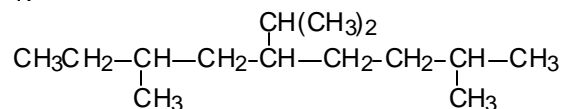


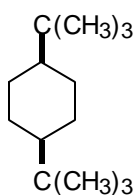
- I. Nomenclature (12 points) Give the IUPAC name for the following compounds: Indicate *R*, *S*, *cis*, *trans*, *E*, or *Z* where appropriate.

1.



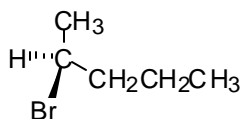
2,7-dimethyl-5-isopropylnonane

2.



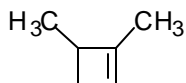
cis-1,4-di-t-butylcyclohexane

3.



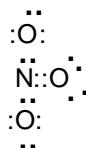
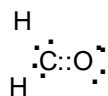
(S)-2-bromopentane

4.

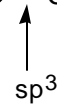
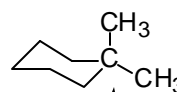
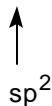
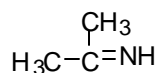
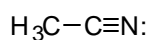


1,4-dimethylcyclobutene

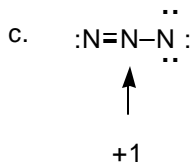
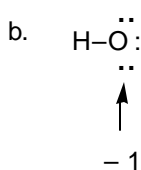
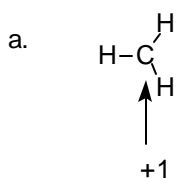
5. Write valid Lewis structures for the following species. Show all nonbonding (unshared) electrons and indicate any formal charges. (6 points).



6. Give the hybridization of the indicated atoms in the species below. (6 points)



7. What is the formal charge on the indicated atoms below? (2 pts each)



8. Are the molecules below ionic or covalently bonded? (2 pts each)

a. NaCl

b. H—CH<sub>3</sub>

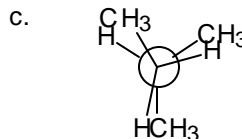
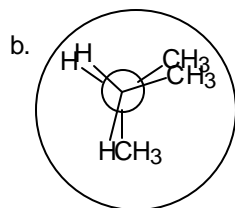
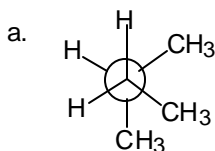
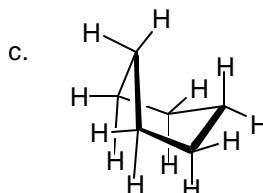
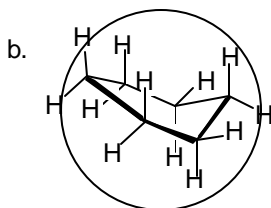
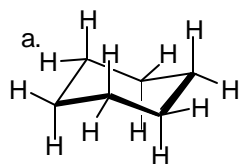
c. H—OH

\_\_\_\_\_ ionic \_\_\_\_\_

\_\_\_\_\_ covalen \_\_\_\_\_

\_\_\_\_\_ covalent \_\_\_\_\_

9. Circle the least stable conformation of each of the groups below. (3 pts ea)



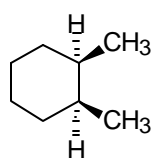
10. What two effects contribute the most to the energy of a cyclohexane half-chair? (2 pts each)

\_\_\_\_\_ bond angle strain \_\_\_\_\_

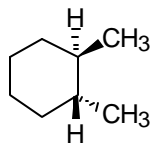
\_\_\_\_\_ torsional strain \_\_\_\_\_

11. Draw all the possible stereoisomers of 1,2-dimethylcyclohexane. Indicate if they are chiral, meso or achiral and indicate their relationship to each other. (i.e. enantiomers, diastereomers) (8 points)

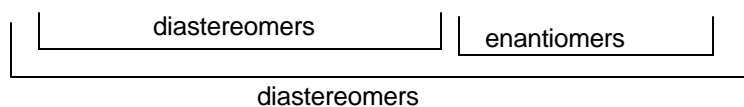
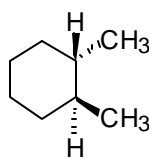
achiral, meso



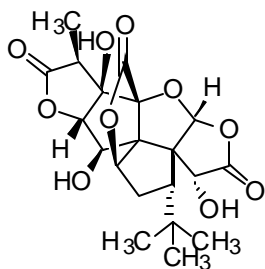
chiral



chiral



12. Label the following as chiral or achiral. (2 pts each)



CH<sub>3</sub>OH

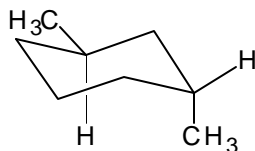
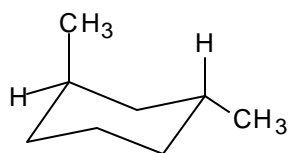
a glove

chiral

achiral

chiral

13. Draw both chair conformations of trans-1,3-dimethylcyclohexane. If one is more stable than the other, circle it. (6 points)

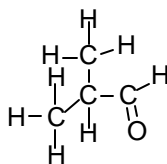
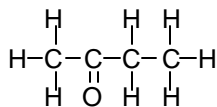
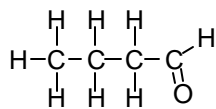


same energy

14. Consider the dipole moments of the anti or gauche conformation of 1,2-dichloroethane. Would the gauche conformation be more favored in a polar solvent or a nonpolar solvent? explain in 10 words or less. (4 points).

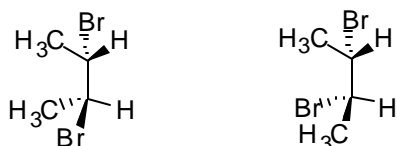
polar solvent: gauche has a dipole, anti does not

15. Draw the structure of all compounds of C<sub>4</sub>H<sub>8</sub>O that contain a carbonyl group. (6 points).



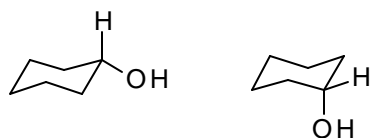
16. In the space to the right, indicate if each of the pairs of molecules below are identical compounds, enantiomers, diastereomers, structural isomers, or conformational isomers. (9 points).

a.



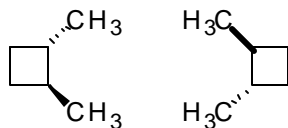
diastereomers

b.



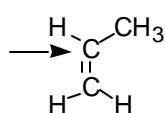
conformational isomers

c.

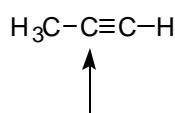


identical

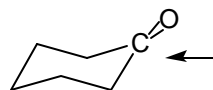
17. Indicate the geometry of carbon in the molecules below (e.g. trigonal bipyramidal). (6 points)



trigonal planar

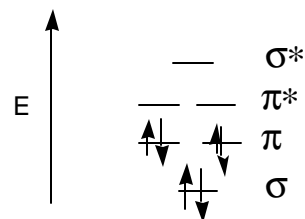


linear

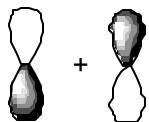


trigonal planar

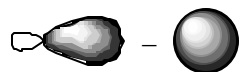
18. Draw an energy diagram of the molecular orbitals of the C+C double bond of acetylene. Indicate the ground state electronic configuration. *Do not draw the orbitals, only an energy diagram which shows their relative energies.* (5 points)



19. What kind of molecular orbital results ( $\sigma$ ,  $\sigma^*$ ,  $\pi$ ,  $\pi^*$ ) results when the pairs of orbitals show below are combined (mathematically) in the indicated manner? (4 pts)



a.      $\pi^*$     



b.      $\sigma^*$