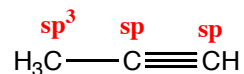


Practice Exam 1 (this is a 60 minute exam)

Question 1. The following questions refer to the compound propyne, shown below.



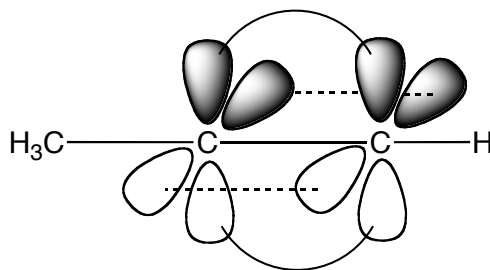
propyne

- a) On the structure above, identify the hybridization state of all carbon atoms.
- b) Draw a picture below that clearly shows the interacting orbitals for all of the C–C single bonds in propyne



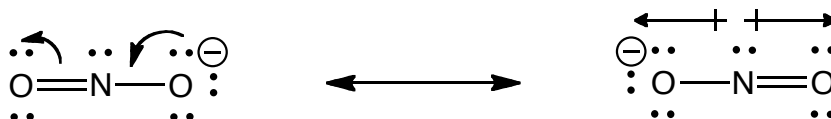
*C–C σ -bonding in propyne
("small" lobes of the orbitals are not shown)*

- c) Draw a picture below that clearly shows the interacting orbitals for all of the C–C multiple bonds in propyne



π -bonding in the triple bond

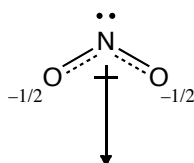
Question 2. a) On the template below, draw two valid Lewis structures for the nitrite ion, NO_2^{-1} that best represent the structure. Make sure to include all lone pairs and identify any non-zero formal charges.



b) Add curved arrows (showing electron movement) to your structure on the left (above) that show how it can be converted into the structure on the right.

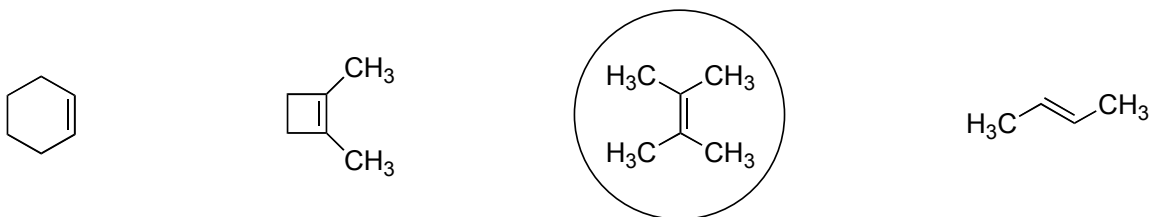
c) Add dipole arrows, where applicable, showing all polar bonds for the structure on the right, above.

d) Is the nitrite ion polar? Why or why not? *A well-drawn picture is worth many words...*

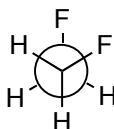


Yes, the molecule is bent and therefore polar due to the bond dipoles

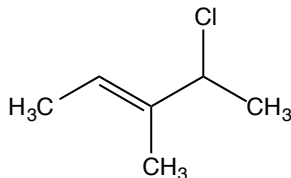
Question 3. Circle the most stable π bond



Question 4. Draw gauche 1,2-difluoroethane (use any notation you wish that clearly depicts gauche 1,2-difluoroethane)



Question 5. Provide the complete IUPAC name for the following compound:

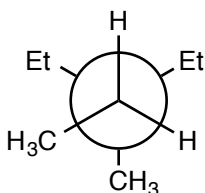


(E)-4-chloro-3-methyl-2-pentene

Question 6. a) Draw a Lewis structure (line notation is OK) for the compound 3-ethyl-3-methyl-pentane.



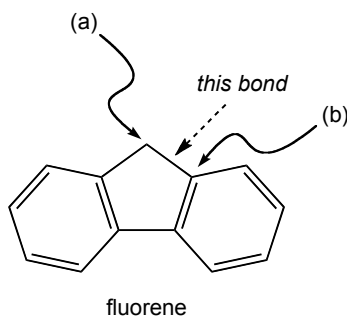
b) Draw a Newman projection of your structure from part (a) as viewed down the C₂-C₃ bond.



c) How many signals will appear in the ¹H NMR spectrum of 3-ethyl-3-methyl-pentane (in other words, how many hydrogen atom environments/types)?

There are three hydrogen environments (3 ¹H NMR signals)

Question 7. Consider the compound fluorene, one of the compounds from laboratory experiment 1.



a) Identify the hybridization states of the carbon atoms labeled (a) and (b).

(a) sp^3

(b) sp^2

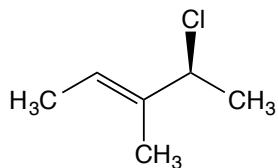
b) The bond between carbon atoms (a) and (b) is identified with a dashed arrow. Is this a sigma or a pi bond? What atomic orbitals on carbon atoms (a) and (b) overlap to make this bond?

Sigma bond, the bond is made between an sp^3 orbital on carbon (a) and an sp^2 orbital on carbon (b)

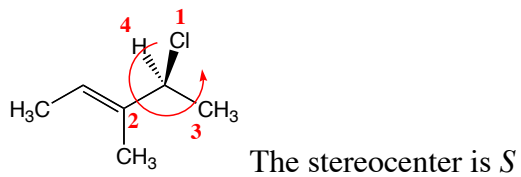
c) When performing column chromatography (with silica gel as the solid phase – just like you did in lab with fluorene and fluorenone), is it true that using a polar solvent (eluant) will make polar compounds move through the column (elute) faster than non-polar compounds? Why or why not?

This is not true. Polar compounds will move through silica gel more slowly than nonpolar compounds. Polar solvents will increase the mobility (elution rate) of all compounds on silica, but will not change the order that compounds elute.

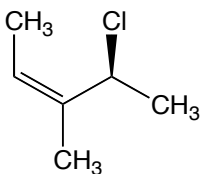
Question 8. The following questions refer to the compound shown below.



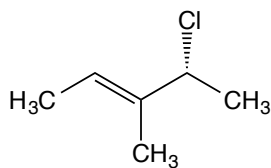
a) Assign *R* or *S* to all stereocenters. *Use the space below to show your work!*



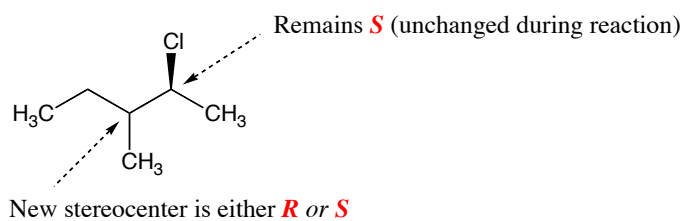
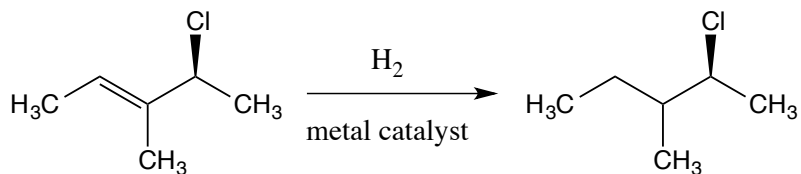
b) Draw a diastereomer of the compound.



c) Draw the enantiomer of the compound.



d) The double bond in the compound can be removed as shown below by reaction with hydrogen gas and a metal catalyst. How many possible stereoisomers will result from this reaction? Remember that your starting material is the single enantiomer shown. Make sure to briefly explain how you arrived at your answer.



Therefore, there are **two** possible stereoisomers that can result from the reaction (*R,S* and *S,S*).