

**1st Semester Organic Chemistry
Exam 1**

Name: *Key*

Recitation Instructor:

Instructions

1. Keep the exam closed until you are instructed to begin.
2. The exam consists of 9 questions. The first thing you should do is make sure that no pages are missing. If a page is missing, notify a proctor immediately.
3. You will have 1 hr and 15 minutes to complete the exam, at which time pencils must be put down. Budget your time wisely.
4. Questions are ranked easy (*), medium (**), and hard (***). You probably shouldn't spend too much time on a hard question if you still have easy or medium difficulty problems you haven't tried yet.
4. Make sure to show all of your work, and make it clear what your thought process was. Answers should fit in the space provided. If you need to use the back of the sheet of paper, you must make note of it in the space allotted for credit.
5. GOOD LUCK!

Breakdown

1 ___/10

2 ___/10

3 ___/10

4 ___/10

5 ___/10

6 ___/10

7 ___/20

8 ___/10

9 ___/10

Tot. _____/100



"Of course the elements are earth, water, fire and air. But what about chromium? Surely you can't ignore chromium."

From: sciencecartoonsplus.com

hydrogen 1 H 1.00794	helium 2 He 4.00260	lithium 3 Li 6.941	beryllium 4 Be 9.0122	boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180	helium 1 H 1.00794	beryllium 4 Be 9.0122	boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
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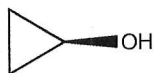
* Lanthanide series

** Actinide series

lanthanum 57 La 138.905	cerium 58 Ce 140.12	praseodymium 59 Pr 140.908	neodymium 60 Nd 144.24	promethium 61 Pm 144.913	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
actinium 89 Ac 227.037	thorium 90 Th 232.038	protactinium 91 Pa 231.036	uranium 92 U 238.029	neptunium 93 Np 237.048	plutonium 94 Pu 244.064	americium 95 Am 243.061	curium 96 Cm 247.070	berkelium 97 Bk 247.070	californium 98 Cf 251.108	einsteinium 99 Es 252.083	fermium 100 Fm 257.103	mendelevium 101 Md 258.103	nobelium 102 No 259.103

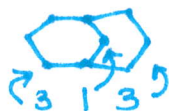
1. IUPAC (10 points, 5 points each)

a. Give the name of the following molecule.* _____



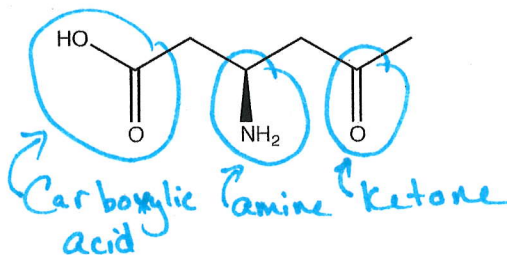
Cyclopropanol

b. Draw bicyclo[3.3.1]nonane using line-angle notation.*



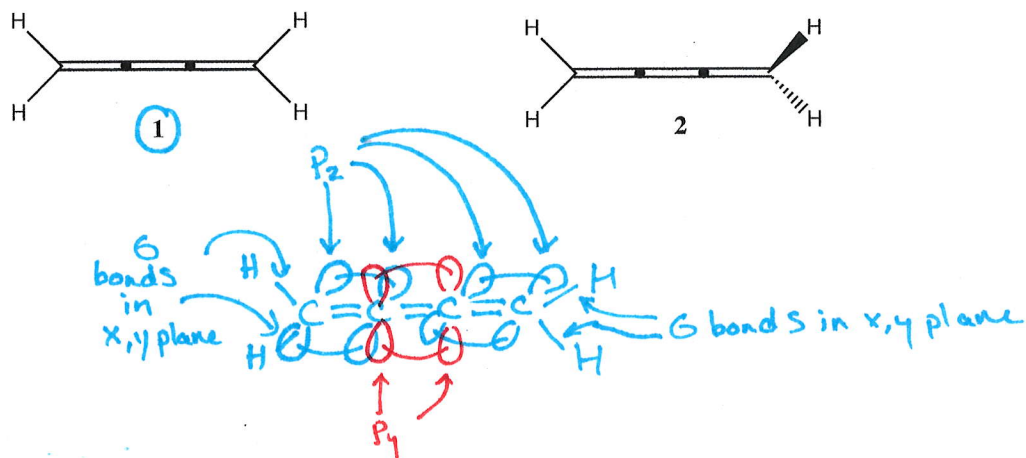
2. Functional Groups (10 points)

Circle and name all functional groups on the following molecule.*



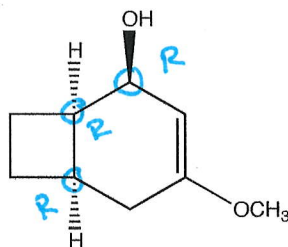
3. Hybridization (10 points)

Which of the following stereochemical representations of the extended allene are most accurate (1 or 2). Explain your answer, drawing in molecular orbitals (p orbitals) to help explain your answer.**



4. Stereochemistry Part 1 (10 points)

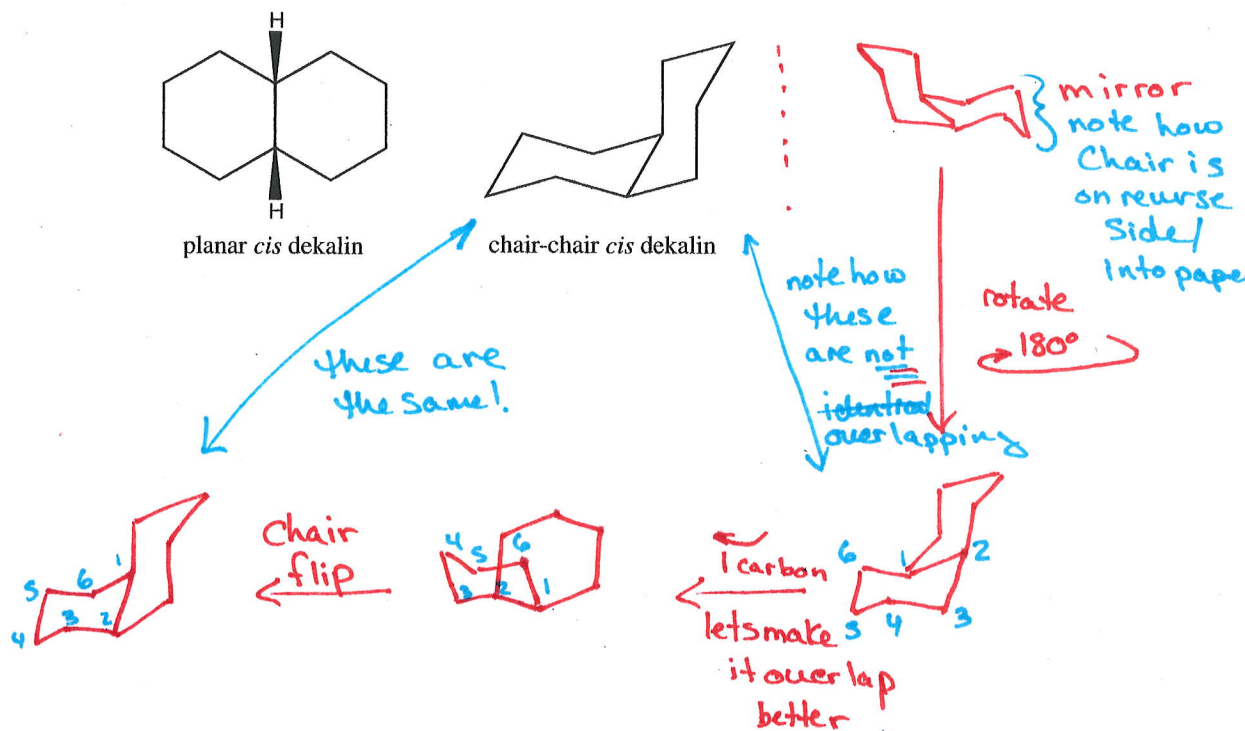
Circle the stereocenter(s) (ie 'chiral centers') on the following molecule and designate it (them) as R or S.**



5. Stereochemistry Part 2 (10 points)

Cis dekalin drawn in its planar form has a plane of symmetry, suggesting that it is achiral. However, when drawn in the chair-chair form, the molecule does not have a super-imposable mirror image, suggesting that it is chiral. Would you classify *cis* dekalin chiral or achiral? Use structures where possible to support your answer. ***

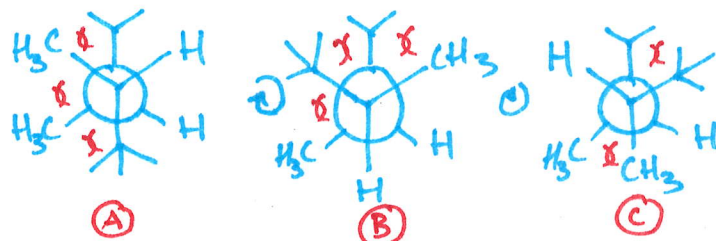
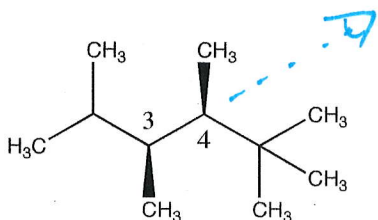
Really Hard!



answer - the molecule is achiral because the two non-superimposable mirror images can interconvert through chair flip.

6. Conformational Analysis Part (10 points)

Draw all 3 staggered conformations of the following molecule in a Newman Projection down the 3-4 bond. Predict which would be the lowest in energy and explain your answer. **



you could have answered one of
2 ways.

Possible Answer #1 - structure (A) is lowest b/c
largest groups (iff: t-Bu) are
anti

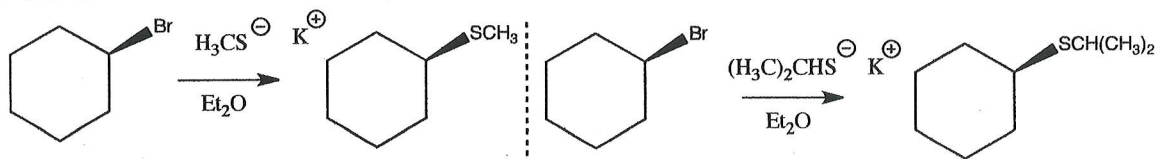
possible answer #2 - structure (C) is lowest b/c
it has the least # of gauche
interactions

To know real answer, you would have to
know the difference in energy between the
different gauche interactions.

7. Substitution Reactions (20 points, 5 points each)

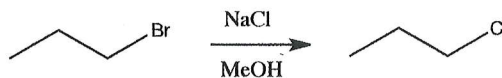
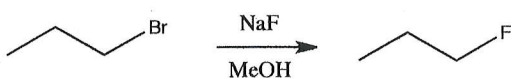
For each of the following substitution reactions, predict which reaction would be faster and explain your answer.

7a. SN2*



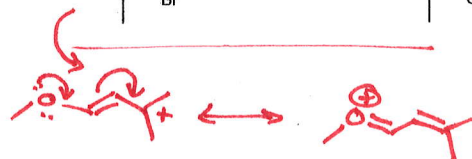
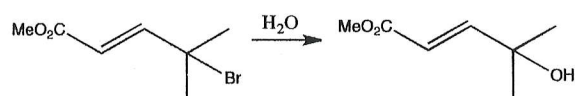
faster b/c of smaller nucleophile / less sterics

7b. SN2**



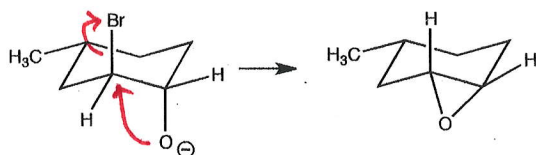
generally F^- is better nucleophile than Cl^- . However solvation effect of protic solvent makes Cl^- better in methanol.

7c. SN1**

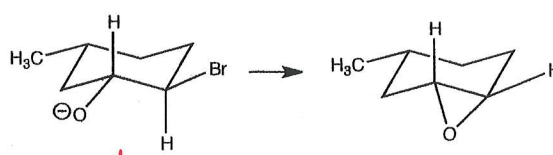


Cation has really good resonance stability. Better than other rxn.

7d. SN2**



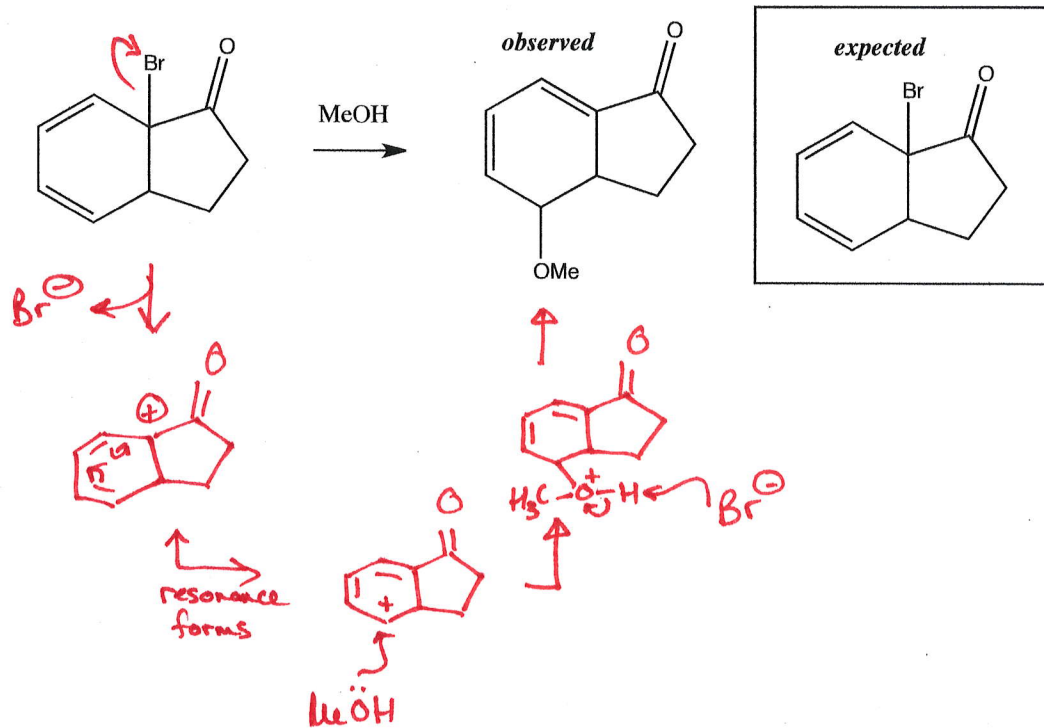
Backside attack necessary for SN2



a chair flip would be needed to get proper positioning. This would put CH_3 axial.

8. Mechanism # 1: Substitution (10 points)

Researchers were attempting to carry out an SN1 reaction to generate the expected product shown. However, instead a different product was observed. Propose a mechanism for the reaction that leads to the observed product.**



9. Mechanism # 2: Resonance (10 points)

Show two resonance forms that illustrate how the positive charge generated through the protonation of the xanthene molecule can be shared with the two other oxygens. Use reaction arrows to show this interconversion.***

