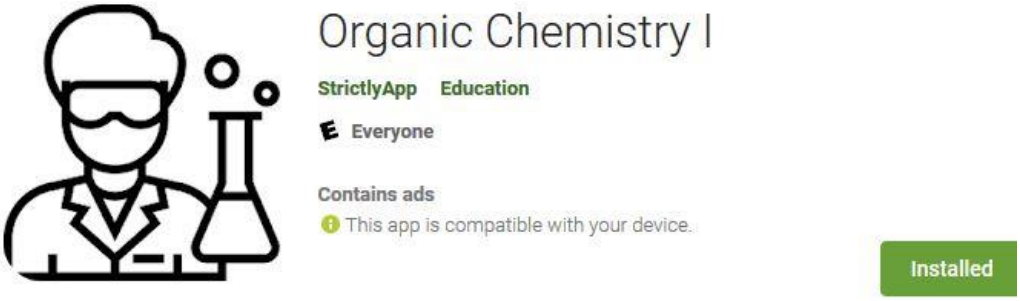
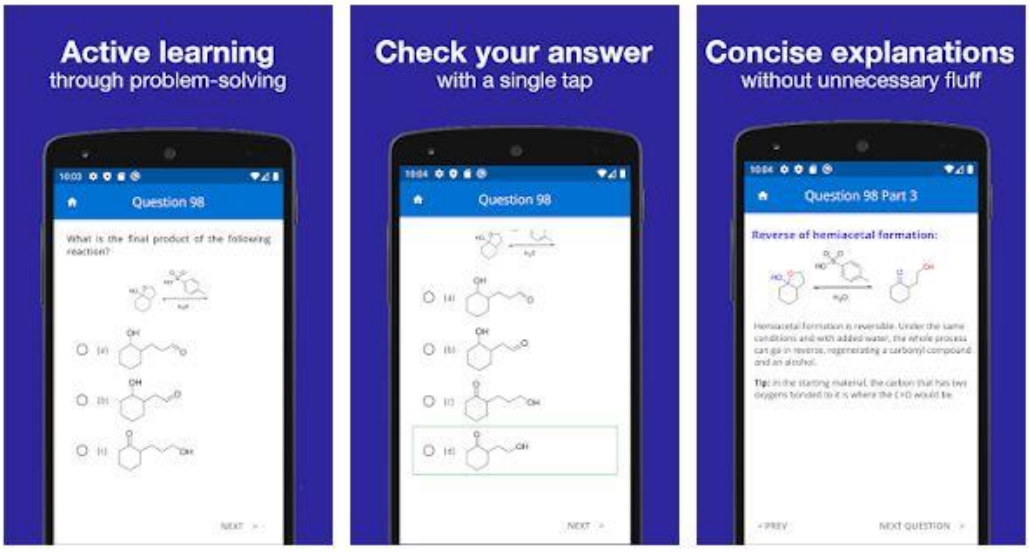
ORGANIC CHEMISTRY I – CHM 1321
WINTER 2020





Free resources for CHM 1321: Organic Chemistry I training app

TOPICS

Part A: Structure

1) Organic molecular structure
   a) "Organic" periodic table
   b) Electronegativity and periodic trends
   c) Drawing organic structures: Lewis & compressed (line) structures
   d) Formal charge method
   e) Polarity
   f) Atomic and molecular orbitals, molecular orbital theory, bonding and antibonding orbitals
   g) Orbital shapes, hybridization, bond angles and structure
   h) σ and π bonds, geometries, relative energies
   i) Dipoles, Van der Waals forces, H-bonding, molecular structure and bulk properties (review/learn on your own)

2) Alkanes
   a) Properties
   b) Line structures
   c) σ bond rotation, conformations, energy potential diagrams, Newman projections, sawhorse projections
   d) Cycloalkanes, ring strain, conformations, configurations, syn/anti and cis/trans terminology.
   e) Chair conformation, axial and equatorial bonds, chair interconversions
   f) Stereochemistry, chiral compounds, configuration and R/S nomenclature, enantiomers, diastereomers and meso compounds, racemic mixtures

Part B: Reactivity

1) Organic reaction mechanisms
   a) Curved arrow notation
   b) Reaction coordinate diagrams
   c) Transition state approximations

2) Acids and bases
   a) Mechanisms of acid-base reactions
   b) Terminology: acid, base, conjugate acid, conjugate base, protonate, deprotonate
   c) Acidity of organic compounds: explain by comparing the relative stability of bases using inductive effects, resonance, electronegativity, atom size, or hybridization.
   d) Predict the direction of an equilibrium
   e) Meaning and use of pK_a values.
   f) Relationship between predominant species at equilibrium, pK_a, and pH (i.e., Henderson-Hasselbalch equation)

3) π bonds as electrophiles
   a) Polarity of bonds. Carbonyl compounds. Effects of resonance. Concept of mechanism, nucleophiles, electrophiles.
   b) Reduction of carbonyl groups. Additions "across" bonds. Sodium borohydride and lithium aluminum hydride.
   c) Imines. Acid catalysis. Sodium cyanoborohydride.
   d) Cyanohydrin formation. Reversal of the reaction. Acid and base catalysis
   e) Grignard reagents. Preparation. Polarity. Acid/base reactions. Carbonyl displacements.
   f) Organo-lithium reagents. Acid/base reactions. Carbonyl displacements. Alkynyl and vinyl nucleophiles.
   g) Hydrate formation. Equilibrium with carbonyl forms. Hemi-acetal formation. Intramolecular reactions and ring formation.
   h) Acid and base catalysis in carbonyl additions. Oxonium ions. Additions to oxoniums.
   i) The principle of microscopic reversibility. Molecular orbitals and reactivity.

4) π bonds as nucleophiles
   a) Markovnikov additions. Hydration. Regiochemistry & stereochemistry.
   b) Anti-Markovnikov additions. Hydroboration-oxidation. Stereochemistry.
   c) Epoxide formation. Concerted mechanisms. Stereochemistry.
   d) Halogenation. Stereochemistry. Halohydrin formation. Regiochemistry.

5) Aromatic compounds as nucleophiles
   a) Aromaticity. Huckel's rule. Antiaromatic compounds. Ions and heterocycles.
   b) Allyl groups and resonance. Allyl cation and anion.
   c) Electrophilic aromatic substitution. Directing groups. Electrophiles. Heterocycles.
   d) Manipulations of directing groups. Reductions. Hydrolysis.
   e) Multi-step synthesis. Retrosynthetic analysis. Disconnections.
   f) Directed metallation. Directing groups. Strong bases. Electrophiles.