Hydrocarbons

SOLUTIONS

Exercise-I (Conceptual Questions)

1. Ans. (1)

Reactivity order of alkyl halide in Wurtz reaction

R—I > R—Br > R—Cl > R—F

2. Ans. (3)

Wurtz reaction is not suitable for preparation of Unsymmetrical alkane.

Ethan → CH_3-CH_3 Symmetrical

Butane → $CH_3CH_2-CH_2CH_3$ Symmetrical

Neo pentane → $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_3$

Hexane→$CH_3CH_2CH_2-CH_2CH_2CH_3$

Symmetrical

3. Ans. (1)

C—C Bond formation

(I) $R-MgX \xrightarrow{H_3O^+} R-H + Mg\begin{matrix}X\\OH\end{matrix}$ (Grignard reagent)

(II) $\dot{R} + \dot{R} \longrightarrow R-R$

(III) Corey house reaction

$R-X \xrightarrow[(iii)\ R'-X]{(i)\ Li\ (ii)\ CuX} R-R'$

(IV) $R\,Na + R-Br \longrightarrow R-R$

4. Ans. (3)

$CH_4 + O_2 \xrightarrow{Cu/523K/\ 200\ atm} CH_3OH$ (Alcohol)

$\xrightarrow{Mo_2O_3}$ H–CHO (Aldehyde)

Both are catalytic oxidation

$CH_4 + O_2 \longrightarrow C + H_2O$ (In complete oxidation)

↓

Carbon Black formation

$CH_4 + O_2 \longrightarrow CO_2 + H_2O$ (complete oxidation)

5. Ans. (4)

Pyrolysis of alkanes

Free Radical elimination reaction

Liquid Hydrocarbon can be convert into a mixture of gaseous hydrocarbon.

CH_2-CH_2 (H, H) $\xrightarrow{500–800°C}$

$CH_2=CH_2 + H_2$

+

CH_4

6. Ans. (2)

$CH_3CH_2CH_2Br \xrightarrow[\Delta]{alc.\ KOH} CH_3-CH=CH_2$ (Elimination)

(A)

$\xrightarrow[(ii)\ Zn,\ H_2O]{(i)\ O_3}$ $CH_3-\underset{\displaystyle O}{\overset{\displaystyle H}{\overset{|}{\underset{||}{C}}}}$ (B) + $H-\underset{\displaystyle O}{\overset{\displaystyle H}{\overset{|}{\underset{||}{C}}}}$ (C)

A → Propene; B → Ethanal; C → Methanal

7. Ans. (3)

3-Methyl-1-butene

$CH_2=CH-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{CH}}}}$

↓ $O_3/H_2O/Zn$

$H-\underset{\displaystyle O}{\overset{\displaystyle H}{\overset{|}{\underset{||}{C}}}}-H + O=\overset{1}{C}(H)-\overset{2}{C}H(CH_3)-\overset{3}{C}H_3$

Methanol 2-Methyl propanol

8. Ans. (3)

$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}=C-CH_3 \xrightarrow{O_3/H_2O/Zn} 2CH_3-\underset{\displaystyle O}{\overset{}{\underset{||}{C}}}-CH_3$

2,3-Dimethyl-2-butene Acetone

9. Ans. (1)

$CH_3-\underset{\displaystyle CH_3}{\overset{}{\underset{|}{C}}}=CH_2 \xrightarrow{KMnO_4} CH_3-\underset{\displaystyle O}{\overset{}{\underset{||}{C}}}-CH_3 + H-\underset{\displaystyle O}{\overset{}{\underset{||}{C}}}-H$

$\longrightarrow H-\underset{\displaystyle O}{\overset{}{\underset{||}{C}}}-OH + H_2O + CO_2$

10. Ans. (4)

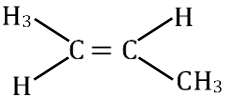
Ozonolysis $\longrightarrow$

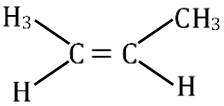
11. Ans. (2)

H.O.H. $\propto$ No. of π Bond

$\propto \frac{1}{\text{stability}}$ (If No. of π Bond same)

(i) $CH_2=CH-CH_2-CH_3$

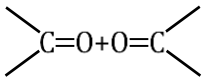
(ii) 

(iii) 

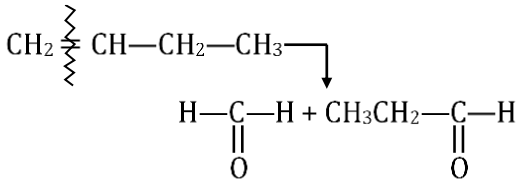
(iv) $CH_2=CH-CH_3$

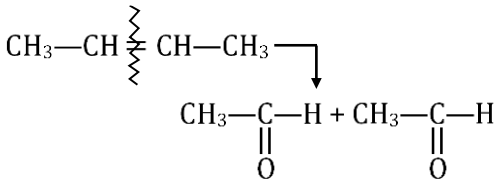
12. Ans. (2)

3 C—C

8 C—H σ Bond $\xrightarrow{\text{ozonolysis}}$  (Aldehyde)

1 C—C π Bond

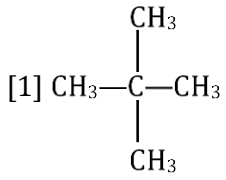
(i) 

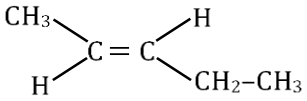
(ii) 

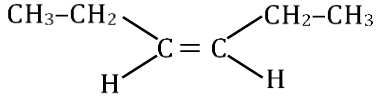
(iii) $CH_3-CH=CH-CH_2-CH_3$

(iv) $CH_3-C\equiv C-CH_3$

13. Ans. (4)

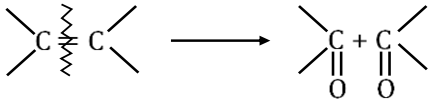
[1]  $\mu = 0$

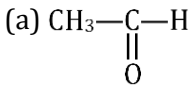
[2]  $\mu \neq 0$

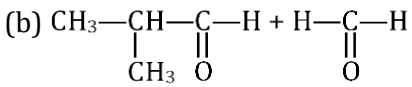
[3]  $\mu \neq 0$

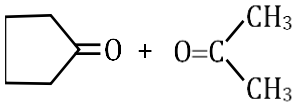
14. Ans. (4)

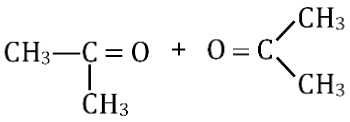
Ozonolysis



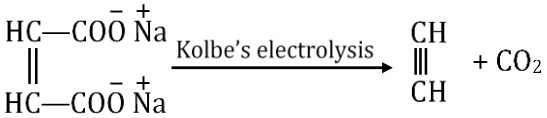
(a) 

(b) 

(c) 

(d) 

15. Ans. (3)



at Anode

16. Ans. (1)

Kolbe's electrolysis

at Anode $\rightarrow$ Hydrocarbon + CO_2

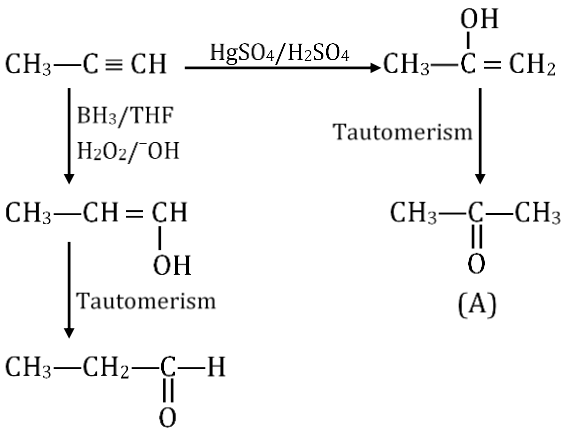
at Cathode $\rightarrow$ H_2 + NaOH

$\therefore$ pH of solution increase with time

17. Ans. (4)

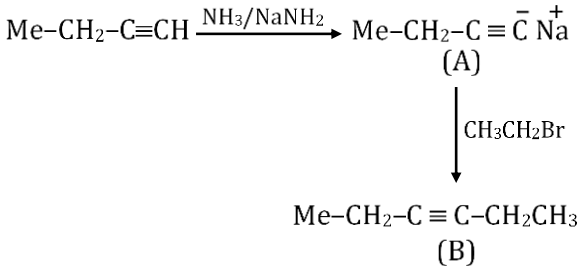
Terminal alkynes react with tollen's reagent and give a P.P.T.

18. Ans. (2)

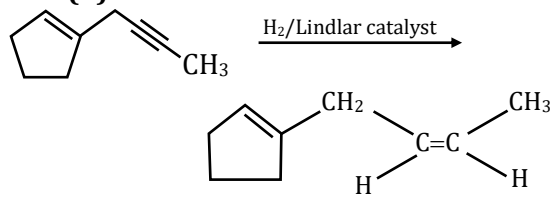


(A)

19. Ans. (1)



20. Ans. (1)



Cis-alkene

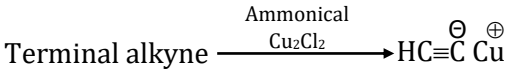
21. Ans. (3)

Propene	Propyne
$CH_2 = CH—CH_3$	$HC \equiv C—CH_3$

(1) Bromine water
(2) Alkaline $KMnO_4$
} Test of Unsaturation ($\therefore$ both gives the test)

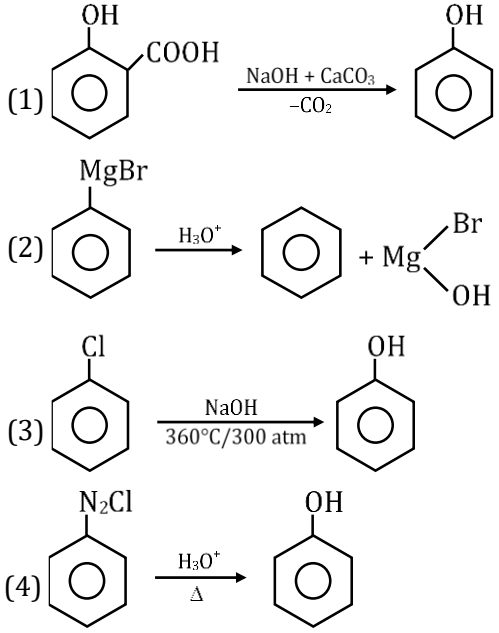
(3) Ammonical silver nitrate → Propyne ✓
(Terminal alkyne gives this test)→Propene ×

22. Ans. (3)

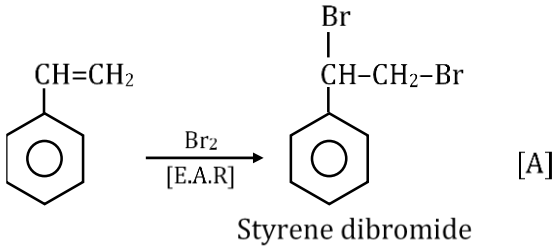


HC≡CH (Red P.P.T.)

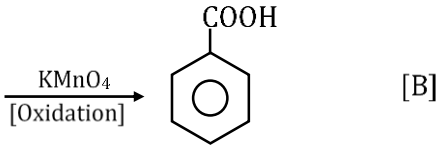
23. Ans. (2)



24. Ans. (4)



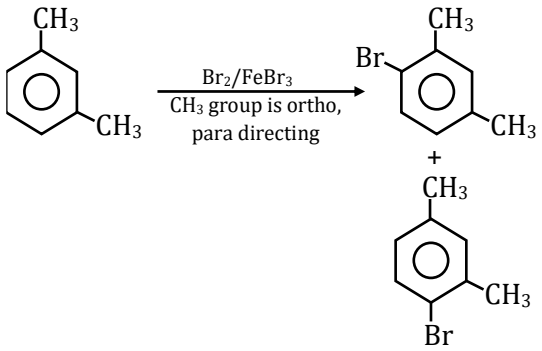
Styrene dibromide



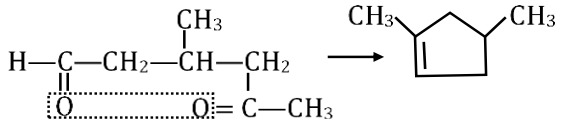
Benzoic acid

Exercise-II (Previous Year Questions)

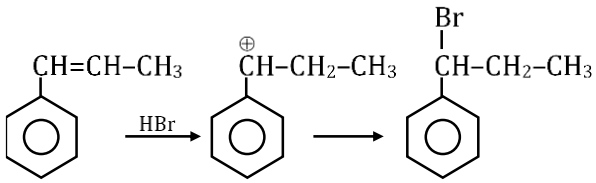
1. Ans. (3)



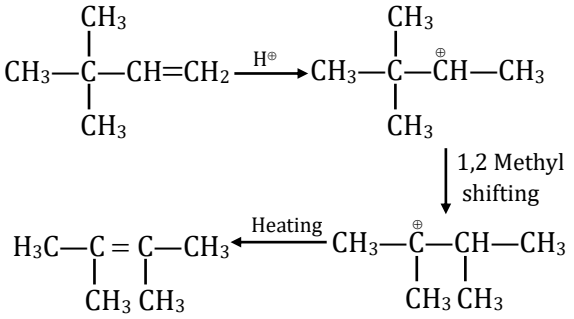
2. Ans. (4)



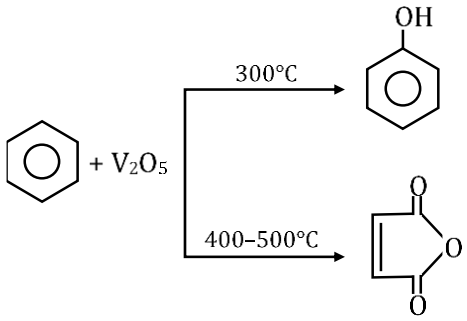
3. Ans. (4)



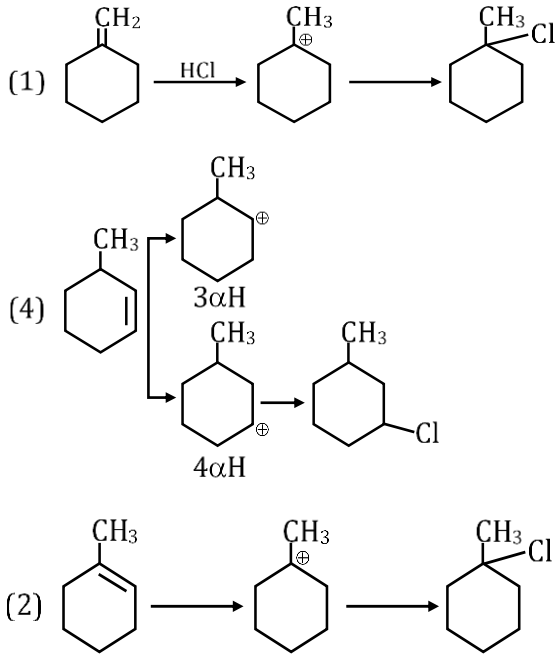
4. Ans. (4)



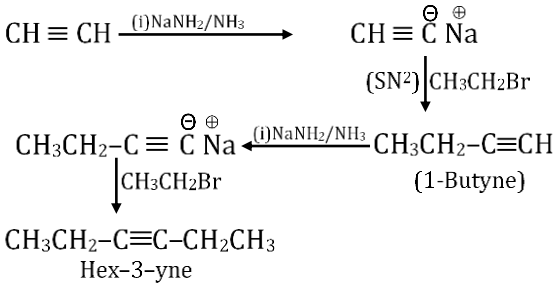
5. Ans. (4)



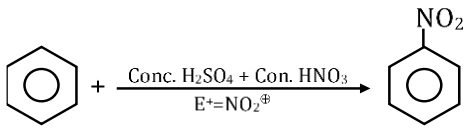
6. Ans. (3)



7. Ans. (1)

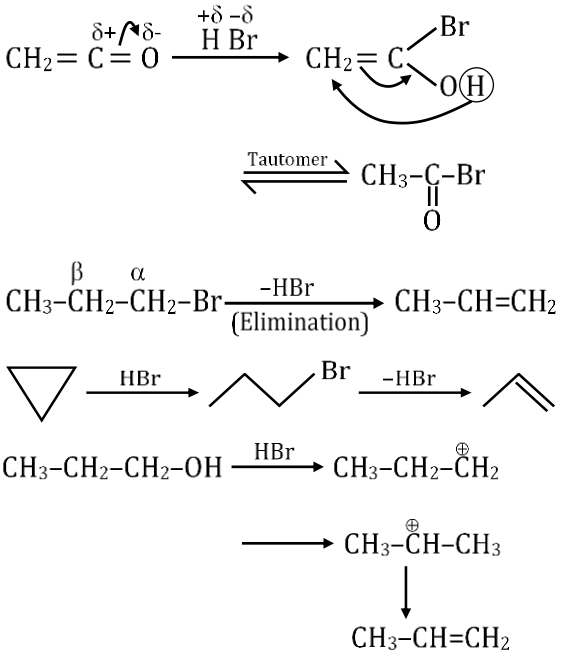


8. Ans. (2)

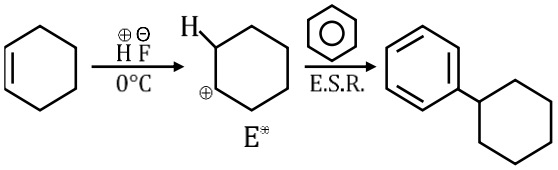


If $KHSO_4$ added, more K^+ HSO_4^- ion form, conc. of $E^⊕$ decrease. So rate of ESR=decrease.

9. Ans. (1)



10. Ans. (1)



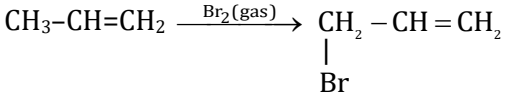
11. Ans. (3)

(1) $CH_3CH_2CH_2CH_3$ (2) $CH_2=CH_2$

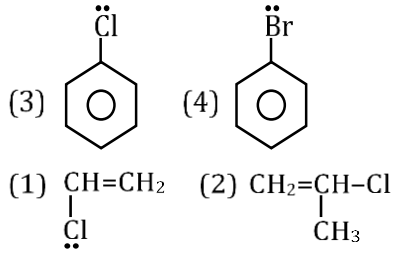
(3) $H_3C–HC=CH_2$ (4) $HC≡CH$

Bromine gas react with alkene to give allylic substituted product by free radical mechanism.

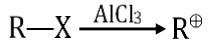
Reaction of free Radical depends upon → Stability of free radical



12. Ans. (2)

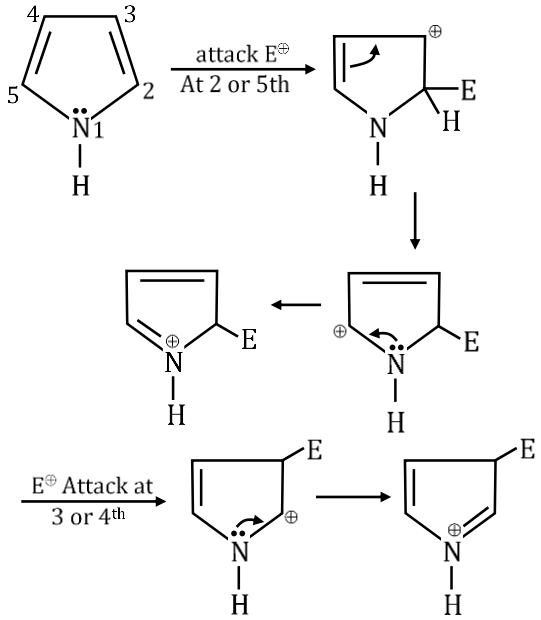


Friedel-Crafts reaction



Option-1,3,4 are Reso. stable.

13. Ans. (2)

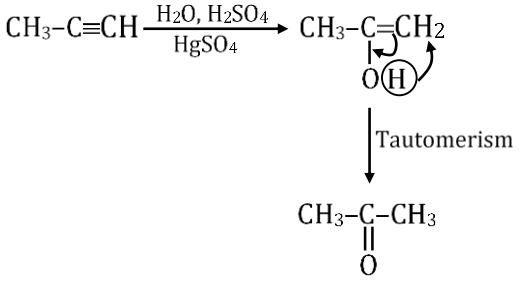


More resonating structure

When $E^{\oplus}$ attack on 2nd or 5th position

So Maxi electron density on 2nd and 5th position.

14. Ans. (3)



15. Ans. (4)

(1) $CH{\equiv}CH \xrightarrow{Br_2} CH(Br)=CH(Br)$

(2) $CH_2{=}CH_2 \xrightarrow{HBr} CH_3{-}CH_2Br \xrightarrow{Na/dry\ ether} CH_3CH_2CH_2CH_3$

(3) $CH_3{-}CH_3 \xrightarrow{HBr} CH_3CH_2Br \xrightarrow{Na/dry\ ether} CH_3CH_2CH_2CH_3$

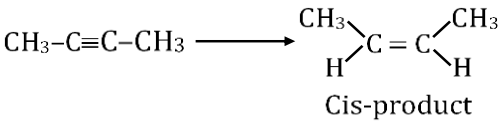
(4) $CH_4 \xrightarrow{Br_2} CH_3{-}Br \xrightarrow{Na/dry\ ether} CH_3{-}CH_3$ [Carbon less than 4]

16. Ans. (3)

NO_2 is meta directing

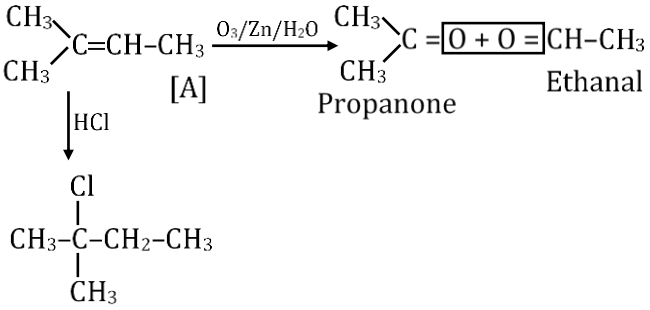
$\therefore$ $E^{\oplus}$ Y attack on meta position

17. Ans. (2)



$H_2/Pd/C$ quinoline → Lindlar catalyst.

18. Ans. (3)

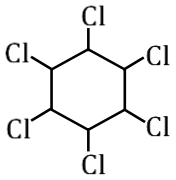


19. Ans. (2)

Electrophilic Substitution reaction

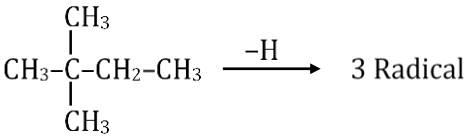
[1] Sandmeyer reaction

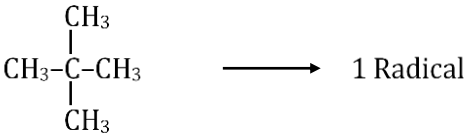
[2] Friedal-Craft's reaction

[3]  Gammexane Or Lindane or BHC — FRAR reaction

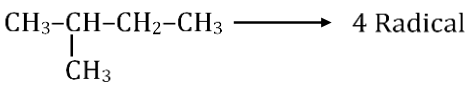
[4] NSR reaction

20. Ans. (2)

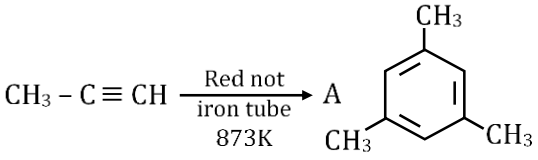




$CH_3CH_2CH_2CH_2CH_3 \longrightarrow$ 3 Radical



21. Ans. (1)



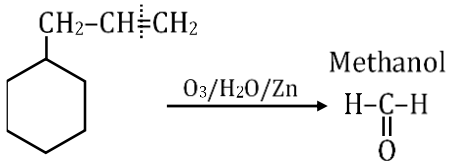
σ Bond = 2^1

π Bond = 3

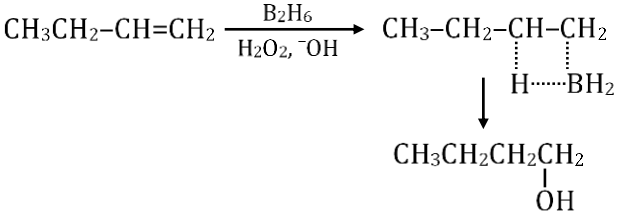
22. Ans. (4)

Wurtz reaction is not suitable for preparation of Unsymmetrical alkane.

23. Ans. (4)



24. Ans. (1)



25. Ans. (4)

ESR ∝ + M ∝ + H ∝ + I

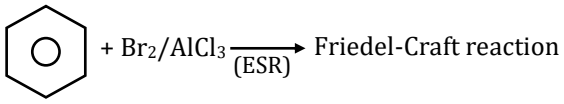
(1) –I effect of Cl (2) –M effect of NO_2

(3) Zero (4) +M effect of –OH

Most reactive option (4)

26. Ans. (3)

(1)

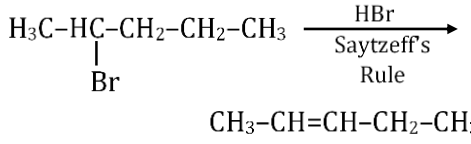


(2) $CH_2=CH_2 \xrightarrow[(EAR)]{HBr}$

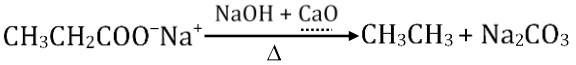
(3) $CH_4 \xrightarrow{Br_2/h\nu}$ FRSR

(4) $CH_3-CH=CH_2 \xrightarrow[(C_6H_5COO)_2]{HBr}$ Peroxide effect (FRAR)

27. Ans. (1)

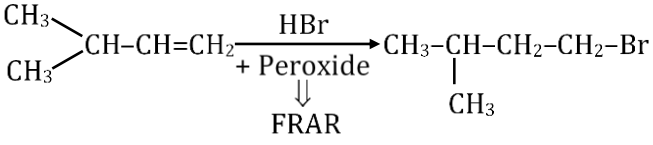


28. Ans. (3)



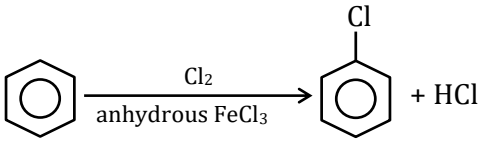
(Soda lime decarboxylation)

29. Ans. (1)

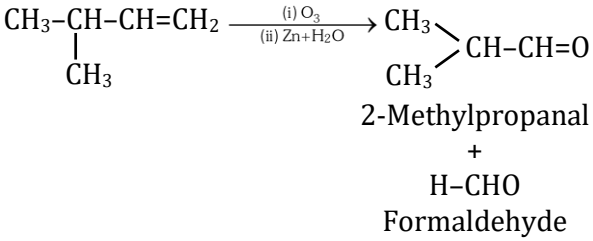


[1st attack by $\dot{B}r$]

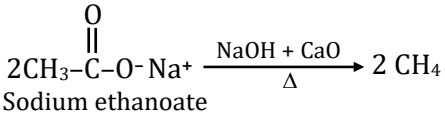
30. Ans. (4)



31. Ans. (4)

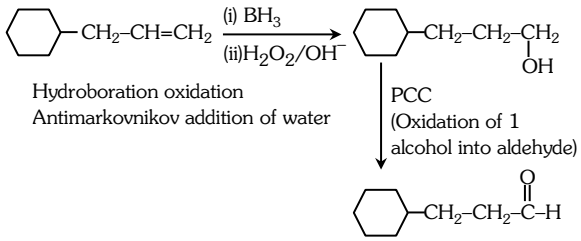


32. Ans. (1)



Weight = 2 × 16 = 32 g

33. Ans. (2)



34. Ans. (3)

(1) $CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$

No tertiary carbon

(2) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_2-CH_3$

One tertiary carbon

(3) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$

Two tertiary carbon

(4) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_2-CH_3$

No tertiary carbon

35. Ans. (1)

For alkanes

Boiling point $\propto$ molecular mass

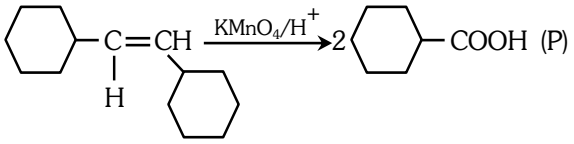
$\propto \frac{1}{\text{Branching}}$ (if molecular mass is same)

Boiling point

$CH_3-CH_2-CH_2-CH_2-CH_3$ > $CH_3-CH(CH_3)-CH_2-CH_3$ > $CH_3-C(CH_3)_2-CH_3$

n-pentane, isopentane, neopentane

36. Ans. (2)



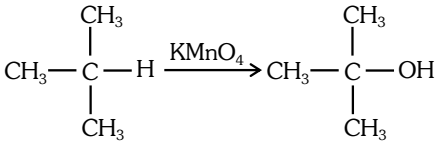
37. Ans. (3)

Bayer's Reagent is cold dilute alkaline aqueous $KMnO_4$.

38. Ans. (1)

F_2 is highly reactive so it is not suitable for the preparation of corresponding haloarene products.

39. Ans. (2)



$R_1 = CH_3$, $R_2 = CH_3$, $R_3 = CH_3$

Exercise-III (Analytical Questions)

1. Ans. (1)

Alkane → FRSR

Reactivity of Reaction $\propto$ stability of Radical

Reactivity of Halogen = $F_2 > Cl_2 > Br_2 > I_2$

2. Ans. (2)

$CH_3CH_2CH_2CH_3 \xrightarrow[\text{(FRSR)}]{Br_2/\text{light at } 130^\circ} CH_3-\underset{Br}{CH}-CH_2-CH_3$

3. Ans. (2)

$\underline{C_2H_6} + Cl_2 \xrightarrow{h\nu} \underline{C_2H_5Cl} + HCl$

$\underline{C_2H_6}$: $\Downarrow$ Excess

$\underline{C_2H_5Cl}$: $\Downarrow$ Maximum yield

4. Ans. (2)

(a) $2CH_3CH_2Br \xrightarrow[\text{(Wurtz reaction)}]{2Na/\text{dry ether}} CH_3-CH_2-CH_2-CH_3$

(b) $CH_3COO^{\ominus}Na^{\oplus} \xrightarrow[\text{Soda lime decarboxylation}]{CaO + NaOH, \Delta} CH_4$ $(-CO_2)$

(c) $CH_3(CH_2)_4CH_3 \xrightarrow[773K,\ 10\text{-}20\ \text{atom}]{V_2O_5}$ 

(d) $2CH_4 + O_2 \xrightarrow[\text{100 atm catalytic oxidation}]{Cu/523K} CH_3-OH$

5. Ans. (3)

(a) $CH_4 + O_2 \xrightarrow[\text{(catalytic oxidation)}]{Mo_2O_3, \Delta}$ HCHO (Aldehyde)

(b) $CH_3CH_3O_2 \xrightarrow[\Delta]{(CH_3COO)_2Mn} CH_3COOH$ (Acid)

(c) $(CH_3)_3CH \xrightarrow{KMnO_4} (CH_3)_3CH-OH$ (Alcohol)

Only 3°C—H

(d) $CH_4 + H_2O \xrightarrow{Ni, \Delta} CO + 3H_2$

6. Ans. (1)

(a) $CH{\equiv}CH \xrightarrow{H_2, Pd}$ (Reduction)

(b)  $\xrightarrow{\text{Anhy. } AlCl_3 + HCl}$ (Isomerisation)

(c)  $\xrightarrow[\text{(High temp.)}]{773\ K}$ Pyrolysis

(d) $CH_3CH_3 \xrightarrow{Cl_2, h\nu}$ F.R.S.R.

7. Ans. (2)

Incorrect statement

(A) Alkene → First 3 member gas

Next 14 are liquid

Higher are solid True

(B) True

(C) Straight chain alkenes > Branched chain compound

$\boxed{BP \propto M.W.}$ $\boxed{BP \propto \frac{1}{\text{Branching}}}$

(D) False

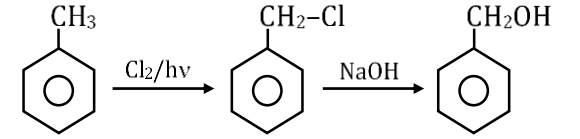
8. Ans. (4)

Reactivity towards NBS $\propto$ Stability of free radical.

(Free radical substitution Reaction)

Remove Benzylic and Allylic Hydrogen then check stability of free radical

9. Ans. (4)



(Toluene) (Benzyl alcohol)

10. Ans. (1)

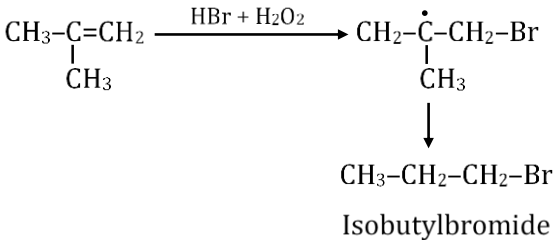
(1) $CH_3-CH_2-CH_2-CH_3$ → 2 Radical possible

(2) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-\underset{\underset{CH_3}{|}}{CH}-CH_3$ → 3 Radical possible

(3)  ⟶ 1 Radical possible

(4) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_3$ ⟶ 4 Radical possible

11. Ans. (1)



Isobutylbromide

12. Ans. (2)

(a) Hydration (q)

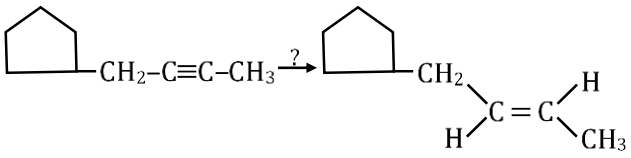
(b) Peroxide effect ∴ FRAR

(s) Hydrohalogenation

(c) EAR ∴ Halogenation (r)

(d) Reduction ∴ Hydrogenation (p)

13. Ans. (2)

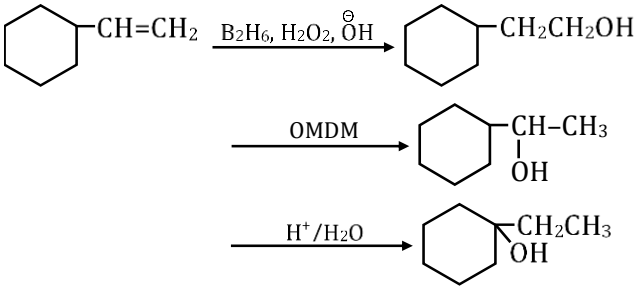


Trans-Alkene

∴ Birch reduction

Reagent = Na/NH_3

14. Ans. (2)



15. Ans. (3)

(a) Lindlar's catalyst ⟶ $H_2/Pd\text{-}CaCO_3$

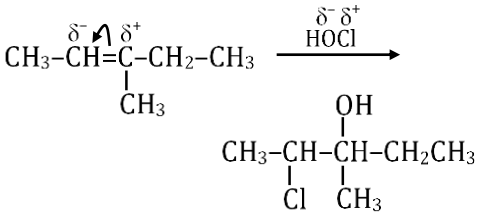
(b) Birch catalyst ⟶ $Na/liq.\ NH_3$

(c) Baeyer's reagent ⟶ $Dil/\ KMnO_4/273k$

(d) Kharash effect ⟶ $HBr + (PhCO)_2O_2$ (Peroxide)

16. Ans. (4)

3–Methyl-2-Pentene



17. Ans. (2)

Reactivity towards EAR ∝ Stability of $C^{\oplus}$

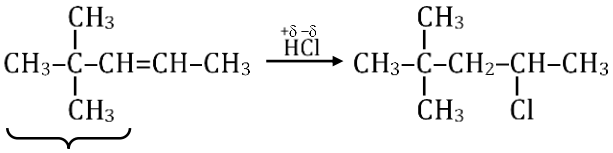
(1) $Ph-\overset{\oplus}{C}H-CH_3$ Reso. + 3αH

(2) $Ph-\overset{\oplus}{\underset{\underset{CH_3}{|}}{C}}-CH_2-CH_3$ Reso. + 5αH

(3) $Ph-\overset{\oplus}{\underset{\underset{Ph}{|}}{C}}-CH_2-CH_3$ More reso.

(4) $\overset{\oplus}{C}H_2-CH_2-NO_2$ 3 > 2 > 1 > 4

18. Ans. (1)



Bulky group (Hofmann product

19. Ans. (4)

Hydration means H^+/H_2O or Addition of water from carbocation and check reactivity.

(1) $CH_3-\overset{\oplus}{C}H_2$ (2) $CH_3-\overset{\oplus}{C}H-CH_3$

(3) $CH_3-\overset{\oplus}{C}H-CH_2CH_3$ (4) $CH_3-\overset{\oplus}{\underset{\underset{CH_3}{|}}{C}}H-CH_3$

Maximum αH ∴ Maximum stable

20. Ans. (2)

$H_3C-CH=CH-CH_3 \xrightarrow{H^+/H_2O} CH_3-\underset{\underset{OH}{|}}{CH}-CH_2-CH_3$

$CH_3-\underset{\underset{CH_3}{|}}{C}=CH_2 \xrightarrow{H^+/H_2O} CH_3-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3$

$CH_2=CH_2 \xrightarrow{H^+/H_2O} CH_3-CH_2-OH$

$CH_2=CH-CH_2CH_3 \xrightarrow{H^+/H_2O} CH_3-\underset{\underset{OH}{|}}{CH}-CH_2-CH_3$

d-(Butylene)

21. Ans. (1)

$CH_3-CH=CH_2 \xrightarrow[(EAR)]{\overset{\delta^+}{H}\ \overset{\delta^-}{I}} CH_3-\overset{\oplus}{C}H-CH_3 \xrightarrow{\overset{\delta^-}{I}} CH_3-\underset{\underset{I}{|}}{CH}-CH_3$

(Propene)

22. Ans. (2)

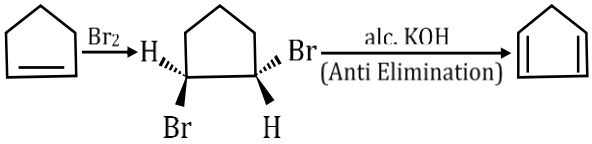
$H_2\overset{\delta^-}{C}=\overset{\delta^+}{C}H-CH_2-Ph \xrightarrow[(EAR)]{\overset{\delta^+}{H}\overset{\delta^-}{Br}} CH_3-\overset{\oplus}{C}H-CH_2-Ph$

(3-Phenyl Propene)

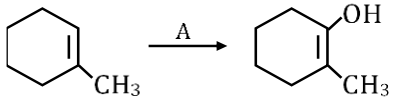
Rearrangment

$CH_3-CH_2-\overset{\oplus}{C}H-Ph \xrightarrow{Br^{\ominus}} CH_3-CH_2-\underset{\underset{Br}{|}}{CH}-Ph$

23. Ans. (4)



24. Ans. (1)



25. Ans. (3)

$CH_3-CH=CH_2 \xrightarrow{dil.\ H_2SO_4} CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$

$CH_3-CH=CH_2 \xrightarrow{B_2H_6/H_2O_2/\overset{\ominus}{O}H} CH_3-CH_2-\underset{\underset{OH}{|}}{CH_2}$

A and B → Same f. g. ✓

→ Position isomer ✓

→ Chain isomer ×

26. Ans. (4)

$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH=CH_2 \xrightarrow{D^{\oplus}/H_2O} CH_3-\underset{\underset{CH_3}{|}}{CH}-\overset{\oplus}{\underset{\underset{D}{|}}{CH}}-CH_2$

Rearrangement

$CH_3-\overset{\oplus}{\underset{\underset{CH_3}{|}}{C}}-CH_2-CH_2-D \xrightarrow{H_2O} CH_3-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2-CH_2-D$

27. Ans. (2)

$CH_3-CH=CH_2 \xrightarrow[\text{No effect of peroxide}]{HCl+H_2O_2} CH_3-\overset{\oplus}{C}H-CH_3$

$\therefore$ EAR Mech.

28. Ans. (3)

$CH_2=CH-CH_3 \xrightarrow[\text{Peroxide effect/ Kharash effect}]{HBr + Peroxide} CH_2-\underset{\underset{Br}{|}}{\overset{\bullet}{C}}H-CH_3$

(Propene)

↓ FRAR

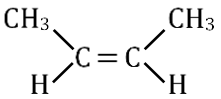
$CH_2-CH_2-CH_3$ (Br)

n-Propyl bromide

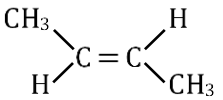
29. Ans. (4)

(A) Cis-trans → Geometrical isomer
Same Molecular formula
Same structural formula
Different configuration or arrangement of atom

(B)



Cis-2-butene

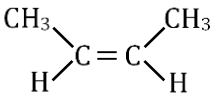


trans-2-butene

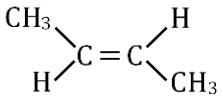
⇓ μ≠0, B.P. more

⇓ μ=0, B.P. less

(C)

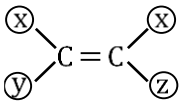


μ≠0

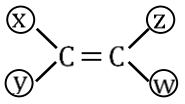


μ=0

(D)



G.I ✓



G.I ✓

A ✓ B ✓ C × D ✓

30. Ans. (2)

$$Ph-CH=\underset{\underset{CH_3}{|}}{C}-CH_3 + HBr \xrightarrow[\text{Kharash rule}\\ \text{Anti M.K.}\\ \text{I}^{st}\text{ attack by } \dot{B}r]{\text{Peroxide}}$$

$$Ph-\overset{\overset{H}{|}}{\overset{\bullet}{C}}-\underset{\underset{CH_3}{|}}{\overset{Br}{\overset{|}{C}}}-CH_3 \longrightarrow Ph-CH_2-\underset{\underset{CH_3}{|}}{\overset{Br}{\overset{|}{C}}}-CH_3$$

31. Ans. (2)

(i) $CH \equiv CH + H_2O \xrightarrow{\text{(More acidic)}}$ No reaction

Acid Base Reaction

(ii)

$$CH\equiv CH + H_2O + Hg^{2+} \longrightarrow \underset{\underset{OH}{|}}{CH_2=CH} \longrightarrow \underset{\underset{O}{||}}{CH_3-C-H}$$

Tautomer (Acetaldehyde)

(iii) $CH\equiv CH + NaNH_2 \longrightarrow CH\equiv C^{\ominus}\overset{\oplus}{N}a + NH_3$

(iv) $CH\equiv CH \xrightarrow[\text{Tube}]{\text{Red Hot}}$ Benzene

32. Ans. (3)

(a) $CH_3-C\equiv C-CH_3 \xrightarrow[\text{(Reduction)}]{H_2, Pd/C} CH_3CH_2CH_2CH_3$

(b) $CH_3-C\equiv C-CH_3 \xrightarrow[\text{(Birch reduction)}]{Na/liq.\ NH_3}$ Trans-alkene

(c) $CH_3-C\equiv C-CH_3 \xrightarrow[\text{Quinoline}]{H_2/Pd\text{-}C}$ Cis-alkene

(Partial reduction)

(d) $CH_3-C\equiv CH \xrightarrow{Na/liq.\ NH_3} CH_3-C\equiv \overset{\ominus\oplus}{C}Na$

(Terminal alkyne)

33. Ans. (4)

$$CH_3-C\equiv CH \xrightarrow[\text{Excess}]{HCl(g)} \underset{\underset{Cl}{|}}{CH_3-C=CH_2} \xrightarrow{HCl} \underset{\underset{Cl}{|}}{\overset{Cl}{\overset{|}{CH_3-C}}}-CH_3$$

(M.K. rule)

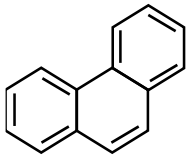
34. Ans. (3)

(p) 

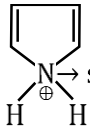
Non-aromatic

(q) 

Anti-aromatic

(r) 

Aromatic

(s)  $\rightarrow sp^3$ ∴ Non aromatic

a → r ; b → q ; c → p, s

35. Ans. (1)

(a) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_3$

2-Methyl propane

(b) $CH_3CH_2CH_2CH_2CH_3$

Pentane

(c) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_3$

2-Methyl butane

(d) $CH_3-\underset{\underset{CH_3}{|}}{\overset{CH_3}{\overset{|}{CH}}}-CH_3$

2,2-Dimethyl propane

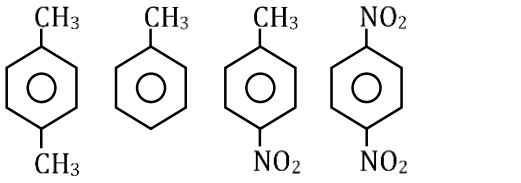
B.P. ∝ M.W.

$$\propto \frac{1}{\text{Branching}}$$

$$\underline{b} > \underline{c} > \underline{d} > \underline{a}$$

309.1 300.9 282.5 261

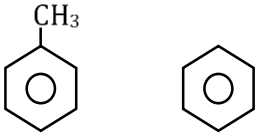
36. Ans. (1)



+H −M −M of two group

1 > 2 > 3 > 4

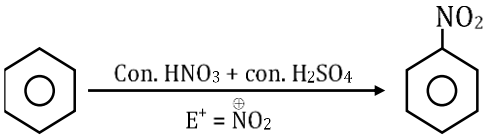
37. Ans. (3)



Toluene Benzene

+H effect of CH_3 group

38. Ans. (3)



E.S.R

39. Ans. (3)

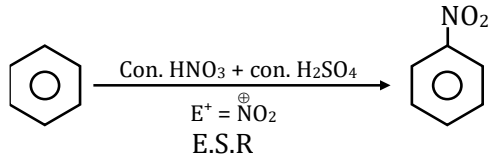
Reactivity towards ESR ∝ + M ∝ +H ∝ +I

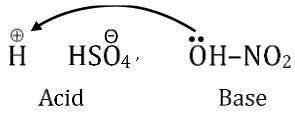
(I) No effect (II) +H effect of CH_3

(III) +M effect OH (IV) –M of NO_2 group

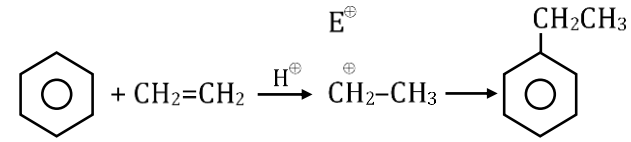
3 > 2 > 1 > 4

40. Ans. (1)



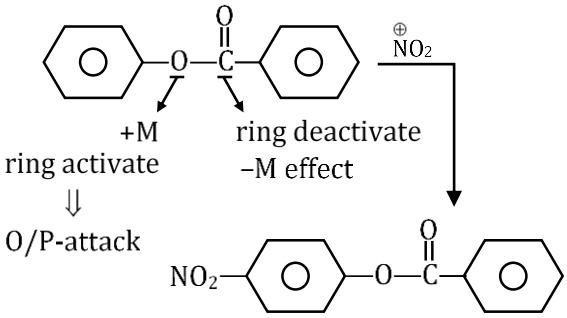


41. Ans. (4)

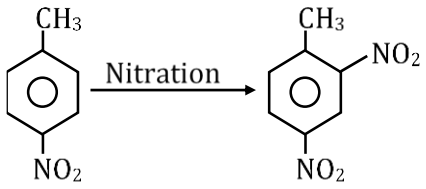


∴ attack on Benzene (ESR mech)

42. Ans. (3)

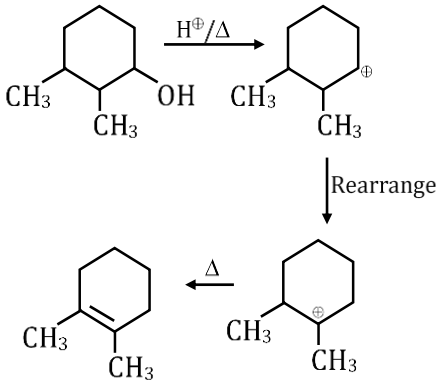


43. Ans. (1)

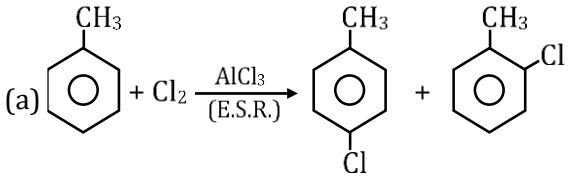


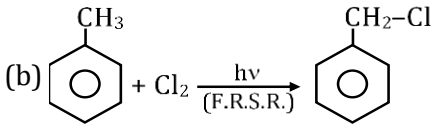
(p-nitro toluene)
ortho attack with
respect to-CH_3 group

44. Ans. (4)

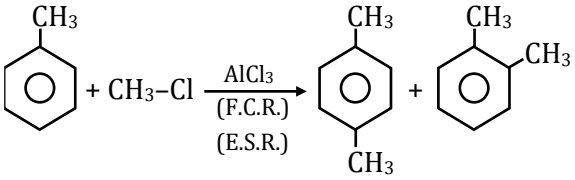


45. Ans. (2)

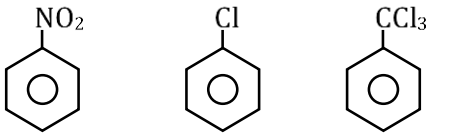




(c)



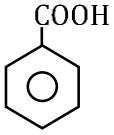
46. Ans. (2)



–M effect
∴ Metal directing

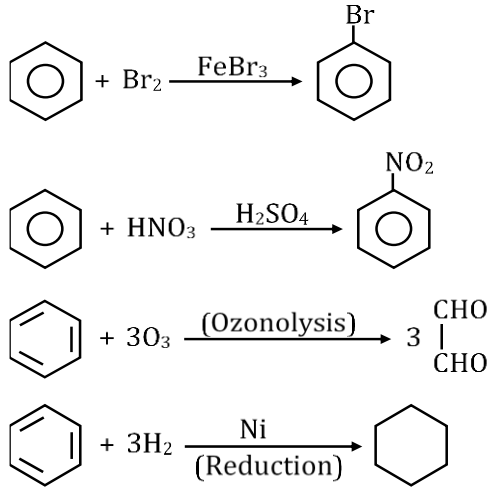
+M
O/P-directing

–H
Meta
directing

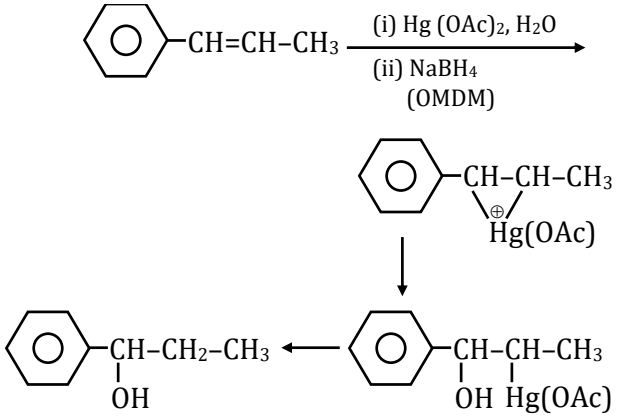


–M effect
∴ Meta directing

47. Ans. (4)



48. Ans. (3)



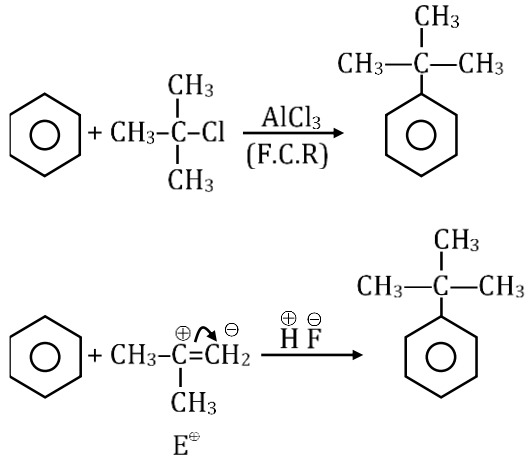
HBO Reaction

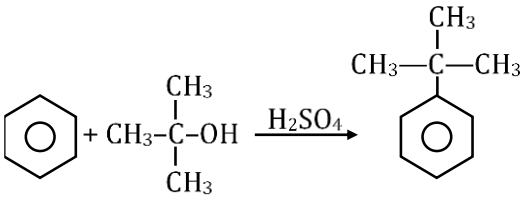
49. Ans. (2)

Halogenation of Alkane → FRSR

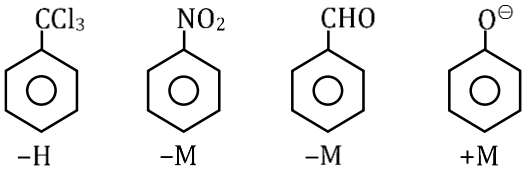
1°H < 2°H < 3°H for monohalo Product

50. Ans. (4)

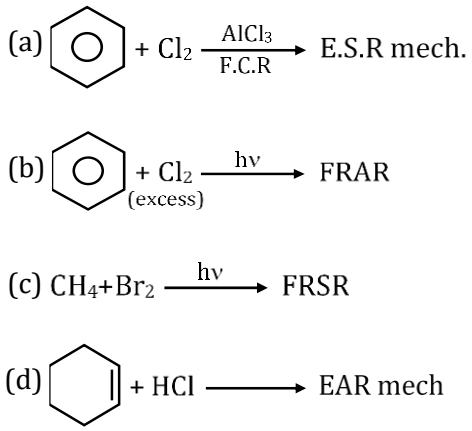




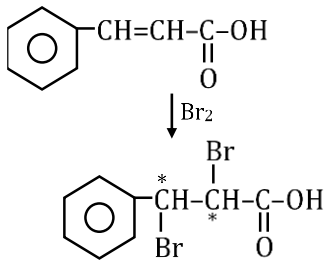
51. Ans. (2)



52. Ans. (4)

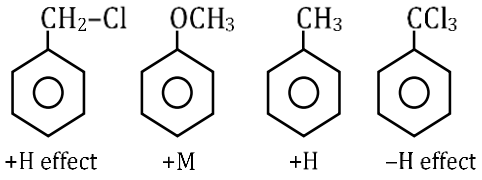


53. Ans. (2)



No. of chiral carbon = 2

54. Ans. (4)

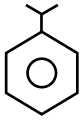


55. Ans. (2)

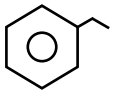
Reactivity towards E.S.R. $\propto$ e⁻ density in ring $\propto \frac{+M}{-M}$

(1) 

(2) 

(3) 

1αH

(4) 

2αH

Option (2) is Maximum reactive

56. Ans. (3)

Friedel craft reaction

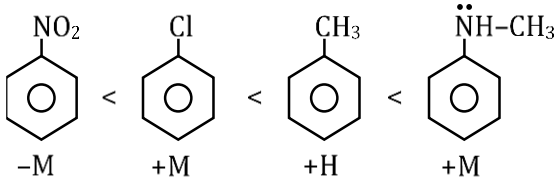
$$R{-}Cl + AlCl_3 \longrightarrow \overset{\oplus}{R}$$

$$R{-}\underset{\underset{O}{\|}}{C}{-}Cl + AlCl_3 \longrightarrow R{-}\overset{\oplus}{\underset{\underset{O}{\|}}{C}}$$

Produce Electrophile

57. Ans. (4)

Reactivity towards E.S.R. $\propto \frac{+M}{-M} \propto \frac{+H}{-H} \propto \frac{+I}{-I}$



–I (Dominate)

58. Ans. (3)

$HNO_3 + H_2SO_4$

$$H\ddot{O}{-}NO_2 + H\,HSO_3 \longrightarrow H_2O + \overset{\oplus}{N}O_2 + \overset{\ominus}{HSO_3}$$

Attacking $E^{\oplus} = \overset{\oplus}{N}O_2$

$HNO_3 \rightarrow$ Base

$H_2SO_4 \rightarrow$ Acid