**CHE2060 Lecture 7 HW: Reaction mechanism overview**

Problems must be solved, or written out, in their entirety with all work shown on engineering graph paper. You must label each set in the upper left hand corner with your name, the date and the chapter. Problems must be identified by number and all work must be shown with answers boxed.

**7.1: Reaction energies & transition states**

1. Rank the relative energies of:

a. reactants

b. transition states

c. products

2. What is activation energy?

**7.2: Review of acid-base reaction mechanisms**

3. In an acid-base reaction, which attacks, the electrophile or the nucleophile?

4. What two numbers can you use to determine whether the reactants or products of a reaction are favored?

5. What is a ‘leaving group’?

**7.4: Substitution reactions**

6. In each reaction, is the nucleophile the substrate or reactant?

a. SN1 reactions

b. SN2 reactions

c. electrophilic substitutions

7. Substitution: 2-chloropentane + water 🡪

1. Draw line-bond structures of the substrate and reactant;
2. Identify Nu: and E+ when appropriate;
3. What type of substitution mechanism occurs?
4. Predict the product and by-product on the right & draw their line-bond structures;
5. Use arrows to show the movement of electrons needed to create the products and use as many steps as needed – be sure to show any intermediates;
6. Re-write each reaction in a simplified form, showing reactant above the arrow and by-product leaving at the arrow; and
7. Does the reaction create any new chiral carbon(s)?

8. Substitution: 2-chloropentane + hydroxide ion

1. Draw line-bond structures of the substrate and reactant;
2. Identify Nu: and E+ when appropriate;
3. What type of reaction mechanism occurs
4. Predict the product and by-product on the right & draw their line-bond structures;
5. Use arrows to show the movement of electrons needed to create the products and use as many steps as needed – be sure to show any intermediates;
6. Re-write each reaction in a simplified form, showing reactant above the arrow and by-product leaving at the arrow; and
7. Does the reaction create any new chiral carbon(s)?

**7.5: Addition reactions**

9. In addition reactions, atoms or groups are added to substrates from reactants. Yet, no atom or group leaves the substrate. How or why is that possible?

10. Addition: 2-hexene + HCl

1. Draw line-bond structures of the substrate and reactant;
2. Identify Nu: and E+ when appropriate;
3. What type of addition reaction is this?
4. Predict the product and by-product on the right & draw their line-bond structures;
5. Use arrows to show the movement of electrons needed to create the products and use as many steps as needed – be sure to show any intermediates;
6. Re-write each reaction in a simplified form, showing reactant above the arrow and by-product leaving at the arrow; and
7. Does the reaction create any new chiral carbon(s)?

11. Addition:

1. Identify Nu: and E+ when appropriate;
2. What type of addition reaction is this?
3. Predict the product and by-product on the right & draw their line-bond structures;
4. Use arrows to show the movement of electrons needed to create the products and use as many steps as needed – be sure to show any intermediates;
5. Re-write each reaction in a simplified form, showing reactant above the arrow and by-product leaving at the arrow; and
6. Does the reaction create any new chiral carbon(s)?



**7.6: Elimination reactions**

12. Elimination reactions remove atoms or groups that become by products and create products with what common characteristic?

13. Elimination:



1. Identify Nu: and E+ when appropriate;
2. Predict the product and by-product on the right & draw their line-bond structures;
3. Use arrows to show the movement of electrons needed to create the products and use as many steps as needed – be sure to show any intermediates;
4. Re-write each reaction in a simplified form, showing reactant above the arrow and by-product leaving at the arrow; and
5. Does the reaction create any new chiral carbon(s)?

14. Elimination:

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1. Identify Nu: and E+ when appropriate;
2. Predict the product and by-product on the right & draw their line-bond structures;
3. Use arrows to show the movement of electrons needed to create the products and use as many steps as needed – be sure to show any intermediates;
4. Re-write each reaction in a simplified form, showing reactant above the arrow and by-product leaving at the arrow; and
5. Does the reaction create any new chiral carbon(s)?

**7.7: Competition between substitution, addition & elimination reactions**

15. When a number of different reaction mechanisms are possible, what does the nature of the substrate determine?

16. When a number of different reaction mechanism are possible, what does the nature of the nucleophile determine?