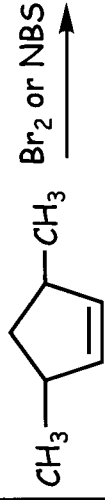


(Monobromination product)

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S1



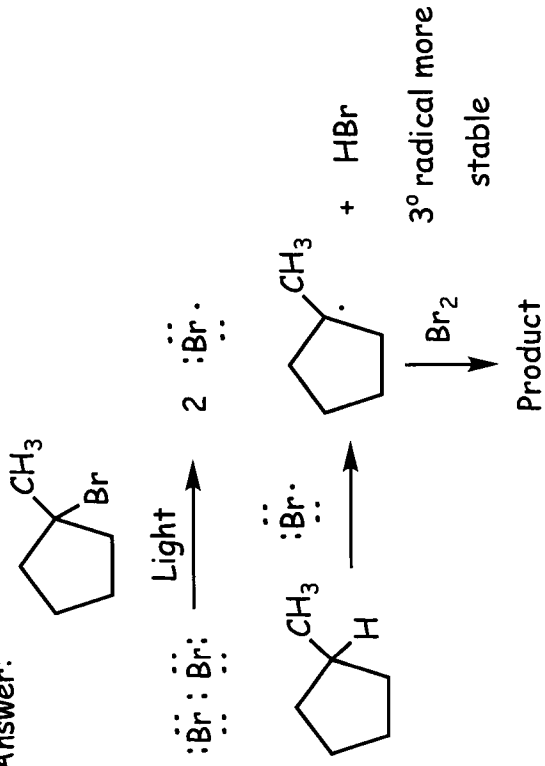
(Give major and minor monobromination products)

NBS = *N*-bromosuccinimide

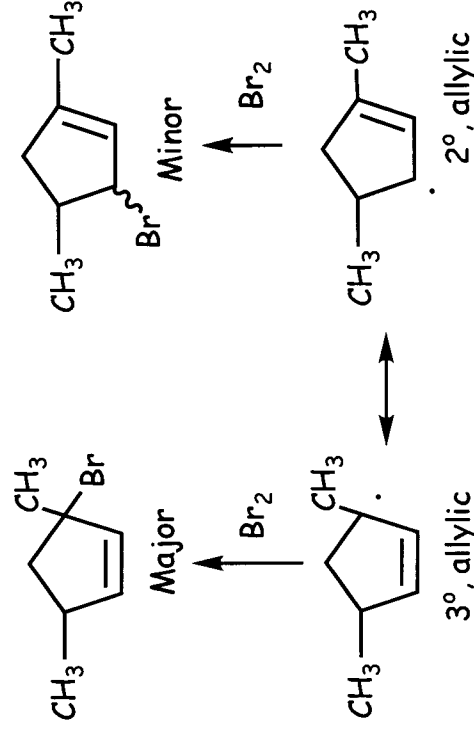
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S2

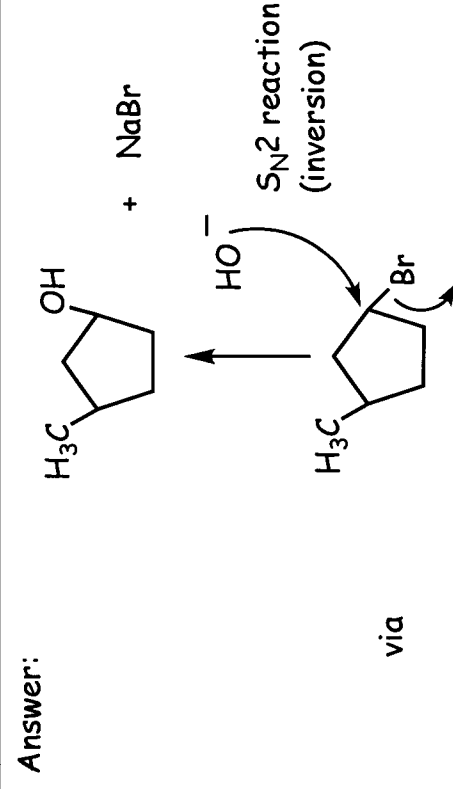
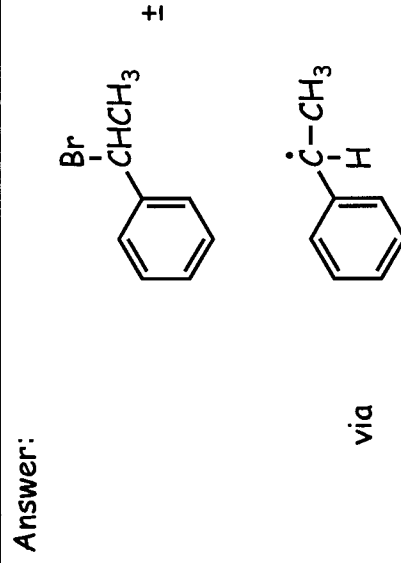
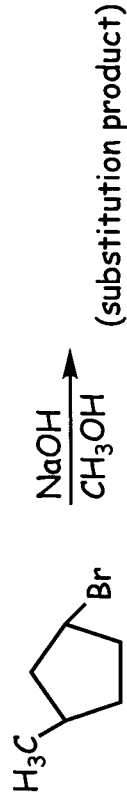
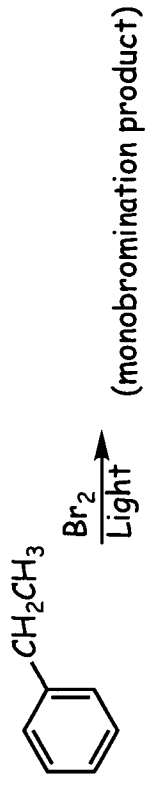
Answer:



Answer:



Note: NBS + HBr \longrightarrow Br₂ + Succinimide



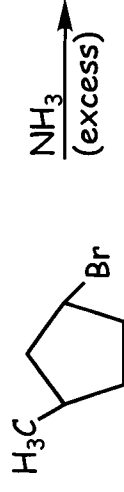
resonance stabilized benzylic radical

Note: An alcohol such as CH_3OH is frequently used as the solvent.



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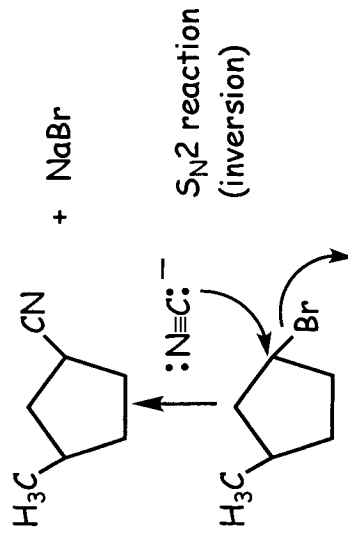
S5



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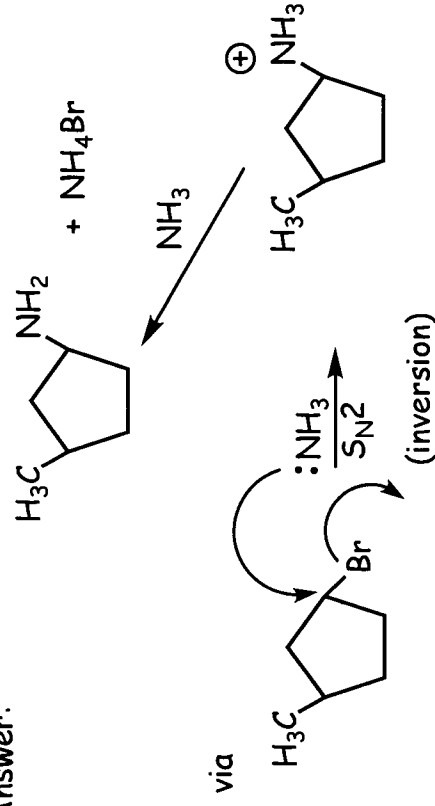
S6

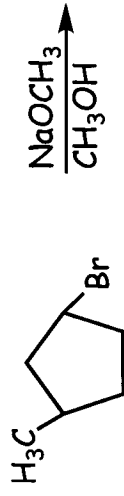
Answer:



Note: Acetone (CC(=O)C) is frequently used as a solvent in $\text{S}_{\text{N}}2$ reactions.

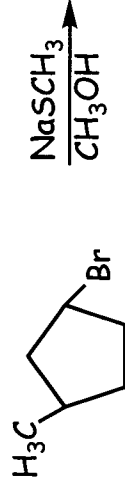
Answer:





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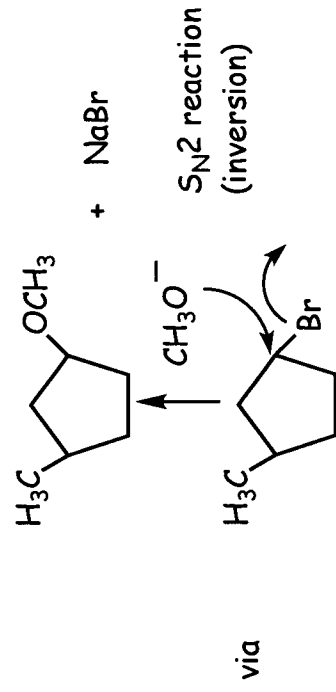
S7



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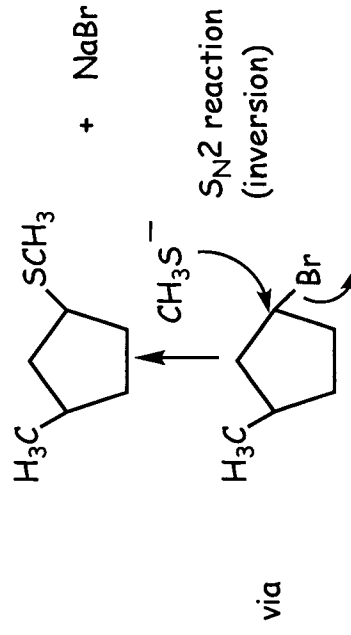
S8

Answer: Williamson ether synthesis

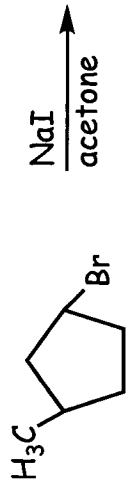


Note: Elimination will occur with bulky bases (^tBuOK, Et₃N, iPr₂EtN).

Answer: Williamson thioether synthesis

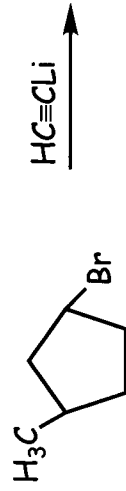


Note: An alcohol such as CH₃OH is frequently used as the solvent.



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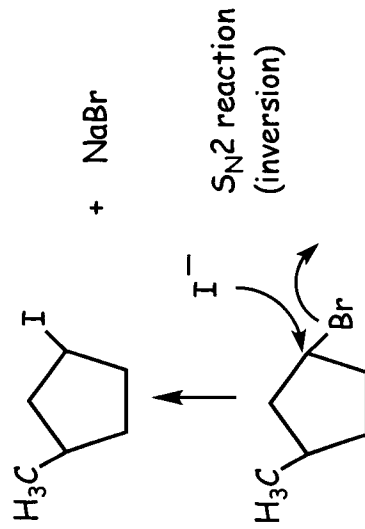
S9



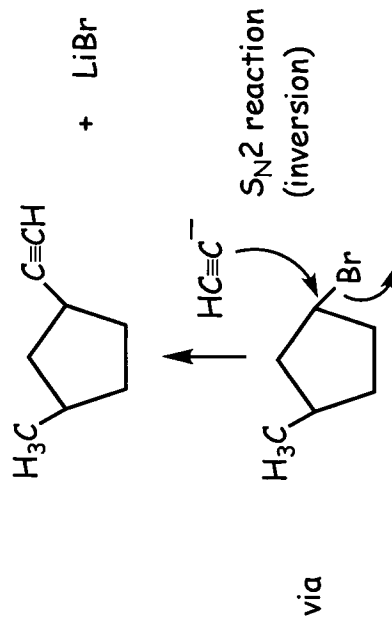
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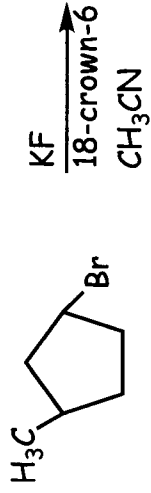
S10

Answer:



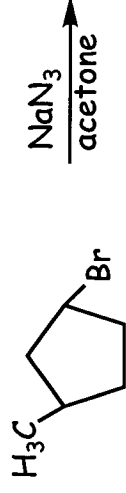
Answer:





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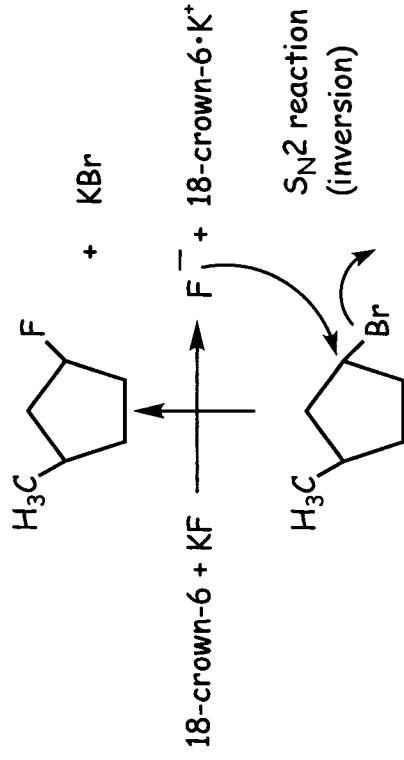
S11



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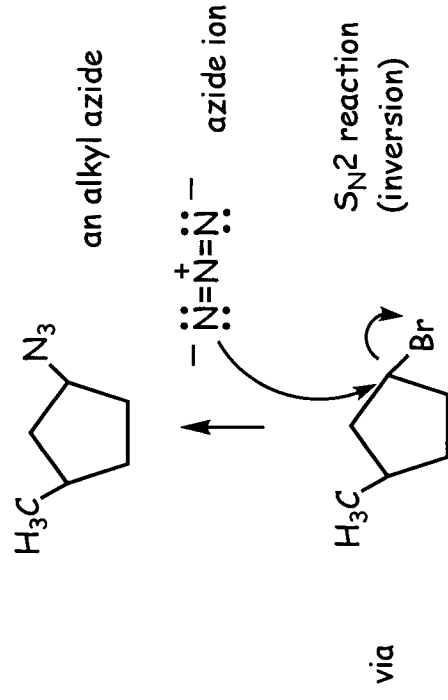
S12

Answer:

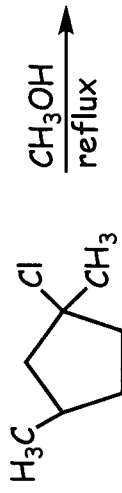


Note: CH3CN is used as the solvent.

Answer:



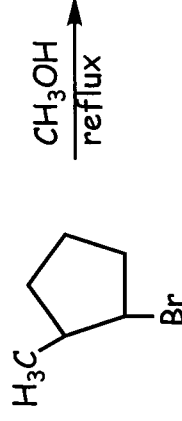
Note: Acetone is used as the solvent.



(substitution products)

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S13

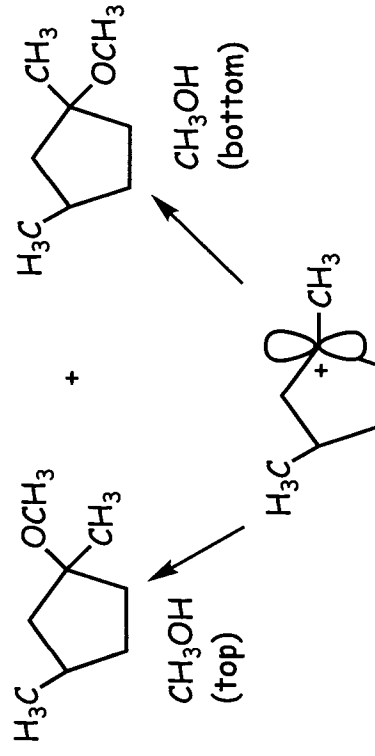


(give major and minor substitution products)

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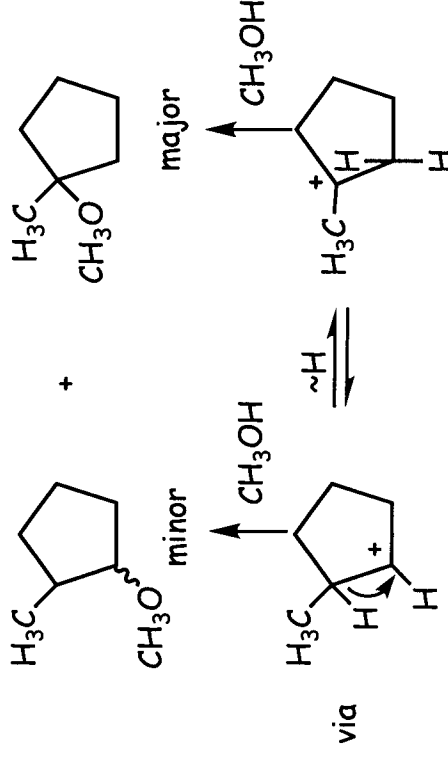
S14

Answer:

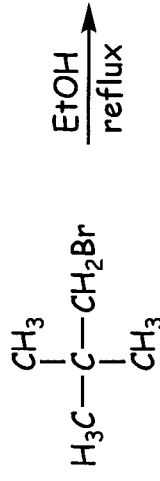


Note: S_N1 solvolysis reaction

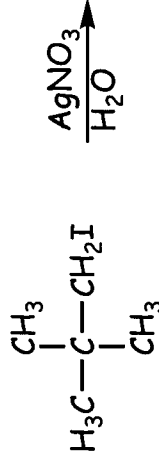
Answer:



Note: The r.d.s. is ionization of the starting material to give the 2° carbocation (S_N1 reaction).

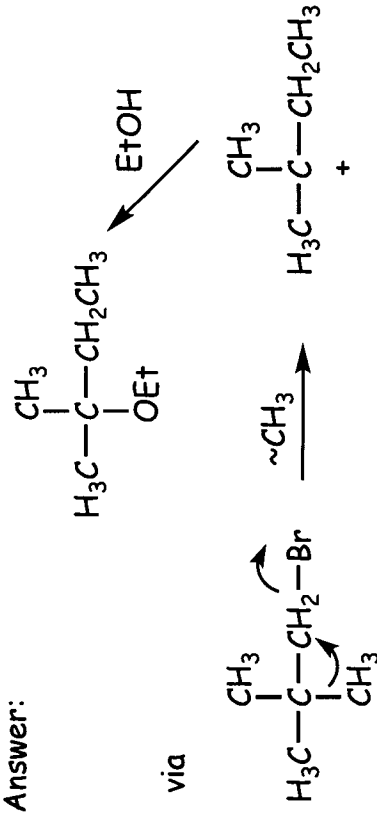


(substitution product)

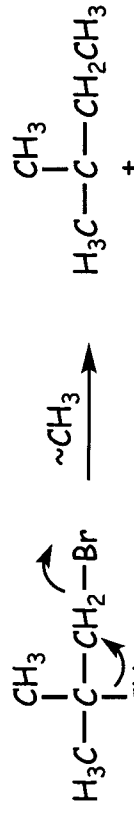


(substitution product)

Answer:



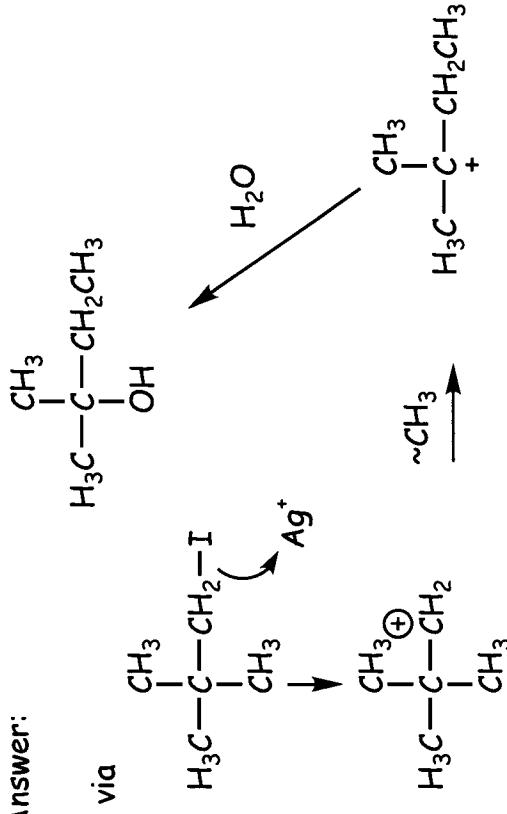
via



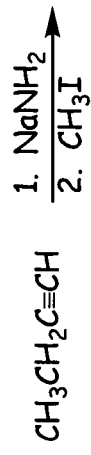
NOTE: The r.d.s. is a concerted methyl migration

with loss of Br^- to give the 3° carbocation ($\text{S}_{\text{N}}1$ reaction with rearrangement).

Answer:

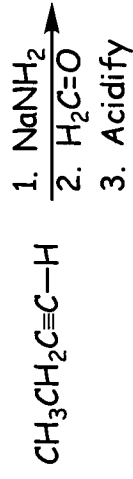


NOTE: Methyl shift may occur simultaneously with ionization.



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S17



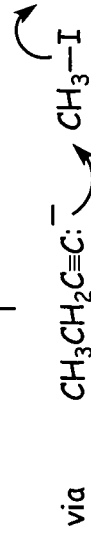
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S18

Answer:



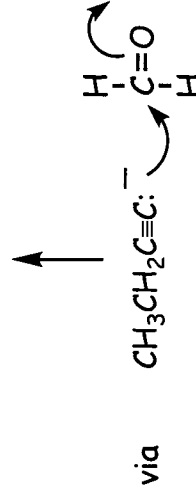
$\text{S}_{\text{N}}2$

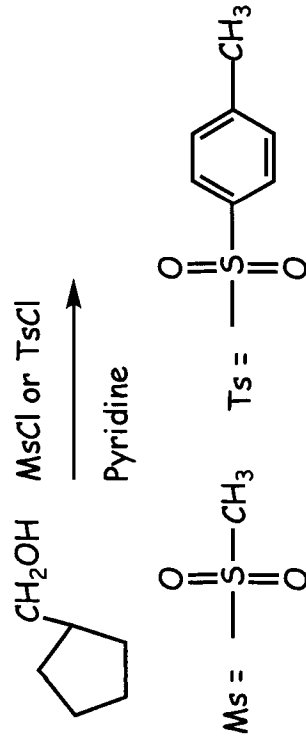


Answer:



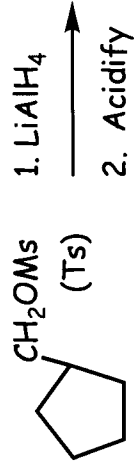
↑
Acidify





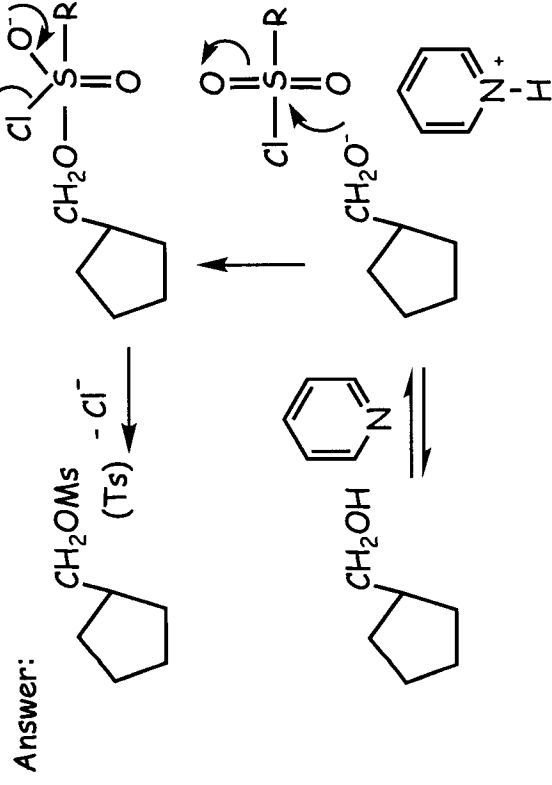
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S 19

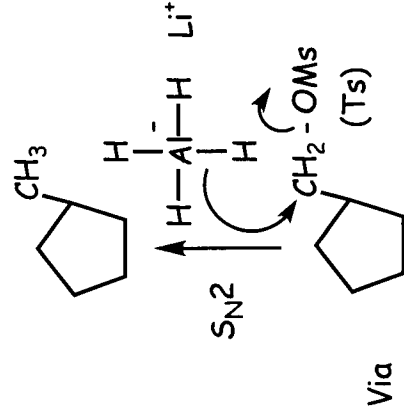


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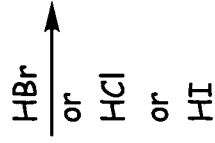
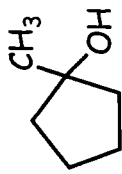
S 20



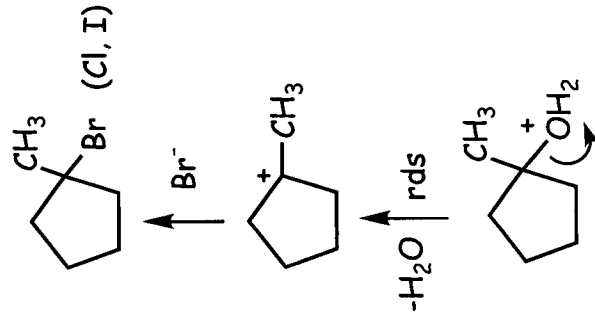
Answer:



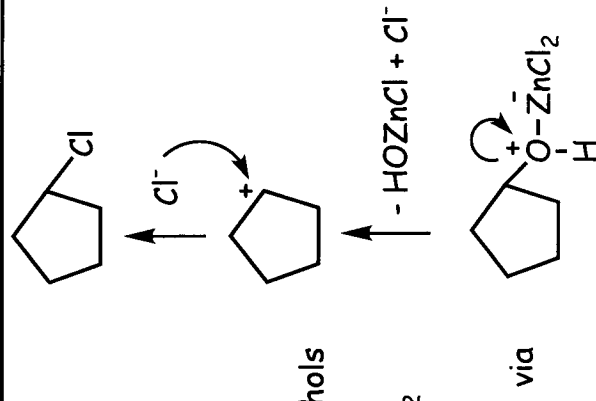
Note: Tosyl and mesyl esters are good leaving groups in other $\text{S}_{\text{N}}2$ reactions.

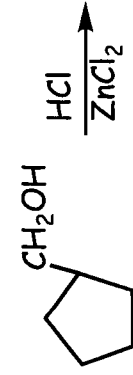


Answer:



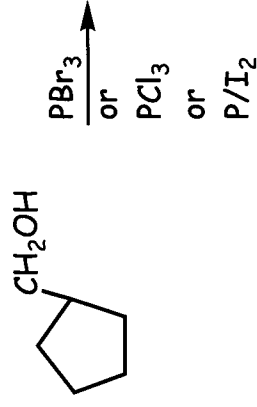
NOTE: Lucas Reagent; 2° alcohols react slowly in absence of ZnCl_2





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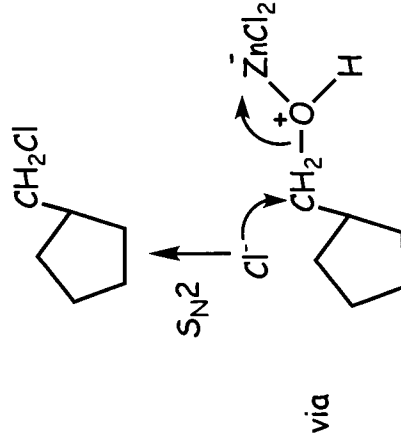
S23



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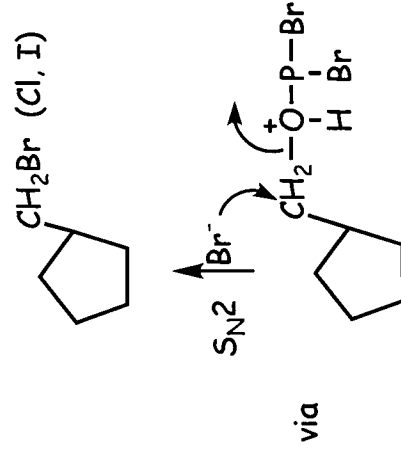
S24

Answer:

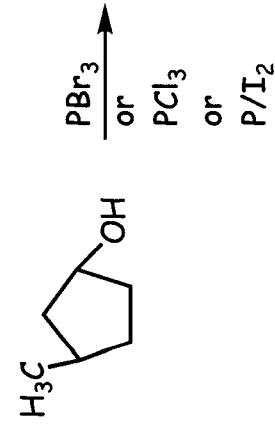


NOTE: Lucas Reagent; 1° alcohols react very slowly in absence of ZnCl₂.

Answer:

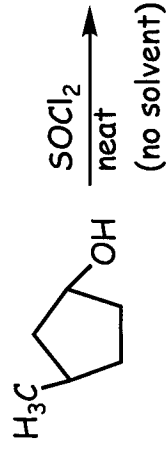


NOTE: S_N2 reaction; P/I₂ generates PI₃ (unstable) *in situ*



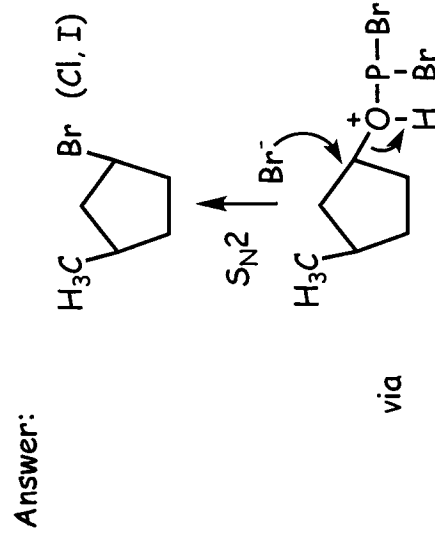
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S25



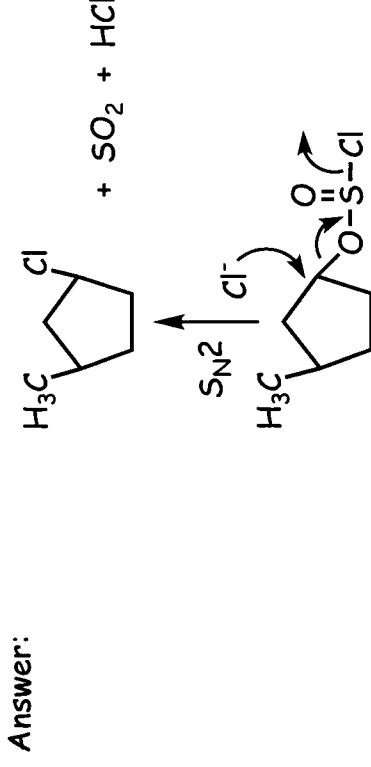
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S26



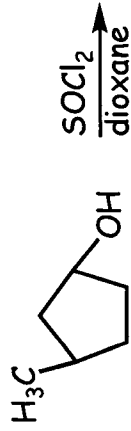
Answer:

NOTE: S_N2 reaction; P/I_2 generates PI_3 *in situ*



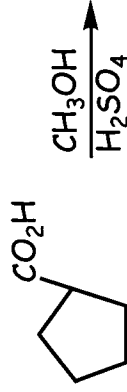
Answer:

NOTE: S_N2 reaction; non-nucleophilic solvents (e.g. benzene) can also be used.



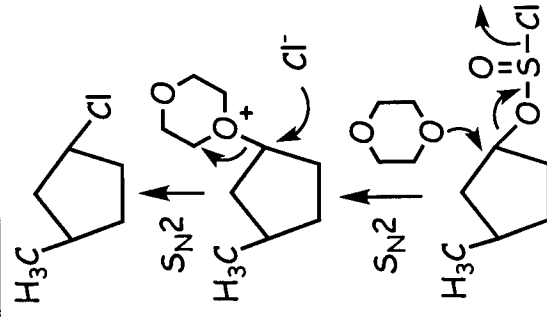
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S27



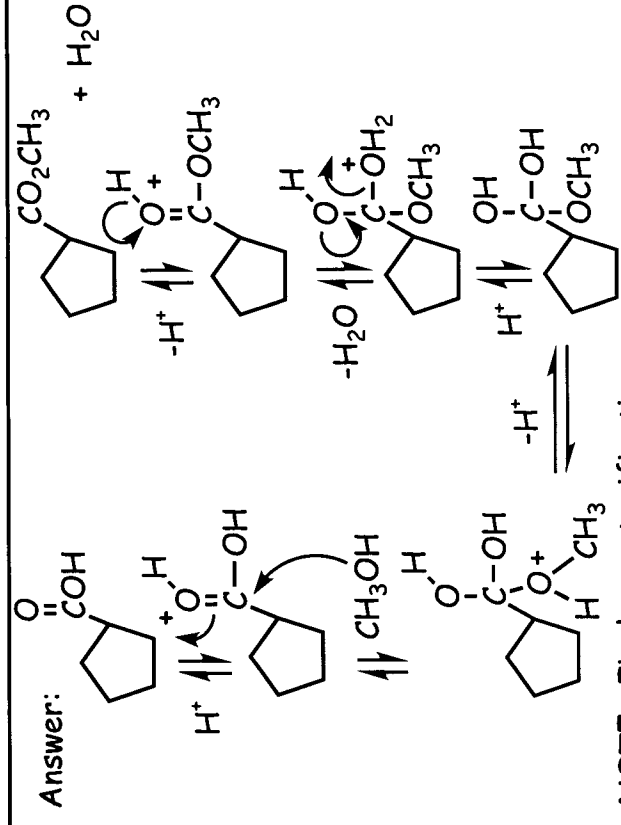
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S28



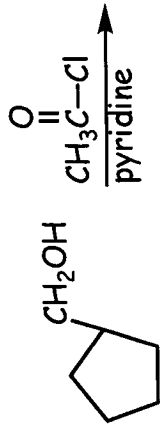
Answer:

NOTE: Double inversion gives overall retention.



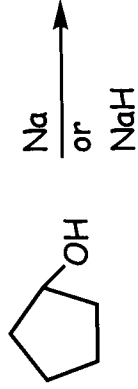
Answer:

NOTE: Fischer esterification



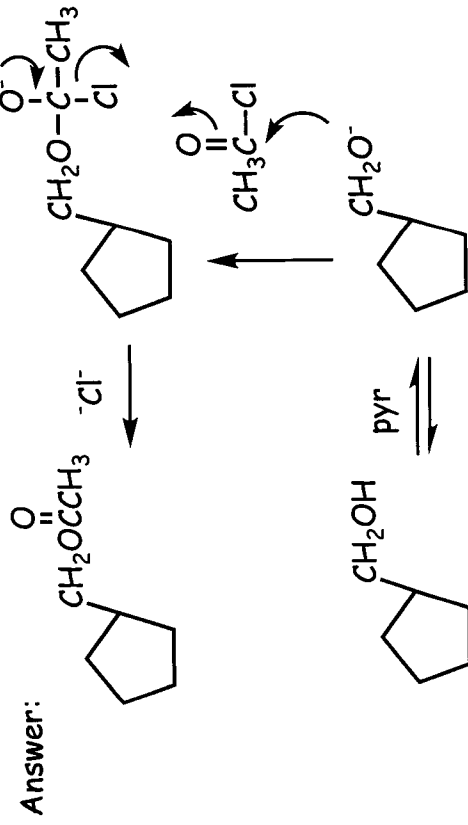
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S29

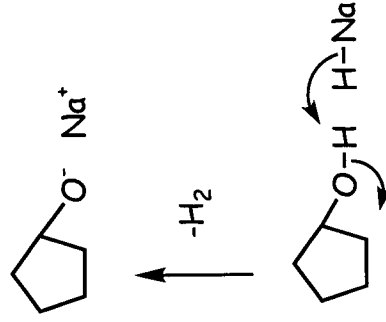


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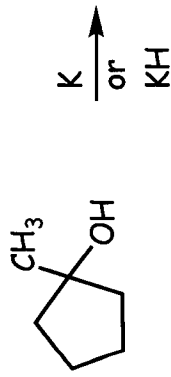
S30



Answer:

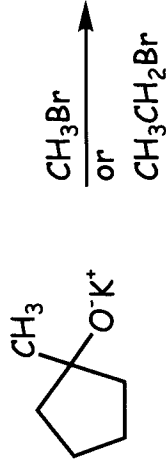


NOTE: Deprotonates 1° or 2° alcohols but not 3° alcohols



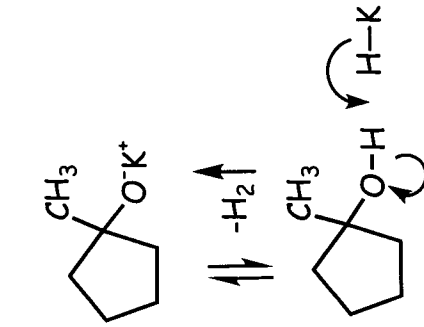
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S31



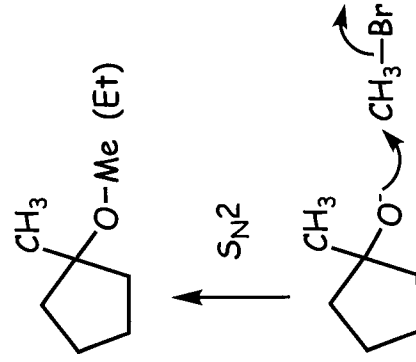
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S32



Answer:

NOTE: Potassium metal or KH used to deprotonate 3° alcohols



Answer:

Williamson
ether
synthesis

NOTE: Methyl or 1° alkyl halides or tosylates (mesylates) must be used as the electrophile, otherwise elimination (E2) usually occurs.