key concepts and learning goals

- be able to name alkane and cycloalkane structures and write structures from a name
- define and apply the concepts of constitutional isomers and stereoisomers to alkanes and cycloalkanes
- know the names and structures of C1-C4 alkyl groups and be able to classify C's and H's of alkanes as 1°, 2°, 3°, or 4°
- alkane conformations - draw 3D pictures (including Newman Projections) of ethane, butane, and cyclohexane
- know names, structures, and relative E's of ethane, butane, and cyclohexane conformations
- read and write PE diagrams depicting alkane and cyclohexane conformations
- know relative ring strain energies and how they are determined (by heats of comb per CH₂ unit)
- classify strain as (a) angular, (b) torsional, and (c) steric stain
- know preferred cycloalkane conformations - for C3, C4, C5, C6 rings
- write chair cyclohexanes with clearly drawn axial and equatorial substituents
- write both chair forms for a chair cyclohexane and know the chair-to-chair interconversion E barrier
- predict preferred chair conformation of substituted (including disubstituted) cyclohexanes
- define and use substituent A-values and apply ΔG=RTlnK relation for chair/chair equilibria
- write and know relative energies of the half-chair, twist-boat, and boat cyclohexane conformations
- bicycloalkane nomenclature: from structure write name, form name write structure;
- write/recognize decalin, norbornane, steroid, and adamantane ring structures

I. Saturated and Unsaturated Hydrocarbons
II. Alkanes and Alkane Isomers
   A. straight chain (normal) alkanes (C₁ - C₁₂)
   B. constitutional isomers
   C. alkyl groups and classification of C-atoms and H-atoms as 1°, 2°, 3°, or 4°
III. Alkane Nomenclature - IUPAC rules for naming alkanes
IV. Alkane Conformations
   A. ethane
   B. butane
   C. strain energies - torsional, angle, and steric strain
V. Cycloalkanes
   A. nomenclature - denote substituent position(s) and stereochemistry (cis and trans isomers)
   B. isomers - constitutional and stereochemical
   C. stability of cycloalkanes - ring strain
VI. Cycloalkane Conformations
   A. cyclopropane and bent bonds
   B. cyclobutane and cyclopentane
   C. cyclohexane - strain-free chair conformation
      1. chair conformation - with axial and equatorial positions
      2. chair-to-chair interconversion (ring flip) - half-chair, boat, and twist-boat conformations
   D. substituted cyclohexanes
      1. mono-substituted cyclohexanes - the preference of substituents for the equatorial position
      2. conformational equilibrium and ΔG=−RT lnKₑq
      3. disubstituted cyclohexanes
VII. Bicyclic and Polycyclic Alkanes
   A. nomenclature
   B. trans- and cis-decalin, norbornane, and the steroid and adamantane ring systems
VIII. Hydrocarbon Physical Properties and Combustion