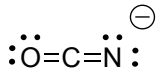
CHEM 2311
E1 practice-iv (answers *not* provided)

1. (32 points) Circle the letter *on the right* which corresponds to the answer to each question. There is only one correct answer for each question.

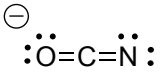
(i) Which of the following ions does not have the electron configuration of a noble gas?

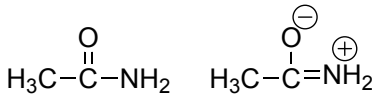
A. F^- **B.** Na^+ **C.** Br^+ **D.** H^- **A B C D**

(ii) Which of the following is a pair of resonance structures?

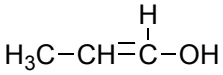


E.





F.



G.

H.

E F G H

I J K L

(iii) The non-bonded electron pair on the nitrogen in trimethylamine is in what type of orbital?

I. *p* **J.** *sp* **K.** sp^2 **L.** sp^3

(iv) How many constitutional isomers of $C_5H_{12}O$ that are 3° alcohols?

M. 0 **N.** 1 **O.** 2 **P.** 3 **M N O P**

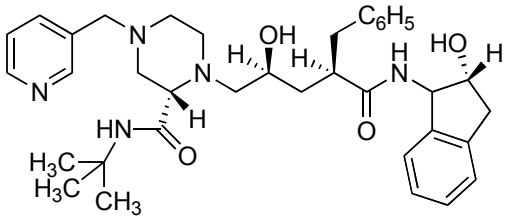
(v) What is the shape of the *sp* orbital of nitrogen in HCN that overlaps with the *sp* orbital of carbon to form the C-N σ molecular bonding orbital?

Q. **R.** **S.** **T.** **Q R S T**

(vi) Which of the following compounds is most soluble in water?

U. $CH_3CH_2CH_2CH_2CH_2OH$ **V.** $CH_3CH_2CH_2CH_2CO_2H$
W. $CH_3CH_2CH(OH)CH_2CO_2H$ **X.** $CH_3CH_2CH_2CH_2CH_3$ **U V W X**

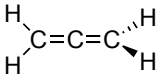
(vii) Which of the following functional groups are in Cetirizine® (a new nonsedating antihistamine), shown at right?



i. 3° amine ii. ester iii. alcohol
iv. ether v. amide vi. carboxylic acid

Y. iv and vi only **Z.** i and ii only
AA. i, iii and v only **BB.** ii, iv, v and v only **Y Z AA BB**

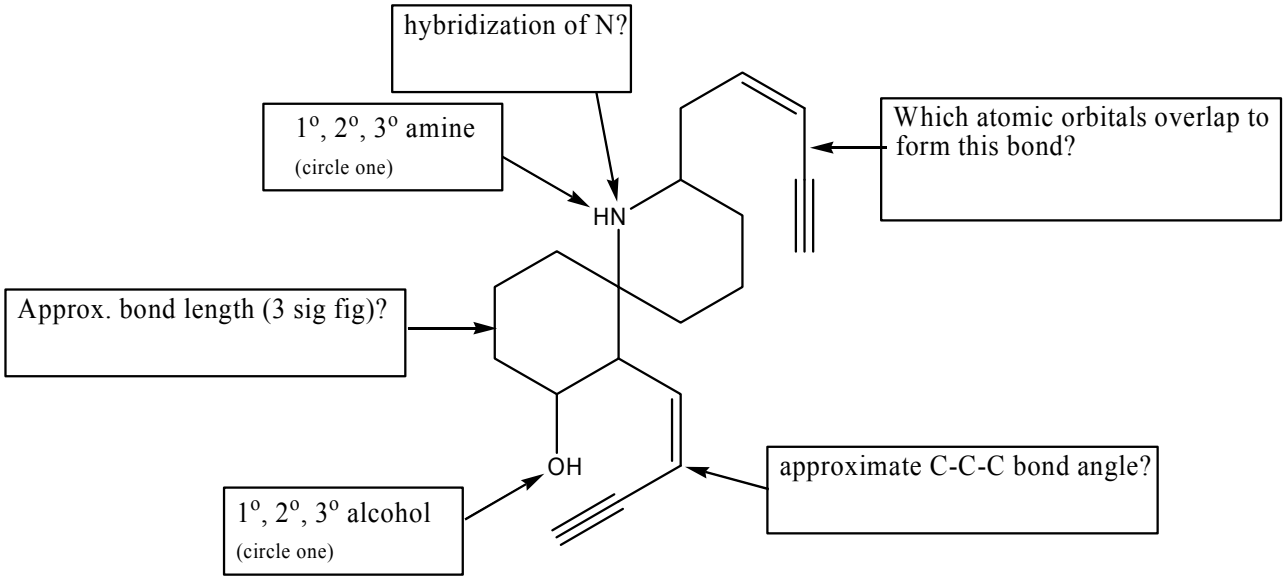
(viii) What is the hybridization of the central carbon atom of allene?



CC. sp **DD.** sp^2 **EE.** sp^3 **FF.** p **CC DD EE FF**

2. (30 points) Histrionicotoxin, shown below, is the toxin of Amazonian poison dart frogs. It acts by binding to receptors for neutrotransmitters in the body.

(a) Provide appropriate descriptions in each of the boxes on the structure below.



(b) What is the molecular formula of Histrionicotoxin? _____

(c) How many of each of the following does Histrionicotoxin have?

(i) *sp* carbon atoms _____

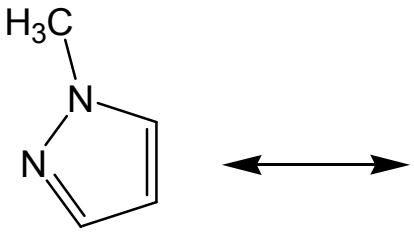
(ii) methylene groups _____

(iii) tertiary (3°) sp^3 carbon atoms _____

(iv) lone pairs of electrons _____

(v) π bonds _____

3. (5 points) All of the atoms of the ring structure shown below (a part of the structure of Viagra) have a planar geometry. Provide a stable resonance contributor *(including lone pairs and formal charges)* that explains this observation (Specifically, how can you account for both nitrogen atoms having planar geometry?)



4. (24 points) Provide a single *line-bond* structure in each of the following boxes, *including the presence of all lone pairs of electrons and formal charges.*

(a) the C_3H_7NO amide with the lowest boiling point

(b) HNO_3 (nitric acid)

(c) benzyl *sec*-butyl ether

(d) a tertiary alkyl halide with the formula $C_5H_{11}Br$

(e) a secondary amine with the formula C_3H_9N

(f) the constitutional isomer of $C_4H_{10}O$ with no 2° carbons

5. (9 points) (a) Which compound in each of the following pairs has the higher boiling point? (Circle the correct answer). What is the strongest intermolecular force in the compound you circled?