HOME ASSIGNMENT – I on
Reactive Intermediates: Carbocations (carbenium and carbonium ions)

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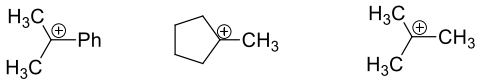
(Submit the answer sheet before 20-09-2023)

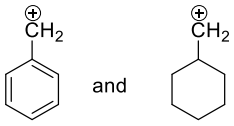
1. Discuss the structure of carbonium ion. How does it differ from carbenium ion?
2. What is the structure of carbocation? Discuss the factors influencing the stability of carbocations.
3. Comment on the relative stabilities of the following carbocations:



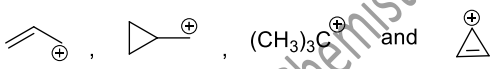
4. Which species in each of the following pairs is more stable and why?

Phenyl cation and cyclohexyl cation

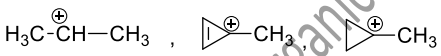
5. Which species in the following pairs is more stable ad why?

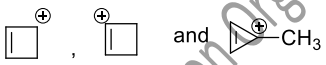


6. Arrange the following carbocations in order of their increasing stability and explain briefly.

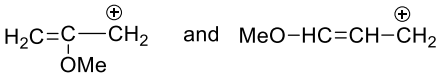


7. Arrange the following carbocations in order of increasing stability. Give reasons.

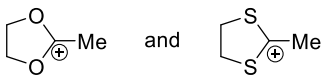
i) 

ii) 

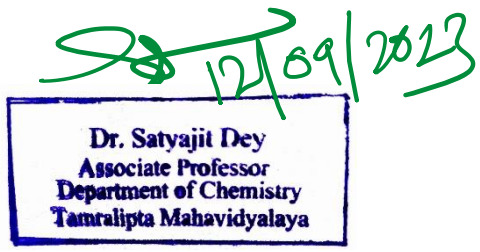
8. Compare the stability between:



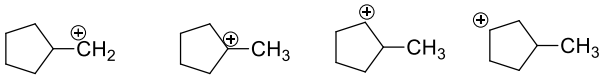
9. Compare the stabilities of each pair in the following ions with reasons.



10. Compare the stability of the following pair of carbocations.



11. Arrange the following species in order of increasing stability and explain.



12. Arrange the following carbocations in order of increasing stability and explain.

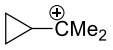
$(CH_3)_3C^+$, $CH_2{=}CHCH_2^+$, $(CH_3)_2C^+CH{=}CH_2$, $(CH_3)_3CCH_2^+$

13. Arrange the following carbocations in order of decreasing stability:

i) $Ph{-}\overset{\oplus}{C}H_2$, $(CH_3)_2\overset{\oplus}{C}CH_3$, $H_3C{-}\overset{\oplus}{C}H_2$ and $H_2C{=}\overset{\oplus}{C}{-}CH_3$

ii) $H_2C{=}CH{-}\overset{\oplus}{C}H_2$, $HC{\equiv}C{-}\overset{\oplus}{C}H_2$, $H_2C{=}\overset{\oplus}{C}H$, $H_2C{=}\overset{\oplus}{C}{-}Me$

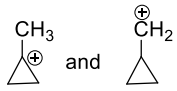
14. Arrange the following carbocation in terms of increasing stability with reason:

$Me_3\overset{\oplus}{C}$ $Ph{-}\overset{\oplus}{C}Me_2$ 

15. Which species in each of the following pairs is more stable and why?

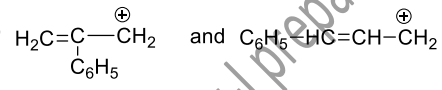
$CF_3\text{-}\overset{\oplus}{C}H_2$ and $CH_3\text{-}\overset{\oplus}{C}F_2$

16. Compare the relative stability of the carbocation of each pair with reasons.

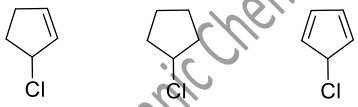
i) 

ii) $CH_3O\text{-}CH{=}CH\text{-}\overset{\oplus}{C}H_2$ and $CH_3\text{-}CH{=}\overset{\oplus}{C}H\text{-}CH_2$

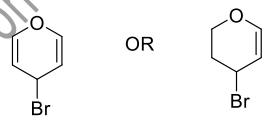
iii) $R_2\overset{\oplus}{O}\text{-}CH{=}CH_2$ and $R_2\overset{\oplus}{S}\text{-}CH{=}CH_2$

iv) 

17. Arrange the following molecules in order of their relative rate of reaction towards aqueous $AgNO_3$. Give proper justification for your prediction.



18. Of the two bromides shown below, which would you expect to undergo reaction with aqueous $AgNO_3$ and why?



19. Predict which one of two chlorines will be substituted preferentially when the following molecule is treated with aq. $AgNO_3$ solution.