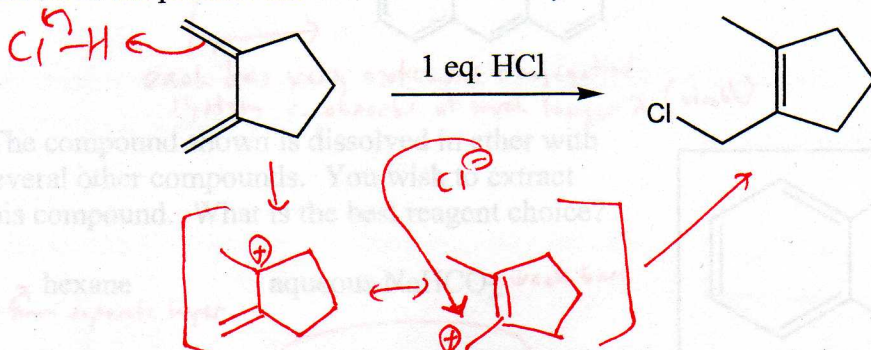
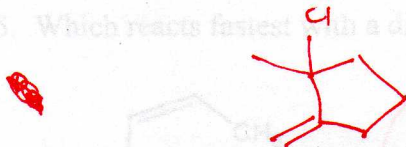


I. (10 pts total) When 1,2-dimethylenecyclopentane is mixed with 1 equivalent of hydrogen chloride, one of the products that forms is the chloride shown.

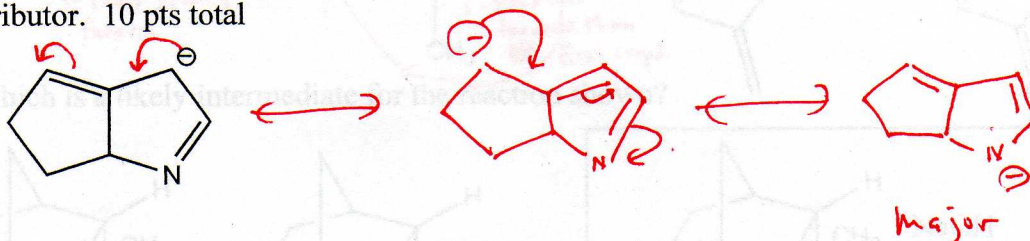
1. Use curved arrow formalism to show a plausible, step-by-step mechanism that accounts for the formation of the product shown. Show all likely intermediates. Don't combine steps.



2. When the above reaction is performed at a very low temperature, a different product dominates the reaction mixture. Draw that product.

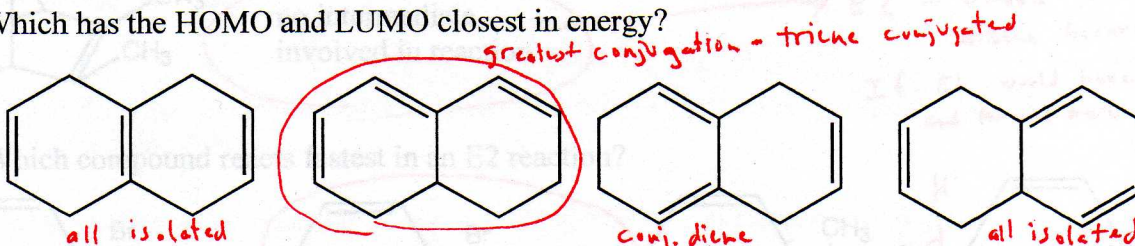


II. Draw each of the significant resonance structures for the structure shown and label the major contributor. 10 pts total

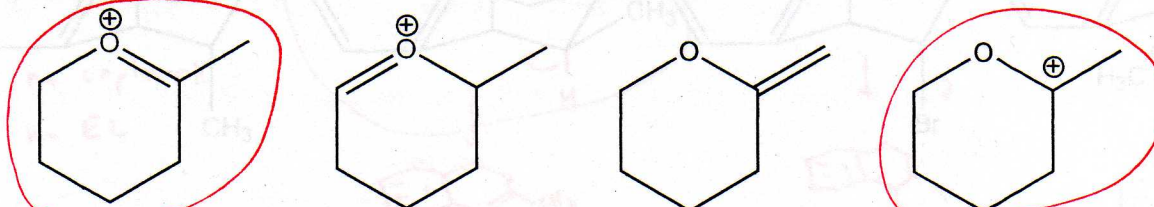


III. Answer each of the following. If choices are given, circle the best response(s). Best 14 count 4 pts each, 56 pts total, try all for bonus.

1. Which has the HOMO and LUMO closest in energy?

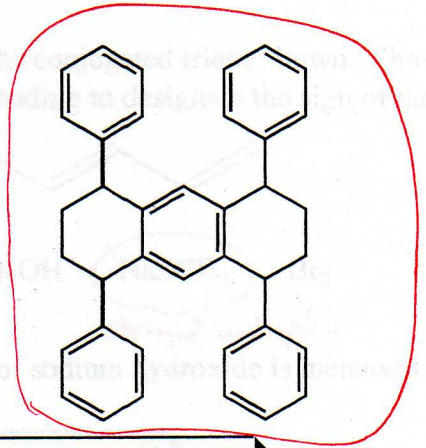
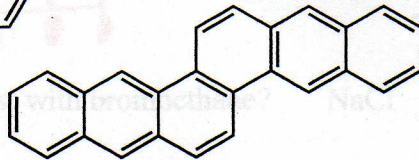
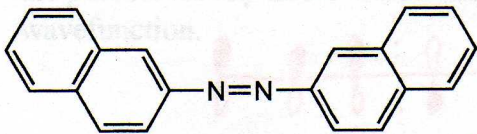


2. Some of the structures below are resonance structures of each other. Circle all the ones that are.



These two are resonance structures of each other

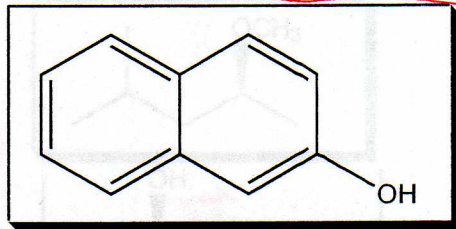
3. Which is/are clear, colorless compound(s)?



little conjugation -  
∴ absorbs at short λ (uv)

each has very extended conjugated system ∴ absorbs at much longer λ (visible)

4. The compound shown is dissolved in ether with several other compounds. You wish to extract this compound. What is the best reagent choice?



hexane  
will form separate layer

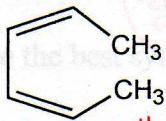
aqueous NaHCO<sub>3</sub> weak base

aqueous HCl  
acid

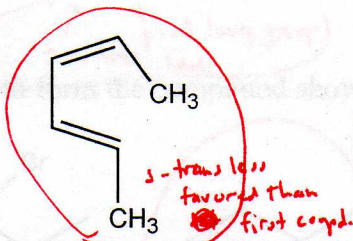
aqueous NaOH

need strong base to make conjugate base that is water soluble

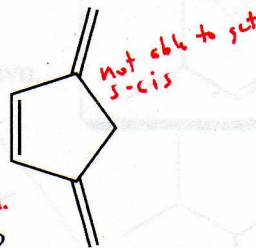
5. Which reacts fastest with a dienophile such as maleic anhydride in a normal diels-alder reaction?



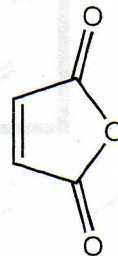
s-trans greatly favored



s-trans less favored than first comp.

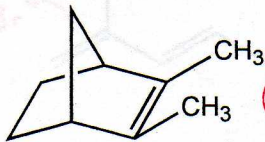
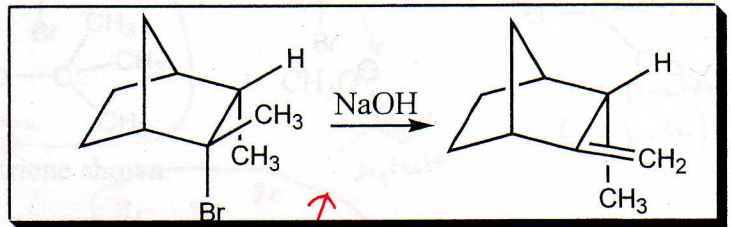
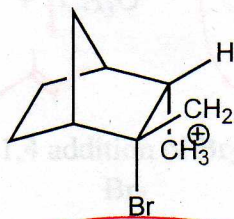
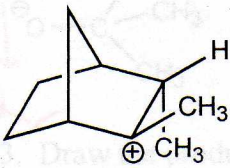


not able to get s-cis



not diene

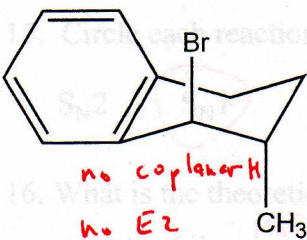
6. Which is a likely intermediate for the reaction shown?



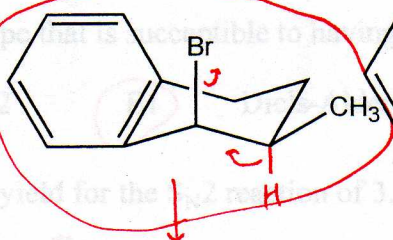
no intermediate involved in reaction

→ E2 - unable to form trisubstituted alkene because of coplanarity  
If E1, would have taken different H and formed more stable trisub. alkene

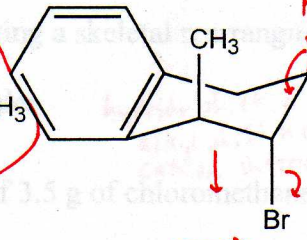
7. Which compound reacts fastest in an E2 reaction?



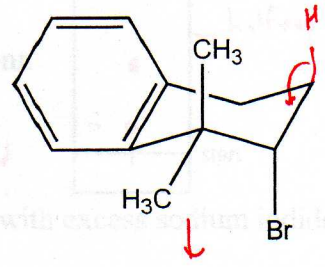
no coplanarity  
no E2



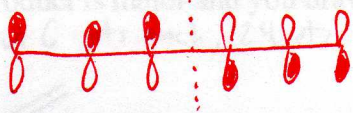
conjugated system  
trisub.



isolated alkene  
disub.



8. Draw the molecular orbital with the second lowest energy ( $\Psi_2$ ) for the conjugated triene shown. Show the position of any nodes with a dashed line. Use shading and lack of shading to designate the sign of the wavefunction.



9. Which compound reacts fastest with bromoethane? NaCl CH<sub>3</sub>OH NaSCH<sub>3</sub> Br<sub>2</sub>

*strongest nucleophile*

10. A reaction yields an alcohol at a faster rate when the concentration of sodium hydroxide is increased. The most likely mechanism is:

S<sub>N</sub>2

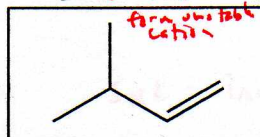
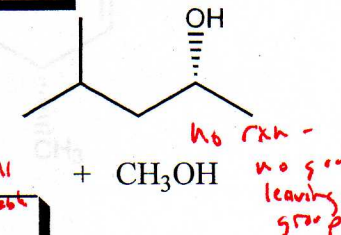
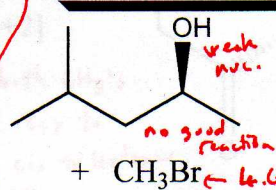
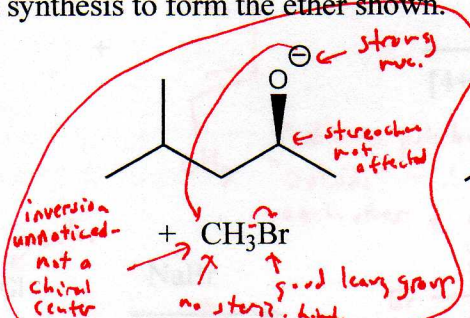
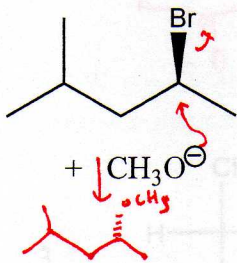
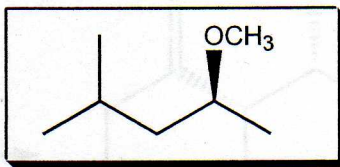
S<sub>N</sub>1

E2

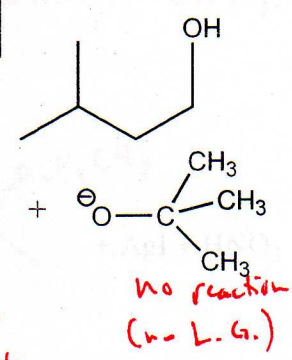
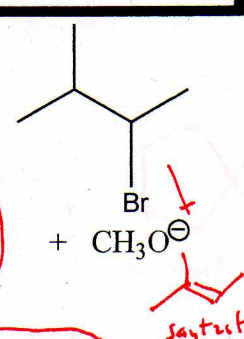
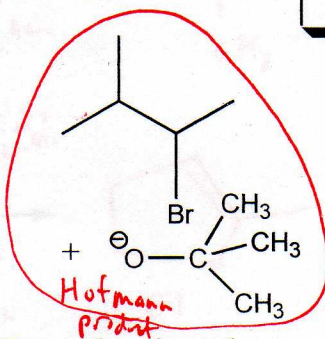
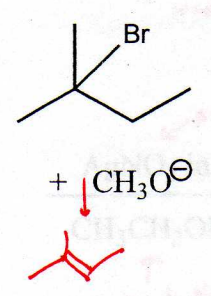
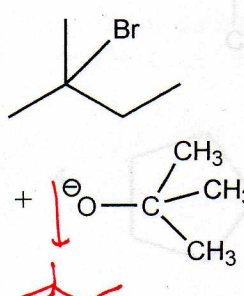
E1

*rate depends on nuc. conc.*

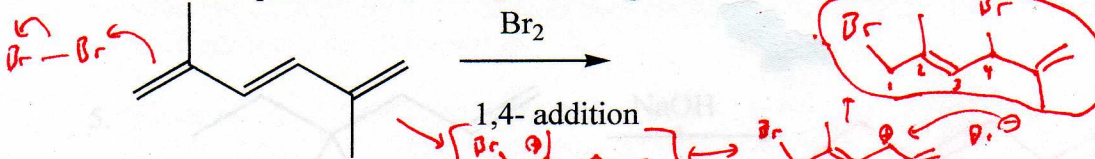
11. Choose the best synthesis to form the ether shown.



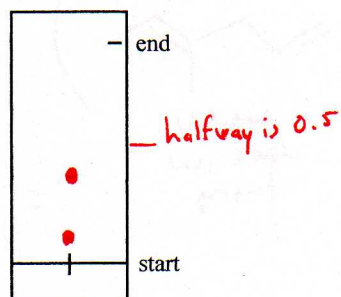
12. Choose the best synthesis to form the compound shown.



13. Draw the product of 1,4 addition of Br<sub>2</sub> to the triene shown.



14. Finish drawing the developed TLC plate of a mixture of two compounds with R<sub>f</sub>'s of 0.1 and 0.4.



15. Circle each reaction type that is susceptible to having a skeletal rearrangement.

S<sub>N</sub>2

S<sub>N</sub>1

E2

E1

Diels-Alder

*hydride shift & alkyl shift need cation interm.*

16. What is the theoretical yield for the S<sub>N</sub>2 reaction of 3.5 g of chloromethane with excess sodium iodide?



$$3.5 \text{ g} \left( \frac{1 \text{ mol CH}_3\text{Cl}}{50.5 \text{ g CH}_3\text{Cl}} \right) \left( \frac{1 \text{ mol CH}_3\text{I}}{1 \text{ mol CH}_3\text{Cl}} \right) \left( \frac{142 \text{ g CH}_3\text{I}}{1 \text{ mol CH}_3\text{I}} \right) = 9.8 \text{ g}$$

