CHEM 344 Midterm Exam Study Guide

Purification techniques

Acid-Base Extraction

identification and reactions of acids and bases (organic and inorganic);

formation and solubilities of conjugate acids and bases;

relative solubilities and densities of solvents used in lab (don't need exact numbers);

washing, neutralization, and drying steps – how are they done, why are they needed?

difference between extraction and washing.

Distillation

identification and correct/safe set-up of distillation apparatus;

difference between distillation and refluxing (what does each one accomplish?)

Recrystalization

why/how we do it;

how it works;

what makes a good recrystalization solvent (think about solubility *vs*. temperature)

melting ranges (broad *vs*. sharp as indicator of purity);

mixed melting point determination

Spectroscopic techniques

NMR

determination of structure by NMR spectroscopy (quiz/problem set questions);

use of coupling constants in alkyl/aromatic/alkene systems;

NMR chemical shift trends and ranges (chem. shift table will be provided);

use of integration values to calculate relative ratios of compounds in a mixture;

common impurities in a ^{1}H-NMR spectrum (Appendix K in lab manual)

IR

Use of IR spectroscopy for functional group identification (table will be provided).

GC-MS

use of GC-MS to assess purity of a reaction mixture or product;

types of species that are/are not detected by EI-MS;

correct drawing of molecular ions and fragments;

common isotope patterns.

Oxidation of 4-*tert*-butyl-cyclohexanol
identification of common oxidizing agents;

oxidation products of organic compounds;

generation of oxidizing agent used in lab experiment;

use of TLC to monitor the progress of a reaction;

calculation of R_f values on a TLC plate;

relative polarities of common solvents and functional groups in TLC (website handout);

use of starch-KI paper to determine presence of oxidant;

types of drying agent and their appropriate use

Nucleophilic substitution reactions (also covered in CHEM 343)
identification of S_N1 and S_N2 reactions & appropriate substrates and conditions for each;

mechanisms of S_N1 and S_N2 reactions.

Elimination reactions (also covered in CHEM 343)
identification of E1 and E2 reactions & appropriate substrates and conditions for each;;

mechanisms of E1 and E2 reactions;

thermodynamic *vs.* kinetic control;

Zaitzev's rule.

WebMO
use of WebMO data (energies, atomic charges, molecular orbitals, hybridization) to explain simple structural and reactivity trends;

relationship between # p-atomic orbitals and # π-molecular orbitals;

features of a potential energy surface (transition states, intermediates, activation energy).

absolute and relative energies of molecules.

Other
lab safety, appropriate disposal of waste;

calculation of mass, volume, molar amounts of reagents;

calculation of % yield of product.