First letter of last name →

Organic Chemistry I
Pham - Chem 14C
University of California, Los Angeles
Spring 2019 - Exam 1 - 04/24/19

I hereby state that I have neither given nor received aid to or from other students during this exam. I vouch for the honesty and integrity of each and every answer given.

*Signature*_____***KEY***_____ *ID#*_____

*Name (printed)*_____

Circle** your **TA: Xiaoyang Shuaijing Shang-Lin (Sean) Danielle

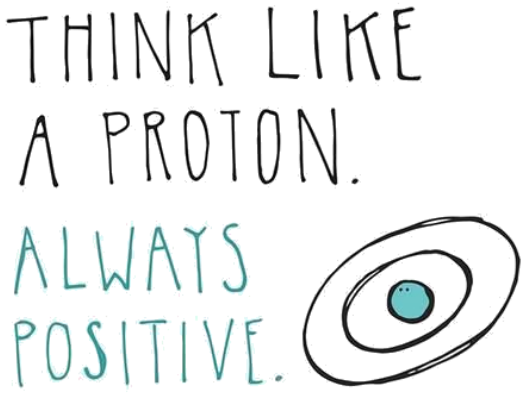
Danlei (Lily) Shanlin Sanghyun Ga Young (Gina)

***Circle** your **Lecture** (enrolled)*: Lecture 1 (12 PM) Lecture 2 (2 PM)

Use the back side of each sheet as scratch paper.

See back page for periodic table.

	Possible	Your score
I. General Knowledge	24	
II. Resonating	30	
III. Two of a Kind	24	
IV. Aromas and Colors	23	
****Bonus**	0 (6)	
Total	100*	

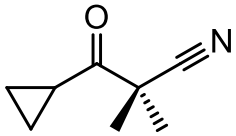


*The actual total is 101. Think of it as extra extra credit points. Good luck!

Last Name _____

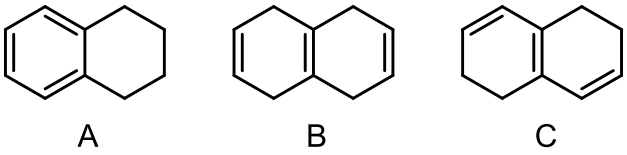
I. General Knowledge (24 pts; 3 pts each) **Answer** the following general knowledge questions by **inputting the correct answers in the spaces provided**.

What is the **molecular formula** of the following molecule?



Molecular Formula: **$C_8H_{11}NO$**

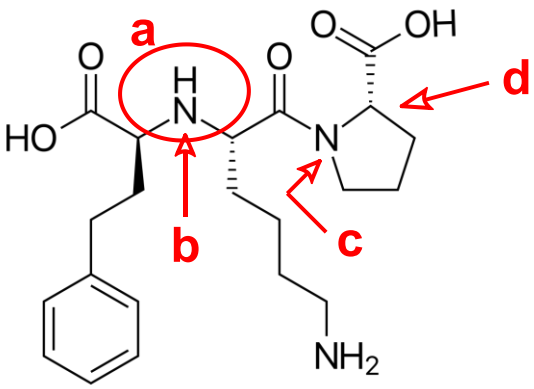
Rank the following molecules in order of **increasing heats of formation** (ΔH_f):



A < **C** < **B**

lowest ΔH_f highest ΔH_f

Answer the next few questions about lisinopril, an antihypertensive and the 2nd most prescribed drug in 2016. **Parts a-f** refer to the image below:



Lisinopril (Prinivil)

a) What is the **name** of the circled functional group? **amine**

b) What is the **hybridization** of this nitrogen? **sp^3**

c) What is the **molecular geometry** of this nitrogen? **trigonal planar**

d) What is the **absolute configuration** (R/S) of this center? **S**

e) How many **total p-orbitals** are present in lisinopril? **15**

f) What is the number of **possible stereoisomers** for lisinopril (including itself)? **$2^3 = 8$**

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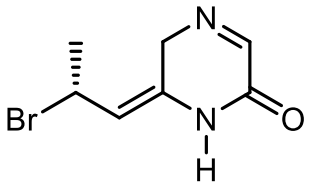
II. Resonating (30 pts) Answer the following questions about Molecule A shown below.

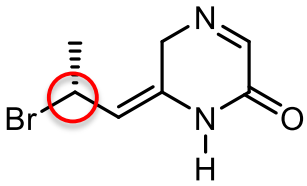
a) (6 pts) **Which functional groups** are present in the molecule? **Circle all** that apply.



Molecule A

ketone	aldehyde	amide	alkene
amine	thiol	ether	alkyne
nitrile	benzene	ester	alkyl halide

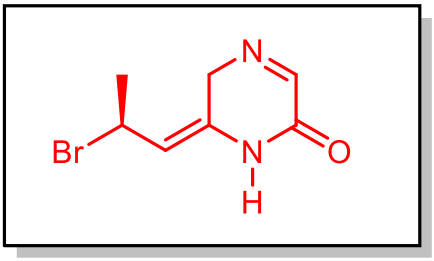
b) (8 pts) **Circle the chiral center** in Molecule A below. What is its **configuration**? **Draw its enantiomer** in the box provided. Furthermore, how many **conjugated p-orbitals** does Molecule A have?



← **Circle** the chiral center! (One atom!)

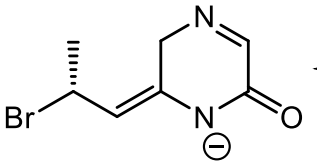
Configuration of chiral center: **R**

of **conjugated p-orbitals**: **7**

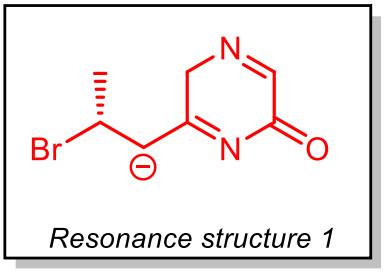


enantiomer of Molecule A

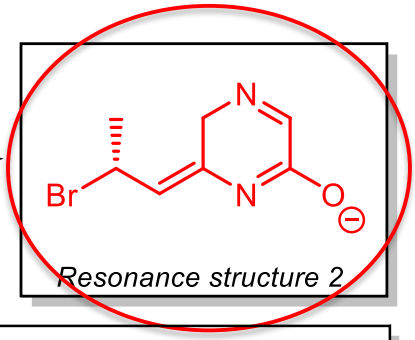
c) (12 pts) The anion of molecule A, shown below, is stabilized through resonance; **draw two major contributing resonance structures** below (no curved arrows). Minor contributors will be given fewer points. Of all 3 resonance structures, **circle the most contributing** resonance structure, and **provide a brief reason why**.



Anion of Molecule A



Resonance structure 1

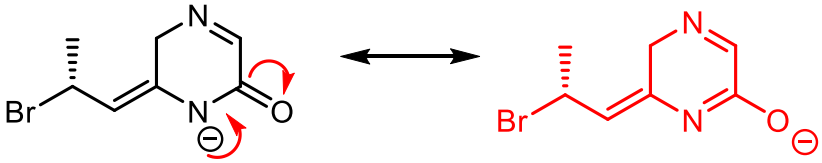


Resonance structure 2

Explanation for most contributing structure:

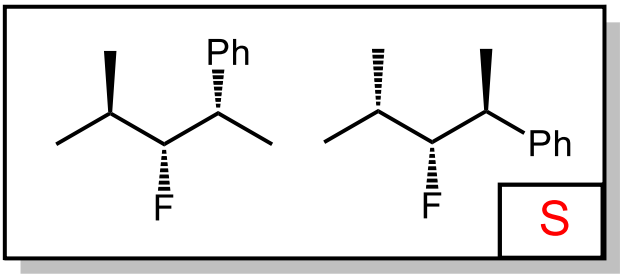
Negative charge on most electronegative atom (all have atoms with full octets)

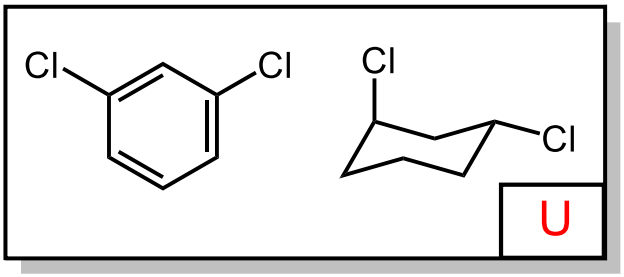
d) (4 pts) Provide the **curved arrows** to show how to get to **one of the resonance structures** you drew above.

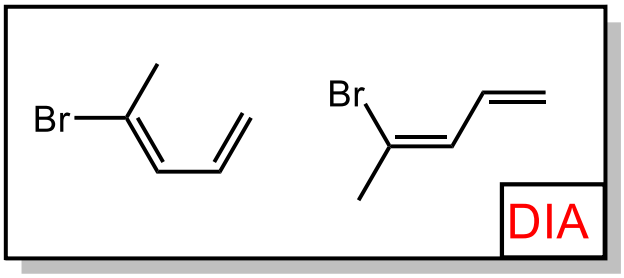


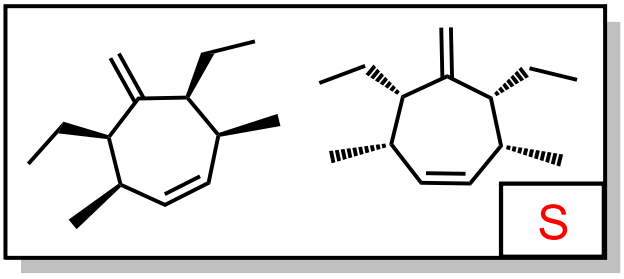
Last Name _____

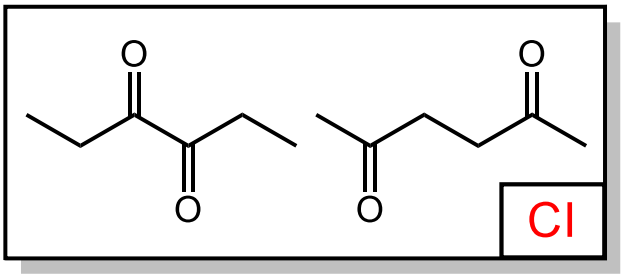
III. Two of a Kind (24 pts; 3 pts each) **Indicate the relationship** between the following pairs of compounds, using the following notation: constitutional isomers (CI), enantiomers (EN), diastereomers (DIA), unrelated (U), or the same molecule (S). **Write your answers inside the corner boxes** provided.

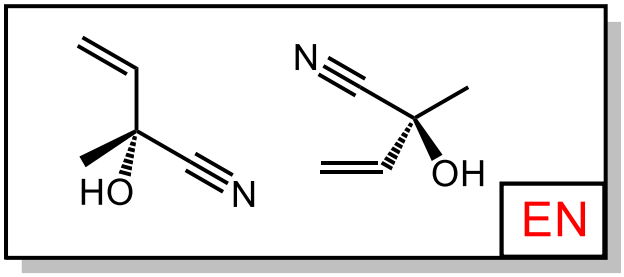




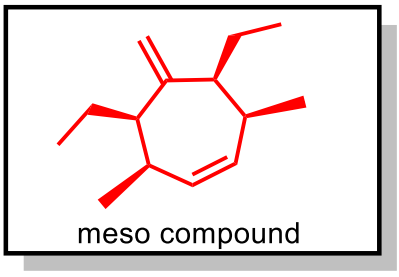






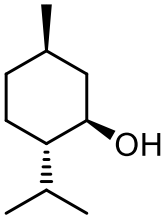


One of the molecules in the above boxes is a **meso compound**. **Draw** it below. Is it **optically active?**



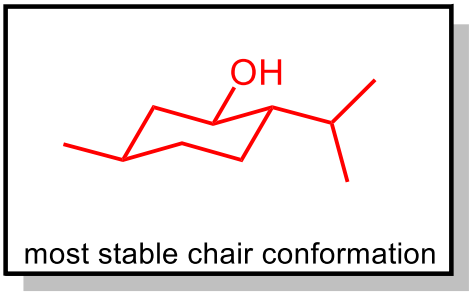
Optically active? **Circle ONE**: YES (NO)

Referring to (-)-menthol below, is it **levorotatory or dextrorotatory**? **Draw its most stable chair conformation** in the box provided.



(-)-menthol

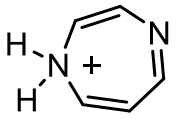
Circle ONE: (levorotatory) dextrorotatory



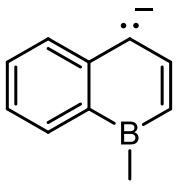
Last Name _____

IV. Aromas and Colors (23 pts) Answer the following questions pertaining to aromaticity and color.

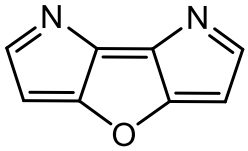
a) (12 pts; 3 pts each) Determine whether the following molecules are **aromatic** (A), **non-aromatic** (NA), or **anti-aromatic** (AA). Please provide your answer on the **line below each molecule**.



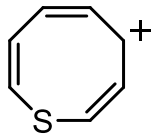
Non-Aromatic (NA)



Aromatic (A)

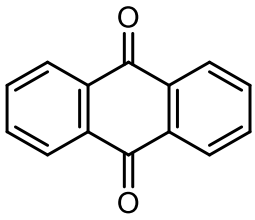


Anti-aromatic (AA)



Anti-aromatic (AA)

b) Anthraquinone, a precursor for many manufacturing dyes, has the molecular structure shown below. In its pure form, it appears as a **yellow powder**.



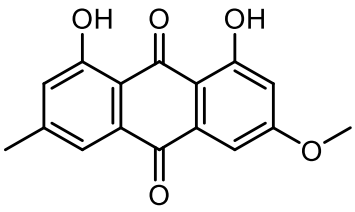
anthraquinone

(3 pts) How many **conjugated p-orbitals** are in anthraquinone? **16**

(2 pts) Anthraquinone **absorbs** photons in **what range of wavelengths**? A color wheel has been provided for you.

Between **420** *nm* and **450** *nm*

(6 pts) Parietin, shown below, is an anthraquinone-based manufacturing dye. What **color** do you predict parietin to be, and **explain your reasoning** using *20 words or fewer*.



Parietin

Predicted color: **orange**

Explanation:

Parietin has more conjugation, resulting in absorption of a longer wavelength of light and reflecting (complementary) orange instead of yellow

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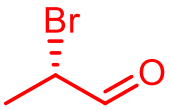
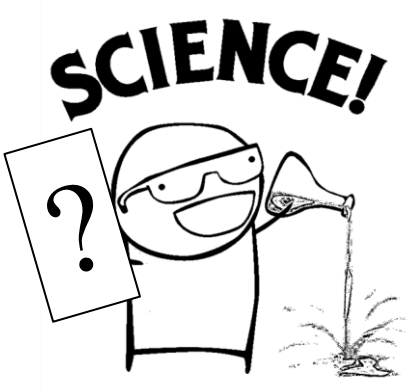
Bonus: **Answer the next few questions for some extra credit points. These are *strictly extra points*, meaning that missing these are fun points meant to help you.

(3 pts) Naming was a scary thing for many of you, so here is a chance to get some extra points with that knowledge. **Draw S-2-bromopropanal**.



(3 pts) If you came to lecture on the first day (and hopefully a few times after that, also), then the following figure should look familiar to you (granted that you show up on time):



What is he holding in his right hand? **Flaming test tube**

If this guy represented Dr. Pham, what would his middle initial be?

Hung V. Pham

Last Name _____

1																	18
1 **H** 1.008	2											13	14	15	16	17	2 **He** 4.0026
3 **Li** 6.94	4 **Be** 9.0122											5 **B** 10.81	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.180
11 **Na** 22.990	12 **Mg** 24.305	3	4	5	6	7	8	9	10	11	12	13 **Al** 26.982	14 **Si** 28.085	15 **P** 30.974	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.948
19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.867	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.845	27 **Co** 58.933	28 **Ni** 58.693	29 **Cu** 63.546	30 **Zn** 65.38	31 **Ga** 69.723	32 **Ge** 72.630	33 **As** 74.922	34 **Se** 78.97	35 **Br** 79.904	36 **Kr** 83.798
37 **Rb** 85.468	38 **Sr** 87.62	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	42 **Mo** 95.95	43 **Tc** (98)	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.76	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
55 **Cs** 132.91	56 **Ba** 137.33	57-71 *	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.84	75 **Re** 186.21	76 **Os** 190.23	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89-103 #	104 **Rf** (265)	105 **Db** (268)	106 **Sg** (271)	107 **Bh** (270)	108 **Hs** (277)	109 **Mt** (276)	110 **Ds** (281)	111 **Rg** (280)	112 **Cn** (285)	113 **Nh** (286)	114 **Fl** (289)	115 **Mc** (289)	116 **Lv** (293)	117 **Ts** (294)	118 **Og** (294)

* Lanthanide series	57 **La** 138.91	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.36	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.05	71 **Lu** 174.97
# Actinide series	89 **Ac** (227)	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** (237)	94 **Pu** (244)	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** (262)