

**ENTRANCE TEST – 2020**

**MDCAT – CHEMISTRY**

TEST # 03 UHS TOPIC – 2 (Organic Chemistry)

TOPIC: HYDROCARBONS

**Q.51 \*\*Which one of the following physical properties is not shown by benzene?**

- A) It is an aromatic hydrocarbon
- B) It is colourless liquid at room temperature and one atmospheric pressure
- C) **It is non-flammable**
- D) It has a peculiar smell and burning taste

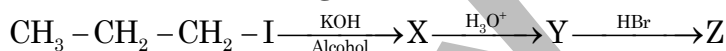
**Q.52 \*\*Alkenes are more reactive than alkanes. This is because:**

- A) The  $\pi$  electrons of a double bond are located much farther from the carbon nuclei and are thus less firmly bound to them
- B) The overlap of atomic orbitals in forming a  $\pi$  bond is not as effective as that in  $\sigma$  bonds.
- C) **Both A and B**
- D) Neither A nor B

**Q.53 \*\*Ethene is not used for:**

- A) The preparation of mustard gas
- B) The artificial ripening of the fruits
- C) The manufacture of ethylene glycol
- D) **The manufacture of varnish as a solvent**

**Q.54 \*\*Consider the following conversions:**



**Which of the above compounds represent X, Y, Z respectively in the conversions?**

- A) 2-Propanol, Propene, 2-Bromopropane
- B) **Propene, 2-Propanol, 2-Bromopropane**
- C) 2-Bromopropane, Propene, 2-Propanol
- D) 2-Propanol, 2-Bromopropane, Propene

**Q.55 \*\*Alkanes have \_\_\_\_\_ boiling points because they are \_\_\_\_\_ and have \_\_\_\_\_ intermolecular forces:**

- A) **Low, non-polar, weak**
- B) High, non-polar, strong
- C) High, non-polar, weak
- D) High, polar, strong

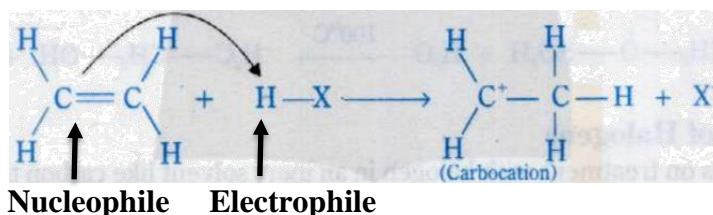
**Q.56 \*\*Identify the correct statement:**

- A) Alkenes are more reactive than alkynes towards electrophilic reagents
- B) Alkynes are more reactive than alkenes towards nucleophilic reagents
- C) **Both 'A' and 'B'**
- D) Neither 'A' nor 'B'

**Answer Explanation: (C)**

**ALKENES**

- Alkenes usually show the mechanism of electrophilic addition reaction as shown in the reaction. The addition of a hydrogen halide to an alkene takes place in two steps.  
STEP-i







**Answer Explanation: (D)**

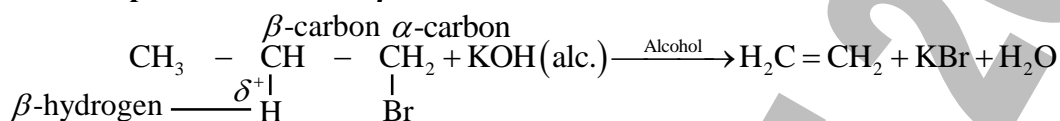
It is incorrect statement. The correct statement is that it confirms regular hexagonal structure of benzene. A, B and C options are correct.

**Q.67** The alkyl halides which give alkenes on dehydrohalogenation with alcoholic potash must have:

- A)  $\alpha$ -H  
B)  $\gamma$ -H  
C)  $\beta$ -H  
D)  $\delta$ -H

**Answer Explanation: (C)**

The alkyl halides which give alkenes on dehydrohalogenation with alcoholic potash must have  $\beta$ -H as shown in the reaction:



$\alpha$ -carbon

- The carbon atom which is directly bonded with functional group is called  $\alpha$ -carbon.

$\beta$ -carbon

- The carbon atom which is directly bonded with  $\alpha$ -carbon is called  $\beta$ -carbon.

$\beta$ -hydrogen

- The hydrogen atom which is directly bonded with  $\beta$ -carbon is called  $\beta$ -hydrogen. It is acidic in nature due to inductive effect. It is source of pi electrons to form double bond in alkene.

**Q.68** \*What happens when one mole of ethane is mixed with six moles of chlorine in the dark at room temperature?

- A) There is no reaction  
B)  $\text{CH}_3\text{CCl}_3$  and HCl are formed  
C)  $\text{CH}_3\text{CH}_2\text{Cl}$  and HCl are formed  
D)  $\text{CCl}_3\text{CCl}_3$  and HCl are formed

**Answer Explanation: (A)**

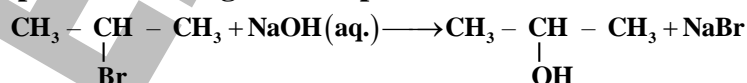
- To undergo free-radical substitution UV radiation or heating is required to initiate the reaction ( $\text{Cl}_2 \xrightarrow{h\nu} 2\text{Cl}^\bullet$ ).
- Since the experiment is performed in the dark without heating (at room temperature), there is no reaction.

**Q.69** Which one of the following reactions would not give propene?

- A) Adding excess hot concentrated sulphuric acid to propan-1-ol  
B) Adding warm aqueous sodium hydroxide to 2-Bromopropane  
C) Adding warm ethanolic sodium hydroxide to 1-Bromopropane  
D) Passing propan-2-ol vapour over heated aluminium oxide

**Answer Explanation: (B)**

Adding warm aqueous sodium hydroxide to 2-Bromopropane would not give propene. It would give 2-Propanol as shown in the reaction.



**Q.70** Which of the following is incorrect statement about differences between elimination and substitution?

Opt.	Elimination	Substitution
A)	Less polar solvent favours it	More polar solvent favours it
B)	A stronger base favours it	A stronger nucleophile favours it
C)	Steric hindrance favours it	Steric hindrance does not favours it
D)	Low temperature favours it	High temperature favours it

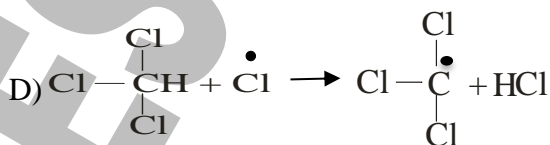
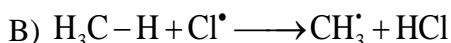
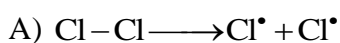
**Answer Explanation: (D)**

It is incorrect statement. The correct statement is shown in the tabular form:

Opt.	Elimination	Substitution
D)	High temperature favours it	Low temperature favours it

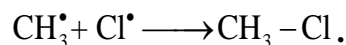
- $C_2H_5O^-$  is more basic and favours elimination while  $C_2H_5S^-$  is stronger nucleophile and favours substitution
- Crowding within the molecule of substrate also generally favours elimination over substitution reaction.
- This is due to greater steric hindrance when the nucleophile approaches towards  $\alpha$ -carbon atom of the substrate.
- The greater number of alkyl groups on the substrate favours elimination over substitution because these alkyl groups stabilize alkene more than the substitution product.

**Q.71** On the chlorination of methane in the presence of diffused sunlight, a mixture of products are obtained. Which of the following is termination step:



**Answer Explanation: (C)**

Termination step (Radical combines with radical to stop the reaction)



**Q.72** The introduction of (X) group in the presence of  $FeBr_3$  in benzene is called:

A) Halogenation

C) Alkylation

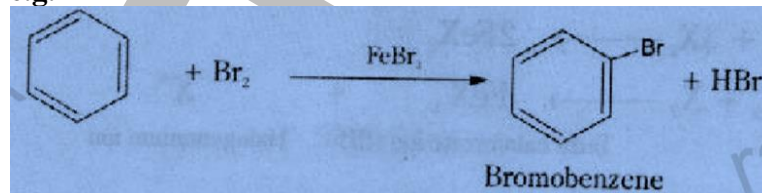
B) Carbonyl reduction

D) Formylation

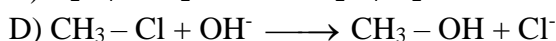
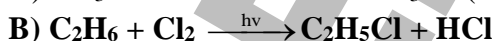
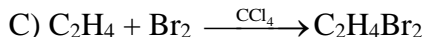
**Answer Explanation: (B)**

The introduction of (X) group in the presence of  $FeBr_3$  in benzene is called halogenation.

e.g.



**Q.73** Which of the following is free radical substitution reaction?



**Answer Explanation: (B)**

- Alkanes react with chlorine and bromine in the presence of sunlight or UV light or at high temperature resulting in the successive replacement of hydrogen atoms with halogens called halogenation.
- Extent of halogenation depends upon the amount of halogen used.
- Reaction of alkanes with fluorine is highly violent and results in a mixture of carbon fluorinated alkanes and hydrofluoric acid.
- Iodine does not substitute directly because the reaction is too slow and reversible.
- The order of reactivity of halogens is  $F_2 > Cl_2 > Br_2 > I_2$ .
- Halogenation is believed to proceed through free radical mechanism. It involves three steps (initiation, propagation and termination).
- e.g.  $C_2H_6 + Cl_2 \xrightarrow{h\nu} C_2H_5Cl + HCl$
- This reaction involves free radical substitution mechanism

**Q.74 Benzene shows the following reactions:**

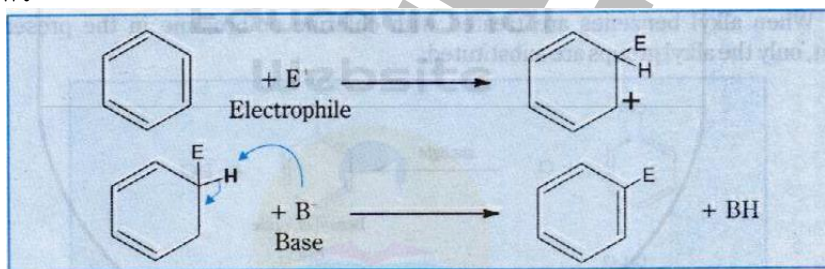
	Type of reactions	Reagents	Chemical reaction
I	Nitration	Conc. HNO <sub>3</sub> , Conc. H <sub>2</sub> SO <sub>4</sub> 50° - 55° C	
II	Sulphonation	Conc. H <sub>2</sub> SO <sub>4</sub> 80° C	
III	Alkylation	CH <sub>3</sub> Cl, AlCl <sub>3</sub>	
IV	Acylation	CH <sub>3</sub> COCl, AlCl <sub>3</sub>	

The mechanism shown by the above reactions is:

- A) Electrophilic substitution reaction      C) Acid base reaction  
B) Nucleophilic substitution reaction      D) β-elimination reaction

**Answer Explanation: (A)**

The mechanism of the reaction is electrophilic substitution reaction as shown below:



**Q.75 All of the following are correctly matched EXCEPT:**

Opt.	Test/Reaction	Identification/Product
A)	Reaction of ammonical AgNO <sub>3</sub> with alkene	Test to detect unsaturation (White ppt are obtained)
B)	Br <sub>2</sub> /CCl <sub>4</sub> with alkene	Test to detect unsaturation reddish brown colour of Br <sub>2</sub> is discharged
C)	Ozonolysis of alkene	To locate double bond in alkene
D)	Catalytic hydrogenation of vegetable oil	Vegetable ghee

**Answer Explanation: (A)**

- It is incorrect statement in fact.
- Ammonical AgNO<sub>3</sub> does not react with alkene.
- Alkene + ammonical AgNO<sub>3</sub> → No reaction
- Alkynes having acidic hydrogen react with ammonical AgNO<sub>3</sub> to give white ppt. as shown in the reaction  

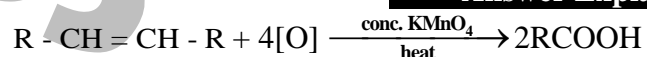
$$\text{HC} \equiv \text{CH} + 2\text{AgNO}_3 + 2\text{NH}_4\text{OH} \longrightarrow \text{AgC} \equiv \text{CAg} + 2\text{NH}_4\text{NO}_3 + 2\text{H}_2\text{O}$$

Disilver acetylide  
(white ppt.)

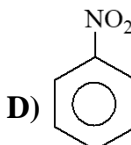
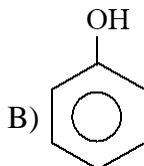
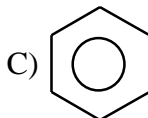
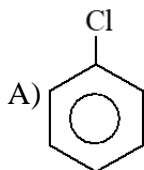
**Q.76 When different alkenes are treated with hot concentrated KMnO<sub>4</sub> solution, different products are obtained. Which of the following alkenes produces two moles of carboxylic acids?**

- A) H<sub>2</sub>C = CH<sub>2</sub>      C) R<sup>1</sup>R<sup>2</sup>C = CR<sup>3</sup>R<sup>4</sup>  
B) R - CH = CH - R      D) R<sup>1</sup>R<sup>2</sup>C = CH<sup>3</sup>R<sup>4</sup>

**Answer Explanation: (B)**

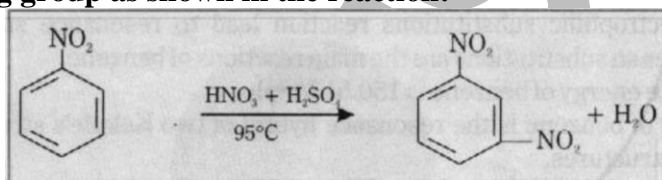


**Q.77** A substance which deactivates the aromatic ring to further substitution is called a deactivating substituent. Which of the following is strongly deactivating group attached with benzene ring:

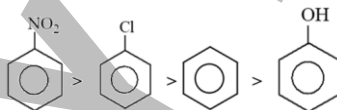


**Answer Explanation: (D)**

- $-\text{NO}_2$  group is strongly deactivating group attached with benzene ring.
- It is electron withdrawing group. It decreases the reactivity of benzene.
- In its presence the incoming group attacks at m-position on the benzene ring. i.e. it is m-directing group as shown in the reaction:



- Order of decreasing deactivating effect of the mono-substituted benzene as shown below:



**Q.78** **\*\*Mark the incorrect statement about mustard gas.**

- A) It is not a gas  
 B) It is a weak vesicant  
 C) It is high boiling liquid  
 D) It is dispersed as a mist of tiny droplets

**Answer Explanation: (B) It is incorrect statement**

The correct statement is given as:

- It is a powerful vesicant i.e. causes blisters
- Its name comes from its mustard like odour.
- Other Properties of Mustard Gas:
  - It is not a gas
  - It is high boiling liquid
  - It is dispersed as a mist of tiny droplets
- Preparation of Mustard Gas:  
 It is prepared by the reaction of ethene with  $\text{S}_2\text{Cl}_2$  as shown below



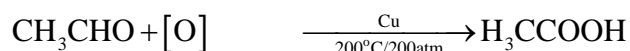
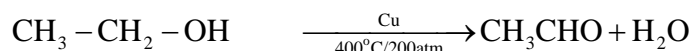
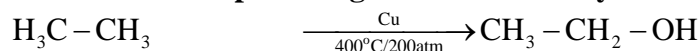
- Uses:
  - It was used as a harmful substance in World War I.

**Q.79** Catalytic oxidation of alkane is used industrially to prepare:

- A) Higher fatty acids  
 B) Alkyl ammine  
 C) Ketones  
 D) Esters

**Answer Explanation: (A)**

Catalytic oxidation of alkanes is used industrially to prepare higher fatty acids in soap and vegetable oil industry as shown in the reaction.



**Q.80** Which property of benzene may be directly attributed to the stability associated with its delocalized electrons?

- A) It has a low boiling point
- B) It does not conduct electricity
- C) Its  $\Delta H_f$  is positive
- D) It tends to undergo electrophilic substitution rather than addition reaction

**Answer Explanation: (D)**

Due to the extra resonance stability of the ring, benzene does not undergo addition reaction in which the ring resonance would be destroyed. Undergoing substitution retains the aromatic system.

(already discussed)

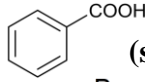
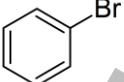


**Q.81** Among the following compounds that can be most readily nitrated is:

- A) Benzoic acid
- B) Bromobenzene
- C) Benzene
- D) Aniline

**Answer Explanation: (D)**

Among the following compounds (Benzoic acid, Bromobenzene, Benzene and Aniline) that can be most readily nitrated is Aniline.

Among the following compounds (Benzoic acid, Bromobenzene, Benzene and Aniline) that can be most readily nitrated is Aniline.

- A) Benzoic acid  (strongly deactivating, m-directing group)
- B) Bromobenzene  (deactivating, o- and p-directing group)
- C) Benzene  (less deactivating, than bromobenzene)
- D) Aniline  (strongly activating, o- and p-directing group)

**Conclusion:** Order of decreasing activating effect of mono-substituted benzene.

Aniline > Benzene > Bromobenzene > Benzoic acid

**DETAILED EXPLANATION:**

**EFFECT OF SUBSTITUENTS ON REACTIVITY OF BENZENE**

Substituent	Effect on reactivity
<b>ortho- and para- directing groups</b>	
-OH -NH <sub>2</sub> , -NHR, -NR <sub>2</sub>	Strongly activating
-R, -CH <sub>3</sub> , -C <sub>2</sub> H <sub>5</sub>	Weakly activating
-F, -Cl, -Br, -I	Deactivating
<b>meta- directing groups</b>	
-NO <sub>2</sub> , -CHO, -COR -SO <sub>3</sub> H, -CN, -COOH	Strongly deactivating

**Q.82** Which of the following reagents could best be used to distinguish between hex-1-ene and methyl benzene?

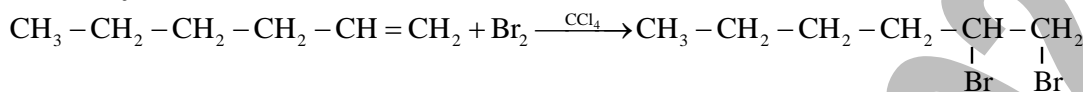
- A)  $[\text{Ag}(\text{NH}_3)_2]^+$  in  $\text{H}_2\text{O}$
- B)  $\text{Br}_2$  in  $\text{CCl}_4$
- C)  $\text{I}_2$  in  $\text{NaOH}_{(\text{aq})}$
- D) 2,4-Dinitrophenylhydrazine



in CH<sub>3</sub>OH

**Answer Explanation: (B)**

- Being an alkene, hex-1-ene undergoes electrophilic addition reaction readily with Br<sub>2</sub> in CCl<sub>4</sub> and decolourises it.
- Methylbenzene is unable to do so

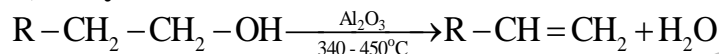


**Q.83 Which of the following methods is not used to prepare alkene:**

- Dehydration of alcohol
- Dehydrohalogenation of alkyl halide
- Dehalogenation of vicinal dihalides
- Dehalogenation of tetrahalides

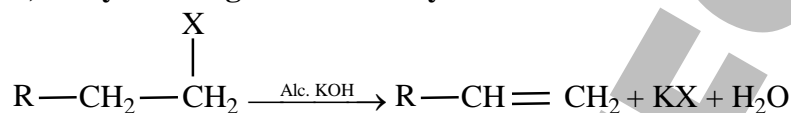
**Answer Explanation: (D)**

**A) Dehydration of alcohol**



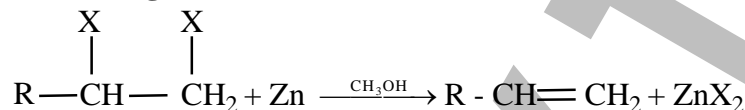
(alkene)

**B) Dehydrohalogenation of alkyl halide**



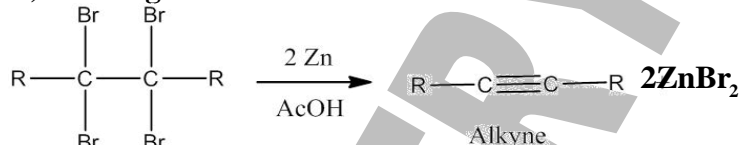
(alkene)

**C) Dehalogenation of vicinal dihalides**



(alkene)

**D) Dehalogenation of tetrahalides**



**Q.84 Alkenes containing \_\_\_\_\_ carbon atoms are in the liquid state:**

- C<sub>2</sub> - C<sub>4</sub>
- C<sub>5</sub> - C<sub>15</sub>
- C<sub>16</sub> to onward
- Both A and C

**Answer Explanation: (C)**

Opt.	Range of carbon atoms in alkenes	State
A)	C <sub>2</sub> - C <sub>4</sub>	Ethene, propene and butene in the gaseous state at room temperature
B)	C <sub>5</sub> - C <sub>15</sub>	In the liquid state
C)	C <sub>16</sub> to onward	In the solid state

**Q.85 When excess methane is treated with chlorine, the mixture of halogenoalkanes are obtained. Condition for the reaction is/are?**

- Reaction of methane with chlorine in the presence of dil H<sub>2</sub>SO<sub>4</sub>
- Reaction of methane with chlorine in the presence of catalyst
- Reaction of methane with chlorine in the presence of diffused sunlight
- Reaction of methane with chlorine in the presence of conc. H<sub>2</sub>SO<sub>4</sub>

**Answer Explanation: (C)**

When excess methane is treated with chlorine, the mixture of halogenoalkanes are obtained. Condition for the reaction is that chlorine reacts with methane in the presence of diffused sunlight (already discussed).