• Lewis dot structures and formal charge (on specific atoms)
• Resonance structures
• Functional groups (note that Spartan has some of the groups built in)
• Acid-base question
• Physical properties (predict dipole moment magnitude or large boiling point)
• Line formulae, condensed, expanded (Lewis dot)
• IR (identify functional groups from spectrum or matching)
• IR frequency chart will be available, and $K_a$ or $pK_a$ values will be provided.

• **Spartan problem**

• Nomenclature
  – Alkanes with substituents, stereochemistry
  – Alkenes (*cis* and *trans*, *Z* and *E*)
  – Cycloalkanes (*cis* and *trans*, and equatorial and axial for cyclohexane)
• Conformational analysis and predicting relative energy.
• Cyclohexane conformations – you must be able to draw chair, do ring flips, and figure out which compound is more (or most) stable.
• Isomers
• Testing for chirality; recognizing enantiomers and diastereomers
• Finding stereocenters, and analyzing compounds with multiple centers.
• Assigning absolute configuration (R and S).
• Different types of projections/representations
• Analysis of optical rotation
• Nucleophilic substitution
  – Reaction mechanisms
    • $S_N1$
    • $S_N2$
  – Stereochemistry
  – Leaving groups
  – Nucleophiles
  – Substrates
  – Solvent effects
  – Products
• Elimination reactions
  – Reaction mechanisms
    • E1
    • E2
    • Dehydration
  – Stereochemistry
  – Leaving groups
  – Nucleophiles
  – Substrates
  – Solvent effects
  – Products
• Factors controlling competition between reaction types
- E2 vs SN2 vs SN1 vs E1

- Rearrangement reactions
  - Reaction mechanisms
    - Methyl and alkyl shifts
    - Hydride shifts
  - Products
- Dihalide reactions
  - Synthesizing dihalides
  - Synthesizing alkenes and alkynes

- Mechanism
- Energy profile diagram
- Fill in the blank
- Relative carbocation stability
- Relative alkene stability

Hydrogenation
Addition reaction
  - Hydrogen halide addition
  - Sulfate addition
  - Alcohol synthesis
  - Halohydrin synthesis

Markovnikov’s rule
Zaitsev and Hoffmann products