

3. Write a chemical equation for a possible light-catalyzed substitution reaction of bromine with cyclohexane. Did you observe any evidence for this reaction?
4. The light-catalyzed reaction of bromine with toluene leads to substitution of the CH_3 — group attached to the aromatic ring. (a) Write a chemical equation for this reaction. (b) What was the purpose of the litmus paper test in this reaction?
5. Summarize the observed reactions of cyclohexane, cyclohexene, and toluene with bromine. Describe: (a) the relative rates of reaction for the three hydrocarbons; (b) the type of reaction that occurred; (c) whether a catalyst was required; and (d) the formation of by-products.
6. What were the observations for a positive test result in the reaction of cyclohexene with potassium permanganate? Write an equation for this reaction.

7. Adding iron to a mixture of toluene and bromine may catalyze a second type of substitution reaction, in which bromine replaces an aromatic C—H bond in the ring. (a) Draw structures for the three different substitution products that are possible in this aromatic substitution reaction. (b) Use resonance to explain why these are the only unique compounds that may be obtained.
8. Describe observations for the chemical reaction that took place when styrene was heated.
9. Polymer solutions or polymer “melts” are generally viscous—thick and slow to pour. Viscosity is related to the difficulty molecules have in slipping past each other. Why do polymers have a higher viscosity than monomers or other small molecules?
10. Write a chemical equation for the reaction of calcium carbide with water and describe the experimental evidence for each product of this reaction.

11. Did complete or incomplete combustion occur when acetylene was burned? Write equations for the two possible combustion pathways. What factor determines which pathway will predominate?
12. Fats and oils consist of long hydrocarbon chains attached to ester functional groups. (a) What do the terms saturated, unsaturated, and polyunsaturated imply about the structures of the hydrocarbon “tails” in fats and oils?
(b) Predict the chemical reaction used to prepare “partially hydrogenated” vegetable oils.
13. Explain the observed trend in the boiling points of straight-chain alkanes based on the strength of their intermolecular forces.