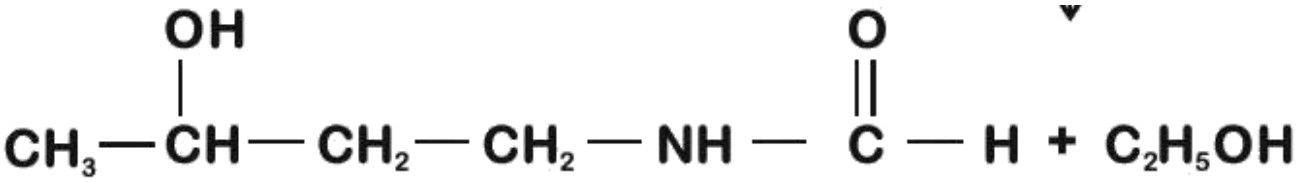


Correct answer: D

Source solution

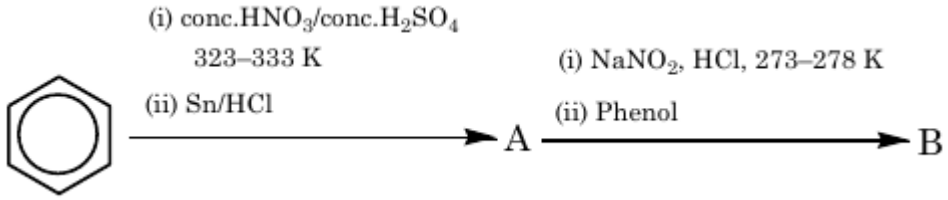
Sol.

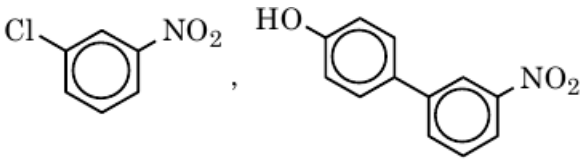
The acylation of NH_2 group takes place and not of OH group due to lower electronegativity of N -atom.

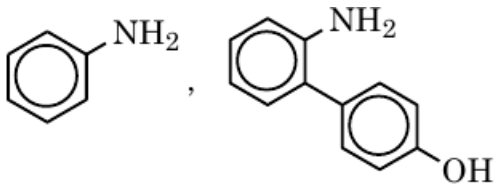


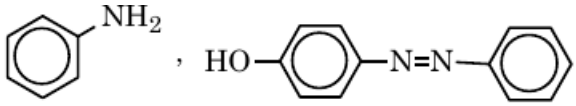
Question 275

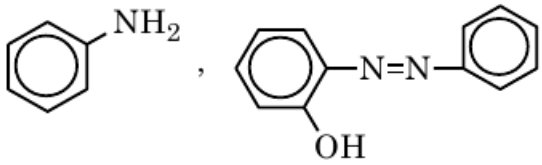
The products A and B formed in the following reaction scheme are respectively:



A. 

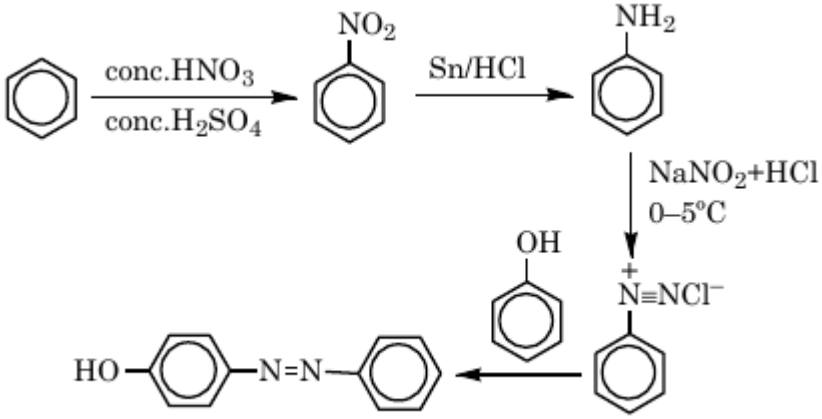
B. 

C. 

D. 

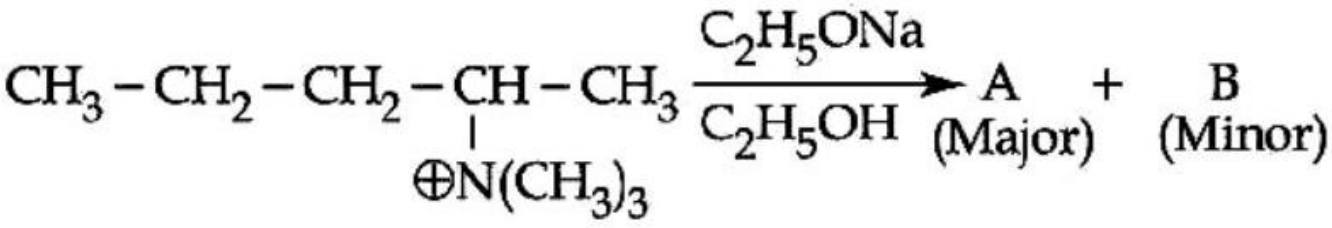
Correct answer: C

Source solution



Question 276

Identify the correct statement for the below given transformation.



A. $\mathbf{A} - CH_3CH_2CH = CH - CH_3$,
$\mathbf{B} - CH_3CH_2CH_2CH = CH_2$,
Saytzeff products

B. $\mathbf{A} - CH_3CH_2CH = CH - CH_3$,
$\mathbf{B} - CH_3CH_2CH_2CH = CH_2$,
Hafmann products

C. $\mathbf{A} - CH_3CH_2CH_2CH = CH_2$,
$\mathbf{B} - CH_3CH_2CH = CHCH_3$,
Hofmann products

D. $\mathbf{A} - CH_3CH_2CH_2CH = CH_2$,
$\mathbf{B} - CH_3CH_2CH = CHCH_3$,
Saytzeff products

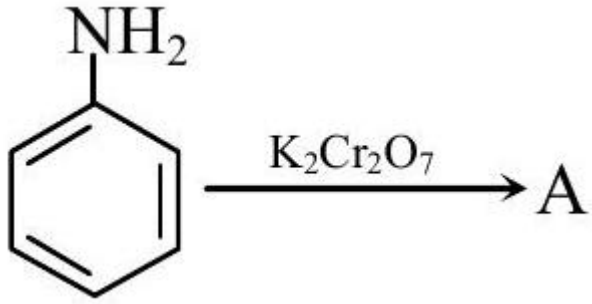
Correct answer: C

Source solution

The quaternary ammonium group undergoes Hofmann elimination. The less substituted pent-1-ene is major A and pent-2-ene is minor B. Option 3 has both structures and the Hofmann label.

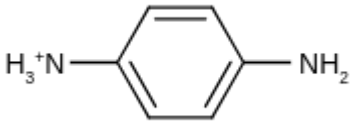
Question 277

Identify A in the following reaction.

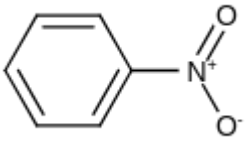




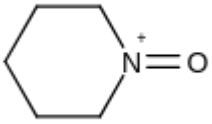
A.



B.



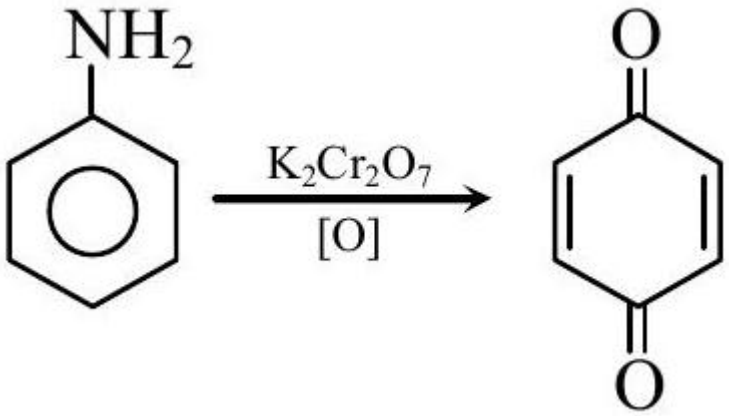
C.



D.

Correct answer: A

Source solution

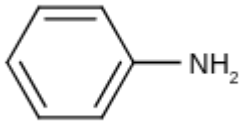


[A]

Question 278

Which among the following react with Hinsberg's reagent?

(A)



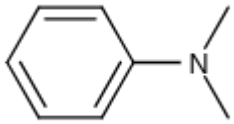
A. B and D only

B. C and D only

C. (2)

(C) $CH_3 - NH_2$

D. (3) A, B and E only



Correct answer: D

Source solution

Sol. (4)

B and D are 3° amine which does not have replaceable H on N , So does not react.

SECTION-B}

Biomolecules

Questions 279-292 / 14 selected / 4.7% practice weight / Focus first

Question 279

Match List-I with List-II.

	List-I Reaction		List-II Catalyst
(A)	$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$	(I)	NO(g)
(B)	$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	(II)	$H_2SO_4(l)$
(C)	$C_{12}H_{22}O_{11}(aq) + H_2O(l) \rightarrow C_6H_{12}O_6(\text{Glucose}) + C_6H_{12}O_6(\text{Fructose})$	(III)	Pt(s)
(D)	$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$	(IV)	Fe(s)

Choose the correct answer from the options given below:

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

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

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

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

Correct answer: C

Source solution

(a) $4NH_3(g) + 5O_2(g) \xrightarrow{Pt(s)} 4NO(g) + 6H_2O(g)$ Ostwald process 500 K

(b) $N_2 + 3H_2 \xrightarrow{Fe(s)} 2NH_3(g)$

Haber's process

(c) $C_{12}H_{22}O_{11}$ (aq.) $+H_2O(\ell) \xrightarrow{H^+} \underset{\text{(glu cose)}}{C_6H_{12}O_6} + \underset{\text{(fructose)}}{C_6H_{12}O_6}$

Inversion of sugar cane

(d) $2SO_2(g) + O_2(g) \xrightarrow{NO(g)} 2SO_3(g)$

Question 280

Match List I with List II}

List I Enzymatic reaction		List II Enzyme	
A	Sucrose $\rightarrow$ Glucose and Fructose	I.	Zymase
B	Glucose $\rightarrow$ ethyl alcohol and CO_2	II.	Pepsin
C	Starch $\rightarrow$ Maltose	III.	Invertase
D	Proteins $\rightarrow$ Amino acids	IV.	Diastase

Choose the correct answer from the options given below:

A. A-III, B-I, C-II, D-IV

B. A-I, B-IV, C-III, D-II

C. A-III, B-I, C-IV, D-II

D. A-I, B-II, C-IV, D-III

Correct answer: C

The source provides a brief answer only. A detailed worked solution is not available for this question.

Source solution

Sol. Factual

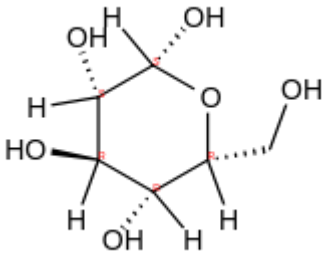
Question 281

Match items of Row I with those of Row II.

Row I
(A)
(i) $\alpha - \mathbf{D} - (-)$-Fructofuranose,

Row II
(B)
(C)
(D)
(iii) $\alpha - D - (-)$ Glucopyranose,
(iv) $\beta - D - (-)$-Glucopyranose
(ii) $\beta - \mathbf{D} - (-)-$ Fructofuranose
(ii) $\alpha - D$ ( ) Glucopyanose,

Correct match is



A. $\mathbf{A \rightarrow i, B \rightarrow ii, C \rightarrow ii, D \rightarrow iv}$

B. A $\rightarrow$ iv, B $\rightarrow$ iii, C $\rightarrow$ i, D $\rightarrow$ ii

C. A $\rightarrow$ iii, B $\rightarrow$ iv, C $\rightarrow$ ii, D $\rightarrow$ I

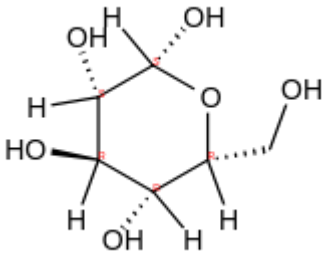
D. A $\rightarrow$ iii, B $\rightarrow$ iV, C $\rightarrow$ i, D $\rightarrow$ ii

---

Correct answer: D

Source solution

Sol. 4
$\alpha - D - (-)$ Glucopyranose
$\beta - D - (-)$-Glucopyranose
$\alpha - \mathbf{D} - (-)$-Fructofuranose
$\beta - \mathbf{D} - (-)-$ Fructofuranose


H
OH
OH
O
H
OH
HO
H
OH
H
H

Question 282

Match List-I with List-II

List-I}
(Saccharides)
(A) Sucrose
(B) Maltose
(C) Lactose
(D) Amylopectin

List_II
(Glycosidic-linkages found)
(I) α 1-4
(II) $\alpha 1-4$ and $\alpha 1-6$
(III) $\alpha 1-\beta 2$
(IV) $\beta 1-4$

Choose the correct answer from the options given below :

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

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

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

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

Correct answer: A

Source solution

Sol. (A) Sucrose $\rightarrow \alpha_1-\beta_2$ Glycosidic linkage
(B) Maltose $\rightarrow \alpha$ 1-4 Glycosidic linkage
(C) Lactose $\rightarrow \beta$ 1-4 Glycosidic linkage
(D) Amylopectin $\rightarrow \alpha 1-4$ and $\alpha 1-6$

Glycosidic linkage
A-III, B-I, C-IV, D-II

Question 283

Match List I with List II.

List I Enzyme	c Conversion of
A. Invertase	I. Starch into maltose
B. Zymase	II. Maltose into glucose
C. Diastase	III. Glucose into ethanol
D. Maltase	IV. Cane sugar into glucose

Choose the most appropriate answer from the options given below :

A. A-III, B-IV. C-II. D-I

B. A-III. B-II. C-I. D-IV

C. A-IV, B-IIL C-I. D-II

D. A-IV, B-II. C-III. D-I

Correct answer: C

Source solution

Sol. Invertase : Cane sugar $\rightarrow$ Glucose and fructose
Zymase : Glucose $\rightarrow$ Ethanol and CO_2
Diastase : Starch $\rightarrow$ Maltose
Maltase : Maltose $\rightarrow$ Glucose

Question 284

Match List I with List II

LIST-I		LIST-II	
A.	Glucose/$NaHCO_3/\Delta$	I.	Gluconic acid
B.	Glucose/ HNO_3	II.	No reaction
C.	Glucose/HI/ Δ	III.	n-hexane
D.	Glucose/Bromine water]	IV.	Saccharic acid

Choose the correct answer from the options given below:

A. A-IV, B-I, C-III, D-II

B. A-II, B-IV, C-III, D-I

C. A-III, B-II, C-I, D-IV

D. A-I, B-IV, C-III, D-II

Correct answer: B

Source solution

Sol. Glucose $\xrightarrow[\Delta]{NaHCO_3}$ no reaction

Glucose $\xrightarrow[\Delta]{HNO_3}$ saccharic acid

Glucose $\xrightarrow[\Delta]{HI}$ n-hexane

Glucose $\xrightarrow[\Delta]{Br_2}$ Gluconic acid

Question 285

Match List I with List II

	LIST I		LIST II
A.	α - Glucose and α-Galactose	I.	Functional isomers
B.	α - Glucose and β-Glucose	II.	Homologous
C.	α - Glucose and α-Fructose	III.	Anomers
D.	α - Glucose and α-Ribose	IV.	Epimers

Choose the correct answer from the options given below:

A. A-III, B-IV, C-II, D-I

B. A-III, B-IV, C-I, D-II

C. A-IV, B-III, C-I, D-II

D. A-IV, B-III, C-II, D-I

Correct answer: C

Source solution

Sol. Based on biomolecules theory and structure of these named compounds -
(A) α-Glucose and α-Galactose (IV) Epimers.
(B) α-Glucose and β-Glucose (III) Anomers
(C) α-Glucose and α-Fructose (I) Functional isomers
(D) α-Glucose and α-Ribose (II) Homologous

Question 286

Match List I with List II

List I Bio Polymer)		List II (Monomer)	
A.	Starch	I.	nucleotide
B.	Cellulose	II.	α-glucose
C.	Nucleic acid	III.	β-glucose
D.	Protein	IV.	α-amino acid

Choose the correct answer from the options given below :-

A. A-II, B-I, C-III, D-IV

B. A-IV, B-II, C-I, D-III

C. A-I, B-III, C-IV, D-II

D. A-II, B-III, C-I, D-IV

Correct answer: D

Source solution

Sol. A-II, B-III, C-I, D-IV
Fact based.

Question 287

Match List-I with List-II

	List-I (Disaccharide)		List-II (Constituent monosaccharides)
(a)	Sucrose	(i)	β-D-Galactose and β-D-Glucose
(b)	Lactose	(ii)	α-D-Glucose and β-D-Fructose
(c)	Maltose	(iii)	α-D-Glucose and α-D-Glucose

Choose the correct answer from the options given below.

A. (a)-(iii), (b)-(ii), (c)-(i)

B. (a)-(iii), (b)-(i), (c)-(ii)

C. (a)-(i), (b)-(iii), (c)-(ii)

D. (a)-(ii), (b)-(i), (c)-(iii)

Correct answer: D

Source solution

Sol. Sucrose $\rightarrow$ α-D- Glucose and β-D- Fructose
Lactose $\rightarrow$ β-D- Galactose and β-D- Glucose
Maltose $\rightarrow$ α-D- Glucose and α-D- Glucose

Question 288

Match List I with List II.

List I
A. Zymase
B. Diastase
C. Urease
D. Pepsin

List II
I. Stomach
II. Yeast
III. Malt
IV. Soyabean

Choose the correct answer from the options given below:

A. A-II, B-III, C-I, D-IV

B. A-II, B-III, C-IV, D-I

C. A-III, B-II, C-IV, D-I

D. A-III, B-II, C-I, D-IV

Correct answer: B

Source solution

Sol. Zymase naturally occurs in yeast.
Diastase is found in malt.
Urease is found in soyabean
Pepsin is found in stomach

Question 289

Match List-I with List-II.

List-I

List-II

(A) Adenine

(I)

(B) Cytosine

(II)

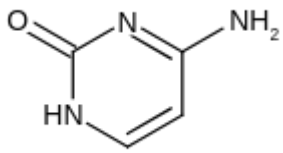
(C) Thymine

(III)

(D) Uracil

(IV)

Choose the correct answer from the options given below:



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

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

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

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

Correct answer: A

Source solution

Sol.

(A) Adenine

(III)

(B)

Cytosine

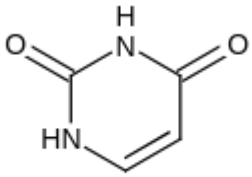
(IV)

(C) Thymine

(II)

(D) Uracil

(I)



Question 290

Match List - I with List - II.

List - I
(Carbohydrate)}
List - II
(Linkage}
Source)}
(A) Amylose
(B) Cellulose
(C) Glycogen
(D) Amylopectin
(I) $\beta - C_1 - C_4$, plant
(II) $\alpha - C_1 - C_4$, animal
(III) $\alpha - C_1 - C_4$,
$\alpha - C_1 - C_6$, plant
(IV) $\alpha - C_1 - C_4$, plant

Choose the correct answer form the options given below:

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

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

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

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

Correct answer: B

Source solution

Sol. Informative

Question 291

The correct match between Item -I and ItemII is :

Item - I (drug)		Item - II (test)	
(A)	Chloroxylenol	(P)	Carbylamine Test
(B)	Norethindrone	(Q)	Sodium Hydrogen carbonateTest
(C)	Sulphapyridine	(R)	Ferric chloride test
(D)	Penicillin	(S)	Bayer's test

A. $\mathrm{A} \rightarrow \mathrm{Q}; \mathrm{B} \rightarrow \mathrm{P}; \mathrm{C} \rightarrow \mathrm{S}; \mathrm{D} \rightarrow \mathrm{R}$

B. $\mathrm{A} \rightarrow \mathrm{R}; \mathrm{B} \rightarrow \mathrm{P}; \mathrm{C} \rightarrow \mathrm{S}; \mathrm{D} \rightarrow \mathrm{Q}$

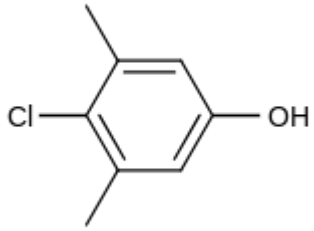
C. $\mathrm{A} \rightarrow \mathrm{R}; \mathrm{B} \rightarrow \mathrm{S}; \mathrm{C} \rightarrow \mathrm{P}; \mathrm{D} \rightarrow \mathrm{Q}$

D. $\mathrm{A} \rightarrow \mathrm{Q}; \mathrm{B} \rightarrow \mathrm{S}; \mathrm{C} \rightarrow \mathrm{P}; \mathrm{D} \rightarrow \mathrm{R}$

Correct answer: C

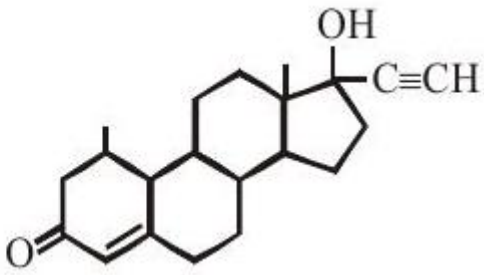
Source solution

(A) Chloroxylenol

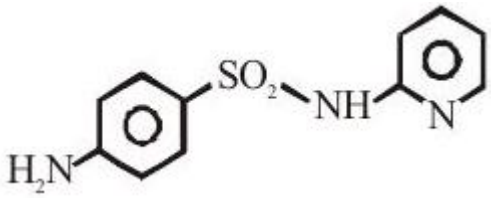


(B)

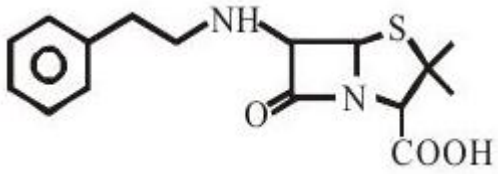
Norethindrone



(C) Sulphapyridine



(D) Penicllin



Question 292

The correct match between item I and item II is

Item I		Item II	
(A)	Allosteric effect	(P)	Molecule binding to the active site of enzyme
(B)	Competitive inhibitor	(Q)	Molecule crucial for communication in the body
(C)	Receptor	(R)	Molecule binding to a site other than the active site of enzyme
(D)	Poison	(S)	Molecule binding to the enzyme covalently

A. $(A) \rightarrow (P); (B) \rightarrow (R); (C) \rightarrow (S); (D) \rightarrow (Q)$

B. $(A) \rightarrow (R); (B) \rightarrow (P); (C) \rightarrow (S); (D) \rightarrow (Q)$

C. $(A) \rightarrow (P); (B) \rightarrow (R); (C) \rightarrow (Q); (D) \rightarrow (S)$

D. $(A) \rightarrow (R); (B) \rightarrow (P); (C) \rightarrow (Q); (D) \rightarrow (S)$

Correct answer: D

The source provides a brief answer only. A detailed worked solution is not available for this question.

Source solution

Practical Chemistry (NCERT Laboratory Manual)

Questions 293-295 / 3 selected / 1.0% practice weight / Consolidate

Question 293

Match List I with List II

List I (Anion)	List II (Gas evolved on reaction with dil. H_2SO_4)
A. CO_3^{2-}	I. Colourless gas which turns lead acetate paper black
B. S^{2-}	II. Colourless gas which turns acidified potassium dichromate solution green.
C. SO_3^{2-}	III. Brown fumes which turns acidified KI solution containing starch blue.
D. NO_2^-	IV. Colourless gas evolved with brisk effervescence, which turns lime water milky.

Choose the correct answer from the options given below:

A. A-III, B-I, C-II, D-IV

B. A-II, B-I, C-IV, D-III

C. A-IV, B-I, C-III, D-II

D. A-IV, B-I, C-II, D-III

Correct answer: D

Source solution

CO_3^{2-} will give $CO_2(g)$ which will turns lime water milky.
S^{2-} will give $H_2S(g)$, will turns lead acetate paper black

SO_3^{2-} will give $SO_2(g)$, which will turns acidified potassium dichromate solution green.
NO_2^- will give brown $NO_2(g)$ will turn KI solution blue.

Question 294

For reaction: $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$
$K_p = 2 \times 10^{12}$ at $27°C$ and 1 atm pressure. The K_c for the same reaction is $\times 10^{13}$. (Nearest integer) (Given $R = 0.082\ L\ atm\ K^{-1}\ mol^{-1}$)

Numerical answer: _____

Enter the requested value (an integer; 0 decimal places). Use the units and scaling stated in the question.

Correct answer: 1

Source solution

$K_c = 1 \times 10^{13}$
$SO_2(g) + \frac{1}{2}O_2 \rightleftharpoons SO_3(g)$
$\Delta n = \frac{-1}{2}$
$K_P = 2 \times 10^{12}$
$K_P = K_C(RT)^{\Delta^{ng}}$
$P = 1\ atm$
$2 \times 10^{12} = K_C(0.082 \times 300)^{-1/2}$
$T = 27°C$
$K_c = 1 \times 10^{13}$

Question 295

Match the List-I with List-II

List-I	List-II
Cations	Group reagents
$A \rightarrow Pb^{2+}, Cu^{2+}$	i) H_2S gas in presence of dilute HCl
$B \rightarrow Al^{3+}, Fe^{3+}$	ii) $(NH_4)_2CO_3$ in presence of NH_4OH
$C \rightarrow Co^{2+}, Ni^{2+}$	iii) NH_4OH in presence of NH_4Cl
$D \rightarrow Ba^{2+}, Ca^{2+}$	iv) H_2S in presence of NH_4OH

Correct match is -

A. A $\rightarrow$ iii, B $\rightarrow$ i, C $\rightarrow$ iv, D $\rightarrow$ ii

B. $A \rightarrow$ i, $B \rightarrow$ iii, $C \rightarrow$ ii, $D \rightarrow$ iv

C. $A \rightarrow$ iv, $B \rightarrow$ ii, $C \rightarrow$ iii, $D \rightarrow$ i

D. A $\rightarrow$ i, B $\rightarrow$ iii, C $\rightarrow$ iv, D $\rightarrow$ ii

Correct answer: D

Source solution

Cations	Group No.	Group reagents
Pb^{2+}, Cu^{2+}	II	$H_2S + HCl$
Al^{3+}, Fe^{3+}	III	$NH_4Cl + NH_4OH$
Co^{2+}, Ni^{2+}	IV	$NH_4OH + H_2S$
Ba^{2+}, Ca^{2+}	V	NH_4OH, Na_2CO_3

Hydrogen

Questions 296-297 / 2 selected / 0.7% practice weight / Historical appendix

Question 296

In basic medium, $\mathbf{H_2O_2}$ exhibits which of the following reactions ?
(A) $\mathbf{Mn^{2+} \rightarrow Mn^{4+}}$
(B) $\mathbf{I_2 \rightarrow I^-}$
(C) $\mathbf{PbS \rightarrow PbSO_4}$

Choose the most appropriate answer from the options given below :

A. , (C) only

B. (A) only

C. (B) only

D. (A), (B) only

Correct answer: D

Source solution

In basic medium, oxidising action of $\mathbf{H_2O_2}$. $\mathbf{Mn^{2+} + H_2O_2 \rightarrow Mn^{+4} + 2OH^-}$
In basic medium, reducing action of $\mathbf{H_2O_2}$ $\mathbf{I_2 + H_2O_2 + 2OH^- \rightarrow 2I^- + 2H_2O + O_2}$
In acidic medium, oxidising action of $\mathbf{H_2O_2}$. $\mathbf{PbS(s) + 4H_2O_2(aq) \rightarrow PbSO_4(\ s) + 4H_2O(\ell)}$ Hence correct option (4)

Question 297

Match List I with List II

LIST I		LIST II	
A.	Cobalt catalyst	I.	$(H_2 + Cl_2)$ production
B.	Syngas	II.	Water gas production
C.	Nickel catalyst	III.	Coal gasification
D.	Brine solution	IV.	Methanol production

Choose the correct answer from the options given below:

A. A-IV, B-I, C-II, D-III

B. A-IV, B-III, C-II, D-I

C. A-II, B-III, C-IV, D-I

D. A-IV, B-III, C-I, D-II

Correct answer: B

Source solution

(a) Cobalt catalyst $\rightarrow$ methanol production.
(b) Syngas $\rightarrow$ coal gasification
(c) Nickel Catalyst $\rightarrow$ water gas production .
(d) Brine solution $\rightarrow$ $H_2 + Cl_2$ production.

The s-Block Elements

Questions 298-298 / 1 selected / 0.3% practice weight / Historical appendix

Question 298

Match List-I with List-II :

List-I	List-II
A. K	I. Thermonuclear reactions
B. KCl	II. Fertilizer
C. KOH	III. Sodium potassium pump
D. Li	IV. Absorbent of CO_2

Choose the correct answer from the options given below :

A. A-III, B-II, C-IV, D-I

B. A-IV, B-I, C-III, D-II

C. A-IV, B-III, C-I, D-II

D. A-III, B-IV, C-II, D-I

Correct answer: A

Source solution

K^+- Sodium - Potassium Pump
KCl -Fertiliser
KOH - absorber of CO_2
Li - used in thermonuclear reactions

Surface Chemistry

Questions 299-300 / 2 selected / 0.7% practice weight / Historical appendix

Question 299

Which of the following represent the Freundlich adsorption isotherms?

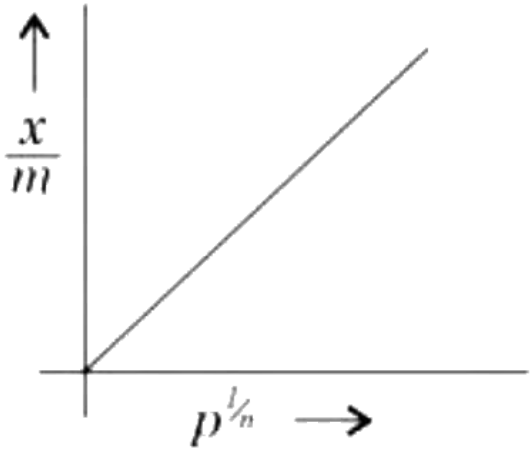
(A)

(B)

(C)

(D)

Choose the correct answer from the options given below:



A. B, C, D only

B. A, B, D only

C. A, B only

D. A, C, D only

Correct answer: B

Source solution

Sol. $\frac{x}{m} = kp^{1/n}$

and $\log \frac{x}{m} = \log k + \frac{1}{n}\log P$

Question 300

Match List I with List II

LIST I		LIST II	
A.	Physisorption	I.	Single Layer Adsorption
B.	Chemisorption	II.	$20 - 40\ \mathbf{kJ\ mol^{-1}}$
C.	$\mathbf{N_2(g) + 3H_2(g) \xrightarrow{Fe(s)} 2NH_3(g)}$	III.	Chromatography
D.	Analytical Application or Adsorption	IV.	Heterogeneous catalysis

Choose the correct answer from the options given below:

A. A - II, B - I, C - IV, D - III

B. A - IV, B - II, C - III, D - I

C. A - II, B - III, C - I, D - IV

D. A - III, B - IV, C - I, D - II

Correct answer: A

Source solution

Sol. 1}
Theory based