Chapters 1-4 review

1. Find the IUPAC name for the following compounds:

a) CH₃-CH₂-C=CH₂-CH₃

b) OH

c) CH₂=CH-CH-CH₂-CH₃

d)

e)

f) CH₂=CH-CH₂-CH₂-CH₃

g) CH₂-CH₃

h) CH₃-C=CH-CH₂-CH₂-CH₂-CH₃
2. Draw structural formulas for the following compounds:

a) 5-Bromo-2,2,5,6-tetramethyl-3-octyne

b) 3-Bromo-1-chloro-3-methylcyclohexene

c) 3-Ethyl-2-methyl-2,4-hexadiene

d) 3-Chloro-2,4-diethyl-5-methylbenzaldehyde

e) 1-Bromo-3-chloro-5-nitrobenzene

f) 3-Bromo-5-ethyl-5-methyl-1,3-cyclohexadiene

g) 4-Methyl-5-phenyl-2-hexyne

h) 5-Bromo-3-isobutyl-2-methylaniline

i) 5-Chloro-4-cyclohexyl-3,5-dimethyl-2-heptene

j) 4-Ethyl-5-isopropyl-6-methyl-3-nitro-2-octene

3. Draw five constitutional isomers for C_{7}H_{14}:
4. What reagents and/or catalysts are necessary to carry out each conversion? Determine the type of reaction.

a) 2,3,4-trimethylphenol to 5-Chloro-2,3,4-triphenol

b) Butane to 1-Butene

c) 1,3-Pentadiene to 2,4-dibromopentane

d) 2-Chloro-3-nitro-2-pentene to 2-Chloro-3-nitropentane

e) 4-Ethyl-4-methyl-1-hexene to 4-Ethyl-4-methyl-2-hexanol

5. Name four physical properties for aromatics?

6. Arrange the following compounds in order of increasing boiling point:

a) CH₃-CH₂-CH₂-CH₃, CH₂=CH₂, CH₂=CH-CH₃

b) CH₃-CH₂-CH₂-CH₂-CH₃, CH₃-CH-CH₂-CH₃, CH₃-C-CH₃

c) CH₃-CH₂-CH₃, CH₃-CH-CH₃, CH₃-C-CH₃

7. Which of these compounds show cis-trans isomerism? For each that does, draw structural formulas for both isomers. Which one has a higher boiling point (cis or trans)?

a) 2-Ethyl-4,5-dimethyl-3-hexene
b) 3,5,5-trimethyl-3-hexene

8. Write the molecular formula for the following compounds:

a) An alkane with 15 carbon atoms

b) An alkyne with 10 carbon atoms

c) An alkene with 8 carbon atoms

9. Give an example for hydrogenation and halogenation of alkenes (write the chemical equation). Determine the type of catalyst (if it is necessary).

10. Why benzene is less reactive than alkenes?

11. Write the equation for the following reactions:

a) 3,5,5-trimethyl-3-hexene with HBr

b) 3,4-dichloro-4-methylcyclohexene with bromine

c) 5-Bromo-5-ethyl-2,2-dimethyl-3-heptyne with water

d) 2-Ethyl-5-methyl-4-nitrobenzoic acid with chlorine
12. Complete these chemical equations:

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\begin{align*}
\text{a) } & \quad \text{CH}_3\text{-CH-CH}=\text{CH}_2 + \text{H}_2\text{O} \quad \text{H}_2\text{SO}_4 \rightarrow \\
\text{b) } & \quad \text{CH}_2=\text{CH}-\text{CH-CH}_3 + \text{HCl} \rightarrow \\
\text{c) } & \quad \text{OH} + \text{NaOH} \rightarrow \\
\text{d) } & \quad \text{NO}_2 + \text{HNO}_3 \quad \text{H}_2\text{SO}_4 \rightarrow 
\end{align*}
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13. Explain why each name is an incorrect IUPAC name. Write the correct IUPAC name for each compound.

a) 2-Ethyl-3,3-dimethyl-5-propylheptane

b) 3-Ethyl-3,6,6-trimethylheptane

c) 4-nitrohydroxylbenzene

d) 5-Ethyl-3,3-dimethyl-4-hexene

e) 1-Bromo-2-Chloro-6-ethylcyclohexane

14. What is the difference between the addition reactions and the substitution reactions? Give an example for each reaction?

15. Why are alkanes called saturated hydrocarbons?
16. Write the chemical equation with the products:

a) Hydration – 5-isopropyl-2,4-dimethyl-3-octene + with an acid catalyst produces?

b) Halogenation – 4-ethyl-3,5-dimethylcyclohexene + bromine produces?

c) Combustion – 3-ethyl-2,4-dimethyl-2-pentene + oxygen → __________ + __________
   (please balance the equation)