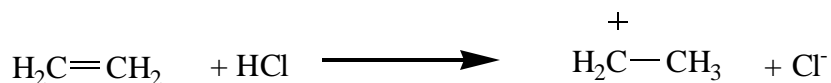
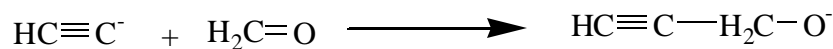
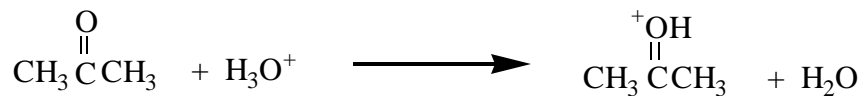
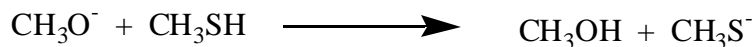
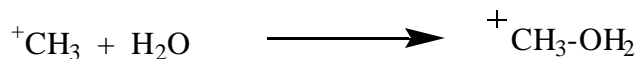
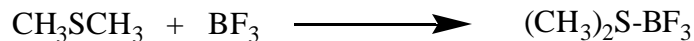


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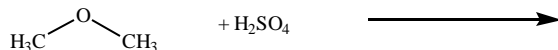
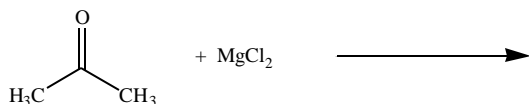
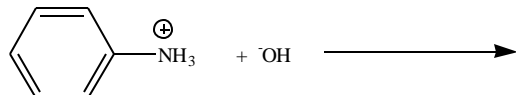
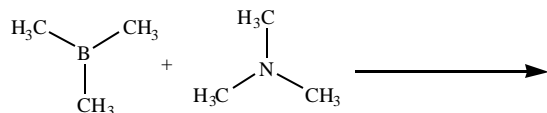
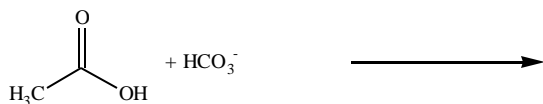
Problem Set #1

Due 10/27

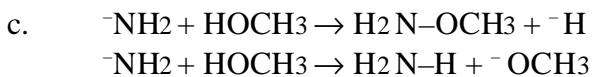
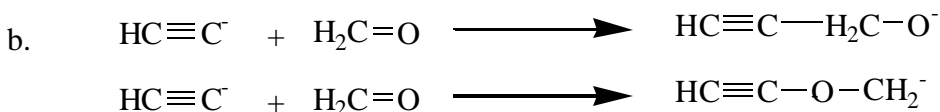
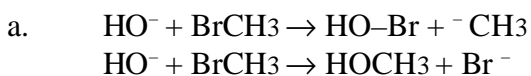
- The following isomers of molecular formula C_5H_{12} were treated under appropriate conditions to give all possible monochloro derivatives, $C_5H_{11}Cl$, in which H's are replaced by Cl. These $C_5H_{11}Cl$ constitutional isomers, derived from each C_5H_{12} compound, could be separated either by careful fractional distillation or by gas chromatography (GC). Give the structures of the C_5H_{12} compounds and the $C_5H_{11}Cl$ derivatives indicated below. Also, name each of these compounds.
 - A C_5H_{12} compound that gives three $C_5H_{11}Cl$ derivatives.
 - A C_5H_{12} compound that gives four $C_5H_{11}Cl$ derivatives.
 - A C_5H_{12} compound that gives only one $C_5H_{11}Cl$ derivative.
 - Also give the structure of a C_8H_{18} compound that gives only one $C_8H_{17}Cl$ derivative. Give the structure of the derivative as well.
- Draw complete Kekule structures of reactants and products using lines for bonds, showing non-bonding electron pairs, and indicating formal charges on atoms. Identify the acid and the base for each reaction. Use curved arrows to show the movement of electron pairs as the reactions proceed from left to right.



3. Predict the product(s) for the following reactions. The ideas that you used in the previous problems will be useful.



4. For each of the following pairs of reactions, draw each reaction using 3-dimensional kekulé structures and predict which reaction would occur with the fastest rate and clearly *explain your choices*.



5. Using only chair conformations, make and draw molecular models for all of the 1,4-dibromocyclohexanes. Clearly indicate which are related as conformational isomers and which are related as configurational isomers. Designate the configurational isomers as *cis* or *trans*. **Explain** which isomers equilibrate rapidly with each other (interconvert).

6. The addition of HBr to 2-methylpropene can, in principle, give either 1-bromo-2-methylpropane or 2-bromo-2-methylpropane. In practice, only the latter is formed. Show mechanisms for the formation of each of these alkyl bromides, using curved arrows to indicate the movement of electron pairs. Also, construct reaction energy diagrams that describe the energy of the system as a function of the progress of the formation of each alkyl bromide. Use these reaction coordinate diagrams to **explain** why 2-bromo-2-methylpropane is the only product.
7. The cyano group (-CN) can be hydrolyzed to a carboxylic acid group (-CO₂H). During this complex process, the steric size increases relative to that of the original cyano group. Any steric interaction of the cyano group with the rest of the molecule would tend to slow down its hydrolysis. Draw the most stable conformation for *cis*- and for *trans*-4-*t*-butyl-1-cyanocyclohexane and, on the basis of the above information, predict which isomer would hydrolyze most rapidly. Construct a reaction energy diagram that illustrates your analysis.
8. The addition of Br₂ to *cis*-4-*t*-butyl-5-methylcyclohexene yields predominantly one stereoisomeric compound.
- What is the general reaction that is occurring?
 - What is the specific reaction for the given starting material and what are the possible products?
 - Which product is the major product?
 - Using the mechanism of the reaction and an energy diagram, explain your answers.