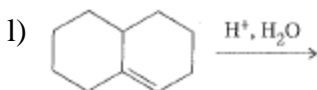
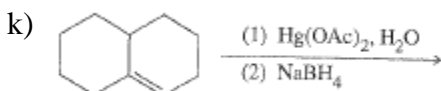
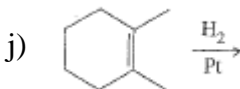
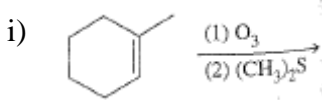
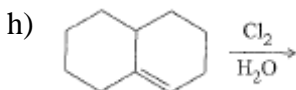
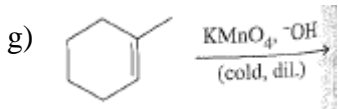
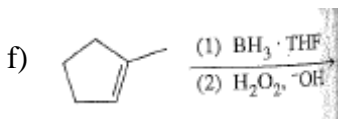
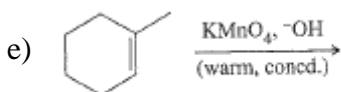
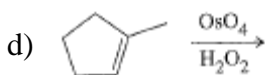
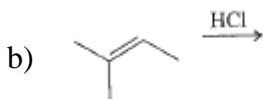
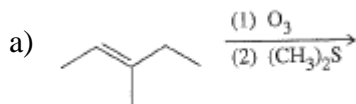
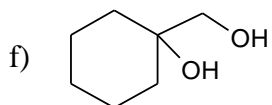
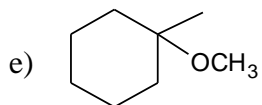
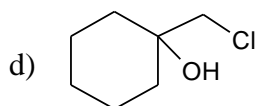
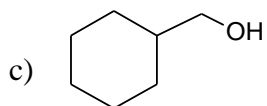
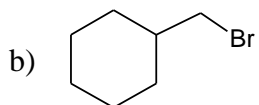
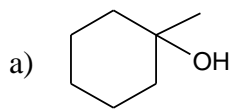
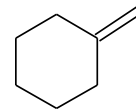


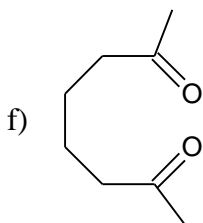
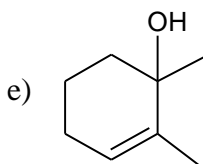
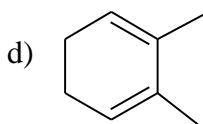
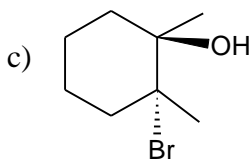
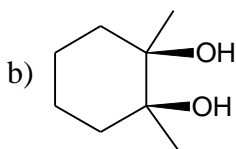
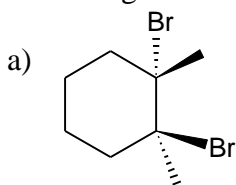
1. Predict the major products of the following reactions. Include stereochemistry where appropriate.



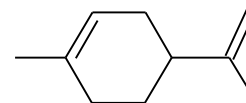
2. Show how you will synthesize the following compounds using methylene cyclohexane (shown on the right)



3. Using 1,2-dimethylcyclohexene as your starting material, show how you will synthesize the following compounds. Once you have shown how to make one compound, you can use that as starting material for another compound in the problem.

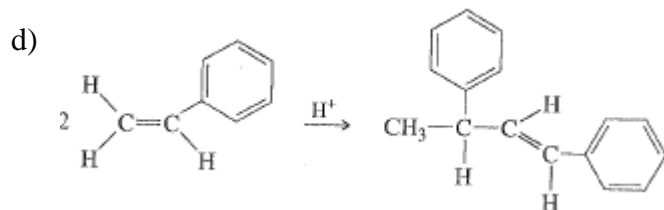
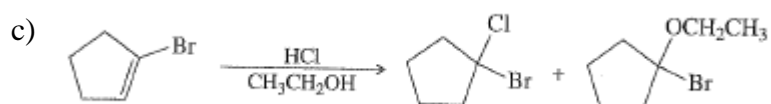
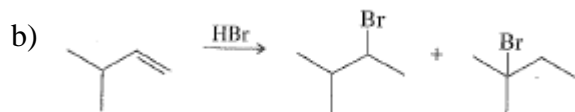
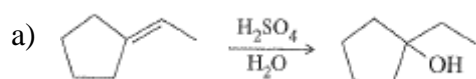


4. Limonene is one of the compounds that give lemons their tangy odor. Show the structures of the products expected when limonene with an excess of each of these reagents.

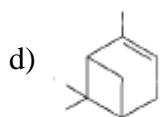
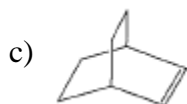
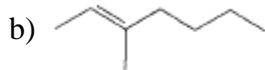
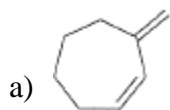


- a) Borane in tetrahydrofuran, followed by hydrogen peroxide.
- b) Ozone, then dimethyl sulfoxide
- c) Osmium tetroxide
- d) Hot concentrated potassium permanganate
- e) Hydrogen and a platinum catalyst
- f) Hydrogen bromide gas
- g) Bromine water
- h) Chlorine gas
- i) Mercuric acetate in methanol followed by sodium borohydride

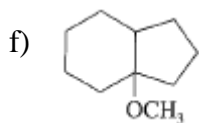
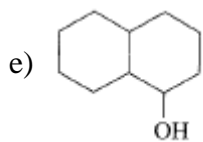
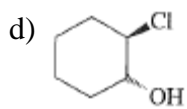
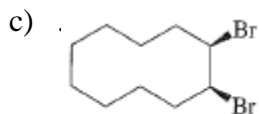
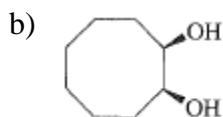
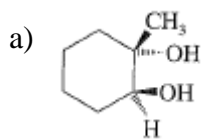
5. Propose a mechanism for the following reactions.



6. Give the products expected when the following are ozonized.



7. Show how you will make the following compounds using a suitable alkene.



8. An unknown, **X**,  $C_5H_9Br$ , does not react with bromine or dilute  $KMnO_4$ . Upon treatment with potassium tert-butoxide, **X** gives only one product, **Y**,  $C_5H_8$ . Unlike **X**, **Y** decolorizes bromine and changes  $KMnO_4$  from purple to brown. Catalytic hydrogenation of **Y** gives methylcyclobutane. Ozonolysis-reduction of **Y** gives dialdehyde **Z**,  $C_5H_8O_2$ . Propose consistent structures for **X**, **Y** and **Z**. Is there any aspect of structure of **X** that is still unknown?

9. The sex attractant of the housefly has the formula  $C_{23}H_{46}$ . When treated with potassium permanganate, this pheromone gives two products:  $CH_3(CH_2)_{12}COOH$  and  $CH_3(CH_2)_7COOH$ . Suggest a structure for this sex attractant. Explain which part of the structure is uncertain.

10. In contact with a platinum catalyst, an unknown alkene reacts with 3 equivalents of hydrogen gas to give 1-isopropyl-4-methylcyclohexane. When the unknown alkene is ozonized, the products are the following:

