

Organic Chemistry I  
Pham - Chem 14C  
University of California, Los Angeles  
Winter 2019 - Exam 1 - 02/07/19

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:**    Stephanie                      Shuaijing                      Sanghyun                      Danlei

*Use the back side of each sheet as scratch paper.*

*See back page for periodic table.*

	Possible	Your score
<b>I. This, That, or the Other</b>	8	
<b>II. Decisions, Decisions</b>	26	
<b>III. Two of a Kind</b>	27	
<b>IV. Azomatic?</b>	22	
<b>V. General Knowledge</b>	18	
<b>**Bonus</b>	0 (4)	
<b>Total</b>	100*	

THINK LIKE  
A PROTON.

ALWAYS  
POSITIVE.

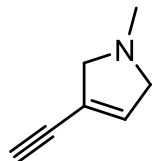


\*The actual total is 101. Think of it as an extra extra credit point. Good luck!

Last Name \_\_\_\_\_

**I. This, That, or the Other (8 pts; 2 pts each)** Answer the following questions by **inputting the correct letter in the box** provided next to each question.

**B** a) What is the **molecular formula** of the following molecule?

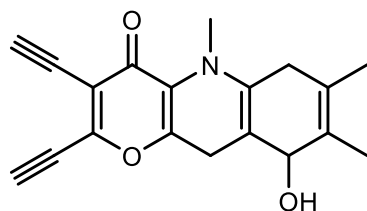


- A)  $C_6H_9N$       B)  $C_7H_9N$   
 C)  $C_7H_7N$       D)  $C_6H_7N$   
 E) None of the above

**C** b) Which of the following statements is **incorrect**?

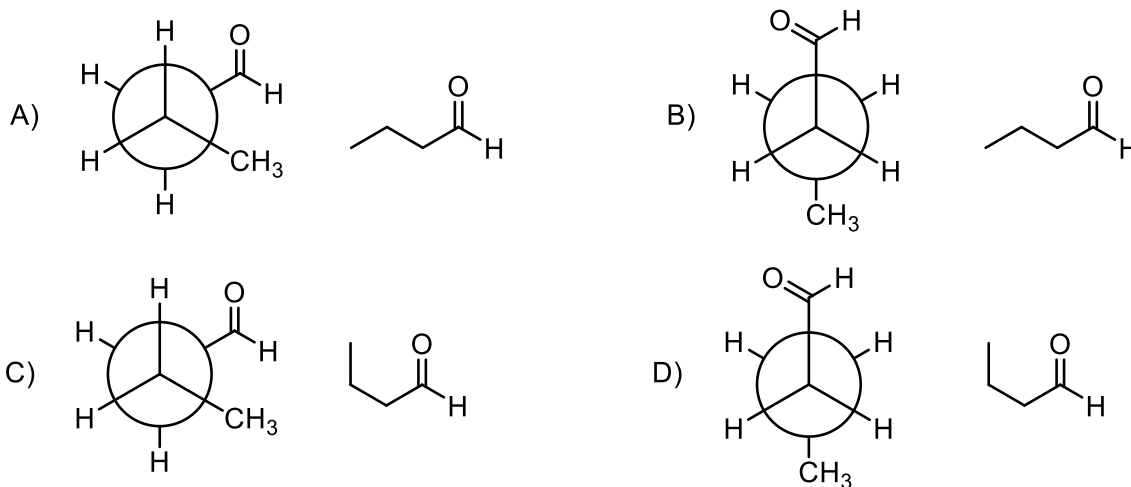
- A) s-cis and s-trans are conformations of the same molecule  
 B) Resonance structures are representations of the same molecule  
 C) If the observed rotations ( $\alpha$ ) of two molecules are the same, they must be the same molecule  
 D) The mirror image of an achiral molecule should be the same molecule

**B** c) How many **conjugated p-orbitals** does the following molecule have?



- A) 12  
 B) 14  
 C) 16  
 D) 18  
 E) None of the above

**B** d) Which pair of representations (Newman and bond-line) accurately show the **anti conformation of butanal**?

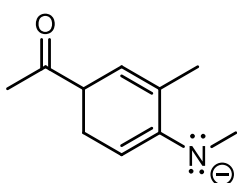


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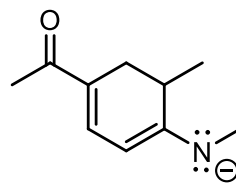
**II. Decisions, Decisions (26 pts)** After performing an acid/base reaction in 14CL, you come across a dilemma – you have two possible structures (A and B) for the conjugate base product!

**a) (6 pts)** Assuming that the structure with **more conjugation** is likely your product, **circle the correct structure** below. Also indicate how many **conjugated p-orbitals** are present in each structure.

A has 5 conjugated p-orbitals



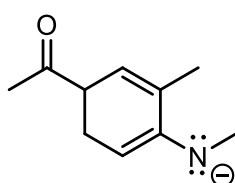
A



B

B has 7 conjugated p-orbitals

**b) (3 pts)** Circle all the terms that accurately describe molecule A.



A

has ketone

has aldehyde

has nitrile

has thiol

has alkyne

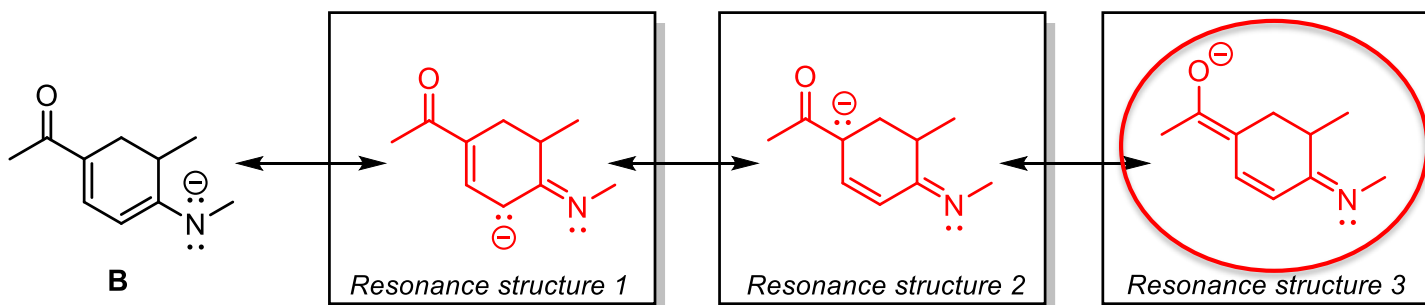
has alkene

aromatic

chair conformation

chiral

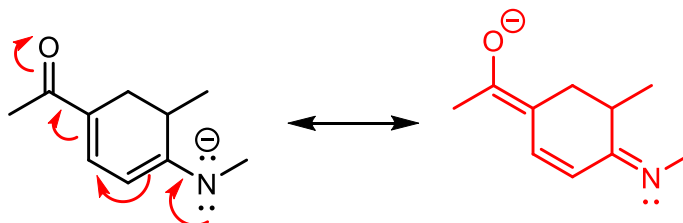
**c) (13 pts)** For molecule B below, **draw three resonance structures**. Minor contributors will be given fewer points. Of all 4 resonance structures, **circle the most contributing** resonance structure, and **provide a brief reason why**.



Explanation for most contributing structure:

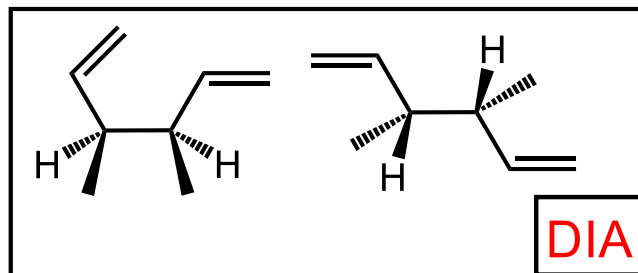
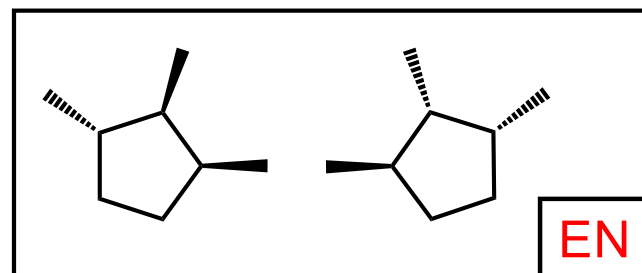
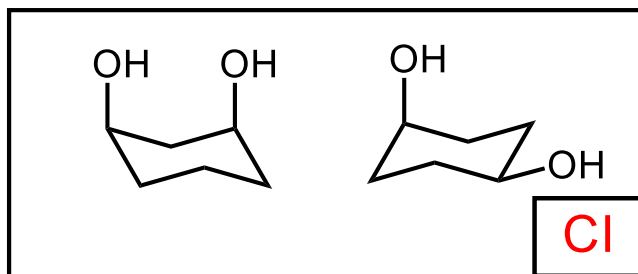
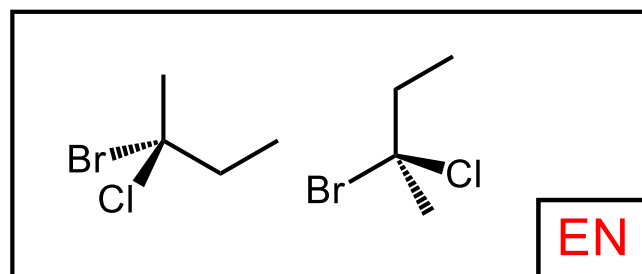
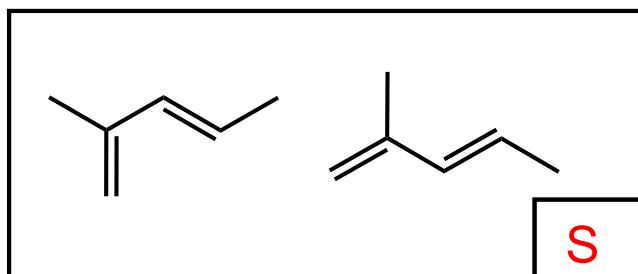
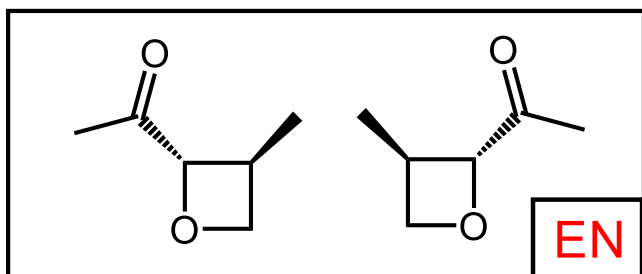
Negative charge on more electronegative atom

**d) (4 pts)** Provide **curved arrows** to show how to get to **Resonance Structure 3** (whichever one that is).

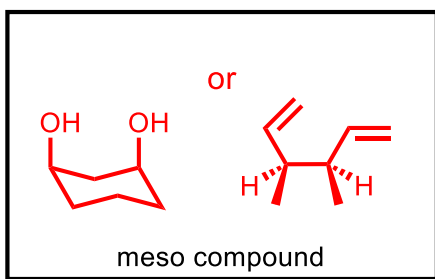


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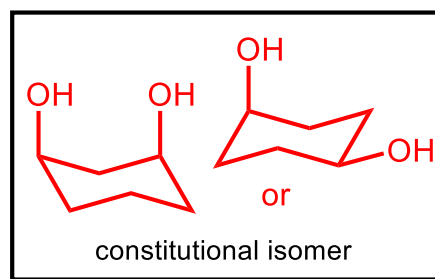
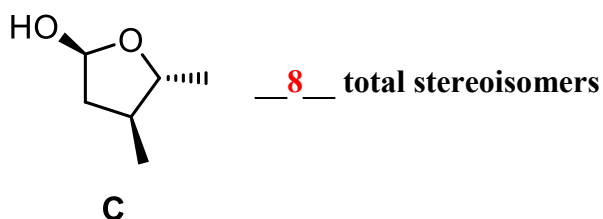
**III. Two of a Kind (27 pts; 3 pts each)** Indicate the relationship between the following pairs of compounds, using the following notation: constitutional isomers (CI), enantiomers (EN), diastereomers (DIA), unrelated (U), or the same molecule (S). Write your answers inside the corner boxes provided.



At least one of the 12 molecules in the above boxes is a **meso compound**. Draw **ONE** of those molecules in the box.



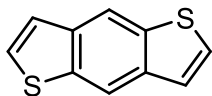
At least one of the 12 molecules in the above boxes is a **constitutional isomer** of the molecule below. Draw **ONE** of those molecules in the box. Also indicate how many **total stereoisomers** (including itself) molecule C can have.



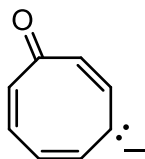
Last Name \_\_\_\_\_

**IV. Azomatic? (22 pts)** Answer the following questions pertaining to aromaticity, conjugation and color.

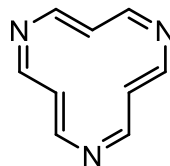
**a) (12 pts; 3 pts each)** Determine whether the following molecules are **aromatic (A)**, **non-aromatic (NA)**, or **anti-aromatic (AA)**. Please provide your answer on the **line below each molecule**.



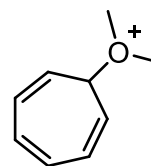
Aromatic (A)



Anti-Aromatic (AA)

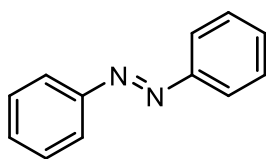


Anti-aromatic (AA)



Non-Aromatic (NA)

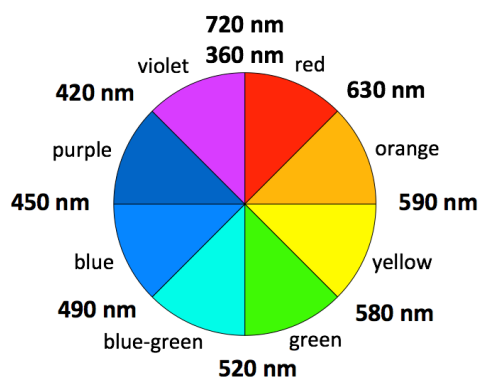
**b) (10 pts)** Azobenzene, shown below, is the main functional group for many commercial dyes; its color can be tweaked by adding different substituents on the rings. In its purest form, it **absorbs photons at ~472 nm**.



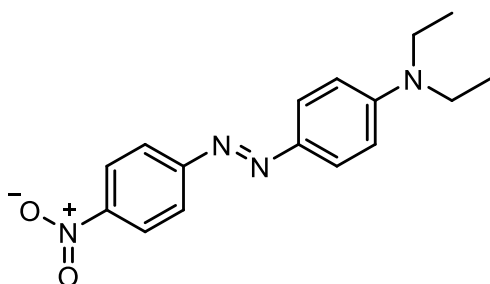
azobenzene

**What color** do you expect azobenzene to appear? A color wheel has been provided for you.

Color: \_\_\_\_\_ **orange** \_\_\_\_\_



The molecule below is a derivative of azobenzene. **What color** do you expect it to appear, and **briefly explain why**.

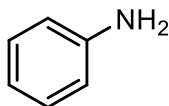


Color: \_\_\_\_\_ **Red (or violet, etc.)** \_\_\_\_\_

Explanation:

**It has more conjugation than azobenzene, leading to a longer wavelength of photon absorbed and likely reflecting red**

Briefly **explain the lack of color** (a.k.a. colorless) of a solution of aniline, shown below; you may use either of the terms “infrared” or “ultraviolet” (or both) in your answer.

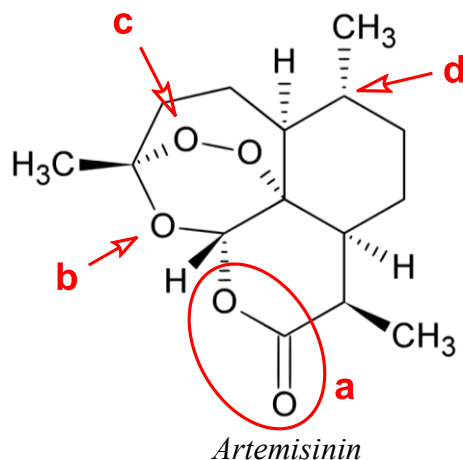


Explanation:

**Aniline has less conjugation than azobenzene, so it likely absorbs photons in the ultraviolet region (<360nm), hence not in the visible spectrum**

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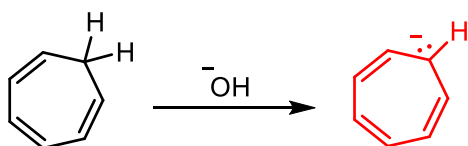
**V. General Knowledge (18 pts, 3 pts each)** Answer the next few questions about artemisinin, an anti-malarial drug that earned its discoverer, Tu Youyou, the 2015 Nobel Prize in Medicine. **Parts a-f** refer to the image below:



- a) What is the **name** of this functional group?  (carboxylic) ester
- b) What is the **hybridization** of this oxygen?   $sp^3$
- c) What is the **molecular geometry** of this oxygen?  tetrahedral/bent
- d) What is the **absolute configuration** (R/S) of this center?  R
- e) How many **conjugated p-orbitals** are in artemisinin?  3
- f) How many **chiral centers** does artemisinin have?  7

**\*\*Bonus:** Answer the next few questions for some extra credit points. These are *strictly extra points*, meaning that missing these will not be detrimental to your grade, and can only help you.

(2 pts) Cycloheptatriene, shown below, is very resistant to deprotonation (i.e. losing a proton). Briefly **explain why**.



Deprotonation would form an anti-aromatic molecule

(2 pts) If you have been coming to lecture, this guy should look familiar to you!

What word is written **above his head**?  Science!

What **color is the shirt** that he's wearing?  Blue



Last Name \_\_\_\_\_

1																						2														
1 H 1.008	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																					13 Al 26.982	14 Si 28.085	15 P 30.974	16 S 32.06	17 Cl 35.45	18 Ar 39.948									
3																																				
19 K 39.098	20 Ca 40.078	21 Sc 44.956																																		
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)										