

3/10/5

Q1 (8 pt): Circle the correct answer in each of the following:

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1- The formal charge of nitrogen in $\text{CH}_3\text{-C}\equiv\text{N}-\ddot{\text{O}}:$, (atomic number of nitrogen is 7).

Formal charge = Group No. - (dots + bonds)
 $= 5 - (0 + 4) = +1$

- a- -1 b- 0 **c- +1** d- +2 e- -2

2- The compound that has the strongest C-C single is:

overlap between orbitals is given as shown:
 $sp-sp > sp^2-sp^2 > sp^2-sp^2$

- a- $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$ **b- $\text{HC}\equiv\text{C}-\text{C}\equiv\text{CH}$** c- $\text{CH}_2=\text{CH}-\text{C}\equiv\text{CH}$
 d- $\text{CH}_3-\text{C}\equiv\text{C}-\text{CH}_3$ e- $\text{CH}_2=\text{C}=\text{CH}-\text{CH}_3$

the higher the overlap, the stronger the bond, the shorter the bond.

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3 What is the number of monochlorinated products obtained upon the reaction of this compound with Cl_2/light



Five different products, look to the arrows.

- a- 5** b- 6 c- 7 d- 8 e- 4

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4- The alkene that contains a conjugated double bond is:



$\text{C}=\text{C}=\text{C}$ cumulated
 $\text{C}=\text{C}=\text{C}-\text{C}=\text{C}-\text{C}=\text{C}$ conjugated
 otherwise, nonconjugated

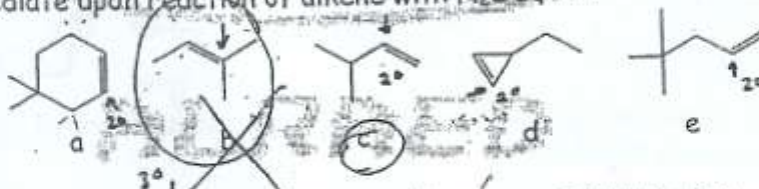
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5- Which of the following does not show cis-trans isomerism?

- a- 1,2-dimethylcyclopentane **b- 2-methyl-2-butene** c- 2-butene
 d- 2,3-dichloro-2-pentene e- 1-chloro-2-ethylcyclopropane

in cis-trans isomers, each carbon of the double bond (or the adjacent carbons on the cycles) must bear two different groups

6- Which of the following alkenes give the most stable carbocation intermediate upon reaction of alkene with H_2SO_4

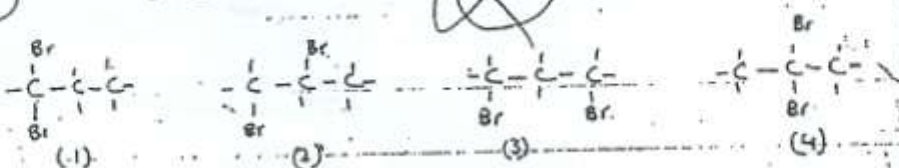


arrow indicate the position of positive charge.

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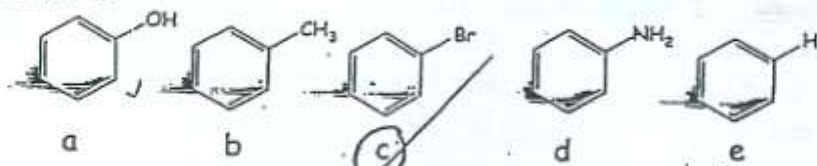
7- The number of structural (constitutional) isomers of $\text{C}_3\text{H}_6\text{Br}_2$ is?

- a- 7 b- 6 c- 5 **d- 4** e- 3



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8- The least reactive aromatic compound in electrophilic aromatic substitution is:



Br is ortho-para director, but it is deactivating group.

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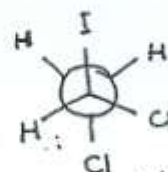
deactivating group.

Q2 (14 pt) Draw the structure of each of the following:

1- The most stable Newman projection of $\text{IClCH}_2\text{CH}_2\text{Cl}$

$\text{I} : \text{Cl}$ Repulsion > $\text{Cl} : \text{Cl}$ Repulsion

Therefore, they should lie far away from each other.

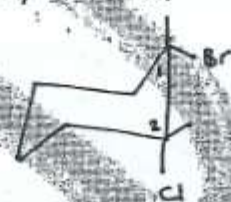


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most stable.

2- The most stable conformation of *cis*-1-Bromo-2-Chlorocyclohexane.

Br is larger atom than Cl, therefore, it must lie in the equatorial position.



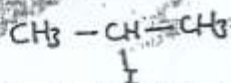
large groups prefer equatorial positions.

Br > Cl
cis - same side.

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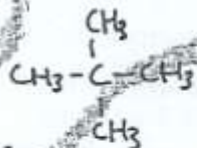
3- The structure of isopropyl iodide.

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4- The alkane C_5H_{12} that has the lowest boiling point among all the structural isomer.

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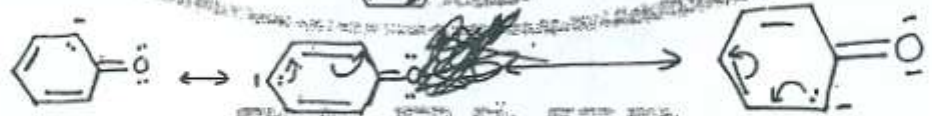


The higher the branching, in certain isomer comparing to others, the lower the boiling point.

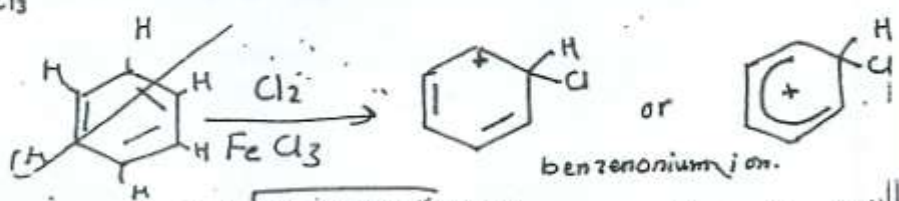
5- A resonance structure of



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6- The structure of the benzenonium ion intermediate formed upon reaction of benzene with $\text{Cl}_2/\text{FeCl}_3$



benzenonium ion.

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➤ Which of the following reactions is chain-propagation step(s) in the chlorination of methane?

- I) $\text{Cl}-\text{Cl} \longrightarrow 2\text{Cl}\cdot$
 II) $\text{Cl}\cdot + \text{CH}_4 \longrightarrow \cdot\text{CH}_3 + \text{H}-\text{Cl}$
 III) $\cdot\text{CH}_3 + \text{Cl}-\text{Cl} \longrightarrow \text{CH}_3\text{Cl} + \text{Cl}\cdot$
 IV) $\cdot\text{CH}_3 + \cdot\text{CH}_3 \longrightarrow \text{CH}_3-\text{CH}_3$

a) I and II only **b) II and III only** c) III and IV only d) II only e) III only

II. Fill in the blanks in each of the following:

➤ Draw a cycloalkane with the formula C_5H_{10} which gives *cis-trans* isomers



➤ Draw the most stable conformation for *cis*-1-isopropyl-4-methylcyclohexane.



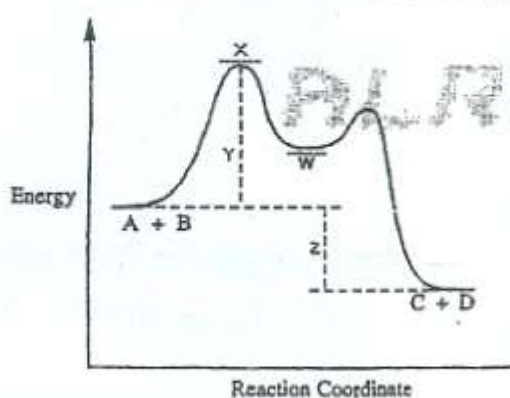
➤ Draw a second resonance structure for



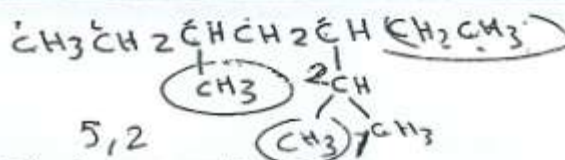
➤ Examine the following reaction energy diagram for the reaction $\text{A} + \text{B} \longrightarrow \text{C} + \text{D}$

Match the letters on the energy diagram to one of the following terms

- transition state
- activation energy
- reactant
- product
- ΔH exothermic
- ΔH endothermic
- intermediate

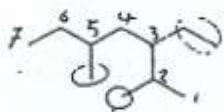


- x ... transition state ...
- y ... activation energy
- w ... intermediate ...
- z ... ΔH exothermic

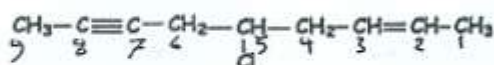


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> Give a correct IUPAC names for each of the following compounds:



~~3,5-Dimethyl~~
 3-Ethyl-2,5-dimethylheptane

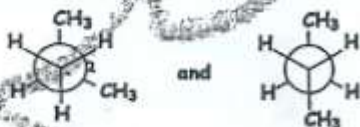


5-Chloro-2-heptene-7-yne

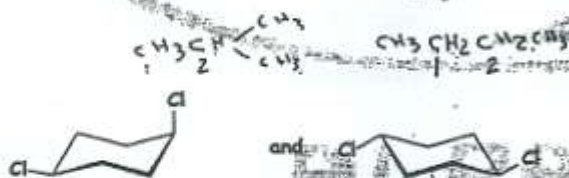
> The following are incorrect names. Give the correct name in each case.

| Incorrect name | Correct name |
|----------------------------------|----------------------------------|
| cis-1-methyl-4-chlorocyclohexane | Cis-1-Chloro-4-methylcyclohexane |
| 3-(1-methylethyl)-pentane | 3-Ethyl-2-methylpentane |

III. Label the following pairs of structures as identical, constitutional, configurational, conformational isomers.

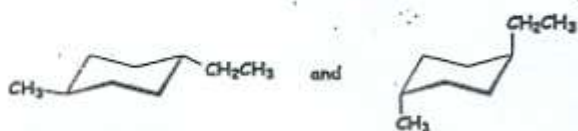


constitutional



Configurational ✓

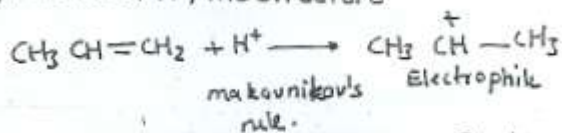
~~Conformational~~



~~Configurational~~
 Conformational.

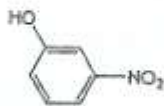
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7- When benzene reacts with propene in the presence of H⁺, the structure of the electrophile is:



Q3 (10 pt) Give the IUPAC Name of each of the following compounds:

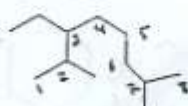
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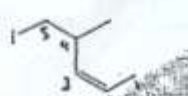
m-nitrophenol.



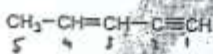
5-methyl-1,3-cyclohexadiene.



3-ethyl-2,7-dimethyloctane.



5-iodo-4-methyl-2-pentene.



3-penten-1-yne.

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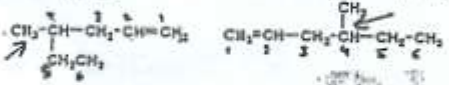
Q4 (6 pt) Classify each of the following pairs of structures as: structural (constitutional) isomers, configurational, conformations, same compound or not related:



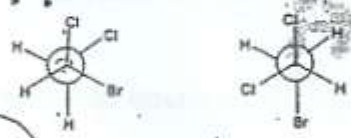
structural isomers.



configurational (cis-trans isomers).



identical



structural isomers.

1-bromo-1,2-dichloroethane | 2-bromo-1,1-dichloroethane

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