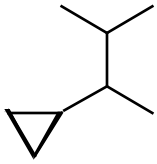
Multiple Choice. Choose the best answer for the following questions. (10 questions, 40 pts)

1. Which atomic orbitals are used in the C-C π-bond of ethylene?
   (a) sp^3, sp^3
   (b) p, p
   (c) sp^2, sp^2
   (d) sp^3, sp^2
   (e) sp^2, s

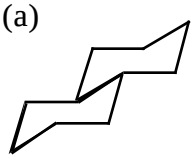
2. Orbitals hybridize because:
   (a) they can form more stable bonds due to greater orbital overlap.
   (b) hybrid orbitals are spatially further apart from each other, reducing repulsive interactions between electrons.
   (c) antibonding interactions are eliminated when hybrid orbitals form bonds.
   (d) all of the above
   (e) (a) and (b) only

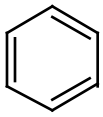
3. Which of the following is the proper IUPAC name of the following molecule?

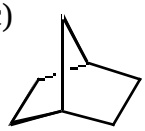


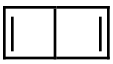
   (a) 1-cyclopropyl-1-(1-methylethyl)ethane
   (b) (1,2-dimethylpropyl)cyclopropane
   (c) 2-(1-cyclopropylethyl)propane
   (d) 2-cyclopropyl-3-methylbutane
   (e) (a)-(d) are all acceptable names

4. Which of the following molecules would not be considered a bicyclic molecule.

(a) 

(b) 

(c) 

(d) 

(e) all are bicyclic molecules

5. The rate of a reaction is dependent upon:
   (a) K_{eq}
   (b) $\Delta G°$
   (c) $\Delta G^{\neq}$
   (d) all the above
   (e) none of the above

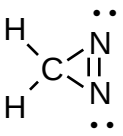
6. The barrier to a chair-chair interconversion of cyclohexane is 45 KJ/mol. What conformation of cyclohexane corresponds to this barrier?
   (a) chair
   (b) boat
   (c) twist-boat
   (d) half chair
   (e) envelope

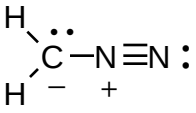
7. The rotational barrier about the C1-C2 bond of 1-chloropropane is 18 KJ/mol. From this we can reason that:
   (a) a -CH_3/-Cl eclipsing interaction is worth 18 KJ/mol
   (b) a -CH_3/-Cl eclipsing interaction is worth 10 KJ/mol
   (c) a -H/-Cl eclipsing interaction is worth 6 KJ/mol
   (d) all of the above
   (e) none of the above

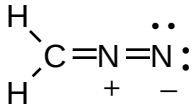
8. The pK_a of acetic acid is 4.75. The $\Delta G°$ for the dissociation of acetic acid at 300 °K is:
   (a) 3.90 KJ/mol
   (b) 27.3 KJ/mol
   (c) -27.3 KJ/mol
   (d) -11.8 KJ/mol
   (e) 11.8 KJ/mol

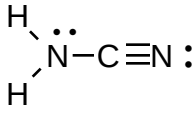
9. Which of the following is <u>not</u> a Lewis acid?
   (a) H^+
   (b) $AlCl_3$
   (c) $(H_3C)_3N$
   (d) H_3C^+
   (e) (a)-(d) are all Lewis acids

10. Which of the following is <u>not</u> a proper Lewis structure for a molecule with the empirical formula CH_2N_2?

(a) 

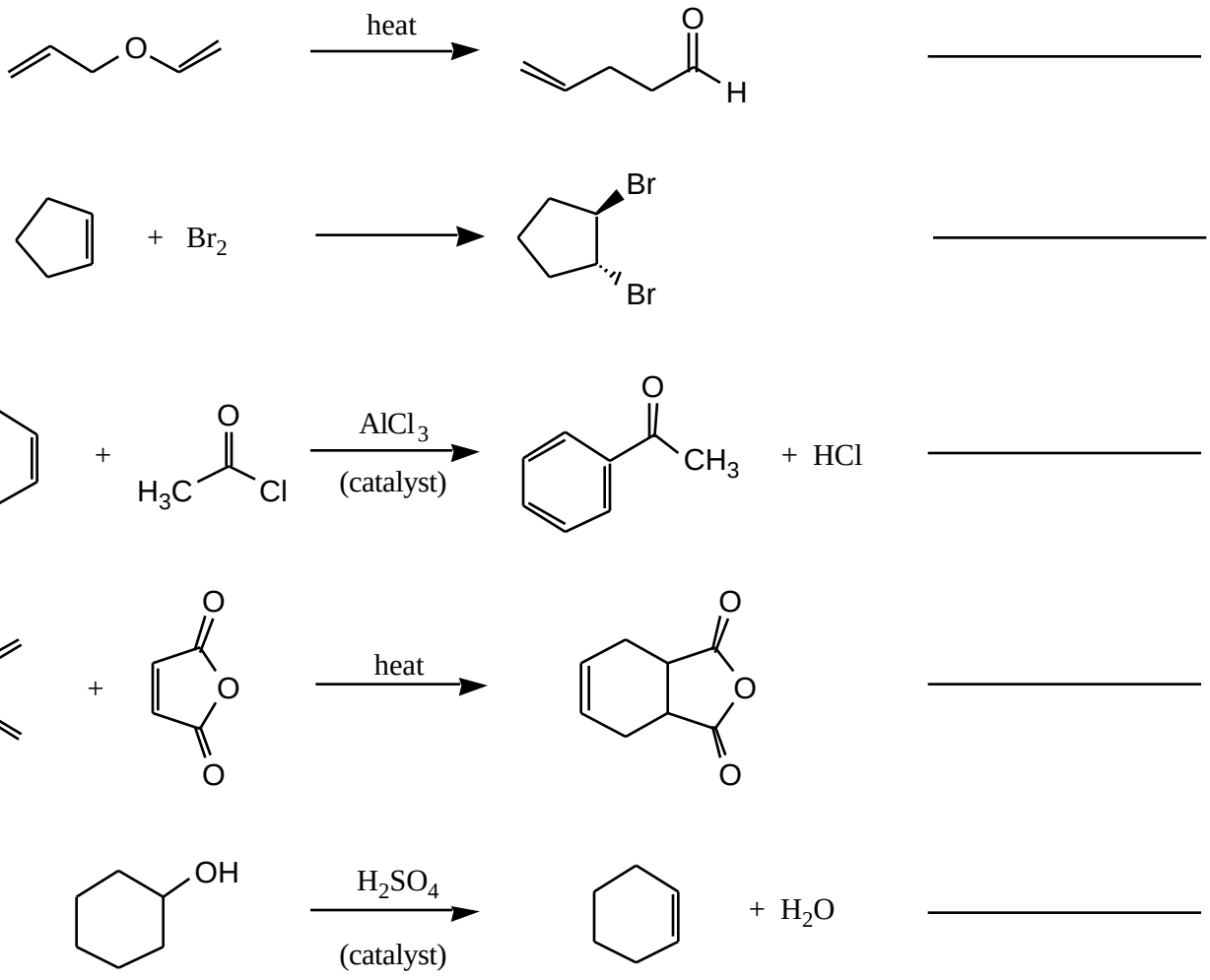
(b) 

(c) 

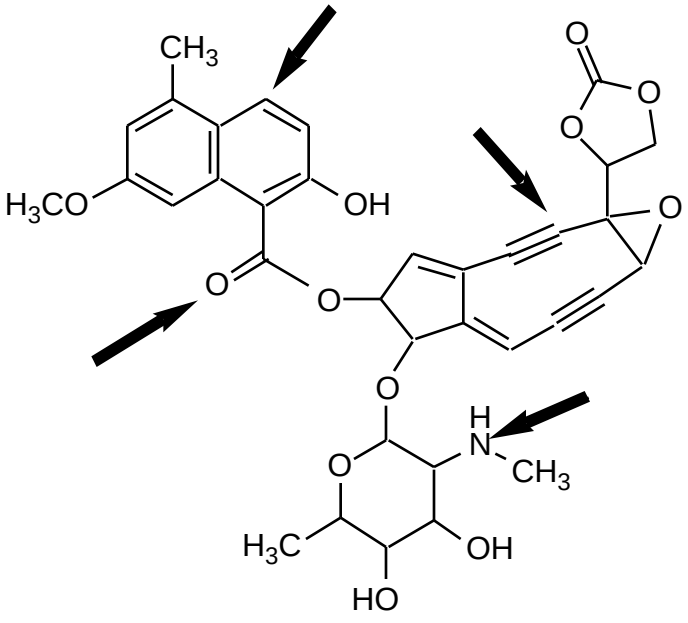
(d) 

(e) (a)-(d) are all proper Lewis structure

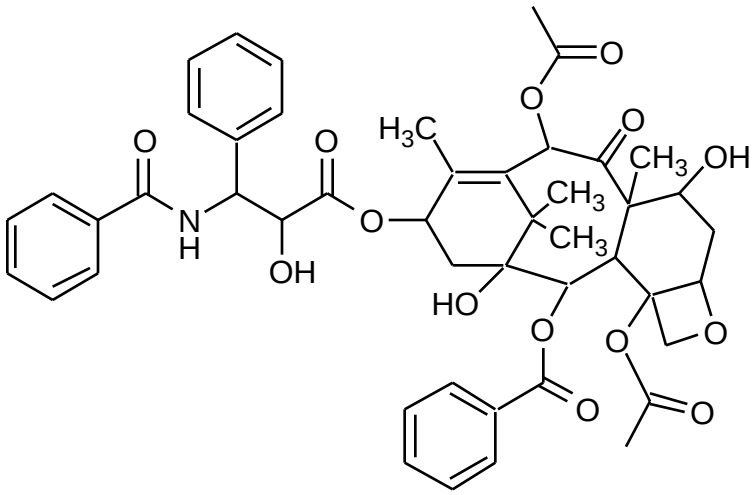
11. The following are examples of reactions you will learn about in this course. What type of reaction is occurring in each example? (10 pts)



12. Indicate the hybridization of the indicated atoms. (4 pts)

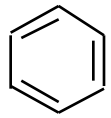


13. Taxol, shown below is isolated from the bark of the pacific yew tree and is clinically used for the treatment of ovarian cancer. Taxol possesses a number of functional groups. Circle and identify six <u>different</u> types of functional groups other than alkane or cycloalkane. (12 pts)

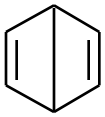


14. Structures **B** and **C** have the same molecular formula as benzene (C_6H_6). Structure **C** is not a resonance form of benzene while structure **B** is (although it contributes little to the resonance hybrid).

(a) Briefly state why is **C** not a resonance form of benzene while structure **B** is? (4 pts)



Benzene

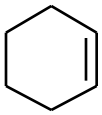


B

C

(b) Draw curved arrows showing benzene converting to the resonance form **B**. (6 pts)

15. (a) The addition of HBr to an alkene is a general reaction for all alkenes. Give the complete mechanism for the addition of HBr to cyclohexene shown below. (7 pts)



cyclohexene

(b) Draw all possible chair conformations of the product. (4 pts)

(c) A 1,3-diaxial interaction for -Br is 1.0 KJ.mol (the A-value for -Br is therefore 2.0 KJ/ mol) Calculate the percentage of the favored chair conformer at 300 °K. (5 pts)

16. Starting with the hybrid atomic orbitals, clearly draw a diagram of all the molecular orbitals for the C-C bond of ethane. Show the relative energies of all the atomic and molecular orbitals and label the orbital. (8 pts)

Problem	1-10:_____	(40 pts)
	11:_____	(10 pts)
	12:_____	(4 pts)
	13:_____	(12 pts)
	14:_____	(10 pts)
	15:_____	(16 pts)
	16:_____	(8 pts)

Total out of 100: _____