CHEM 3311-100 Fall 2007

Exam 1

Professor R. Hoenigman

I pledge to uphold the CU Honor Code:

Signature_____

Name (printed)_____

Last four digits of your student ID number_____

Recitation TA_____

Recitation number, day, and time_____

You have 1 hour to complete this exam.
No model kits or calculators allowed.
Periodic table and scratch paper are attached.

DO NOT TURN THIS PAGE UNTIL INSTRUCTED TO DO SO.

Recitation Sections:

#	Day	Time	TA
111	Monday	8 am	Noel
151	Monday	2 pm	Noel
191	Monday	5 pm	Noel
113	Tuesday	8 am	Noel
193	Tuesday	5 pm	Noel
112	Wednesday	8 am	Doug
152	Wednesday	11 am	Jon
192	Wednesday	5 pm	Doug
153	Thursday	8 am	Noel

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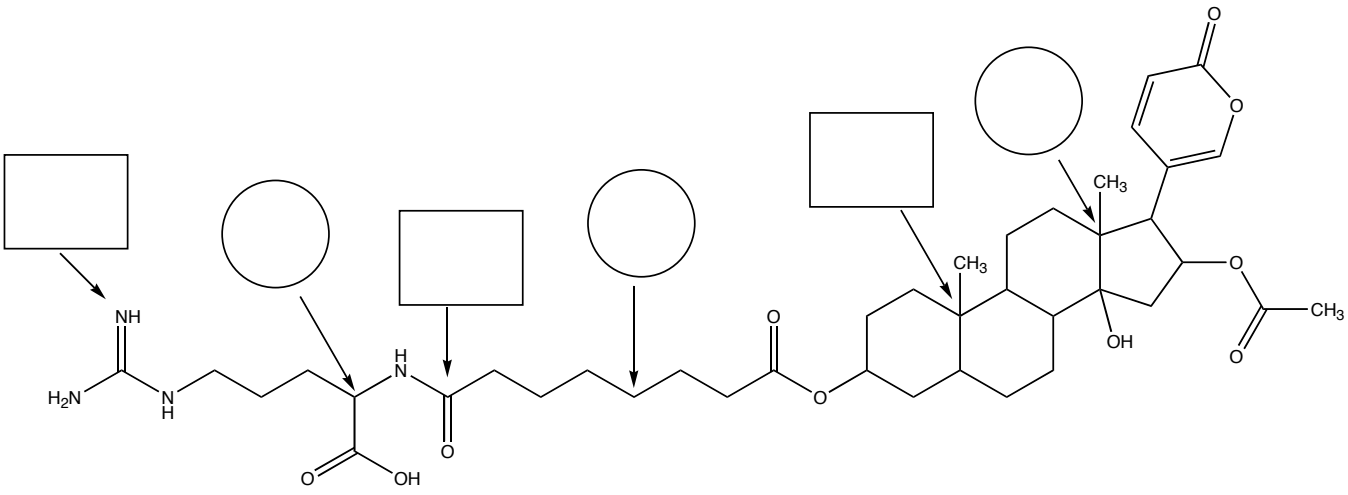
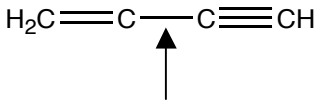
TOTAL_____/100

1. (15 pts) Bufotoxin (shown below) is the active component of the venom of the common European toad *Bufo vulgaris*, and is one of the most toxic compounds known.*
(*Le Couteur, P.; Burreson, J. *Napoleon's Buttons*, New York, Tarcher/Putnam, 2003.)

A. Label each atom indicated by a box as sp^3, sp^2, sp, or none of these.
B. Label each atom indicated by a circle as 1°, 2°, 3°, or 4°.
C. Draw a triangle around the most acidic hydrogen in bufotoxin.



2. (6 pts) Vinylacetylene (shown below) is used in the synthesis of neoprene, a synthetic rubber. Identify the orbital overlaps involved in the indicated bond. How many σ bonds, and how many π bonds are there in vinylacetylene?

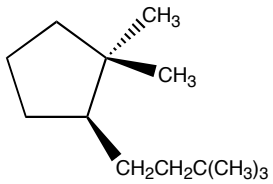


_____ π bonds

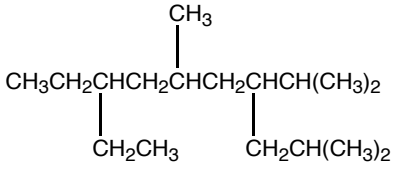
_____ σ bonds

3. (6 pts) Give the IUPAC name for each of the following compounds.

A.

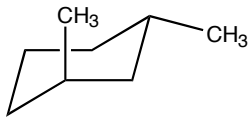


B.

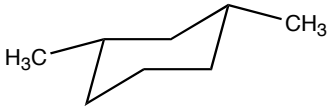


4. (8 pts) State whether the following pairs of compounds are constitutional isomers, stereoisomers, conformers, resonance structures, the same structure, or have no relation. Place your answer in the box.

A.



and

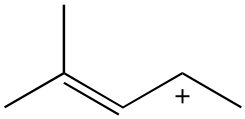


B. cyclobutylcyclopentane

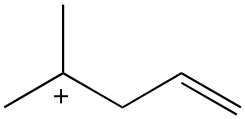
and

1-ethyl-1-methylcyclohexane

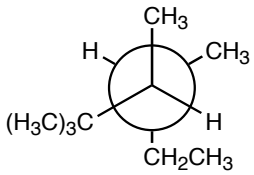
C.



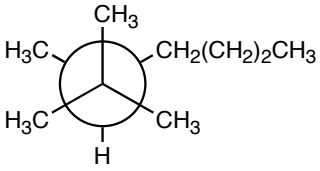
and



D.



and



5. (6 pts) Among isomeric alkanes, the unbranched isomer is the least stable and has the highest boiling point; the most branched isomer is the most stable and has the lowest boiling point. Does this mean that one alkane boils lower than another because it is more stable? Explain.

6. (12 pts) Circle the more basic species in each of the following pairs. In the box, provide a short explanation for your choice.

A. $(CH_3)_3N$ *or* $(CH_3)_3P$

B. $NaNH_2$ *or* $NaOCH_2CH_3$

C. NaC_2H *or* $NaNH_2$

7. (12 pts) For each of the following pairs, circle the compound that has the *lower* heat of combustion. In the box, give a brief reason for your choice.

A. *trans*-1-*tert*-butyl-3-methylcyclohexane

or

cis-1-*tert*-butyl-3-methylcyclohexane

B. *cis*-1,2-dimethylcyclopentane

or

1,1,2,2-tetramethylcyclopropane

C. 3-ethyl-5-isobutyl-4,4-dimethylnonane

or

5-*tert*-butyl-3-ethyl-4,4-dimethylnonane

8. (11 pts) This is a two part question.

A. Draw Newman projections for the gauche and anti conformations of 1,2-dichloroethane ($ClCH_2CH_2Cl$). Label your Newman projections as gauche or anti.

B. The measured dipole moment of $ClCH_2CH_2Cl$ is 1.12 D. Which one of the following statements about 1,2-dichloroethane is *false*? Explain why.

i. It may exist entirely in the anti conformation.

ii. It may exist entirely in the gauche conformation.

iii. It may exist as a mixture of anti and gauche conformations.

9. (24 pts) Complete the following acid-base reactions. Show all non-zero formal charges. If no reaction occurs write NR. Label each acid and base in the reactants. If the reaction is a Bronsted-Lowery acid-base reaction, also label the conjugate acid and conjugate base.

A.

$H_2S + HSe^- \rightarrow$

B.

$HCl + (CH_3)_3N \rightarrow$

C.

$BCl_3 + (CH_3)_3N \rightarrow$

D.

$CH_3Li + C_2H_2 \rightarrow$

E.

$CH_3COOH + NaOH \rightarrow$

F.

$AlBr_3 + CH_3Br \rightarrow$