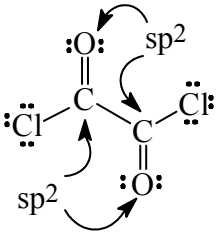
Chemistry 201-01 Name_____*Dr. Price*_____
Hour Examination I
20 September 2002

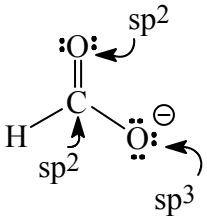
Answer all of the questions in the spaces provided. Point values are in parentheses. Be sure to ***read the questions carefully***.

1.(15) Propose the best possible **Lewis-dot structures** for the following species. Use lines for covalent bonds, show any **formal charges** where appropriate, and indicate the **hybridization** of each atom other than hydrogen or halogen.

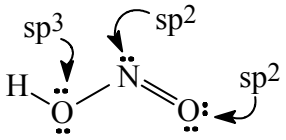
a) $C_2O_2Cl_2$



b) $CHO_2^{\ominus}$



c) HNO_2

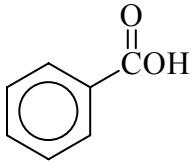
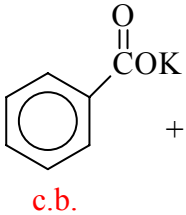


best with
no formal charges

2.(10) For the following reactions identify the acid, base and both conjugate species. Also determine whether or not the reaction proceeds to the right as written. (pKa values *in general*: alcohols 15-18; alkanes 49-55; carboxylic acids 4-6; phosphoric acid 2.)

a) $(CH_3)_3CLi$ +  ⇌  + $(CH_3)_3CH$

base acid c.b. c.a.

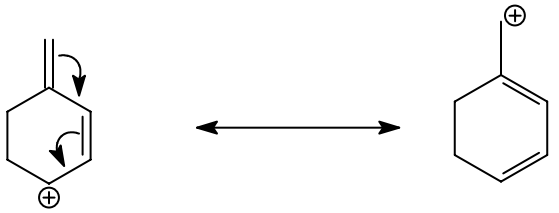
b)  + KH_2PO_4 ⇌  + H_3PO_4

acid base c.b. c.a.

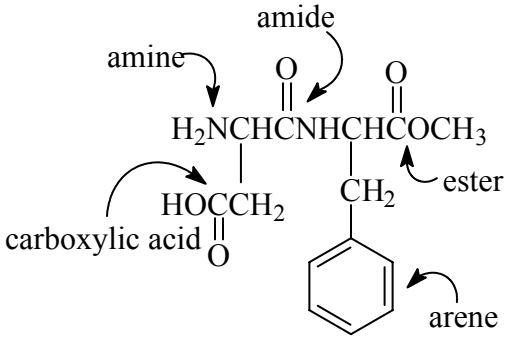
3.(10) Draw the resonance structure for each of the species below using the arrows indicating the electron flow.

a)

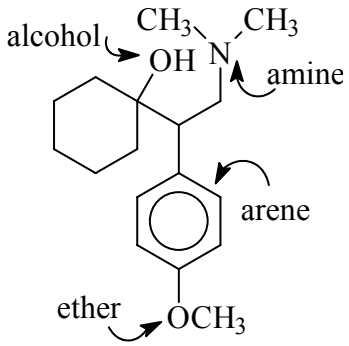
b)



4.(12) Identify and name all of the functional groups in aspartame (Nutrasweet®) and Effexor® (antidepressant Vanlafaxine) shown below:

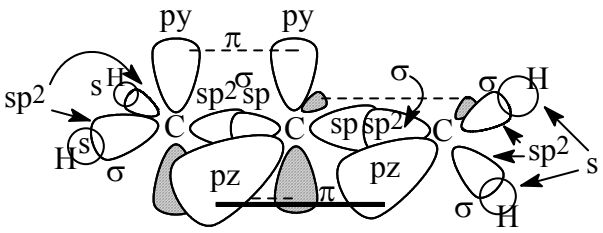


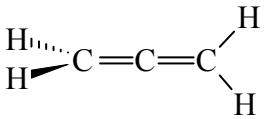
Aspartame



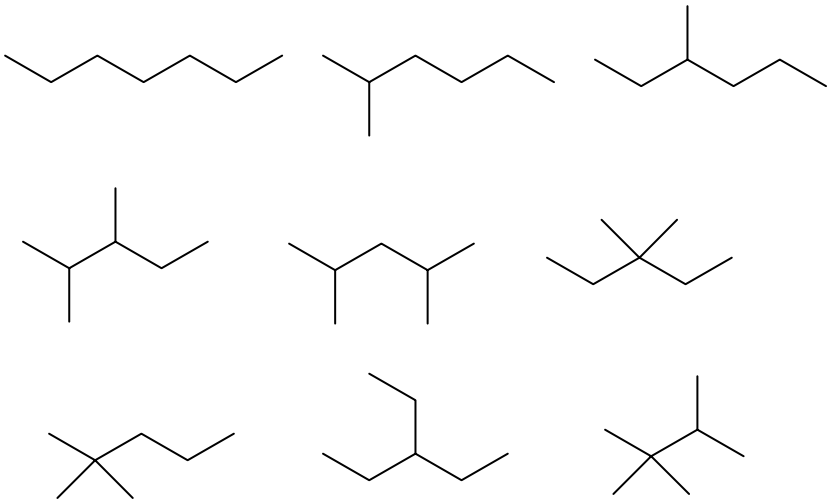
Venlafaxine

5.(12) The molecule shown below is an extremely unusual, unstable and unsaturated hydrocarbon. In the diagram below, identify all orbitals (e.g. p_x, sp^2) and bond types (e.g. π, σ). Additionally, propose a Lewis structure (lines for all bonds) for this hydrocarbon.



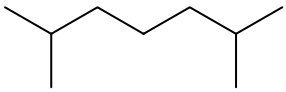


6.(15) Using Kekulé structures (zig-zag), draw 7 unique structural isomers with the formula of C_7H_{16}. There are 9 possible isomers.



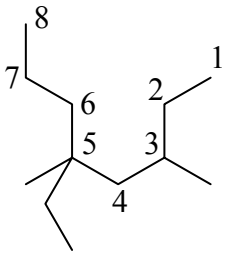
7.(16) Give the names for the following compounds using I.U.P.A.C. nomenclature.

a) $(CH_3)_2CH(CH_2)_3CH(CH_3)_2$



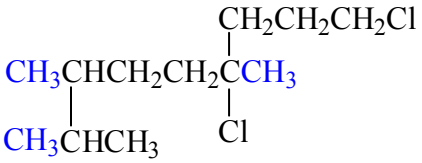
2,6-dimethylheptane

b)



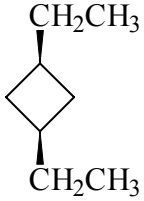
5-ethyl-3,5-dimethyloctane

c)



1,4-dichloro-4,7,8-trimethylnonane

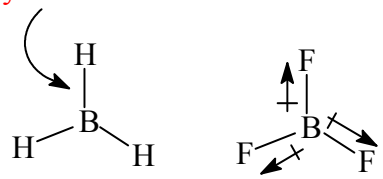
d)



cis 1,4-diethylcyclobutane

8.(10) Compare **BF_3** and **BH_3**. Which do you suppose is the stronger Lewis acid. Draw *accurate* depictions of both structures (make sure the bond angles are reasonable) and explain why you feel one is a stronger Lewis acid than the other.

very small bond moments



Both are Lewis acids but BF_3 is stronger
because the Boron is more electron-deficie
thus its empty p orbital is more likely
to act as an electron-pair acceptor.

Draw the product of the Lewis acid-base reaction between boron trifluoride and ammonia.