

- Which of the following reactions of alkenes involves a 3-membered ring intermediate? (Multiple answers are correct.)
  - Oxymercuration
  - Hydroboration
  - Halogenation
  - Hydrohalogenation
  - Halohydrin formation
  - Hydrogenation
- Which of the following gives the correct order of **decreasing** acidity?
  - Propene>propane>propyne
  - Propyne>propene>propane
  - Propane>propyne>propene
  - Propane>propene>propyne
  - Propyne>propane>propene
- Match the definitions to the correct theory.

Theory

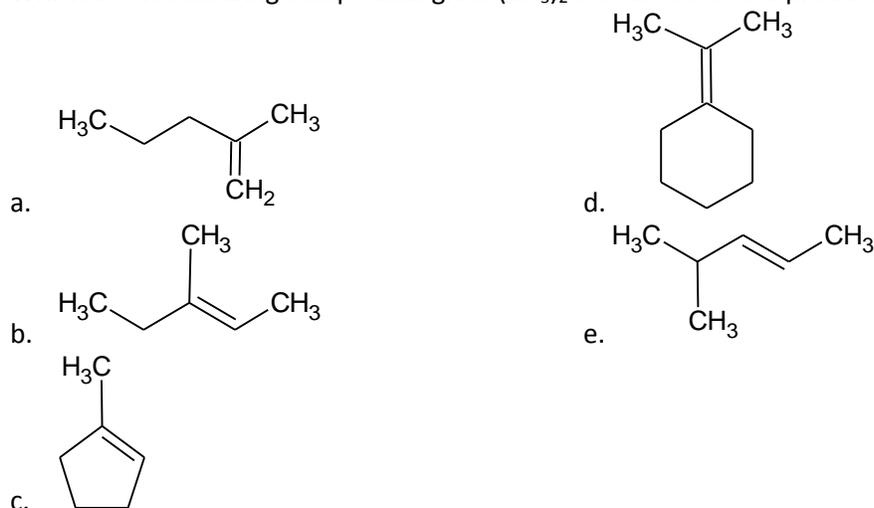
- Arrhenius
- Bronsted-Lowery
- Lewis

Definition

- Donates or accepts protons
- Donates or accepts a lone pair of electrons
- Donates a proton or a hydroxide

- A,I; B,II; C,III
  - A,I; B,III; C,II
  - A,II; B,III; C,I
  - A,II; B,I; C,III
  - A,III; B,I; C,II
- There are currently three known ways to convert alkenes to alcohols. Which of the following statements about these reactions is **false**?
    - Hydroboration results in syn stereochemistry of the added H and OH
    - Acid catalyzed hydration and hydroboration follow Markovnikov's rule while oxymercuration does not.
    - In all three reactions, water is the nucleophile
    - Rearrangements are possible for acid catalyzed hydration and not possible for oxymercuration and hydroboration.
    - B and C
    - C and D
  - Syn addition refers to the process where:
    - One atom adds to one carbon atom in a double bond.
    - One atom adds to each carbon atom in a double bond.
    - Two atoms add to each carbon atom in a double bond.
    - One atom adds to each carbon atom in a double bond from opposite sides of the double bond.
    - One atom adds to each carbon atom in a double bond from the same side of the double bond.
  - Which of the following molecular formulas corresponds to a compound with a degree of unsaturation of two.
    - $C_5H_{10}Br_2$
    - $C_6H_{15}N$
    - $C_5H_{10}O$
    - $C_5H_8O_2$

7. Which of the following compounds gives  $(\text{CH}_3)_2\text{C}=\text{O}$  as one of the products of ozonolysis?



8. Which of the following reagents will react with alkenes in a syn addition? (Multiple answers are correct)

- $\text{BH}_3$  followed by  $\text{H}_2\text{O}_2$  and  $\text{OH}^-$
- $\text{Hg}(\text{OAc})_2$  followed by  $\text{NaBH}_4$
- $\text{OsO}_4$  followed by  $\text{NaHSO}_3$
- $\text{Br}_2$  over  $\text{H}_2\text{O}$
- $\text{Br}_2$  over  $\text{CH}_2\text{Cl}_2$

9. Which of the following reactions are regioselective in Markovnikov fashion? (Multiple answers are correct)

- $\text{HCl}$
- $\text{Hg}(\text{OAc})_2$  followed by  $\text{NaBH}_4$
- $\text{Br}_2$  over  $\text{H}_2\text{O}$
- $\text{BH}_3$  followed by  $\text{H}_2\text{O}_2$  and  $\text{OH}^-$
- $\text{H}_2\text{O}$  in  $\text{H}_3\text{O}^+$

10. Which of the following is the reaction sequence to use if you wanted to add water to an alkene in Markovnikov fashion **without** rearrangement?

- Water and dilute acid
- Oxymercuration
- Halogenation
- Hydroboration

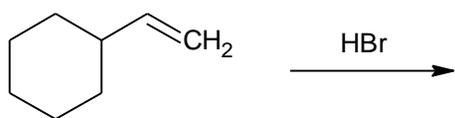
11. Which of the following statements are **false** concerning propyne?

- The pi bonds are weaker than the sigma bonds.
- The H-C-H bond angle is approximately  $109.5^\circ$ .
- The C-C-C bond angle is approximately  $180^\circ$ .
- There are 3 pi bonds.
- There are 6 sigma bonds.



16. Give the structures of the major products formed from reacting 1-methylcyclohexene with the following reagents. Indicate regiochemistry and stereochemistry when appropriate.
- $\text{Hg}(\text{OAc})_2$ ,  $\text{H}_2\text{O}$  followed by  $\text{NaBH}_4$ ,  $\text{NaOH}$
  - $\text{OsO}_4$ , followed by  $\text{NaHSO}_3$  and  $\text{H}_2\text{O}$  or  $\text{H}_2\text{O}_2$
  - $\text{BH}_3$ , THF followed by  $\text{H}_2\text{O}_2$ ,  $\text{HO}^-$
  - $\text{O}_3$  followed by  $(\text{CH}_3)_2\text{S}$
  - $\text{Br}_2$  in  $\text{H}_2\text{O}$
  - $\text{Br}_2$  in  $\text{CH}_2\text{Cl}_2$
  - $\text{H}_2\text{O}$ ,  $\text{H}_2\text{SO}_4$

17. All the questions below refer to the following reaction.



- Draw the step-wise mechanism for the two products of this reaction. Show all movements of electrons.
- Which product will be the major product? Why?