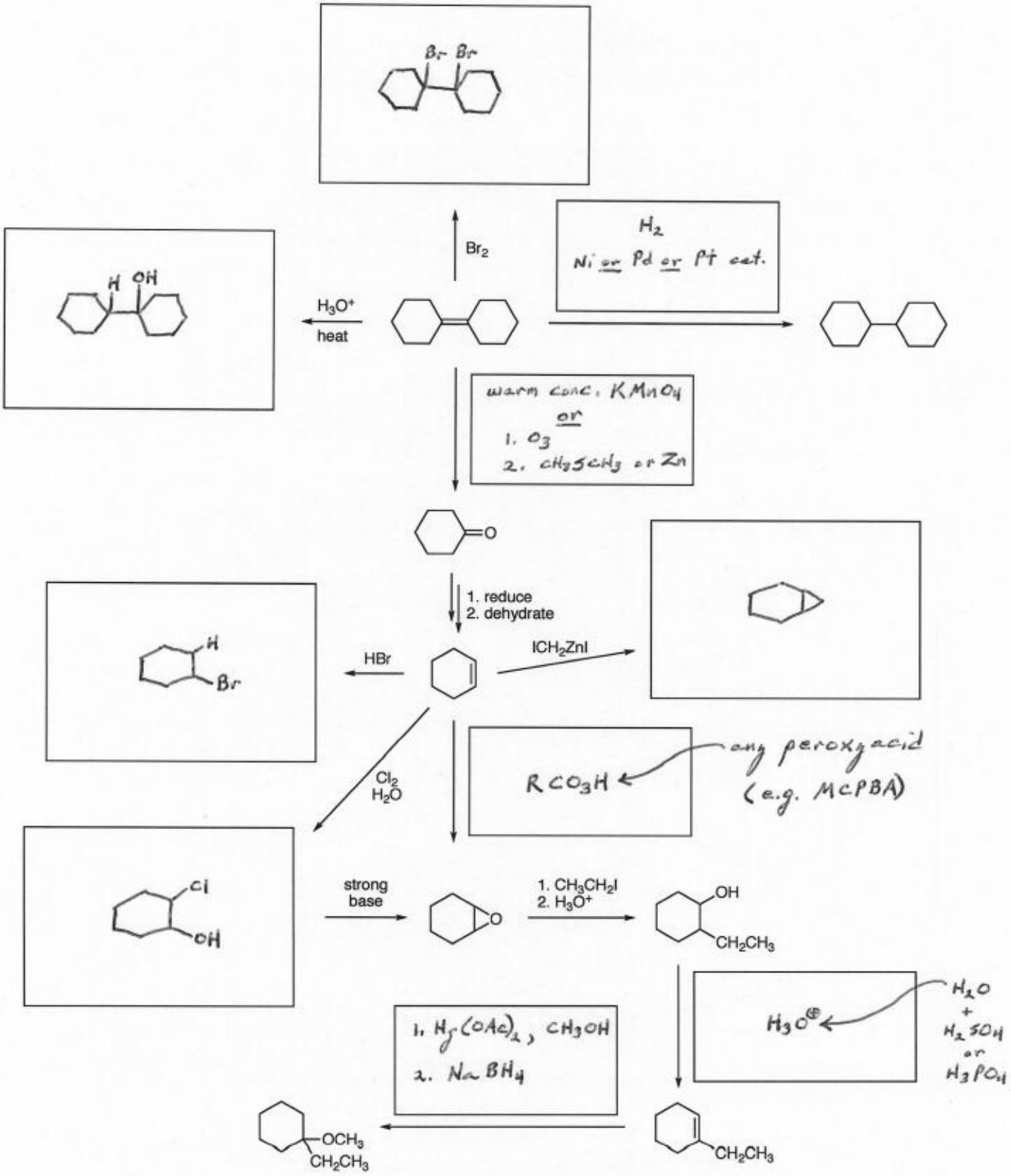
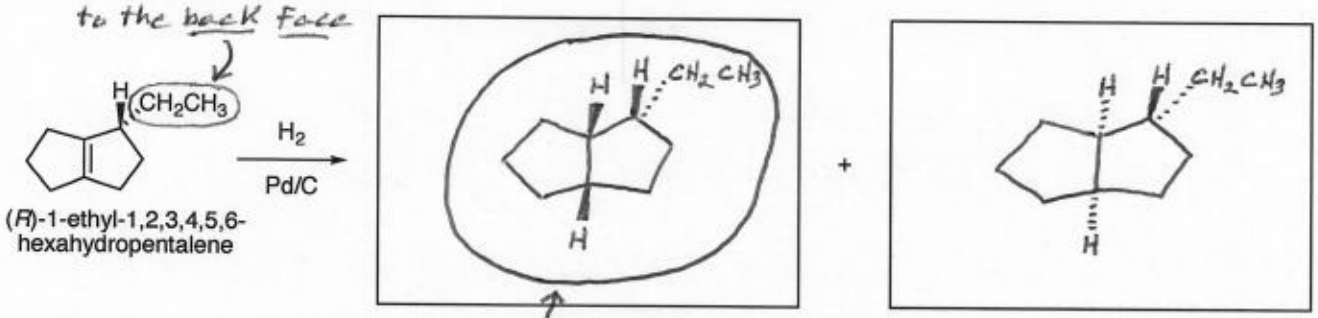
Name: Solutions [1 pt]

1. Provide the missing starting material, major product, or reagent/set of reagents in the boxes provided. Use numbers to indicate the order in which reagents should be added for any reactions that require more than one step. [30 pts; 3 pts each]



2. a. Catalytic hydrogenation of *(R)*-1-ethyl-1,2,3,4,5,6-hexahydropentalene yields a mixture of two products in a 20:1 ratio. Draw the two products using dashed lines and wedges to indicate stereochemistry at all stereocenters. [6 pts; 3 pts each]

hinders addition to the back face



b. Circle the major product. [3 pts]

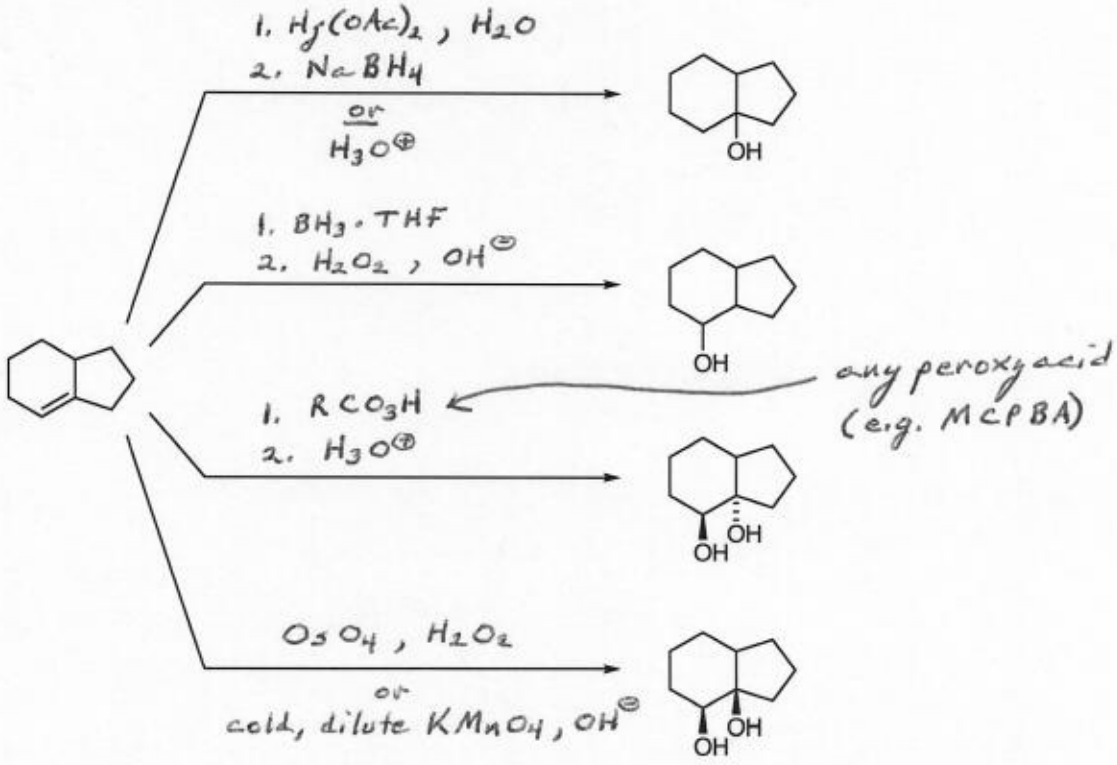
c. True or false— addition of hydrogen across the C=C bond will still occur in the absense of a Pd metal catalyst, only more slowly . Circle your answer. [3 pts]

True (False)

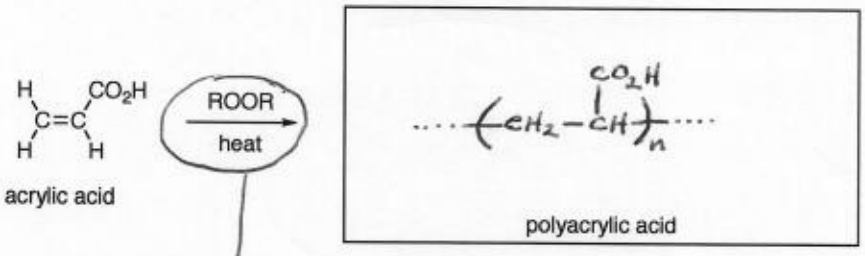
d. True or false— addition of hydrogen across the C=C bond occurs via *anti* addition. Circle your answer. [3 pts]

True (False)

3. Show how to convert the alkene below into the corresponding four alcohols shown by writing the reagent or set of reagents on the reaction arrows. Use numbers to indicate the order in which reagents should be added for any reactions that require more than one step. [12 pts; 3 pts each]



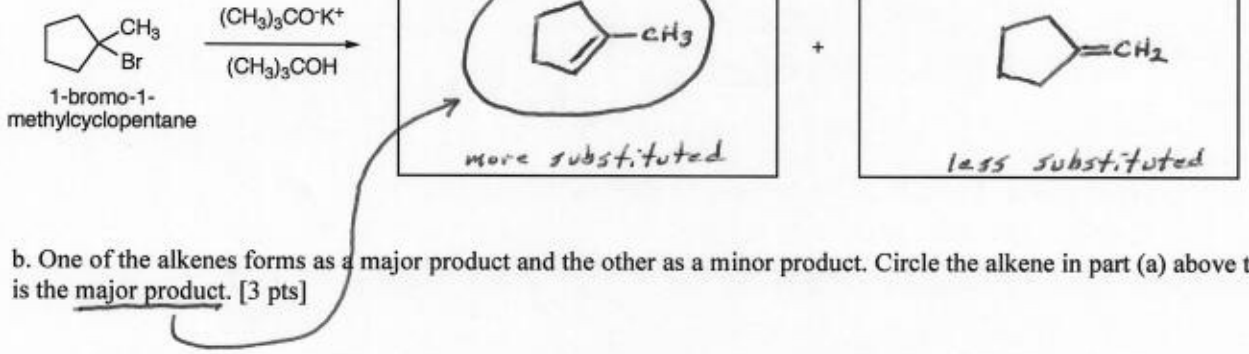
4. a. Polyacrylic acid is used in disposable diapers because it can absorb up to 200 times its weight in water. Polyacrylic acid is synthesized by heating a solution of acrylic acid containing a peroxide as shown. Draw the structure of the polymer polyacrylic acid in the box provided. [3 pts]



b. What type of polymerization reaction is involved in the formation of polyacrylic acid? Circle your answer. [3 pts]

cationic polymerization radical polymerization anionic polymerization

5. a. Reaction of 1-bromo-1-methylcyclopentane with a strong, bulky, sterically-hindered base such as potassium *t*-butoxide in *t*-butanol as the solvent gives two different alkenes as products, as shown below. Draw the two different alkenes that form from this reaction in the boxes provided. [6 pts; 3 pts each]



b. One of the alkenes forms as a major product and the other as a minor product. Circle the alkene in part (a) above that is the major product. [3 pts]

6. a. An unknown hydrocarbon has the formula $C_{10}H_{18}$. Indicate the number of elements (degrees) of unsaturation in the box provided. [3 pts]

number of elements (degrees) of unsaturation = 2

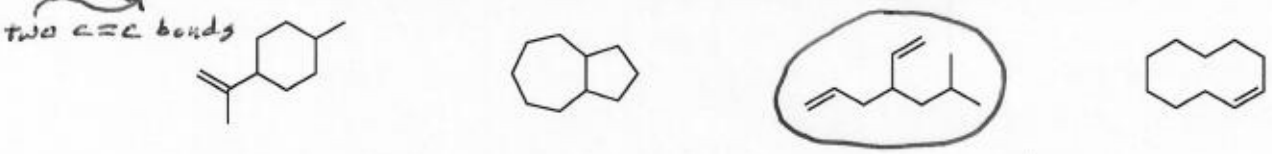
$C_{10}H_{22}$ ← saturated alkane

$-C_{10}H_{18}$

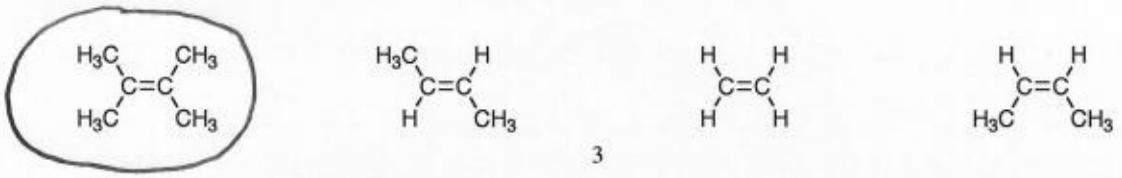
H_4 ⇒ 2 elem./deg. unsat.

b. You place the hydrocarbon into a flask with excess HBr and find that one mole of the hydrocarbon reacts with two moles of HBr. Which one of the following molecules could be the unknown compound? Circle your answer. [3 pts]

two C=C bonds

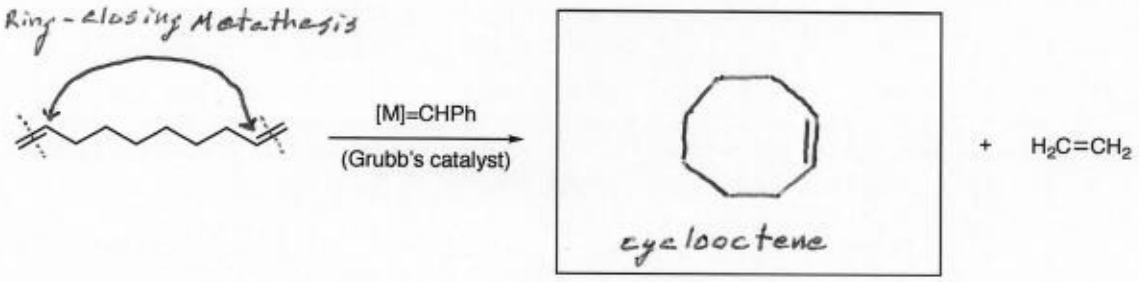


7. Circle the alkene that will be *most* reactive toward acid-catalyzed hydration with H_3O^+—that is, the alkene that will undergo electrophilic addition at the fastest rate. [3 pts]

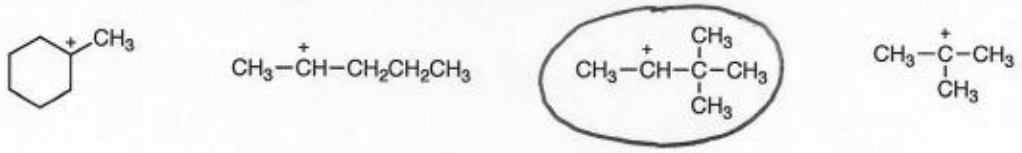


Forms a 3° carbocation

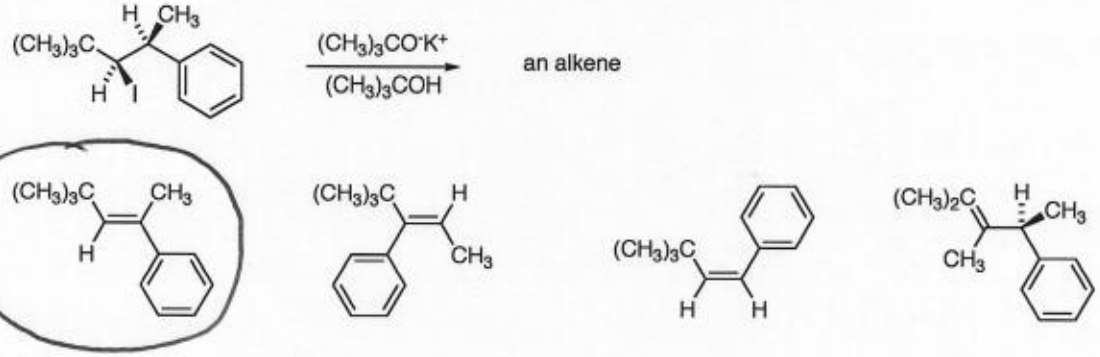
8. Reacting deca-1,9-diene with Grubb's catalyst produces a cyclic product and ethene gas via olefine metathesis as shown. Draw the structure of the cyclic product in the box provided. [3 pts]



9. Circle the carbocation most likely to undergo rearrangement. [3 pts]

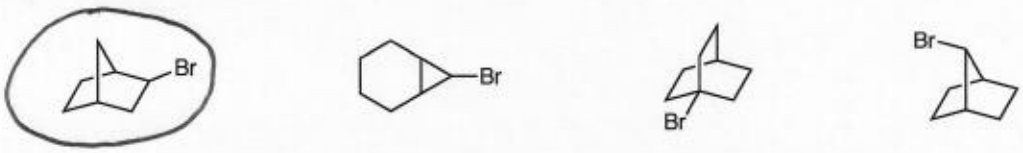


10. In the E2 reaction below, elimination of HI by potassium *tert*-butoxide occurs predominantly from the anti periplanar conformation of the alkyl halide. Circle the structure of the alkene that forms as the major product. [3 pts]



11. Circle the alkene that will release the *greatest* amount of heat per mole when subjected to catalytic hydrogenation (i.e., H_2, Pd catalyst). [3 pts]

12. Circle the only compound below that will undergo E2 elimination of HBr to form an alkene when reacted with potassium *tert*-butoxide. [3 pts]



13. Circle the cycloalkene that can form stable *cis* and *trans* isomers. [3 pts]

cyclohexene cyclobutene cyclodecene cycloheptene

Score: _____/100