CHEMISTRY 138S
Term Test #1

February 13, 2014

Name (print): _____

Student Number: _____

Tutorial Group: _____

Instructions:

Answer **ALL** questions in the spaces provided on the attached answer sheet. You may detach the answer sheet. The question sheet WILL NOT be marked.

PRINT your name, student number and tutorial group on this test and on the answer sheet. **Write all answers in blue or black INK. Please do not use red pen.**

You may use unboxed molecular models.

A periodic table is included on page 5 of the test.

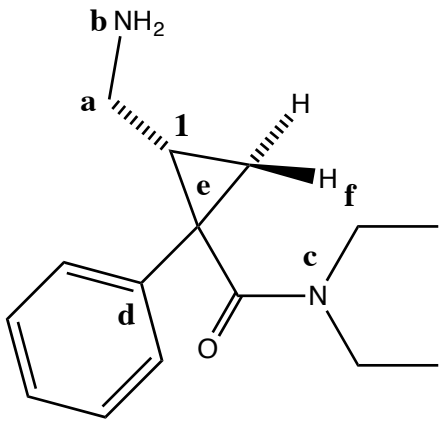
At the end of the test, place the answer sheet inside the test paper and HAND BOTH IN.

GOOD LUCK

☺

Part I - Multiple Choice (*20 marks*, *2 marks each)* Place your answers in the boxes on the answer sheet.

Levomilnacipran is a drug used to treat depression. Questions 1-7 pertain to the structure of levomilnacipran, which is shown to the right.



1. The bond between carbon "**a**" and nitrogen "**b**" is formed by which type of orbitals on these atoms?

a) C sp – N sp^2 b) C sp^2 – N sp^2 c) C sp^3 – N sp^2
d) C sp^2 – N sp^3 e) C sp^3 – N sp^3

2. The hybridization of the nitrogen atom labeled "**c**" is best described as
a) sp b) sp^2 c) sp^3 d) 2p e) tetrahedral

3. What is the geometry at the carbon atom labeled "**d**"?
a) tetrahedral b) T-shaped c) bent d) trigonal planar
e) trigonal pyramidal

4. How many stereocentres (chirality centres) are present in levomilnacipran?
a) 0 b) 1 c) 2 d) 3 e) 4

5. The ring labeled "**e**" is reactive due to
i. angle strain
ii. torsional strain
iii. acidic hydrogen atoms

a) i only b) i and ii only c) i and iii only d) ii and iii only e) i, ii and iii

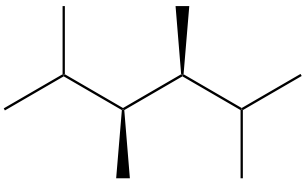
6. Which term best describes the relationship between the hydrogen atom labeled "**f**" and the substituent attached to the carbon atom labeled "**1**"?

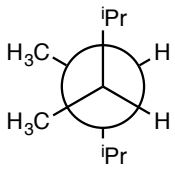
a) *cis* b) *trans* c) gauche d) eclipsed e) *R*

7. Which term best describes the configuration of the carbon atom labeled "**1**"?

a) *cis* b) *trans* c) up d) *R* e) *S*

8. What is the relationship between the molecules shown below?

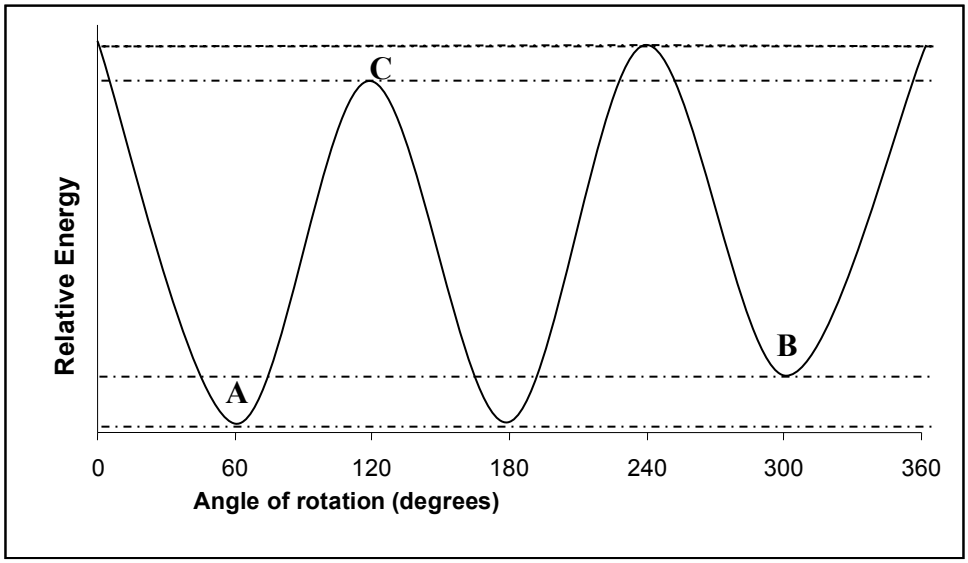




^{i}Pr = isopropyl

a) not isomers b) identical c) *cis-trans* isomers d) constitutional isomers
e) enantiomers

Questions 9 and 10 refer to the rotational energy diagram below.



9. Which alkane would give the rotational energy diagram shown above for the rotation about the C2-C3 bond?

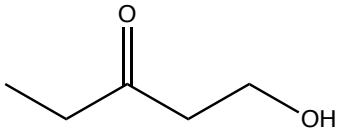
a) 2-methylpentane b) 1-bromopentane c) pentane
d) 2,2,3,3-tetramethylpentane e) cyclopentane

10. Which of the following statements is TRUE?
a) Conformer **A** must be eclipsed.
b) Conformer **B** must be staggered with more gauche interactions than conformer **A**.
c) Conformer **C** is the eclipsed conformation with the most steric strain.
d) Conformer **A** cannot have any gauche interactions.
e) None of these statements are true.

Part II – Short Answer Questions Write your answers in the spaces provided on the answer sheet.

1. (*12 marks*) Draw unambiguous structures that correspond to the following compounds. **Only skeletal structures will be graded**.

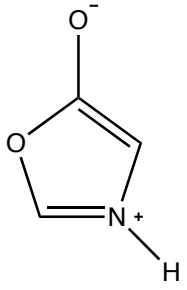
a) a chiral constitutional isomer that is much more acidic that the molecule shown below:



b) (*S*)-1,2-dibromobutane

c) an isomer of methylcyclopentane that contains only secondary carbon atoms.

2. (*13 marks*) One resonance structure for a compound known as a muchnone is shown below:

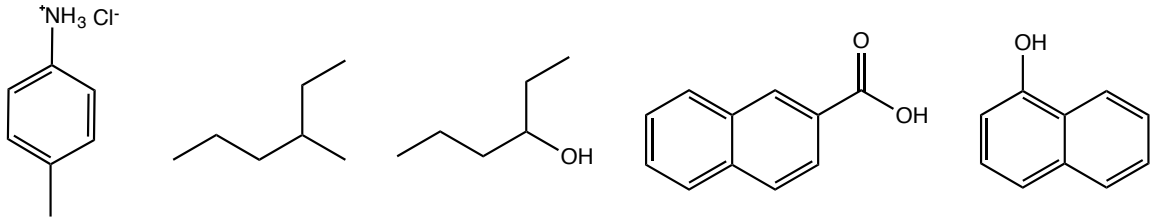


a) On the answer sheet, draw all of the lone pairs of electrons on this structure.

b) In the next three boxes, draw **important** resonance structures for the compound (one per box). Be sure to include lone pairs and formal charges on each structure

c) In the first box, draw appropriate curved arrows to show how the first structure is related to the next structure you drew.

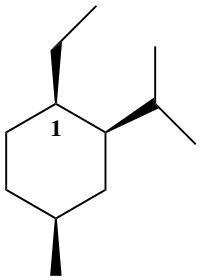
3. (*10 marks*) Consider the five compounds shown below.



a) On the answer sheet, circle the compound that is most soluble in water.

b) One of the five compounds reacts with sodium hydroxide, NaOH, to form a water-insoluble conjugate base. Write the acid-base reaction for this compound with sodium hydroxide, using curved arrows to show electron flow and drawing all products.

4. (*10 marks)* A trisubstituted cyclohexane derivative is shown below.



a) On the answer sheet, complete the partial structure for the chair conformation of this trisubstituted cyclohexane (**A**). Draw the chair conformation that results from a ring flip (**B**).

b) Circle the conformation that is lower in energy. List the types of steric strain present in conformer **A**.

END OF TERM TEST 1

1 **H** 1.01																	2 **He** 4.00
3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.8	6 **C** 12.0	7 **N** 14.0	8 **O** 16.0	9 **F** 19.0	10 **Ne** 20.2
11 **Na** 23.0	12 **Mg** 24.3											13 **Al** 27.0	14 **Si** 28.1	15 **P** 31.0	16 **S** 32.1	17 **Cl** 35.5	18 **Ar** 40.0
19 **K** 39.1	20 **Ca** 40.1	21 **Sc** 45.0	22 **Ti** 47.9	23 **V** 50.94	24 **Cr** 52.0	25 **Mn** 54.94	26 **Fe** 55.9	27 **Co** 58.9	28 **Ni** 58.7	29 **Cu** 63.6	30 **Zn** 65.4	31 **Ga** 69.7	32 **Ge** 72.59	33 **As** 74.9	34 **Se** 78.96	35 **Br** 79.9	36 **Kr** 83.8
37 **Rb** 85.5	38 **Sr** 87.6	39 **Y** 88.9	40 **Zr** 91.2	41 **Nb** 92.9	42 **Mo** 95.9	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (210)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 **Ac** (227)	104 **Rf** (263)	105 **Db** (262)	106 **Sg** (266)	107 **Bh** (267)	108 **Hs** (277)	109 **Mt** (268)	110 **Ds** (281)	111 **Rg** (272)	112 **Cn** (285)	113 (284)	114 (289)	115 (288)	116 (292)		118 (294)

58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (147)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
90 **Th** 232.0	91 **Pa** (231)	92 **U** 238.0	93 **Np** (237)	94 **Pu** (242)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)