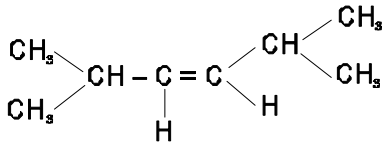
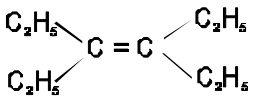
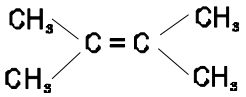
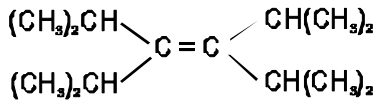
HYPERCONJUGATION

Q.1 Which of the following is most stable alkene ?

(A) 

(B) 

(C) 

(D) 

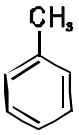
Q.2 Hyperconjugation is best described as

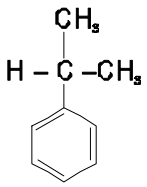
(A) delocalization of π electrons into a nearby empty orbital
(B) delocalization of σ electrons into a nearby empty orbital
(C) the effect of alkyl groups donating a small amount of electron density inductively into a carbocation
(D) the migration of a carbon or hydrogen from one carbocation to another

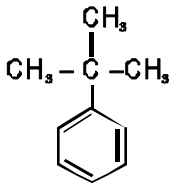
Q.3 The observed dipole moment of Nitromethane is higher than the dipole moment calculated from its structural descriptions. It is because of ?

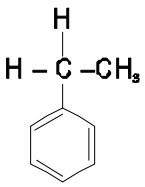
(A) Hyperconjugation
(B) Resonance
(C) Inductive effect
(D) None of the above

Q.4 Arrange following compounds in increasing order of Electrophilic substitution

(I) 

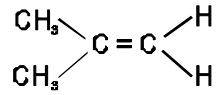
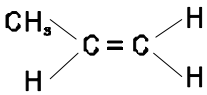
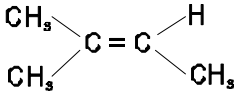
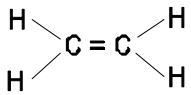
(II) 

(III) 

(IV) 

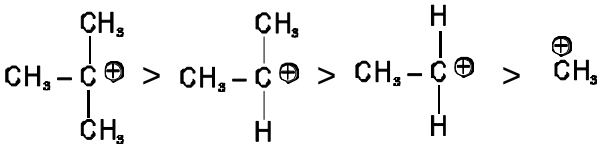
(A) III < II < IV < I
(B) II < IV < III < I
(C) IV < II < I < III
(D) I < II < III < IV

Q.5 Arrange the following alkenes in decreasing order of stability

(a)  (b)  (c)  (d) 

(A) c > b > a > d
(B) c > a > b > d
(C) c > b > d > a
(D) d > b > c > a

Q.6 The following drder of stability of carbocation can be explained on basis of

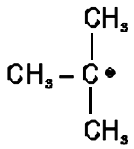
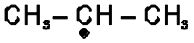
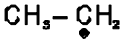


(A) Hyperconjugation
(B) Both of the above
(C) Inductive effect
(D) None of the above

Q.7 Hyperconjugation can not be used to explain following-

(A) Stability of carbocations
(B) Stability of free radicals
(C) E.S. in arenes
(D) Stability of carbanions

Q.8 Arrange following free radicals in increasing order of no-bond resonance structures

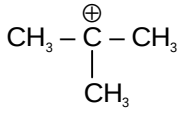
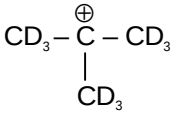
(I)  (II)  (III) 

(A) I > II > III
(B) III > II > I
(C) I > III > II
(D) All have same no. of structures

Q.9 The kind of delocalization involving sigma bond orbitals is called-

(A) Inductive effect
(B) Hyperconjugation effect
(C) Electromeric effect
(D) Mesomeric effect

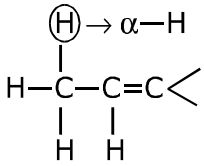
Q.10 Which is more stable ?

(I)  (II) 

(A) I > II
(B) II > I
(C) I = II
(D) Stability can't be predicted

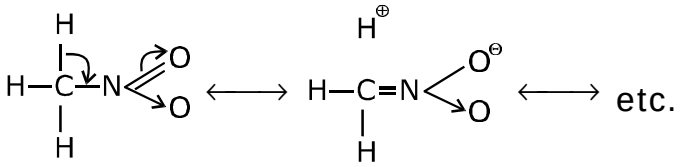
SOLUTIONS (HYPERCONJUGATION)

Ans.1 Stability of alkene $\propto$ no. of Hyperconjugative structures
$\propto$ no. of α—H

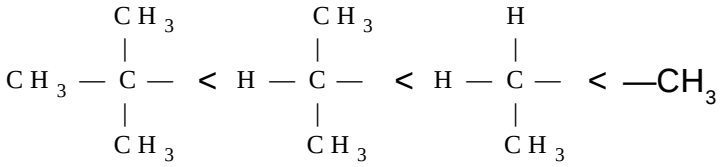


In (A) = 2 α-Hydrogen
(B) = 8 α-Hydrogen
(C) = 12 α-Hydrogen
(D) = 4 α-Hydrogen

Ans.3 Due to following Hyperconjugative structure, distance between the charges is increased which results in higher dipole moment ($\mu = \pm qd$)



Ans.4 Alkyl groups are o, p-directing due to Hyperconjugation Hyperconjugative effect of alkyl group increases in the following order which also determine the increasing order of electrophilic substitution at o, p-positions.



Ans.5 Stability of alkene $\propto$ No. of α—Hydrogens.

Ans.6 Stability of carboncation $\propto$ no. of Hyperconjugative structure
$\propto$ no. of α—Hydrogen

Ans.7 Hyperconjugation is the delocalisation of σ electrons into nearby empty orbital. But in case of carbanion there is no. empty orbital to receive σ electrons.

Ans.8 More the Hyperconjugative structures, Greater is the stability of free radicals.

Ans.9 By definition.

Ans.10 C–D is bond stronger than C–H bonds resulting in difficult delocalization of σ electrons of C–D bond into empty 'p' orbital.