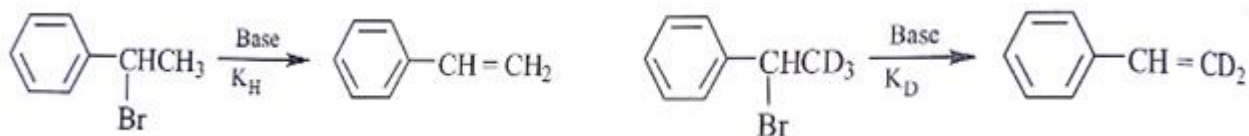


Questions and Answers – Elimination Reaction

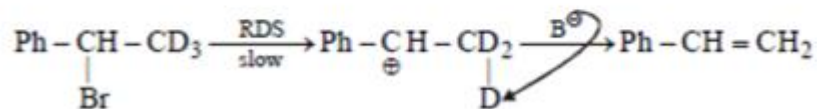
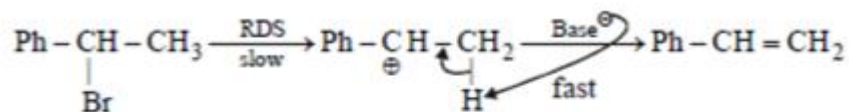
1. Assuming both the reactions as E1, where will the expected ratio between K_H/K_D lies between?



- a) nearly 1
- b) nearly 3
- c) nearly 5
- d) anything in between 2 and 8

Answer: a

Explanation: In E1 elimination RDS is the formation of carbocation from halide hence C – H and C – D are not the part of RDS there K_H/K_D is approx. 1.



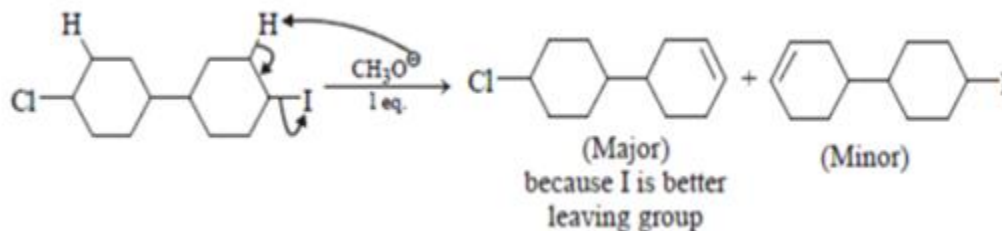
2. Predict the product for the following elimination reaction.



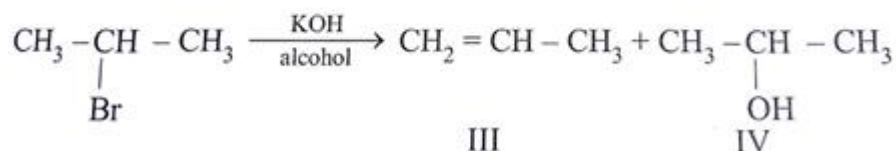
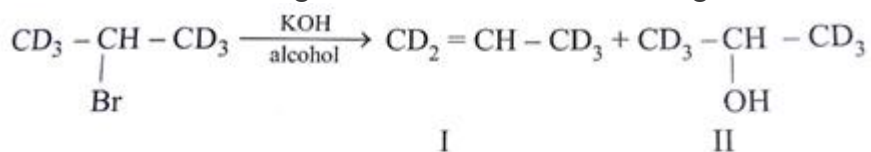
- a)
- b)
- c)
- d)

Answer: b

Explanation: Iodine is a better leaving group than chlorine, so attach will be at iodine site.



3. Which of the following is incorrect statement for the given reaction?



- a) Rate of formation of II and IV would be identical
- b) Rate of formation of I would be slower than that of III
- c) Formation of I would show primary isotope effect
- d) Formation of III involves E1 reaction

Answer: d

Explanation: Rate of formation of II and IV similar because H & D are approximately of same size.

C-H & C-D bond breaking is the part of RDS hence rate in I is slower than III

It undergoes E2 not via E1 because carbocation is not stable.

4. When the all-cis isomer of $\text{C}_6\text{H}_6\text{Cl}_6$ (2, 3, 4, 5, 6-Hexachlorocyclohexane) is heated with alc.KOH, what will be the most probable product?

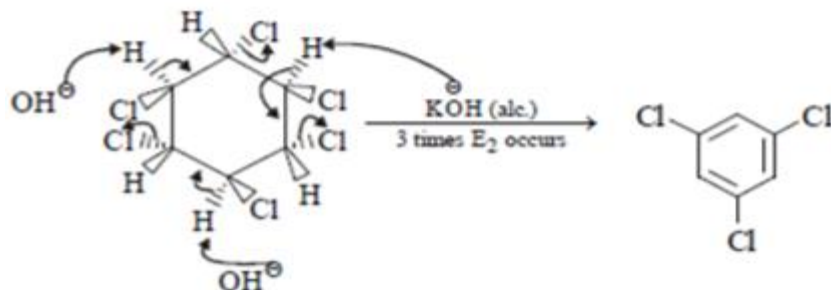
- a)
- b)
- c)



d)

Answer: b

Explanation: Here three times Elimination(E2) occurs and three pi bond will be formed and three water molecule will be removed as shown below.



5. Which of the following statements is correct for alkyl halide?

- Alkyl halide will always show S_N1 mechanism
- As branching at carbon increases, E1 mechanism is favoured as compared to S_N1 mechanism
- In unimolecular reaction, increasing the temperature donot favours E1 mechanism
- In most unimolecular reactions of alkyl halide E1 reaction is favoured over S_N1 reaction

Answer: b

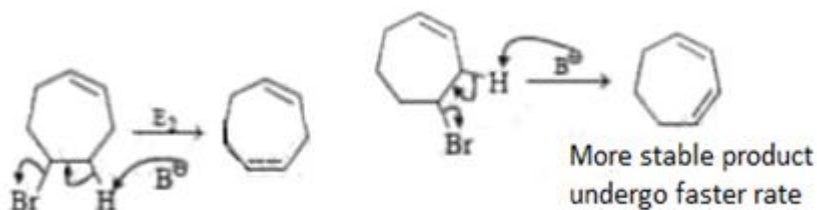
Explanation: In most unimolecular reactions of alkyl halide S_N1 reaction is favoured over E1 reaction. E1 mechanism is favoured as compared to S_N1 mechanism by branching at carbon increases, as more steric hinderence at the attacking site will leads to E1 mechanism.

6. Which of the following order is incorrect for the rate of E2 reaction?

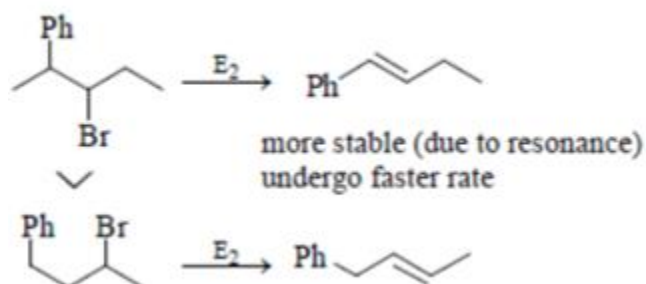
- 5-Bromocycloheptene > 4-Bromocycloheptene
- 2-Bromo- I -phenylbutane > 3-Bromo- I-phenylbutane
- 3-Bromocyclohexene > Bromocyclohexane
- 3-Bromo-2-methylpentane > 2-Bromo-4-methylpentane

Answer: a

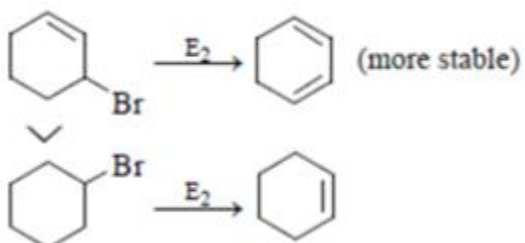
Explanation: For 5-Bromocycloheptene > 4-Bromocycloheptene, more stable product leads to faster rate of reaction. Product formed by E2 of 4-Bromocycloheptene is more stable than 5-Bromocycloheptene. So, rate of reaction 4-Bromocycloheptene is fater than 5-Bromocycloheptene. So option 5-Bromocycloheptene > 4-Bromocycloheptene is incorrect.



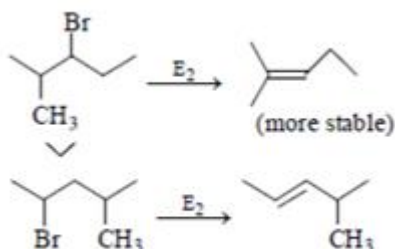
For 2-Bromo-1-phenylbutane > 3-Bromo-1-phenylbutane, it is true rate of reaction for 2-Bromo-1-phenylbutane is more than 3-Bromo-1-phenylbutane as product formed in former is more stable due to resonance.



For 3-Bromocyclohexene > Bromocyclohexane, it is true rate of reaction for 3-Bromocyclohexene is more than Bromocyclohexane as product formed in former is more stable.



For 3-Bromo-2-methylpentane > 2-Bromo-4-methylpentane, it is true rate of reaction for 3-Bromo-2-methylpentane more stable than 2-Bromo-4-methylpentane as product formed in



former is more stable.

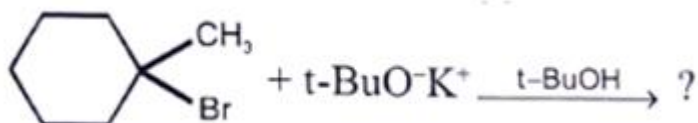
7. Which of the following statement is correct?

- E2 is a concerted reaction in which bonds break and new bonds form at the same time in a single step
- Order of reactivity of alkyl halides towards E2 dehydrohalogenation is found to be $3^\circ > 2^\circ > 1^\circ$
- In E2 elimination different stereoisomer (diastereomer) converts into different stereo product
- All of the mentioned

Answer: d

Explanation: E2 is a concerted reaction in which bonds break and new bonds form at the same time in a single step. Order of reactivity of alkyl halides towards E2 dehydrohalogenation is found to be $3^\circ > 2^\circ > 1^\circ$. In E2 reaction both hydrogen and leaving group should be antiperiplanar and that's why In E2 elimination different stereoisomer (diastereomer) converts into different stereo product.

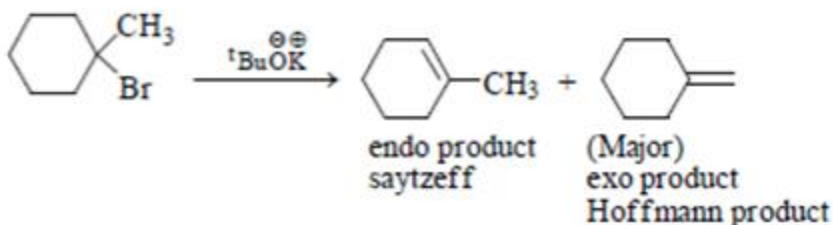
8. Which of the following statement is correct regarding the following reaction?



- a) Major product is endocyclic alkene formed according to Saytzeff
- b) Major product is exocyclic alkene formed according to Saytzeff
- c) Major product is exocyclic alkene formed according to Hoffmann
- d) Major product is endocyclic alkene formed according to Hoffmann

Answer: c

Explanation: Exocyclic alkene are more stable than endo because of but due to "steric hindrance" the less substituted alkene is formed.



9. Which of the following statement (s) is/are true about the following eliminations?



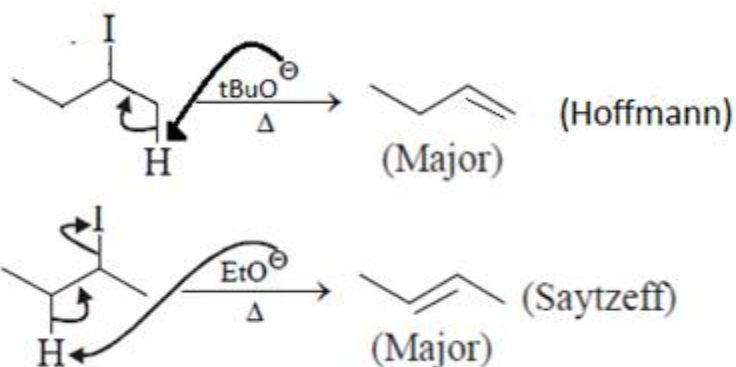
- (1) Hoffmann product is major product in I
- (2) Saytzeff product is major product in I
- (3) Hoffmann product is major product in II
- (4) Saytzeff product is major product in II

- a) 1 and 2
- b) 1 and 4
- c) 2 and 3
- d) 3 and 4

Answer: b

Explanation: Here correct is statement 1 and 4 are true. Due to steric hinderence tert-Butyl alcohol anion will attack less substituted C-H bond.

Ethanol anion will attack more substituted C-H bond to form more stable alkene.



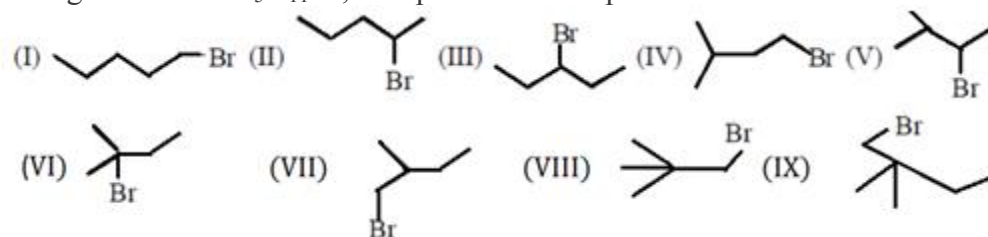
10. Which incorrect about alkyl bromide having molecular formula $C_5H_{11}Br$?

- One isomeric alkyl bromide undergoes E1 elimination at the fastest rate
- Only one is incapable of reacting by the E2 mechanism
- Only one isomer gives a single alkene on E2 elimination
- 2-Bromopentane gives the most complex mixture of alkenes on E2 elimination

Answer: c

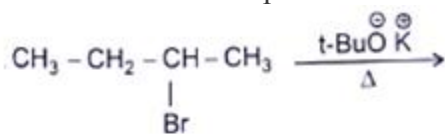
Explanation:

From the following isomers of $C_5H_{11}Br$, except IX all are capable of E2

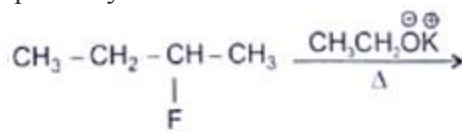


elimination.

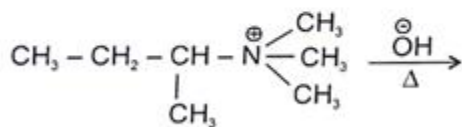
11. In which reaction product formation takes place by hoffmann rule?



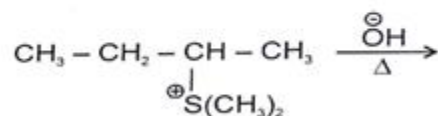
I



II



III



IV

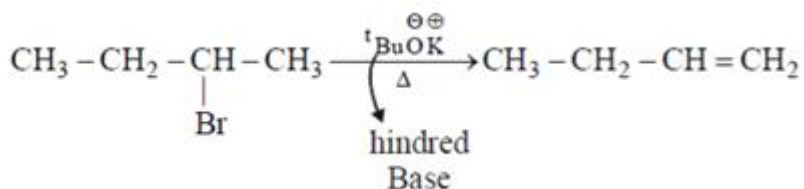
- I and II
- II and III

- c) I, II and III
 d) I, II, III and IV

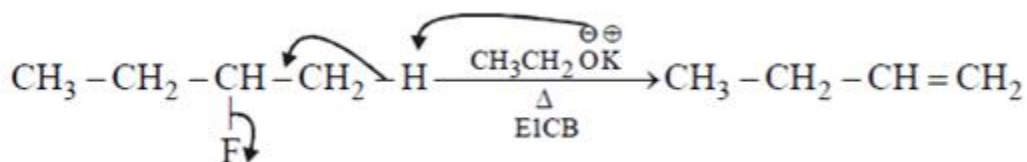
Answer: d

Explanation: All of the above molecules will form product by hoffmann rule that is less substituted C-H bond will be attacked because more stable product will be formed via this in all cases.

I.

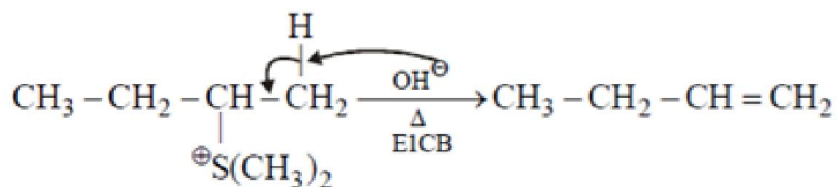
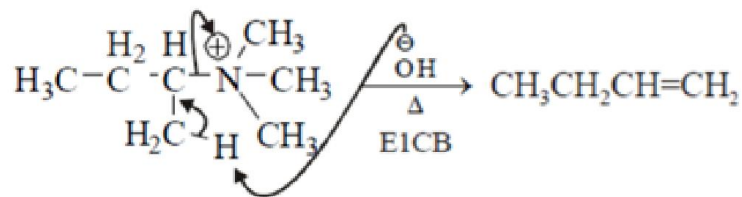


II.



When leaving group are F & NH₂ type then they give hoffmann product.

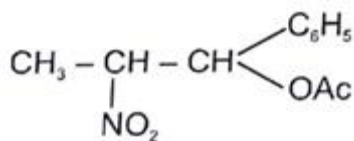
III.



IV.

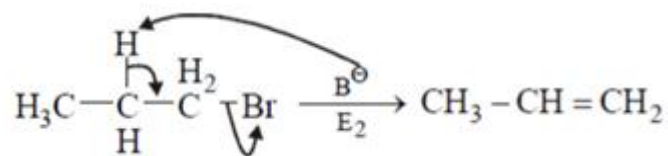
12. Which of the following compounds cannot give E₁CB reaction?

- a) CF₃ - CHCl₂
 b) C₆H₅ - CH₂ - CH₂F
 c) CH₃ - CH₂ - CH₂Br



d)

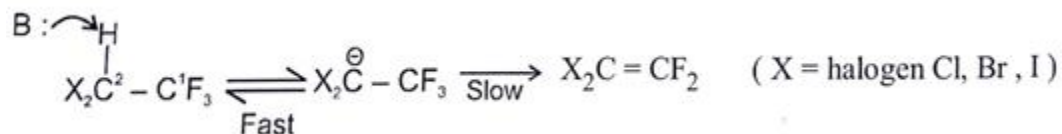
Answer: d



Explanation:

Compound d will give E₂ reaction, Br is a better leaving group so formation of carboanion and removal of leaving group occurs simultaneously. But E₁CB reaction is shown by poor leaving group like in compounds a, b and c.

13. Incorrect statement (s) is (are)



- a) X being electronegative, makes the H (on C-2) more acidic
- b) Due to electron withdrawal nature of X, it stabilises the carbanion
- c) (X) destabilises the carbanion due to the presence of lone pairs
- d) The reaction proceeds by an E₁CB pathway

Answer: c

Explanation: Due to inductive effect of halogen it stabilize the negative charge on adjacent to carbon atom, as X will withdraw the electron towards itself.

14. Which of the following is not the examples of E₁CB reaction?

- a)

Reaction of 4-hydroxy-2-pentanone with OH[⊖].
- b)

Reaction of 4-hydroxy-2-pentanone with (1) MsCl and (2) NMe₃.
- c)

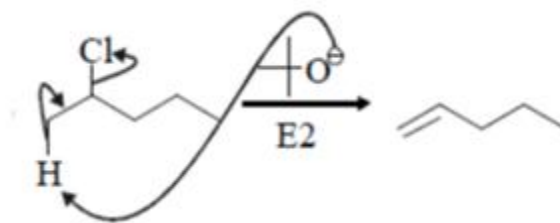
Reaction of 1,3-diphenylbutane-1,3-diol with KOH.
- d)

Reaction of 2-chloropentane with an alkoxide ion (represented as a carbon with a positive charge and an oxygen with a negative charge).

Answer: d

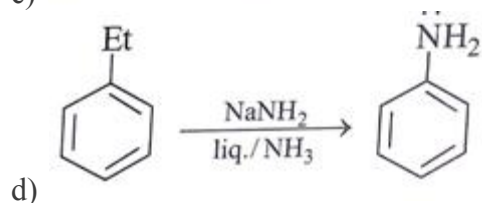
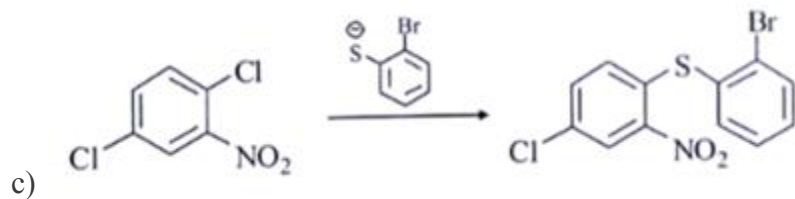
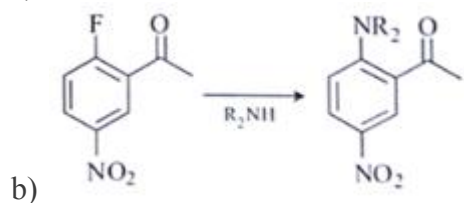
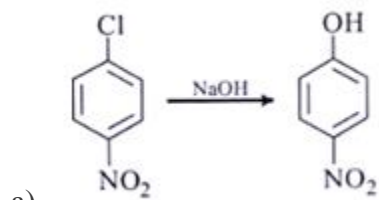
Explanation: Compound d will give E₂ reaction, Cl is a better leaving group so formation of

carbanion and removal of leaving group occurs simultaneously. But E₁CB reaction shown by



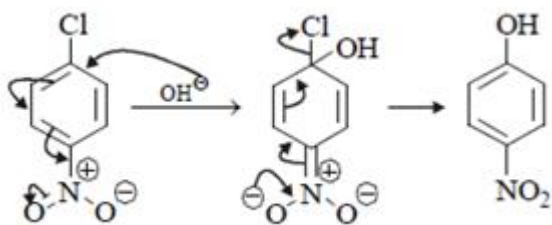
poor leaving group like in compounds a, b and c.

15. Which of the following reaction will not show addition elimination mechanism?



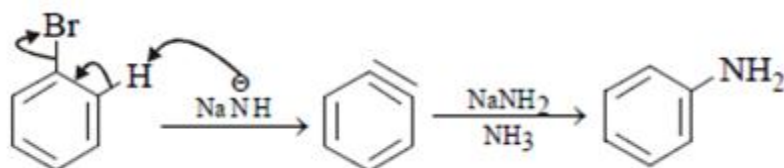
Answer: d

Explanation: Compounds a, b and c will follow Addition- Elimination mechanism.



Compound will follow elimination -addition mechanism, as shown in below reaction. NH⁻ anion

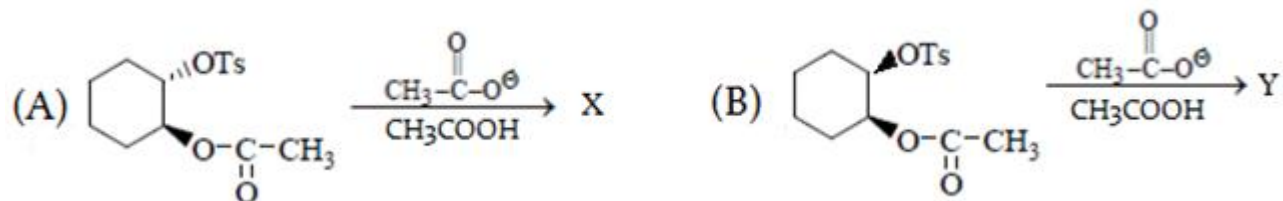
first attack on the ring which lead to formation of benzyne ring and further addition of -NH_2 will



take place.

Questions and Answers – Nucleophilic & Electrophilic Substitution Reaction

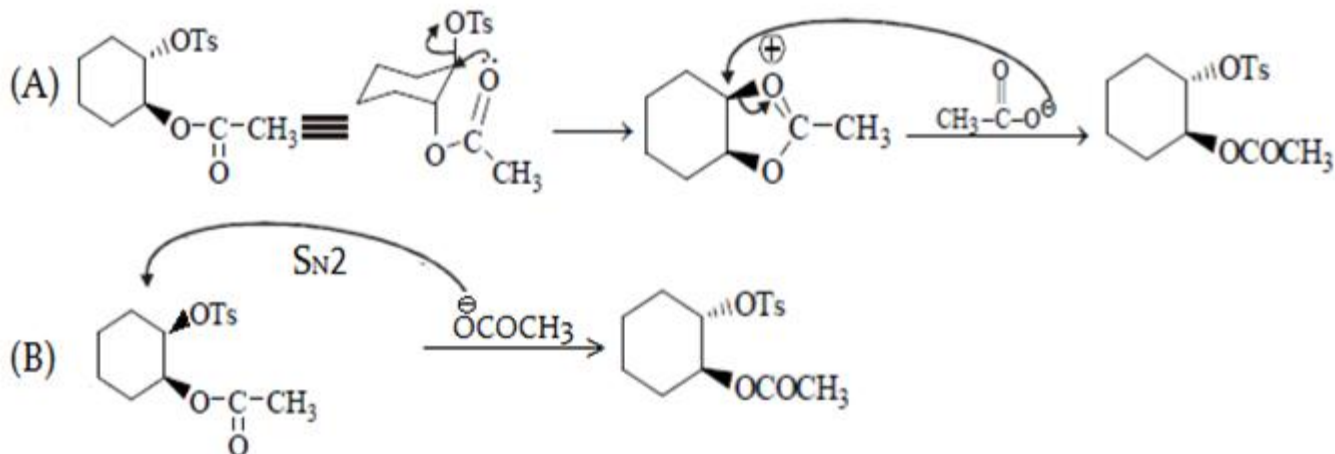
1. What is the correct statement for the given reactions?



- B reacts faster than A
- Both give the same product
- A gives trans and B gives cis product
- A gives cis and B gives trans product

Answer: b

Explanation:



In reaction A, groups attached to benzene are on opposite plane so S_N2 mechanism will be followed and B will undergo S_N2. Due to S_N2 (A) reacts faster than B and both give same product.

2. Which of the following statement is incorrect about nucleophiles?

- Nucleophiles have an unshared electron pair and can make use of this to react with an electron deficient species
- The nucleophilicity of an element (an electron donor) generally increases on going down a group in the periodic table
- A nucleophile is electron-deficient species

d) All good nucleophiles are good bases when we deal across the period

Answer: c

Explanation: A nucleophile is a chemical species that donates an electron pair to an electrophile to form a chemical bond in relation to a reaction, it is an electron rich species.

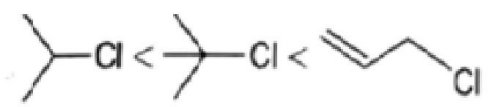
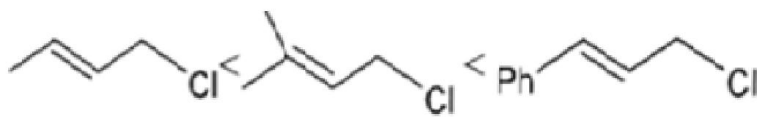
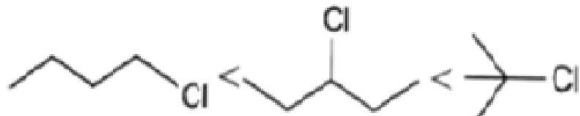
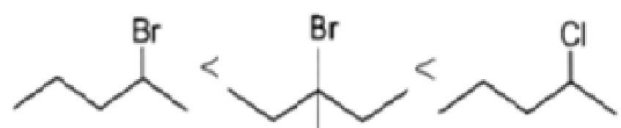
3. What is the correct order of nucleophilicity in the following options?

- a) $(\text{CH}_3)_3\text{CO}^- > \text{CH}_3^-$
- b) $\text{CH}_3\text{S}^- > \text{CH}_3\text{SH}$
- c) $\text{CH}_3\text{CH}_2\text{CH}_2\text{O}^- < (\text{CH}_3)_3\text{CO}^-$
- d) $(\text{CH}_3\text{CH}_2)_3\text{N} > (\text{CH}_3\text{CH}_2)_3\text{P}$

Answer: b

Explanation: Alkoxides are weaker Nu^- than carbanion because negative charge on oxygen is more stable than carbon. $\text{CH}_3\text{CH}_2\text{CH}_2\text{O}^-$ is more nucleophilic, due to less steric hindrance. The negative charge is more nucleophilic than a stable compound.

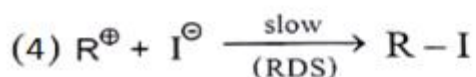
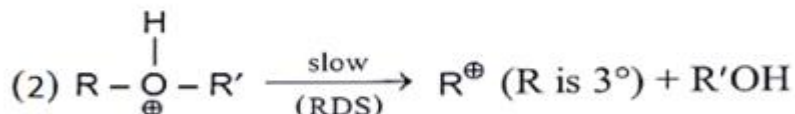
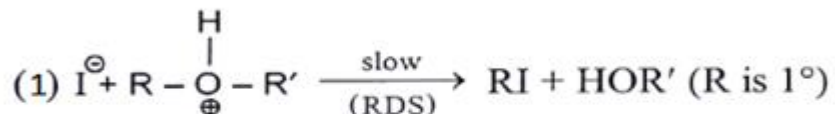
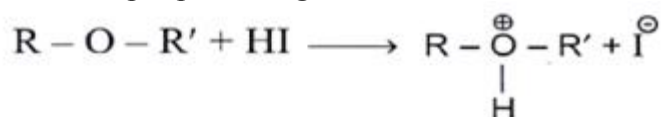
4. Which of the following order is correct for the solvolysis in 50% aqueous ethanol at 44.6°C?

- a) 
- b) 
- c) 
- d) 

Answer: b

Explanation: Solvolysis is a nucleophilic substitution ($\text{S}_{\text{N}}1$) or elimination, where the nucleophile is a solvent molecule. Solvolysis order $\text{CH}_3\text{X} < 1^\circ \text{ halide} < 2^\circ \text{ halide} < \text{allylic halide} < 3^\circ \text{ halide}$.

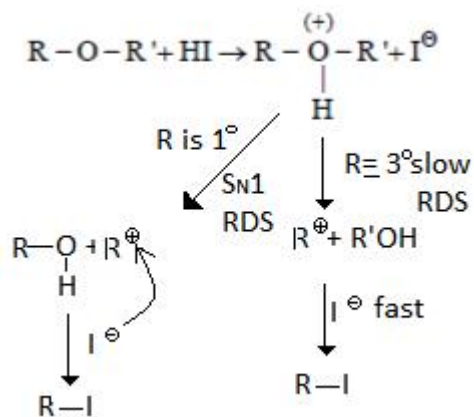
5. Identify correct step representing S_N1 mechanism for the cleavage of ether with HI.



- a) 1 and 3
 b) 2 and 3
 c) 1 and 4
 d) 2 and 4

Answer: b

Explanation: As we can see in below reaction first step is a slow step in which carbocation is formed. And the second step is fast where nucleophile will attach carbocation.



6. The relative rates of nucleophilic substitution for the given substrates are as follows:

Compound	Approx. Relative rate
CH ₃ CH ₂ Br	1.0
CH ₃ CH ₂ CH ₂ Br	0.28
(CH ₃) ₂ CHCH ₂ Br	0.030
(CH ₃) ₃ CCH ₂ Br	0.00000042

Which of the following statement is correct?

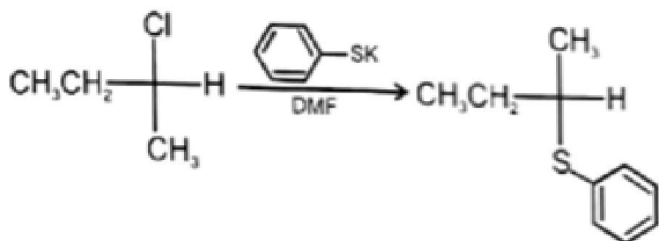
- a) Each of the above reactions is likely to be S_N2

- b) Each of the above reactions is likely to be S_N1
- c) First two reactions follow S_N2 and next two reactions follow S_N1 pathway
- d) There is no role of “steric factor”

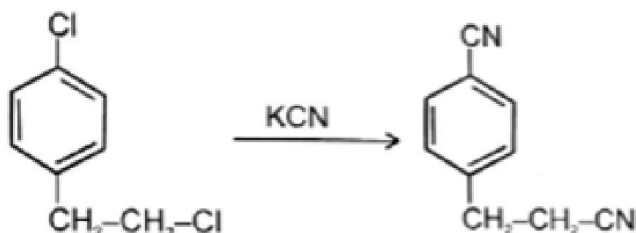
Answer: a

Explanation: As the steric hindrance increase, attack on carbon attached to Br decreases. It is possible only when reaction undergoes via S_N2 reaction.

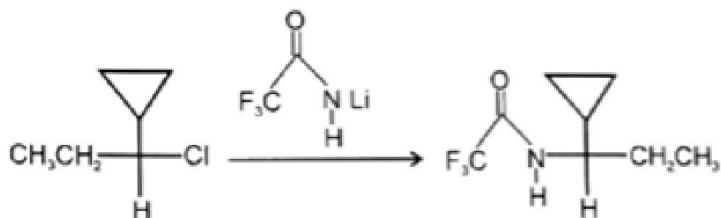
7. Which of the following reaction is not possible?



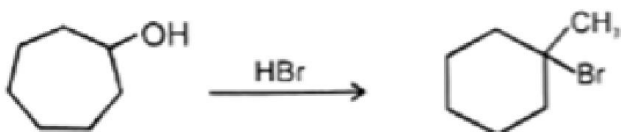
a)



b)



c)

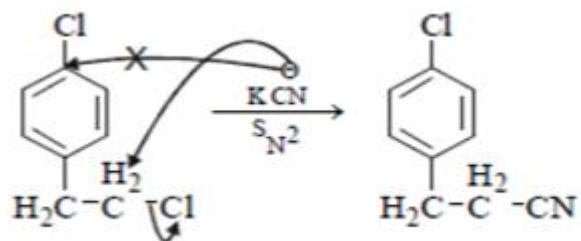


d)

Answer: b

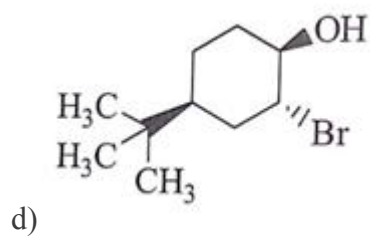
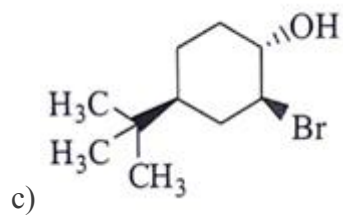
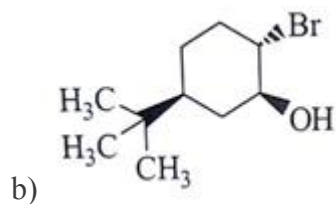
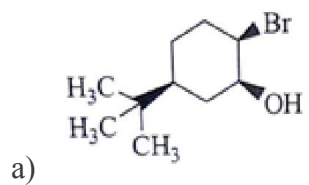
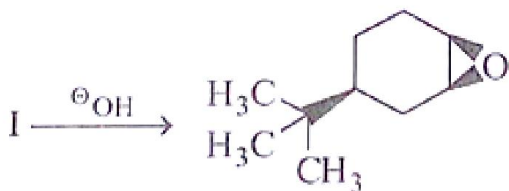
Explanation: In reaction, the nucleophilic attack will be at aliphatic chlorine atom instead of

aromatic chlorine because aromatic carbon S_N2 is not



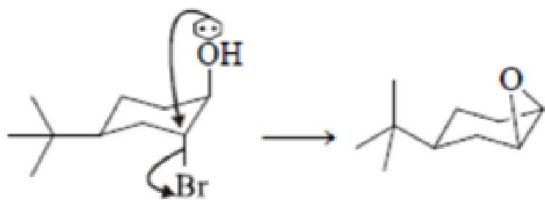
possible.

8. What will be the starting material (I) in the given reaction?

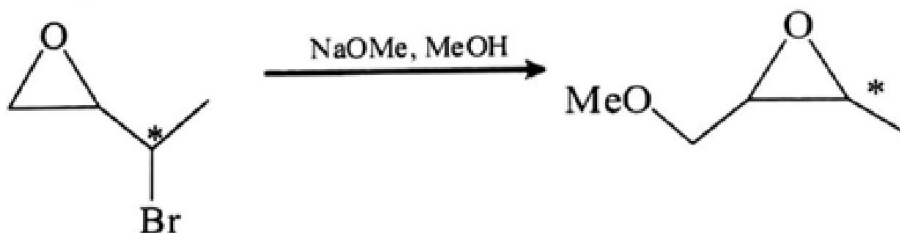


Answer: d

Explanation: Leaving group center should be anti to each other and nucleophilic.



9. Which of the following statement is true about the reaction given below?



- a) It involves a carbocation intermediate
- b) The rearrangement is due to S_N1 reaction mechanism
- c) It proceeds via a concerted S_N2 pathway
- d) It proceeds via a concerted S_N1 pathway

Answer: c

Explanation: In this reaction nucleophile (-OMe) will attack at carbon attach to oxygen and in this mechanism, one bond is broken and one bond is formed synchronously, i.e., in one step, so it will undergo S_N2 pathway.

10. Benzyl chloride is reacted with different nucleophiles (HO⁻, CH₃COO⁻, PhO⁻, CH₃O⁻). Arrange them in the decreasing order of reactivity with Benzyl chloride.

- a) CH₃O⁻ > HO⁻ > PhO⁻ > CH₃COO⁻
- b) HO⁻ > CH₃O⁻ > PhO⁻ > CH₃COO⁻
- c) HO⁻ > PhO⁻ > CH₃O⁻ > CH₃COO⁻
- d) CH₃COO⁻ > CH₃O⁻ > HO⁻ > PhO⁻

Answer: b

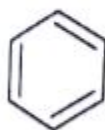
Explanation: HO⁻ > CH₃O⁻ > PhO⁻ > CH₃COO⁻

Here, CH₃O⁻ is most stable as the negative charge is distributed among two oxygen, followed by oxygen attach to phenyl group will share electron in resonance. And carbon is more electronegative than hydrogen attached to oxygen that's why HO⁻ is less stable than CH₃O⁻ and more nucleophilic.

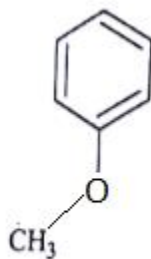
11. Among the following compounds, what is the decreasing order of reactivity towards electrophilic substitution?



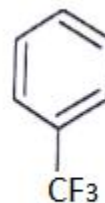
I



II



III



IV

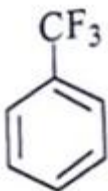
- a) III > I > II > IV
- b) IV > I > II > III
- c) II > III > I > IV
- d) I > III > II > IV

Answer: a

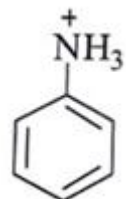
Explanation: This is an electrophilic substitution and more the electron density on the ring faster the reaction.

III > I > II > IV (Reactivity order towards E substitution)

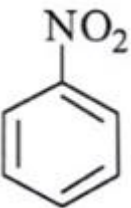
12. Among the following, which one is not a meta directing group in an electrophilic attack?



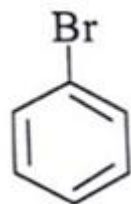
a)



b)



c)

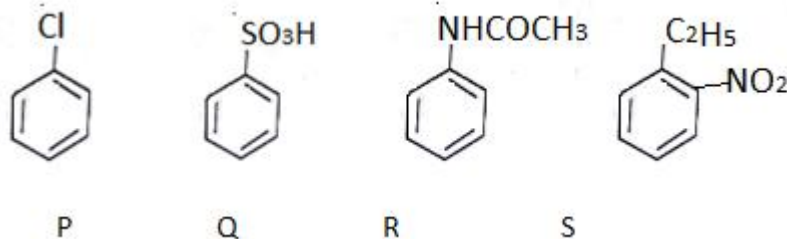


d)

Answer: d

Explanation: d is not a meta directing group in electrophilic attack because halogens are ortho-para directing and ring deactivating group.

13. What will be the decreasing order of electrophilic nitration of the following compounds?



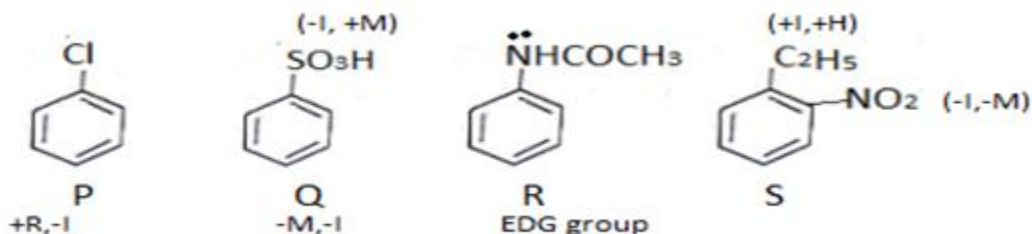
- a) $S > R > P > Q$
- b) $R > S > P > Q$
- c) $R > P > S > Q$
- d) $P > S > R > Q$

Answer: c

Explanation: $R > P > S > Q$

In R electron donating group is present. In P, Cl will attract ring's electron and donation will increase. In S there is an electron donating group hence it is more reactive. If C_2H_5 is not there then this order reverses.

In Q electron pair will get into



resonance.

14. Nitro group is meta-directing in electrophilic aromatic substitution reactions?

- a) increases electron density at meta-position
- b) increases electron density at ortho and para-positions
- c) decreases electron density at meta-position
- d) decreases electron density at ortho and para-positions

Answer: d

Explanation: Because nitro group decreases electron density at ortho and para-positions, which will lead to deactivation of ring.