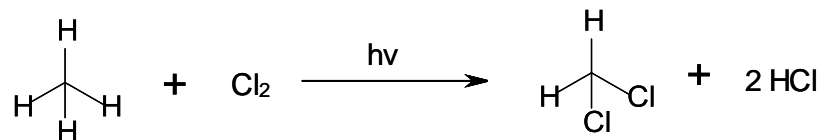


- I. Write the following definitions
 - a. Addition reactions
 - b. Elimination reactions
 - c. Substitution reactions
 - d. Rearrangement reactions
 - e. Radical reactions
 - i. 3 main steps
 - f. Polar reactions
 - g. Hydrohalogenation
 - h. Markovnikov's rule
 - i. Non-Markovnikov's rule
 - j. Reaction mechanism
 - k. Homolytic cleavage
 - l. Heterolytic cleavage
 - m. Radical
 - n. Carbocation
 - o. Carbanion
 - p. Electrophile
 - q. Nucleophile
 - r. Exothermic
 - s. Endothermic
 - t. Gibb's Free Energy change

- u. Enthalpy
 - v. Entropy
 - w. Equilibrium constant expression
 - x. Rate of a reaction
 - y. Bond dissociation energy
 - z. Energy of activation
 - aa. Transition state
 - bb. Intermediate
 - cc. Catalyst
- II. Show the polarity patterns for the following functional groups (δ^- & δ^+)
- a. Ketone
 - b. Ester
 - c. Carboxylic acid
 - d. Aldehyde
 - e. Acetyl chloride
 - f. Alcohol
 - g. Thiol
 - h. Nitrile
 - i. Ether
 - j. Alkyl halide
 - k. Amine
 - l. Nitrile
 - m. Grignard Reagent

- III. Draw an energy diagram for a one step reaction with $K_{eq} < 1 \times 10^{-3}$ label
- Reactants
 - Transition state
 - Products
 - Energy of activation
 - ΔH
 - Exothermic or endothermic
- IV. Draw an energy diagram for a one step reaction with $K_{eq} > 1 \times 10^3$ label
- Reactants
 - Transition state
 - Intermediate
 - Products
 - Energy of activation 1
 - Energy of activation 2
 - ΔH
 - Exothermic or endothermic
- V. Draw an energy diagram for a 2 step exothermic reaction when the second step is faster than the first step
- VI. The addition of water to ethylene to yield ethanol has the following thermodynamic parameters $\Delta H^\circ = -44 \text{ kJ/mol}$ $\Delta S^\circ = -0.12 \text{ kJ/K}\cdot\text{mol}$ $K_{eq} = 2.4 \times 10^5$
- Is this reaction exothermic or endothermic?
 - Is this reaction favored in the forward or reverse direction? Why?
 - Is this reaction spontaneous at room temp?

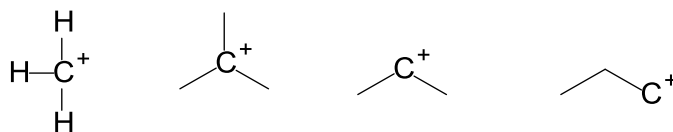
- VII. Draw the complete mechanism for the following radical reaction



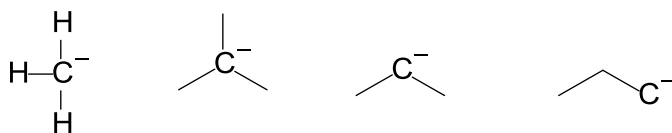
- VIII. Draw the complete mechanism for the following hydrohalogenation
- Do you get 1 or 2 alkylhalide products?
 - Is this reaction Markovnikov?



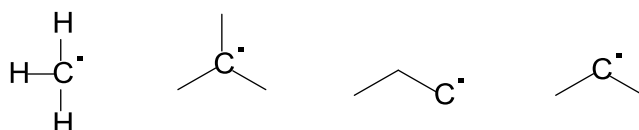
IX. List the following carbocations from least stable to most stable and explain why



X. List the following carbanions from least stable to most stable and explain why

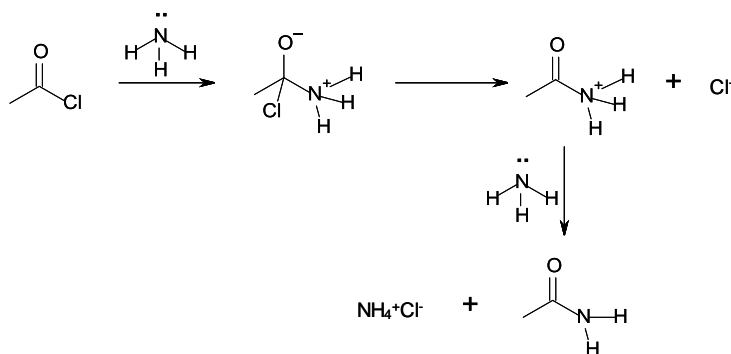


XI. List the following radicals from least stable to most stable and explain why

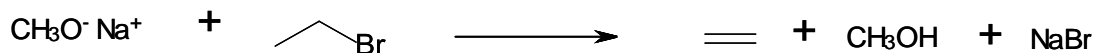


XII. Add curved arrows to the following reactions to indicate the flow of electrons

a.



b. 1 step



c.

