

Organic Chemistry: CHEM 331

Fall 2000 - Whittier College

Problem Set #4

September 27, 2000

Use separate pieces of paper to answer these questions.

1. When 77% optically pure 1,3-dimethylcyclopentene is reacted with hydrogen gas in the presence of platinum on carbon, two products are observed by NMR.
 - 1a. Draw a graphical representation of the reaction. What reaction is occurring?
 - 1b. What is(are) the product(s) from this reaction? If you predict more than two products, explain why only two products are observed by NMR.
 - 1c. What is the reaction mechanism for formation of the product(s)? Include a drawing of any important transition states.
 - 1d. What is the optical purity for each product?

2. When (5R) 1,5-dimethylcyclopentene is reacted, first with borane in tetrahydrofuran and then with hydrogen peroxide, sodium hydroxide in water, two products, Compounds A&B are observed by NMR in a 55:45 ratio, respectively. When (3R) 1,3-dimethylcyclopentene is reacted, first with borane in tetrahydrofuran and then with hydrogen peroxide, sodium hydroxide in water, two products, Compounds C & D are observed by NMR in a 80:20 ratio, respectively.
 - 2a. Draw a graphical representation for each reaction. What general reaction is occurring?
 - 2b. What are the structures of A & B?
 - 2c. What are the structure of C & D?
 - 2d. What is (are) the reaction mechanism(s) for formation of the product(s)? Include a drawing of any important transition states.
 - 2e. Using your mechanism, explain why there is a preference for the formation of A over B.
 - 2f. Using your mechanism, explain why there is a preference for the formation of C over D?
 - 2g. Why do you see a difference in selectivity (A over B versus C over D) between the two different starting materials?

3. Propose structures for each of the lettered compounds. Be sure to include an explanation of your choices.

Two isomeric compounds, E & F, have the formula C_9H_{18} . Both react with H_2 in the presence of Pd on carbon catalyst to give the same compound, 2,6-dimethylheptane, G. Both E and F react with HCl in dichloromethane to give just one product, H. On the other hand, E reacts with Cl_2 in carbon tetrachloride solvent to give a single product, I. F also reacts with Cl_2 in carbon tetrachloride solvent to give a single product, J, which is different from I.