



### CHE 322 First Exam

February 18, 2009

The first 12 questions are 5 point multiple choice questions.

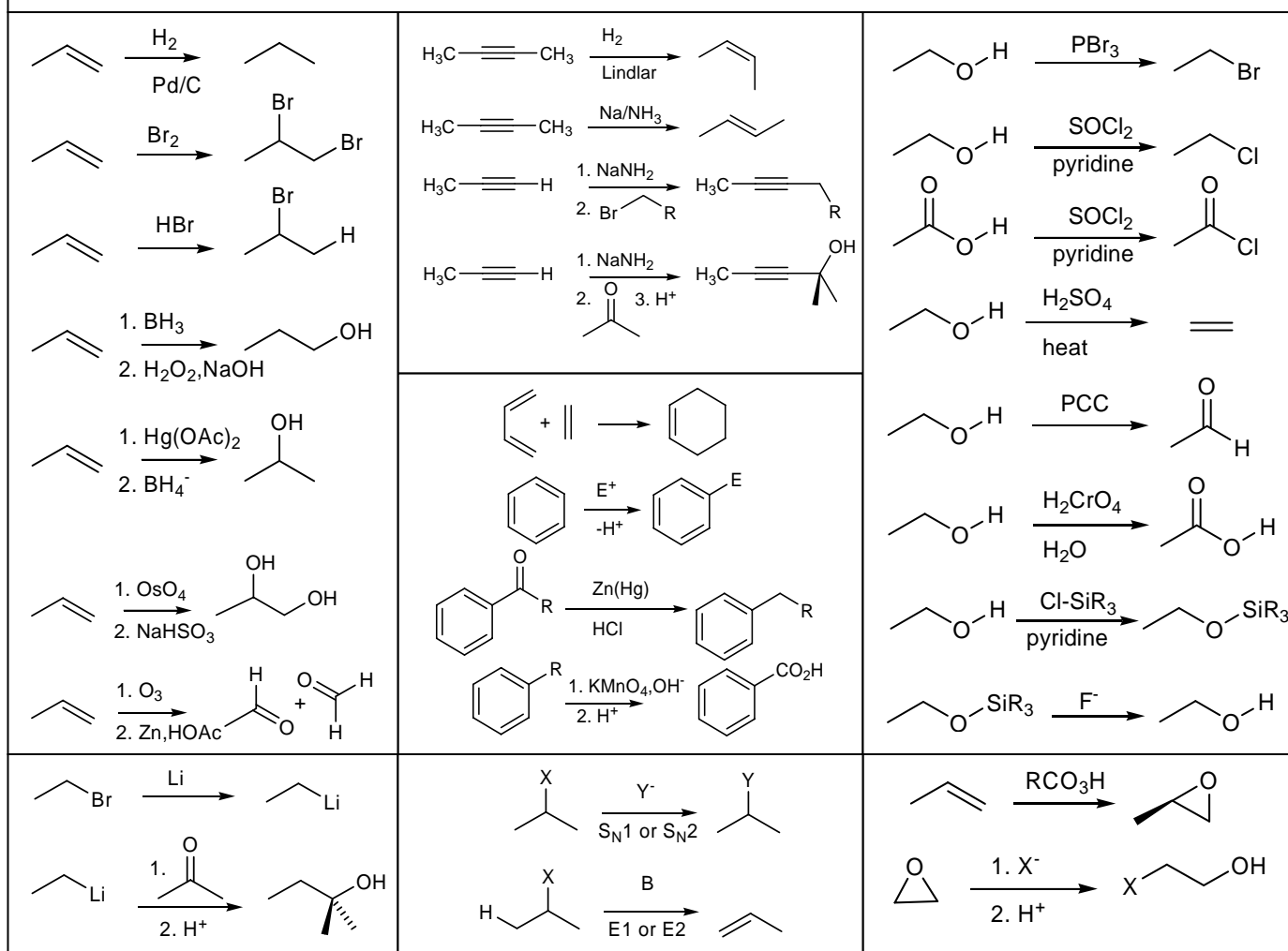
Questions 13-16 are 10 point short answer questions. .

**Form 0**

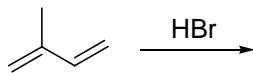
I		II		Transition elements										III	IV	V	VI	VII	VIII
1	1 H																		2 He
2	3 Li	4 Be												5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg												13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	
6	55 Cs																	85 At	86 Rn

Metals  
 Metalloids  
 Nonmetals

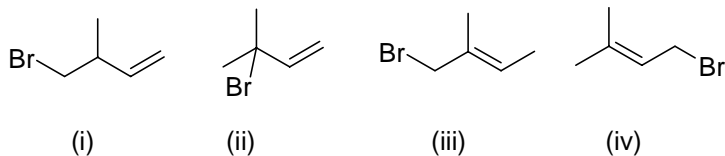
### Selected Reactions of CHE 321-322



1. Consider the following reaction of isoprene ( $C_5H_8$ ) with HBr.

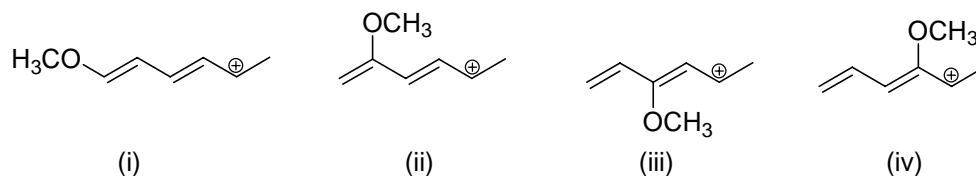


Here are some possible products.

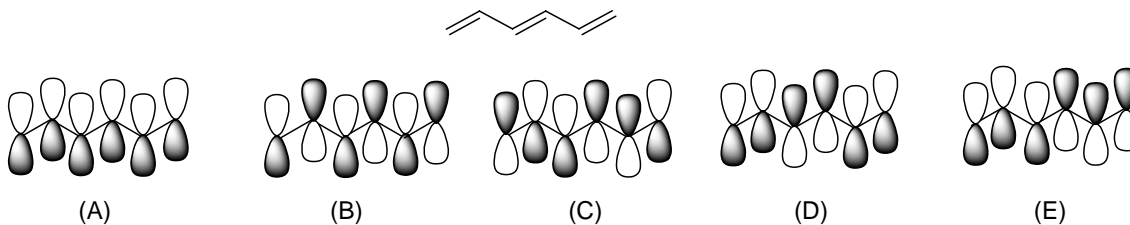


Which one of the following statements is incorrect?

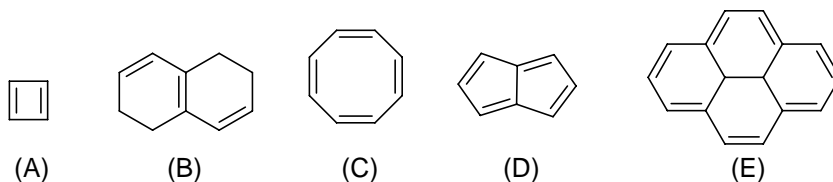
- A. Compound (i) is the predicted product at low temperature.  
 B. Compound (iv) is the predicted product at high temperature.  
 C. Compound (i) is chiral.  
 D. Compound (ii) is the kinetic product.  
 E. Compound (iv) is the thermodynamic product.
2. Consider the four carbocations shown below. Which two are the most stabilized by the methoxy substituent?



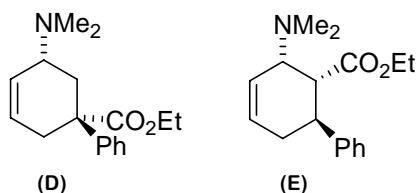
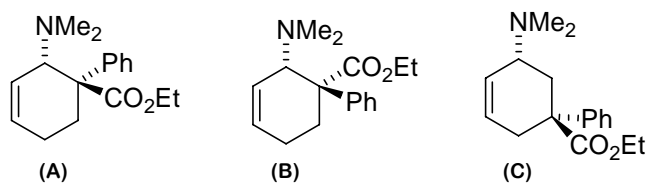
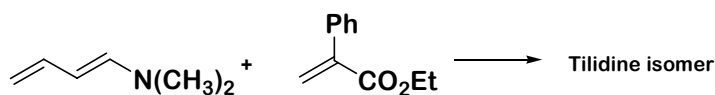
- A. (i) and (ii)    B. (i) and (iii)    C. (ii) and (iii)    D. (ii) and (iv)    E. (iii) and (iv)
3. Which of the following MOs would be the best representation of the HOMO of hexatriene?



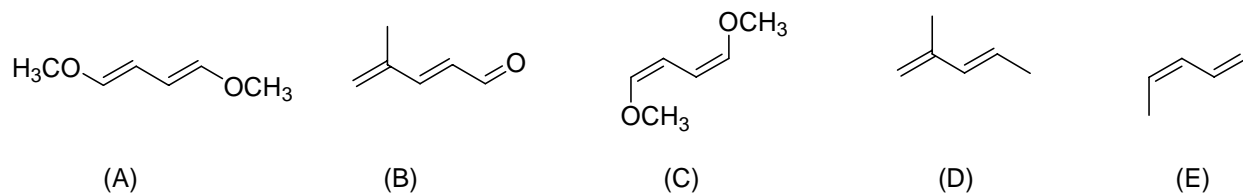
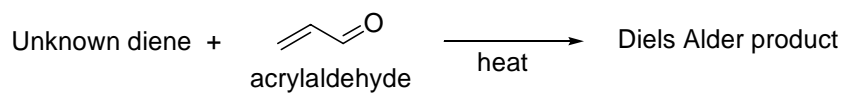
4. Which one of the following compounds is aromatic?



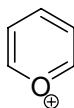
5. The analgesic tilidine is effective in cases of severe pain. An isomeric analogue of tilidine can be prepared from the following Diels Alder reaction. Predict the structure of this Diels Alder product.



6. Which of the following dienes would you predict to be the most reactive in a Diels Alder reaction with acrylaldehyde?



7. Which one of the following compounds is antiaromatic?



(A)



(B)



(C)

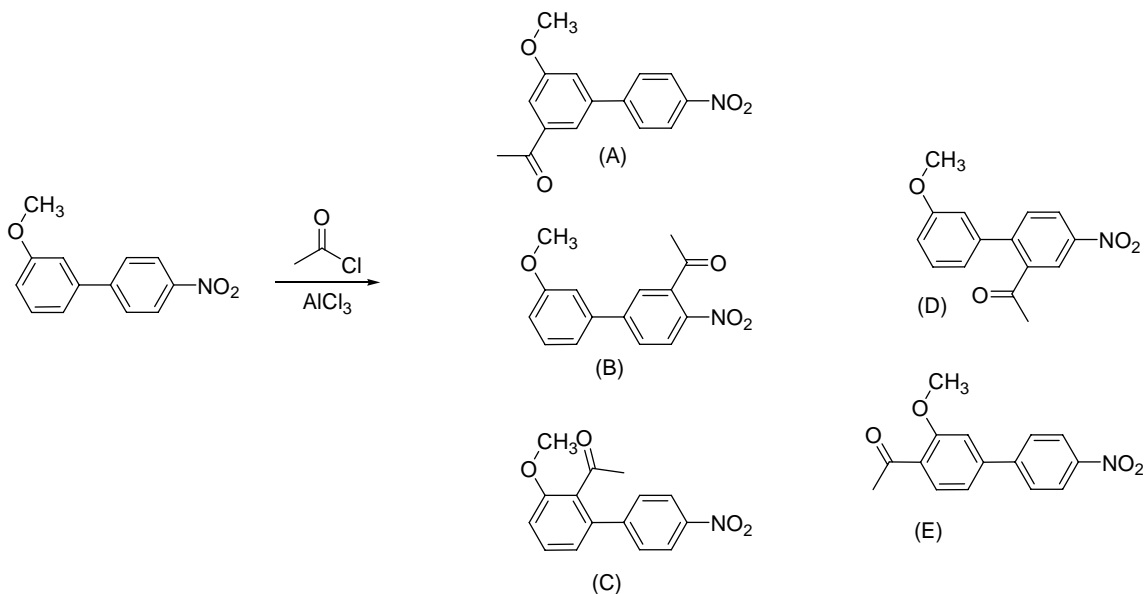


(D)

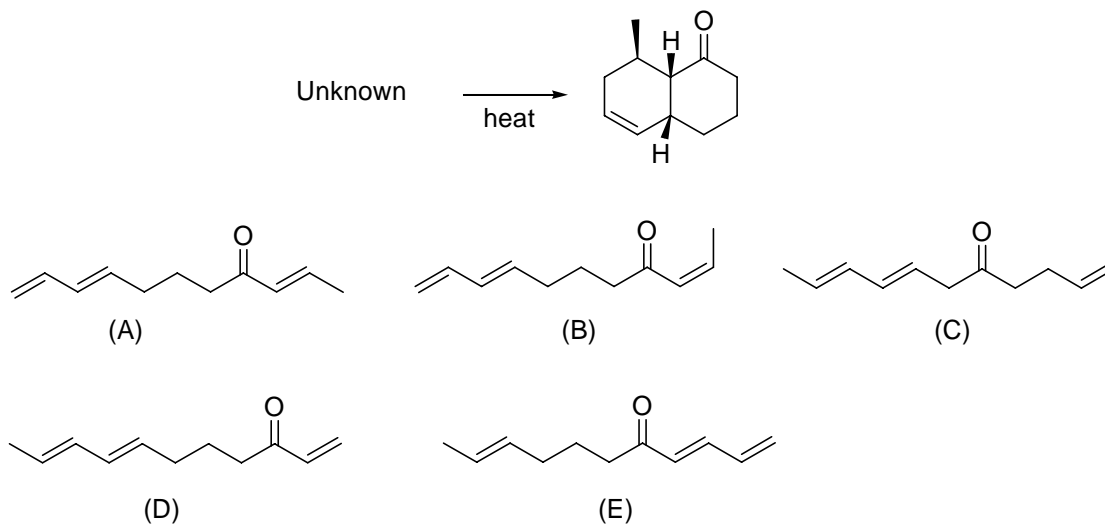


(E)

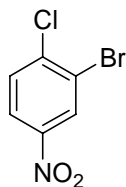
8. Which of the indicated compounds would be the major product in the following Friedel Crafts reaction?



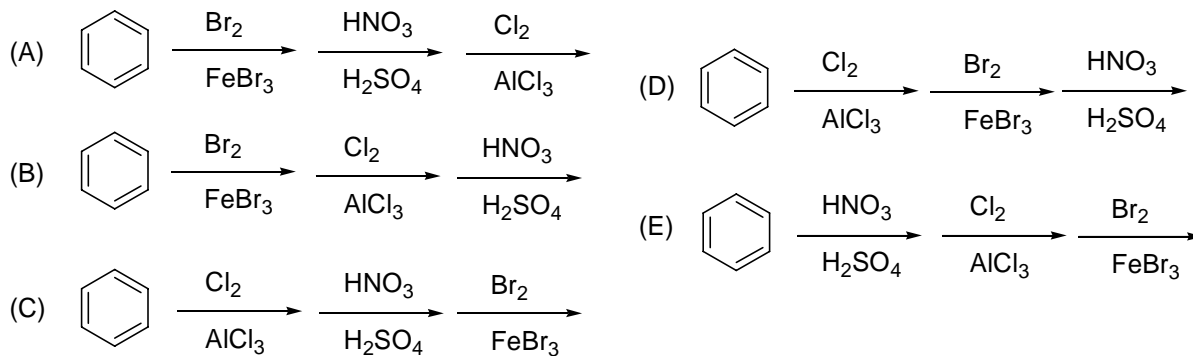
9. What reactant would undergo an intramolecular Diels Alder reaction to give the product shown?



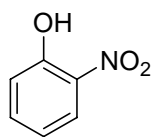
10. Which of the following synthetic schemes would be the best for the synthesis of the compound, 2-bromo-1-chloro-4-nitrobenzene?



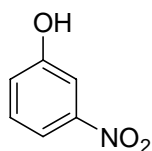
2-bromo-1-chloro-4-nitrobenzene



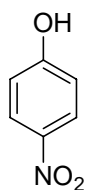
11. Which of the following compounds has the highest  $pK_a$ ? (Which is the least acidic?)



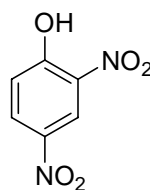
(A)



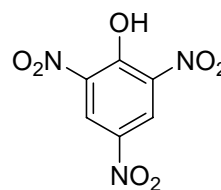
(B)



(C)

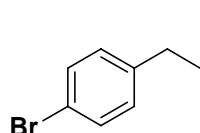
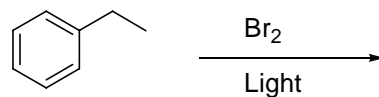


(D)

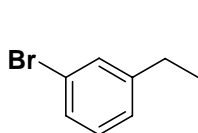


(E)

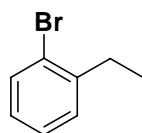
12. Predict the main product of the following reaction?



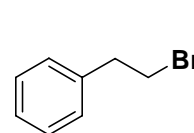
(A)



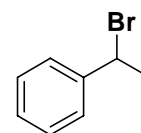
(B)



(C)

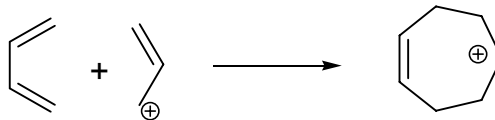


(D)



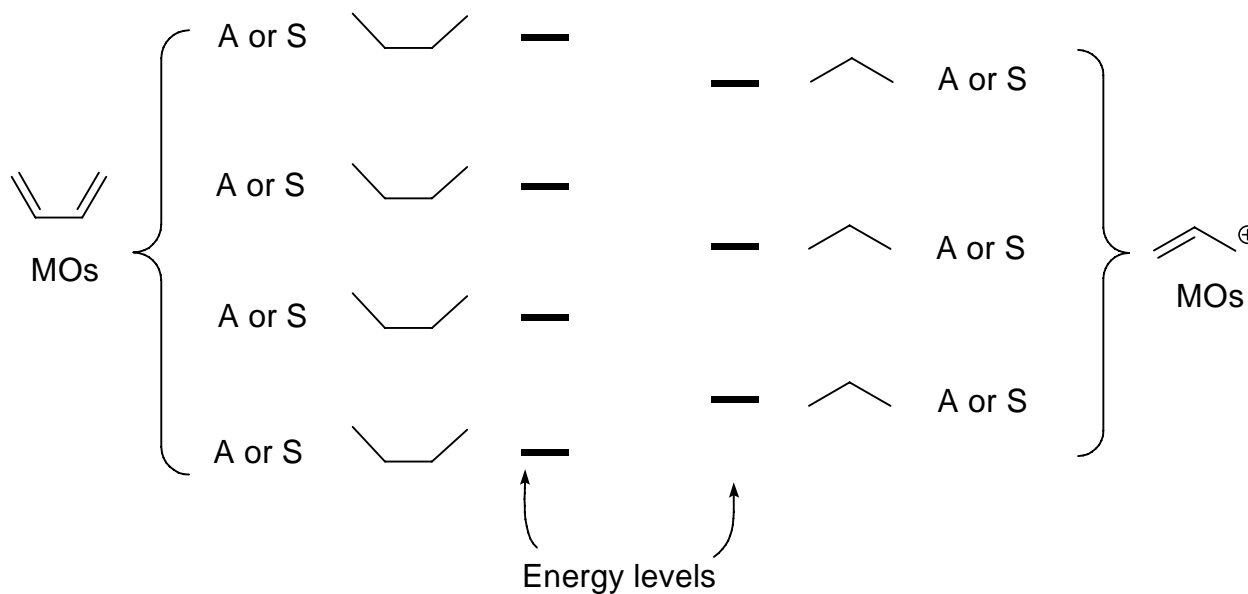
(E)

13. The Diels Alder reaction is an example of a cycloaddition reaction. Another possible cycloaddition reaction is the reaction of a diene with an allyl cation to give a seven membered ring. Complete the MO energy level interaction diagram shown below and determine if the reaction is allowed or forbidden.



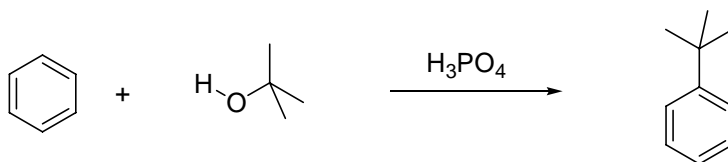
Complete the following steps:

- Draw the MOs, butadiene on the left, the allyl cation on the right.
- Indicate which levels are occupied with electrons.
- Label each MO as symmetric or antisymmetric by circling (S) or (A) for each MO.
- Check the appropriate blank to indicate if the reaction is allowed or forbidden.



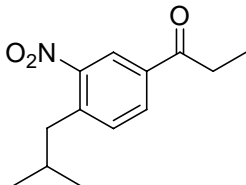
Check one: Allowed  Forbidden

14. Draw a curved arrow mechanism for the following reaction.



15. Give a synthesis of the following compound starting with benzene and other compounds of four carbons or less.

*Hint: The key to planning this synthesis is determining the proper order of addition of each substituent.*



16. Give a synthesis of the following compound starting with benzene and other compounds of four carbons or less.

*Hint: This synthesis will require you to use both the Friedel Crafts and the Diels Alder reaction.*

