DPP - Daily Practice Problems

Date : | **Start Time :** | **End Time :**

CHEMISTRY

CC11

SYLLABUS : Hydrocarbons

Max. Marks : 74 **Time : 60 min.**

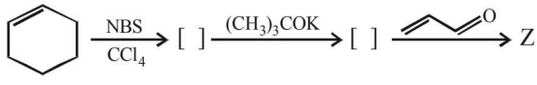
GENERAL INSTRUCTIONS

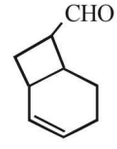
- The Daily Practice Problem Sheet contains 20 Questions divided into 5 sections.
  Section I has **6** MCQs with ONLY 1 Correct Option, **3** marks for each correct answer and **–1** for each incorrect answer.
  Section II has **4** MCQs with ONE or MORE THAN ONE Correct options.
  For each question, marks will be awarded in one of the following categories:
  Full marks: **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  Partial marks: **+1** For darkening a bubble corresponding to each correct option provided NO INCORRECT option is darkened.
  Zero marks: If none of the bubbles is darkened.
  Negative marks: **–2** In all other cases.
  Section III has **4** Single Digit Integer Answer Type Questions, **3** marks for each Correct Answer and 0 marks in all other cases.
  Section IV has Comprehension/Matching Cum-Comprehension Type Questions having **4** MCQs with ONLY ONE correct option, **3** marks for each Correct Answer and 0 marks in all other cases.
  Section V has **2** Matching Type Questions, **2** mark for the correct matching of each row and 0 marks in all other cases.
- You have to evaluate your Response Grids yourself with the help of Solutions.

Section I - Straight Objective Type

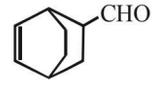
This section contains 6 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** is correct.

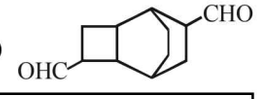
1. The final product Z in the following reaction is



(a) 

(b) 

(c) 

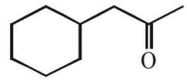
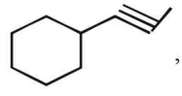
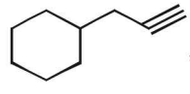
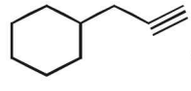
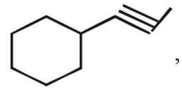
(d) 

RESPONSE GRID	1. ⓐⓑⓒⓓ

Space for Rough Work

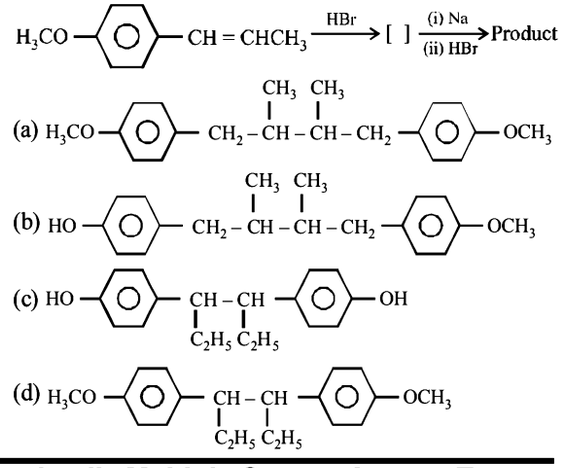
2. Methane can be chlorinated by
   (i) treating with chlorine in presence of UV light
   (ii) heating with chlorine in presence of tetraethyl lead
   (iii) treating with tert-butyl hypochlorite in presence of UV light
   (a) only method (i)
   (b) by methods (i) and (ii)
   (c) by methods (i) and (iii)
   (d) by methods (i), (ii) and (iii)

3. The gas liberated by the electrolysis of Dipotassium succinate solution is
   (a) Ethane (b) Ethyne
   (c) Ethene (d) Propene

4. Choose the correct alkyne and reagents for the preparation of 
   (a)  , $HgSO_4$, H_2SO_4, H_2O
   (b)  , $HgSO_4$, H_2SO_4, H_2O
   (c)  , BH_3, H_2O_2, NaOH
   (d)  , BH_3, H_2O_2, NaOH

5. *n*-Propylbenzene can be obtained in quantitative yield by following method :
   (*i*) By treating benzene with *n*-propyl chloride in presence of $AlCl_3$
   (*ii*) By treating excess of benzene with *n*-propyl chloride in presence of $AlCl_3$
   (*iii*) By treating benzene with allyl chloride in presence of $AlCl_3$ followed by reduction
   (*iv*) By treating benzene with propinoyl chloride in presence of $AlCl_3$ followed by Clemmensen reduction.
   (a) By (ii), (iii) and (iv) (b) By (i), (iii) and (iv)
   (c) By (iii) and (iv) (d) By (ii) only

6. The final product in the following series of reactions should be



Section II - Multiple Correct Answer Type

This section contains 4 multiple correct answer(s) type questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONE OR MORE** is/are correct.

7. Which of the following statements are correct?
   (a) Monochlorination of ethane gives C_2H_5Cl only
   (b) Thermal or photochemical chlorination of C_2H_5Cl gives, 1, 1-dichloroethane and 1,2-dichloroethane
   (c) Chlorination of isobutane gives tertiary butyl chloride and isobutyl chloride in the ratio of 2 : 1 even though there are nine 1° H atoms in the compound in comparison to only one 3° H atom
   (d) Monochlorination of CH_4 is not possible

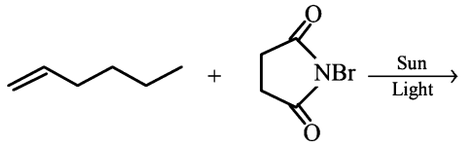
8. Which of the following method can not be used for preparation of CH_3-CH_3 ?
   (a) $CH_3Cl \xrightarrow{Zn/dust}$ (b) $CH_3CH_2Cl \xrightarrow{LiAlH_4}$
   (c) $Al_4C_3 \xrightarrow{H_2O/HCl}$ (d) $CaC_2 \xrightarrow{H_2O/H^+}$

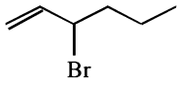
9. Propene (I), 2-methylpropene (II), and ethene (III), each containing one carbon-carbon double bond, is separately treated with HI under the same set of conditions. The order of reactivity for the three alkenes should be
   (a) I is more reactive than II as well as III
   (b) I is more reactive than III, but less than II
   (c) II is more reactive than both I and III
   (d) III is more reactive than I which is more reactive than II

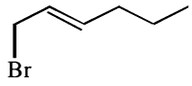
RESPONSE GRID					
	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ	6. ⓐⓑⓒⓓ
	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ		

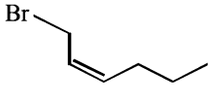
Space for Rough Work

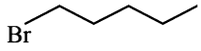
10. The possible compounds formed in the following reaction is



(a) 

(b) 

(c) 

(d) 

Section III - Integer Type

This section contains 4 questions. The answer to each of the questions is a single digit integer ranging from 0 to 9.

11. Number of monochloro derivatives (excluding stereoisomers), dichloro derivatives and trichloro derivatives of cyclopentane are n_1, n_2 and n_3 then $(n_1 + n_2)/n_3$ is equal to

12. How many stereoisomers are possible for dichlorocyclobutane?

13. On conversion into the Grignard reagent followed by treatment with water, how many alkyl bromides would yield isopentane?

14. Total no. of alkynes that on catalytic reduction gives 3-ethyl-4-methylheptane.

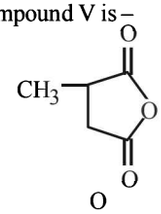
Section IV - Comprehension Type

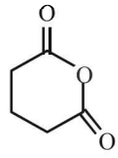
Directions (Qs. 15-18) : Based upon the given paragraphs, 4 multiple choice questions have to be answered. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** is correct.

PARAGRAPH-1

A hydrocarbon (X) of the formula C_6H_{12} does not react with bromine water but reacts with bromine in presence of light, forming compound (Y). Compound (Y) on treatment with alc. KOH gives compound [Z] which on ozonolysis gives (T) of the formula $C_6H_{10}O_2$. Compound (T) reduces Tollen's reagent and gives compound (W). (W) gives iodoform test and produces compound (U) which when heated with P_2O_5 forms a cyclic anhydride (V).

15. Compound V is –

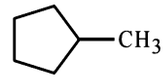
(a) 

(b) 

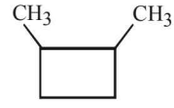
(c) 

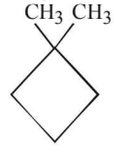
(d) OHC – CH = CH – CHO

16. Compound X is –

(a) 

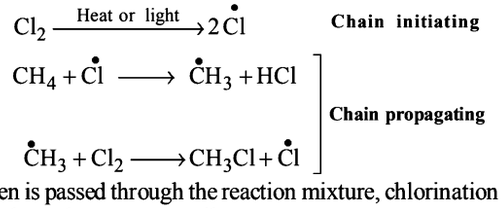
(b) 

(c) 

(d) 

PARAGRAPH-2

Chlorination of methane involves three steps : chain-initiating, chain-propagating and chain-terminating.



When oxygen is passed through the reaction mixture, chlorination of methane slows down temporarily.

17. Although chlorination of methane is an exothermic, the reaction requires high temperature because

(a) Activation energy is low

(b) Heat of reaction is negative

(c) Chain-initiating step is endothermic

(d) Chain-terminating step is endothermic

18. Temporary slow down of chlorination of methane in presence of oxygen in due to the formation of

(a) $CH_3OO^{\bullet}$ which is highly unstable and decomposes easily

(b) $CH_3OO^{\bullet}$ which is less reactive than $^{\bullet}CH_3$

(c) $ClO^{\bullet}$ which is highly reactive

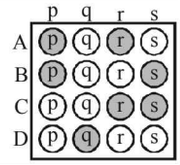
(d) a diradical $\dot{C}l\dot{O}$

RESPONSE GRID	
	10. ⓐⓑⓒⓓ **11.** ⓪①②③④⑤⑥⑦⑧⑨ **12.** ⓪①②③④⑤⑥⑦⑧⑨
	13. ⓪①②③④⑤⑥⑦⑧⑨ **14.** ⓪①②③④⑤⑥⑦⑧⑨
	15. ⓐⓑⓒⓓ **16.** ⓐⓑⓒⓓ **17.** ⓐⓑⓒⓓ **18.** ⓐⓑⓒⓓ

Space for Rough Work

Section V - Matrix-Match Type

This section contains 2 questions. It contains statements given in two columns, which have to be matched. Statements in column I are labelled as A, B, C and D whereas statements in column II are labelled as p, q, r and s. The answers to these questions have to be appropriately bubbled as illustrated in the following example. If the correct matches are A-p, A-r, B-p, B-s, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following:



19.

	Column-I **Reaction**		**Column-II** **Factor responsible for the reaction**
(A)	$CH_3CH_2CH=CHCH_3$ on reaction with HCl gives two products	p.	Rearrangement
(B)	$CH_2=CH-CH=CH_2$ reacts with HCl to form 1, 2- and 1, 4-addition products	q.	Inductive effect
(C)	$C_6H_5CH=CHCH_3+HBr$ gives only one product	r.	Hyperconjugation
(D)	$C_6H_5CH_2CH=CH_2+HBr$ forms a compound identical to that obtained in (C).	s.	Resonance

20.

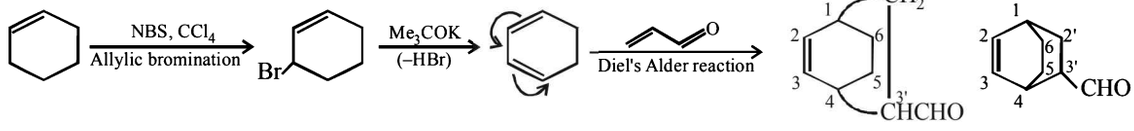
	Column-I		**Column-II**
(A)	$CH_2=CHCN + (CH_3)_2NH \longrightarrow$	p.	Transition state involves pentavalent carbon
(B)	$CH_2=CHCN \xrightarrow{\text{catalyst}}$	q.	Nucleophilic substitution
(C)	$CH_3-\overset{\overset{O}{\|\|}}{C}-Cl + (CH_3)_2NH \longrightarrow$	r.	Nucleophilic addition
(D)	$ClCH_2CH=CHCN+(CH_3)_2NH \longrightarrow$	s.	Free radical addition

RESPONSE GRID	**19. A - (p)(q)(r)(s)(t); B - (p)(q)(r)(s)(t); C - (p)(q)(r)(s)(t); D - (p)(q)(r)(s)(t)** **20. A - (p)(q)(r)(s)(t); B - (p)(q)(r)(s)(t); C - (p)(q)(r)(s)(t); D - (p)(q)(r)(s)(t)**

DAILY PRACTICE PROBLEM DPP CHAPTERWISE 11 - CHEMISTRY			
Total Questions	20	Total Marks	74
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	24	Qualifying Score	35
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

1. **(c)**



Numbering is done only for explaining the two six membered rings. The numbering is not in accordance with IUPAC rule

2. **(d)** Chlorination of methane is a free radical reaction and hence it can be initiated by any factor that can produce chlorine free radical.

(*a*) $Cl—Cl \xrightarrow{UV} Cl^{\bullet} + Cl^{\bullet}$

$CH_4 + Cl^{\bullet} \longrightarrow CH_3^{\bullet} + HCl$

$CH_3^{\bullet} + Cl—Cl \longrightarrow CH_3Cl + Cl^{\bullet}$

(*b*) $(C_2H_5)_4Pb \xrightarrow{heat} 4CH_3CH_2^{\bullet} + Pb^{\bullet}$

$CH_3CH_2^{\bullet} + Cl—Cl \longrightarrow CH_3CH_2Cl + Cl^{\bullet}$

$CH_4 + Cl^{\bullet} \longrightarrow CH_3^{\bullet} + HCl$

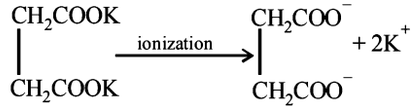
$CH_3^{\bullet} + Cl—Cl \longrightarrow CH_3Cl + Cl^{\bullet}$

(*c*) $(CH_3)_3COCl \xrightarrow{UV} (CH_3)_3CO^{\bullet} + Cl^{\bullet}$

$CH_4 + (CH_3)_3CO^{\bullet} \longrightarrow CH_3^{\bullet} + (CH_3)_3COH$

$CH_3^{\bullet} + (CH_3)_3COCl \longrightarrow CH_3Cl + (CH_3)_3CO^{\bullet}$

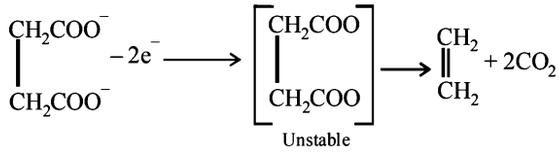
3. **(c)** Ethene is obtained by electrolysis of dipotassium succinate as follows



Pot. Succinate

$2H_2O \underset{}{\overset{ionization}{\rightleftharpoons}} 2OH^- + 2H^+$

At anode :

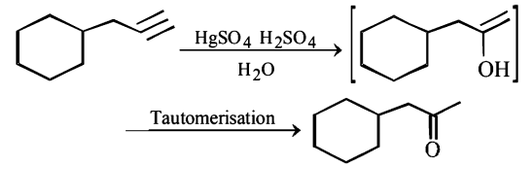


Unstable

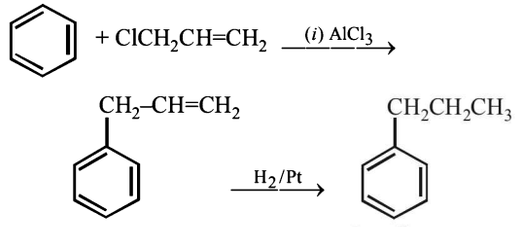
At cathode :

$2H^+ + 2e^- \longrightarrow [2H] \longrightarrow H_2$

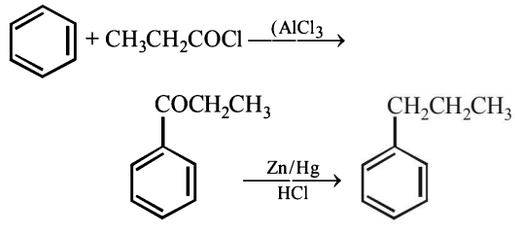
4. **(b)**



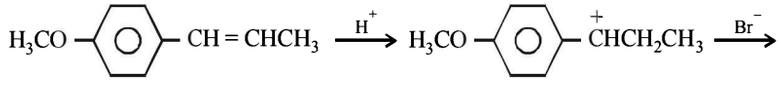
5. **(c)** (*i*) and (*ii*) methods will form isopropylbenzene because *n*-propyl carbocation, being less stable, rearranges to the more stable (2°) isopropyl carbocation. Moreover, method (*i*) will lead to polyalkylation. Methods (*iii*) and (*iv*) can be used for preparing *n*-propylbenzene.



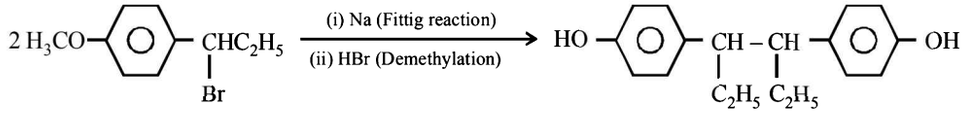
n-Propylbenzene



6. **(c)**



Benzylic carbocation



7. **(a, b, c).** $C_2H_6 + Cl_2 \xrightarrow{h\nu} C_2H_5Cl + HCl$

$C_2H_5Cl + Cl_2 \xrightarrow{h\nu} CH_3CHCl_2 + CH_2Cl.CH_2Cl$

The attack of chlorine atom on the hydrocarbon is selective, that is, a tertiary C – H hydrogen atom is abstracted more easily than a secondary or a primary hydrogen. Thus rate of abstraction of hydrogen atom follows the order $3° > 2° > 1°$.

$$CH_3CHCH_3 + Cl_2 \xrightarrow{h\nu} CH_3-\overset{CH_3}{\underset{CH_3}{C}}-Cl(67\%) + CH_3CHCH_2Cl(33\%)$$

It is likely that the activation energy required to form a 3° free radical is much less than that for the formation of 2° or 1° free radical. The ease of formation of free radicals thus parallels their stability, i.e. $3° > 2° > 1°$. Thus more stable a free radical, the more easily it is formed.

8. **(c, d)** (a) $CH_3 - Cl \xrightarrow{Zn/dust} CH_3 - CH_3$

(b) $CH_3 - CH_2Cl \xrightarrow{LiAlH_4} CH_3 - CH_3$

(c) $Al_4C_3 \xrightarrow{H_2O/HCl} CH_4$

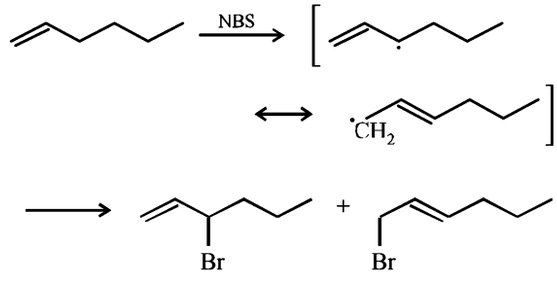
(d) $CaC_2 \xrightarrow{H_2O/H^+} C_2H_2$

9. **(b, c)**

$$CH_2 = \overset{CH_3}{\underset{}{C}} - CH_3 \text{ (II)} > CH_2 = CH - CH_3 \text{ (I)} > CH_2 = CH_2 \text{ (III)}$$

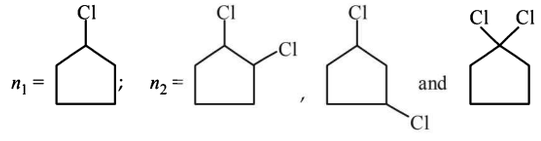
Intermediate $CH_3-\overset{CH_3}{\underset{}{C}}{}^{+}-CH_3$ (3° carbocation, II) > $CH_3-\overset{+}{C}H-CH_3$ (2° carbocation, I) > $CH_3-\overset{+}{C}H_2$ (1° carbocation, III)

10. **(a, b, c)**

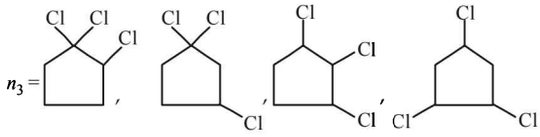


cis- and *trans*-

11. **(1)**



and



Hence $\frac{n_1 + n_2}{n_3} = \frac{4}{4} = 1$

12. **(5)** 1, 3-Dichlorocyclobutane can exist in *cis* and *trans* forms. *trans*-1, 2-Dichlorocyclobutane can exist in (+)– and (–)-forms. However, *cis*-1, 2 Dichlorocyclobutane has a plane of symmetry and hence it can exist as *meso* isomer.

13. **(4)** All alkyl bromides having carbon skeleton of isopentane (2-methylbutane $(CH_3)_2CHCH_2CH_3$) will give isopentane via Grignard reagent.

$$BrCH_2\overset{CH_3}{\underset{}{C}}HCH_2CH_3 \qquad CH_3\overset{CH_3}{\underset{}{C}}BrCH_2CH_3$$

$$CH_3\overset{CH_3}{\underset{}{C}}H\ \overset{Br}{\underset{}{C}}HCH_3 \qquad CH_3\overset{CH_3}{\underset{}{C}}HCH_2CH_2Br$$

14. **(3)**

$$CH_3 - CH_2 - CH_2 - \underset{CH_3}{\underset{|}{CH}} - \underset{CH_2 - CH_3}{\underset{|}{CH}} - CH_2 - CH_3$$

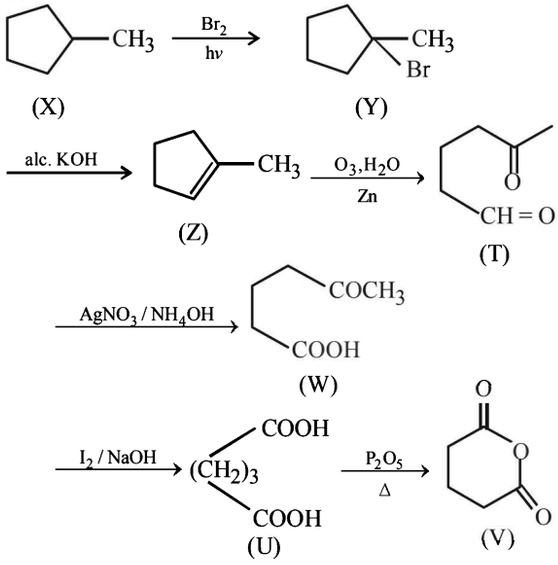
3-Ethyl-4-methylheptane

$$CH \equiv C - CH_2 - \underset{CH_3}{\underset{|}{CH}} - \underset{CH_2CH_3}{\underset{|}{CH}} - CH_2 - CH_3$$

$$CH_3 - CH_2 - CH_2 - \underset{CH_3}{\underset{|}{CH}} - \underset{C \equiv CH}{\underset{|}{CH}} - CH_2CH_3$$

$$CH_3 - C \equiv C - \underset{CH_3}{\underset{|}{CH}} - \underset{CH_2CH_3}{\underset{|}{CH}} - CH_2CH_3$$

15. **(b)** **16.** **(a)**



17. **(c)** The chain-initiating step $(Cl-Cl \longrightarrow 2\,{}^{\bullet}Cl)$ is highly endothermic ($\Delta H = +58$ kcal/mol) and therefore requires high temperatures.

18. **(b)** Oxygen reacts with the methyl radical to form new radical $(CH_3OO^{\bullet})$ which is *markedly less reactive*

$$^{\bullet}CH_3 + O-O \longrightarrow CH_3-O-O^{\bullet}$$

than $^{\bullet}CH_3$ and therefore drastically slows down the chain reaction.

19. **A-q, r; B-s; C-s; D-p, s**

(A) $CH_3\overset{+}{C}HCH_2CH_2CH_3 \xleftarrow{H^+} CH_3CH_2CH=CHCH_3 \xrightarrow{H^+} CH_3CH_2\overset{+}{C}HCH_2CH_3$

(Five hyperconjugative structures)

Highly favoured due to inductive of ethyl group (4 hyperconjugative structures)

$\downarrow Cl^-$ $\qquad$ $\downarrow Cl^-$

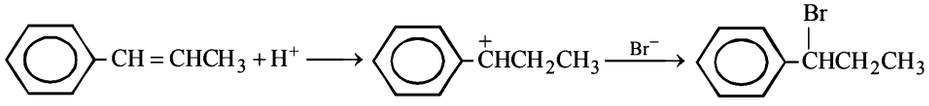
$CH_3CH_2CH_2\underset{Cl}{\underset{|}{C}}HCH_3$ $\qquad$ $CH_3CH_2\underset{Cl}{\underset{|}{C}}HCH_2CH_3$

(B) $CH_2=CH-CH=CH_2 \xrightarrow{H^+} \left[CH_3\overset{+}{C}HCH=CH_2 \longleftrightarrow CH_3CH=C\overset{+}{H}CH_2 \right]$

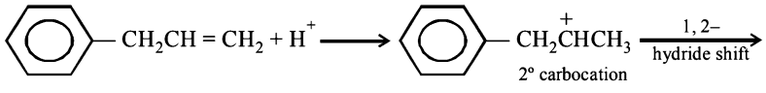
2°Carbocation, stable due to resonance

$$\xrightarrow{Cl^-} CH_3\underset{Cl}{\underset{|}{C}}HCH=CH_2 + CH_3CH=\underset{Cl}{\underset{|}{C}}HCH_2$$

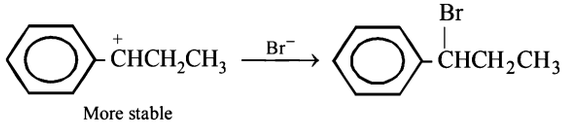
(1,2 – addition) $\qquad$ (1,4 – addition)

(C) 

Highly stable benzyl carbocation

(D) 

2° carbocation



More stable benzyl carbocation

20. **A-r; B-s; C-q; D-p, q, r**

(A) The electron-withdrawing group ($-C\equiv N$) is in conjugation with the carbon-carbon double bond, hence the intermediate carbanion, formed by the attack of nucleophile, stabilizes due to resonance. Hence such alkenes undergo nucleophilic addition reactions.

(B) Vinyl monomers when heated in presence of catalyst undergo free radical polymerisation.

(C) Acyl halides, typically, undergo nucleophilic substitution. This is due to the fact that – Cl is a good leaving group.

(D) The given compound has 1° alkyl halide, hence undergoes S_{N^2} reaction involving transition state with pentavalent carbon. Further the presence of $-CH_2CH=CN$ grouping causes the compound to undergo nucleophilic addition.