CHEMISTRY

BOOKS - G.R. BATHLA & SONS CHEMISTRY (HINGLISH)

BASIC PRINCIPLES OF ORGANIC COMPOUNDS (MECHANISM OF ORGANIC REACTIONS)

SOME SOLVED PROBLEMS

1. Arrange the following groups in order of increasing $+I$ effect:

$CH_3^-, \quad (CH_3)_2CH^-, \quad (CH_3)_3C^-$

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2. Select the most stable carboncation from the following:

$CH_3^+, (CH_3)_2CH^+, CH_3CH_2^+, (CH_3)_3C^+$

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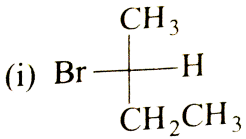
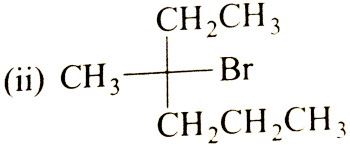
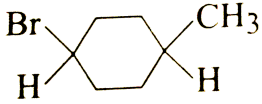
3. What is the major product(s) in each of the following :

(i) 

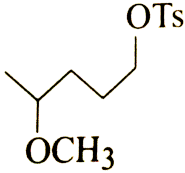
$\xrightarrow[S_N2]{KOH,\ H_2O} (A)$

(ii) 

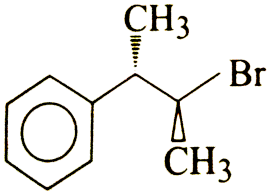
$\xrightarrow[S_N1]{CH_3CH_2OH} (B)$

(iii) 

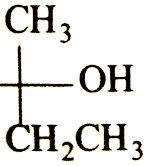
$+ OH^- \xrightarrow{S_N2} (C)$

(iv) 

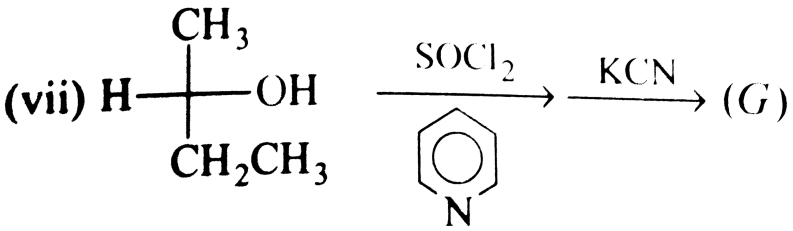
$\xrightarrow{CH_3OH} (D)$

(v) 

$\xrightarrow{CH_3COOH} (E)$

(vi) 

$\xrightarrow{SOCl_2} \xrightarrow{KCN} (F)$

(vii) 

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4. Explain why alkyl groups act as electron donors when attacted to a $\pi - system.$

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5. Explain the reaction mechanism of the addition of HBr on acetylene by equations only.

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6. Explain the reaction mechanism of the addition of bromine on acetylene by equations only.

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7. Explain the reaction mechanism of the following reaction by equations only :

$$\underset{\substack{|\\ \mathrm{CH_3}}}{CH_3-CH}-\underset{\substack{|\\ \mathrm{OH}}}{CH}-CH_3 \xrightarrow[\text{Heat}]{H_2SO_4} \underset{\substack{|\\ \mathrm{CH_3}}}{CH_3-C}=CH-CH_3$$

3-Methylbutan-2-ol — 2-Methylbut-2-ene

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8. Classify the following reactions as S_{N^1}, S_{N^2}, E_1 and E_2:

(i) A first order reaction between an alkyl halide and alkali, to give alcohol, the order in alkali being zero.

(ii) The formation of an olefin from an alkyl halide and alkali, the reaction being first order in each of the reactants.

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9. Calculate the pK values of the following organic acids and bases from their given K constants:

(a) CH_3COOH, $K_a = 1.8 \times 10^{-5}$

(b) CH_3OH, $K_a = 3.1 \times 10^{-16}$

(c) CH_3NH_2, $K_b = 4.5 \times 10^{-4}$

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10. Explain that, unlike other amines (RNH_2), guanidine, $\left(H_2N - \underset{\underset{\text{NH}}{\|}}{\text{C}} - NH_2 \right)$, is a strong base.

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11. 3,3-dimethylbutan-2-ol losses a molecule of water in the presence of concentrated sulphuric acid to give tertramethylethylene as a major

product. Suggest a suitable mechanism.

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12. Explain a possible mechanism for the S_N1 reaction of $Me_3C - Br$ and MeOH.

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13. Suggest the possible pathways of coverting $(R) - n - C_3H_7CH(OH)CH_3(A)$ into its ethyl ether $n - C_3H_7CH(OC_2H_5)CH_3$ using Fischer projections and give their R, S designations.

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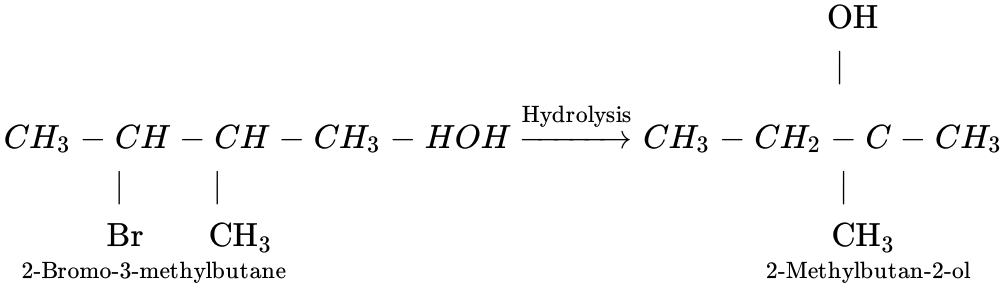
14. Explain the S_{N^1} reaction mechanism of the following by equations only.



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15. Explain a suitable mechanism for the following addition of HBr to hexa-2, 4-diene.

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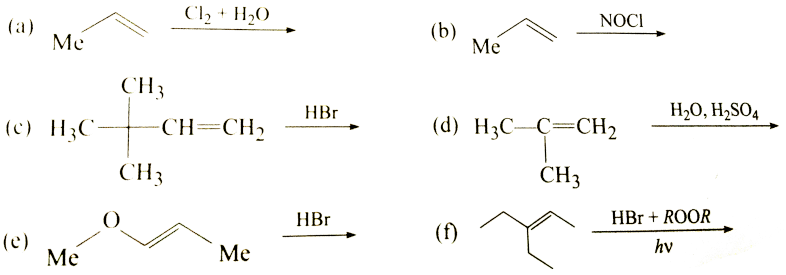
16. Complete the following reactions :



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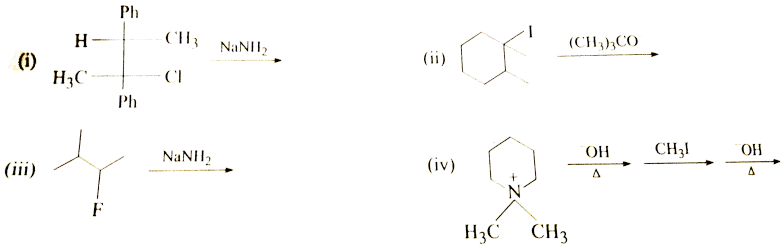
17. Explain the mechanism of elimination of the HBr in the given reaction

$$CH_3CH = CHCH_2 - \overset{\overset{Br}{|}}{CH} - CH_2CH_2$$

(b) Given the major products following reactions.



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18. Complete the following and identify the type for the intertmediate species:

(a) $CH_3—N\equiv N \xrightarrow{\text{Heat}} \text{-------} + N_2$

(b) $C_6H_5—N_3 \xrightarrow{\text{Light}} \text{-------} + N_2$

(c) $CH_3—N=C=O \xrightarrow{\text{Light}} \text{-------} + CO$

(d) $CH_3CON_3 \xrightarrow{\text{Light}} \text{-------} + N_2$

(e) $CH_3CH=CHCH_3 + \text{---} \longrightarrow CH_3—CH(N(H))—CHCH_3$

(f) $(CH_3)_3CH + \text{------} \longrightarrow (CH_3)_3CNHCOCH_3$

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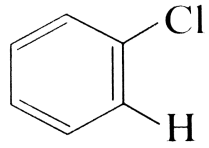
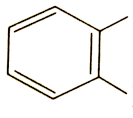
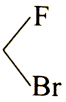
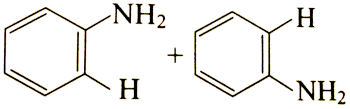
19. Complete the following and identify the type for the intermediate species:

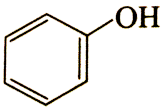
(a) $N_3H \xrightarrow{h\nu} \text{-------} + N_2$

(b)  $+ \bar{N}H_2 \longrightarrow \text{----} + NH_3 + Cl$

(c)  $\xrightarrow{\text{Heat}}$ ---- + Mg 

(d) ---- + NH_3(liquid) $\longrightarrow$ 

(e) $CH_3CH_2CH_3 + \text{------} \longrightarrow CH_3CH_2CH_2CH_3 + (CH_3)_3CH$

(f) ------ + HOH $\longrightarrow$ 

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20. Choose the member of each of the following pairs of compounds that is likely to be the stronger base :

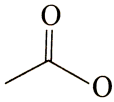
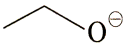
(a) NH_3 *or* $\overset{\ominus}{N}H_2$

(b) H_2O *or* $\overset{\ominus}{O}H$

(c) NH_3 *or* $\overset{\oplus}{N}H_4$

(d) H_2O *or* $\overset{\oplus}{H_3}O$

(e) $\overset{\ominus}{O}H$ *or* $\overset{\ominus}{S}H$

(f)  *or* 

(g) $C_6H_5\overset{\ominus}{O}$ *or* C_5H_5N

(h) $I^{\ominus}$ *or* $F^{\ominus}$

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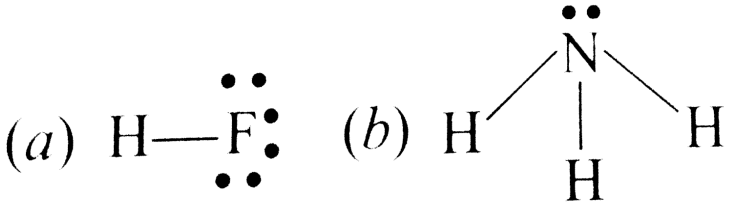
21. Write equations showing ambiphilic nature of the following molecules

:



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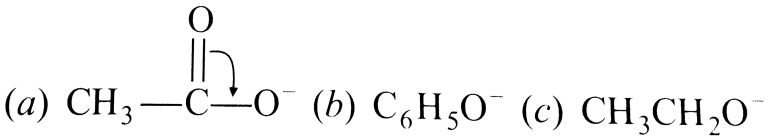
22. Which one of the following is a batter nucleophile and why?



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23. The decreasing order of basicity of nitrogen in the following compounds is :

(a) $CH_3 - CH_2 - NH_2, C_6H_5 - NH_2, H_2C = CH - NH_2$

(b) $(C_6H_5)_3N, (C_6H_5)_2NH, C_6H_5NH_2$

(c) $H_2C = NH, HCN, CH_3NH_2$

(d) $C_6H_5NH_2, C_6H_{11}NH_2, C_6H_5CONH_2$

(e) $C_5H_5N, C_4H_4NH, C_6H_5NH_2, CH_3CONH_2$

(f) $C_6H_5N(CH_3)_2, C_6H_3(CH_3)_2N(CH_3)_2, C_6H_5NH_2$

(g) $H_2N - C_6H_4 - OCH_3, C_6H_5NH_2,$

$H_2N - C_6H_4 - NO_2, H_2N - C_6H_4 - CH_2,$

$H_2N - C_6H_4 - Cl$

(h) $C_6H_5 - \underset{\underset{\text{NH}}{\|}}{\text{C}} - NH_2$, $O_2N - C_6H_4 - \underset{\underset{\text{NH}}{\|}}{\text{C}} - NH_2$

$Cl - C_6H_4 - \underset{\underset{\text{NH}}{\|}}{\text{C}} - NH_2$, $H_2N - C_6H_4 - \underset{\underset{\text{NH}}{\|}}{\text{C}} - NH_2$

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ILLUSTRATIONS OF OBJECTIVE QUESTIONS

1. Among the following which acid is strongest?

A. Acetic acid

B. Monochloroacetic acid

C. Dichloroacetic acid

D. Trichloroacetic acid

Answer: D

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2. Which of the following acid is strongest?

A. $HCOOH$

B. CH_3COOH

C. CH_3CH_2COOH

D. $CH_3CH_2CH_2COOH$

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3. Which of the following alkyl groups has the maximum $+I$ effect?

A. CH_3-

B. CH_3CH_2-

C. $(CH_3)_2CH-$

D. $(CH_3)_3C-$

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4. Considering the following alkene:

The correct decreasing order of stability is:

$CH_3CH_2=CH_2$, But-1-ene (I)

$(CH_3)_2C=C(CH_3)_2$, 2,3-Dimethylbut-2-ene (II)

$(CH_3)_2C=CHCH_3$, 2-Methylbut-2-ene (III)

$(CH_3)_2C=CH_2$, 2-Methylpropene (IV)

A. I gt II gt III gt IV

B. II gt III gt IV gt I

C. IV gt III gt II gt I

D. III gt IV gt I gt II

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5. The decreasing order of basic strength in

$$\underset{(\mathrm{I})}{C_6H_5NH_2}, \quad \underset{(\mathrm{II})}{(C_6H_5)_2NH}, \quad \underset{(\mathrm{III})}{CH_3NH_2}, \quad \underset{(\mathrm{IV})}{NH_3}$$

A. $IV > III > II > I$

B. $I > II > III > IV$

C. $III > IV > I > II$

D. $II > I > III > IV$

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6. Benzyne is:

A. 1,2-dihydrobenzene

B. 1,2-dehydrobenzene

C. 1,2,3,4-tetrahydrobenzene

D. imidogenes

Answer: B

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7. Which of the following is true about the cycloheptatrienyl free radical ?

A. it is an isolated stable free radical

B. it is an aromatic free radical

C. it has $4n + 2\pi$ electrons

D. none of the above.

Answer: D

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8. Heterolysis of propane gives:

A. methyl and ethyl free radicals

B. methylium ion and ethyl anion

C. methyl anion and ethylium cation

D. methylium and ethylium ions

Answer: C

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9. Which of the following pairs of ions is more stable?

(a) $CH_3CH_2O^{\ominus}$ and $\underset{(II)}{CH_2 = CH - O^{\ominus}}$

(b) $(CH_3)_2\overset{\ominus}{\underset{(I)}{C} - CH = O}$ and $(CH_3)_2\overset{\ominus}{\underset{(II)}{C} - CH = CH_2}$

(c) $Me\ddot{\underset{\cdot\cdot}{N}} - \underset{(I)}{CH = CH} - CH = \overset{\oplus}{N}Me_2$

and $Me\ddot{\underset{\cdot\cdot}{O}} - CH = CH - CH = \overset{\oplus}{N}Me_2$

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10. Which among the following compounds behave both as an electrophile as well a nucleophile?

$\underset{(1)}{CH_2 = CH_2}$ $\underset{(2)}{CH_2 = CH - \overset{+}{C}H_2}$

$\underset{(3)}{CH_3 - \overset{O}{\overset{||}{C}} - CH_3}$ $\underset{(4)}{CH_3 - \overset{O}{\overset{||}{C}} - Cl}$

Answer using the following codes:

A. only (1)

B. (1) and (2)

C. (3) and (4)

D. (2), (3) and (4)

Answer: C

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11. Which of the following species is an ambident nucleophile?

A. $\overset{\ominus}{C}H_3CH_2$

B. $H_2C = CH_2$

C. $\overset{\ominus}{O} - \ddot{N} = O$

D. $\overset{\ominus}{N}H_2$

Answer: C

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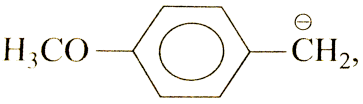
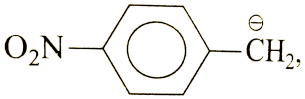
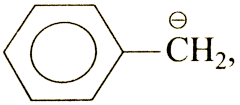
12. Consider the following carbanions:



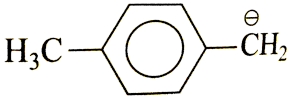
(I)



(II)



(III)



(IV)

Correct decreasing order of stability is :

A. II gt III gt I gt IV

B. III gt IV gt I gt II

C. IV gt I gt II gt III

D. I gt II gt III gt IV

Answer: A

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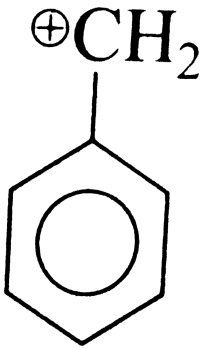
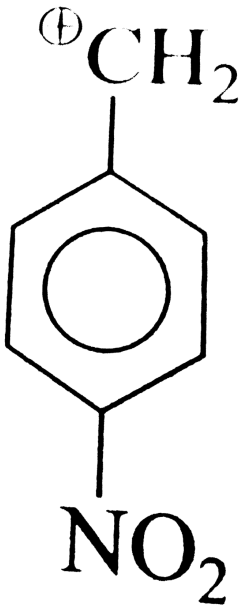
13. Which one of the following carbocations are most stable?

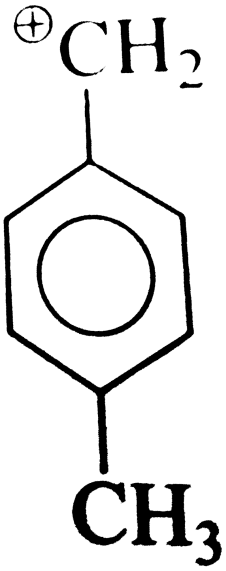
A.

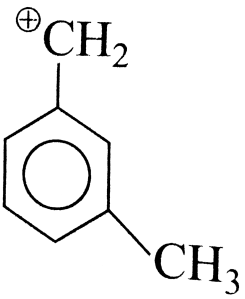


B.



C.





D.

Answer: C

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14. Which of the following is not a nucleophile ?

A. H_2

B. CH_3OH

C. H_2O

D. NH_3

Answer: A

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15. Nucleophilicity of which species is least?

A. $\overset{\ominus}{N}H_2$

B. $CH_3 - \overset{\ominus}{N}H$

C. $C_6H_5 - \overset{\ominus}{N}H$

D. $CH_3 - \overset{\ominus}{N} - CH_3$

Answer: D

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16. The nitration of benzene is :

A. S_{N^1} reaction

B. S_{N^2} reaction

C. S_{E^1} reaction

D. S_{E^2} reaction

Answer: D

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17. Classify the following as electrophiles and nucleophiles:

(a) CN^- (b) H_2O (c) Br^+ (d) NO_2^- (e) $\overset{+}{N}O_2$

(f) CH_3OH (g) $H_2C=CH_2$ (h) $RCOCl$ (i) H_2N-OH

(j) : $(CCl_2$ (k) H_3O^+ (l) NH_3 (m) BF_3 (n) $AlCl_3$

(o) OH^- (p) R_3N

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18. Which of the following most readily undergoes E_2 elimination with a strong base?

A. 2-Bromopentane

B. 2-Bromo-2-methylbutane

C. 1-Bromo-2,2-dimethylpropane

D. 2-Bromo-3-methylbutane

Answer: B

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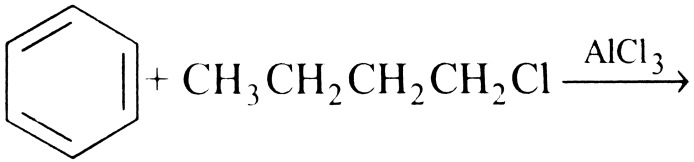
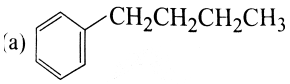
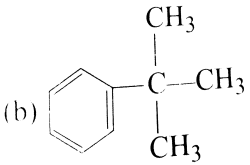
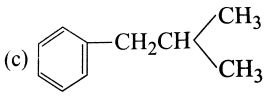
19. In the reaction:



the product formed will be:

A. 

B. 

C. 

D. all of these

Answer: B

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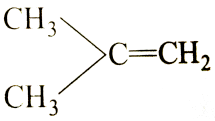
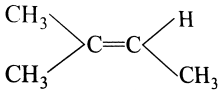
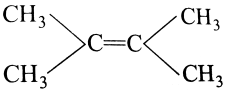
20. Which of the following alkene is most statble?

A. $CH_3CH = CH_2$

B. (b) 

C. (c) 

D. (d) 

Answer: D

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PROBLEMS FOR PRACTICE

1. Classify the following into electrophilic and nucleophilic reagents:

(a)H^+ (b) Cl^- (d) NH_3 (d)NO_2^+ (e)$C\overline{N}$ (f)H_2O

(g) Br^+ (h)ROH (i)BF_3 (j)RNH_2 (k)$AlCl_3$

(l) ROR (m) Carbocations (n) Carbanions (o) SO_3H

(p) $BeCl_2$ (q) I^- (r) $SnCl_4$ (s) : CCl_2 (t) $:P(CH_3)_3$

$(u)H_2C = CH_2$

(B) Classify the following as Lewis acids and Lewis bases :

$(a)CH_3NH_2$ (b)CN^- (c)$AlCl_3$ (d)Fe^{3+} (e) CO_2^-

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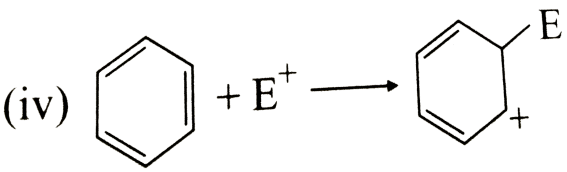
2. For the following bond cleavages, use curved arrows to show the electron flow and classify each as homolysis or heterolysis. Identify

reactive intermediate produced during the fission.

(i) $CH_3O—OCH_3 \longrightarrow CH_3\dot{O} + \dot{O}CH_3$

(ii) $>C=O + CN^- \longrightarrow >C<^{O^-}_{CN}$

(iii) 

(iv) 

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3. Identify each of the following as carbon-intermediates:

$(a) CH_3 - \overset{+}{C}H = CH$ $(b) (CH_3)_3\dot{C}$

$(c) (CH_3)_3\overline{C}$ $(d) C_2H_5\dot{C}CH_3$

$(e) CH_3 - \overline{C}H - CH_3$ $(d) C_2H_5\dot{C}CH_3$

$(e) CH_3 - \overline{C}H - CH_3$ $(f) C_2H_5\ddot{C} - H$

$(g) C_6H_5 - \ddot{N}$ $(h) : CCl_2$

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4. Classsify the following reactions by type:

(a) $HCHO + HCN \longrightarrow CH_2(OH)CN$

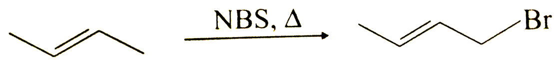
(b) $(CH_3)_2CHOH \xrightarrow{\text{Heat, Cu}} (CH_3)_2C{=}O + H_2$

(c) $CH_3Cl + KOH\,(aq.) \longrightarrow CH_3OH + KCl$

(d) $CH_2{=}CH_2 + Br_2 \longrightarrow \underset{Br}{CH_2}{-}\underset{Br}{CH_2}$

(e) $CH_3{-}\overset{NOH}{\overset{\|}{C}}{-}CH_2CH_3 \longrightarrow CH_3NH\overset{O}{\overset{\|}{C}}CH_2CH_3$

Ethyl methyl ketoxime → *N*-Methylpropionamide

(f) 

(g) $CHCl_3 + OH^- \longrightarrow :CCl_2 + H_2O + \bar{Cl}$

(h) $CH_3\underset{Br}{CH}{-}\underset{Br}{CH}CH_3 + Zn \longrightarrow CH_3CH{=}CHCH_3 + ZnBr_2$

(i) $\underset{I}{CH_2}{-}CH_2{-}\underset{I}{CH_2} + Zn \longrightarrow$ (cyclo) $CH_2{-}CH_2{-}CH_2$ $+ ZnI_2$

(j) $NH_4NCO \longrightarrow O{=}C(NH_2)_2$

(k) $(CH_3)_2\overset{+}{NH_2} + CH_3O^- \longrightarrow (CH_3)_2NH + CH_3OH$

(l) $H_3C{-}N{=}N{-}CH_3 \xrightarrow{\text{Heat}} H_3C{-}CH_3 + N_2$

(m) $C_2H_5Br + OH^- \longrightarrow C_2H_5OH + Br^-$

(n) $H_2C{-}CH_2$ (epoxide, bridged by O) $+ H_2O \xrightarrow{H^+} \underset{OH}{H_2C}{-}\underset{OH}{CH_2}$

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5. Arrange the following according to their stability:

$CH_3CH_2CH_2\overset{+}{C}H_2$, $(CH_3)_3\overset{+}{C}$, $CH_3CH_2\overset{+}{C}H_2$,

$CH_3CH_2\overset{+}{C}HCH_3$, $CH_3\overset{+}{C}H_2$, $\overset{+}{C}H_3$

(b) Arrange the following according to their stability:

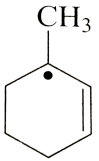
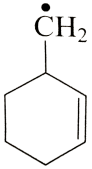
$C_6H_5\bar{C}H_2$, $(CH_3)_3\bar{C}$, $\bar{C}Cl_3$, $\bar{C}H_3$, $(CH_3)_2\bar{C}H$

(c) Arrange the following according to their stability:

(i) $\dot{C}H_3$, $(CH_3)_3\dot{C}$, $(C_6H_5)_3\dot{C}$, $C_6H_5\dot{C}H_2$, $CH_3\dot{C}H_2$

(ii) $CH_3-\underset{\underset{CH_3}{|}}{CH}-\dot{C}HCH_3$ (I), $CH_3-\underset{\underset{CH_3}{|}}{\dot{C}}-CH_2CH_3$ (II)

$CH_3-\underset{\underset{CH_3}{|}}{CHCH_2}\dot{C}H_2$ (III)

(iii) $H_2C=\dot{C}H$ (I), $H_2C=CH\dot{C}H_2$ (II),  (III),  (IV)

(d) Arrange the following in order of their :

(i) increasing basicity:

H_2O, OH^-, CH_3OH, CH_3O^-

(ii) increasing reactivity in nucleophilic substitution reaction:

CH_3F, CH_3I, CH_3Br, CH_3Cl.

(iii) increasing order of expected enol content:

CH_3COCH_2CHO, CH_3COCH_3, CH_3CHO,

$CH_3COCH_2COCH_3$.

decreasing order of S_{N^2} reactivity:

RCH_2X, R_2CHX, R_3CX, MeX.

(v) decreasing order of S_{N^1} reactivity:

(i) 2-bromopentane (A), 1-bromopentane (B), 2-bromo-2-methylbutane (C).

(ii) 1-bromo-3-methylbutane(A),

2-bromo-2-met-hylbutane (B),

2-bromo-3-methylbutane(C)

(vi) decreasing order of S_{N^2} reactivity:

1-bromobutane, (A), 1-bromo-2,2-dimethyl-propane (B), 1-bromo-2-methylbutane (C), 1-bromo-3-methylbutane (D).

(vii) decreasing order of S_{N^2} reactivity in alkoxide nucleophiles:

$Me_2C\bar{H}O$, $Me_3C\bar{O}$, $MeCH_2$, $\bar{O}$, $Me\bar{O}$

(c) Arrange the following as stated:

(i) increasing order of acid strength:

$ClCH_2COOH$, CH_3CH_2COOH, $ClCH_2CH_2COOH$,

$(CH_3)_2CHCOOH$, CH_3COOH

(ii) increasing order of acidity : $HClO$, $HCiO_2$, $HClO_3$, $HClO_4$

(iii) increasing strength of H-bonding $(X - - - - H - X)$:

O, S, F, Cl, N

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6. Answer the following :

(a) How many types of fission are possible of a covalent bond?

(b) how many types of ions are formed by heterolytic fission and what are their names?

(c) What are the names and nature of the parts formed by homolytic fission?

(d) How many electrons are present in the valence shell of the carbon atom of the carbonium ion?

(e) How many electrons are present in the valence shell of carbon atom of the carbanion ion?

(f) Name the attacking reagents and give their nature.

(g) Write the names of the parts obtained when $C - Cl$ bond of ethyl chloride undergoes heterolytic fission.

(h) What is the major factor that influences the relatives stabilities of carbocations, carbanions and free radicals.

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7. Explain:

(i) Why trichloroacetic acid is stronger than acetic acid?

(ii) Why formic acid is stronger than butyric acid?

(iii) Why alkyl amines are stonger bases than ammonia?

(iv) Why benzyl carbocation is more stable than ethyl caebocation?

(v) What is the effect of introduction of an alkyl group or the stability of the carbocation?

(vi) Why allyl cation is more stabe than ethyl cation?

(vii) Why does tert-butyl chloride react with sodium hydroxide solution bt S_{N^1} mechanism while n-butyl chloride react by S_{N^2} mechanism?

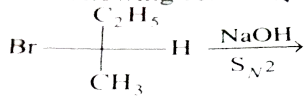
(viii) In acylium ion, the structure $R-C\equiv \overset{+}{O}:$ is more stable than $R-\overset{+}{C}=O.$

(ix) Why toluene reacts with bromine is presence of light gives benzyl bromide while in presence of $FeBr_3$, it gives p-bromotoluene?

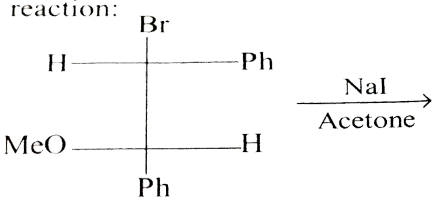
(x) Why aryl halides are less reactive than alkyl halides towards nucleophilic reagents?

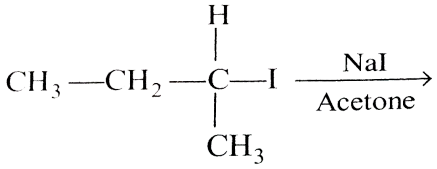
(xi) Draw the stereochemical structures of the products in the following reaction:

(xi) Draw the stereochemical structures of the products in the following reaction:



(xii) Predict the structure of the product in the following reaction:



(xiii) 

(xvii) Predict the relative yields of the product of Me_3CBr in $80\,\%$ EtOH and $20\,\%$ H_2O.

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8. Complete the following and identify the type for the inter-mediate species:

(a) $CH_3CH(OH)CH_3 + H^+ \xrightarrow{\text{Heat}} \ldots\ldots\ldots + HOH$

(b) $CH_3 - C \equiv C - H + Na^+NH_2^- \rightarrow \ldots\ldots\ldots + Na^+ + NH_3$

(c) $CH_3CH_2 - N = N - CH_2CH_3 \xrightarrow{\text{Heat}} \ldots\ldots + N_2$

(d) $CH_3 - CH = CH - CH_3 + HI \rightarrow \ldots\ldots\ldots + I^-$

(e) $CH_3CHI_2 + Zn \rightarrow \ldots\ldots\ldots + ZnI_2$

(f) $CH_3CH_2Cl + AlCl_3 \rightarrow \ldots\ldots + AlCl_4$

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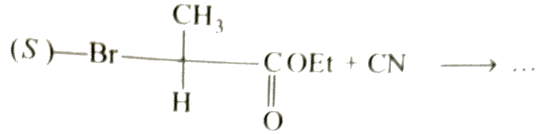
9. Complete the following and identify the type of displacement reactions:

(a) (R)—$CH_3CH(Br)CH_2CH_3 + MeO^- \longrightarrow$ ...

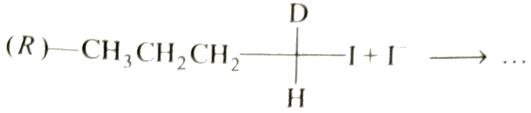
(b) (S)—$CH_3CH(Br)CH_2CH_3 + MeO^- \longrightarrow$ ...

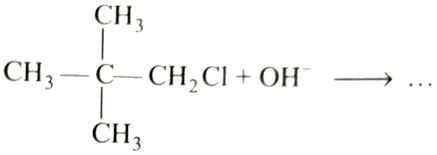
(c) $(CH_3)_3C—Br + MeOH \longrightarrow$ ...

(d) $[Me_3C—SMe_2]^+Cl^- + 2MeOH \longrightarrow$ ...
A sulphonium salt

(e) 

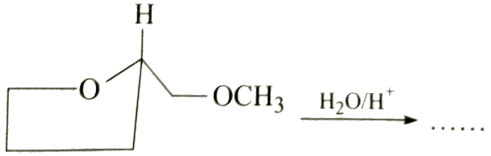
(f) $CH_3CH_2—O—CH_2Cl + C_2H_5OH \longrightarrow$ ...

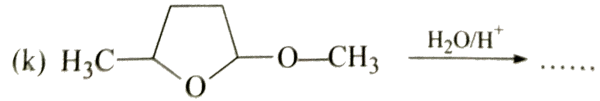
(g) 

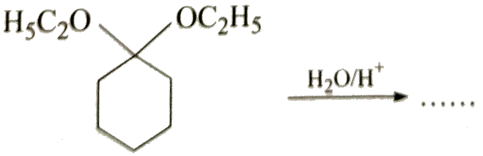
(h) 

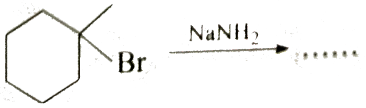
(i) $Me_3C—Br + HCOOH \longrightarrow$ ...

(B) Complete the followings :

(j) 

(k) 

(l) 

(m) 

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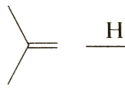
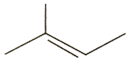
10. Complete the following addition reactions through the intermediate formation of stable carbocation (A) :

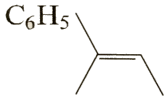
(i) $CH_3 - \underset{\displaystyle CH_3}{\overset{|}{\underset{|}{CH}}} - CH = CH_2 \xrightarrow{HCl} (A) \xrightarrow{Cl^-} (B)$

(ii) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} - CH = CH_2 \xrightarrow{HCl} (A) \xrightarrow{Cl^-} (B)$

(iii) $CH_3-\underset{\displaystyle C_6H_5}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH=CH_2 \xrightarrow{HBr} (A) \xrightarrow{Br^-} (B)$

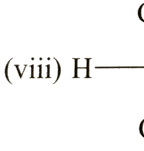
(iv)  $\xrightarrow{HCl}$ (A) $\xrightarrow{Cl^-}$ (B)

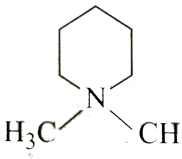
(v)  $\xrightarrow{HBr}$ (A) $\xrightarrow{Br^-}$ (B)

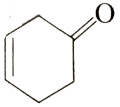
(vi)  $\xrightarrow{HCl}$ (A) $\xrightarrow{Cl^-}$ (B)

(vii) $H_2C=CH-CH=CH_2 \xrightarrow{HBr} (A) \xrightarrow{Br^-} (B)$.

(B) Complete the following reactions :

(viii)  $\xrightarrow[C_5H_5N]{SOCl_2}$ (A) $\xrightarrow{KCN}$ (B)

(ix)  $\xrightarrow[\Delta]{\ominus OH}$ (A) $\xrightarrow{CH_3I}$ (B) $\xrightarrow[\Delta]{\ominus OH}$ (C)

(x)  $\xrightarrow{C_6H_5CH_2MgBr}$ (A) $\xrightarrow{H_2O/H^+}$ (B)

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11. What are the various alkanes obtained due to insertion when 2-methylbutane reacts with singlet methylene $(:CH_2)$?

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12. Suggest a possible mechanism for the formation of $R-Li$ from $R-X$ by equation only.

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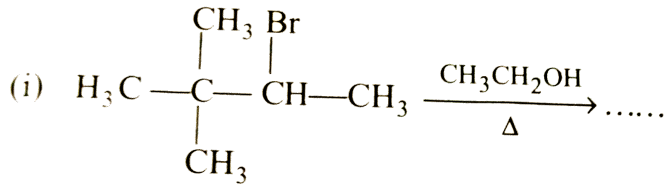
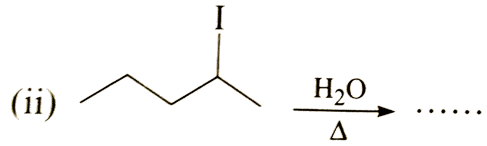
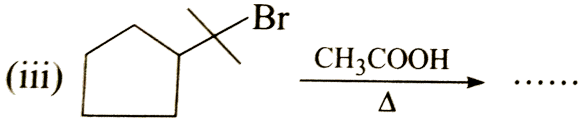
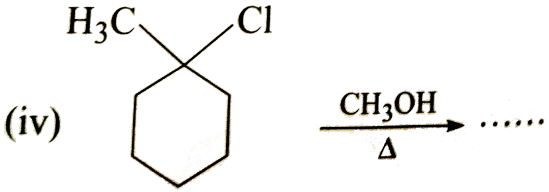
13. Give the major E_1 product of the following reactions :









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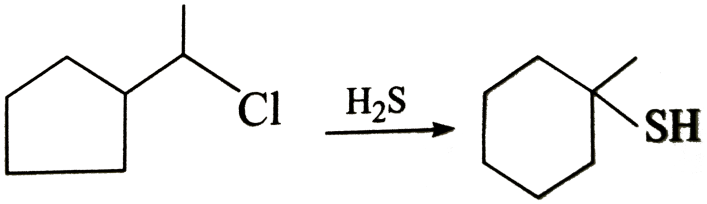
14. Give possible mechanism of the given reaction using carbocation rearrangement.



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15. Which the resonance structure of the following species :

(i) $:\bar{C}H_2 - C \equiv N:$

(ii) $CH_3CH = CH - \overset{+}{C}H - CH_3$

(iii) $\overset{+}{C}H_2 - CH = CH - \bar{C}H_2$

(iv) $CH_3 - \overset{:O:}{\overset{||}{C}} - \bar{C}H_2$

(B) Write resonance structure for the intermediate carbocation in the aromatic chlorination of benzene.

(C) Write the main resonance structure of the conjugate base of a 1, 3-diketone.

(D) Write the resonance structure of $CH_2 = CH - CHO$. Indicate relative stability of the contributing structures.

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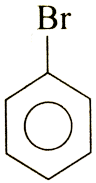
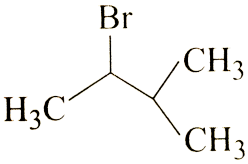
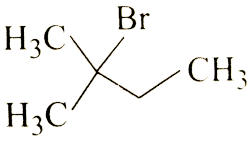
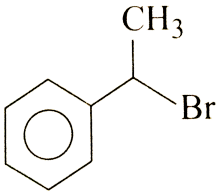
16. Which one hydrolysis at a faster rate by S_N1 mechanism?

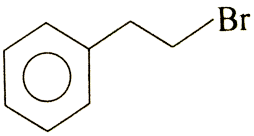
(a) (i) 

(ii) 

(b) (i) 

(ii) 

(c) (i) 

(ii) 

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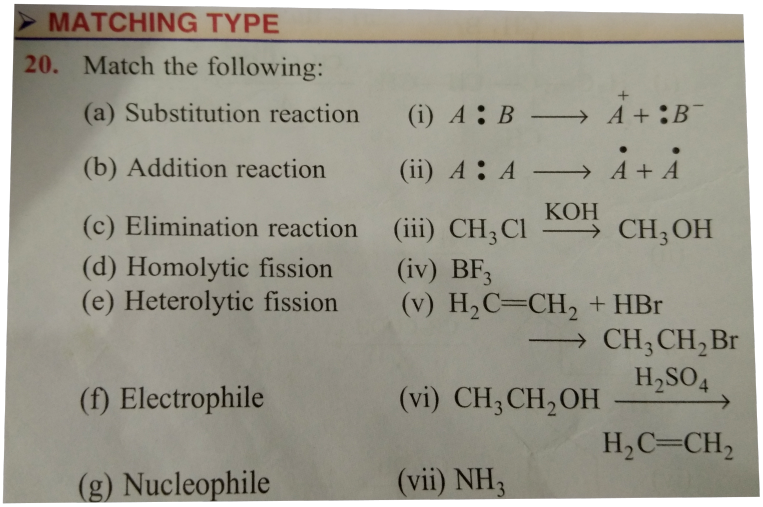
17. Match the following columns



MATCHING TYPE

20. Match the following:

(a) Substitution reaction	(i) $A : B \longrightarrow \overset{+}{A} + :B^-$
(b) Addition reaction	(ii) $A : A \longrightarrow \dot{A} + \dot{A}$
(c) Elimination reaction	(iii) $CH_3Cl \xrightarrow{KOH} CH_3OH$
(d) Homolytic fission	(iv) BF_3
(e) Heterolytic fission	(v) $H_2C{=}CH_2 + HBr \longrightarrow CH_3CH_2Br$
(f) Electrophile	(vi) $CH_3CH_2OH \xrightarrow{H_2SO_4} H_2C{=}CH_2$
(g) Nucleophile	(vii) NH_3

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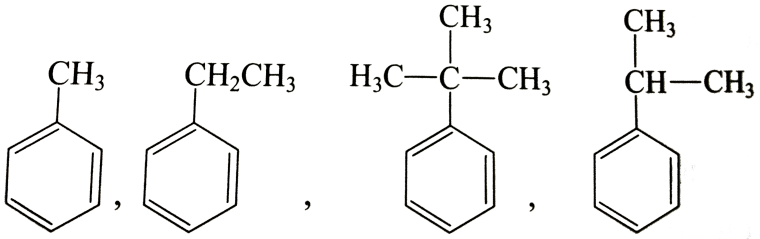
BRAIN STORMING PROBLEMS

1. Arrange the following in decreasing order of reactivity towards electrophilic substitution:



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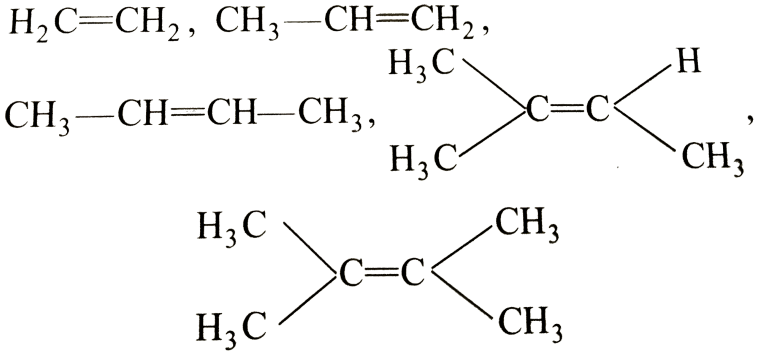
2. Arrange the following in decreasing order of stability:



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3. Arrange the following carbonyl compounds in decreasing order of reactivity towards nucleophilic addition:

(a) $HCHO, CH_3CHO, CH_3COCH_3, CCl_3CHO$

(b) $C_6H_5COC_6H_5, CH_3COC_6H_5, CH_3COCH_3$

(c) ltimg

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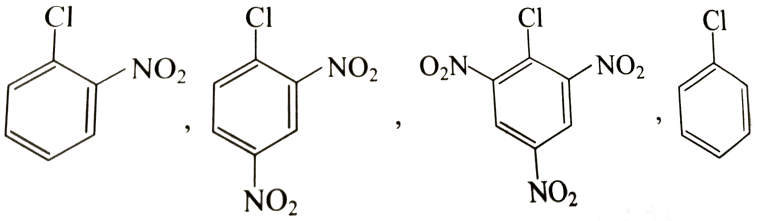
4. Arrange the following compounds in increasing order of reactivity towards nucleophilic substitution:



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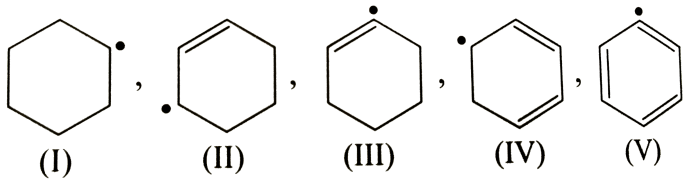
5. Arrange the following free radicals in increasing order of stability:



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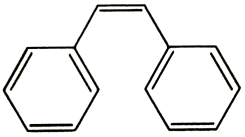
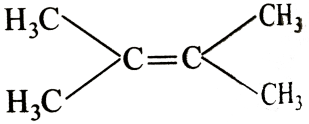
6. Which compound in each of the following pairs will add HCl readily?

I II

(a) $H_2C{=}CH_2$ OR $CH_3{-}CH{=}CH{-}CH_3$

(b) $CH_3{-}CH{=}CH{-}CH_3$ OR $H_2C{=}CH{-}CH{=}CH_2$

(c)  OR $CH_3{-}CH{=}CH{-}CH_3$

(d) $CH_3{-}CH{=}CH{-}CH_3$ OR 

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7. Complete the following reactions:

(a) $CH_3 - CH = CH_2 + CCl_4 \xrightarrow{\text{Peroxide}} ?$

(b) $H_2C = CH - (CH_2)_5 - CH_3 + CHCl_3 \xrightarrow{\text{Peroxide}} ?$

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8. Which product will be obtained when CCl_4 adds on $R - CH = CH_2$?

Give the mechanism of formation of the products.

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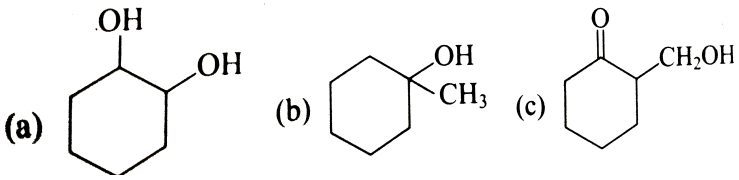
9. Which down the dehydration products of the following alcohols:



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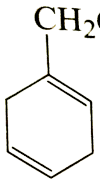
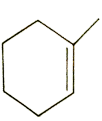
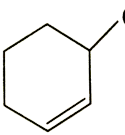
10. Give the major product of the following electrophilic addition reactons:

(a) 

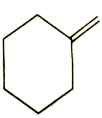
$+ HBr \longrightarrow ?$

(b) 

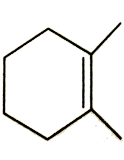
$+ HBr \longrightarrow ?$

(c) 

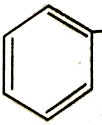
$+ HBr \longrightarrow ?$

(d) 

$+ HBr \longrightarrow ?$

(e) 

$+ HBr \longrightarrow ?$

(f) 
$-CH{=}CHCH_3 + HBr \longrightarrow ?$

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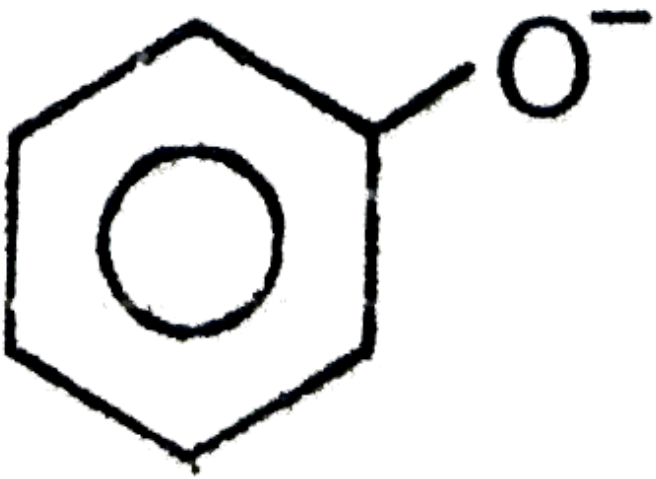
11. Consider the following anions.

(I) $CF_3 - \overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}} - O^-$ (II) $C_6H_5 - \overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}} - O^-$ (III)



(III)

(IV)

$$CH_3 - \overset{\overset{O}{||}}{C} - O^-$$

When attached to sp^3-hybridized carbon, their leaving group ability in nucleophilic substitution reactions decreases in the order

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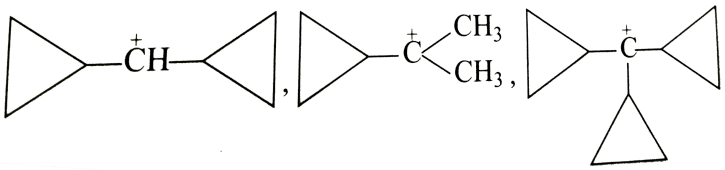
12. Arrange the following carbocations in increasing order of stability:



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13. Designate the type of each set of hydrogens in $(CH_3)_2C = CHCH_2CH_2CH(CH_3)_2$ and arrange them in order of decreasing reastivity towards radical substitution.

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14. Match the following reactions :

(a) $CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl$ (i) Electrophilic addition

(b) $C_6H_6 + HNO_3 \xrightarrow{H_2SO_4} C_6H_5NO_2 + H_2O$ (ii) Free radical addition

(c) $CH_3CH{=}CH_2 + HBr \longrightarrow CH_3CH(Br)CH_3$ (iii) Free radical substitution

(d) $CH_3CH{=}CH_2 + HBr \xrightarrow{\text{Peroxide}} CH_3CH_2CH_2Br$ (iv) Electrophilic substitution

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OBJECTIVE QUESTIONS (Level-A)

1. Inductive effect refers to-

A. electron displacement along a carbon chain

B. complete transfer of one of the shared pair of electrons to one of the atoms joined by a double bond

C. complete transfer of electrons hitherto unshared

D. none of the above

Answer: A

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2. $+I$ effect is shown by:

A. $-NO_2$

B. $-Cl$

C. $-Br$

D. $-CH_3$

Answer: D

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3. Polarization of electrons in acrolein may be written as:

A. $H_2\overset{\delta+}{C} = CH - CH = \overset{\delta-}{O}$

B. $H_2\overset{\delta+}{C} = CH - \overset{+\delta-}{C}\ H = O$

C. $H_2\overset{\delta-}{C} = \overset{\delta+}{C}H - CH = O$

D. $H_2\overset{\delta-}{C} = CH - CH = \overset{\delta+}{O}$

Answer: A

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4. Choose the weakest acid among the following :

A. $F_3\mathrm{CCOOH}$

B. FCH_2COOH

C. CH_3COOH

D. $(CH_3)_2CHCOOH$

Answer: D

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5. Among the following which one is most basic in aqueous solution ?

A. NH_3

B. CH_3NH_2

C. $(CH_3)_2NH$

D. $(CH_3)_3N$

Answer: C

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6. Most acidic compound is :

A. CH_3COOH

B. C_6H_5COOH

C. $O_2NC_6H_4CO_2H$

D. C_6H_5OH

Answer: C

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7. Maximum -I effect is exerted by the group-

A. C_6H_5-

B. $-OCH_3$

C. Cl

D. NO_2

Answer: D

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8. Zero inductive effect is exerted by:

A. C_6H_5-

B. H

C. $CH_3 -$

D. Cl

Answer: B

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9. Electromeric effect:

A. comes into play at the demand of attacking reagent

B. involves displacement of electrons in a sigma bond

C. comes into play in the molecule when atleast one atom has unshared pair of electrons

D. involves the distortion of the electron cloud

Answer: A

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10. The reaction intermediate produce by homolytic cleavage of bond is called,

A. carbocations

B. carbanions

C. free radicals

D. carbenes

Answer: C

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11. The stablest free radical among the following is :

A. $CH_3\dot{C}H_2$

B. $CH_3 - \dot{C}H_2 - CH_3$

C. $CH_3 - CH_2 - \dot{C}H_2$

D. $C_6H_5 - \dot{C}H_2 - CH_3$

Answer: D

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12. In CH_3CH_2OH, the bond that undergoes heterolytic cleavage most readily is:

A. $C - C$

B. $C - O$

C. $C - H$

D. $O - H$

Answer: B

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13. The most stable carbocation is :

A. methyl carbocation

B. primary carbocation

C. secondary carbocation

D. tertiary carbocation

Answer: D

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14. The most stable carbanion is :

A. methyl carbanion

B. primary carbanion

C. secondary carbonion

D. tertiary carbanion

Answer: A

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15. Which of the following ions is most stable?

A. $CH_3CH_2\overset{+}{C}H_2$

B. $CH_3\overset{+}{C}HCH_2CH_3$

C. $(CH_3)_3\overset{+}{C}$

D. $(CH_3)_3C\overset{+}{C}H_2$

Answer: C

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16. In which of the following, homolytic bond fission takes place :

A. Nitration of benzene

B. Alkaline hydrolysis of ethyl chloride

C. Addition of HBr to double bond

D. Free radical chlorination of methane

Answer: D

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17. The temporary effect in which there is a complete transfer of shared pair of $\pi -$ electrons to one of the atoms joined by a multiple bond on the demand of an attacking reagent is called:

A. inductive effect

B. electromeric effect

C. hyperconjugation

D. negative resonance effect

Answer: B

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18. The number of electrons present in the valence shell of carbon of $CH_3\overset{+}{C}H_2$ ion bearing $+ve$ charge:

A. 8

B. 7

C. 6

D. 4

Answer: C

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19. The number of electrons, present in the valence shell of carbon of carbanion bearing $-ve$ charge, is:

A. 8

B. 7

C. 6

D. 4

Answer: A

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20. In which of the following compounds the carbon marked with asterisk is expected to have greatest positive charge ?

A. $CH_3 - {}^*CH_2 - Br$

B. $CH_3 - {}^*CH_2 - Cl$

C. $CH_3 - {}^*CH_2 - CH_3$

D. $CH_3 - CH_2 - \overset{+}{M}g\overline{C}l$

Answer: B

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21. Electronegativity of carbon atoms depends upon their state of hybridisation. In which of the following compounds, the carbon marked with asterisk is most electronegative ?

A. $CH_3 - CH_2 - CH = \overset{*}{C}H_2$

B. $CH_3CH_2 - C \equiv \overset{*}{C}H$

C. $CH_3 - \overset{*}{C}H = CH - CH_3$

D. $CH_3 - CH_2 - \overset{*}{C}H_2 - CH_3$

Answer: B

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22. The strongest acid amongst the following compound is

A. CH_3COOH

B. $HCOOH$

C. $CH_3CH_2CH(Cl)COOH$

D. $ClCH_2CH_2CH_2COOH$

Answer: C

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23. The shape of CH_3^+ is .....

A. triangular planar

B. square planar

C. tetrahedral

D. none of these

Answer: A

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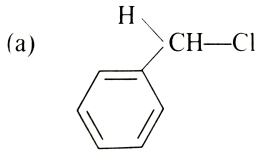
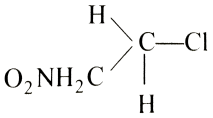
24. In which of the following compounds, the $C - Cl$ bond ion-isation shall give most stable carbonium ion?

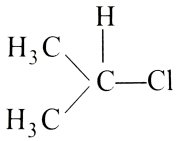
A. (a)



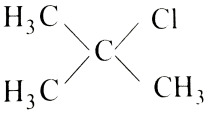
B. (b)



C. (c)



D. (d)



Answer: D

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25. Most stable carbocation is:

A. $CH_3 - \overset{+}{C}H_2$

B. $\overset{+}{C}H_2CHCl_2$

C. $\overset{+}{C}H_2CH_2Cl$

D. $\overset{+}{C}H_2 - CH_2NO_2$

Answer: A

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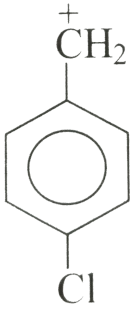
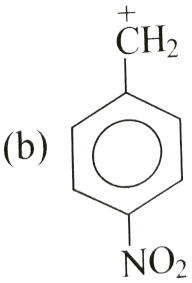
26. Most stable carbocation is:

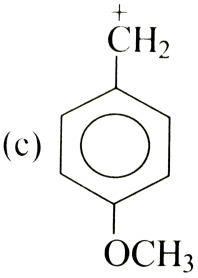
A. (a)



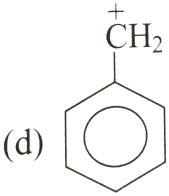
B.



C.



D.



Answer: C

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27. The shape of carbanion, $[CH_3]^-$ is :

A. linear

B. pyramidal

C. planar

D. tetrahedral

Answer: B

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28. Carbon atom in methyl carbocation and methyl carbanion is _____ and _____ hybridised :

A. sp, sp^2

B. sp^3, sp

C. sp^3, sp^2

D. sp^2, sp^3

Answer: D

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29. An electrophilic reagent is:

A. electron-rich species

B. electron-deficient spcies

C. a Lewis base

D. negatively charged species

Answer: B

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30. A nucleophile is:

A. electron-rich species

B. electron-deficient species

C. a Lewis base

D. positively charged species

Answer: A

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31. Which of the following compounds prossesses the $C - H$ bonds with the lowest bond dissociation energy?

A. Benzene

B. n-Pentane

C. Toluene

D. 2,2-Dimethylpropane

Answer: C

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32. The pair of electrons in the given carbanion, $CH_3C \equiv C^{\Theta}$ is present in which of the following orbitals?

A. sp^3

B. sp^2

C. $2p$

D. sp

Answer: D

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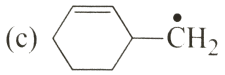
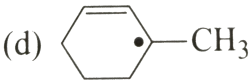
33. Most stable radical is

A. $CH_2 = \dot{C}H$

B. $CH_2 = CH - \dot{C}H_2$

C. 

D. 

Answer: B

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34. Which of the following reactions is an example of S_{N^2} reaction?

A. $(CH_3)_3C - Br + OH^- \rightarrow (CH_3)_3C - OH + Br^-$

B. $(CH_3)_2CH - Br + OH^- \rightarrow (CH_3)_2CH - OH + Br^-$

C. $CH_3 - Br + OH^- \rightarrow CH_3 - OH + Br^-$

D. $CH_3CH_2OH \xrightarrow[(-H_2O)]{} H_2C = CH_2$

Answer: C

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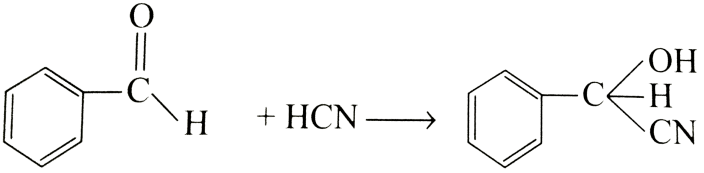
35. The following reaction is an example of:



A. nucleophilic substitution

B. electrophilic substitution

C. electrophilic addition

D. nucleophilic addition

Answer: D

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36. The reaction between ethylene and bromine is an example of:

A. electrophilic additon

B. electrophilic substitution

C. nucleophilic addition

D. nucleophilic substitution

Answer: A

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37. In the nitration of benzene with a mixture of conc. HNO_3 and conc. H_2SO_4, the active species involved is :

A. nitrite ion

B. nitrate ion

C. nitronium ion

D. nitrogen dioxide

Answer: C

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38. Nitration of benzene is:

A. nucleophilic substitution

B. nucleophilic addition

C. electrophilic substitution

D. free radical substitution

Answer: C

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39. Consider the following structure

$$\underset{\text{I}}{CH_2C = \overset{+}{C}H} \quad , \qquad \underset{\text{II}}{CH_3 - \overset{+}{C}H_2}$$

$$\underset{\text{III}}{H_2C = CH - \overset{+}{C}H_2} \quad , \qquad \underset{\text{IV}}{C_6H_5 - \overset{+}{C}H - C_6H_5}$$

The correct sequence of these carbocations in the decreasing order of their stability is :

A. I, II, III, IV

B. IV, III, II, I

C. IV, II, III, I

D. I, III, II, IV

Answer: B

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40. Addition of HI on the double bond of propene yields isopropyl iodide and not n-propyl iodide as the major product. This is because the addition proceeds through:

A. a more stable carbonium ion

B. a more stable carbanion ion

C. a more stable free radical

D. none of the above is a correct statement

Answer: A

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41. Which of the following alkyl halides is hydrolysed by S_{N^1} mechanism?

A. CH_3Cl

B. CH_3CH_2Cl

C. $CH_3CH_2CH_2Cl$

D. $(CH_3)_3CCl$

Answer: D

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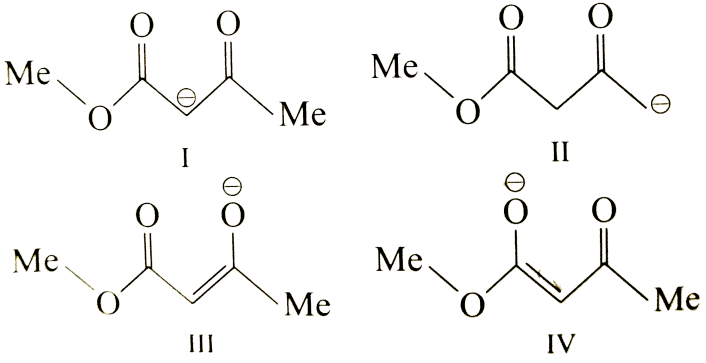
42. Among the following structures the one which is not a resonating structure of other is :



A. IV

B. II

C. III

D. I

Answer: B

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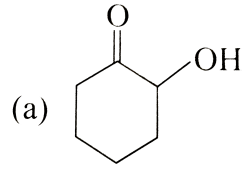
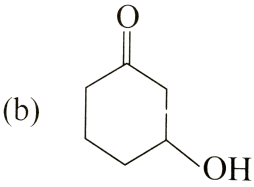
43. Which is dehydrated to maximum extent using conc. H_2SO_4?

A.



B.



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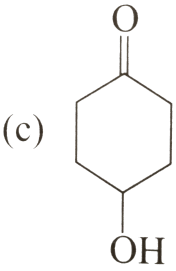
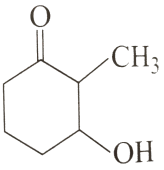


(d) 

D.

Answer: D

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44. Which one of the following statements wrong about S_{N^2} reaction?

A. The rate of reaction is independent of the concentration of nucleophile

B. Nucleophilic attacks the carbon from the side opposite to where the leaving group is attached

C. Only in one step the bond formation and bond breaking takes place

D. The rate of reaction $\propto$ [substrate] [nucleophile]

Answer: A

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45. Which of the following statements is not correct for a nucleophiles?

A. Nucleophiles are not electron seeking

B. Nucleophile attack low e^- density sites

C. Nucleophile is a Lewis acid

D. Ammonia is a nucleophile

Answer: C

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46. The addition of HBr to propylene takes place opposite to Markownikoff's rule in presence of:

A. sunlight

B. hydrogen peroxide

C. platinum catalyst

D. none of these

Answer: B

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47. Anti-Markownikoff's addition is not observed in:

A. propene

B. 1-butene

C. 2-pentene

D. 2-butene

Answer: D

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48. Ammonia is iso-structural with:

A. carbanion

B. free radical

C. carbocation

D. carbene

Answer: A

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49. Which of the following statements is correct?

A. Allyl carbocation $\left(H_2C = CH - \overset{+}{C}H_2\right)$ is more stable than propyl carbocation

B. Propyl carbocation is more stable than allyl carbocation

C. Both are equally stable

D. None of the above

Answer: A

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50. Which of the following statements is correct about a carbocation?

A. It reacts with nucleophile

B. It can undergo rearrangement

C. It can eliminate H^+ to form an olefin

D. All are correct

Answer: D

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51. S_{N^1} mechanism for the hydrolysis of an alkyl halide involves the formation of intermediate:

A. free radical

B. carbocation

C. carbanion

D. none of these

Answer: B

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52. Stability of $\overset{+}{C}H_2 - CH = CH_2$ can be explained by:

A. inductive effect

B. electromeric effect

C. resonance

D. polar effect

Answer: C

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53. Nucleophilic part of the reagent attacks the substrate $CH_3CH_2COCH_3$ on the :

A. carbon atom of carbonyl group

B. oxygen atom of carbonyl group

C. methyl group

D. CH_2 group

Answer: A

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54. Which of the following is electron deficient ?

A. PH_3

B. $(BH_3)_2$

C. $(SiH_3)_2$

D. $(CH_3)_2$

Answer: B

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55. Hyperconjugation is most useful for stabilizing which of the following carbocations?

A. Neopentyl

B. tert-Butyl

C. Isopropyl

D. Ethyl

Answer: B

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56. Arrange the following in order of decreasing tendency towards S_{N^2} reaction :

$\underset{(I)}{CH_3CH_2CH_2CH_2Cl}$, $\underset{(II)}{CH_3CH_2CHClCH_3}$,

$\underset{(III)}{(CH_3)_2CHCH_2Cl}$, $\underset{(IV)}{(CH_3)_3C-Cl}$

A. $IV > III > II > I$

B. $III > IV > II > I$

C. $I > III > II > IV$

D. $II > I > III > IV$

Answer: C

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57. The peroxide effect in anti-Markownikoff's additon involves:

A. ionic mechanism

B. free radical mechanism

C. heterolytic fission of double bond

D. homolytic fission of double bond

Answer: B

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58. The decreasing order of strength of the bases, $OH^-, NH_2^-, H-C\equiv C^-$ and $CH_3-CH_2^-$:

A. IV > II > III > I

B. III > IV > II > I

C. I > II > III > IV

D. II > III > I > IV

Answer: A

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59. Which one of the following reactions proceeds through free radical chain mechanism?

A. Hydrolysis of tert-butyl chloride with aqueous KOH

B. Photochemical chlorination of methane

C. Addition of HBr to ethene

D. Addition of $NaHSO_3$ on acetone

Answer: B

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60. Which is the decreasing oreder of acidity in the following compounds?

$CH_3CH_2OH(\mathrm{I})$ $CF_3CH_2OH(\mathrm{II})$

$\mathrm{CCl}_3 - CH_2OH(\mathrm{III})$ $(NO_2)_3C - CH_2OH(\mathrm{IV}$

A. $I > II > III > IV$

B. $II > I > III > IV$

C. $IV > II > I > III$

D. $IV > II > III > I$

Answer: D

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61. Carbocation is a reaction intermediate in which of the following reactions?

A. E_1 reactions

B. Electrophilic addition reactions of alkenes and alkynes

C. S_{N^1} reaction

D. All of the above

Answer: D

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62. The compound that does not undergo hydrolysis by S_{N^1} mechanism is :

A. $H_2C = CHCH_2Cl$

B. C_6H_5Cl

C. $C_6H_5CH_2Cl$

D. $C_6H_5CH(C_6H_5)Cl$

Answer: B

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63. Which one is a nucleophilic substitution reaction among the following ?

A. $CH_3CH = CH_2 + H_2O \xrightarrow{H^+} CH_3 - \underset{\underset{OH}{|}}{C}H - CH_3$

B. $RCHO + R'MgX \rightarrow R\underset{\underset{OH}{|}}{C}H - R'$

C.

$$CH_3 - CH_2 - \underset{\underset{CH_3}{|}}{CH} - CH_2Br + NH_3 \rightarrow CH_3CH_2 - \underset{\underset{CH_3}{|}}{CH} - CH_2N$$

D. $CH_3CHO + HCN \rightarrow CH_3CH(OH)CN$

Answer: C

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64. Hypercojnugation is not possible in :

A. $H_3C - CH = CH_2$

B. $H_2C = CH_2$

C. (c) $H_3C—\overset{+}{C}\begin{matrix}CH_3\\CH_3\end{matrix}$

D. $(CH_3)_2C = C(CH_3)_2$

Answer: B

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65. Reimer-Tiemann reaction of phenol with cholorform and aqueous alkali takes place through the intermediate formation of:

A. carbocations

B. carbanions

C. carbon radicals

D. carbenes

Answer: D

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66. The reaction intermediate carbenes are produced from"

A. diazo methane

B. ketene

C. $CHCl_3 / C_2H_5ONa$

D. all of these

Answer: D

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67. In the following group :

$-OAc(I),\ -OMe(II),\ -OSO_2(III),\ -OSO_2CF_3(IV)$

The order of leaving group ability is :

A. $IV > III > I > II$

B. $I > II > III > IV$

C. $III > II > I > IV$

D. $II > III > IV > I$

Answer: A

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68. $:CCl_2$ is :

A. a free radical

B. a nucleophile

C. an electrophilie

D. none of these

Answer: C

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69. In additon reactions of alkenes, the Markownikoff's rule follow:

A. ionic mechanism

B. radical mechanism

C. substitution mechanism

D. rearrangement mechanism

Answer: A

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70. Addition of HBr to propene in presence of peroxide (antiMarkownikoff's additon) occurs when:

A. Br^+ first adds to propene

B. Br^- first adds to propene

C. H^+ first adds to propene

D. $Br^\cdot$ first adds to propene

Answer: D

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71. A nucleophile must have :

A. a negative charge

B. a positive charge

C. a lone pair of electron

D. an electron deficient centre

Answer: C

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72. In a Friedel-Crafts reaction, the electrophile is:

A. Cl^- or X^-

B. CH_3^+ or CH_3CO^+

C. CH_3Cl

D. CH_3COCl

Answer: B

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73. Arrange the following carbanions in decreasing orde of stability:

$HC \equiv \overline{C}(I), \qquad H_3C - C \equiv \overline{C}(II),$

$H_2C = \overline{C}H(III), \qquad H_3C - \overline{C}H_2(IV)$

A. $IV > III > I > II$

B. $II > I > III > IV$

C. $IV > III > II > I$

D. $I > II > III > IV$

Answer: D

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74. Arrange the following carbocations in order of increasing stability :

$\underset{(I)}{(CH_3)_3\overset{+}{C}CH_2}$, $\underset{(II)}{(CH_3)_3\overset{+}{C}}$,

$\underset{(III)}{CH_3CH_2\overset{+}{C}H_2}$, $\underset{(IV)}{CH_3\overset{+}{C}HCH_2CH_3}$

A. $IV < III < II < I$

B. $III < IV < I < II$

C. $I < III < IV < II$

D. $II < IV < III < I$

Answer: C

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75. Which one of the following behaves both as a nucleophile and an electrophile ?

A. CH_3NH_2

B. CH_3OH

C. CH_3CN

D. CH_3Cl

Answer: C

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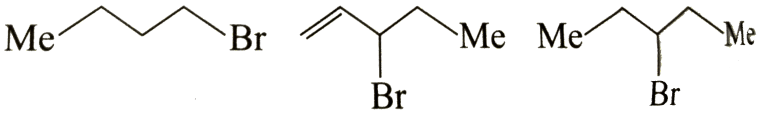
76. Consider the following bromides:



(I) (II) (III)

The correct order of S_{N1} reactivity is :

A. $I > II > III$

B. $II > III > I$

C. $II > I > III$

D. $III > II > I$

Answer: B

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77. Which one is the correct order of decreasing stability of car banions?

A. $P > S > T > C_6H_5CH_2$

B. $C_6H_5CH_2 > P > S > T$

C. $T > S > P > C_6H_5CH_2$

D. $C_6H_5CH_2 > T > S > P$

Answer: B

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78. The stability order in the following carbocations,

$CH_3CH_2^+(\mathrm{I}), \quad (CH_3)_2\overset{+}{C}H(\mathrm{II}), \quad (CH_3)_3C^+(\mathrm{III}) \quad \overset{+}{C}H_3(\mathrm{IV})$ is :

A. $I > IV > III > II$

B. $I > II > III > IV$

C. $III > IV > I > II$

D. $III > II > I > IV$

Answer: D

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79. Which one of the following carbocations is most stable?

A. $C_6H_5 - \overset{+}{C}H - C_6H_5$

B. $CH_3 - \overset{+}{C}H - CH_3$

C. $H_2C = CH - \overset{+}{C}H_2$

D. $H_2C = CH - \overset{+}{C}H - CH_3$

Answer: A

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80. Which is the weakest base of the following whose pK_b val-use are?

A. 4.75

B. 3.23

C. 3.12

D. 3.07

Answer: A

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81. Which is decreasing order of acidity in,

$HCOOH(I), CH_3COOH(II), CH_3CH_2COOH(III)$ and $C_6H_5COOH(I$

?

A. $I > II > III > IV$

B. $IV > III > II > I$

C. $IV > I > II > III$

D. $I > IV > II > III$

Answer: D

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82. Which one of the following is the weakest base in queous medium ?

A. NH_3

B. $(C_2H_5)_2NH$

C. $C_2H_5NH_2$

D. $(C_2H_5)_3N$

Answer: A

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83. Which of the following compounds prossesses the $C-H$ bonds with the lowest bond dissociation energy?

A. 2,2-Dimethylpropane

B. n-pentane

C. Benzene

D. Toluene

Answer: D

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84. Which one of the following compounds is most acidic?

A. Phenol

B. Trichloroacetaldehyde

C. Trichloroacetic acid

D. Benzoic acid

Answer: C

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85. Arragne basicity of the following compounds in decreasing order:

$CH_3CH_2NH_2(I), \qquad H_2C = CH - NH_2(II),$

$HC \equiv C - NH_2(III), \qquad C_6H_5NH_2(IV)$

A. $I > II > III > IV$

B. $IV > III > II > I$

C. $III > II > I > IV$

D. $I > III > II > IV$

Answer: A

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86. Which is the increasing order of acidic strength in the following compounds ?

$CH_3CH_2CH_2COOH(I), \mathrm{NCCH_2}COOH(II), H_2C=CHCH_2COOH(II$

A. $I < II < III$

B. $I < III < II$

C. $III < II < I$

D. $II < I < III$

Answer: B

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87. Which of the following compounds is not a Lewis acids?

A. BF_3

B. $SnCl_4$

C. $R-OR$

D. $P - MgX$

Answer: C

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88. Which of the following contains three pairs of electron?

A. Carbocation

B. Carbanion

C. Free radical

D. None of these

Answer: A

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89. In the following compounds phenol (I), p-cresol (II), m-nitrophenol (III) and p-nitrophenol (IV), the order of acidity is:

A. $III > IV > I > II$

B. $I > IV > III > II$

C. $II > I > III > IV$

D. $IV > III > I > II$

Answer: D

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90. In the following compounds piperidine (I), pyridine (II), morpholine (III) and pyerrole (IV), the order of basicity is :

A. $IV > I > III > II$

B. $III > I > IV > II$

C. $II > I > III > IV$

D. $I > III > II > IV$

Answer: D

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91. The kind of delocalization involving sigma bond orbitals is called:

A. hybridization

B. conjugation

C. hyperconjugation

D. conformation

Answer: C

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92. Hyperconjugation phenomenon is possible in:

A. $H_2C = CH_2$

B. $CH_3CH_2 - CH = CH_2$

C. $C_6H_5CH = CH_2$

D. $(CH_3)_3C - CH = CH_2$

Answer: B

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93. In the following compounds, anisole (I), benzene (II) and nitrobenzene (III), the ease of reaction with electrophiles is:

A. $II > III > I$

B. $III > II > I$

C. $II > I > III$

D. $I > II > III$

Answer: D

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94. Among the given compounds, the most susceptible to nucleophilic attack at the cabonyl group is:

A. $MeCOCl$

B. $MeCHO$

C. $MeCOOMe$

D. $MeCOOCOMe$

Answer: A

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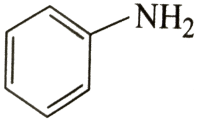
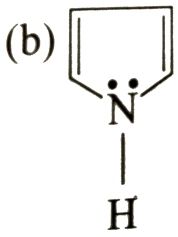
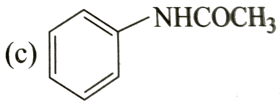
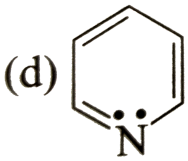
95. The most nucleophilic nitrogen is in:

A. (a) 

B. 

C. 

D. 

Answer: D

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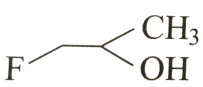
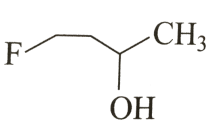
96. The order of reactivity of following alcohols, towards conc. HCl is :



(I)



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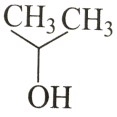

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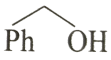

(IV)

A. $I > II > III > IV$

B. $I > III > II > IV$

C. $IV > III > II > I$

D. $IV > III > I > II$

Answer: C

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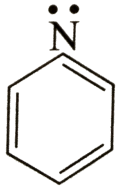
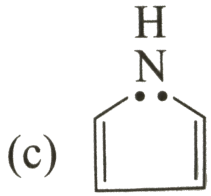
97. Strongest base is :

A. (a)

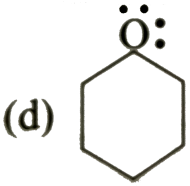
B. (b)



C.



D.



Answer: A

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98. In the reaction of phenol with $CHCl_3$ and aqueous $NaOH$ at 70°, the electrophile attacking the ring is:

A. $CHCl_3$

B. $CHCl_2$

C. $: CCl_2$

D. $COCl_2$

Answer: C

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99. A solution of $(+)$-2-chloro-2-phenyl ethane in toluene racemises slowly in the presence of small amount of $SbCl_5$, due to the formation of:

A. carbanion

B. carbene

C. free radical

D. carbocation

Answer: D

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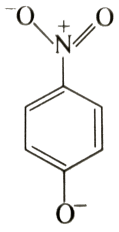
100. The most unlikely representation of resonance structure of p-nitrophenoxide ion is:

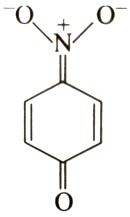
A.

(a)



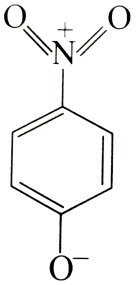
B.

(b)



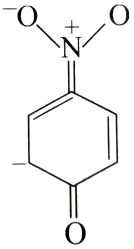
C.

(c)



D.

(d)



Answer: C

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101. Among the following anions, the order of basicity is :

$\bar{C}H_3(I), \bar{N}H_2(II), OH^-(III), F^-(IV)$

A. I > II > III > IV

B. II > I > III > IV

C. III > II > I > IV

D. III > I > II > IV

Answer: A

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102. Which of the following has the highest nucleophilicity ?

A. F^-

B. OH^-

C. CH_3^-

D. NH_2^-

Answer: C

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103. Among the following the strongest base is

A. $C_6H_5NH_2$

B. $p - NO_2 - C_6H_4NH_2$

C. $m - NO_2 - C_6H_4NH_2$

D. $C_6H_5CH_2NH_2$

Answer: D

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104. The order of reactivities of the following alkyl halides for a S_{N^2} reaction is :

A. RF > RCl > RBr > RI

B. RF > RBr > RCl > RI

C. RCl > RBr > RF > RI

D. RI > RBr > RCl > RF

Answer: D

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105. which of the following has the most acidic hydrogen?

A. 3-Hexanone

B. 2,4-Hexanedione

C. 2,5-Hexanedione

D. 2,3-Hexanedione

Answer: B

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106. Which of the following is the correct order of acidic strength ?

A.

$$CF_3COOH > CHCl_2COOH > HCOOH > C_6H_5CH_2COOH > C$$

B.

$$CH_3COOH > HCOOH > CF_3COOH > CHCl_2COOH > C_6H_5C$$

C.

$$HCOOH > C_6H_5CH_2COOH > CHCl_2COOH > CHCl_2COOH >$$

D.

$$CF_3COOH > CH_3COOH > HCOOH > CHCl_2COOH > C_6H_5C$$

Answer: A

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107. The set with correct order of acidity is :

A. $HClO < HClO_2 < HClO_3 < HClO_4$

B. $HClO_4 < HClO_3 < HClO_2 < HClO$

C. $HClO < HClO_4 < HClO_3 < HClO_2$

D. $HClO_4 < HClO_2 < HClO_3 < HClO$

Answer: A

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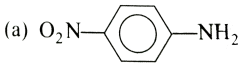
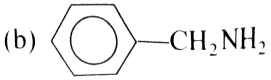
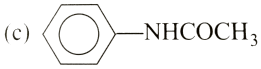
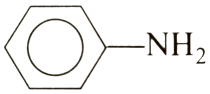
108. Which of the follwing compounds is most basic ? .

A. 

B. 

C. 

D. (d) 

Answer: B

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109. Consider the following carbocations :

(I) $C_6H_5\overset{+}{C}H_2$

(II) $C_6H_5CH_2\overset{+}{C}H_2$

(III) $C_6H_5\overset{+}{C}HCH_3$

(IV) $C_6H_5\overset{+}{C}(CH_3)_2$

The correct sequance of the stability of these is :

A. II < I < III < IV

B. II < III < I < IV

C. III < I < II < IV

D. IV < III < I < II

Answer: A

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110. : $CH_2 - \underset{\underset{\underset{\cdot\cdot}{O:}}{||}}{C} - CH_3$ and $H_2C = \underset{\underset{:\underset{\cdot\cdot}{O}:}{|}}{C} - CH_3$ are :

A. resonating structures

B. tautomers

C. geometrical isomers

D. optical isomers

Answer: A

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111. Arrangements of $(CH_3)_3C -$, $(CH_3)_2CH -$, $CH_3.CH_2 -$ when attached to benzyl or n unsaturated group in increasing order of

inductive effects is:

A. $(CH_3)_3C- < (CH_3)_2CH- < CH_3CH_2-$

B. $CH_3CH_2- < (CH_3)_2CH- < (CH_3)_3C-$

C. $(CH_3)_2CH- < (CH_3)_3C- < CH_3CH_2-$

D. $(CH_3)_3C- < CH_3CH_2- < (CH_3)_2CH-$

Answer: B

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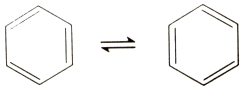
112. Which of the following statements regarding the resonance energy of benzene is correct?

A. The energy required to break the $C-H$ bond in benzene

B. The energy required to break the $C-C$ bond in benzene

C. The energy is a measure of stability of benzene

D. The energy required to convert



Answer: C

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113. The strongest base in aqueous solution among the following amines is :

A. N,N-diethylethanamine

B. N-ethylethanamine

C. M-methylmethanamine

D. ethanamine

Answer: B

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114. As S_{N^2} reaction at an asymmetric carbon of a compound always gives:

A. an enantiomer of the substrate

B. a product with opposite optical rotation

C. a mixture of diastereomers

D. a single stereoisomer

Answer: D

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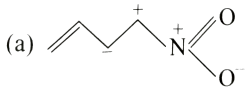
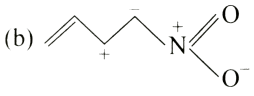
115. Among the following, the least stable resonance structure is :

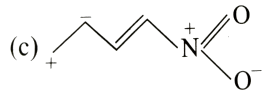
A.



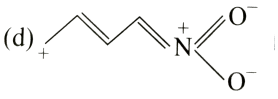
B.



C.



D.



Answer: A

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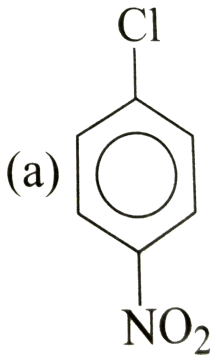
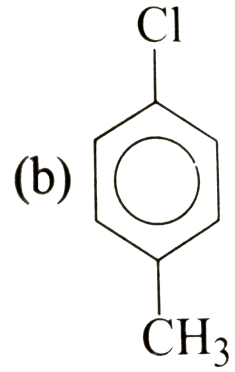
116. Which the following compound undergoes nucleophilic substitution reaction most easily

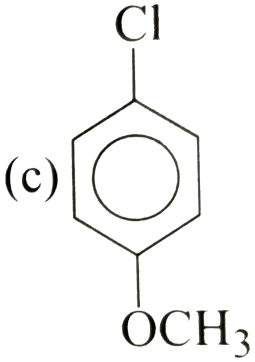
A.



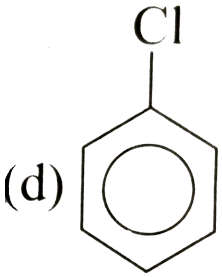
B.



C.



D.



Answer: A

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117. The corret order of increasing basicity of the given conjugated bases $(R = CH_3)$ is :

A. $RCOO^- < HC \equiv C^- < NH_2^- < R^-$

B. $RCOO^- < HC \equiv C^- < R^- < NH_2^-$

C. $R^- < HC \equiv C^- < RCOO^- < NH_2^-$

D. $RCOO^- < NH_2^- < HC \equiv C^- < R^-$

Answer: A

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118. Which of the following is correct for stability of phenoxide ion?

A. Resonating structure of benzene ring

B. Localization of π-electrons in phenoxide ion

C. Delocalization of π-electrons in phenoxide ion

D. All of the above

Answer: C

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119. In the anion $HCOO^-$, the two carbon-oxygen bonds are found to be equal length. What is the reason for it?

A. The $C = O$ bond is weaker than the $C - O$ bond

B. The anion $HCOO^-$ has two resonating structures

C. The electronic orbitals of carbon atom are hybridized

D. The anion is obtained by removal of a proton from the acid molecule

Answer: B

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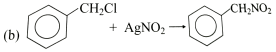
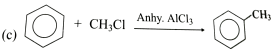
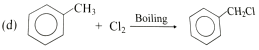
120. Which of the following is a free radical substitution reaction?

A. $CH_3CHO + HCN \rightarrow CH_3CH(OH)CN$

B. 

C. 

D. 

Answer: D

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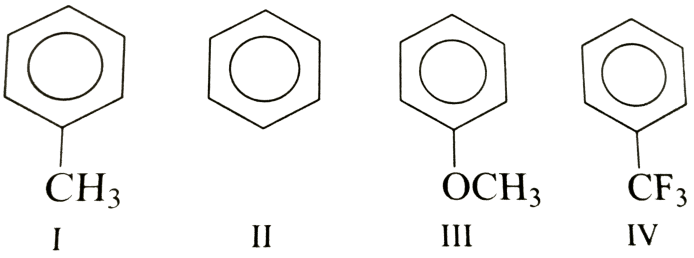
121. Among the following compounds, the decreasing order of reactivity towards electrophilic substitution is :



A. $I > II > III > IV$

B. $II > I > III > IV$

C. $IV > I > II > III$

D. $III > I > II > IV$

Answer: D

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122. Arrange the following nucleophiles in the order of their nucleophilic strength.

A. $OH^- > CH_3COO^- > CH_3O^- > C_6H_5O^-$

B. $CH_3COO^- < C_6H_5O^- < CH_3O^- < OH^-$

C. $C_6H_5O^- < CH_3COO^- < CH_3O^- < OH^-$

D. $CH_3COO^- < C_6H_5O^- < OH^- < CH_3O^-$

Answer: C

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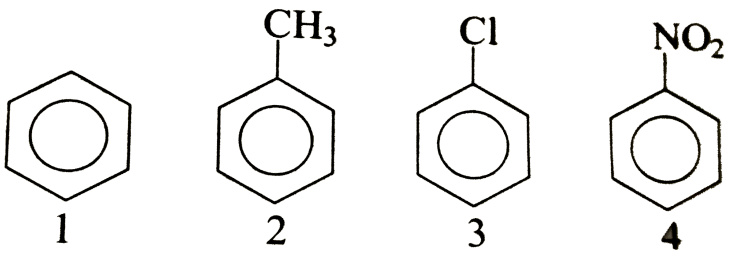
123. Identify the correct order of reactivity in electrophilic substitution reactions of the following compounds :



A. $1 > 2 > 3 > 4$

B. $4 > 3 > 2 > 1$

C. $2 > 1 > 3 > 4$

D. $2 > 3 > 1 > 4$

Answer: C

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124. Which one of the following is not true regarding electromeric effect?

A. It required an attacking reagent

B. It results in the appearance of partial charges on the carbon atoms

C. It operates on multiple bonds.

D. It is a temporary effect

Answer: B

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125. Which of the following acids has the smallest dissociation constant?

A. $CH_3CHFCOOH$

B. FCH_2CH_2COOH

C. $BrCH_2CH_2COOH$

D. $CH_3CHBrCOOH$

Answer: C

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126. $H_3C - \underset{\displaystyle D}{\underset{|}{CH}} - \underset{\displaystyle CH_3}{\underset{|}{C}}H_3 + Br^{\cdot} \rightarrow 'X' + HBr$:

Identify the structure of the major product 'X':

A. $H_3C - \underset{\displaystyle D}{\underset{|}{CH}} - \underset{\displaystyle CH_3}{\underset{|}{CH}} - \dot{C}H_2$

B. $H_3C - \underset{\displaystyle D}{\underset{|}{CH}} - \underset{\displaystyle CH_3}{\underset{|}{C^{\cdot}}} - CH_3$

C. $H_3C - \underset{\displaystyle D}{\underset{|}{C^{\cdot}}} - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$

D. $H_3C - \overset{*}{C}H - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$

Answer: B

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127. Among the following carbocations :

(I) $Ph_2\overset{+}{C}CH_2Me (II) PhCH_2CH_2\overset{+}{C}HPh$

(III) $Ph_2CH\overset{+}{C}HMe$ (IV) $Ph_2C(Me)\overset{+}{C}H_2$ the order of stability is :

A. $IV > II > I > III$

B. $I > II > III > IV$

C. $II > I > IV > III$

D. $I > IV > III > II$

Answer: B

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128. Which one of the following characteristics belongs to an electrophile?

A. It is any species having electron deficiency, which reacts at an electron rich C-centre

B. It is any species having electron enrichment, that reacts at an electron deficient C-centre

C. It is cationic in nature

D. It is anionic in nature

Answer: A

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129. Carbocation as an intermediate is likely to be formed in the reaction :

A. $\text{Hexene} \xrightarrow{\text{Anhyd. } AlCl_3 / HCl} \text{2-chloro-2-methylpentane}$

B. $\text{Propene} + Cl_2 \xrightarrow{hv} \text{2-chloropropane}$

C. $\text{Ethyl bromide} + KOH(aq.) \xrightarrow{\Delta} \text{ethyl alcohol}$

D. $\text{Acetone} + \text{HCN} \xrightarrow{.^- OH} \text{acetonecyanohydrin}$

Answer: A

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130. Which of the following pK_a values, represents the strongest acid?

A. 10^{-4}

B. 10^{-8}

C. 10^{-5}

D. 10^{-2}

Answer: D

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131. Which of the following orders regarding relative stability of free radicals is correct?

A. $3^{\circ} < 2^{\circ} < 1^{\circ}$

B. $3^{\circ} > 2^{\circ} > 1^{\circ}$

C. $1^{\circ} < 2^{\circ} > 3^{\circ}$

D. $3^{\circ} > 2^{\circ} < 1^{\circ}$

Answer: B

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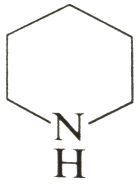
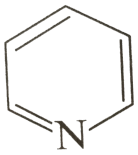
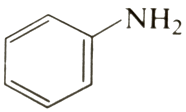
132. Which of the following is the strongest base?

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: A

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133. Which of the following is least reactive in a nucleophilic substitution reaction?

A. $(CH_3)_3C - Cl$

B. $CH_2 = CHCl$

C. CH_3CH_2Cl

D. $CH_2 = CHCH_2Cl$

Answer: B

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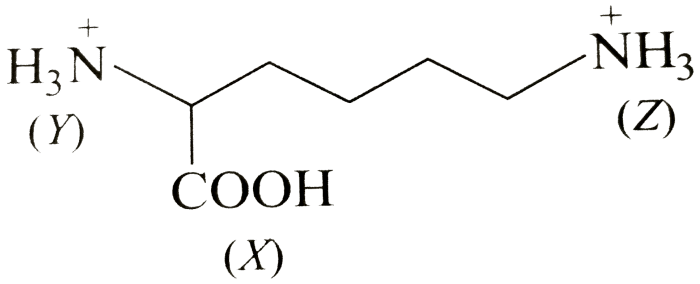
134. In the compound given below: the correct order of acidity of the positions



(X), (Y) and (Z) is :

A. (Z) gt (X) gt (Y)

B. (X) gt (Y) gt (Z)

C. (X) gt (Z) gt (Y)

D. (Y) gt (X) gt (Z)

Answer: B

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135. Due to the presence of an unpaired electron, free radicals are:

A. chemically reactive

B. chemically inactive

C. anions

D. cations

Answer: A

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136. Among the following the strongest nucleophilic is

A. C_2H_5SH

B. CH_3COO^-

C. CH_3NH_2

D. $NCCH_2^-$

Answer: A

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137. Which one of the following is most reactive towards nucleophilic substitution reaction ?

A. $H_2C = CH - Cl$

B. C_6H_5Cl

C. $CH_3CH = CHCl$

D. $ClCH_2 - CH = CH_2$

Answer: D

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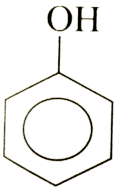
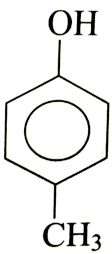
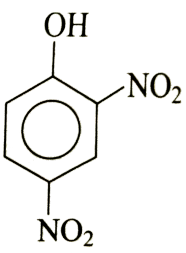
138. Strength of acidity is in order:



(I)



(II)



(III)

(IV)

A. II gt I gt III gt IV

B. III gt IV gt I gt II

C. I gt IV gt III gt II

D. IV gt III gt I gt II

Answer: B

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139. Which is most stable carbocation?

A. n-Propyl cation

B. Isopropyl cation

C. Ethyl cation

D. Triphenylmethyl cation

Answer: D

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140. Which of the following undergoes nucleophilic substitution exclusively by S_{N1} mechanism?

A. Ethyl chloride

B. Isopropyl chloride

C. Chlorobenzene

D. Benzyl chloride

Answer: D

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141. In the S_{N1} reaction on chiral centres there is :

A. $100\ \%$ racemization

B. inversion more than retention leading to partial racemization

C. $100\ \%$ retention

D. $100\ \%$ inversion

Answer: B

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142. Which one of the following halogen compounds is difficult to be hydrolysed by S_{N^1} mechanism?

A. tert-Butyl chloride

B. Isopropyl chloride

C. Benzyl chloride

D. Chlorobenzene

Answer: D

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143. The stability of $Me_2C = CH_2$ is more than that of $MeCH_2CH = CH_2$ due to :

A. inductive effect of the Me group

B. resonance effecta of the Me group

C. hypercojugative effect of the Me group

D. resonance as well as inductive effect of the Me group

Answer: C

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144. $CH_3Br + Nu^- \rightarrow CH_3Nu + Br^-$

The decreasing order of the rate of the above reaction with nucleophiles $\left(Nu^-\right)$ A to D is :

$\left[Nu^- = (A)PhO^-, (B)AcO^-, (C)HO^-, (D)CH_3O^-\right]$

A. D gt C gt A gt B

B. D gt C gt B gt A

C. A gt B gt C gt D

D. B gt D gt C gt A

Answer: A

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145. The increasing order of stability of the following free radicals is :

A. $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C}$

B. $(C_6H_5)_3\dot{C} < (C_6H_5)_2\dot{C}H < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$

C. $(C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C} < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$

D. $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_3\dot{C} < (C_6H_5)_2\dot{C}H$

Answer: A

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146. Which of the following is more basic than aniline?

A. p-Nitroaniline

B. Benzyl amine

C. Diphenyl amine

D. Triphenyl amine

Answer: B

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147. Nucleophilic addition reaction will be most favoured in

A. CH_3CH_2CHO

B. CH_3CHO

C. $CH_3CH_2CH_2-\overset{\overset{O}{||}}{C}-CH_3$

D. $(CH_3)_2C=O$

Answer: B

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148. The correct increasing order of the reactivity of halides for S_{N^1} reaction is:

A.

$$CH_3CH_2 - X < (CH_3)_2CH - X < H_2C = CHCH_2 - X < PhCH$$

B.

$$(CH_3)_2CH - X < CH_3CH_2 - X < H_2C = CHCH_2 < PhCH_2 -$$

C.

$$PhCH_2 - X < (CH_3)_2CH - X < CH_3CH_2 - X < H_2C = CH -$$

D.

$$H_2C = CHCH_2 - X < PhCH_2 - X < (CH_3)_2CH - X < CH_3CH$$

Answer: A

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149. Inductive effect involve

A. partial displacement of $\sigma -$ electrons

B. delocalisation of $\pi -$ electrons

C. delocalisation of $\sigma -$ electrons

D. displacement of $\pi -$ electrons

Answer: A

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150. The basicity of aniline is less than that of cyclohexylamine. This is due to :

A. $-R$ effect of $-NH_2$ group

B. $-I$ effect of $-NH_2$ group

C. $+R$ effect of $-NH_2$ group

D. hyperconjugation effect

Answer: C

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151. In the solvolysis of 3-methyl-3-bromohexane, which of the following statements is not correct?

A. It involves carbocation intermediate

B. The intermediate involves sp^2 -carbon

C. Polar solvents accelerates the reaction

D. It involves inversion of configuration

Answer: D

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152. Neopentyl bromide undergoes dehydrohalogenation to give alkene even though it has no β -hydrogen. This is due to :

A. E_2 mechanism

B. E_1 mechanism

C. Hofmann elimination

D. rearrangement of carbocation by E_1 mechanism

Answer: D

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153. Which one is most reactive towards S_{N^1} reaction?

A. $C_6H_5CH(C_6H_5)Br$

B. $C_6H_5C(CH_3)(C_6H_5)Br$

C. $C_6H_5CH(CH_3)Br$

D. $C_6H_5CH_2Br$

Answer: D

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154. What is the correct order of decreasing stability of the following cations ?

$CH_3 - \overset{\oplus}{C}H - CH_3$

II $CH_3 - \overset{\oplus}{C}H - OCH_3$

III $CH_3 - CH - \overset{\oplus}{C}H_2 - OCH_3$

A. I gt II gt III

B. III gt I gt II

C. II gt I gt III

D. II gt III gt I

Answer: C

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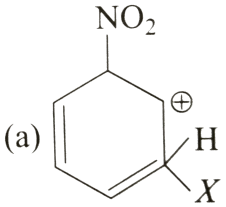
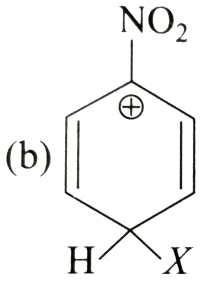
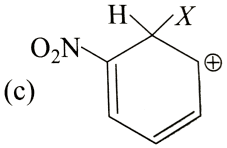
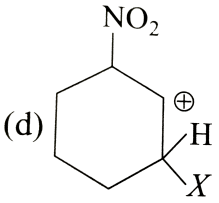
155. Which of the following carbocations is most stable?

A. 

B. 

C. 

D. 

Answer: A

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156. $CH_3 - O - CH_3$ is:

A. Lewis acid

B. Arrhenius acid

C. Lewis base

D. Bronsted acid

Answer: C

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157. Which one is ambidentate ligand?

A. SO_3^{2-}

B. CN^-

C. NH_3

D. H_2O

Answer: B

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158. The decreasing order of acidity among the following compounds is :

ethanol (I), 2,2,2-trifluoroethanol (II), trifluoroacetic (III), acetic acid (IV)

A. III gt IV gt II gt I

B. IV gt III gt II gt I

C. III gt II gt IV gt I

D. I gt II gt III gt IV

Answer: A

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159. Which of the following intermediates have the complete octet around the carbon atom?

A. Carbonium ion

B. Carbanion

C. Free radical

D. Carbene

Answer: B

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160. Which of the following is the correct order of decreasing S_{N^2} reactivity ?

A. $R_2CHX > R_3CX > RCH_2X$

B. $RCH_2X > R_3CX > R_2CHX$

C. $RCH_2X > R_2CHX > R_3CX$

D. $R_3CX > R_2CHX > RCH_2X(\text{X is a halogen})$

Answer: C

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161. Which of the following presents the correct order of the acidity in the given compounds?

A.

$$BrCH_2COOH > ClCH_2COOH > FCH_2COOH > CH_3COOH$$

B. $FCH_2COOH > ClCH_2COOH > BCH_2COOH > CH_3COOH$

C.

$$CH_3COOH > BrCH_2 > BrCH_2COOH > ClCH_2COOH > FCH$$

D.

$$FCH_2COOH > CH_3COOH > BrCH_2COOG > ClCH_2COOH$$

Answer: B

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162. For the following

$(i)I^-(ii)Cl^-(iii)Br^-$

the increasing order of nucleophilicity would be:

A. $I^- < Cl^- < Br^-$

B. $Br^- < Cl^- < I^-$

C. $I^- < Br^- < Cl^-$

D. $Cl^- < Br^- < I^-$

Answer: D

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163. Which one of the following is correct?

Formic acid has lower pK_a than that of CH_3COOH because:

A. formic acid does not dissociate

B. formic acid does not have an alkyl group

C. formic acid is smaller is size than acetic acid

D. formic acid is a strong reducing agent

Answer: B

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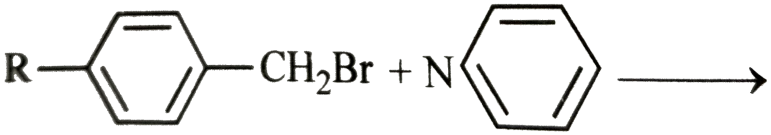
164. The rate of the reaction



is influenced by the hyperconjugation effect of group R. If R is sequentially

CH_3^- (II) $CH_3 - CH_2$

(III) $CH_3 - \underset{\underset{CH_3}{|}}{C}H -$, (IV) $H_3C - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} -$

the increasing order of speed of above reaction is

A. (iv), (iii), (ii), (i)

B. (i),(ii), (iii), (iv)

C. (i), (Iv), (iii), (ii)

D. (iii), (ii), (i), (iv)

Answer: A

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165. The S_{N^1} reactivity of the following halides will be in the order:

(i) $(CH_3)_3C - Br$

(ii) $(C_6H_5)CHBr$

(iii) $(C_6H_5)_2C(CH_3)Br$

(iv) $(CH_3)_2CHBr$

(v) C_2H_5Br

A. (v) gt (iv) gt (iv) gt (iii)

B. (ii) gt (i) gt (iii) gt (v) gt (iv)

C. (i) gt (iii) gt (v) gt (ii) gt (iv)

D. (iii) gt (ii) gt (i) gt (iv) gt (v)

Answer: D

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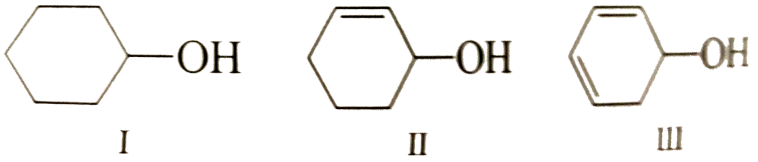
166. The correct order of case of dehydration of following is:



I II III

A. I gt II gt III

B. III gt II gt I

C. I gt III gt II

D. III gt I gt II

Answer: B

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167. The effect that makes 2,3-dimethyl-2-butene more stable than 2-butene is :

A. hyperconjugation

B. reseonce

C. steric effect

D. inductive effect

Answer: A

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168. Condiser the reactions,

(i) $(CH_3)_2CH - CH_2Br \xrightarrow{C_2H_5OH} (CH_3)_2CH - CH_2OC_2H_5 + HBr$

(ii) $(CH_3)_2CH - CH_2Br \xrightarrow{C_2H_5O^-} (CH_3)_2CH - CH_2OC_2H_5 + Br^-$

The mechanism of reactions (i) and (ii) are respectively :

A. S_{N^1} and S_{N^2}

B. S_{N^1} and S_{N^1}

C. S_{N^2} and S_{N^1}

D. S_{N^2} and S_{N^2}

Answer: D

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169. Which of the following is the most stable compound?

A. Ph_3C^+

B. $Ph_2\overset{+}{C}H$

C. $Ph_2\overset{+}{C}H$

D. $Ph\overset{+}{C}H_2$

Answer: A

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170. Hyperconjugation involves overlap of which of the following orbitals?

A. $\sigma - \sigma$

B. $\sigma - p$

C. $p - p$

D. $\pi - \pi$

Answer: B

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171. Mesomeric effect invloves the :

A. partical displacement of electrons

B. delocalization of sigma electrons

C. delocalization of pi electrons

D. delocalization of pi and sigma electrons

Answer: C

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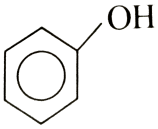
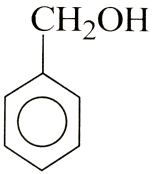
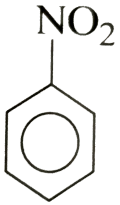
172. Which one of the following is most reactive towards electrophilic attack?

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: A

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173. Which among the following statements are true with respect to electronic displacement in a covalent bond?

(1) Inductive effect operates through a π - bond

(2) Resonance effect operates through a σ-bond

(3) Inductive effect operates through a σ -bond

(4) Resonance effect operates through a $\pi -$ bond

(5) Resonance and inductive effects operate through σ-bond

A. 1 and 2

B. 1 and 3

C. 2 and 3

D. 3 and 4

Answer: D

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174. The hydrolysis of 2-bromo-3-methylbutane by S_{N^1} mechanism gives meinly:

A. 3-methyl-2-butanol

B. 2-methyl-2-butanol

C. 2,2-dimethyl-2-propanol

D. 2-methyl-1-butanol

Answer: B

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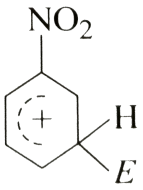
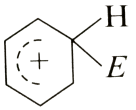
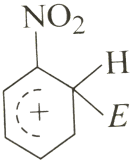
175. The electrophile, $E^{(\oplus)}$ attacks the benzene ring to generate the intermediate σ-complex. Of the following which σ-complex is of lowest energy?

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: C

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176. Which one of the following carbanions is the least stable?

A. $CH_3CH_2^-$

B. $HC \equiv C^-$

C. CH_3^-

D. $(CH_3)_3\overline{C}$

Answer: D

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177. CH_3CH_2Cl undergoes homolytic fission produces:

A. $CH_3\dot{C}H_2$ and $Cl^{\cdot}$

B. $CH_3\overset{+}{C}H_2$ and Cl^-

C. $CH_3\overset{+}{C}H_2$ and $Cl^{\cdot}$

D. $CH_3\dot{C}H_2$ and Cl^-

Answer: A

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178. Tertiary butyl chloride preferably undergo hydrolysis by:

A. S_{N^1} mechanism

B. S_{N^2} mechanism

C. and of (a) and (b)

D. none of these

Answer: A

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179. In a S_{N^2} substitution reaction of the type

$$R - Br + Cl^- \xrightarrow{\text{DMF}} R - Cl + Br^-$$

Which one of the following has the highest relative rate?

A. $(CH_3)_3C - CH_2Br$

B. CH_3CH_2Br

C. $CH_3CH_2CH_2Br$

D. $(CH_3)_2CH - CH_2Br$

Answer: B

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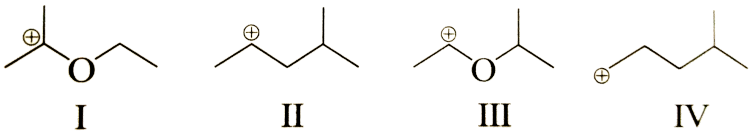
180. The correct stability order for the following speceis is :



I II III IV

A. II gt IV gt I gt III

B. I gt II gt III gt IV

C. II gt I gt IV gt III

D. I gt III gt II gt IV

Answer: D

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181. Arrange the carbanions, $(CH_3)_3\overline{C}$, $\overline{C}Cl_3$, $(CH_3)_2\overline{C}H$, $C_6H_5\overline{C}H_2$, in order of their decreasing stability

A. $C_6H_5\overline{C}H_2 > \overline{C}Cl_3 > (CH_3)_3\overline{C} > (CH_3)_2\overline{C}H$

B. $(CH_3)_2\overline{C}H > \overline{C}Cl > C_6H_5\overline{C}H_2 > (CH_3)_3\overline{C}$

C. $\overline{C}Cl_3 > C_6H_5\overline{C}H_2 > (CH_3)_2\overline{C}H > (CH_3)_3\overline{C}$

D. $(CH_3)_3\overline{C} > (CH_3)_2\overline{C}H > C_6H_5\overline{C}H_2 > \overline{C}Cl_3$

Answer: C

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182. Which of the following carbocations will be more stable?

A. Ph_3C^+

B. $CH_3 - \overset{+}{C}H_2$

C. $(CH_3)_2\overset{+}{C}H$

D. $CH_2 = CH - \overset{+}{C}H_2$

Answer: A

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183. Arrange the following free radicals in order of decreasing stability:

Methyl(I), Vinly(II), Allyl(III), Benzyl(IV)

A. I gt II gt III gt IV

B. III gt II gt I gt IV

C. II gt I gt IV gt III

D. IV gt III gt I gt II

Answer: D

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184. The most easily hydrolysed molecule under S_{N1} condition is:

A. allyl chloride

B. benzyl chloride

C. ethyl chloride

D. isopropyl chloride

Answer: B

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185. Least active electrophile is :

A. $CH_3 - \overset{O}{\overset{||}{C}} - OCH_3$

B. $CH_3 - \overset{O}{\overset{||}{C}} - Cl$

C. $CH_3 - \overset{O}{\overset{||}{C}} - NMe_2$

D. $CH_3 - \overset{\overset{O}{||}}{C} - SCH_3$

Answer: C

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186. In the following carbocation, H/CH_3 that is most likely to migrate to the positve charged carbon is :

$$H_3\overset{1}{C} - \underset{OH}{\overset{H}{\overset{|2}{C}}} - \overset{+}{\underset{H}{\overset{3|}{C}}} - \underset{CH_3}{\overset{H}{\overset{|4}{C}}} - \overset{5}{C}H_3$$

A. CH_3 at C-4

B. H at C-4

C. CH_3 at C-2

D. H at C-2

Answer: D

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187. Arrange the following resonating structures in order of increasing stability

$$\underset{(I)}{CH_2 = \overset{+}{N} = \overset{-}{N}} \qquad \underset{(II)}{H_2\overset{+}{C} = N = \overset{-}{N}} \qquad \underset{(III)}{H_2\overset{-}{C} - \overset{+}{N} \equiv N} \qquad \underset{(IV)}{H_2\overset{-}{C} - N = \overset{+}{N}}$$

A. I gt II gt IV gt III

B. I gt III gt II gt IV

C. II gt I gt III gt IV

D. III gt I gt IV gt II

Answer: B

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188. Identify a species which is not a Bronsted acid but a Lewis acid:

A. HCl

B. NH_3

C. BF_3

D. H_3^+O

Answer: C

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189. A solution of (-l)- chloro -1 phenyletane in toluene recemises slowly in the presence of a small amunt of $SbCI_5$ due to the formation of .

A. free radical

B. carbanion

C. carbene

D. carbocation

Answer: D

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190. The order of stability of the following carbocations:

$$\underset{\text{I}}{CH_2C = CH - \overset{\oplus}{C}H_2} \quad , \quad \underset{\text{II}}{CH_3 - CH_2 - \overset{\oplus}{C}H_2} \quad , \quad \underset{\text{III}}{C_6H_5 - \overset{\oplus}{C}H_2}$$

A. III gt I gt II

B. III gt II gt I

C. II gt III gt I

D. I gt II gt III

Answer: A

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191. The hyperconjugative stabilities of tert-butyl cation and 2-butene, respectively, are due to

A. $\sigma \rightarrow p$ (empty) and $\sigma \rightarrow \pi^*$ electron delocalizations

B. $\sigma \rightarrow \sigma^*$ and $\sigma \rightarrow \pi$ delectron delocalizations

C. $\sigma \rightarrow p$ (filled) and $\sigma \rightarrow \pi$ electron delocalizations

D. p(fillled) $\rightarrow \sigma^*$ and $\sigma \rightarrow \pi^*$ electron delocalizations

Answer: A

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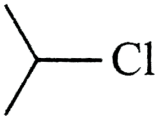
192. KI in acetone, undergoes S_N2 reaction with each of P, Q, R and S

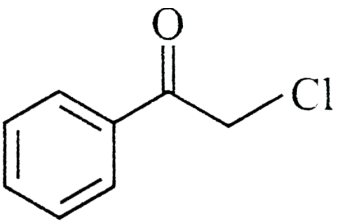
The rates of the reaction very as

$H_3C - \underset{P}{Cl}$



Q

R



S

.

A. P gt Q gt R gt S

B. S gt P gt R gt Q

C. P gt R gt Q gt S

D. R gt P gt S gt Q

Answer: B

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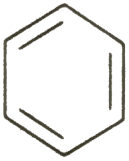
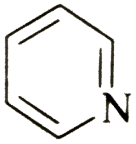
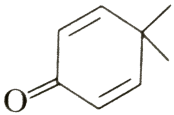
193. Which of the following molecules is least resonance stabilised?

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: D

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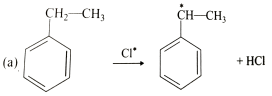
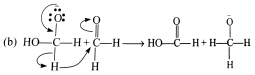
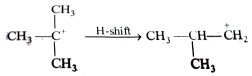
OBJECTIVE QUESTIONS (Level-B)

1. Which of the following is incorrect?

A. 

B. 

C. 

D. $CH_3CH_2CHO \xrightarrow{\overline{O}H} CH_3 - \overline{C}H - CHO + H_2O$

Answer: C

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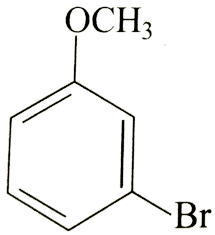
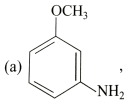
2. 

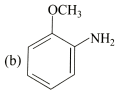
$\xrightarrow{NaNH_2}$ Product (A) by the reaction is:

Product (A)

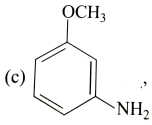
by the reaction is :

A. 

, elimination addition

B. 

, elimination addition

C. 

, substitution

D. none of the above

Answer: A

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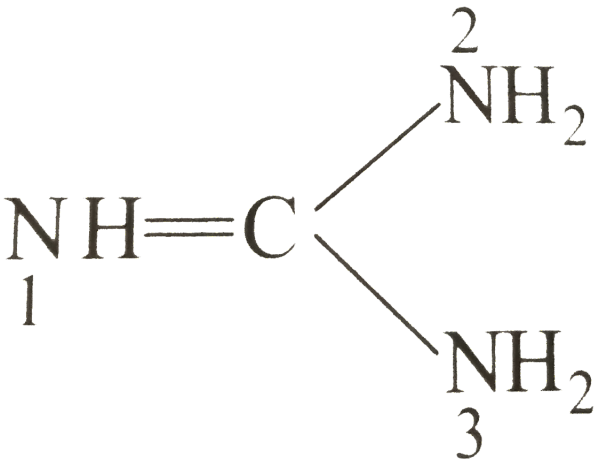
3. Which nitrogen is protonated readily in the guanidine?



A. 1

B. 2

C. 3

D. none of the above

Answer: A

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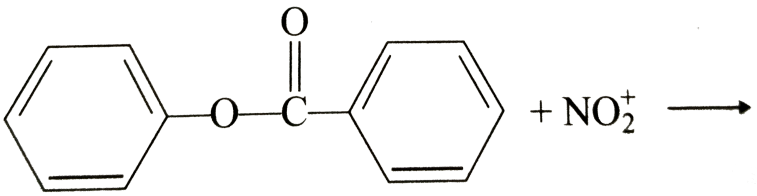
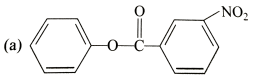
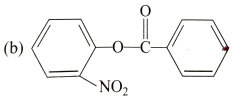
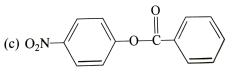
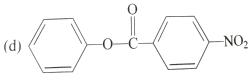
4. 

Product of this reaction by single (S_E) electrophilic substitution is :

A. 

B. 

C. 

D. 

Answer: C

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5. Which of the following can undergo nucleophilic substitution under ordinary conditions?

I Allyl chloride

II Benzyl chloride

III n-Propyl chloride

IV Vinyl chloride

A. I, II and III are correct

B. I and II are correct

C. II and IV are correct

D. I and III are correct

Answer: A

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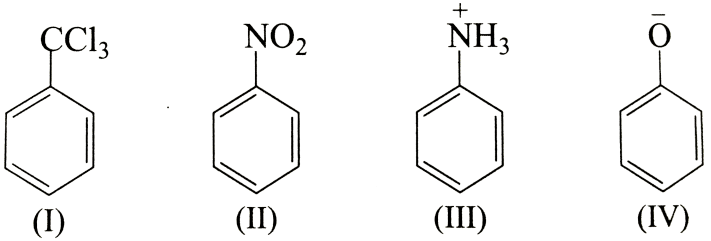
6. Electrophile NO_2^+ attacks on the following:



(I) (II) (III) (IV)

In which cases will NO_2^+ be at meta-position?

A. II and IV

B. I, II and III

C. II and III

D. I only

Answer: B

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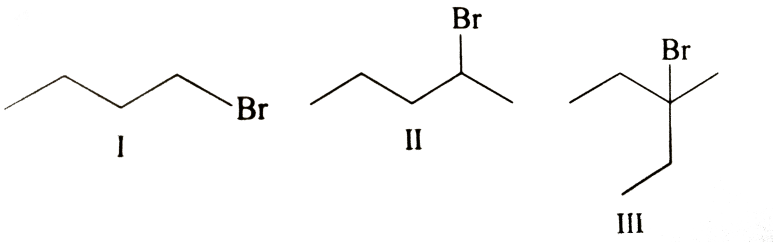
7. Dehydrobromination $(-HBr)$ of the following in increasing order will be :



A. $I < II < III$

B. $III < II < I$

C. $I = II < III$

D. $III < I = II$

Answer: A

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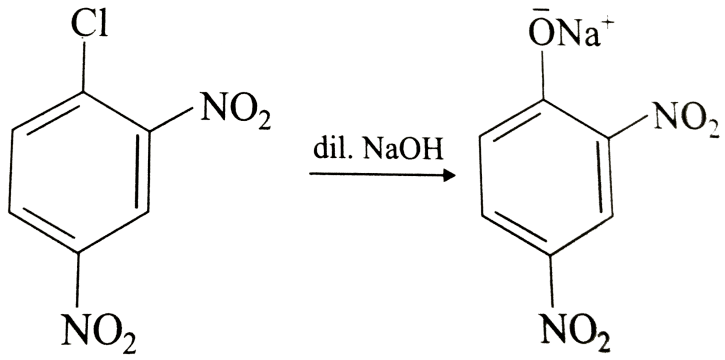
8.



The above trasformation proceeds through:

A. electrophilic addition

B. benzyne intermediate

C. activated nucleophilic substitution

D. elimination

Answer: C

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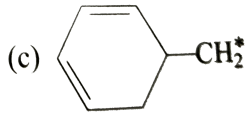
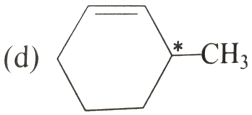
9. Maximum stability will be in which of the following free radicals?

A. $H_2C = \overset{*}{C}H$

B. $H_2C = CH - \overset{*}{C}H_2$

C. 

D. 

Answer: D

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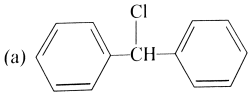
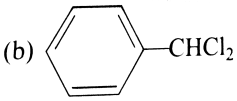
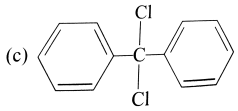
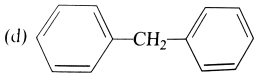
10. Which of the following structures correspond to the product expected, when excess of C_6H_6 reacts with CH_2Cl_2 in presence of anhydrous $AlCl_3$?

A. 

B. 

C. 

D. 

Answer: D

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11. The intermediate during the addition of HCl to propene in the presence of peroxide is :

A. $CH_3 - \overset{*}{C}H - CH_2Cl$

B. $CH_3 - \overset{+}{C}H - CH_3$

C. $CH_3 - CH_2 - \overset{*}{C}H_2$

D. $CH_3 - CH_2 - \overset{+}{C}H_2$

Answer: B

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12. A covalently strated host group present in the benzene nucleus is ortho and para-directing, if unsaturated group is present, it is meta-directing. This rule is known as:

A. Vorlander's rule

B. Crum Brown Gibson rule

C. Korner's rule

D. Huckel rule

Answer: A

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13. Select the incorrect statement among the following

A. Benzene undergoes predominant reactions by electrophilic substitution

B. Toluene is more easily sulphonated than benzene

C. Benzene reacts with CCl_4 in the presence of anhydrous $AlCl_3$ to give trichloromethyl benzene

D. Benzene reacts with chlorine (Cl_2) in presence of light to give benzyl chloride

Answer: D

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14. Kharasch effect regarding addition of HBr is not observed in:

A. hex-1-ene

B. hex-2-ene

C. hex-3-ene

D. pent-1-ene

Answer: C

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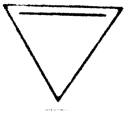
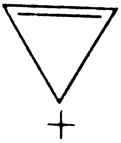
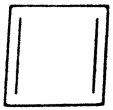
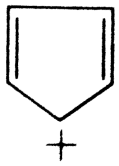
15. Among the following the aromatic compound is

A. (a) 

B. (b) 

C. (c) 

(d) 

D.

Answer: B

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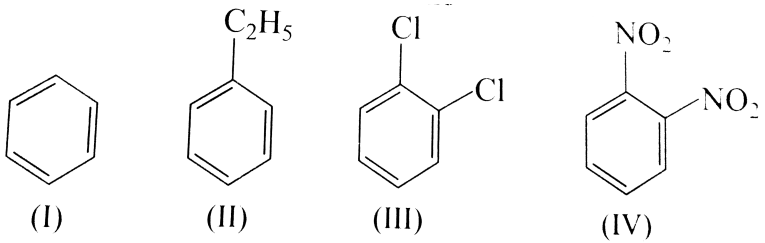
16. Identify the correct order of reactivity in electrophilic substitution reactions of the following compounds:



(I) (II) (III) (IV)

A. $I > II > III > IV$

B. $IV > III > II > I$

C. $II > I > III > IV$

D. $II > III > I > IV$

Answer: C

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17. In which of the following, first memeber is more stable than second?

A. $(C_6H_5)_2\overset{*}{C}CH_3, (C_6H_5)_3\overset{*}{C}$

B. $:CH_2, \cdot CH_2 \cdot$

C. $(C_6H_5)_3\overset{+}{C}, \overset{+}{C}H_3$

D. $(C_2H_5)_3, \overset{*}{C}, (CH_3)_3\overset{*}{C}$

Answer: C

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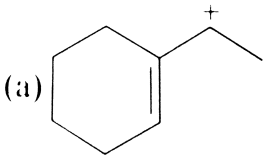
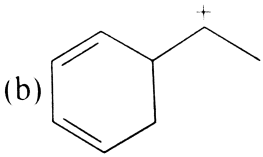
18. Most stable carbocation is:

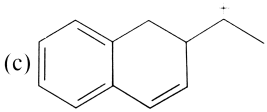
A.



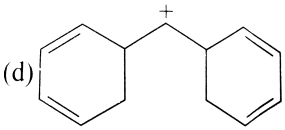
B.



C.



D.



Answer: A

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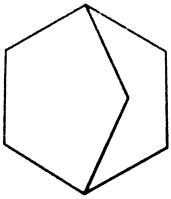
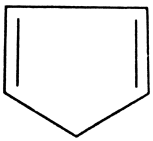
19. Which of the following is least stable ?

A. (a)



(–)

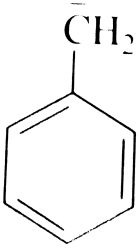
B. (b)



(–)

C. $HC \equiv \bar{C}$

D. (d)



Answer: A

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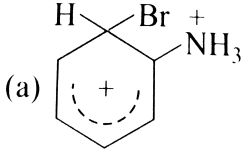
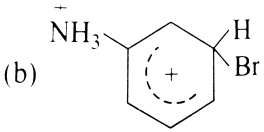
20. The structure of Wheland intermediate obtained after the attack of Br^+ on anilinium ion is:

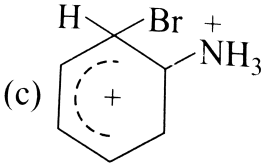
A.



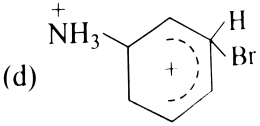
B.



C.



D.



Answer: B

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21. Which of the following halides will be most reactive towards S_{N^2} reaction?

A. $C_6H_5CH_2CH_2CH_2Br$

B. $C_6H_5 - \underset{\underset{CH_3}{|}}{CH} - CH_2Br$

C. $C_6H_5\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} - Br$

D. $C_6H_5 - CH_2 - \underset{\underset{Br}{|}}{CH} - CH_3$

Answer: A

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22. Conjugation of electron withdrawing groups, e.g., $-CHO$,

$-\overset{\overset{O}{|}}{C} - R, \quad -\overset{\overset{O}{||}}{C} - OR, \quad -C \equiv N, \quad -NO_2$ activates

nucleophilic addition. The order of reactivity of these groups is:

A. $-NO_2 > -C \equiv N > -\overset{\overset{O}{||}}{C} - OR > -\overset{\overset{O}{||}}{C} - R > -\overset{\overset{O}{||}}{C} - H$

B. $-\overset{\overset{O}{||}}{C} - H > -\overset{\overset{O}{||}}{C} - R > -\overset{\overset{O}{||}}{C} - OR > -C \equiv N > -NO_2$

C. $-C \equiv N > -NO_2 > -\overset{\overset{O}{||}}{C} - H > -\overset{\overset{O}{||}}{C} - R > -\overset{\overset{O}{||}}{C} - OR$

D. $-\overset{O}{\overset{||}{C}}-H > -NO_2 > -C\equiv N > -\overset{O}{\overset{||}{C}}-OR > -\overset{O}{\overset{||}{C}}-R$

Answer: B

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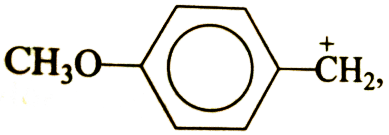
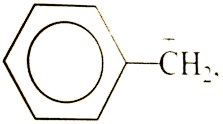
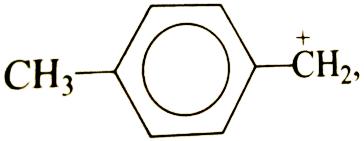
23. Relative stabilities of the following carbocations will be in the order:



(I)



(II)



(III)

(IV)

A. I lt II lt III lt IV

B. IV lt III lt II lt I

C. IV lt II lt III lt I

D. II lt IV lt III lt I

Answer: C

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24. Consider the reaction :

$$CH_3CH_2CH_2Br + NaCN \rightarrow CH_3CH_2CH_2CN + NaBr$$

This reaction will be the fastest in :

A. water

B. ethanol

C. methanol

D. N,N' - dimethyl formamide (DMF)

Answer: D

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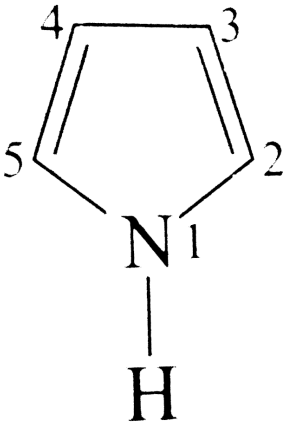
In pyrrole,



25. In pyrrole,

The electron density is maximum on :

A. 2 and 3

B. 2 and 4

C. 2 and 5

D. 3 and 4

Answer: B

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SET II

1. Compound which shows positive mesomeric effect:

A. $H_2C = CH - Cl$

B. $C_6H_5 - \overset{+}{N} - Me_3$

C. $H_2C = CH - CH_2Cl$

D. $C_6H_5 - CH = CHCl$

Answer: A::B

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2. Which of the following are nucleophile?

A. NH_3

B. OH^-

C. $R - O - R$

D. $AlCl_3$

Answer: A::B::C

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3. Which of the following are electrophile?

A. CN^-

B. BF_3

C. NO_2^+

D. $AlCl_3$

Answer: B::C::D

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4. Which types of mechanism take place in sec-halides, $(CH_3)_2CH - X$?

A. S_{N^1}

B. S_{N^2}

C. S_{N^1} and S_{N^2}

D. None of these

Answer: A::B::C

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5. The correct statement(s) about , $HCIO_4$ and $HCIO$, is

A. $HClO_4$ is more acidic than HClO because of resonance stabilization of its anion

B. The central atom in both $HClO_4$ and $HClO$ is sp^3 hybridized

C. $HClO_4$ is formed in the reaction between Cl_2 and H_2O

D. The conjugate base of $HClO_4$ is weaker base than H_2O

Answer: A::B::D

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6. Which gives nucleophilic addition reaction?

A. Methanal

B. Ethanal

C. Propanone

D. Propene

Answer: A::B::C

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7. Acetyl nitrene has been proposed as possible intermediate in:

A. Reimer-Tiemann reaction

B. Hofmann's rearrangement

C. Lossen's rearrangement

D. Curtius rearrangement

Answer: B::C::D

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8. Carbenes are the reactive intermediates in:

A. Carbyamine reaction

B. ReimerTiemann reaction

C. Hofmann's bromamide reaction

D. Witting reaction

Answer: A::B::D

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9. Which of the statements are correct?

A. $-NH_2$ is ortho-para directing group

B. $-CHO$ is meta directing group

C. $:CCl_2$ is an electrophile

D. $-\ddot{O}H$ is $(-M)$ group

Answer: A::B

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10. Which of the following are aprotic solvents?

A. $DMSO$

B. DMF

C. H_2O

D. CH_3COOH

Answer: A::B

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11. On treatment with strong NaOH at 613K, p-chlorotoluene gives:

A. ortho-cresol

B. meta-cresol

C. para-cresol

D. none of these

Answer: B::C::D

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12. In which of the following reacations is there a possibility of rearrangement?

A. S_{N^1}

B. S_{N^2}

C. E_1

D. E_2

Answer: A::C

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13. In the reaction

$$CH_3 - CH = CH_2 \xrightarrow[\text{Benzoyl peroxide}]{HX} \underset{(A)}{CH_3CH_2CH_2X}$$

The product (A) cannot be obtained by using:

A. HBr

B. HCl

C. HI

D. HF

Answer: B::C::D

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14. Which of the following are examples of electrophilic addition?

A. $CH_3 - HC = CH_2 + H_2O \rightarrow CH_3 - \overset{OH}{\overset{|}{CH}} - CH_3$

B. $CH_3 - HC = CH_2 + HBr \xrightarrow{\text{Peroxides}} CH_3 - \underset{Br}{\underset{|}{CH}} - CH_3$

C. $CH_3 - HC = CH - CH_3 + Cl_2 \rightarrow CH_3 - \underset{Cl}{\underset{|}{CH}} - \underset{Cl}{\underset{|}{CH}} - CH_3$

D. None of these

Answer: A::C

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15. Which of the following statements are correct?

A. The addition of HBr to propene gives 2-bromo propane

B. The addition of HBr to propene gives 1-bromo propane

C. The addition of HCl to vinyl chloride gives ethylidene chloride

D. The addition of HCl to vinyl chloride gives ethylene chloride

Answer: A::C

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16. Which of the following is an example of nucleophilic addition of acetone?

A. Ketal formation

B. Reduction with hydrogen gas

C. Cyanohydrin formation

D. Bisulphite additon

Answer: A::C::D

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17. Which of the following are correct for S_{N^2} reaction?

A. The reaction intermediate is carbocation

B. In this reaction the complete inversion takes place

C. It is favoured by polar solvents

D. It is favoured by stability of carbocation

Answer: B

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18. Which of the following are statements regarding anti-Markownifoff's rule is correct?

A. It is catalysed by peroxide

B. Only HBr shows this effect

C. Br adds to more substituted radical

D. $CF_3 - CH = CH_2$ forms anti-Markownikoff's product

Answer: A::B::C::D

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19. Reaction involving carbanion formation is/are:

A. Cannizzaro's reaction

B. Addition reaction of Grignard reagent

C. Perkin's reaction

D. Beckmann's reaction

Answer: B::C

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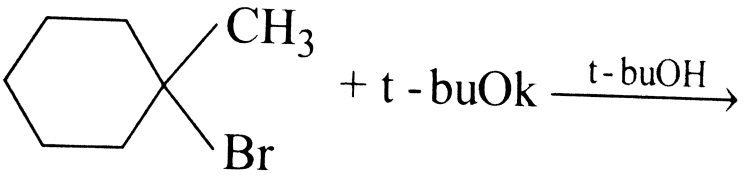
20. Which of the following statements are incorrect regarding following reaction?



A. Product is exocyclic alkene formed according to Saytzeff

B. Product is exocyclic alkene formed according to Hofmann

C. Product is endocyclic alkene formed according to Saytzeff

D. Product is endocyclic alkene formed according to Hofmann

Answer: A::C::D

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21. Which is/are correctly linked here?

	List I		List II
(a)	E_1Cb	(a)	Carbanion formation
(b)	E_2	(b)	Stereo specific
(c)	S_{N^1}	(c)	Presence of non-polar solvent
(d)	E_1	(d)	Carbocation formation

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22. Toluene when treated with Br_2/Fe, give p-bromotoluene as the major product because of the $-CH_3$ group:

A. is p-directing

B. deactivates the ring

C. is m-directing

D. activates the ring by hyperconjugation

Answer: A::D

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23. $-CX_3$ group is associated with:

A. m-directing

B. increasing acidic

C. ring deactivation

D. increase of stability of carbocation

Answer: A::B::C

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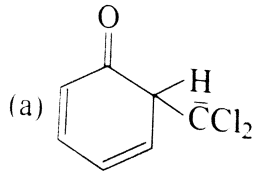
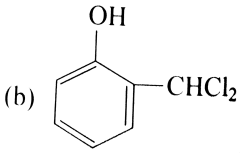
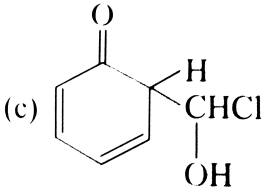
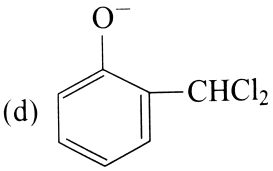
24. When phenol reactes with $CHCl_3$ and NaOH followed by acidification, salicyladehyde is obtained. Which of the following species are involed in the above-mentioned reaction as intermediates ?

A. 

B. 

C. 

D. 

Answer: A::D

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ASSERTION-REASON TYPE QUESTIONS

1. (A) S_{N^2} reactioin takes place in single step.

(R) S_{N^2} reaction involves transition state intermediate.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: B

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2. (A) Ethyl chloride is more reactive than vinyl chloride towards nucleophilic substitution reactions.

(R) Vinyl chloride is $+I$ electron pushing group.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: C

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3. (A) $-NO_2,\ -CN,\ -CNO$ act as ambident nucleophles.

(R) These consist atoms of same period.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: A

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4. (A) Nucleophiles attack the regions of high electron density.

(R) Nucleophiles act as Lewis bases.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: D

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5. (A) Cation carriers, e.g., $H-Br, Cl-OH$ and $Br-Br$ and oxidising agents such as O_3 and $R-O-O-R$, etc. act as electrophilic reagents.

(R) Electrophilec are Lewis bases.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: B

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6. (A) Inductive and electromeric effects require polar nature in the molecule.

(R) Polar nature in inductive effect is a must but not necessarily in electromeric effect.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: D

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7. (A) Singlet carbenes have opposite spin (antiparallel).

(R) They have a bent structure.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: A

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8. (A) Carbenes act as free radicals.

(R) Only triplet carbenes act as biradical (divalent free radical).

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: D

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9. (A) Tertiary carbocations are generally formed more easily than primary carbocations.

(R) Hyperconjugation as well as inductive effect due to additional alkyl groups stabilize tertiary cabocations.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: A

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10. (A) Allyl free radical is more stable than simple alkyl free radical.

(R) The allyl free radical is stabilized by resonance.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: A

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11. (A) Heterolytic fission involves the breaking of a covalent bond in such a way that both the electrons of the shared pair are carried away by one of tha atoms.

(R) Heterolytic fission occurs readily in polar covalent bonds.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: B

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12. (A) Tertiary butyl carbonion is more stable than methyl carbanion.

(R) $+I$ effect of the three methyl groups in tertiary butyl carbanion tends to make it more stable than methyl carbanion.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: D

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13. (A) In S_{N^2} reactions, complete inversion of configuration takes place.

(R) In S_{N^1} reactions, retention but not the inversion takes place,

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: C

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14. (A) In allylic substitution propene gives allyl bromide.

(R) NBS is a selective brominating agent and gives substitution at the alpha carbon with respect to the double bond.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: A

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15. Alkene $A(Me_2C = CMe_2)$ is more stable than alkene $B(Et_2C = Cet_2)$.

Baker-Nathan effect.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct but (R) is incorrect.

D. IF (A) is incorrect but (R) is correct.

Answer: A

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MATRIX-MATCH TYPE QUESTIONS

1. Match the following :

Column I	Column II
(a) Singlet carbene	(p) Diamagnetic
(b) Triplet carbene	(q) Paramagnetic
(c) Free radical	(r) Formed by homolytic fission
(d) Carbocation	(s) Formed by heterolytic fission

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PASSAGE-I

1. Nuclephilic substitution reaction is given by those compounds which have nucleophilic groups as leaving groups. The weaker the basicity of a group of the substrate, the better is its leaving ability.

In nucleophilic substitution reactions, the basicity of leaving group should be less than the incoming nucleophilic group. Nucleophilc substitution reaction at sp^3 -hybridised carbon is either bimolecular (S_{N^2}) or unimolecular (S_{N^1}). Bimolecular reaction takes place in single step, involving transition state intermediate. In S_{N^2} reaction is preferred

if the compound has less steric hindrance.

Unimolecular (S_{N^2}) reaction involves two steps and carbonium ion intermediate. Optically active substrates give recemic mixture in these reactions.

Which compound will give Walden inversion in S_{N^2} reaction?

A. CH_3CH_2Br

B. $CH_3 - CHD - Br$

C. $CH_3 - Br$

D. $C_6H_5CH_2CH_2Cl$

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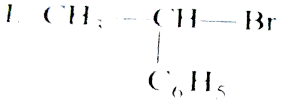
2. Nuclephilic substitution reaction is given by those compounds which have nucleophilic groups as leaving groups. The weaker the basicity of a group of the substrate, the better is its leaving ability.

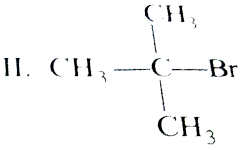
In nucleophilic substitution reactions, the basicity of leaving group

should be less than the incoming nucleophilic group. Nucleophilc substitution reaction at sp^3 -hybridised carbon is either bimolecular (S_{N^2}) or unimolecular (S_{N^1}). Bimolecular reaction takes place in single step, involving transition state intermediate. In S_{N^2} reaction is preferred if the compound has less steric hindrance.

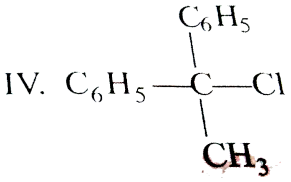
Unimolecular (S_{N^2}) reaction involves two steps and carbonium ion intermediate. Optically active substrates give recemic mixture in these reactions.

Which among the following will give S_{N^1} reaction?

I. 

II. 

III. 

IV. 

A. I,II,III

B. I,II,IV

C. III

D. II and IV

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3. Nuclephilic substitution reaction is given by those compounds which have nucleophilic groups as leaving groups. The weaker the basicity of a group of the substrate, the better is its leaving ability.

In nucleophilic substitution reactions, the basicity of leaving group should be less than the incoming nucleophilic group. Nucleophilc substitution reaction at sp^3 -hybridised carbon is either bimolecular (S_{N^2}) or unimolecular (S_{N^1}). Bimolecular reaction takes place in single step, involving transition state intermediate. In S_{N^2} reaction is preferred if the compound has less steric hindrance.

Unimolecular (S_{N^2}) reaction involves two steps and carbonium ion intermediate. Optically active substrates give recemic mixture in these reactions.

Which among the following will give enantiomeric pair on treatment with HOH?

A. $C_6H_5 - \underset{\underset{C_6H_5}{|}}{\overset{\overset{C_6H_5}{|}}{C}} - Br$

B. $C_6H_5 - \underset{\underset{CH_3}{|}}{\overset{\overset{H}{|}}{C}} - Cl$

C. $C_6H_5 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - I$

D. $CH_3 - \underset{\underset{C_6H_5}{|}}{\overset{\overset{CH_3}{|}}{C}} - Br$

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4. Nuclephilic substitution reaction is given by those compounds which have nucleophilic groups as leaving groups. The weaker the basicity of a group of the substrate, the better is its leaving ability.

In nucleophilic substitution reactions, the basicity of leaving group should be less than the incoming nucleophilic group. Nucleophilc substitution reaction at sp^3 -hybridised carbon is either bimolecular (S_{N^2}) or unimolecular (S_{N^1}). Bimolecular reaction takes place in single step, involving transition state intermediate. In S_{N^2} reaction is preferred if the compound has less steric hindrance.

Unimolecular (S_{N^2}) reaction involves two steps and carbonium ion intermediate. Optically active substrates give recemic mixture in these reactions.

Select the correct statements among the following:

A. carbocation rearrangement takes place in S_{N^1} reaction

B. S_{N^2} mechanism is favoured when nucleophile is neutral

C. S_{N^1} mechanism is favoured when nucleophile is neutral

D. tertiary alkyl halides give only S_{N^1} reaction

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5. Nuclephilic substitution reaction is given by those compounds which have nucleophilic groups as leaving groups. The weaker the basicity of a group of the substrate, the better is its leaving ability.

In nucleophilic substitution reactions, the basicity of leaving group should be less than the incoming nucleophilic group. Nucleophilc substitution reaction at sp^3 -hybridised carbon is either bimolecular (S_{N^2}) or unimolecular (S_{N^1}). Bimolecular reaction takes place in single step, involving transition state intermediate. In S_{N^2} reaction is preferred if the compound has less steric hindrance.

Unimolecular (S_{N^2}) reaction involves two steps and carbonium ion intermediate. Optically active substrates give recemic mixture in these reactions.

S_{N^2} reaction involves transition state intermediate, hence it is favoured in which of the following solvents?

A. Polar protic solvent

B. Non-polar solvent

C. Polar aprotic solvent

D. All of these

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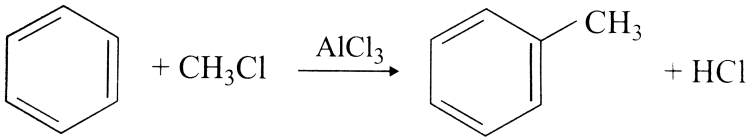
PASSAGE-II

1. Alkylation of aromatic compounds with aliphatic compounds like halides in presence of Lewis acid catalyst is known as Friedel-Crafts alkylation. It is an exapmle of electrophilic substitution.



In the process of acylation, $R-\overset{O}{\overset{||}{C}}-$ group is introduced to the ring. Compounds having ($+$ mesomeric groups) like $-NH_2$ do not give Friedel-Crafts reaction because these compounds undergo conjugation with the catalyst. In the alkylation process, most branched alkyl group is substituted because isomerisation of carbonium ion takes place. In some Friedel-Crafts reactions, the nature of product changes with the solvent used in the reaction.

Predict whether the following statements are ture or false:

$AlCl_3$ (aq.) is used as catalst in Frieded-Crafts reaction:

(a) True (b) False

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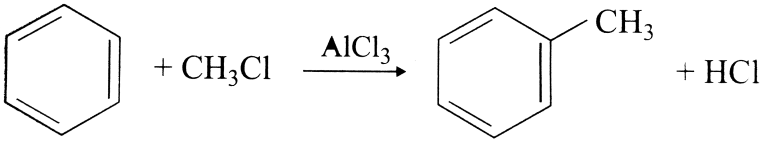
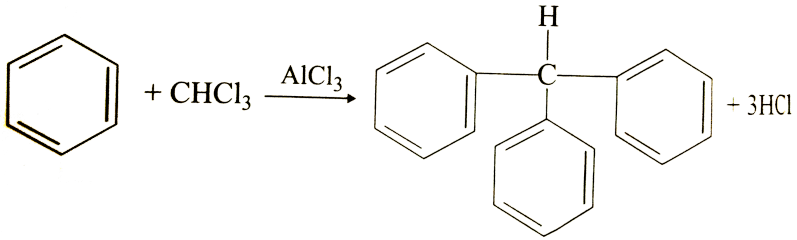
2. Alkylation of aromatic compounds with aliphatic compounds like halides in presence of Lewis acid catalyst is known as Friedel-Crafts alkylation. It is an exapmle of electrophilic substitution.



In the process of acylation, $R-\overset{O}{\overset{||}{C}}-$ group is introduced to the ring. Compounds having ($+$ mesomeric groups) like $-NH_2$ do not give Friedel-Crafts reaction because these compounds undergo conjugation with the catalyst. In the alkylation process, most branched alkyl group is substituted because isomerisation of carbonium ion takes place. In some Friedel-Crafts reactions, the nature of product changes with the solvent used in the reaction.

Predict whether the following statements are ture or false:

When benzene is treated with $CHCl_3$ in presence of $AlCl_3$ catalyst, the following reaction takes place:



(a) True (b) False

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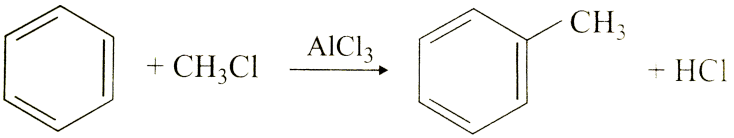
3. Alkylation of aromatic compounds with aliphatic compounds like halides in presence of Lewis acid catalyst is known as Friedel-Crafts alkylation. It is an exapmle of electrophilic substitution.



In the process of acylation, $R-\overset{O}{\overset{||}{C}}-$ group is introduced to the ring. Compounds having ($+$ mesomeric groups) like $-NH_2$ do not give

Friedel-Crafts reaction because these compounds undergo conjugation with the catalyst. In the alkylation process, most branched alkyl group is substituted because isomerisation of carbonium ion takes place. In some Friedel-Crafts reactions, the nature of product changes with the solvent used in the reaction.

Predict whether the following statements are ture or false:

Carbocations undergo isomerisation in Frieded-Crafts reaction. In each of the following alkyl halides the isomerisation takes place:

$CH_3 - CH_2 - CH_2 - Cl$,

$CH_3 - CH_2 - CH_2 - CH_2 - Cl$

(a) True (b) False

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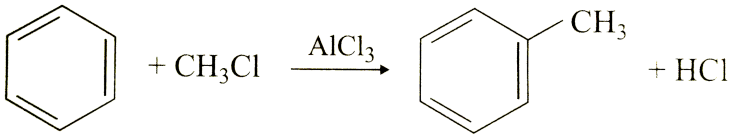
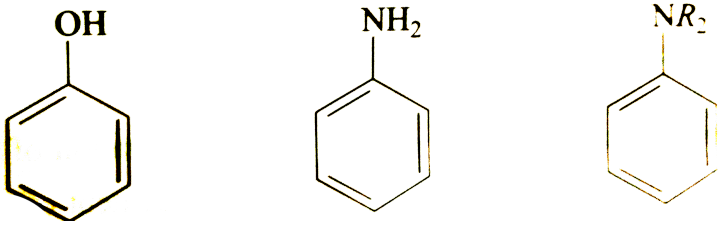
4. Alkylation of aromatic compounds with aliphatic compounds like halides in presence of Lewis acid catalyst is known as Friedel-Crafts alkylation. It is an exapmle of electrophilic substitution.



In the process of acylation, $R-\overset{\overset{O}{||}}{C}-$ group is introduced to the ring. Compounds having ($+$ mesomeric groups) like $-NH_2$ do not give Friedel-Crafts reaction because these compounds undergo conjugation with the catalyst. In the alkylation process, most branched alkyl group is substituted because isomerisation of carbonium ion takes place. In some Friedel-Crafts reactions, the nature of product changes with the solvent used in the reaction.

Predict whether the following statements are ture or false:

Following compounds easily give Friedel-Crafts reaction:



(a) True (b) False

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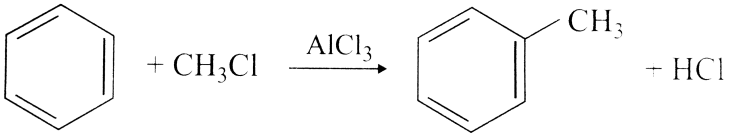
5. Alkylation of aromatic compounds with aliphatic compounds like halides in presence of Lewis acid catalyst is known as Friedel-Crafts alkylation. It is an exapmle of electrophilic substitution.



In the process of acylation, $R-\overset{O}{\overset{||}{C}}-$ group is introduced to the ring. Compounds having ($+$ mesomeric groups) like $-NH_2$ do not give Friedel-Crafts reaction because these compounds undergo conjugation with the catalyst. In the alkylation process, most branched alkyl group is substituted because isomerisation of carbonium ion takes place. In some Friedel-Crafts reactions, the nature of product changes with the solvent used in the reaction.

Predict whether the following statements are ture or false:

Diphenyl methane is obtained when benzene is treated with dichloro methane is presence of anhydrous $AlCl_3$:

(a) True (b) False

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PASSAGE-III

1. Hyperconjugation describes the orbital interactions between the π-system and the adjacent σ-bond of the substituent group(s) in organic compounds. Hyperconjugation is called as Baker and Nathan effect. The necessary and sufficient conditions for the hyperconjugation are:

(i) Compound should have at least one sp^2-hybrid carbon of either alkene, carbocation or alkyl free radical.

(ii) α-carbon with respect to sp^2 -hybrid carbon should have at least one hydrogen.

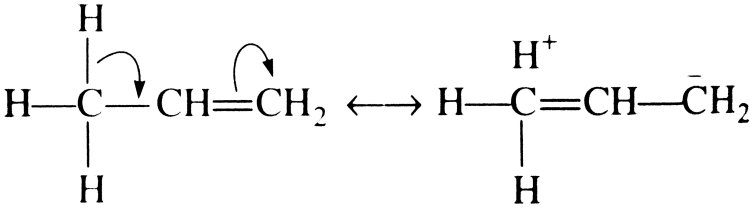
Hyperconjugation are of three types:

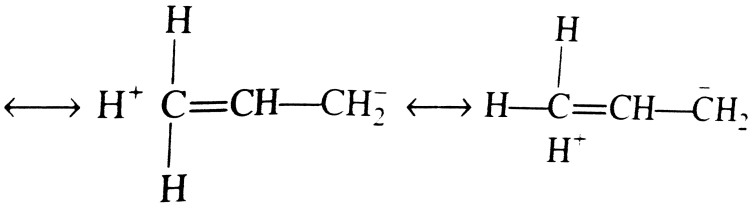
(i) $\sigma(C-H)$, π-conjugation,

(ii) $\sigma(C-H)$, positive charge conjugation,

(iii) $\sigma(C-H)$, odd electron conjugation.

The hyperconjugation may be represented as,





Number of resonating structures due to hyperconjugation $= (n+1)$, where n is the numebr of α-hydrogen. Greater is the number of such forms, more is the stability of the species under consideration.

Hyperconjugation is possible in which of the following species?

A. $CH_3 - CH_2 -$

B. $C_6H_5 - CH_3$

C. $H_2C = CH_2$

D. $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH = CH_2$

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2. Hyperconjugation describes the orbital interactions between the π-system and the adjacent σ-bond of the substituent group(s) in organic

compounds. Hyperconjugation is called as Baker and Nathan effect. The necessary and sufficient conditions for the hyperconjugation are:

(i) Compound should have at least one sp^2-hybrid carbon of either alkene, carbocation or alkyl free radical.

(ii) α-carbon with respect to sp^2 -hybrid carbon should have at least one hydrogen.

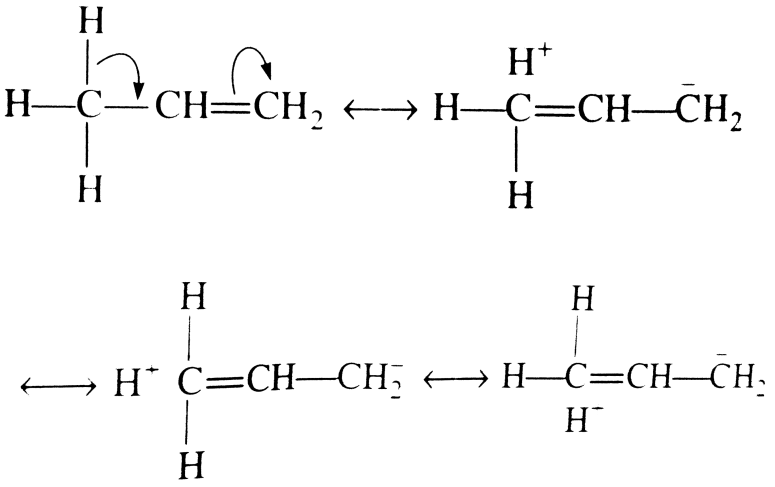
Hyperconjugation are of three types:

(i) $\sigma(C-H)$, π-conjugation,

(ii) $\sigma(C-H)$, positive charge conjugation,

(iii) $\sigma(C-H)$, odd electron conjugation.

The hyperconjugation may be represented as,



Number of resonating structures due to hyperconjugation $=(n+1)$, where n is the numebr of α-hydrogen. Greater is the number of such

forms, more is the stability of the species under consideration.

Which of the following carbocations will show highest number of hyperconjugative forms?

A. $CH_3 - \overset{+}{C}H_2$

B. $CH_3 - \overset{+}{\underset{\underset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}}$

C. $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C^+}}$

D. $CH_3 - CH_2 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C^+}}$

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3. Hyperconjugation describes the orbital interactions between the π-system and the adjacent σ-bond of the substituent group(s) in organic compounds. Hyperconjugation is called as Baker and Nathan effect. The necessary and sufficient conditions for the hyperconjugation are:

(i) Compound should have at least one sp^2-hybrid carbon of either alkene,

carbocation or alkyl free radical.

(ii) α-carbon with respect to sp^2 -hybrid carbon should have at least one hydrogen.

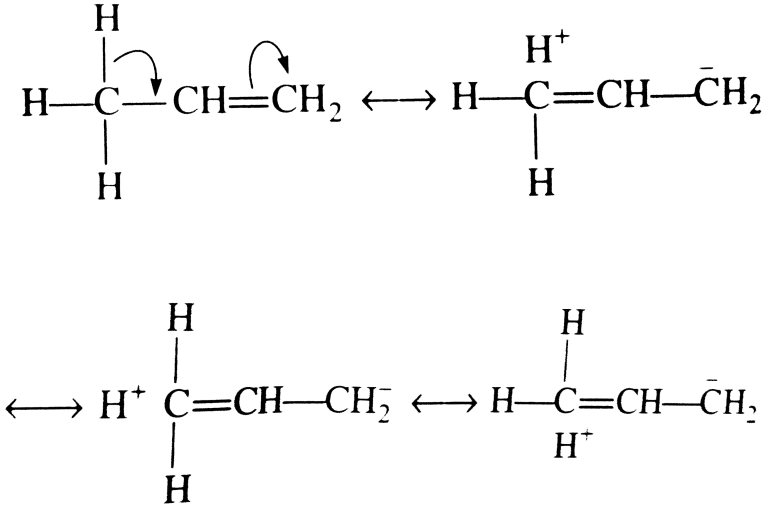
Hyperconjugation are of three types:

(i) $\sigma(C-H)$, π-conjugation,

(ii) $\sigma(C-H)$, positive charge conjugation,

(iii) $\sigma(C-H)$, odd electron conjugation.

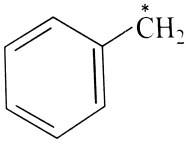
The hyperconjugation may be represented as,



Number of resonating structures due to hyperconjugation $=(n+1)$, where n is the numebr of α-hydrogen. Greater is the number of such forms, more is the stability of the species under consideration.

Which of the following free redicals will not show the phenomena of hyperconjugation?

A. $\overset{*}{C}H_3$

B. (b) 

C. $CH_3 - \overset{*}{C}H_2$

D. $CH_3 - \underset{*}{\overset{CH_3}{\overset{|}{C}}}H$

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4. Hyperconjugation describes the orbital interactions between the π-system and the adjacent σ-bond of the substituent group(s) in organic compounds. Hyperconjugation is called as Baker and Nathan effect. The necessary and sufficient conditions for the hyperconjugation are:

(i) Compound should have at least one sp^2-hybrid carbon of either alkene, carbocation or alkyl free radical.

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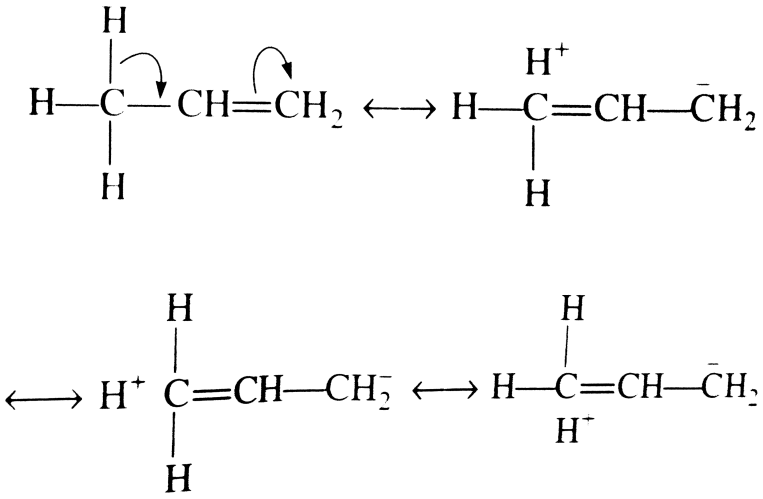

Number of resonating structures due to hyperconjugation $=(n+1)$, where n is the numebr of α-hydrogen. Greater is the number of such forms, more is the stability of the species under consideration.

Which of the following alkenes will show maximum number of hyperconjugation forms?

A. $H_2C = CH_2$

B. $CH_3 - CH = CH_2$

C. $CH_3 - CH_2 - CH = CH_2$

D. $CH_3 - \overset{CH_3}{\underset{|}{C}}H - CH = CH_2$

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5. Hyperconjugation describes the orbital interactions between the π-system and the adjacent σ-bond of the substituent group(s) in organic compounds. Hyperconjugation is called as Baker and Nathan effect. The necessary and sufficient conditions for the hyperconjugation are:

(i) Compound should have at least one sp^2-hybrid carbon of either alkene, carbocation or alkyl free radical.

(ii) α-carbon with respect to sp^2 -hybrid carbon should have at least one hydrogen.

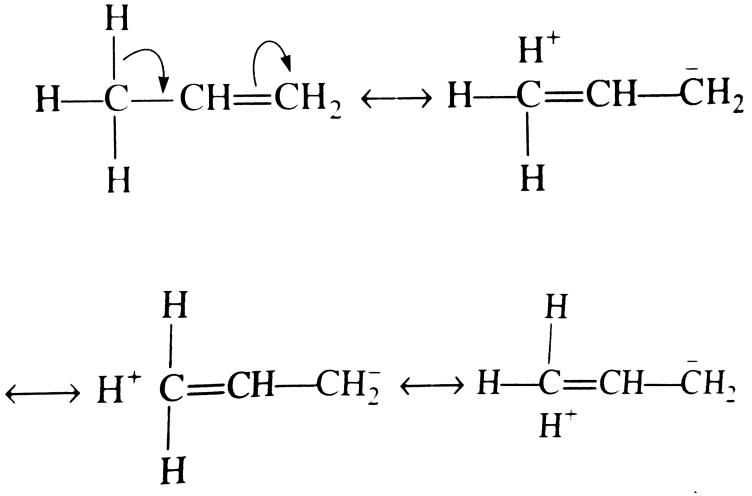
Hyperconjugation are of three types:

(i) $\sigma(C-H)$, π-conjugation,

(ii) $\sigma(C-H)$, positive charge conjugation,

(iii) $\sigma(C-H)$, odd electron conjugation.

The hyperconjugation may be represented as,



Number of resonating structures due to hyperconjugation $=(n+1)$, where n is the numebr of α-hydrogen. Greater is the number of such forms, more is the stability of the species under consideration.

Stability of alkyl carbocations can be explained by

A. inductive effect

B. hyperconjugation

C. both inductive effect and hyperconjugation

D. electromeric effect

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PASSAGE-IV

1. Free redical halogenation takes place in presence of light or at high temperature (above $500^{\circ}C$). Formation of halogen free radical intermediate takes place in first step called chain initiation step.

$Cl_2 \xrightarrow{hv} 2Cl^*$

This reaction is mainly given by those compounds which have at least one hydrogen atom present at sp^3 -hybrid carbon. Reactivity of sp^3-hybrid carbon depends on the reactivity of reaction intermediate.

The relative rate of formation of alkyl radicals by a chlorine radical is:

$$\underset{(5)}{\text{Tertiary}} > \underset{(3.8)}{\text{secondary}} > \underset{(1)}{\text{Primary}}$$

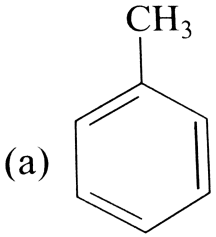
$$\text{Percentage yield of the product} = \frac{\text{Relative amount} \times 100}{\text{Sum of relative amounts}}$$

$$\text{Relative amount} = \text{Number of hydrogen atoms on the respective carbon} \times$$

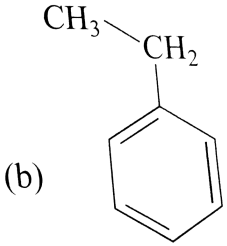
NBS(N-bromosuccinimide) is used for bromination at allylic and benzylic carbon, whereas Br_2/hv gives bromination at benzylic, allylic and allyl carbons.

Select most reactive compound for chlorination in presence of light:

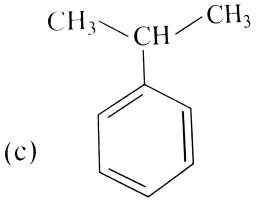
A.



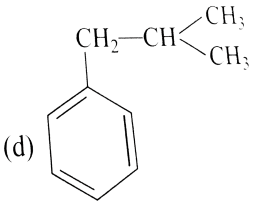
B.



C.



D.



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2. Free redical halogenation takes place in presence of light or at high temperature (above $500^{\circ}C$). Formation of halogen free radical intermediate takes place in first step called chain initiation step.

$Cl_2 \xrightarrow{hv} 2Cl^*$

This reaction is mainly given by those compounds which have at least one hydrogen atom present at sp^3 -hybrid carbon. Reactivity of sp^3-hybrid carbon depends on the reactivity of reaction intermediate.

The relative rate of formation of alkyl radicals by a chlorine radical is:

$\underset{(5)}{\text{Tertiary}} > \underset{(3.8)}{\text{secondary}} > \underset{(1)}{\text{Primary}}$

$$\text{Percentage yield of the product} = \frac{\text{Relative amount} \times 100}{\text{Sum of relative amounts}}$$

$\text{Relative amount} = \text{Number of hydrogen atoms on the respective carbon} \times$

NBS(N-bromosuccinimide) is used for bromination at allylic and benzylic carbon, whereas Br_2/hv gives bromination at benzylic, allylic and allyl carbons.

Which one of the following compounds will react with NBS?

A. $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH = CH_2$

B. $C_6H_5 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH = CH_3$

C. $C_6H_5 - CH = CH_2$

D. $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_3$

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3. Free redical halogenation takes place in presence of light or at high temperature (above $500^\circ C$). Formation of halogen free radical intermediate takes place in first step called chain initiation step.

$Cl_2 \xrightarrow{h\nu} 2Cl^*$

This reaction is mainly given by those compounds which have at least one hydrogen atom present at sp^3 -hybrid carbon. Reactivity of sp^3-hybrid carbon depends on the reactivity of reaction intermediate.

The relative rate of formation of alkyl radicals by a chlorine radical is:

$\underset{(5)}{\text{Tertiary}} > \underset{(3.8)}{\text{secondary}} > \underset{(1)}{\text{Primary}}$

$$\text{Percentage yield of the product} = \frac{\text{Relative amount} \times 100}{\text{Sum of relative amounts}}$$

$\text{Relative amount} = \text{Number of hydrogen atoms on the respective carbon} \times$

NBS(N-bromosuccinimide) is used for bromination at allylic and benzylic carbon, whereas Br_2/hv gives bromination at benzylic, allylic and allyl carbons.

Arrange decreasisng order of reactivity of given compounds with NBS (N-bromosuccinimide).

I. $C_6H_5 - CH_3$

II. $C_6H_5 - CH_2 - CH_2 - CH_3$

III. $C_6H_5 - CH_2 - CH = CH_2$

IV. $C_6H_5 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{\text{CH}}} - CH = CH_2$

Select the correct answer from the codes given below:

A. IV, III, I, II

B. IV, III, II, I

C. I, II, III, IV

D. I, III, II, IV

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PASSAGE-V

1. The electronic displacements in covalent bonds may occur either in the ground state under the influence of an atom or a substituent group or in presence of an appropriate attacking reagent. As a result of these electron displacements, centres of different electron densities are created and these centres are susceptible to attack by the reagents. These electron displacements occur through inductive electromeric, resonance and hyperconjugation effects. Whereas inductive effect involves displacement of $sigam$-electrons towards the substituent, resonance effect involves delocalization of $\pi-$ electrons transmitted through the chain and both are permanent effect. Electromeric effect is the complete transfer of a shared pair of π- electrons to one of the atoms joined by a multiple bond on the demand of an attacking reagent. Hyperconjugation effects on the other hand involve delocalization of σ-

electrons of $C-H$ bond of an alkyl group directly attached to an atom of unsaturated system (i.e., $\sigma-\pi$-conjugation). Both inductive and hyperconjugation effects can be used to explain the stability of carbocations and free radicals which follow the stability order : $3^{\circ}>2^{\circ}>1^{\circ}$. The stability or carbanions, however, follows the reverse order.

An organic reaction occurs through making and breaking of bonds. The breaking of a covalent bond may occur either homolytic leading to the formation of free radicals or heterolytic forming positively (carbocations) or negatively (carbanions) charged species. Most of the attacking reagents carry either a positive or a negative charge. The positively charged species with electron deficient centre or neutral species (free radicals, carbenes, nitrene) are collectively called electrophiles, while negatively charged species with electron rich centre or neutral species (like water, alcohol, ammonia, etc.) are called nucleophiles.

Which of the following groups has highest inductive effect?

A. CH_3-

B. CH_3CH_2-

C. $(CH_3)_2CH-$

D. $(CH_3)_3C-$

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2. The electronic displacements in covalent bonds may occur either in the ground state under the influence of an atom or a substituent group or in presence of an appropriate attacking reagent. As a result of these electron displacements, centres of different electron densities are created and these centres are susceptible to attack by the reagents. These electron displacements occur through inductive electromeric, resonance and hyperconjugation effects. Whereas inductive effect involves displacement of $sigam$-electrons towards the substituent, resonance effect involves delocalization of $\pi-$ electrons transmitted through the chain and both are permanent effect. Electromeric effect is the complete transfer of a shared pair of π- electrons to one of the atoms joined by a multiple bond on the demand of an attacking reagent.

Hyperconjugation effects on the other hand involve delocalization of σ-electrons of $C-H$ bond of an alkyl group directly attached to an atom of unsaturated system (i.e., $\sigma-\pi$-conjugation). Both inductive and hyperconjugation effects can be used to explain the stability of carbocations and free radicals which follow the stability order : $3^{\circ}>2^{\circ}>1^{\circ}$. The stability or carbanions, however, follows the reverse order.

An organic reaction occurs through making and breaking of bonds. The breaking of a covalent bond may occur either homolytic leading to the formation of free radicals or heterolytic forming positively (carbocations) or negatively (carbanions) charged species. Most of the attacking reagents carry either a positive or a negative charge. The positively charged species with electron deficient centre or neutral species (free radicals, carbenes, nitrene) are collectively called electrophiles, while negatively charged species with electron rich centre or neutral species (like water, alcohol, ammonia, etc.) are called nucleophiles.

The decreasing order of basic strength in

$\underset{\text{(I)}}{C_6H_5NH_2}, \quad \underset{\text{(II)}}{(C_6H_5)_2NH}, \quad \underset{\text{(III)}}{CH_3NH_2}, \quad \underset{\text{(IV)}}{NH_3}$ is:

A. (IV)gt(III)gt(II)gt(I)

B. (I)gt(II)gt(III)gt(IV)

C. (III)gt(IV)gt(I)gt(II)

D. (II)gt(I)gt(III)gt(IV)

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3. The electronic displacements in covalent bonds may occur either in the ground state under the influence of an atom or a substituent group or in presence of an appropriate attacking reagent. As a result of these electron displacements, centres of different electron densities are created and these centres are susceptible to attack by the reagents. These electron displacements occur through inductive electromeric, resonance and hyperconjugation effects. Whereas inductive effect involves displacement of $sigam$-electrons towards the substituent, resonance effect involves delocalization of $\pi -$ electrons transmitted through the chain and both are permanent effect. Electromeric effect is

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An organic reaction occurs through making and breaking of bonds. The breaking of a covalent bond may occur either homolytic leading to the formation of free radicals or heterolytic forming positively (carbocations) or negatively (carbanions) charged species. Most of the attacking reagents carry either a positive or a negative charge. The positively charged species with electron deficient centre or neutral species (free radicals, carbenes, nitrene) are collectively called electrophiles, while negatively charged species with electron rich centre or neutral species (like water, alcohol, ammonia, etc.) are called nucleophiles.

Out of the following series, the one containing only electrophiles is:

A. H_2O, Cl^+, NH_3

B. H_2O, RNH_2, H_3O^+

C. BF_3, SO_3, NO_2^+

D. $AlCl_3, NH_3, H_2O$

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4. The electronic displacements in covalent bonds may occur either in the ground state under the influence of an atom or a substituent group or in presence of an appropriate attacking reagent. As a result of these electron displacements, centres of different electron densities are created and these centres are susceptible to attack by the reagents. These electron displacements occur through inductive electromeric, resonance and hyperconjugation effects. Whereas inductive effect involves displacement of $sigam$-electrons towards the substituent, resonance effect involves delocalization of $\pi -$ electrons transmitted through the chain and both are permanent effect. Electromeric effect is

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An organic reaction occurs through making and breaking of bonds. The breaking of a covalent bond may occur either homolytic leading to the formation of free radicals or heterolytic forming positively (carbocations) or negatively (carbanions) charged species. Most of the attacking reagents carry either a positive or a negative charge. The positively charged species with electron deficient centre or neutral species (free radicals, carbenes, nitrene) are collectively called electrophiles, while negatively charged species with electron rich centre or neutral species (like water, alcohol, ammonia, etc.) are called nucleophiles.

Consider the following alkenes and what is correct decreasing order of

stability?

$CH_3CH_2CH = CH_2$, But-1-ene (I)

$(CH_3)_2C = (CH_3)_2$, 2,3-Dimethylbut-2-ene (II)

$(CH_3)_2C = CHCH_3$, 2-Methylbut-2-ene (III)

$(CH_3)_2C = CH_3$, 2-Methylpropene (IV)

A. (I) gt (II) gt (III) gt (IV)

B. (II) gt (III) gt (IV) gt (I)

C. (IV) gt (III) gt (II) gt (I)

D. (III) gt (IV) gt (I) gt (II)

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5. The electronic displacements in covalent bonds may occur either in the ground state under the influence of an atom or a substituent group or in presence of an appropriate attacking reagent. As a result of these electron displacements, centres of different electron densities are created and these centres are susceptible to attack by the reagents. These electron displacements occur through inductive electromeric,

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An organic reaction occurs through making and breaking of bonds. The breaking of a covalent bond may occur either homolytic leading to the formation of free radicals or heterolytic forming positively (carbocations) or negatively (carbanions) charged species. Most of the attacking reagents carry either a positive or a negative charge. The positively charged species with electron deficient centre or neutral species (free radicals, carbenes, nitrene) are collectively called electrophiles, while

negatively charged species with electron rich centre or neutral species (like water, alcohol, ammonia, etc.) are called nucleophiles.

Which of the following is most stable cation?

A. $(CH_3)_2\overset{+}{C}H$

B. $\overset{+}{C}H_2$

C. $\overset{+}{C}F_3$

D. $F_3C-\overset{+}{C}H_2$

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SINGLE INTEGER ANSWER TYPE QUESTIONS

1. Amongst following the total number of electrophiles is:

$Cl^+, OH^-, CN^-, H^+, H_3O^+, Na^+, R^-, NO_2^+, :CH_2, :NH_3$

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2. Amongst following the total number of nucleophiles is:

$R^-, OR^-, H_2O, SO_3, NH_2^-, CO_2, ROH, BF^3, AlCl_3, H^-$

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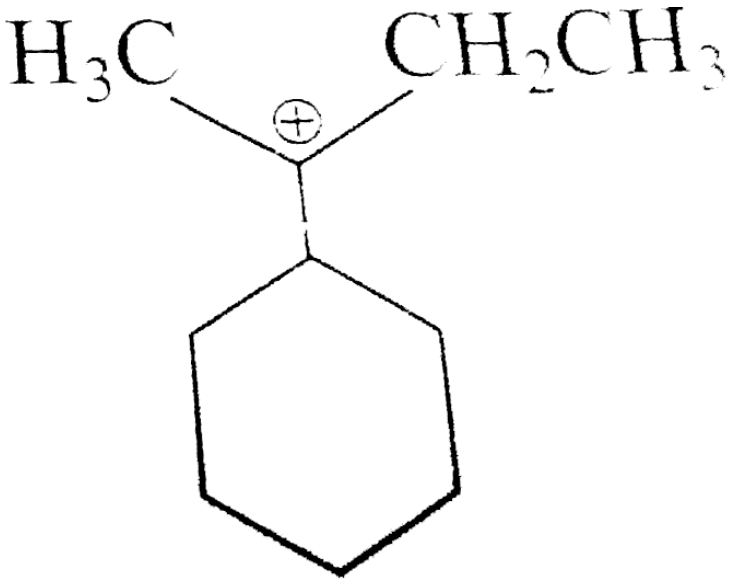
3. The total number of contributing structures showing hyperconjugation (involving $C-H$ bonds) for the following carbocation is:



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4. Total number of Lewis acids among the following is :

$BF_3, H_3PO_4, NH_3, SiF_4, CH_3COOH, NaOH, CO_2, HCl, SO_3.$

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