

BRAIN BOOST – ORGANIC CHEMISTRY

TUTORIAL 1

Alkanes, Alkenes, Alkynes



PART A

Underline the correct answer

- Which of the following is the correct order of increasing reactivity?
a) Alkane < Alkene < Alkyne b) Alkyne < Alkene < Alkane c) Alkene < Alkane < Alkyne
d) Alkane < Alkyne < Alkene e) Alkyne < Alkane < Alkene
- Which of the following compounds exhibits geometrical isomerism?
a) Butane b) Butene c) Butyne d) Propane e) Methane
- Which of the following best describes the bonding in ethyne (C₂H₂)?
a) sp³ hybridization b) sp² hybridization c) sp hybridization d) None of the above
e) All of the above
- Which of the following reagents can be used to distinguish alkynes from alkanes?
a) Bromine water b) Acidified KMnO₄ c) Ammoniacal silver nitrate (Tollen's reagent)
d) Fehling's solution e) Conc. H₂SO₄
- What is the general formula for alkynes?
a) C_nH_{2n+2} b) C_nH_{2n} c) C_nH_{2n-2} d) C_{n+2}H_{2n} e) C_{n+2}H_{2n+2}
- Which of the following tests can be used to distinguish between alkanes and alkenes?
a) Silver mirror test b) Tollen's test c) Bromine water test d) Iodine test
e) Fehling's solution test
- Which is the correct initiation step in the chlorination of methane?
a) CH₄ → CH₃· + H· b) Cl₂ → 2Cl· c) CH₃· + Cl₂ → CH₃Cl + Cl·
d) CH₄ + Cl₂ → CH₃Cl + HCl e) CH₃Cl → CH₃· + Cl·
- What is the major product when propene reacts with HBr in the presence of peroxides?
a) 1-Bromopropane b) 2-Bromopropane c) Propanol
d) Allyl bromide e) 2-Bromopropene
- Which alkene shows cis-trans isomerism?
a) 2-Methylpropene b) But-1-ene c) But-2-ene d) Cyclohexene e) 2-Methylpropane
- Which factor increases the boiling point of alkanes?
a) Increased branching b) Increased molecular weight c) Presence of halogens
d) Presence of H bonding e) Presence of a double bond

PART B

Answer all the parts. Write your answers in the space provided.

1. Compounds **A**, **B**, **C**, and **D** are structural isomers of each other with the molecular formula C_4H_8 . **A** and **B** react with bromine water, decolorizing it. **C** and **D** react with ammoniacal silver nitrate, forming a precipitate. None of these compounds undergo substitution reactions with chlorine in the presence of UV light. When **A**, **B**, **C**, and **D** react separately with hydrogen gas (H_2) in the presence of Ni catalyst, compounds **E**, **F**, **G**, and **H** are obtained. **E** and **F** are alkanes with the molecular formula C_4H_{10} . **G** and **H** are also alkanes but are obtained from the hydrogenation of **C** and **D**, respectively. Draw the structures of **A**, **B**, **C**, **D**, **E**, **F**, **G**, and **H** in the boxes given below.

2. **A** reacts with HBr according to Markovnikov's rule to form a single major product. Draw the structure of the product.

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3. **C** undergoes combustion in the presence of oxygen. Write the balanced equation for this reaction.

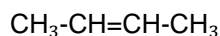
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PART C

Answer all the parts.

1. The following statements refer to alkanes, alkenes, and alkynes. Indicate whether each of these statements is correct (✓) or wrong (X) in the appropriate box.
 - a. Methane is the simplest alkane and has a tetrahedral structure ()
 - b. Alkenes are less reactive than alkanes due to the presence of a π bond. ()
 - c. Ethyne is more acidic than ethene due to the higher s-character of its C-H bonds. ()
 - d. The bond angle in ethene is approximately 120° ()
 - e. Alkanes can undergo addition reactions with halogens ()
 - f. The hybridization of carbon in ethyne is sp^2 ()
 - g. Enantiomers are stereoisomers that are non-superimposable mirror images of each other ()
 - h. Methane, ethane, and propane are gases at room temperature ()
 - i. Hydrogenation of an alkene results in the formation of an alkyne ()
 - j. The bond angle in alkynes is 180° ()

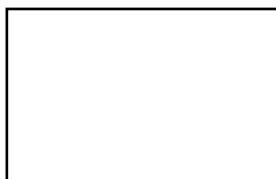
2. Consider the following structure of molecule **A**.



- I. Write the IUPAC name of molecule **A**.

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- II. Draw the structural formula of the major product formed when **A** reacts with HBr.



- III. Using curved arrows, complete the mechanism for the reaction of **A** with HBr. State whether **A** can show geometrical (cis-trans) isomerism and explain your reasoning.

IV. Would the product from part (III) be optically active? Give a reason for your answer.

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3. Using only the chemicals given in the list, show how you would carry out the following conversion



Alc. KOH, Br₂, Al₂O₃