Name: _____ Date: ____ / ____ / _____

Oh No, It's OChem! (+ more)

Honors chem pset on periodic trends, ionic bonding, covalent bonding, and organic chemistry

1. Calculate the lattice energy of $NaCl$ knowing that the bond length between the two atoms is 2.85Å

2. Calculate the lattice energy of ammonium nitrate knowing that the bond length 1.031Å

3. Which of the following pairs of molecules has the most exothermic lattice energy?
   (a) K_2Se or KBr
   (b) Rb_2S or Cs_2Se
   (c) BeF or MgF
   (d) $Mg(OH)_2$ or $MgSO_4$
   (e) Cu_2O_2 or CuO
4. For each of the following compounds, rank them in terms of increasing exothermicity (more negative) of their lattice energies
   (a) NaF, $NaCl$, Na_2S, KCl, K_2S
   (b) VSO_4, VNH_4, VPO_3
5. For each of the following, answer the question assuming all bonds within each compound have the same length
   (a) Find the bond length for CH_4
   (b) Find the bond length for C_2H_5OH
   (c) Find the bond length for $CH_3OC_2H_5COOH$
   (d) Find the bond length for dodecane ($C_{12}H_{26}$)
   (e) Find the bond length for cyclododecane ($C_{12}H_{24}$)
   (f) Find the bond length for dodecene ($C_{12}H_{24}$)
   (g) Find the bond length for 20-ene ($C_{20}H_{40}$)
   (h) Find the bond length for 30-yne ($C_{30}H_{58}$)
   (i) Without referencing the table, should we expect NO_3^- to have a greater or smaller bond length than NO_2^-
   (j) Without referencing the table, should we expect SO_3 to have a greater or smaller bond length than SO_2
   (k) Find the bond length for $CH_3(CH_2)_{100}COO(CH_2)_{100}CH_3$
   (l) Find the bond length for H_2O

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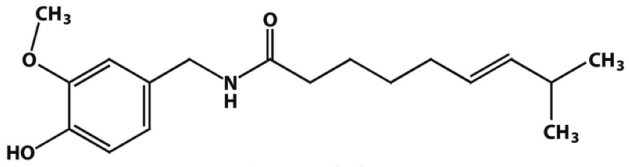
6. Use the following diagram to answer the following questions about capsaicin.



Capsaicin

   (a) What is the approximate bond angle between the oxygen in the alcohol group and all of its neighboring atoms?

   (b) What is the approximate bond angle between the nitrogen and all of its neighboring atoms?

   (c) What is the approximate bond angle between the carbon that forks off into two methyl groups and all its neighboring atoms?

   (d) What is the approximate bond angle between the oxygen in the ether group and all of its neighboring atoms?

   (e) How many σ bonds and π bonds does this molecule have?

   (f) What is this molecule's bond order?

   (g) What is the molecular formula of this molecule?

   (h) What is the bond energy for this molecule?

   (i) What is the ΔH of the complete combustion of this molecule if one of the products is known to be N_2

7. A molecule has 58 σ bonds and 17 π bonds. What is its bond order?

8. For each of the following molecules, find the bond order, the number of σ bonds, and the number of π bonds

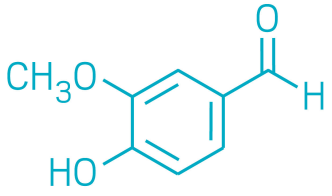
   (a) $C_4H_9COOC_2H_5COOH$

   (b) $CH_3(CH_2)_{1000}CO(CH_2)_{1000}CH_3$

   (c) $C_2H_5OCH_2COOC_6H_{12}OH$

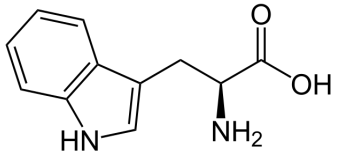
   (d) $C_{5000}H_{9998}$

   (e)



Vanillin

   (f)



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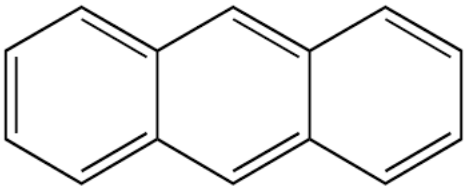
9. Find the enthalpy of the reaction of dilute nitric acid with copper metal

10. Find the enthalpy of the incomplete combustion of anthracene (attached below)



11. A Friedel-Craft Alkylation is a reaction in which an alkyl group is added to an aromatic hydrocarbon using an alkyl halide (alkyl group attached to a halogen). Find the enthalpy of the alkylation of naphthalene using CH_3Cl