Worksheet Week 9

1) Draw curvy arrows for the following reaction to denote where the electrons travel.

\[ \text{Cl} \quad \text{O} \quad \text{H} \quad \text{H} \quad \text{3} \quad \text{C} \quad \text{O} \quad \text{CH}_3 \quad \text{OH} \quad \text{CH}_3 \quad \text{OH} \quad + \quad \text{CH}_3 \text{OH} \quad \text{2} \]

\[ \text{A} \quad \text{B} \quad \text{C} \quad \text{D} \]

Step 1

Step 2

Step 3

a) Which step is the slow step? Is it endothermic or exothermic? 

b) Which step is the fast step? Is it endothermic or exothermic? 

c) Would the entire reaction be considered endothermic or exothermic? 

d) What kind of reaction is A to C called (Lewis acid-base, addition, substitution, elimination, or Bronsted)? 

e) What kind of reaction is B to C called (Lewis acid-base, addition, substitution, elimination, or Bronsted)? 

f) What kind of reaction is C to D called (Lewis acid-base, addition, substitution, elimination, or Bronsted)? 

g) Identify the intermediate that is part of the highest energy transition state. 

h) Classify the name of the overall reaction from A —> D called (addition, substitution, or elimination)? 

i) Write down the rate equation for this reaction. 

j) If the concentration of A is doubled, what would happen to the reaction rate? 

k) If the concentration of CH\text{3OH} is doubled, what would happen to the reaction rate?
1) If the concentration of A and of CH₃OH is doubled, what would happen to the reaction rate?

2. Give the IUPAC name for each compound.

![Chemical structures](image)

3. Draw the products of each nucleophilic substitution reaction and which reaction is stronger.

   a) 
   ![Chemical structure](image) + :OH⁻ → ![Chemical structure](image)

   b) 
   ![Chemical structure](image) + :Cl⁻ → ![Chemical structure](image)

4. Which of the following statements is wrong?

   a) It is not necessary for a nucleophile to have an unshared electron pair.

   b) A species can react as an electrophile if it contains an atom (other than hydrogen) with an incomplete valence octet.

   c) A species can react as an electrophile, even if it has one or more unshared electron pairs.

   d) Any species bearing a lone pair can normally react as a nucleophile.

5. Which of the following cannot react as a nucleophile?

   a) H₂C=CH₂

   b) BH₃

   c) H₂C=NH

   d) CH₃CH₂SH