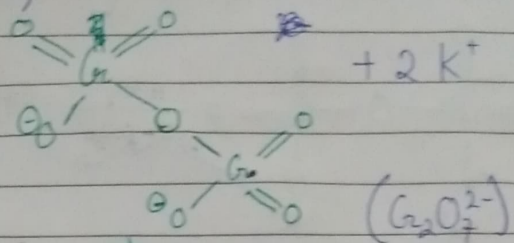
Oxidation ($K_2Cr_2O_7$)

Structure of $K_2Cr_2O_7$:-



$+ 2K^+$

$(Cr_2O_7^{2-})$

Oxidation state of Cr = +6

$K_2Cr_2O_7$ causes oxidation of F.G (Functional group)

- For Primary Alcohols :-

Primary alcohol ($-OH$) → Aldehyde ($-CHO$) → Carboxylic acid ($-COOH$)

- For Secondary Alcohols :-

Secondary alcohol ($-OH$) → Ketone ($-C=O$)

- For Tertiary Alcohols :-

They lack H^+, hence they do not undergo oxidation

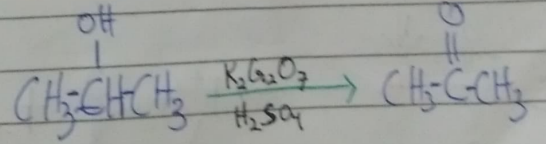
Eg:- Primary alcohol :- (1° alcohol / OH at 1st C position)

$$CH_3CH_2OH \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3CHO + H_2O$$

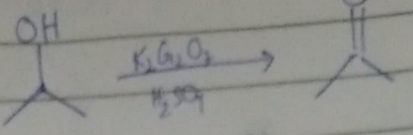
But, if nascent oxygen [O] is also involved, ~~then the~~ then the reaction will continue :-

$$CH_3CHO \xrightarrow{[O]} CH_3COOH$$

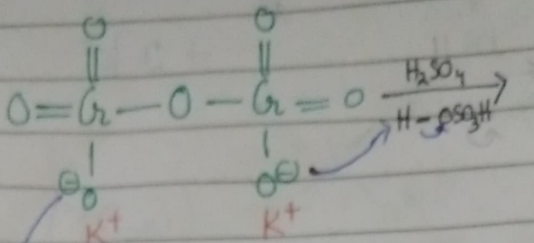
Secondary alcohol :- (2° alcohol / OH at 2nd C position)

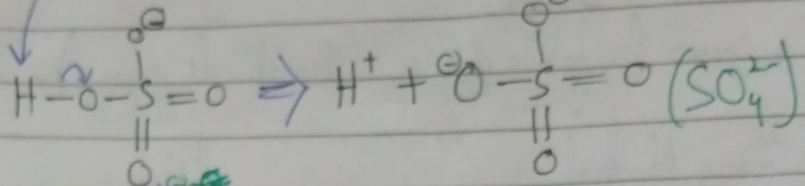


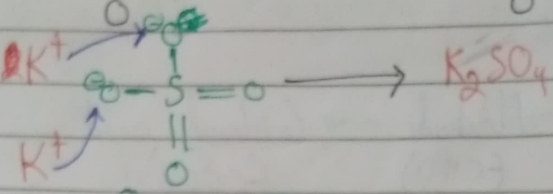
Tertiary alcohol :- No oxidation

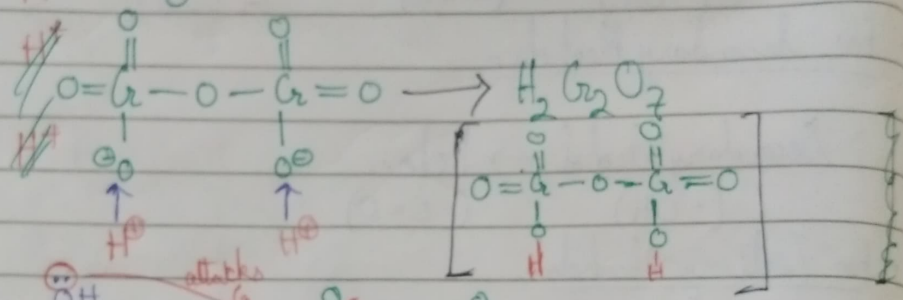
Mechanism: Eg: 

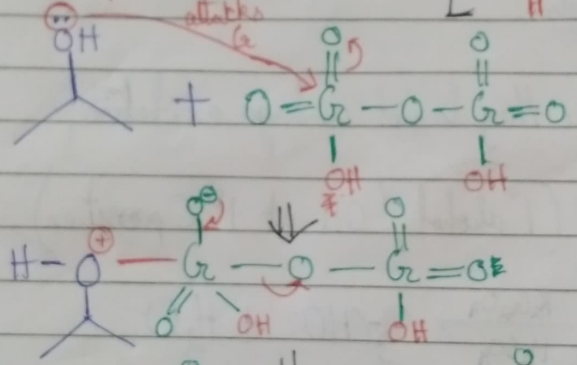
[2° alcohol → ketone]

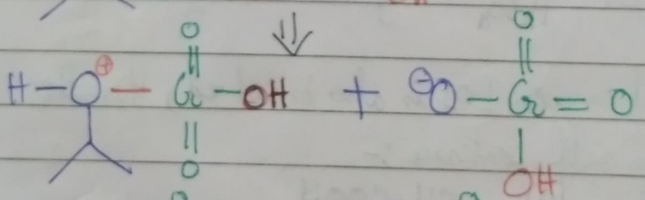
① 

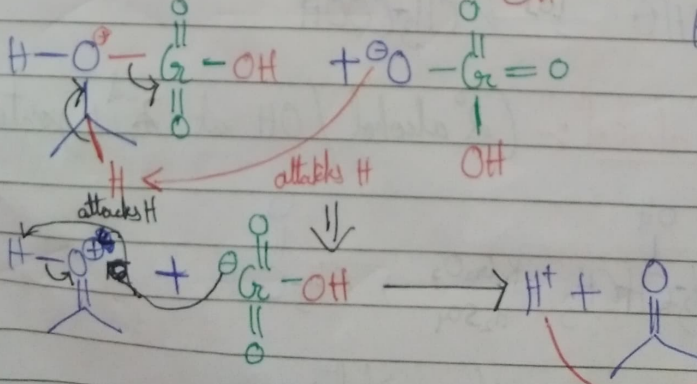


② 

③ 

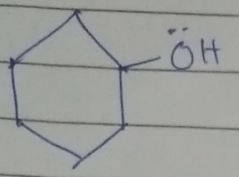
④ 



⑤ 

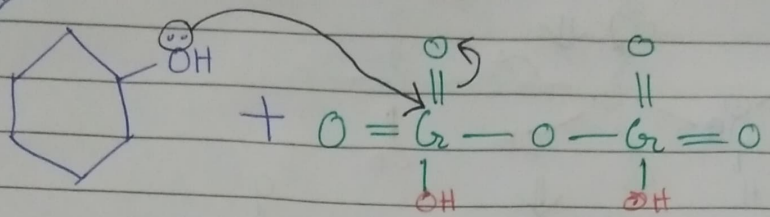
Q. Show oxidation by $K_2Cr_2O_7$ for following:-

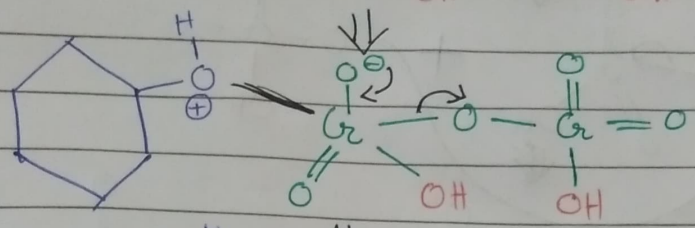
(i)

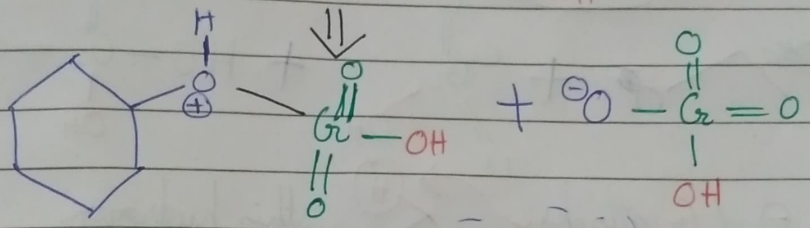


Sol:- (1)

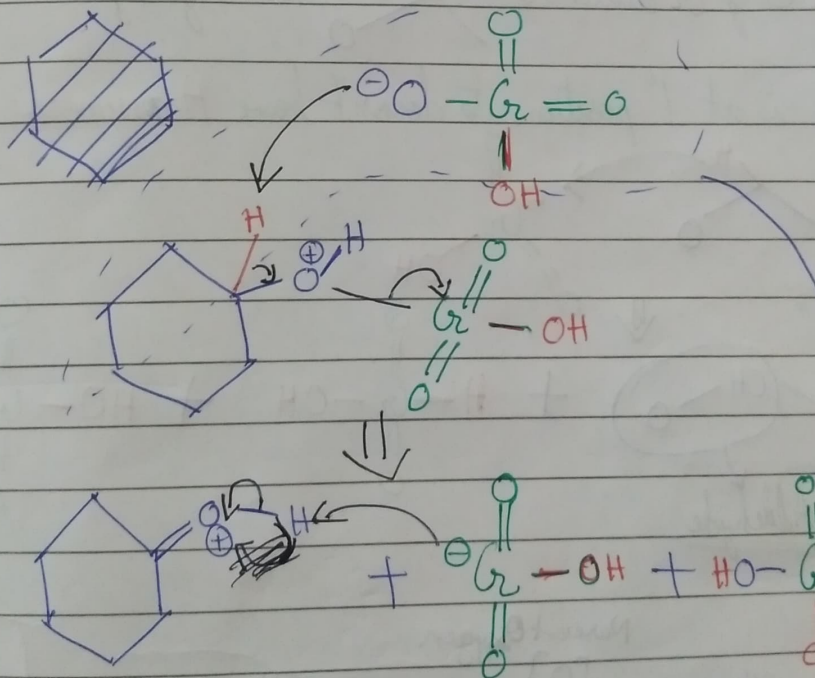
(4th step directly)



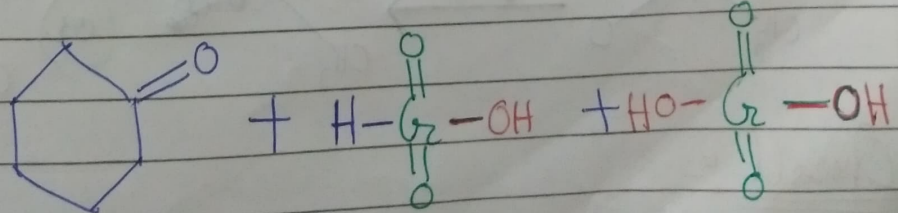




(2)



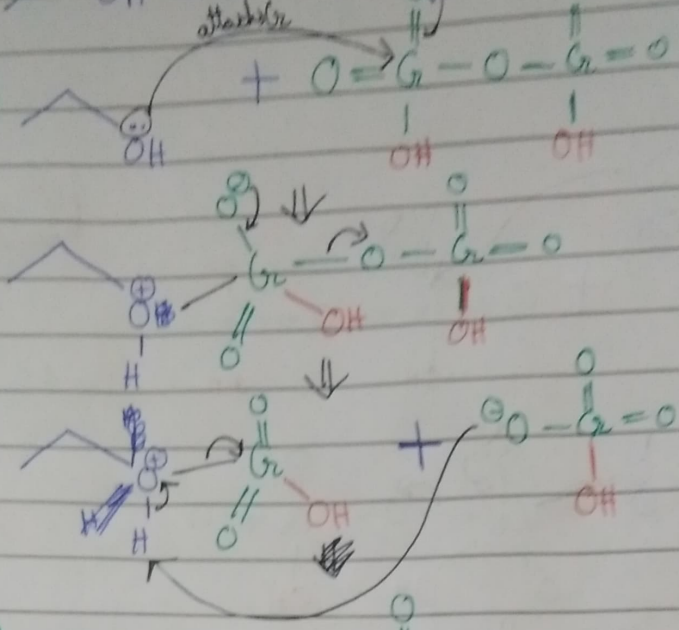
Products :-

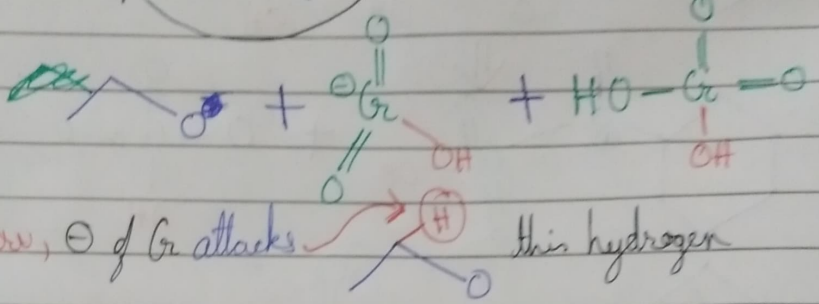


(*) 1° alcohol → aldehyde → acid

(ii) CH_3CH_2OH

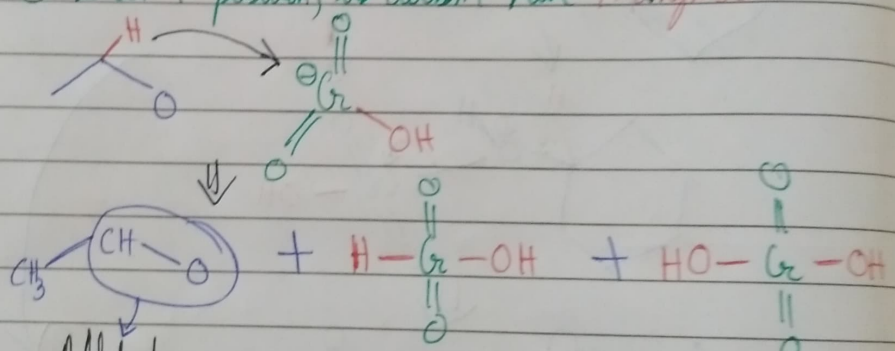
Sol:-

① 

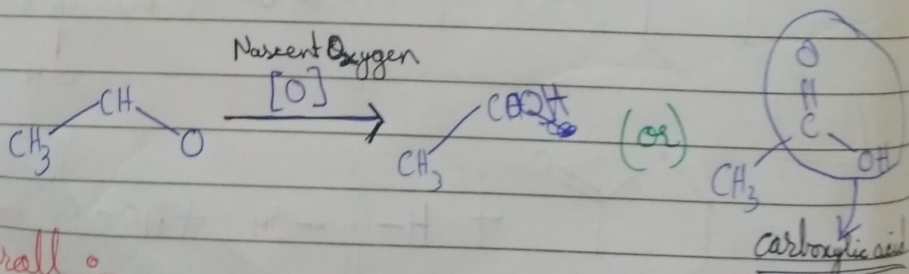
② 

(*) Now, ⊖ of Cr attacks this hydrogen

∵ O is at 1° position, it doesn't have H anymore



Aldehyde

③ 

carboxylic acid

Overall :-