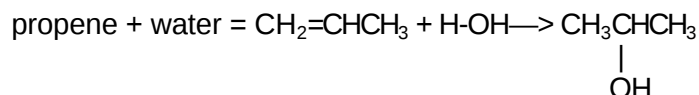


Student Packet: 10.4: Basic Organic Reactions: Student Handout

Reactions

Addition reactions - In addition reactions a molecule adds to each side of a double or triple bond in a hydrocarbon. The bond order gets reduced by one and the molecule breaks up to add to each side.

For example: 2-butene + bromine = $\text{CH}_3\text{CH}=\text{CHCH}_3 + \text{Br}_2 \longrightarrow \text{CH}_3\text{CHBrCHBrCH}_3$



Obviously, addition reactions create isomers. The rule for determining which isomer is predominantly formed is credited to Vladimir Markovnikov, it's called Markovnikov's rule and it says: when a polar molecule adds to a multiple bond, the electropositive part of the molecule bonds to the carbon that holds the largest number of carbons (hydrogen goes to the carbon with the most hydrogens attached).

propene + water produces 2-propanol over 1-propanol
propene + HCl produces 2-chloropropane over 1-chloropropane

Elimination reactions - An elimination reaction is where a stable species is lost with the formation of a multiple bond. It's sort of the reverse of an addition reaction.

For example: The elimination of water to form 1-propanol: $\text{CH}_2\text{CH}_2\underset{\text{OH}}{\text{CH}_3} \longrightarrow \text{CH}_2=\text{CHCH}_3 + \text{H}_2\text{O}$

The elimination of HBr from 2-bromobutane: $\text{CH}_3\text{CHBrCH}_2\text{CH}_3 \longrightarrow \text{CH}_2\text{CHCH}_2\text{CH}_3 + \text{HBr}$

Elimination reactions with H and OH are called dehydration.

Condensation reactions - In a condensation reaction, two molecules combine by splitting out a small molecule (often H_2O).

ethanol + ethanol = $\text{CH}_3\text{CH}_2\text{OH} + \text{HOCH}_2\text{CH}_3 \longrightarrow \text{Et-O-Et} + \text{H}_2\text{O}$

Substitution reactions - A substitution reaction is where one atom or group replaces another in a molecule. These are very common.

Substituting a halogen onto an alkane: $\text{CH}_4 + \text{Br}_2 \longrightarrow \text{CH}_3\text{Br} + \text{HBr}$

Nitration of an arene: $\text{C}_6\text{H}_6 + \text{HNO}_3 \longrightarrow \text{C}_6\text{H}_5\text{NO}_2 + \text{H}_2\text{O}$

Producing an alcohol from an alkyl halide: $\text{CH}_3\text{Br} + \text{OH}^- \longrightarrow \text{CH}_3\text{OH} + \text{Br}^-$

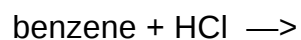
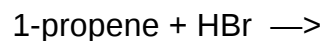
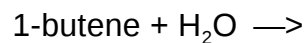
*Arenes or Aromatics - For a reaction in which you would normally expect an alkene to undergo addition across a double bond, aromatics (we're talking about benzene) undergo a substitution reaction.

Student Packet: 10.4: Basic Organic Reactions: AssessMe questions

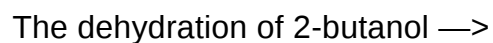
- 1) What kind of compound is benzene?
- A) an aromatic B) an alkyl C) an alcohol D) an alkane E) I'm clueless
- 2) All alkanes are
- A) highly flammable
B) volatile
C) polar
D) non-polar
E) I'm clueless
- 3) In general, what type of solid will dissolve in a non-polar solvent?
- A) ionic B) metallic C) covalent D) molecular E) I'm clueless
- 4) What type of solid will melt at a very high temperature to give a conducting liquid?
- A) ionic B) metallic C) covalent D) molecular E) I'm clueless
- 5) What is the geometry of XeF_2 ?
- A) octahedral B) bent C) linear D) tee-shaped E) I'm clueless
- 6) What is the geometry of XeF_4 ?
- A) square planar
B) tetrahedral
C) trigonal planar
D) tee-shaped
E) I'm clueless

Student Packet: 10.4: Basic Organic Reactions: ShowMe questions

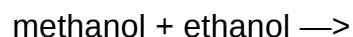
1) Complete the following addition reactions:



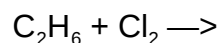
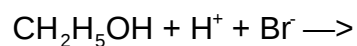
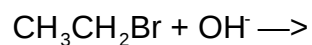
2) Complete the following elimination reactions:



3) Complete the following condensation reactions:

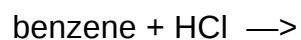
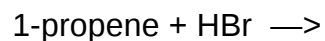
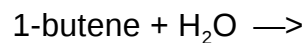


4) Complete the following substitution reactions:

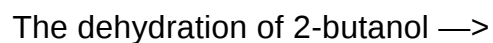


Student Packet: 10.4: Basic Organic Reactions: ShowMe questions

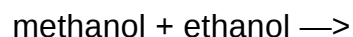
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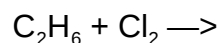
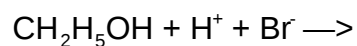
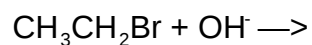
2) Complete the following elimination reactions:



3) Complete the following condensation reactions:

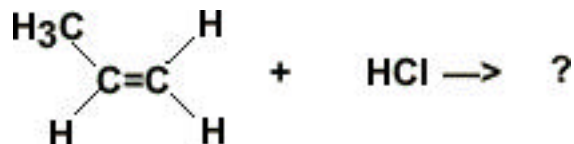


4) Complete the following substitution reactions:



Student Packet: 10.4: Basic Organic Reactions: TestMe questions

- 1) What reaction is the expected product of the following reaction?



- A) $\text{CH}_3\text{CH}_2\text{CH}_3$
B) $\text{CH}_3\text{CHClCH}_3$
C) $\text{CH}_3\text{CHClCH}_2\text{Cl}$
D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$
E) None of the above
- 2) What is the expected product for the dehydration of 2-propanol?
- A) $\text{CH}_3\text{CH}_2\text{CH}_3$
B) CH_2CH_2
C) CH_3CHCH_2
D) CH_3CHCOOH
E) None of the above
- 3) Determine the hydrocarbon and reagent that would react to form ethyl benzene.
- A) benzene, ethanol
B) benzene, dichloroethane
C) benzene, methanol
D) 1-methylbenzene, methanol
E) None of the above
- 4) Name the organic product(s) for the reaction of 2-chloropropane in potassium hydroxide solution.
- A) propanol
B) propanoic acid
C) 2-propene
D) 2-propanol
E) No reaction occurs
- 5) What is the final product when an excess of HCl is reacted with acetylene (ethyne)?
- A) No reaction occurs
B) 1-chloroethene
C) 1,2-dichloroethene
D) 1,1-dichloroethene
E) None of the above