

**Phillips**  
**CHE 255: Organic Chemistry I**  
**Test 3 Review Sheet**

**General details**

- This test will cover elements of Chapter 7, 8, & 10
- 20 questions, mixture of multiple choice and short answer
- 2 questions directly from homework problems
- You **will** be provided with the following resources: periodic table, pKa table, 3 extra sheets of paper
- You are allowed to bring models **preassembled** for the test. I suggest a tetrahedral, cyclohexane and butane, with lots of extra atoms of various colors.
- You will have one **bonus** question

**Specific details**

- Addition reactions of alkenes: be able to identify electrophiles, nucleophiles, stereochemistry of the products, and be able to identify the intermediates of addition reactions in chapter 8
  - HX
  - IBr or ICl
  - cold H<sub>2</sub>SO<sub>4</sub>
  - H<sup>+</sup>, H<sub>2</sub>O (H<sub>3</sub>O<sup>+</sup>)
  - (1) Hg(OAc)<sub>2</sub>/THF-H<sub>2</sub>O; (2) NaBH<sub>4</sub>, OH<sup>-</sup>
  - (1) BH<sub>3</sub>:THF; (2) H<sub>2</sub>O<sub>2</sub>, OH<sup>-</sup>
  - X<sub>2</sub>, CCl<sub>4</sub>
  - X<sub>2</sub>, H<sub>2</sub>O
  - (1) OsO<sub>4</sub>, pyridine; (2) NaHSO<sub>4</sub>, H<sub>2</sub>O
  - cold KMnO<sub>4</sub>, OH<sup>-</sup>, H<sub>2</sub>O
  - (1) KMnO<sub>4</sub>, OH<sup>-</sup>, H<sub>2</sub>O, hot; (2) H<sup>+</sup>
  - (1) O<sub>3</sub>, CH<sub>2</sub>Cl<sub>2</sub>; (2) Zn/HOAc
- be able to repeat the previous bullet with alkynes; remember the products obtained from the alkyne addition reaction can be different products than those obtained from the alkene addition reaction – know which reactions produce different products
- What is Markovnikov's rule, and how does this apply to addition reactions?
- Be able to predict radical stabilities in a series
- Be able to predict the products of free radical halogenation reactions of chlorine and bromine.
- What do we mean by the fact that "bromine atom is both less reactive and more selective than chlorine atom in free radical halogenation reactions"?
- Know products and stereochemistry from the reaction of HBr/ROOR and how does this reaction differ from the addition of HBr with no peroxides?
- Know the 3 steps of the free radical halogenation mechanism - initiation, propagation, and termination – and be able to identify them or provide examples if asked.
- Considering all elements: structure of alkyl halide, nucleophile or base, solvent, and leaving group all contribute to determining the mechanism and rate of reaction. You should be able to predict which mechanism (S<sub>N</sub>1, S<sub>N</sub>2, E1, or E2) is likely to occur and why for a given reaction
- Solvent effects of reactions (S<sub>N</sub>1, S<sub>N</sub>2, E1, or E2) will be covered on this test
- Be able to use the (E)-(Z) system of nomenclature to assign names to alkenes
- Know the order of stability for substituted alkenes
- What is Zaitsev's rule?

- What is a catalyst? And how does it work? Can you show this on an energy diagram? (Section 7.14)
- Be able to recognize a dehydrohalogenation reaction and predict products and stereochemistry – you will be asked to use this reaction in the synthesis of alkenes and alkynes
- Be able to convert a sawhorse structure to a Newman projection and provide the mechanism for an E2 elimination reaction correctly predicting product structure and stereochemistry
- Why is there a requirement for the proton and leaving group to be anti-coplanar?
- Be able to predict the order of reactivity of alcohols in the acid-catalyzed dehydration
- Be able to discuss the E1 mechanism of the acid-catalyzed reaction of alcohols, know steps 1-3 on pages 281-282
- Be able to discuss the E2 mechanism of the acid-catalyzed reaction of alcohols (Section 7.7C); what substrates favor E1 vs E2 dehydration reactions?
- BEWARE OF CARBOCATION REARRANGEMENTS, YOU WILL HAVE ONE
- You were introduced to the catalytic hydrogenation of alkenes and alkynes in Chapter 6; Chapter 7 provides the mechanism of heterogeneous catalytic hydrogenation pictured in Figure 7.10. Be able to explain why this reaction is a “syn” addition, and predict the products.
- Know the reagents that will give you an anti-addition of hydrogen to produce trans-alkenes; you will use this in a synthesis question