• Points to remember in Structure Isomerism

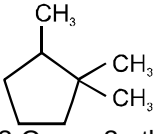
Isomers	Characteristics	Conditions
(1) Chain Isomers	They have different size of main chain or side chain	They have same nature of locants
(2) Positional Isomers	They have different position of locants	They should have same size of main chain and side chain and same nature of locant
(3) Functional Isomers	Different nature of locant	Chain and positional isomerism is not considered
(4) Metamerism	Different nature of alkyl group along a polyvalent functional group	They should have same nature of functional groups chain & positional isomer is ignored
(5) Tautomerism	Different position of hydrogen atoms	The two functional isomers remains in dynamic equilibrium to each other

MISCELLANEOUS SOLVED PROBLEMS

1. Write the IUPAC name of following compounds.

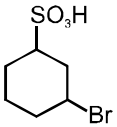
(i) $H_3C-CH_2-\underset{\displaystyle OC_2H_5}{\underset{|}{CH}}-COOH$

(ii) 3-Bromocyclohexane-1-sulphonic acid

(iii) 

(iv) 3-Cyano-3-ethoxy-4-nitropentanoyl bromide

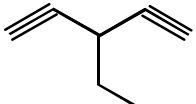
Sol. (i) 2-Ethoxybutanoic acid

(ii) 

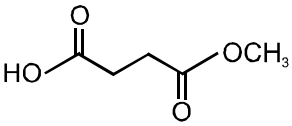
(iii) 1,1, 2-Trimethylcyclopentane

(iv) $CH_3-\underset{\displaystyle NO_2}{\underset{|}{CH}}-\underset{\displaystyle OC_2H_5}{\underset{|}{C}}(CN)-CH_2-C(=O)-Br$

2. Draw the structure of following IUPAC name.

(i) 

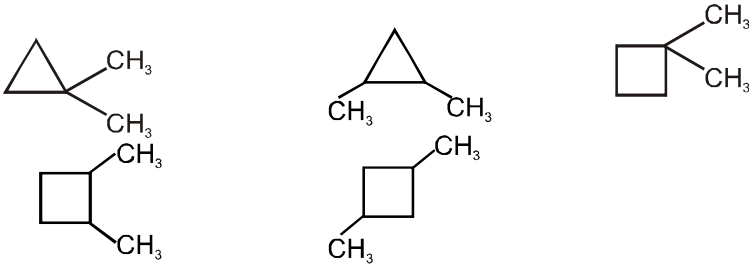
(ii) 3-Methoxycarbonylpropanoic acid

Sol. (i) 3-Ethylpenta-1,4-diyne **(ii)** 

3. Find total number of structure isomers of dimethyl cyclopropane and dimethyl cyclobutane are respectively.

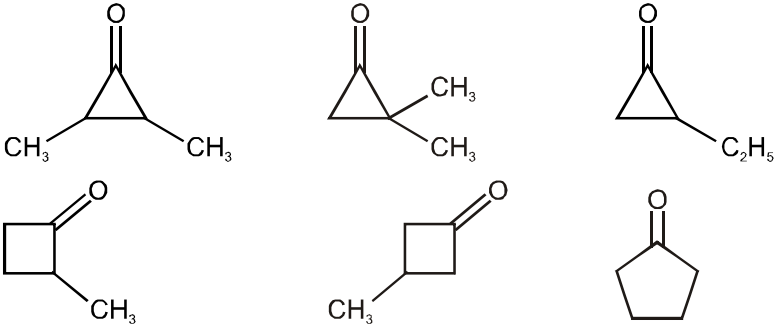
(A) 4, 6 (B) 3, 4 (C) 4, 5 (D) 2, 3

Ans. (D)

Sol. 

4. How many structures of cycloalkanone are possible with molecular formula C_5H_8O.

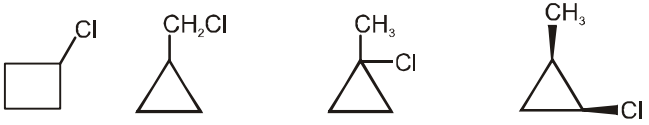
Ans. 6

Sol. 

5. Find out the total number of cyclic isomers of the compound (X) C_4H_7Cl.

Ans. 4.

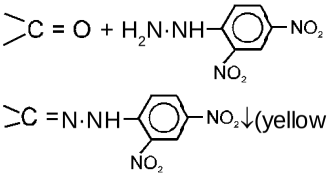
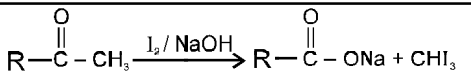
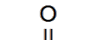
Sol. $X = C_4H_7Cl$ $\quad DU = 5 - \frac{8}{2} = 1$



Total = 4

Identification of Functional Groups by Laboratory Tests

Functional Groups	Reagent	Observation	Reaction	Remarks
C–C (Alkane)	conc. H_2SO_4 conc. NaOH $KMnO_4$ $LiAlH_4$	NR NR NR NR	----------	Inert paraffins
C=C / C≡C	[Bayer's reagent] alk. dil. cold $KMNO_4$	Pink colour disappears	$CH_2=CH_2+H_2O+O \xrightarrow{alk.KMnO_4} \underset{OH}{\overset{|}{CH_2}}-\underset{OH}{\overset{|}{CH_2}}$	Hydroxylation
C=C / C≡C C=C C≡C	Br_2 / H_2O O_3(ozone) O_3	Red colour decolourises $>C=O$ Compounds Acid formed.	$Br_2+CH_2=CH_2 \longrightarrow$ white ppt $H_2C=CH_2 + O_3 \xrightarrow{Zn/H_2O} 2HCHO$ $R-C\equiv C-R' \xrightarrow{O_3} RCOOH + R'COOH$	Bromination Ozonolysis Ozonolysis
R–C≡CH (Terminal alkyne)	(a) Cuprous chloride+NH_4OH (b) $AgNO_3$+NH_4OH	Red ppt. White ppt.	$R-C\equiv CH + CuCl \xrightarrow{NH_4OH} R-C\equiv C\ Cu\downarrow$ (red) $R-C\equiv CH + Ag^+ \longrightarrow R-C\equiv C\ Ag\downarrow$ (white)	
(R–OH) ROH 3° 2° 1°	Na Lucas Reagent [Conc. HCl + anhyd. $ZnCl_2$]	Bubbles of H_2 come out (3)° Cloudiness appears immidiately (2°) Cloudiness appears within 5 min. (1°) Cloudiness appear after 30 min.	$2ROH + Na \rightarrow 2RONa + H_2\uparrow$ $R-OH + HCl \xrightarrow{anhydrous\ ZnCl_2} \underbrace{R-Cl}_{cloudiness} + H_2O$	Presence of active 'H' Lucas Test I. ter.alcohol II. sec. alcohol III. pri.alcohol

Functional Groups	Reagent	Observation	Reaction	Remarks
Ar–OH Enols	$FeCl_3$ (Neutral)	Coloured ppt. (violet, blue, green buff)	$6C_6H_5OH + FeCl_3 \longrightarrow [Fe(PhO)_6]^{-3}$	Test of enols/phenols
$>C=O$	2, 4-Dinitrophenyl hydrazine (2, 4-DNP) solution	Yellow orange ppt.	 (yellow orange ppt.)	DNP-test
R–CHO	Fehling solution A & B	Red ppt.	$RCHO + Cu^{+2} \rightarrow RCOOH + Cu_2O\downarrow + 2H_2O$ Fehling sol^n. Red	Fehling's test
	Tollen's reagent	Black ppt. or silver mirror	$RCHO + Ag^+ \rightarrow RCOOH + 2Ag$ (Silver mirror)	Tollen's test
	Schiff's Reagent *	Pink colour resume		
$R–COCH_3$ or $ArCOCH_3$ or CH_3CHO	I_2 / NaOH	Yellow ppt of CHI_3 (iodoform)	 (Iodoform)	Iodoform reaction
	Blue litmus	Litmus change to red.		Litmus test.
	Conc. $NaHCO_3$ solution	Effervescence evolve.	$R-COOH + NaHCO_3 \longrightarrow RCOONa +$ $H_2O + CO_2\uparrow$	Sodium bicarbonate test
Ester	NaOH, phenophthalein	Pink colour $\downarrow$ disappear on heating.	RCOOR' + NaOH + Phenophthalein $\downarrow\Delta$ (pink) RCOOH + R' OH (Colourless solution)	
Amides	Conc. NaOH, Δ	Smell of NH_3	$RCONH_2 + NaOH \xrightarrow{\Delta} RCOONa + NH_3\uparrow$	

★ Schiff's reagent : p-Rosiniline hydrochloride saturated with SO_2 so it is colourless. The pink colour is resumed by RCHO.

Functional Groups	Reagent	Observation	Reaction	Remarks
Nitro Compounds (RCH_2NO_2) or $ArNO_2$	Mulliken's test	black ppt	$Ar{-}NO_2$ ($R{-}NO_2$) $\xrightarrow[(1)]{Zn\,/\,NH_4Cl,\,\Delta}$ ArNHOH $\xrightarrow[(2)]{\text{Tollen's reagent } AgNO_3 + NH_4OH}$ Ag↓	
Amines(pri.) RNH_2	$CHCl_3$, KOH	Nauseating odour (Offensive smell) (Carbylamine)	$RNH_2 + CHCl_3 + 3KOH \rightarrow RNC + 3KCl + 3H_2O$	Carbylamine Reaction
	HNO_2 ($NaNO_2$+HCl)	Effervescence of N_2	$RNH_2 + HONO \rightarrow ROH + N_2 + H_2O$	
Ar. amines. $ArNH_2$	HNO_2 ($NaNO_2$+HCl) + β-Naphthol	Orange red dye is formed	$NaNO_2 + HCl \rightarrow NaCl + HNO_2$ $NH_2.HCl$ + HNO_2 → N_2Cl + $2H_2O$ Benzenediazonium chloride + β-Naphthol → orange-red dye	Azo dye test
R_2NH Sec. Amines	(i) $NaNO_2 + H_2SO_4$ (ii) Phenol	red colouration Liebermann test	Ninhydrin + $H_2N.CHR.COOH$ (Amino acid) → (Blue colour) + CO_2 + RCHO + H_2O	Ninhydrin test
Carbohydrate	Molisch's reagent (10% α-naphthol in alcohol).	Violet colour		
Amino acids	Ninhydrin reagent (0.2 % sol.^{n})	Blue colour		