Houston Community College

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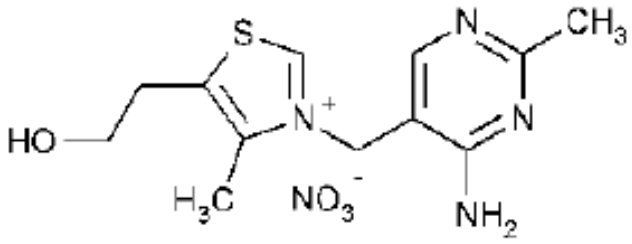
SAMPLE EXAM # 1B

Organic Chemistry I

2425



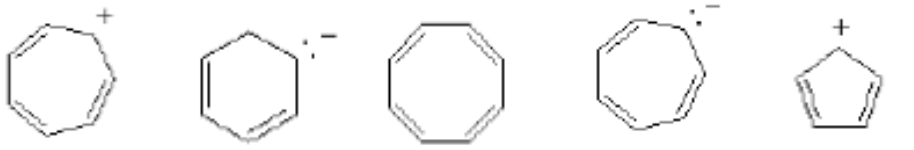
Thiamin

Thiamin– Thiamine Mononitrate: Nitrate salt form of thiamine for the preparation of various multivitamins. Thiamine Pyrophosphate: The coenzyme in a variety of reactions or prosthetic component of carboxylase.

CHEM 2425 - Sample Exam #2A (Chapters 13, 14, and 15)

Part I. Multiple choice questions. Please write your answer in the space provided.

_____ 1. Which of the following is aromatic?



A. B. C. D. E.

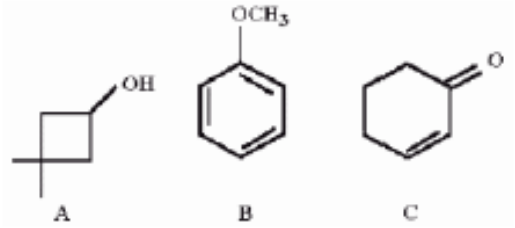
_____2. What is the major difference between an antiaromatic and aromatic compound?

A)The structure must be cyclic for aromatic but not antiaromatic compounds?
B)Antiaromatic compounds have at least one *sp*3 hybridized atom in the ring.
C) Antiaromatic compounds can assume a chair-like structure while aromatic compounds are nearly flat.
D) Aromatic compounds cannot have a charged atom in the structure.
E) Only aromatic compounds follow Huckle's rule.

_____3. 2-Methylhexane shows an intense peak in the mass spectrum at $m/z = 43$. Propose a likely structure for this fragment.

A. $CH_3CH_2^+$ B. $(CH_3)_2CH^+$ C. $CH_3CH_2\,CH_2^+$ D. CH_3C^+ E. none of these

_____ 4. Which compound would be expected to show intense IR absorption at 1680 cm^{-1}?



A. A only B. B only C. C only D. A and C E all of these

_____5. What is the major organic product which results when cycloheptene is irradiated in the presence of *N*- bromosuccinimide?

A. 1-bromocycloheptene B. 2-bromocycloheptene C. 1,2-dibromocycloheptane
D. 3-bromocycloheptene E. 4-bromocycloheptene

_____6. When a high energy electron impacts molecule M in the ionization chamber, what type of species is initially produced?

A. Cation B. anion C. radical D. radical cation E. radical anion

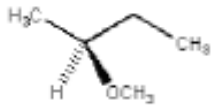
_____7. Which of the following most closely matches the C≡C stretching frequency?

A. 3300 B. 3000 C. 2200 D. 1700 E. 1200

_____8. Which of the following does not have a broad absorption with one or more spikes that is centered about 3300 cm^{-1} in the IR?

A. $(CH_3CH_2CH_2)_3N$ B. $(CH_3CH_2CH_2)_2NH$ C. $CH_3CH_2CH_2NH_2$
D. $(CH_3)_3CNH_2$ E. $(CH_2{=}CHCH_2)_2NH$

_____9. Predict the number of signals expected (disregarding splitting) in the ^1H NMR spectrum of the compound shown below.



A. 6 B. 5 C. 4 D. 3 E. 2

_____10. What is the hybridization of the central carbon of allene (1,2-propadiene)?

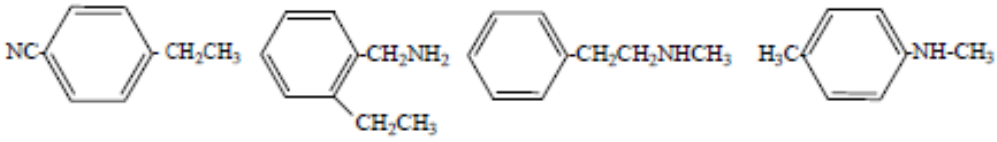
A. sp B. sp^2 C. sp^3 D. p E. none of the above

_____11. What descriptive term is applied to the type of diene represented by 2,4-hexadiene?

A. conjugated diene B. cumulated diene C. isolated diene
D. alkynyl diene E. none of the above

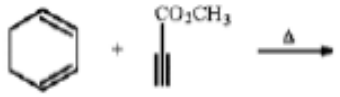
_____12. Provide a structure that is consistent with the data below. **C_9H_9N**

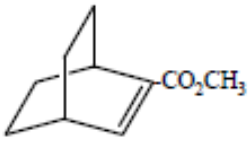
IR (cm^{-1}): 3050, 2950, 2240, 1630
^1H NMR (d): 7.5 (2H, d), 7.1 (2H, d), 2.3 (2H, q), 0.9 (3H, t)



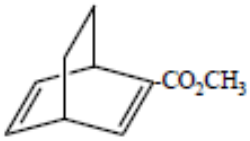
A. B. C. D.

_____13. Provide the structure of the major organic product in the following reaction.

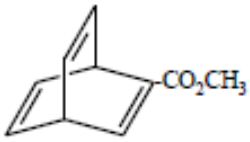




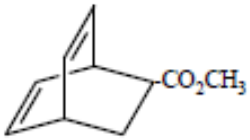
A.



B.

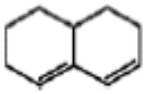


C.



D.

_____14. Why does the diene shown below fail to undergo a Diels-Alder reaction with even the most reactive dienophiles?



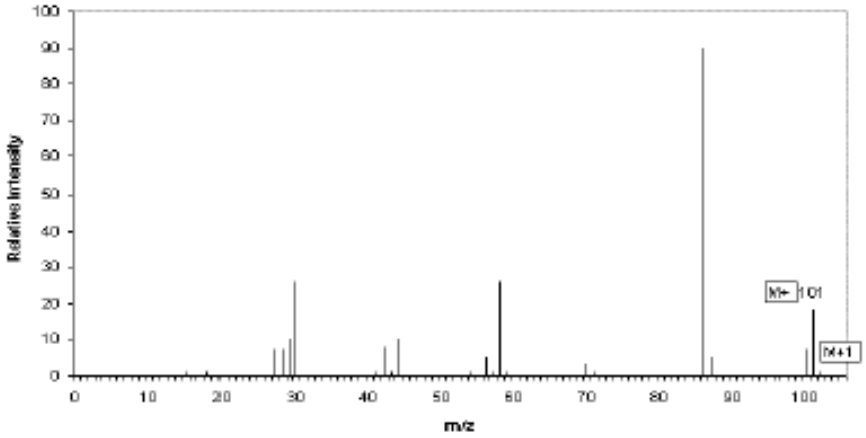
A. The diene cannot achieve the necessary *s*-cis conformation.
B. This is not dienene
C. It is not monocyclic
D. It is a planar molecule
E. Do not obey Hukel's rule

_____15. Which of the following is **correct** description of benzene?

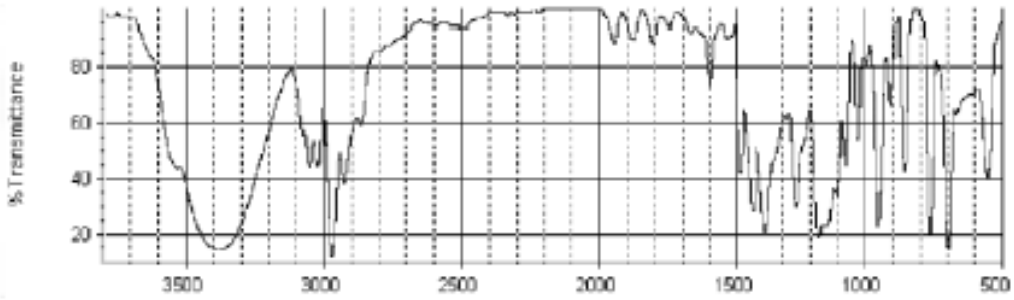
A. The CCC bond angles are all equal to 120°.
B. Addition of Br_2 to benzene is highly unfavorable.
C. The molecule can be drawn as a resonance hybrid of two Kekule structures.
D. all carbons have are sp2 hybridized.
E. All of these are correct.

Part II. Show all your work for complete credit.

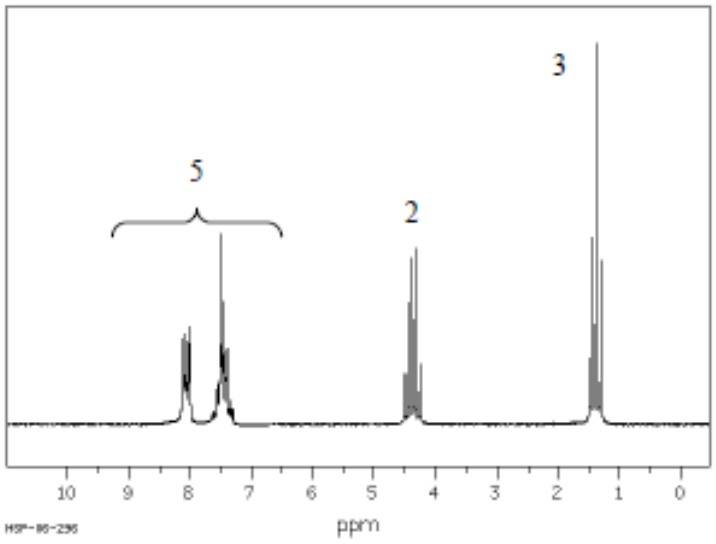
16. Suggest a structure, which is consistent with all the spectral data given below.
($C_6H_{15}N$)



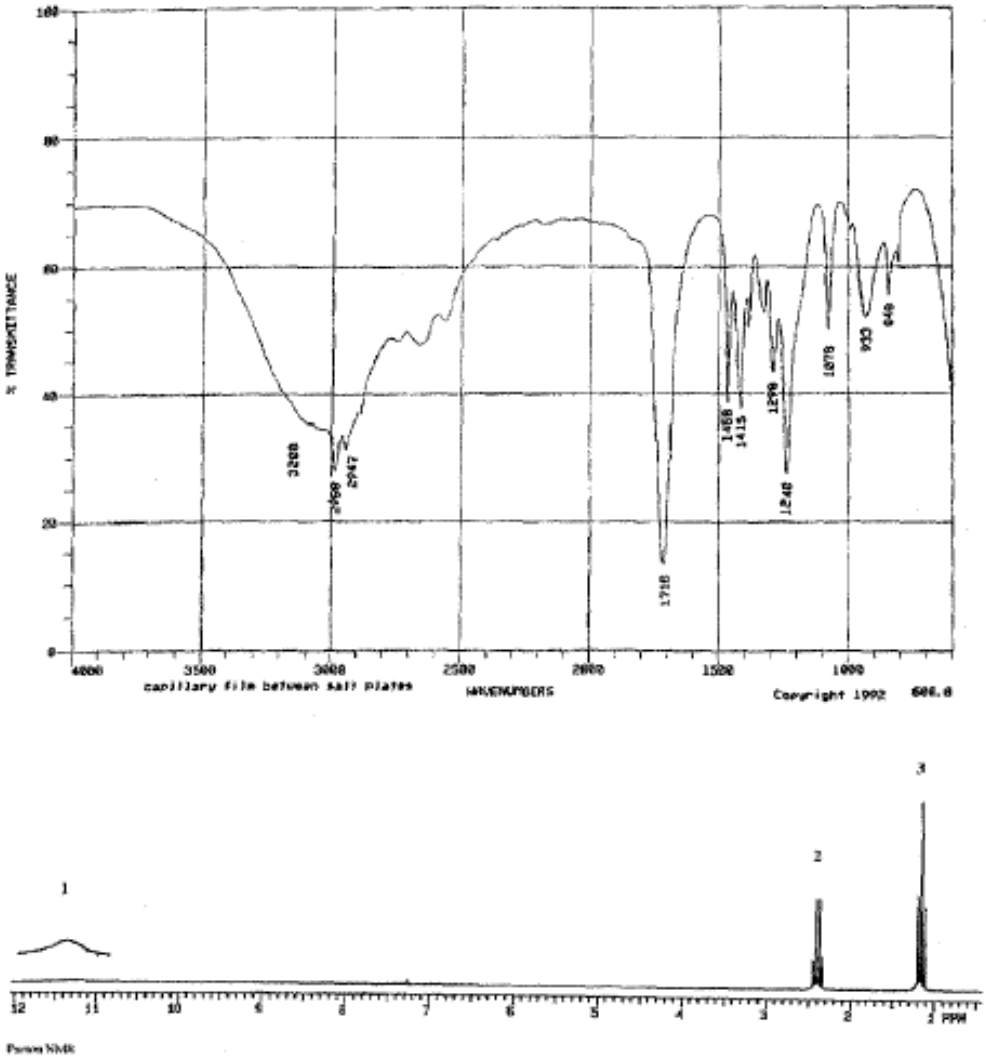
17. Suggest a structure, which is consistent with all the spectral data given below. ($C_9H_{12}O$)



18. Suggest a structure, which is consistent with the NMR spectra shown below. ($C_9H_{10}O_2$)



19. Suggest a structure, which is consistent with the IR and 1 H NMR spectras shown below. ($C_3H_6O_2$)



20. How many different type of hydrogens are there in the following compounds?

a) m - Chlorotoluene

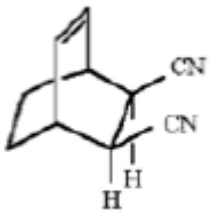
b) 1-Methyl-1,3- cyclohexaadiene

21. Propose structure that fits the following ^{1}H NMR data:

a) $C_3H_6O_2$ 3 signals: (3H, triplet); (2H, quartet); (1H, singlet)

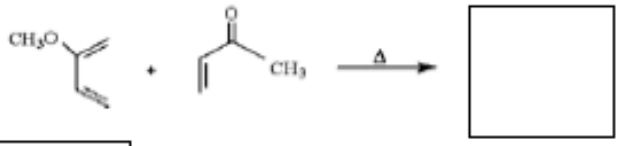
b) C_3H_8O 3 signals: (3H, triplet); (2H, quartet); (3H, singlet)

22. What diene and dienophile would you react to give the product below?

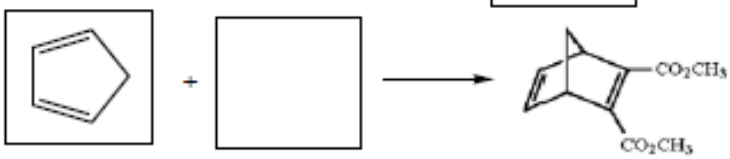


23. Provide the structures of missing compounds in the following reactions.

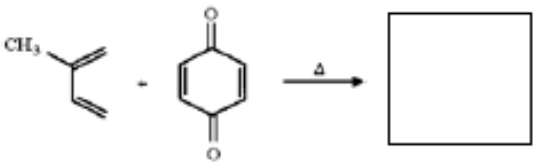
a)



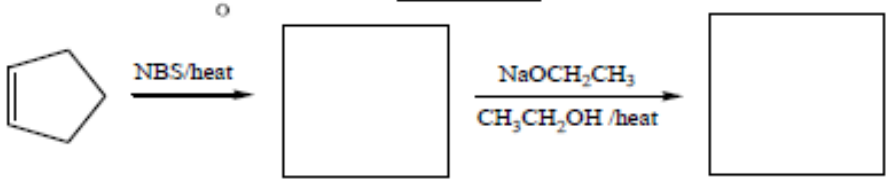
b)



c)

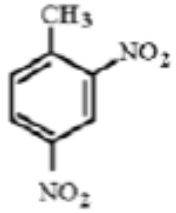


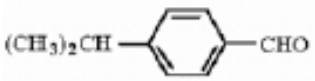
d)

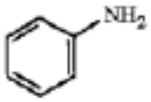


24. **Nomenclature**

I) Give the correct names (IUPAC)







_____ _____ _____

II) Give the correct structures

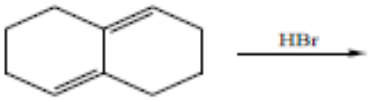
a) Acetophenone

b) 2-Bromo-4-chlorobenzoic acid

c) cis 1,3-pentadiene

Bonus question. Show all your work.

Provide a detailed stepwise mechanism for the reaction of 1,4 - addition of HBr to the diene shown below. Identify the major product and show all your work including electron flow.



Provide a detailed stepwise mechanism for the reaction of 1,2 - addition of Br_2 to the diene shown below. Identify the major product and show all your work including electron flow.