SUBJECTIVE SOLVED EXAMPLES

Example - 1 *Give the structure of A, B and C (explanation are not required) :*

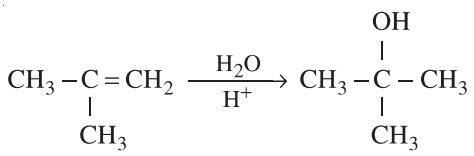
(i) *A (C_4H_8) which adds on HBr in the presence and in the absence of peroxide to give same product, C_4H_9Br*

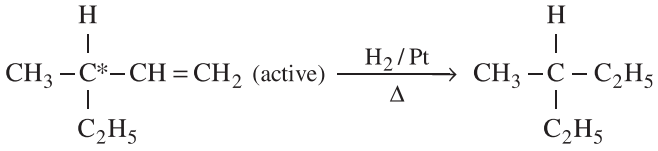
(ii) *B (C_4H_8) which when treated with H_2O/H_2SO_4 gives $C_4H_{10}O$ which cannot be resolved into optical isomers.*

(iii) *C (C_6H_{12}), an optically active hydrocarbon which on catalytic hydrogenation gives an optically inactive compound C_6H_{14}.*

SOLUTION :

(i) A : $CH_3CH=CHCH_3$ symmetric alkenes give same product.

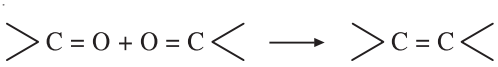
(ii) B :

; optically inactive (No chiral centre)

(iii) C :

optically inactive (No chiral centre)

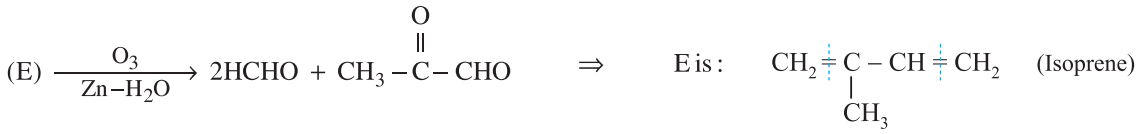
(* : Chiral centre)

Example - 2 *An organic compound E (C_5H_8) on hydrogenation gives compound F (C_5H_{12}). Compound E on ozonolysis gives formaldehyde and 2-ketopropanal. Deduce the structure of compound E.*

SOLUTION : In such questions, by working backwards we join :

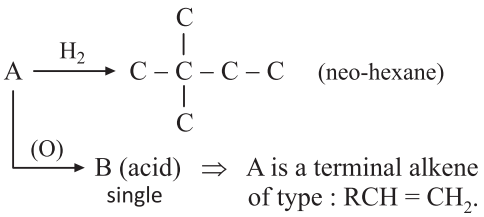


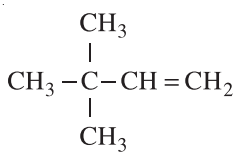
Note : Since 2-ketopropanal has two keto groups, hence there must be 2 moles of HCHO.

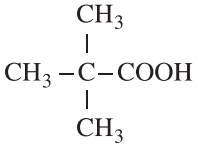


Example - 3 *The hydrocarbon, A adds one mole of hydrogen in the presence of a platinum catalyst to form neo-hexane. When A is oxidised vigorously with $KMnO_4$, a single carboxylic acid, B is isolated. Give the structures of A and B.*

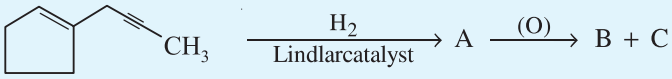
SOLUTION :



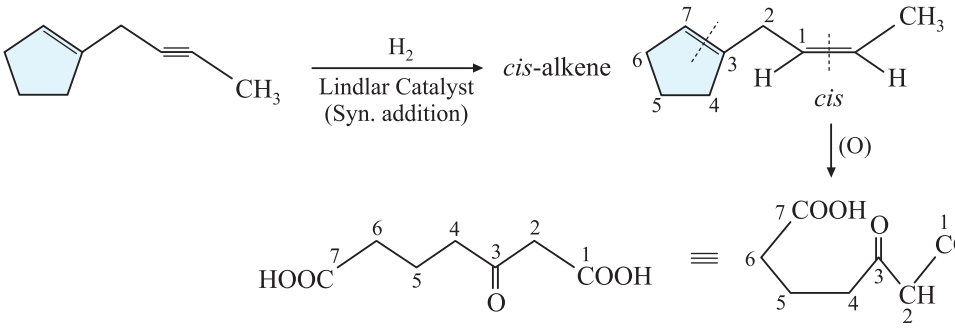
Hence A is :


Clearly B is :


Example - 4 *What are product A, B and C in the following rection ?*



SOLUTION : Visualise the structure of given compound as follows :



Example - 5 *Identify the products A, B and C and the reagent R in the following reactions* :

(i) $(CH_3)_2\underset{\underset{Cl}{|}}{C}-CH_2CH_3 \xrightarrow{alc.\ KOH} A$ **(ii)** $HC \equiv CH \xrightarrow[H^+/Hg^{2+}]{H_2O} B$

(iii) $A \xrightarrow{R} B + C$

SOLUTION :

(i) $CH_3-\underset{\underset{Cl}{|}}{\overset{\overset{CH_3}{|}}{C}}-\underset{\underset{H}{|}}{CH}CH_3 \xrightarrow{RO^-} CH_3-\underset{(A)}{\overset{\overset{CH_3}{|}}{C}}=CHCH_3$ (Saytzeff's product)

(ii) $HC \equiv CH \xrightarrow[H^+/Hg^{2+}]{H_2O} CH_2=CHOH \underset{}{\overset{Tautomerises}{\rightleftharpoons}} \underset{(B)}{CH_3CHO}$

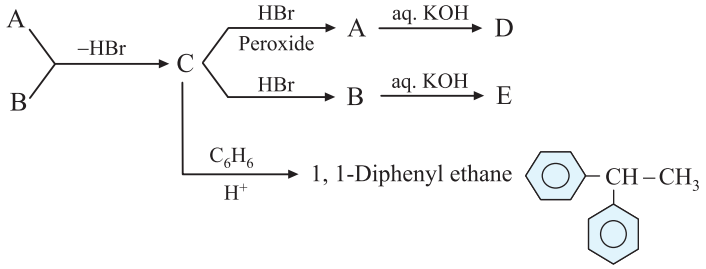
(iii) $CH_3-\overset{\overset{CH_3}{|}}{C}=CHCH_3 \xrightarrow{R} CH_3CHO + (C)$

R is clearly $O_3/Zn\text{-}H_2O$ and (C) is acetone (CH_3COCH_3)

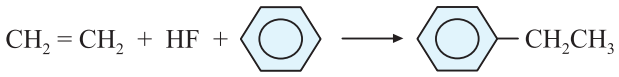
$$\underset{(A)}{CH_3-\overset{\overset{CH_3}{|}}{C}=CHCH_3} \xrightarrow[Zn/H_2O]{O_3} \underset{(B)}{CH_3CHO} + \underset{(C)}{(CH_3)_2C=O}$$

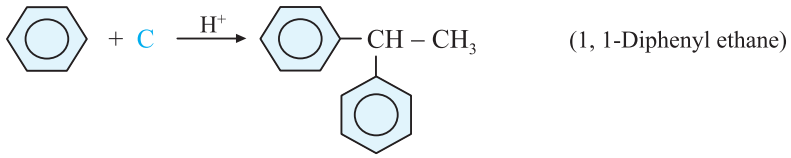
Example - 6 *De-hydro-bromination of two compounds A and B gives the same compound C. C regenerates A and B when reacts with HBr in the presence and absence of peroxide respectively. The hydrolysis of A and B gives isomeric products D and E respectively. C when reacts with benzene in presence of H^+ ions gives* 1, 1-*Diphenylethane. Identify the compounds A to E.*

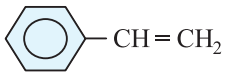
SOLUTION : Visualizing the flow chart of the question as follows.

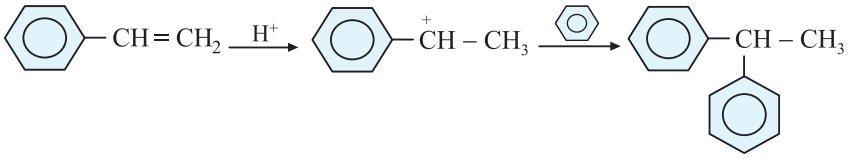


Recall Friedal Craft alkylation

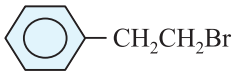


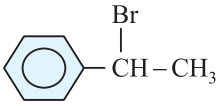


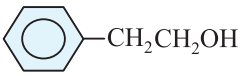
$\Rightarrow$ C is an alkene containing a – C = C – bond, hence C is vinyl benzene. C: 

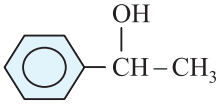


As per given reactions in question :

A: 

B: 

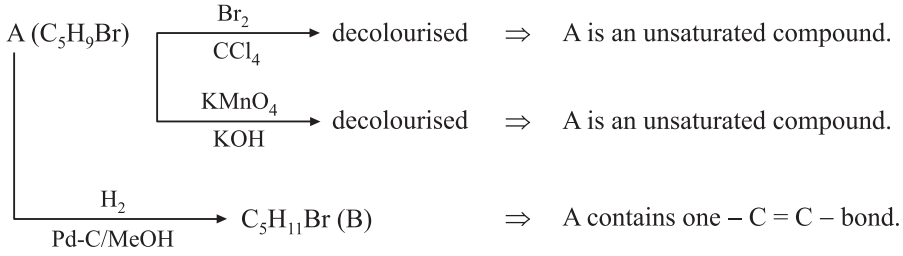
D: 

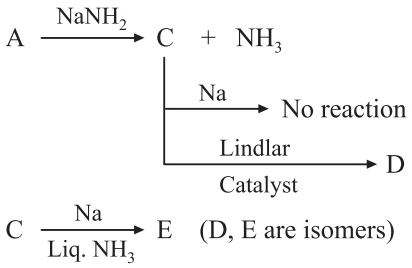
E: 

Example - 7 *An organic compound A, C_5H_9Br de-colourises bromine water and alk. $KMnO_4$. It gives B, $C_5H_{11}Br$ when treated with H_2, Pd-carbon in methanol. The reaction of A with $NaNH_2$ gives C with the evolution of NH_3. C does not react with sodium but reacts with Lindlar catalyst to give D. It also reacts with Nalliquid NH_3 to give E. Both D and E are isomers. Identify the compounds A to E with proper reasoning.*

SOLUTION :

Visualizing the flow chart of the question as follows :



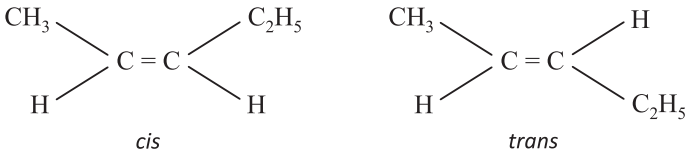


Since D and E are isomers obtained by partial hydrogenation of 'C' (C : an alkyne) from two different reagents, D and E must be geometric isomers with molecular formula C_5H_{10}. "*Check this as follows*"

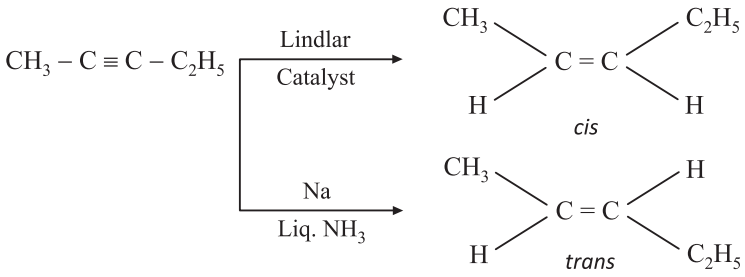
$$(A)\ C_5H_9Br \xrightarrow[\text{(Dehydrobro min ation)}]{NaNH_2} C_5H_8 + NH_3 + Br^-$$

$$C(C_5H_8) \xrightarrow{H_2} C_5H_{10}\ (D \text{ and } E)$$

The alkene with molecular formula, C_5H_{10} showing geometric isomerism is only 2-Pentene [$CH_3CH = CHC_2H_5$]



Hence the compound (C) is 2-Pentyne (Non-terminal alkynes do not react with Na).



A can be :

$$CH_3\underset{\underset{Br}{|}}{C}=CH-C_2H_5 \quad \text{or} \quad CH_3CH=\underset{\underset{Br}{|}}{C}-C_2H_5$$

Both will give 2-Pentyne with $NaNH_2$.

Accordingly B can be :

$$CH_3\underset{\underset{Br}{|}}{C}H-CH_2-C_2H_5 \quad \text{or} \quad CH_3CH_2-\underset{\underset{Br}{|}}{C}HC_2H_5$$