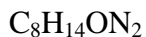


1. (4) Calculate the degree of unsaturation of each of the following:



2



3



4

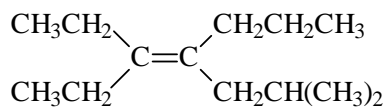


1

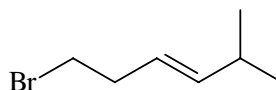
2. (3) Briefly state Markovnikov's rule (as he formulated it in 1869):

When a hydrogen halide adds to an unsymmetrically substituted alkene, the H adds to the end of the double bond that has the most Hs; the X adds to the other (more highly substituted) end of the double bond.

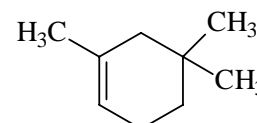
3. (6) Write the correct, complete IUPAC name for each of the following:



3-ethyl-6-methyl-4-propyl-3-heptene

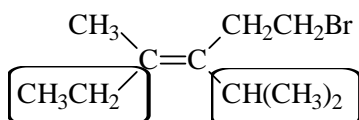


trans-1-bromo-5-methyl-3-hexene

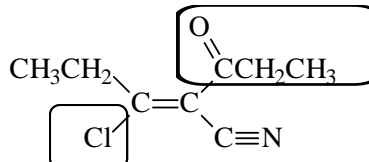


1,5,5-trimethylcyclohexene

4. (4) Assign the configuration (E or Z) of the following alkenes:

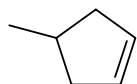
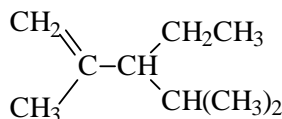
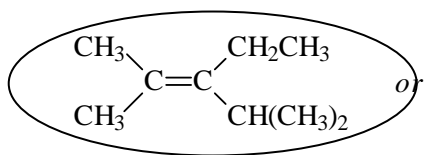


Z

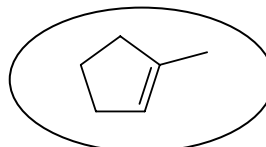


E

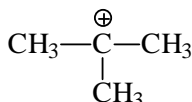
5. (4) Circle the more stable (lower energy) alkene in each pair of isomers.



or

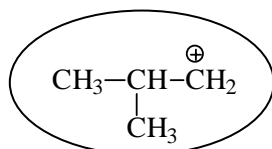


6. (6) Below each carbocation write its degree of substitution (1° , 2° , or 3°). Circle the higher energy (less stable) carbocation in each pair of isomers:

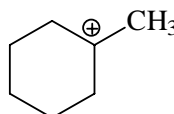


3°

or

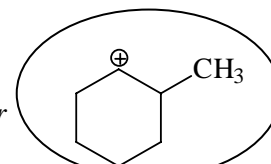


1°



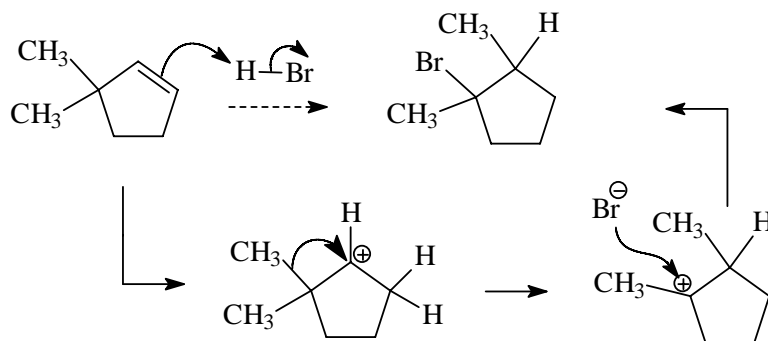
3°

or

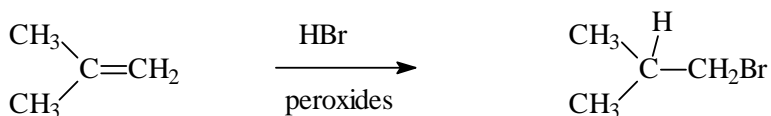
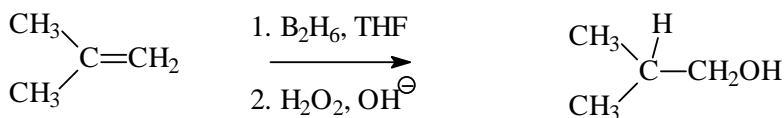
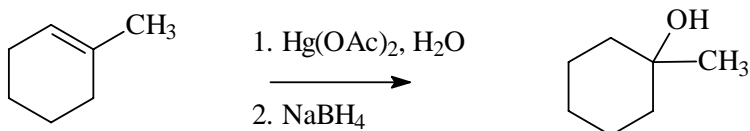
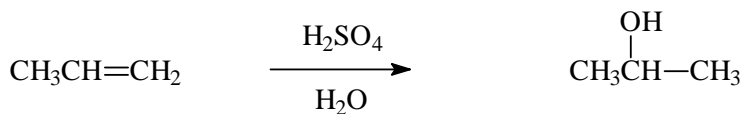
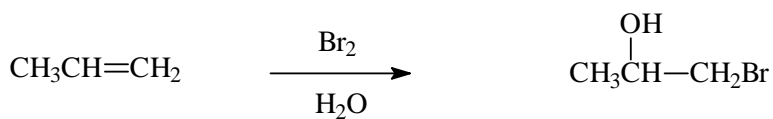
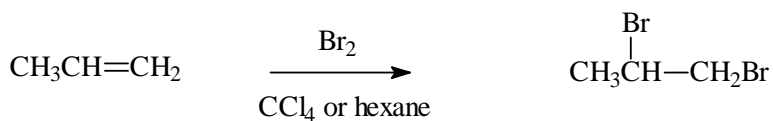


2°

7. (3) Write the detailed step-by-step mechanism that explains the following reaction.



8. (14) Draw the structure of the major organic product of each of the following.



9. (16) Draw the structure of the major organic product of each of the following. If two products are formed in equal amounts, show both.

